ANNUAL REPORT
CALENDAR YEAR 2013
OF ACTIVITIES UNDER THE
ANADROMOUS FISH AGREEMENT
AND HABITAT CONSERVATION PLAN
ROCKY REACH HYDROELECTRIC PROJECT
FERC LICENSE NO. 2145

Prepared for

Federal Energy Regulatory Commission
888 First Street N.E.
Washington, D.C. 20426

Prepared by

Anchor QEA, LLC
720 Olive Way, Suite 1900
Seattle, Washington 98101
and
Public Utility District No. 1
of Chelan County, Washington
327 N. Wenatchee Ave
P.O. Box 1231
Wenatchee, Washington 98807

April 2014

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1 INTRODUCTION

On June 21, 2004, the Federal Energy Regulatory Commission (FERC) approved an Anadromous Fish Agreement and Habitat Conservation Plan (HCP) for the Rocky Reach Hydroelectric Project (Rocky Reach – FERC License No. 2145) on the Columbia River in Washington State, operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The HCP provides a comprehensive and long-term adaptive management plan for species addressed in the plan (Plan Species) and their habitat. This document fulfills Article 10 of Appendix B and Section 9.8 of Appendix E of the new FERC License issued on February 19, 2009[1], and Section 4.8 of the HCP, which requires annual reporting of progress toward achieving the No Net Impact (NNI) goal, as described in Section 3 of the HCP, in a 10-year Comprehensive Report assessing overall status of NNI, and in common understandings based upon completed studies, including those conducted as research and development for NNI progress or those not considered valid due to extenuating circumstances (Section 5.2.3 of the HCP).

The signatories of the Mid-Columbia HCPs (HCPs for the Wells, Rocky Reach, and Rock Island hydroelectric projects) meet as combined Coordinating Committees, Hatchery Committees, and Tributary Committees to expedite the process of overseeing and guiding HCP implementation. Minutes from the monthly meetings are compiled in Appendices A (Coordinating Committees), B (Hatchery Committees), and C (Tributary Committees); Appendix D lists members of the Rocky Reach committees. In addition, there is a Policy Committee whose function is to provide dispute resolution if issues arise in the Coordinating, Hatchery, or Tributary Committees. The Policy Committee did not meet in 2013. The Coordinating Committee for the Rocky Reach HCP oversaw the preparation of this tenth Annual Report for calendar year 2013, which covers the period from January 1 to December 31, 2013. (The first nine Annual Reports covered January 1 to December 31, 2004 through 2012, respectively.)

[1] 126 FERC, paragraph 61,138 (2009)

2 PROGRESS TOWARD MEETING NO NET IMPACT

The Rocky Reach HCP requires preparation of an Annual Report that describes progress toward achieving the performance standard of NNI for each Plan Species. The NNI standard consists of three elements: 1) project passage survival; 2) hatchery production; and 3) funding a Plan Species Account for tributary restoration. Survival standards and measures established in the HCP include: 1) 91% combined adult and juvenile project survival, as achieved by project improvement measures implemented within the geographic area of the project; and 2) up to 9% compensation for unavoidable project mortality provided through hatchery and tributary programs, with up to 7% compensation provided through hatchery programs and 2% through tributary programs (Section 3.1 of the HCP).

In 2013, Chelan PUD has met or exceeded all requirements for NNI under the Rocky Reach HCP for spring migrant HCP Plan Species (spring Chinook, steelhead, and sockeye). Project survival standards have been exceeded for steelhead, yearling Chinook, and sockeye. Yearling Chinook, sockeye, and steelhead are currently designated Phase III (Standards Achieved). In April 2013, the Rocky Reach Coordinating Committee re-evaluated the phase designation for subyearling summer/fall Chinook (a summer migrant and a non-Endangered Species Act [ESA]-listed Plan Species), and determined that considerable life history variability and limited technology constrain the ability to meaningfully estimate project survival (see Section 2.1.1). As a result, the phase designation for subyearling summer Chinook was maintained as Phase III (Additional Juvenile Studies), and subyearling summer Chinook will continue to be compensated through the Tributary Conservation and Hatchery Compensation Plans at levels consistent with direction provided in the HCP. As established in Section 3.1 of the HCP, the inability to estimate survival due to limitations of technology shall not be construed as a success or a failure to achieve NNI. Coho salmon also are currently classified as Phase III (Additional Juvenile Studies[2]) and are compensated at levels indicated by the HCP to achieve NNI through Tributary Conservation and Hatchery Compensation Plans as the species is being reintroduced to the Upper Columbia River (UCR).

Hatchery Compensation commitments for initial production under the Rocky Reach HCP were implemented through 2013; recalculated NNI production levels were agreed upon in

[2] The current phase designation will be re-evaluated in 2017.

2011, and implementation will begin with the 2014 release year and continue for the next 10 years (2014 through 2023). Chelan PUD has funded the Tributary Conservation Plan at the level agreed to in the HCP ($229,800 in 1998 dollars) and will continue to do so for the duration of the HCP (see Section 2.3; Table 1).

Table 1
Rocky Reach HCP NNI Progress for Plan Species, 2013

HCP Plan Species (ESA Status)	Survival Standard Met?	Hatchery Compensation Provided?	Tributary Conservation Plan Funded?	NNI?
Spring Chinook Yearlings (ESA-Listed)	Yes-Combined Adult and Juvenile	Yes	Yes	Yes
Steelhead (ESA-Listed)	Yes- Combined Adult and Juvenile	Yes	Yes	Yes
Sockeye (Not Listed)	Yes- Combined Adult and Juvenile	Yes	Yes	Yes
Summer/Fall Chinook (Not Listed)	Phase III (Additional Studies)	Yes	Yes	Yes-NNI compensation provided but additional studies required
Coho (Not Listed)	Phase III (Additional Studies)	Yes	Yes	Yes

Note:
TBD = To be determined

Chelan PUD was required to prepare for the Coordinating Committee a comprehensive progress report that assesses the status of NNI during the first 10 years of the HCP by no later than March 2013, per Section 4.8 of the Rocky Reach HCP. In December 2012, Chelan PUD distributed their revised draft 2013 Comprehensive NNI Progress Report for review by the Coordinating Committee. The report documented 10 years of successful collaboration between Chelan PUD, and tribal, state, and federal fisheries managers to implement the Rock Island and Rocky Reach Anadromous Fish Agreements and HCPs. Specifically, the report summarized the progress towards and achievement of NNI for Plan Species (spring and summer/fall Chinook salmon, sockeye salmon, coho salmon, and steelhead) by the HCPs' signatory parties. On February 4, 2013, the Chelan PUD Final 2013 Comprehensive NNI Progress Report (Appendix G) was distributed to the Coordinating Committees; and on February 26, 2013, the Rocky Reach Coordinating Committee approved the Statement of Agreement (SOA) approving the final report (Appendix E).

The remainder of this section of the report summarizes decisions and agreements reached by the Rocky Reach Coordinating, Hatchery, and Tributary Committees in 2013 in support of achieving and maintaining NNI. This summary is followed by individual sections that summarize achievements, actions, and activities in 2013 that are specific to the areas of project survival and dam operations, hatchery compensation, and funding of tributary habitat protection and restoration projects.

Throughout 2013, the HCP Coordinating, Hatchery, and Tributary Committees reached agreement on numerous issues during meetings, all of which were documented in the meeting minutes, with many described in stand-alone SOAs. These agreements, along with approvals for funding of habitat projects by the Rocky Reach Tributary Committee, are summarized in Table 2 and are discussed in the remainder of this report.

Table 2
Summary of 2013 Decisions for Rocky Reach HCP

Date	Agreement	HCP Committee	Reference
January 16, 2013	Agreed that the revised Hatchery Monitoring and Evaluation (M&E) Analytical Framework 5-Year Update will consolidate and replace both the former Hatchery M&E Analytical Framework and Conceptual Framework	Hatchery	Appendix B
January 16, 2013	Agreed to extend the current HCP Hatchery Committees Conflict of Interest Policy, which was originally approved in November 2010, for two additional years	Hatchery	Appendix B
January 22, 2013	Approved the Rocky Reach Juvenile Bypass Final Operating Plan for April 2013	Coordinating	Appendix A
February 14, 2013	Approved the Chelan PUD 2013 HCP Action Plan	Tributary	Appendix C

Date	Agreement	HCP Committee	Reference
February 26, 2013	Approved the SOA for Phase III standards achieved for the combined adult and juvenile survival of steelhead, sockeye, and spring-run Chinook at Rocky Reach and Rock Island hydroelectric projects	Coordinating	Appendix A and Appendix E
February 26, 2013	Approved the SOA that approves the Chelan PUD Final 2013 HCP Comprehensive Progress Report	Coordinating	Appendix A and Appendix E
February 26, 2013	Approved the Chelan PUD 2013 HCP Action Plan	Coordinating	Appendix A
March 14, 2013	Approved funding for the Colville Confederated Tribes' (CCT's) *Okanogan Basin Stream Discharge Monitoring Project*	Tributary	Appendix C
March 20, 2013	Agreed to Chelan PUD's 2013 Wenatchee River Basin Steelhead Release Strategy	Hatchery	Appendix B
March 26, 2013	Approved the Rocky Reach and Rock Island 2013 Fish Spill Plan	Coordinating	Appendix A
March 26, 2013	Approved the 2013 Rocky Reach Juvenile Fish Bypass Operations Plan, as revised	Coordinating	Appendix A
April 15, 2013	Approved the 2012 Rocky Reach Juvenile Fish Bypass Report	Coordinating	Appendix A
April 15, 2013	Approved the Chelan PUD 2012 Pikeminnow Control Report	Coordinating	Appendix A
April 17, 2013	Approved the Chelan PUD SOA approving the Revised Analytical Framework 5-Year Update	Hatchery	Appendix B and Appendix F
April 17, 2013	Approved the SOA for the Carlton Acclimation Facility Capacity Utilization	Hatchery	Appendix B and Appendix F
April 26, 2013	Approved the spring Chinook Pilot Trapping Study at Rocky Reach	Hatchery	Appendix B
April 30, 2013	Approved the Chelan PUD 2012 Annual Hatchery M&E Report	Hatchery	Appendix B
May 1, 2013	Approved the spring Chinook Pilot Trapping Study at Rocky Reach	Coordinating	Appendix A
June 3, 2013	Approved the Chelan PUD Methow Spring Chinook Hatchery and Genetic Management Plan (HGMP) Addendum via email	Hatchery	Appendix B
June 13, 2013	Approved a contract extension for Trout Unlimited's *Chewuch River Instream Passage Project*	Tributary	Appendix C
June 13, 2013	Approved a cost increase for Chelan-Douglas Land Trust's *Nason Creek Lower White Pine Alcove Acquisition Project*	Tributary	Appendix C

Date	Agreement	HCP Committee	Reference
June 19, 2013	Agreed to a shortened 14-day review period for Chelan PUD's full Methow Spring Chinook HGMP	Hatchery	Appendix B
June 19, 2013	Agreed with Washington Department of Fish and Wildlife's (WDFW's) request to begin Wenatchee spring Chinook broodstock collection for the Nason Creek and Chiwawa River programs of up to 136 natural origin spring Chinook adults at Tumwater Dam, contingent on National Marine Fisheries Service (NMFS) approval for transport back to the river of adults not assigning to either Nason Creek or Chiwawa River	Hatchery	Appendix B
June 19, 2013	NMFS approved via email, transport back to the river of Wenatchee spring Chinook adults collected for the Nason Creek and Chiwawa River programs not assigning to either Nason Creek or Chiwawa River	Hatchery	Appendix B
June 25, 2013	Approved the SOA maintaining Rock Island and Rocky Reach Subyearling Chinook in Phase III (Additional Juvenile Studies) for 3 years	Coordinating	Appendix A and Appendix E
June 25, 2013	Agreed to review the Phase III (Additional Juvenile Studies) designation for subyearling Chinook under the Wells, Rocky Reach, and Rock Island Hydroelectric Projects HCPs in January 2015	Coordinating	Appendix A
July 17, 2013	Agreed to Chelan PUD's proposed schedule to provide their draft 2014 Hatchery M&E Implementation Plan for Hatchery Committees review as early as September 2013, and no later than October 2013	Hatchery	Appendix B
July 17, 2013	Agreed to the Yakama Nation's (YN's) request to continue planning for co-acclimation of Chelan PUD's Methow spring Chinook production with the YN coho salmon production at the Chewuch Pond in 2015	Hatchery	Appendix B
July 23, 2013	Agreed to include data from the month of June in the summer study period in the updated flow duration curves for valid survival studies	Coordinating	Appendix A
August 15, 2013	Approved funding for CCFEG's *Silver Side Channel Design Project*	Tributary	Appendix C
August 15, 2013	Approved funding for Chelan-Douglas Land Trust's *Entiat Stillwaters Gray Reach Acquisitions*	Tributary	Appendix C

Date	Agreement	HCP Committee	Reference
August 15, 2013	Approved funding for Okanogan Conservation District's *Similkameen RM 3.8 Habitat Design Project*	Tributary	Appendix C
August 21, 2013	Agreed that Greg Mackey would develop draft tables for inclusion in the Hatchery M&E Plan Appendices, for Hatchery Committee review	Hatchery	Appendix B
August 27, 2013	Agreed to extend the 2013/2014 winter maintenance work period at Rocky Reach Dam by one month; rather than beginning January 2, 2014, the new start will be December 2, 2013, to allow more time to complete required work	Coordinating	Appendix A
September 12, 2013	Approved a time extension for ONA's *Shingle Creek Fish Passage Project*	Tributary	Appendix C
September 12, 2013	Approved funding the entire project for CCFEG's *Silver Side Channel Design Project*	Tributary	Appendix C
September 12, 2013	Approved funding the entire project for Okanogan Conservation District's *Similkameen RM 3.8 Design Project*	Tributary	Appendix C
September 24, 2013	Chelan PUD agreed to extend fish counts at Rocky Reach Dam into the "off-season" winter months in 2014/2015	Coordinating	Appendix A
September 24, 2013	Agreed to hold the Coordinating Committees meeting on October 22, 2013, by conference call	Coordinating	Appendix A
September 24, 2013	Agreed to reschedule the Coordinating Committees meeting on November 26, 2013, to November 19, 2013, which will be held in person at the Radisson Hotel in SeaTac, Washington	Coordinating	Appendix A
September 24, 2013	Agreed to reschedule the Coordinating Committees meeting on December 24, 2013, to December 17, 2013, which will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined	Coordinating	Appendix A
October 16, 2013	Agreed to a Chelan PUD request for 3,500 summer Chinook salmon eggs (from those destined for final acclimation and release at the Chelan Falls Acclimation Facility) for use in an egg-fry survival study in the Chelan River Tailrace and habitat channel	Hatchery	Appendix B
October 16, 2013	Agreed to Chelan PUD's request for a shortened review period for their draft 2014 Hatchery M&E Implementation Plan, in order to assist Chelan PUD in meeting their contracting deadlines	Hatchery	Appendix B

Date	Agreement	HCP Committee	Reference
October 22, 2013	Approved the Rock Island and Rocky Reach 2013 Fish Spill Report, as revised	Coordinating	Appendix A
October 22, 2013	Chelan PUD agreed to incorporate a graphic for Rock Island spring spill in future Rock Island and Rocky Reach Fish Spill Reports	Coordinating	Appendix A
November 6, 2013	Agreed to continue discussions about fish marking at the Hatchery Committees meeting on November 20, 2013, including developing a timeline and outlining what needs to be done in terms of developing a marking strategy	Hatchery	Appendix B
November 20, 2013	Approved the Chewuch Acclimation Plan SOA, as revised	Hatchery	Appendix B and Appendix F
November 20, 2013	Approved the Chelan PUD 2014 Hatchery M&E Implementation Plan, as revised	Hatchery	Appendix B
November 20, 2013	Agreed to continue discussions on fish marking schemes after the Joint Fisheries Parties (JFP) develop a document summarizing the current status of marking for each program	Hatchery	Appendix B
December 18, 2013	Approved the sacrifice of 375 Chelan PUD Chiwawa spring Chinook juveniles for Grant PUD's White River Size Target Study	Hatchery	Appendix B

2.1 Project Survival and Dam Operations

2.1.1 Status of Phase Designations for Current Plan Species

A major feature of the Rocky Reach HCP is what is termed "a phased implementation of measures to achieve the survival standards." Briefly, Phase I consists of a 3-year period in which studies are conducted to determine annual survival rates for each of the Plan Species. Following the completion of three years of valid studies, the Rocky Reach HCP Coordinating Committee will determine whether the survival standard has been achieved. Depending on the results of this determination, Chelan PUD will proceed to either Phase II or Phase III. Under Phase II, the Rocky Reach HCP Coordinating Committee may determine that the standards are not met, and that Chelan PUD is responsible for evaluating additional tools to improve survival. Under Phase III, the Rocky Reach HCP Coordinating Committee may determine that the survival standards are achieved, and that Chelan PUD is required to re-evaluate survival every 10 years, or that Phase III and NNI compensation is in place, but additional juvenile studies remain

Current phase designations for all Rocky Reach HCP Plan Species are summarized in Table 3.

Table 3
Current Phase Designations for Rocky Reach HCP

Plan Species	Project Survival (percent)	Phase Designation	SOA Date
UCR steelhead	95.79[1]	Phase III (Standards Achieved)	October 24, 2006
UCR yearling Chinook	92.28[2]	Phase III (Standards Achieved)	August 30, 2011
UCR subyearling summer/fall Chinook	TBD	Phase III (Additional Juvenile Studies)	June 25, 2013
Okanogan River sockeye	93.59[1]	Phase III (Standards Achieved)	December 17, 2010
Coho	NA	Phase III (Standards Achieved – Interim Value)	June 20, 2007

Notes:
1. Juvenile project survival achieved (HCP standard is 93%)
2. Combined adult and juvenile survival achieved (HCP standard is 91%)

TBD = To be determined
NA = Not applicable

In 2010, the Coordinating Committees approved a Chelan PUD request to restart passage survival testing of UCR yearling Chinook salmon at the Rocky Reach Project, starting with the year 2011. In 2011, the estimated juvenile yearling Chinook project survival was 92.94%. In 2011, Chelan PUD also presented to the Coordinating Committees passive integrated transponder (PIT) tag data in support of an empirically based estimate of adult spring Chinook project passage survival for the Rocky Reach Project (dam and reservoir). As described in Section 2.1.2 of this report, Section 5.2 of the Rocky Reach HCP states that a combined adult and juvenile project survival of 91% shall be achieved and maintained. Due to an inability to differentiate hydro-related mortality from natural adult losses and straying rates when the HCP was developed, 93% juvenile project survival and 95% juvenile dam passage survival standards were used as alternative measures of initial compliance. Using PIT tag data, the 3-year (2009 to 2011) average adult spring Chinook passage survival rate at Rocky Reach was estimated to be 99.90%. Combined with a 4-year average (2004, 2005, 2010, and 2011) Rocky Reach Project yearling spring Chinook passage survival estimate of 92.37%, the combined adult and juvenile survival was estimated to be 92.28%, which exceeds the HCP combined survival standard of 91%. On August 30, 2011, a Phase III (Standards Achieved) designation for UCR spring Chinook for the Rocky Reach Project was approved by the Rocky Reach Coordinating Committee.

No new or additional project survival studies were conducted in 2012 for the Rocky Reach Project.

In April 2013, information was reviewed on the status of tag technology and life-history attributes of subyearling summer Chinook in the Mid-Columbia. Based on this information and review, the Rocky Reach Coordinating Committee agreed that empirical estimates of juvenile project survival are not currently feasible; and as a result, on June 25, 2013, the Rocky Reach Coordinating Committee approved an SOA maintaining subyearling summer Chinook in Phase III (Additional Juvenile Studies) for up to three years (June 2016; Appendix E). The SOA stipulated additional assessments of improvements in tag technology and study methods to evaluate survival study feasibility by 2016. The first annual assessment will take place in January 2015 (see the Coordinating Committees' June 25, 2013 meeting minutes [Appendix A]).

2.1.2 Assessment of Project Survival

The HCP requires that Chelan PUD shall work toward 91% combined adult and juvenile project survival at Rocky Reach Dam, achieved by project improvement measures implemented within the geographic area of the project. Progress toward this objective is described in the following sections.

2.1.2.1 Adult Passage Monitoring

2.1.2.1.1 Rocky Reach Project

When the HCP was signed in 2002, it was acknowledged that there was no scientifically rigorous method for the Rocky Reach HCP Coordinating Committee to assess adult project passage survival for Plan Species. Existing methods did not differentiate between mortality caused by the project and other sources of mortality (such as mortality from natural causes, injuries and delayed mortality resulting from passage at downstream projects and marine mammal predation, harvest, or other types of non-project-specific mortality). Section 5.2 of the HCP states that given the inability to differentiate between the sources of adult mortality, initial compliance with the combined adult and juvenile survival standard would be based on the measurement of 93% juvenile project survival or 95% juvenile dam passage survival, and an adult survival estimate of 98 to 100%.

Beginning in December 2012, Chelan PUD was able to evaluate adult passage survival through the Rocky Reach Project (dam and reservoir) for steelhead and sockeye, even though unknown harvest mortality remained in the survival estimates. PIT tag detections from the PIT Tag Information System (PTAGIS) database were used to evaluate adult fish migrating upstream in 2010, 2011, and 2012 to estimate project conversion rates. For steelhead, adult fish destined for the Methow and Okanogan River systems were used for the survival evaluation. For sockeye, adults returning to the Okanogan River Basin were evaluated. The 3-year arithmetic mean survival rates at Rocky Reach Project for adult steelhead and sockeye were 98.93% and 98.92%, respectively (Table 4). A year prior in 2011, Chelan PUD estimated the 3-year mean survival rates for adult spring Chinook migrating through the Rocky Reach Project. This survival estimate was 99.90% for migration years 2009 through 2011. Chelan PUD will re-evaluate adult passage survival at Rocky Reach in 10-year intervals, as required.

Table 4 details HCP juvenile, adult, and combined survival rates at the Rock Island and Rocky Reach projects. Adult conversion rates were calculated from adult passage data for the years 2010 through 2012 (Buchanan and Skalski, University of Washington, 2012).

Table 4
HCP Juvenile, Adult, and Combined Survival Rates at Rock Island and Rocky Reach

Project	Species	Juvenile Survival	Adult Survival	Combined [5]
Rock Island	Steelhead	96.75%	99.31% [2]	96.08%
	Spring Chinook	93.75% [1]	99.89% [3]	93.65%
	Sockeye	93.27%	98.37% [2]	91.75%
Rocky Reach	Steelhead	95.79%	98.93% [2]	94.77%
	Spring Chinook	92.37% [1]	99.90% [3]	92.28%
	Sockeye	93.59%	98.92% [4]	92.58%

1. Spring-migrating yearling Chinook.
2. Estimate does not account for fish losses due to recreational harvest in any years
3. No recreational harvest occurred.
4. Estimate adjusted for fish losses from recreational harvest in 2010 and 2011, but not for harvest losses in 2012.
5. Combined survival is the product of juvenile and adult survival estimates (e.g., 98% × 93% = 91%).

The HCP combined adult and juvenile project survival standard is 91%. The HCP combined adult and juvenile project survival estimates apply to fish actively migrating through the Rock Island and Rocky Reach projects in the mainstem Columbia River and do not include mortality occurring in other locations (i.e., they do not include ocean or tributary mortality).

2.1.2.1.2 Rocky Reach Trap Pilot Study

In March 2013, Chelan PUD proposed a pilot study to test the feasibility of using the Rocky Reach Trap for broodstock collection for Chelan PUD's Methow spring Chinook program. The purpose of the study was to test the feasibility of visually identifying and selectively collecting adipose (ad)-clipped spring Chinook. In May 2013, following a tour of the trapping facility, the Coordinating Committee approved the spring Chinook Pilot Trapping Study at Rocky Reach (Appendix R). Additional discussion of the pilot can be found in section 2.2.2.15 of this report.

2.1.2.2 Valid Study Flow Duration Curve Update

The Rocky Reach HCP, Section 13.24, requires that as part of the 2013 comprehensive review, and every 10 years thereafter, the Coordinating Committee shall update the spring and summer period Flow Duration Curves used to define valid survival studies. The updated

Flow Duration Curves must reflect "Representative Flow Conditions," meaning river flows between the 10th and 90th percentiles on the Flow Duration Curve, as calculated from the Grand Coulee Dam day average outflow. In March 2013, efforts began to update the flow duration curve, as required by the Rocky Reach HCP. The Coordinating Committees agreed to develop the updated Flow Duration Curve with the historical 1929-1978 and 1983-2001 data sets used previously, to which the new 2002-2012 dataset is added. For comparison, Flow Duration Curves were also constructed using only the 1983-2012 dataset. The Coordinating Committees also agreed to revise the definition and expand the dataset used for the "summer period," to include data from June 1 through August 15, as opposed to the former definition of July 1 through August 15 for the summer period. Efforts to update the Flow Duration Curves are underway, and are expected to materialize in early 2014.

2.1.2.3 2013 Survival Studies

2.1.2.3.1 Yearling Chinook Salmon

No yearling Chinook survival studies were conducted in 2013 at the Rocky Reach Project.

2.1.2.3.2 Subyearling Chinook Salmon

Since 2010, Chelan PUD has been compiling information on PIT tag detections of subyearling Chinook salmon at Rocky Reach Dam to further the understanding of subyearling life histories in the mainstem Columbia River upstream of Rocky Reach Dam. As discussed in Section 2.1.1 above, in April 2013, data were presented regarding the status of tag technology and life-history attributes for subyearling summer Chinook in the Mid-Columbia. The Rocky Reach Coordinating Committee agreed that, based on this information, an empirical estimate of subyearling project passage survival is not currently feasible. In June 2013, the Rocky Reach Coordinating Committee approved an SOA maintaining subyearling summer Chinook in Phase III (Additional Juvenile Studies) for up to 3 years (June 2016; Appendix E), and agreed to conduct annual assessments of improvements in tag technology and study design to evaluate survival study feasibility by 2016.

2.1.2.4 2014 Planned Survival Studies

There are no planned Rocky Reach juvenile salmonid project survival studies for 2014. Chelan PUD has achieved a Phase III (Standards Achieved) designation for yearling Chinook, sockeye, and steelhead at the Rocky Reach Project (Section 2.1.1). Subyearling Chinook project survival status is pending development of suitable technology, and is currently designated Phase III (Additional Juvenile Studies). The Rocky Reach Coordinating Committee agreed to annually assess improvements in tag technology and study design to evaluate subyearling Chinook survival study feasibility (Section 2.1.1). All designations will be re-evaluated at 10-year intervals, as required.

2.1.3 Project Operations and Improvements

This section summarizes project operations and progress toward maintaining the juvenile project survival standard at Rocky Reach Dam in 2013. Actions in 2013 were guided by the 2013 Chelan PUD HCP Action Plan (Appendix H), as approved by the Coordinating Committees (Appendix A).

2.1.3.1 Operations

2.1.3.1.1 Juvenile Bypass and Fish Spill Operations[3]

In March 2013, the Coordinating Committees approved the 2013 Rocky Reach Fish Bypass Operations Plan (Appendix I) and the 2013 Rocky Reach and Rock Island Fish Spill Plan (Appendix J). The juvenile bypass system operated continuously from April 1, 2013, through August 31, 2013, during the outmigration of juvenile salmon and steelhead at Rocky Reach. The target level for summer spill was 9% of the daily average river flow. Spill for summer-migrating subyearling Chinook at Rocky Reach Dam began on June 5, 2013, at 0001 hours, and continued through midnight on August 21, 2013. Following completion of the bypass operations on August 31, 2013, it was estimated that spill was provided for 97.81% of the subyearling Chinook outmigration. Spill volume for the 78-day summer period averaged 11.73% of the total river flow, and was composed of 9% fish spill and an additional 2.74% unavoidable hydraulic spill. The Columbia River flows past Rocky Reach Dam during the

[3] 129 FERC ¶ 62,183 (issued December 8, 2009). Order Modifying and Approving Operations Plan Pursuant To License Article 402.

spill period averaged 153,805 cubic feet per second (cfs) and the daily average spill rate was 18,044 cfs. Complete Rocky Reach Dam 2013 fish spill operations results are summarized in the 2013 Rocky Reach and Rock Island Fish Spill Report as attached to the Coordinating Committees' October 22, 2013 meeting minutes (Appendix A).

2.1.3.1.2 Pikeminnow Predator Control

In 2013, northern pikeminnow predator control work continued with Columbia Research long-line angling during the pre-migration period to target large pikeminnow staging in deep reservoir areas that are difficult to capture with other gear types; the contract was extended to overlap with the 2013 USDA effort. The USDA hook-and-line angling program commenced during the peak of juvenile salmonid migration. The total combined harvest of pikeminnow in 2013 from Rocky Reach and Rock Island reservoirs was 80,552 fish. Harvest numbers from the various control efforts in 2013 were as follows: USDA hook-and-line angling—47,563 fish; Columbia Research long-line angling —29,310 fish; East Wenatchee Rotary Club pikeminnow derby—2,944 fish; angling by Chelan PUD Fish and Wildlife personnel—735 fish. Chelan PUD once again provided contract funding for the annual East Wenatchee Rotary Club Pikeminnow Derby in 2013. A report summarizing results of the 2013 removal effort is expected sometime in early 2014. In April 2013, the HCP Coordinating Committees approved the Chelan PUD 2012 Pikeminnow Control Report (Appendix K).

2.1.3.1.3 Total Dissolved Gas Testing at Rocky Reach Dam

Under the Clean Water Act 401 Water Quality Certification of the Rocky Reach FERC License, Chelan PUD is required to implement alternative spillway operations to determine whether total dissolved gas (TDG) levels can be reduced. In 2011, Chelan PUD conducted an informal test of spillway operations not previously tested under the high-flow conditions to evaluate the effectiveness of alternative operations using gates 2 through 12, to determine whether TDG levels could be reduced without adverse effects on adult fish passage. In June 2012, the same four spill configurations were again tested at Rocky Reach to collect additional data on how tailrace TDG levels respond to different spill gate patterns. Testing was conducted 24 hours a day, every day, from June 18, 2012, until July 30, 2012. During this time, fish passage counts were monitored daily, using PIT tag data, to see if passage trends showed any obvious time differences for the three test patterns compared with the "normal spill" pattern. Results from the 2011 testing were combined with 2012 data to determine if there is a statistical difference in the gate patterns. Washington State Department of Ecology (Ecology) is currently reviewing the draft report.

2.1.3.2 Improvements and Maintenance

Facility improvements and maintenance at the Rocky Reach Project in 2013 that had the potential to affect Plan Species are described in this section.

Late winter 2012/early winter 2013 annual maintenance of the Rocky Reach fishways was completed and the ladders were fully operational by the deadline of March 1, 2013. In addition to the planned maintenance, a missing gasket was repaired on the flap gate indicator rod, which is associated with the attraction water pumps for the adult fishway.

In April 2013, Turbine Unit 1 (C1) at Rocky Reach Dam was placed back online after being taken offline during the 2012/2013 maintenance period for mandatory rotor crack repair. While C1 was offline, the Rocky Reach Juvenile Fish Bypass (RRJFB) Surface Collector (SC) used additional SC pumps to increase attraction flow, and Turbine Unit 2 (C2) flow was increased. No issues of fish de-scale or injury were observed in juvenile fish samples at the bypass with this adjusted configuration, which ran for a total of 22 days, from April 1, 2013, through April 22, 2013.

In March 2013, Turbine Unit 10 (C10) was taken offline due to internal hydraulic issues that caused an adjustment of the blade. In August 2013, Turbine Unit 5 (C5) was taken offline for transformer repair, and then Turbine Unit 6 (C6) was also taken offline for rotor repair. Maintenance and repairs were completed on C5 and C6, and both units returned to service in December 2013 and December 2013, respectively. In October 2013, while repairing C10, mechanic crews discovered a deep hairline crack in a stainless steel rod that delivers oil to the servo motor. Turbine Unit 8 (C8), Turbine Unit 9 (C9), and Turbine Unit 11 (C11) all have the same stainless steel rod design as part of the servo motors; therefore, Rocky Reach engineers made the decision to take C8, C9, and C11 out of service for repair, as well. Interim fixes are scheduled to be installed on C8, C9, C10, and C11 during the 2013/2014 annual maintenance period; permanent fixes are anticipated to require six months per unit, and should be complete by fall 2018.

The Coordinating Committees approved an earlier-than-usual start time for the 2013/2014 annual maintenance to allow more time to complete needed work; however, in November 2013, Chelan PUD reported that winter maintenance at Rocky Reach Dam will start at the usual start date of January 2. Rocky Reach fishway maintenance work scheduled for the 2013/2014 maintenance period includes completing the rotor repair in C6 and installing interim fixes on C8, C9, C10, and C11. The interim fix will involve fixing the blades at selected steep angles that were determined to be the most efficient at full river flow (23,000 cubic feet per second [23 kcfs]) on the unit curve; these steep angles also represent the safest position, minimizing cavitation and minimizing the risk of turbine runaway. Repairs on C8, C9, and C11 are expected to be complete by April 2014, and C10 is expected to be repaired and back online by August 2014. Mandatory rotor crack repair on C2 was originally planned for the 2013/2014 maintenance period; however, due to the unforeseen C8, C9, C10, and C11 outages, the C2 outage has been postponed to July 2014.

2.2 Hatchery Compensation

Section 8.1 of the Rocky Reach HCP describes a Hatchery Compensation Plan with two primary objectives: 1) to provide compensation for Plan Species; and 2) to implement specific elements of the hatchery program consistent with the overall objectives of rebuilding natural populations and achieving NNI. In 2013, Chelan PUD continued funding and providing capacity for hatchery production consistent with meeting NNI, and will continue to do so through 2014. Recalculated hatchery production values required to meet NNI for the next 10 years (2014 through 2023) were approved by the Rocky Reach Hatchery Committee on December 14, 2011, and represent "*Chelan PUD's No Net Impact and Inundation obligations for release years 2014-2023*." Hatchery compensation for Rocky Reach Project in 2013 included the release of 1,808,607 juvenile salmonids, consisting of 964,807fish from smolt production and 843,800 sockeye fry from Shuswap River Hatchery (combined Rocky Reach and Rock Island hatchery compensation—see Table 5).

To improve coordination, a representative from Grant PUD is invited to the monthly Hatchery Committees meetings. In addition, the Grant PUD representative and the Priest Rapids Coordinating Committees (PRCC) Hatchery Subcommittee facilitator receive meeting announcements, draft agendas, and meeting minutes. This practice benefits the Hatchery Committees through increased coordination and sharing of expertise. The Grant PUD representative has no voting authority.

2.2.1 Hatchery Production Summary

Table 5 summarizes and compares HCP hatchery production objectives and actual 2013 smolt releases.

Table 5
2013 Production Level Objectives and Smolt Releases for Rocky Reach HCP Hatchery Programs

Species	Program	Final Rearing Site	Rocky Reach Production Level Objectives (2004 to 2013)	Total Smolt Releases for Rocky Reach in 2013 (Number of fish)
Spring Chinook	Methow	Methow Hatchery	144,000[1]	133,003
Summer Chinook	Chelan Falls	Chelan Falls	600,000	582,460
Steelhead	Wenatchee	Chiwawa Hatchery[2]	247,300[3]	249,344
Sockeye	Okanogan	Shuswap Hatchery	291,040[4]	843,800[5]

Notes:
1. Combined with the Rocky Reach HCP, Wells HCP, and Grant PUD Biological Opinion production obligation, the spring Chinook production at the Methow Fish Hatchery totals 480,737 smolts.
2. Includes releases from Blackbird Island Pond.
3. Steelhead production at Chiwawa includes both Rock Island and Rocky Reach obligations.
4. Combined with the Rocky Reach HCP, the Okanogan sockeye production requirement totals 591,040 fish (production is allocated between the two HCPs); the table includes the number of fry released. By agreement of the HCP Hatchery Committees, this production requirement is satisfied for Okanogan sockeye by funding of the Okanogan Skaha Lake sockeye reintroduction program until otherwise determined by the HCP Hatchery Committees.
5. The total number of fry released by the Skaha Lake Program was 843,800 in 2013 (including Grant PUD's production).

*Coho mitigation met by the Funding Agreement with the Yakama Nation.

2.2.2 Hatchery Planning

The following sections detail 2013 actions that are relevant to planning for hatchery operations that support the HCP.

2.2.2.1 2013 Broodstock Collection Protocols

In March 2013, the Hatchery Committees began their review of the draft 2013 Broodstock Collection Protocols (for Chinook and steelhead). The protocols were updated throughout the year and finalized in November 2013 and implemented at program hatcheries (Appendix L); in-season revisions were made as needed in coordination with the Hatchery Committees. As agreed by the Hatchery Committees, a provision was added to the 2013 protocols which stipulated that in the event that Carson Hatchery ancestry is detected in natural origin fish collected for broodstock, those fish will be retained and used for broodstock. The 2013 Broodstock Collection Protocols were intended to guide the collection of salmon and steelhead broodstock in the Methow River, Wenatchee River, and Columbia River basins. The protocols are consistent with previously defined program objectives such as program operational intent (i.e., conservation and/or harvest augmentation) and mitigation production levels (HCPs, Priest Rapids Dam 2008 Biological Opinion), and they comply with ESA permit provisions.

2.2.2.2 2014 to 2023 NNI Production Levels

The Rocky Reach HCP, Section 8.4.3, specifies that hatchery production levels, except for original inundation mitigation, will be adjusted in 2013 and every 10 years thereafter to achieve and maintain NNI. In September 2010, the process to recalculate hatchery production was initiated by the HCP Hatchery Committees. After approving a method for recalculating hatchery production on July 20, 2011, and approving as final a database containing the numeric inputs for use in the recalculation efforts on August 17, 2011, the Hatchery Committees approved recalculated hatchery production for Chelan PUD's NNI supplementation programs for release years 2014 through 2023 on December 14, 2011. In 2013, the recalculated hatchery production levels were implemented with broodstock collection, as required.

2.2.2.3 HCP Comprehensive Progress Report (NNI Check-in Report)

In late 2012, Chelan PUD distributed their draft 2013 HCP Comprehensive Progress Report for review. This report documents 10 years of successful collaboration and accomplishments towards achieving NNI for Plan Species by the HCPs' signatory parties. In February 2013, the Chelan PUD 2013 HCP Comprehensive Progress Report was finalized (Appendix G), and the SOA approving the final report was approved by the Rocky Reach Coordinating Committee (Appendix E).

2.2.2.4 Wenatchee Steelhead Acclimation and Release Plan

In March 2013, Chelan PUD and WDFW developed a 2013 Wenatchee River Basin Steelhead Release Strategy to begin evaluating possible explanations for low survival in 2012 and to improve survival in future years. This evaluation is based on analyses of post-release survival rates of Wenatchee steelhead which indicated unprecedentedly low post-release survival rates of steelhead smolts migrating from the Chiwawa River, Nason Creek, and Wenatchee River in 2012, based on PIT tag detections at McNary Dam. The strategy is to compare the estimated survival to McNary Dam of force-released fish with those of volitionally released fish, sorted by PIT tags, and raised in either circular tanks or raceways. The volitional group in 2013 would also be released earlier than in 2012 in order to evaluate whether survival improves with an earlier release date. Study results will be available in 2014 and will be used to inform and develop the 2014 release strategy.

2.2.2.5 M&E Plan Implementation

Since 2006, Chelan PUD hatchery programs have been operated in accordance with three documents: 1) the Hatchery M&E Plan, titled *Conceptual Approach to Monitoring and Evaluating the Chelan County PUD Hatchery Programs*, originally developed in 2005; 2) the Hatchery M&E Analytical Framework, titled *Analytical Framework for Monitoring and Evaluating PUD Hatchery Programs*, prepared in 2006 and updated in 2007, which identifies the analytical strategies and methods for the M&E Program; and 3) the Chelan PUD Hatchery M&E Implementation Plan, titled *Chelan County PUD Hatchery M&E Work Plan*, prepared annually to describe the M&E activities for the next calendar year and anticipate adaptive management modifications of the plan as necessary in future years. The Chelan PUD 2013 Hatchery M&E Implementation Plan was finalized in January 2013, following a

30-day Hatchery Committees review period, and was appended to the 2012 Rocky Reach HCP Annual Report.

The Rocky Reach HCP, Section 8.5.1, requires updates to the Hatchery M&E Plan every five years. In April 2012, the HCP Hatchery Committees began the process of updating the Hatchery M&E Plan capitalizing on the lessons learned during the first five years of Hatchery M&E Plan implementation; and in June 2012, a Hatchery M&E Workgroup was established to review and recommend revisions to the Hatchery M&E Plan. In August 2012, the HCP Hatchery Committees agreed to defer implementation of the fully revised Hatchery M&E Program until 2014, and agreed to implement the existing M&E programs with minor updates in 2013. This revised schedule was intended to align new permit deadlines with the proposed date for the new M&E programs, and also would allow more time for a thorough review of the existing programs and for development of M&E updates.

In January 2013, while updating the Hatchery M&E Plan, for simplicity, the HCP Hatchery Committees agreed to consolidate the Hatchery M&E Plan and the Hatchery M&E Analytical Framework into a single document, simply referred to as the Hatchery M&E Plan. In April 2013, after several meetings of the Hatchery M&E Workgroup and months of revisions and review, the Rocky Reach HCP Hatchery Committee approved the 5-year update of the Hatchery M&E Plan, titled *Monitoring and Evaluation for PUD Hatchery Programs: 2013 Update*, with the caveat that any future appendices for the plan will require HCP Hatchery Committee approval (Appendix M and F). The Hatchery M&E Plan Appendices are still under development. A small workgroup plans to meet in early 2014 to further discuss the development of the appendices, including incorporating information on carrying capacity estimates.

In November 2013, the Chelan PUD 2014 Hatchery M&E Implementation Plan (Appendix N) was finalized (except for the sockeye component which was outstanding) following an approved shortened HCP Hatchery Committees review period. In December 2013, a draft sockeye addendum was distributed for review, and is expected to be approved in early 2014. The Chelan PUD 2012 Hatchery M&E Plan Report, titled *Monitoring and Evaluation of the Chelan County PUD Hatchery Programs,* that documented M&E activities in 2012

(Appendix O) was approved in April 2013. A similar report will be completed in 2014 for 2013 M&E activities of natural production and hatchery operations.

2.2.2.6 Okanogan Sockeye Mitigation

In 2013, Chelan PUD provided an eighth year of funding for a portion of the Skaha Lake Sockeye Salmon Reintroduction Program (current Rocky Reach obligation for Okanogan sockeye salmon mitigation is 591,040 smolts for Rocky Reach and Rock Island HCPs combined). The Shuswap River Hatchery compensation included the release of 843,800 sockeye fry into the Okanogan River. Funding in 2013 also included the continued design and development of the new Kl cp'elk' stim Fish Hatchery in Penticton, British Columbia. In August 2013, construction began and the facility is scheduled to be available to receive sockeye eggs and milt in fall 2014.

2.2.2.7 HGMPs

Chiwawa Spring Chinook

In October 2009, Chelan PUD submitted their Chiwawa Spring Chinook Hatchery and Genetic Management Plan (HGMP) to NMFS. In 2012, NMFS continued their review of the Chiwawa spring Chinook program HGMP; and in late 2012, draft terms and conditions were developed. In early 2013, NMFS elected to combine into one Biological Opinion (BiOp) all Wenatchee Basin spring Chinook programs consisting of the Chiwawa River, Nason Creek (Grant PUD), and White River (Grant PUD) spring Chinook programs. On July 3, 2013, NMFS issued a new Permit No. 18121 jointly to WDFW, Chelan PUD, and the Yakama Nation (as an authorized agent of Chelan PUD) for operation of the Chiwawa spring Chinook hatchery program.

On November 28, 2012, NMFS requested formal consultation with USFWS under section 7(a)(2) of the ESA on the proposed permitting of the Chiwawa spring Chinook and Wenatchee steelhead programs. Several coordination meetings were held throughout 2013 between Chelan PUD, NMFS, and USFWS. Consultation is ongoing and a BiOp is expected to be issued by USFWS in 2014.

Wenatchee Steelhead

In October 2009, Chelan PUD submitted their Wenatchee Steelhead HGMP to NMFS. In 2012, NMFS began their review of the Wenatchee Steelhead program HGMP; and in late 2012, draft terms and conditions were developed. In June 2013, the existing National Environmental Policy Act documentation was determined sufficient for Wenatchee steelhead; however, the Wenatchee steelhead BiOp was put on hold pending the completion of the spring Chinook BiOp. In August 2013, NMFS alerted the Hatchery Committees that the new permits would not be complete by the expiration of the current permits. Subsequently, on September 20, 2013, Chelan PUD received a letter from NMFS indicating that the existing ESA permits would be extended during consultation, until consultations are complete and a determination made on the new permits. In December 2013, NMFS indicated that Joint Fisheries Parties (JFP) approval of a Fisheries Harvest Plan, a critical component of the BiOp, was still pending, but permitting is expected to be complete in 2014.

Methow Spring Chinook

In June 2013, NMFS requested that Chelan PUD prepare a full Methow Spring Chinook HGMP, despite formerly indicating that the Hatchery Committee-approved addendum (Appendix P) would be acceptable for the program. In December 2013, the draft Chelan PUD Methow Spring Chinook HGMP was distributed for review. Hatchery Committees approval of the HGMP is anticipated in February 2014.

Wenatchee Summer Chinook

In May 2013, NMFS requested that Chelan PUD and other Permit No. 1347 permit holders submit letter applications for extension of permit 1347. NMFS indicated that a 10-year extension of the existing Permit No. 1347 was feasible. Chelan PUD submitted an extension request letter on August 27, 2013. Subsequently, on September 20, 2013, Chelan PUD received a letter from NMFS indicating that the existing ESA permits would be extended during consultation, until consultations are complete and a determination made on the new permits.

2.2.2.8 Objective 10 of the Hatchery M&E Plan—Non-target Taxa of Concern

In 2012, the Hatchery Evaluation Technical Team (HETT) began preliminary runs of a risk assessment model using the recalculated production numbers. By November 2013, all models had been run and those data were entered in a database. While running the models, a coding issue was discovered and it was determined that fixing the program could not be done easily. In the interest of finalizing the Non-Target Taxa of Concern (NTTOC) study, the HCP Hatchery Committees agreed to move forward and develop a report that summarizes the results, and also acknowledges the limitations of the existing model. This report is expected to be available in early 2014. At that time, the Hatchery Committees will determine any next steps.

2.2.2.9 Steelhead Reproductive Success Study

The Rocky Reach HCP, Section 8.5.3, requires that Chelan PUD fund and implement a steelhead reproductive success study (RSS). The RSS began in 2008 and has incorporated data from each subsequent brood year, to date. A final report summarizing the findings of the study will be available at the end of 2014.

2.2.2.10 Wenatchee Steelhead Hatchery, Wild Spawn Timing, and Spawner Distribution Activities

In 2010 Chelan PUD funded a study on the distribution and spawn-timing of hatchery and wild steelhead in the Wenatchee and Methow Subbasins; WDFW is conducting the study. All steelhead trapped at Priest Rapids Dam were PIT tagged, with females also receiving Floy tags. During subsequent spawning ground surveys, the numbers of redds, redd locations, and tagged fish were recorded. Results of the study in 2010 indicated that both Wenatchee and Methow Basin hatchery and wild steelhead spawned in the same general locations. In 2011, WDFW continued the study, with improved tagging methods as indicated by the 2010 results; the frequency of the surveys was increased to twice per week. The 2012 draft report summarizing 2011 results will be available in early 2013.

2.2.2.11 Dryden Overwintering Feasibility Study/Wenatchee River TMDL

In 2012, Chelan PUD began evaluating the feasibility of converting the Dryden facility to a permanent overwintering facility for the purpose of accommodating Grant County PUD's production obligations, which require overwinter acclimation. Overwintering was proposed by the JFP as an alternative acclimation method to improve smolt-to-adult returns (SARs) and to reduce straying for Grant PUD's summer Chinook programs. In conjunction with these discussions, Chelan PUD has been evaluating ways to meet Ecology's addendum to the Wenatchee River Total Maximum Daily Load (TMDL), which establishes a modified phosphorus target not to exceed 743 micrograms per liter for the entire Wenatchee River and also a point discharge limit for the Dryden Facility. Facilities must be compliant with the TMDL in 2018.

In July 2012, after discussions and presentation of data to the Hatchery Committees, Chelan PUD proposed a path forward to ensure that summer Chinook production and infrastructure at the Dryden facility would comply with the Wenatchee River TMDL for phosphorus. In April 2013, Chelan PUD updated the Hatchery Committees on the progress made on Chelan PUD's plan for meeting Dryden TMDL compliance and conducting the feasibility on Dryden Pond. Three of five planned actions are underway, while the remaining two planned actions are scheduled to start in 2014. This proposed path forward would result in a decision in 2015 on how to meet the Wenatchee River TMDL and whether or not it is feasible to convert Dryden to an overwinter facility.

2.2.2.12 Chelan Falls Brood Collection

In 2012, Chelan PUD and WDFW conducted a Chelan Falls summer Chinook salmon pilot broodstock collection study designed to investigate alternate broodstock collection locations for returning Chelan River summer/fall Chinook to use as brood for Chelan Falls summer Chinook production. The study's purposes were: 1) to determine if adult summer Chinook salmon could be captured in the vicinity of the Chelan River; 2) to determine which stocks are returning to the area; and 3) to determine the best methods for capture. Concurrently, WDFW sampled fish returning to the Eastbank Hatchery (EBO), which resulted in the highest number of fish captures over attempted collections near the Chelan River. Fish collected from the EBO were predominantly male and the coded wire tags (CWTs) indicated that most fish were 4-year-olds from Turtle Rock Island. Based on these results, recommendations for future collection included: 1) discontinuing testing collection methods in the vicinity of the Chelan River; and 2) utilizing the EBO as a trap location for the Chelan Falls program beginning July 2013. The Hatchery Committees also recommended that in 2013, sampling activities be conducted earlier to have the opportunity to intercept females.

In 2013, Chelan PUD and WDFW completed preparations to utilize the EBO as the primary broodstock source for the Chelan Falls summer Chinook program, and summer Chinook broodstock collection at the EBO was included in the 2013 Broodstock Protocols for Chelan Falls' broodstock collection. Collection of the required number of males and females was successful in 2013, and the EBO will be utilized again in 2014 as the primary broodstock collection location.

2.2.2.13 Chelan Falls Summer Chinook Health Issue

The 2011 broodyear Wells stock summer Chinook reared at the Chelan Falls Acclimation Facility from November 2012 until release in mid-April 2013 suffered nearly a 15% mortality from a combination of physical trauma at transfer; external fungus; Bacterial Cold Water Disease (BCWD); erythrocytic inclusion body syndrome (EIBS), or anemia in fish; and, to a lesser extent, bacterial gill disease (BGD). Probable causes were physical trauma likely resulting in loading/hauling procedures and equipment; poor water quality due to suspended materials from elevated feed rates as well as a poorly operating center drain/waste separator in one of the four round ponds; and intermittent low dissolved oxygen (DO) levels as a result of the aforementioned water quality and over-densities of fish (initial stocking of fish into the facility was 114% of program size). Despite the loss, program goals were still met, and Chelan PUD has taken measures to improve feed rates, increase the efficacy of waste removal, and monitor oxygen levels more closely in the tanks to avoid a similar situation in the future.

2.2.2.14 Chelan PUD Spring Chinook Production

In 2012, Chelan PUD and Douglas PUD agreed to terminate their Methow Hatchery Sharing Agreement. As a result, the last release of Chelan PUD spring Chinook from the Methow Hatchery was in 2013. In 2013, the committee agreed to meet the 2013 program requirement of 60,516 spring Chinook by: 1) broodstock collection, holding, and incubation at Winthrop National Fish Hatchery; 2) transfer of eyed eggs to Eastbank Hatchery for initial rearing; 3) overwinter acclimation at Grant PUD's Carlton Acclimation Facility; and 4) final rearing at the Chewuch Acclimation Pond via the Yakama Nation coho multi-species acclimation plan (Appendix F).

2.2.2.15 Rocky Reach Trap Pilot Study

In March 2013, Chelan PUD proposed a pilot study to test the feasibility of using the Rocky Reach Trap for broodstock collection for Chelan PUD's Methow spring Chinook program. The purpose of the study was to test the feasibility of visually identifying and selectively collecting ad-clipped spring Chinook. In April 2013, the Hatchery Committees approved the spring Chinook Pilot Trapping Study at Rocky Reach (Appendix R), and the Coordinating Committees approved the same study in May 2013. Beginning in May 2013, the study was conducted over a 4-week period. One trap event was allowed per hour, a maximum of three trap events were allowed per day, and no more than five trap events were conducted per week. A total of 59 trapping hours were conducted over the course of 15 days, and a total of 8 targeted fish were trapped out of 34 total trapping opportunities (i.e., identified ad-clipped, singled-out fish). No bycatch or incidentals were reported. Issues encountered included limited visibility due to turbid waters, slow mechanics of the trap door, and the potential change in water velocity due to opening and closing of the trap door. Based on the 2013 pilot study, several recommendations were discussed to improve future trapping efforts, including modifications to the trap door, installations of additional lighting and cameras, and additional trap operator options. These recommended modifications are planned to be installed during the annual winter maintenance at Rocky Reach Dam, and a second pilot study will be proposed in early 2014, with the newly modified trap.

2.2.2.16 Spring Chinook Broodstock Collection at Tumwater Dam

In June 2013, spring Chinook broodstock collection began at Tumwater Dam using genetic assignment methodologies to target broodstock for the Nason Creek (a Grant PUD program) and Chiwawa River programs. Collection at Tumwater for Chelan PUD's program was a departure from recent years' protocols that included collection of natural-origin-recruits at the Chiwawa River weir. Ultimately, the genetic assignment methodologies did not perform as expected, but all broodstock for Chelan PUD's program were obtained.

2.2.2.17 Similkameen Pond Production

In late 2013, the Chelan PUD 2012 brood summer Chinook program reared at Similkameen Pond suffered a loss of approximately 44,000 fish. Approximately 115,000 to 116,000 summer Chinook remained at the end of 2013 (the 2014 release target is 166,569 smolts). Loss was attributed to a fungal infection of the gills/isthmus.

2.2.3 Maintenance and Improvements

No major maintenance or improvements occurred at hatchery facilities in 2013.

2.3 Tributary Committees and Plan Species Accounts

As outlined in the Rocky Reach HCP, the signatory parties designated one member each to serve on the Tributary Committee. The Rock Island, Rocky Reach, and Wells Tributary Committees meet on a regularly scheduled basis as a collective group to enhance coordination and minimize meeting dates and schedules. Subject items requiring decisions are voted on in accordance with the terms outlined in the specific HCPs. During 2013, the Tributary Committees met on eight different occasions.

An initial task of the Tributary Committees in 2013 was to review and update their operating procedures, which provide a mechanism for decision-making; these procedures were initially developed in 2005 and were included in that year's annual report (Anchor 2005)[4]. At that time, the Tributary Committees also developed Policies and Procedures for soliciting, reviewing, and approving project proposals (Anchor 2005); this document was last reviewed and updated in January and March 2013. The Policies and Procedures provide formal guidance to project sponsors on submission of proposals for projects to protect and restore habitat of Plan Species within the geographic scope of the HCP. The Tributary Committees

[4] Anchor Environmental, L.L.C. 2005. Annual Report, Calendar Year 2005, of Activities Under the Anadromous Fish Agreement and Habitat Conservation Plan. Wells Hydroelectric Project, FERC license no. 2149. Prepared for FERC by Anchor Environmental L.L.C. and Public Utility District No. 1 of Douglas County.

established two complementary funding programs: the General Salmon Habitat Program and the Small Projects Program.

In 2013, the Tributary Committees updated the membership list in Section III in the Operating Procedures. The WDFW representative was changed from Dennis Beich to Jeremy Cram. In the Policies and Procedures document, under Section 3.4, The General Salmon Habitat Program, the Tributary Committees agreed to increase the minimum size proposal value from $50,000 to $100,000 (total project cost). The Tributary Committees may provide lesser amounts for phased projects. Under Section 4.4, Administrative and Support Costs, the Tributary Committees included language about the use of approved appraisers for evaluating conservation easements and acquisitions funded by the Tributary Committees. Under Section 3.8, Management Guidelines for Conservation Easements/Acquired Lands, the Tributary Committees added language that states that all protection projects funded by the Tributary Committees will have public access except under extraordinary circumstances. In addition, they added language that states that the project sponsor will allow restoration on protection projects if deemed necessary and that the restoration actions must be approved by the Tributary Committees. Under Section 4.2, Eligible Projects and Elements, the Tributary Committees added language that indicates that they may provide a one-time fee for the development of a stewardship plan for acquisition projects. Finally, under Section 4.4, Administrative and Support Costs, the Tributary Committees included by reference the items described in the Salmon Recovery Funding Board (SRFB) document for Architectural and Engineering Services (A&E) and Administrative costs for restoration projects. Thus, the revised language in the Policies and Procedures document reads:

> *Acceptable Architectural and Engineering Services and Administrative costs are provided on pages 11-15 in Section 2 of the SRFB Manual 5 Restoration Projects document (see: http://www.rco.wa.gov/documents/manuals&forms/Manual_5.pdf). A&E costs cannot exceed 15% of the total restoration cost and Administrative costs cannot exceed 15% of the total restoration cost.*

In August 2013, the Wells Tributary Committee voted to retain Tracy Hillman as the Chairperson for the next 3-year period (2014 through 2016). Dr. Hillman is an Ecological Society of America board-certified senior ecologist and CEO of BioAnalysts, Inc. He has 28 years of experience as an ecologist and has chaired the Wells Tributary Committee since 2007.

2.3.1 Regional Coordination

Similar to the Hatchery Committees and to improve coordination, a representative from Grant PUD and the facilitator of the Priest Rapids Coordinating Committees (PRCC) Habitat Subcommittee were invited to the Tributary Committees monthly meetings. In addition, they received meeting announcements, draft agendas, and meeting minutes. This setup benefits the Tributary Committees through increased coordination and sharing of expertise. The Grant PUD representative and PRCC Habitat Subcommittee facilitator have no voting authority. The Tributary Committees, through the HCP Coordinating Committees, also invited American Rivers and the Confederated Tribes of the Umatilla Indian Reservation to participate in Tributary Committees meetings. Both parties contributed to the development of the HCP, yet elected not to sign the document. Neither of these parties participated in the deliberations of the Tributary Committees in 2013.

The Tributary Committees also coordinate with the Upper Columbia Salmon Recovery Board (UCSRB). Coordination is typically between the chairperson of the Tributary Committees and the Executive Director or Associate Director of the UCSRB. The Tributary Committees also invite representatives from the UCSRB to at least one meeting per year to update the Tributary Committees on activities proposed by the UCSRB. In addition, some members of the Tributary Committees typically attend the UCSRB meetings to foster coordination in developing and selecting projects for funding. Some members of the Tributary Committees are also members of the UCSRB's Regional Technical Team (RTT), which increases coordination in selecting projects for funding. Many of the policies and procedures of the SRFB and Tributary Committees are complementary, and annual funding rounds by these funding entities have been coordinated over the last several years.

In August 2013, the Rocky Reach Tributary Committee received a letter from the UCSRB extending an opportunity for the Tributary Committee to help sponsor the 2013 Upper Columbia Science Conference on November 13 and 14, 2013. The UCSRB asked for a contribution of $500 or more to help organize and implement the event. The Rocky Reach

Tributary Committee elected to contribute $1,000 from its administrative account (no greater than $80,000 per year) of the Plan Species Account.

2.3.2 Fiscal Management of Plan Species Accounts

The Tributary Committees set up methods for the long-term management of the Plan Species accounts for each HCP. The Rocky Reach Tributary Committee appointed the accounting firm Clifton Larson Allen to perform the necessary tasks for fiscal management of the Rocky Reach Plan Species Account. These tasks include, but are not limited to, the following: 1) develop a long-term approach to maintain the funds and to carry out tax calculations and reporting; 2) conduct the daily management of activities (such as processing of invoices); and 3) provide technical expertise on financial matters to the committees. The beginning balance of the Rocky Reach Plan Species Account on January 1, 2013, was $2,063,006.53; Chelan PUD's annual Rocky Reach contribution was $327,041; interest accrued during 2013 was $1,144.63; funds disbursed for projects in 2013 totaled $167,092.62; an amount of $5,200.78 was paid to Clifton Larson Allen and Chelan PUD for account administration during 2013; and $1,000 was paid to the Upper Columbia Salmon Recovery Board for sponsorship of the 2013 Upper Columbia Science Conference, resulting in an ending balance of $2,217,802.36 on December 31, 2013. The 2013 Annual Financial Report for this Plan Species Account is provided in Appendix S.

The Rocky Reach Tributary Committee delegated signatory authority to the chairperson for processing of payments for invoices approved by the Tributary Committee, with the Coordinating Committee Chairperson serving as the alternate. Chelan PUD recognizes the uniqueness of the Tributary Committee decision-making process and delegation of signatory authority to the Chairperson, and the Chelan PUD subsequently has provided funding necessary to assign reasonable liability insurance to the Tributary Chairperson.

2.3.3 General Salmon Habitat Program

The Tributary Committees established the General Salmon Habitat Program as the principal mechanism for funding projects. The goal of the program is to fund projects for the protection and restoration of Plan Species habitat. An important aspect of this program is to assist project sponsors in developing practical and effective applications for relatively large projects. Many habitat projects are increasingly complex in nature and require extensive design, permitting, and public participation to be feasible. Often, a reach-level project involves many authorities and addresses more than one habitat factor. Because of this trend, the General Salmon Habitat Program was designed to fund relatively long-term projects. There is no maximum financial request in the General Salmon Habitat Program; the minimum request is $100,000, although the Tributary Committees may provide lesser amounts during a phased project.

In an effort to coordinate with ongoing funding and implementation programs within the region, the Tributary Committees used the previously established technical framework and review process for this geographic area, and worked with the other funding programs to identify cost-sharing procedures (see Section 1.1.1).

2.3.3.1 2013 General Salmon Habitat Projects

The Tributary Committees announced their 2013 funding cycle in March, with pre-proposal applications due on May 7, 2013, and full proposals due on July 12, 2013. The Tributary Committees received and reviewed 13 pre-proposal applications. The Tributary Committees identified nine projects that they believed warranted full proposals and dismissed four projects because they did not have strong technical merit.

In July, the Tributary Committees received nine full proposals to the General Salmon Habitat Program. All were "cost-shares" with the SRFB or other funding entities. The Tributary Committees approved funding for seven projects. Table 6 identifies the projects, sponsors, total cost of each project, amount requested from Tributary Funds, and, if funded, which Plan Species Account supported the project.

Table 6
General Salmon Habitat Program Projects Reviewed by the Tributary Committees in 2013

Project Name	Sponsor[1]	Total Cost	Request from T.C.	Plan Species Account[2]
Silver Side Channel Design	CCFEG	$183,733	$66,000	RR: $132,000[3]
Chiwawa Nutrient Enhancement	CCFEG	$684,000	$342,000	RI: $342,000
Janis Rapids Side Channel	CCFEG	$98,750	$37,000	Not funded
Twisp to Carlton Reach Assessment	CCFEG	$173,016	$46,500	RI: $46,500
Icicle-Peshastin Irrigation Dist Pump Exchange	CCNRD	$322,000	$25,000	Not funded
Nason Creek RM 4.6 Side Channel Reconnection	CCNRD	$525,030	$88,000	RI: $88,000
CDLT Entiat Stillwaters Gray Reach Acquisition	CDLT	$569,625	$170,000	RR: $170,000
Similkameen RM 3.8 Habitat Design	OCD	$84,640	$21,160	RR: $84,640[4]
MVID Instream Flow Improvement	TU-WWP	$9,747,000	$400,000	W: $400,000

Notes:
1 CCFEG = Cascade Columbia Fisheries Enhancement Group; CCNRD = Chelan County Natural Resource Department; CDLT = Chelan-Douglas Land Trust; Okanogan Conservation District; TU-WWP = Trout Unlimited – Washington Water Project.
2 RI = Rock Island Plan Species Account; RR = Rocky Reach Plan Species Account; W = Wells Plan Species Account.
3 The Silver Side Channel Design did not receive funding from the SRFB; therefore, the Rocky Reach Plan Species Account funded the SRFB and Committee's share of the project ($132,000).
4 The Similkameen RM 3.8 Habitat Design Project did not receive funding from the SRFB; therefore, the Rocky Reach Plan Species Account funded the entire cost of the project ($84,640).

In 2013, the Rocky Reach Tributary Committee agreed to fund the following General Salmon Habitat Program projects:

- Silver Side Channel Design Project for the amount of $132,000 (with cost share the total cost of the project was $183,733). This project will evaluate past, current, and future desired conditions and develop permit-ready (30%) designs for the Silver Side Channel and adjacent floodplain. The Silver Side Channel is located between Twisp and Carlton on the Methow River at about River Mile (RM) 35.
- CDLT Entiat Stillwaters Gray Reach Acquisitions Project for the amount of $170,000 (with cost share the total cost of the acquisition was $569,625). This project will protect in perpetuity and maintain 77.31 acres of largely riparian habitat including

6,730 linear feet of stream bank of the Stillwaters Reach. This action will prevent degradation of spawning and rearing habitat by eliminating threats of subdivision development and associated habitat degradation, and will facilitate restoration and enhancement actions. The parcels are located between RM 17.6-17.9 and RM 16.8-17.3.

- Similkameen RM 3.8 Habitat Design Project for the amount of $84,640 (the total cost of the project was $84,640). This project will design a restoration action that will reduce bank erosion and improve spawning and fry rearing habitat at RM 3.8 on the Similkameen River. As part of funding for this project, the Rocky Reach Committee required that the landowner establish a riparian buffer zone that is no less than 100 feet from the ordinary high-water mark. This buffer will protect the restored bank from livestock grazing.

2.3.3.2 Modifications to General Salmon Habitat Program Contracts

In 2013, the Rocky Reach Tributary Committee received the following requests from sponsors asking for modifications to General Salmon Habitat Program projects funded by the Committee.

- In June, Trout Unlimited asked the Rocky Reach Tributary Committee for a time extension on the Chewuch River Instream Flow Project. This was because of unforeseen delays in permitting. The project was scheduled to end on June 30, 2013. The sponsor requested an extension from June 30, 2013, to December 31, 2013. The Rocky Reach Tributary Committee approved the time extension.
- In June, Chelan-Douglas Land Trust asked the Rocky Reach Tributary Committee for a budget amendment on the Chewuch River Instream Flow Project. This was because the appraisal for the Click property was greater than estimated. The sponsor asked for an extra $27,300. The Rocky Reach Tributary Committee approved the budget amendment.
- In September, the Okanagan Nation Alliance (ONA) asked the Rocky Reach and Wells Tributary Committees for a time extension on the Shingle Creek Fish Passage Project. This was because there were some issues with coordination between ONA and the contractor. Because there was no contract in place, rock from the quarry was not available for the fish passage project. To that end, ONA asked the Rocky Reach

and Wells Tributary Committees for a contract extension from December 31, 2013, to December 31, 2014. The Rocky Reach and Wells Tributary Committees approved the time extension.

- In December, WDFW asked the Rocky Reach and Wells Tributary Committees for a time extension on the Silver Protection Project. The contracts were scheduled to end on December 31, 2013. The sponsor requested that the contracts be extended to December 31, 2014, because they needed additional time to explore opportunities related to ensuring the permanent preservation and enhancement of salmonid habitat on the properties. The Rocky Reach and Wells Tributary Committees approved the time extension.
- In December, Trout Unlimited asked the Rocky Reach Tributary Committee for a budget amendment on the Chewuch River Instream Flow Project. Because of an accounting error, the sponsor asked to move $1,838.71 from "Indirect/Overhead/ Administration" to "Contract Labor." The Rocky Reach Tributary Committee approved the budget amendment.

2.3.4 Small Projects Program

The Small Projects Program has an application and review process that increases the likelihood of participation by private stakeholders that typically do not have the resources or expertise to go through an extensive application process. The Tributary Committees encourage small-scale projects by community groups, in cooperation with landowners, to support salmon recovery on private property. Project sponsors may apply for funding at any time, and in most cases, will receive a funding decision within 3 months. The maximum contract allowed under the Small Projects Program is $100,000.

2.3.4.1 2013 Small Projects

In 2013, the Tributary Committees received four requests for funding under the Small Projects Program. The Tributary Committees approved funding for two projects. Table 7 identifies the projects, sponsors, total cost of the projects, amount requested from Tributary Funds, and which Plan Species Accounts supported the projects.

Table 7
Projects Reviewed by the Tributary Committees under the Small Projects Program in 2013

Project Name	Sponsor[1]	Total Cost	Request from T.C.	Plan Species Account[2]
Okanogan Basin Stream Discharge Monitoring	CTCR	$90,954	$74,984	RR
Methow/Chewuch Shallow Groundwater Monitoring	CCFEG	$34,180	$30,580	W
Beaver Creek Late Season Well Installation	TU-WWP	$16,397	$16,397	Not funded
Antoine Creek Feedlot Relocation	TU-WWP	$97,533	$37,533	Not funded[3]

Notes:
1 CTCR = Confederated Tribes of the Colville Reservation; CFEG = Cascade Columbia Fisheries Enhancement Group; TU-WWP = Trout Unlimited – Washington Water Project.
2 RR = Rocky Reach Plan Species Account; W = Wells Plan Species Account.
3 The sponsor pulled the project because the Confederated Tribes of the Colville Reservation elected to fund the entire project.

In 2013, the Rocky Reach Tributary Committee agreed to fund the following Small Project:

- Okanogan Basin Stream Discharge Monitoring Project for the amount of $74,984 (with cost share the total cost of the project was $90,954). This project will fund the monitoring of stream flows for 2 years within Loup Loup and Nine-Mile creeks, tributaries to the Okanogan River. The 2-year period will allow the Colville Tribes enough time to find a long-term funding source.

2.3.4.2 Modifications to Small Project Contracts

The Rocky Reach Tributary Committee received no requests from sponsors in 2013 asking for modifications to Small Projects funded by the Tributary Committee.

2.3.5 Tributary Assessment Program

In 2013, the Rocky Reach Tributary Committee did not receive or solicit any proposals to monitor the effectiveness of habitat restoration actions.

3 HCP ADMINISTRATION

3.1 Mid-Columbia HCP Forums

In 2005 and 2006, Mid-Columbia Forums (Forums) were held as a means of communicating and coordinating with the non-signatories and other interested parties on the implementation of the HCPs. Non-signatory parties at the time of the 2006 meeting included the Confederated Tribes of the Umatilla Reservation and American Rivers. As in 2007 through 2012, these parties were invited by letter in 2013 to attend a Forum, in conformity with the 2005 FERC Order on Rehearing 109 FERC 61208 and in accordance with the offer to non-signatory parties of non-voting membership in HCP Tributary and Hatchery Committee processes. The non-signatory parties again indicated no interest in attending a Forum in 2013, and thus a Forum was not held in 2013.

3.2 Mid-Columbia HCP File Sharing

In January 2013, the HCP Coordinating Committees discussed transitioning HCP file sharing from the historically used ftp site to a more user-friendly platform. One of the primary purposes for transitioning to a new filing system is to facilitate a more efficient process for retrieving historical documents. In May 2013, Douglas PUD presented to the Coordinating Committees an overview of their new SharePoint system, as a potential option for the new HCP document repository. Chelan PUD agreed in principle to use the site being developed by Douglas PUD, pending further discussion and agreement by Chelan PUD upper managers. Douglas PUD plans to provide a similar presentation to the Hatchery Committees in January 2014.

3.3 Mid-Columbia HCP Committees' Chairperson

In 2013, a review was held of the HCP Coordinating, Hatchery, and Tributary Committees' chairpersons and supporting staff. All three Committees recommended retaining the existing chairpersons for an additional 3-year term.

APPENDIX A
HABITAT CONSERVATION PLAN COORDINATING COMMITTEES 2013 MEETING MINUTES AND CONFERENCE CALL MINUTES

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	February 26, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the January 22, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at the Radisson Hotel in SeaTac, Washington on Tuesday, January 22, 2013, from 9:30 am to 1:00 pm. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Tom Kahler will send Kristi Geris the Douglas PUD Final 2013 HCP Action Plan for distribution to the Coordinating Committees (Item II-A).
- Bryan Nordlund will send Shane Bickford a letter or email documenting National Marine Fisheries Service (NMFS) approval of the Douglas PUD Final 2013 Bypass Operations Plan, no later than Friday, February 1, 2013 (Item II-B).
- Jim Craig will send Shane Bickford a letter or email documenting United States Fish and Wildlife Service (USFWS) approval of the Douglas PUD Final 2013 Bypass Operations Plan, no later than Friday, February 1, 2013 (Item II-B).
- Bryan Nordlund will review the Douglas PUD Draft 2013 Gas Abatement Plan, and upon approval, will send Shane Bickford a letter or email documenting NMFS approval of the plan, no later than Friday, February 1, 2013 (Item II-C).
- Jim Craig will review the Douglas PUD Draft 2013 Gas Abatement Plan, and upon approval, will send Shane Bickford a letter or email documenting USFWS approval of the plan, no later than Friday, February 1, 2013 (Item II-C).
- Coordinating Committees representatives will review the Douglas PUD Draft 2013 Gas Abatement Plan and provide comments to Tom Kahler and Kristi Geris no later than Friday, February 1, 2013 (Item II-C).

- Coordinating Committees representatives will review the Douglas PUD Draft 2013 10-year No Net Impact (NNI) Comprehensive Check-in Report and provide comments to Tom Kahler no later than Monday, February 11, 2013 (Item II-D).
- Coordinating Committees representatives will review the Douglas PUD Draft 2012 Wells Post-Season Bypass Report and provide comments to Tom Kahler no later than Friday, February 15, 2013 (Item II-E).
- Steve Hemstrom will add information on juvenile survival estimates (dates tested and results) to the Statement of Agreement (SOA) to Re-approve Phase III Standards Achieved for Combined Adult and Juvenile Survival at Rocky Reach and Rock Island, and will provide the revised SOA to Kristi Geris for distribution to the Coordinating Committees (Item IV-C).
- Chelan PUD will incorporate the latest revisions to the Chelan PUD Draft 2013 NNI Report and redistribute the revised report to the Coordinating Committees; the report will be considered for approval at the Coordinating Committees February 26, 2013 meeting (Item IV-D).
- Chelan PUD and Douglas PUD will explore options for developing a shared HCP filing system and will report back to the Coordinating Committees for further discussion (Item VI-A).

DECISION SUMMARY

- No SOAs were approved at this meeting.

AGREEMENTS

- Coordinating Committees representatives present approved the Douglas PUD 2013 HCP Action Plan, as revised (Item II-A).
- Coordinating Committees representatives present approved the Douglas PUD 2013 Bypass Operations Plan (Item II-B).
- Coordinating Committees representatives present agreed to include in the Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report the Executive Summary of the Fish and Water Management Tool (FWMT) Report from Dr. Kim Hyatt, Department of Fisheries and Oceans Canada (DFO), in lieu of the full report,

with the expectation that the full report will be appended when available about August 2013 (Item II-D).

- Coordinating Committees representatives present approved the Rocky Reach Juvenile Bypass Final Operating Plan for April 2013 (Item IV-A).

REVIEW ITEMS

- The Douglas PUD Draft 2013 Gas Abatement Plan is available for review, with comments due to Tom Kahler and Kristi Geris no later than Friday, February 1, 2013.
- Kristi Geris sent an email to the Coordinating Committees on December 11, 2012, notifying them that the Douglas PUD Sub-yearling Report is available for a 60-day review period, with comments due to Tom Kahler and Andrew Gingerich no later than Monday, February 11, 2013.
- Kristi Geris sent an email to the Coordinating Committees on December 27, 2012, notifying them that the Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report is available for review. Comments are due to Tom Kahler no later than Monday, February 11, 2013.
- Kristi Geris sent an email to the Coordinating Committees on January 17, 2013, notifying them that the Douglas PUD Draft 2012 Wells Post-Season Bypass Report is available for a 30-day review period, with comments due to Tom Kahler no later than Friday, February 15, 2013.

REPORTS FINALIZED

- The Douglas PUD 2013 HCP Action Plan was finalized and distributed to the Coordinating Committees on January 23, 2013.
- The Douglas PUD 2013 Bypass Operations Plan was finalized and distributed to the Coordinating Committees on January 23, 2013.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and announced that Kirk Truscott will be replacing Jerry Marco as the Colville Confederated Tribes (CCT) HCP Coordinating Committees representative. He has requested that Randy Friedlander, Interim Director of

Fish and Wildlife for the CCT submit a formal letter designating the replacement. Schiewe asked for any additions or other changes to the agenda, and the following revisions were requested:

- Tom Kahler requested two additions: 1) Douglas PUD Draft 2012 Wells Post-Season Bypass Report; and 2) Wells Dam ladder outage and maintenance activities update.
- Steve Hemstrom requested one addition: 1) Chelan PUD Draft 2013 HCP Action Plans for Rocky Reach and Rock Island.
- Schiewe requested one addition: 1) file sharing follow-up discussion.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft December 11, 2012 meeting minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to consider. The draft December 11, 2012 meeting minutes were approved as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Douglas PUD

A. Douglas PUD Draft 2013 HCP Action Plan (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2013 HCP Action Plan (Attachment B) that was distributed to the Coordinating Committees by Kristi Geris on December 26, 2012, was reviewed and approved by the Wells HCP Tributary Committee. He said that the Wells HCP Hatchery Committee also reviewed and approved the draft action plan with incorporation of the following revisions to the hatchery section of the plan:

- Item 1e – "August 2013" was revised to read "July 2013"
- Item 1f – "October 2013" was revised to read "September 2013"
- Item 1g – This item has been deleted
- Item 3 – "2010 Broodstock Collection Protocol" was revised to read "2013 Broodstock Collection Protocol"
- Item 3b – "Approval deadline" was revised to read "NMFS Submission deadline"

Kahler said that the draft action plan is now ready for review by the Wells HCP Coordinating Committee. Teresa Scott asked if the draft 2013 action plan differs appreciably from the 2012 action plan. Kahler said that the 2013 action plan addresses similar measures that are addressed every year, but also includes the completion of the NNI progress report.

The Coordinating Committees representatives present approved the Douglas PUD 2013 HCP Action Plan, as revised. Kahler will send Geris the Douglas PUD Final 2013 HCP Action Plan for distribution to the Coordinating Committees.

B. Douglas PUD Draft 2013 Bypass Operations Plan (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2013 Bypass Operations Plan (Attachment C) was distributed to the Coordinating Committees by Kristi Geris on December 26, 2012. He said that Douglas PUD is requesting a shortened review period because the draft plan needs to be filed with Washington State Department of Ecology (Ecology) no later than February 28, 2013.

Kahler noted that a change was made to the Juvenile Fish Bypass Contingency Plan (Bypass Contingency Plan) in this year's Bypass Operations Plan. He recalled that the 2010 Bypass Contingency Plan was developed in response to a gate-hoist cable failure in a bypass spillway at Wells Dam that resulted in shutting down a turbine in August 2010. He said that in the event that a similar incident would occur, the 2010 Bypass Contingency Plan prescribed shutting down associated turbine units as per Section 4.3 of the Wells HCP. Kahler said, however, that high river discharge in 2011 and 2012 highlighted the need to incorporate total dissolved gas (TDG) compliance requirements into the Bypass Contingency Plan. He said that the plan was, therefore, modified to include Option 1 that spills greater than 10,000 cubic feet per second (kcfs) through adjacent odd-numbered spillways as necessary to minimize TDG, when the HCP-required turbine shutdowns would threaten TDG compliance. Bryan Nordlund asked if the Wells Dam bypass can be operated in full when high TDG water is entering the project. Kahler clarified that in scenarios where Douglas PUD would implement Option 1, the project would already be spilling in excess of bypass spill (i.e., full bypass spill plus involuntary spill, and that the new plan prescribes spilling in adjacent odd-numbered spillways to avoid the resultant dramatic increase in involuntary spill and associated TDG from shutting down the turbines associated with a crippled bypass spillway.

Kahler also noted a minor change to the Emergency Action Plan measures. He said that in previous years, bypass barrier removal was initiated at an inflow forecast of 210 kcfs; whereas now, an inflow forecast of 200 kcfs triggers bypass barrier removal (see Table 2 in Attachment C). He said that the basic operating dates are the same as last year, from April 9 at midnight to August 9 at midnight. He reminded the Coordinating Committees that Dr. John Skalski's analysis of the new dates of bypass operations at Wells Dam was distributed to the Coordinating Committees on December 7, 2012, and that the Douglas PUD Draft 2012 Wells Post-Season Bypass Report was distributed to the Coordinating Committees on January 17, 2013. Teresa Scott asked about the "Spill Playbook," as described on page 4 of Attachment C, and Kahler said that the annual spill playbooks are further described on page 3 and are the same as in previous years.

Kahler said that after Coordinating Committees approval, the Douglas PUD Final 2013 Bypass Operations Plan needs to be submitted to Ecology, per Section 401 of the Wells Dam Federal Energy Regulatory Commission (FERC) License. He said that the FERC license also requires coordination of the Bypass Operations Plan and the Gas Abatement Plan; and, in addition to Aquatic Settlement Workgroup (SWG) and HCP Coordinating Committees approvals, FERC also requires separate approvals from NMFS and USFWS. Kahler said that the provisions of the new license are not totally clear but clarifications are not expected until FERC rules on Douglas PUD's request for rehearing. He said for now, however, that Douglas PUD is requesting letters, or emails, of approval from NMFS and USFWS, and that Douglas PUD will coordinate submittal of the Bypass Operations Plan and the Gas Abatement Plan as separate but "coordinated" documents.

Coordinating Committees representatives present approved the Douglas PUD 2013 Bypass Operations Plan; and Nordlund and Jim Craig said that they will send Shane Bickford a letter or email documenting NMFS and USFWS approval, respectively, of the Douglas PUD Final 2013 Bypass Operations Plan, no later than Friday, February 1, 2013.

C. Douglas PUD Draft 2013 Gas Abatement Plan (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2013 Gas Abatement Plan was distributed to the Coordinating Committees by Kristi Geris on December 28, 2012. He said that there were a few grammatical revisions; however, there was nothing substantive. Mike Schiewe added that the draft plan will also be thoroughly vetted within the Aquatic SWG as a part of their Water Quality Management Plan. Coordinating Committees representatives agreed to review the Douglas PUD Draft 2013 Gas Abatement Plan and provide comments to Kahler and Kristi Geris no later than Friday, February 1, 2013; and Bryan Nordlund and Jim Craig said that they will review the draft plan and, upon approval, will send Shane Bickford a letter or email documenting NMFS and USFWS approval, respectively, of the Douglas PUD Draft 2013 Gas Abatement Plan, no later than Friday, February 1, 2013.

D. Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report was distributed to the Coordinating Committees by Kristi Geris on December 27, 2012, and that the 60-day review period is underway. Coordinating Committees representatives will review the Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report and provide comments to Kahler no later than Monday, February 11, 2013.

Kahler noted that Douglas PUD is still waiting for the full FWMT Report from Dr. Kim Hyatt, DFO, and that only a summary of the FWMT Report is currently included in the Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report that is available for review. Kahler explained that Hyatt originally intended to have the full report available by August 2013, and therefore will not have it finished before the March 2013 deadline. However, Kahler said that the executive summary of the FWMT Report will be available by the March 2013 deadline. Coordinating Committees representatives present agreed to include in the Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report the Executive Summary of the FWMT Report, in lieu of the full report, with the expectation that the full report will be appended when available around August 2013. Kahler suggested inviting Hyatt to provide a presentation of the FWMT at either a HCP Hatchery Committees or Coordinating Committees meeting after his report is completed.

E. Douglas PUD Draft 2012 Wells Post-Season Bypass Report (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2012 Wells Post-Season Bypass Report was distributed to the Coordinating Committees on January 17, 2013. He said that the draft report includes discussions from the December 11, 2012 meeting of the Coordinating Committees, and also includes Dr. John Skalski's analyses of bypass operations in 2012, which Kahler noted, documented that all plan species were provided with bypass passage for more than 99 percent of their respective migrations in 2012. Coordinating Committees representatives agreed to review the Douglas PUD Draft 2012 Wells Post-Season Bypass Report and provide comments to Kahler no later than Friday, February 15, 2013. This report will be considered for approval at the Coordinating Committees February 26, 2013 meeting.

F. Wells Dam Ladder Outage and Maintenance Activities Update (Tom Kahler)

Tom Kahler said that the Wells Dam east ladder was taken offline on December 4, 2012. He said that completed work includes: 1) installation of grating to benefit passage of lamprey and other plan species; 2) installation of walkways on lower ladder sections; and 3) installation of half-duplex passive integrated transponder (HDX-PIT) detection in the east ladder at pool 19, which Kahler noted is similar to what was installed in the west ladder in January 2012. He said that now both Wells Dam fish ladders have 2020 readers with both full-duplex (FDX) and HD-PIT detection which greatly increases detection efficiency for fish tagged with FDX PIT tags. He said that radio telemetry (RT) antennas in both fishways are being installed or repaired in preparation for the upcoming lamprey passage study. He also said that PUD mechanics completed work on the fish pumps for the auxiliary-water-supply system that provides attraction flow in the collection gallery. Kahler said that the east ladder will be back in service by January 24, 2013, and that the west fish ladder will be taken offline for a 3-week maintenance period on January 29, 2013. He said that work on the west ladder will also include installation of lamprey grating and walkways, and also installation of RT antennas.

III. Douglas PUD and Chelan PUD

A. NNI Hatchery Obligation Re-Calculation for Population Dynamics (Josh Murauskas)

Josh Murauskas said that the presentation on hatchery recalculation (Attachment D) was distributed to the Coordinating Committees by Kristi Geris on January 21, 2013. He said that the presentation was prepared in response to an inquiry from Bryan Nordlund on the process used to recalculate NNI hatchery program sizes. Mike Schiewe explained that recalculation is a requirement of the HCPs, and was completed for the first time last year; from start to finish this process took a total of 15 months and involved a great deal of discussion on appropriate data and methods. Murauskas reviewed the presentation which included a brief explanation of NNI and recalculation. He also reviewed methods employed and examples of calculations, technical issues, and conclusions. Bryan Nordlund asked if the calculation method adjusted for larger runs, i.e., higher dam counts. Murauskas responded that they did. Schiewe said that the PUDs have both NNI responsibilities and inundation responsibilities under their licenses, and the inundation requirements are not subject to recalculation. Nordlund asked if there is a mechanism to adjust program sizes based on increasing numbers of natural origin fish resulting from, for example, habitat improvements. He also asked if certain fish are treated differently in the recalculation if they have higher survival. Murauskas replied that, for example, increased production from Chief Joseph Hatchery (CJH) will be proportionally incorporated in future recalculations along with any increase in the numbers of natural origin returns. Murauskas said that there was concern on the part of some Hatchery Committees members that reducing program sizes would decimate populations in the Mid-Columbia; however, while Douglas PUD and Chelan PUD mitigation had decreased, there will be an increase in production with CJH and Grant PUD facilities.

Bob Rose noted that Yakama Nation (YN) staff associated with the Hatchery Committees were not aware that this information was being presented to the Coordinating Committees, and commented that the presentation should have been reviewed by the Hatchery Committees prior to presenting it to the Coordinating Committees. Murauskas acknowledged the oversight and said that in the future, he will first coordinate with the Hatchery Committees. Nordlund also explained that the presentation was by his request and he had not intended to go around the Hatchery Committees.

IV. Chelan PUD

A. Rocky Reach Juvenile Bypass Final Operating Plan for April 2013 (Steve Hemstrom and Lance Keller)

Steve Hemstrom said that the Rocky Reach Juvenile Bypass Final Operating Plan for April 2013 (Attachment E) was distributed to the Coordinating Committees by Kristi Geris on January 10, 2013. Hemstrom reviewed the operating plan and noted that the six items summarized in the plan are based on discussions from the last couple of Coordinating Committees meetings, and include (briefly): 1) three additional Rocky Reach Juvenile Fish Bypass surface collector (SC) pumps for additional flow to maintain efficiency; 2) increased automated screen cleaning, as needed; 3) uniformly increased water velocity (Vn) through the dewatering screens, proportionate to the SC inflow-rate increase; 4) increased Turbine Unit 2 (C2) flow; 5) pre-season testing of increased Turbine Unit 2 (C2) flow with marked fish releases; and 6) normal SC/Bypass operation will resume once Turbine Unit 1 (C1) work is completed (no later than April 30, 2013).

Bryan Nordlund said that NMFS was previously concerned with increased Vn through the dewatering screens due to the possibility of fish impingement; however, further analysis indicated that the proposed increase in Vn should not present an issue. Lance Keller also noted that testing of the increased Turbine Unit 2 (C2) flow will occur the week of March 18, 2013. Nordlund asked if there would be an opportunity to conduct testing using smaller fish, and Keller replied that only fish representative of spring migrants (100 to 120 millimeters, maybe longer) will be available for testing. Nordlund said that he understands the logistical difficulties in testing smaller fish at that time of year; however, he asked that fish as small as possible be selected for the test. Keller said that smaller fish will be targeted for the testing.

Coordinating Committees representatives present approved the Rocky Reach Juvenile Bypass Final Operating Plan for April 2013.

B. Rocky Reach/Rock Island Fishway Maintenance Updates (Lance Keller)

Lance Keller said that the upper portion of the Rocky Reach adult ladder was dewatered on December 17, 2012, and that the lower portion of the adult fishway was dewatered on

December 20, 2012, with a fish rescue occurring on the both days, respectively. Keller said that the dewatering of the lower fishway was compromised by a piece of the right powerhouse entrance half-duplex PIT antenna that broke and fell, resting on the sill for the stop logs. He said that divers were deployed to remove the obstruction, and that a second dewatering and fish rescue of the lower fishway was conducted on December 27, 2012. He said that annual maintenance and inspections are currently being performed, and crews are prepping to replace the damaged half-duplex PIT antenna at the right powerhouse entrance. Keller said that the ladder is scheduled to be back in service March 1, 2013.

At Rock Island, Keller said that the left ladder was dewatered for maintenance on December 3, 2012, and a fish rescue was conducted on the same day. He said that the left ladder is still currently dewatered. Keller said that a fish exclusion grating has been installed on the left ladder blowout gate, preventing adults from entering the deadwater space should the gate be open; which, Keller noted is the same spacing as in the fishway wall. Keller said that pictures of the newly installed 1-inch bar screen (Attachment F) were distributed to the Coordinating Committees by Kristi Geris on January 21, 2013. He said that during the yearly inspection, a structural issue in the concrete floor associated with the attraction flow regulating gates was discovered. Repairs are currently being implemented, but there is a possibility that the repairs may not be completed prior to the March 1, 2013, water-up date. Keller said that the current floor will be cut and drilled for new steel support brackets on January 25, 2013, the brackets and steel deck will be installed on February 5, 2013, and concrete should be poured by February 8, 2013. He added that the concrete should be set up and ready for operation by February 20, 2013. Keller said that the center ladder was dewatered on December 10, 2012, a fish rescue was conducted on the same day, and the center ladder was back in service on January 4, 2013. He explained that last year, the center ladder was subject to a long outage, and so this year, only general maintenance was required. Keller said that the right ladder was dewatered on January 7, 2013, and fish rescues were conducted in the upper fishway on January 7, 2013, and the lower fishway on January 9, 2013. He said that annual maintenance and inspections are currently being performed, as well as the "ping" test on the diffuser grating bars. The right ladder is scheduled to be back in service on February 4, 2013, to coincide with the dewatering of Unit 7.

C. Coordinating Committees December 2012 Approval of Juvenile and Adult Combined Survivals (Steve Hemstrom)

Steve Hemstrom explained that the table of adult, juvenile, and combined survival estimates for the Rock Island and Rocky Reach Projects was discussed at the December 11, 2012 meeting of the Coordinating Committees. He said that per recommendations at the December meeting, the revised table (Attachment G) was distributed to the Coordinating Committees by Kristi Geris on December 18, 2012, and that approval was requested via email by December 31, 2012. Hemstrom said that Chelan PUD has now drafted an SOA to approve Phase III Standards Achieved for Combined Adult and Juvenile Survival at Rocky Reach and Rock Island; and added that the SOA was distributed to the Coordinating Committees by Geris on January 18, 2013. Hemstrom reminded the committees that Chelan PUD would like to incorporate this table into their Draft 2013 10-Year NNI Check-in Report.

Bob Rose noted that Chelan PUD had not noted the differences in years between adult and juvenile studies as discussed at the Coordinating Committees December 11, 2012, meeting. Hemstrom explained that the information is implicitly included in the background language, and that he had hoped this was sufficient. Teresa Scott said that she would also like to see that information explicitly included in the SOA. Josh Murauskas noted that the years in which studies were conducted for each species are thoroughly reported in the Chelan PUD Draft 2013 10-Year NNI Check-in Report. Hemstrom said that Chelan PUD will add information on juvenile survival estimates (dates tested and results) to the SOA, and will provide the revised SOA to Geris for distribution to the Coordinating Committees.

D. Chelan PUD 2013 NNI Check-In Report – Status of Draft and Final (Steve Hemstrom)

Steve Hemstrom said that the Chelan PUD Draft 2013 NNI Check-in Report, with track changes, was distributed to the Coordinating Committees by Kristi Geris on December 3, 2012. He said that he expects to receive all comments by January 14, 2013. Chelan PUD will then incorporate the latest revisions into the draft report and redistribute the revised report to the Coordinating Committees at least two weeks prior to the February 26, 2013 meeting of the Coordinating Committees, when the report will be considered for approval.

E. Timeline and Path Forward for HCP Subyearling Chinook (Steve Hemstrom)

Steve Hemstrom said that a proposed timeline and path forward for HCP Subyearling Chinook (Attachment H) was distributed to the Coordinating Committees by Kristi Geris on December 28, 2012. He said that based on past Coordinating Committees discussions, Chelan PUD proposed a four-step process to review technology and survival studies from 2009 to those that are most current. Bryan Nordlund noted that he is particularly interested in technical upgrades (step 1 in Attachment H), and consideration of new biological data (step 2 in Attachment H). He added that this document as an outline looks good. Josh Murauskas noted the diagram attached to the end of the outline, where convening a workshop is incorporated. Hemstrom said that this proposed timeline and path forward is also incorporated into Chelan PUD's 2013 Action Plan.

F. Chelan PUD Draft 2013 HCP Action Plans for Rocky Reach and Rock Island (Steve Hemstrom)

Steve Hemstrom said that the Chelan PUD 2013 HCP Action Plans for Rocky Reach and Rock Island (Attachment I) were distributed to the Coordinating Committees by Kristi Geris on January 16, 2013. He said that the proposed Coordinating Committees 2013 activities are the same as those performed in 2012 with the exception of three: 1) Rocky Reach and Rock Island 2013 Comprehensive NNI Progress Report; 2) Rocky Reach and Rock Island Subyearling Chinook Path Forward; and 3) Piscivorous Bird Monitoring and Report. Mike Schiewe explained that Chelan PUD will vet the proposed activities within the respective committees and after approval, will bring the action plans back to the Coordinating Committees for final approval.

G. A Case Study – Adult sockeye passage under intensive trapping operations at Tumwater Dam (Josh Murauskas and Bryan Nordlund)

Josh Murauskas said that this presentation on adult sockeye passage under intensive trapping operations at Tumwater Dam (Attachment J) was distributed to the Coordinating Committees by Kristi Geris on January 21, 2013. Murauskas explained that PIT-tag arrays were installed at Tumwater Dam in 2008 and that, by 2010, analyses of PIT-tag data indicated that significant delays were occurring as a result of trapping. Bryan Nordlund said that after Chelan PUD presented these data to him, operations were modified and, subsequently, delays were decreased. Murauskas said that after implementation of a new operating plan at Tumwater Dam, a drastic reduction in delay time was observed, from greater than 8.7 days in 2010, to 6 minutes in 2011. Murauskas said that the return in 2011 was also lower than in 2010; but then in 2012, nearly 70,000 fish passed Tumwater Dam (almost a record return), and the average delay times remained only approximately 6 minutes. He said that the 2012 results confirmed that the reduced delay times were a result of operational improvements.

Nordlund recalled a similar situation in the early 1990s, when he observed poor fish passage at the Imnaha weir. He recalled that he consulted Steve Rainey at the time, and they developed a paper, based on minimal data, on issues to consider when installing fish weirs. Nordlund noted that a clear message from the Tumwater Dam experience is to check the facility design to make sure it accomplishes what it is intended to do. He added that it is important that management and research objectives outweigh the detriments.

V. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees meeting on January 16, 2013:

- *Review of Policies and Procedures Documents*: In the Policies and Procedures document under Section 3.4, The General Salmon Habitat Program, the Tributary Committees agreed to increase the minimum size proposal value from $50,000 to $100,000 (total project cost).
- *Wells 2013 Draft Action Plan*: The Wells Tributary Committee reviewed and accepted the 2013 Wells Action Plan for the Wells Tributary Committee.
- *Okanagan River Restoration Initiative Monitoring Budget Modification*: The Wells Committee reviewed and approved a budget increase request from the Okanagan Nation Alliance (ONA) for Okanagan River Restoration Initiative (ORRI) monitoring, and also approved a two-month time extension for the project.
- *Public Outreach and Coordination*: Tom Kahler said that Pyramid Communications investigated the success of outreach efforts by local restoration practitioners in the Methow and Entiat basins and compared those with other outreach efforts around North America. The goal of this exercise was to identify approaches that could potentially be applied in the Methow and Entiat basins that would improve messaging

to the target audiences within the local basins. He said that this is a tailoring exercise to determine what will work well, and what will not considering the specific misunderstandings in the local basins.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Hatchery Committees meeting on January 16, 2013, hosted by Douglas PUD:

- *Updating the PUD Monitoring and Evaluation Plans*: Greg Mackey and Josh Murauskas reported progress updating the Hatchery monitoring and evaluation (M&E) Plans based on new information from the 5-year summary reports. Up until now, a smaller working group has been developing the revised document that details the plans, and it is now being presented to the full Hatchery Committees for approval in April 2013. This update will be the basis for contracting for M&E in 2014.
- *Draft Douglas PUD 2013 HCP Action Plan*: The Hatchery Committees reviewed and approved the Douglas PUD 2013 HCP Action Plan with minor revisions.
- *Methow Hatchery and Genetic Management Plans Update*: Lynn Hatcher has replaced Craig Busack as the NMFS Hatchery Committees Representative; however, Busack still participates for select agenda items. Busack noted that there is controversy surrounding the percentage of hatchery origin spawners (pHOS) target of 0.25, which was proposed by NMFS, in an effort to minimize hatchery fish spawning in the wild; this proposal will likely go beyond the technical group to the *U.S. v Oregon* Policy Group. Another issue Busack noted was the controversy over planting of hatchery steelhead in the Elwha River after dam removal is complete. He noted that the Wild Fish Conservancy and several other groups have filed a lawsuit to block the planting and has named NMFS as one of several defendants. One result of the litigation is that National Oceanic and Atmospheric Administration (NOAA) General Counsel is now taking a much harder look at Hatchery Biological Opinions (BiOps) and permits, and in particular, the sections dealing with the potential adverse effects of ecological interaction between hatchery and wild fish.
- *Chelan PUD Methow Spring Chinook Production*: Arrangements for 2013 have been agreed to by Chelan PUD and USFWS. Broodstock will be obtained, spawned, and fertilized at Winthrop National Fish Hatchery (NFH), and rearing will occur at

Eastbank Fish Hatchery (FH). A couple of in-basin acclimation options are being discussed. Options for brood year (BY) 2014 and beyond are still under discussion.

- *Kelt Reconditioning Update*: The YN is exploring options for live-spawning natural-origin steelhead (females) from the Twisp River, and then reconditioning them to spawn again in the wild.
- *Steelhead/Chinook Conversion Follow-up*: The YN is proposing to convert 40,000 Lake Wenatchee sockeye to spring Chinook, instead of steelhead (as specified in the 2011 SOA on hatchery recalculation). There is currently no Hatchery Committees consensus. This is not an active dispute, but rather was brought up to keep the discussion on the table.
- *Conflict of interest*: The Hatchery Committees agreed to extend the current HCP Hatchery Committees Conflict of Interest Policy two additional years.

VI. HCP Committees Administration (Mike Schiewe)

A. File Sharing

Mike Schiewe recalled that he had previously indicated two different platforms for creating an archive for the Coordinating Committees and Hatchery Committees: SharePoint and Relativity. Schiewe said that he had previously stated that Relativity was capable of searching all platforms; whereas, SharePoint could only search Microsoft Office documents. He said, however, that Douglas PUD reported that SharePoint with an available add-on is also capable of searching all documents. Schiewe noted that Douglas PUD and Chelan PUD both have a requirement to maintain their own sites, and now the discussion is whether to create a third SharePoint site. Tom Kahler said that Douglas PUD plans to maintain its own repository and also a public site. He said additionally, Douglas PUD would be willing to maintain an extranet site for the use of the Committees. He explained that this system would facilitate a process where, for example, links to documents would be distributed, as opposed to the actual document. He added that once the details are worked out, a presentation could be provided to the Coordinating Committees which would better explain system capabilities. Schiewe reminded the Committees that the primary purpose for this new filing system is to facilitate a more efficient process for retrieving historical documents. Kahler said that this system could also better facilitate the ability to revert back to combining the meeting attachments and meeting minutes into a single document. Josh Murauskas said that Chelan PUD has created an internal SharePoint site for Hatchery materials, and noted that the system has filters and search features that are really helpful. Kahler said that Douglas PUD Information Systems (IS) Staff will be installing SharePoint 2013, and did not want to roll out the proposed file-sharing system until that version was installed. Kahler suggested that they present this system at the Coordinating Committees May 28, 2013 meeting in Eastern Washington.

Schiewe asked how ownership of this third SharePoint site will work between the PUDs, and Kahler asked if Chelan PUD would agree to Douglas PUD as the “data keepers” for the HCP. Schiewe said that the SharePoint site would not only be a repository, but also a workspace; and Kahler added that all three committees would use this same site. Kahler also noted that each entity would have its own login and password information. Teresa Scott verified that final documents will be available to the public, and that it is the workspace that would be password protected. Kahler confirmed this and said that Douglas PUD has requirements under their FERC license to make all final documents available to the public. Schiewe added that until documents are final, they will be password protected. Bryan Nordlund requested that the Coordinating Committees have input on setting up the file structure, and Kahler agreed and said that some different options will be demonstrate during the presentation in May. Chelan PUD and Douglas PUD agreed to explore options for developing a shared HCP filing system and will report back to the Coordinating Committees for further discussion.

B. Next Meetings

The next scheduled Coordinating Committees meeting is February 26, 2013, to be held in person in at the Radisson Hotel in SeaTac, Washington. The March 26, 2013, and April 23, 2013 meetings will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, but this is yet to be determined.

List of Attachments

Attachment A List of Attendees
Attachment B Douglas PUD Draft 2013 HCP Action Plan

Attachment C	Douglas PUD Draft 2013 Bypass Operations Plan
Attachment D	Presentation: Overview of hatchery recalculation
Attachment E	Rocky Reach Juvenile Bypass Final Operating Plan for April 2013
Attachment F	Pictures of the new hydraulic relief gate screen at Rock Island Dam
Attachment G	Adult, juvenile, and combined survival estimates for the Rock Island and Rocky Reach Projects
Attachment H	Proposed timeline and path forward for HCP Subyearling Chinook
Attachment I	Chelan PUD 2013 HCP Action Plans for Rocky Reach and Rock Island
Attachment J	Adult sockeye passage under intensive trapping operations at Tumwater Dam presentation

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Josh Murauskas	Chelan PUD
Tom Kahler*	Douglas PUD
Bob Rose*†	Yakama Nation
Bryan Nordlund*	National Marine Fisheries Service
Jim Craig*†	U.S. Fish and Wildlife Service
Teresa Scott*†	Washington Department of Fish and Wildlife

Notes
* Denotes Coordinating Committees member or alternate
† Joined by phone

FINAL 2013 ACTION PLAN
WELLS HCP

WELLS HCP COORDINATING COMMITTEE

1. **Juvenile Fish Bypass Plan**
   a. Draft to Coordinating Committee (CC) .... December 2012
   b. CC comments to DCPUD .... January 2013
   c. Submit to FERC for approval .... February 2013
   d. Draft report to CC .... November 2013

2. **2013 NNI Progress Report (per Wells HCP §6.9)**
   a. Douglas submits Draft NNI Progress Report to the CC .... December 2012
   b. Report deadline .... March 2013

3. **Predator Control Programs**
   a. Draft 2012 pikeminnow report to HCP CC .... January 2013
   b. Final 2012 pikeminnow report integrated into HCP Annual Report .... March 2013
   c. Pikeminnow removal – Wells Project........ March – November 2013
   d. Draft 2013 pikeminnow report to DCPUD........ January 2014
   e. Draft 2013 pikeminnow report to HCP CC .... March 2014
   f. Avian predator hazing at Wells........ October 2012 – May 2013
   g. 2012-2013 hazing memo to PUD .... June 2013
   h. 2012-2013 hazing memo to HCP CC .... July 2013
   i. 2012-2013 hazing memo integrated into 2013 HCP Annual Report........ March 2014

4. **Sub-yearling Chinook Life-history Study**
   a. 2011 draft report to HCP CC .... December 2012
   b. 2011 final report to HCP CC .... February 2013
   c. Presentation of 2012 data analysis to HCP CC........ December 2013
   d. Update study plan for 2013........ January-April 2013
   e. Tag and release study fish........ June-July 2013
   f. Monitor study fish........ through life cycle
   g. 2011-13 draft report to CC........ December 2013
   h. 2011-13 final report .... April 2014

5. **Annual Monitoring of Juvenile Migration Run Timing**
   a. 2013 Skalski analysis of index data from RR........ September 2013
   b. 2013 draft of Skalski's report to DCPUD........October 2013
   c. 2013 final report presented to CC........November 2013

6. **Fish Passage and Count-station Maintenance**
   a. Install grating around count station in the east ladder .... December 2012
   b. Install grating around count station in the east ladder .... January 2013

7. FDX/HDX PIT-tag Detection System Installation

a. Install system in Pool 19 of east ladder ....December 17-20, 2012

8. Fishway Outage Schedule for Fishway Inspection, Maintenance, and Fishway Projects

a. East Fishway ....December 4, 2012 – January 18, 2013
b. West Fishway...January 21 – February 21, 2013

9. Lamprey Passage and Enumeration Study

a. Study plan ....February 2013
b. Conduct head-differential test and efficiency study ....July – October 2013
c. Draft report..November 2013
d. Final report...February 2014

10. HCP Annual Report

a. Draft 2012 annual report to DCPUD for review..January 16, 2013
b. Draft 2012 annual report to CC for 30-day review....................................February 8, 2013
c. CC comments due to Anchor QEA...March 6, 2013
d. Final 2012 annual report to DCPUD ....March 22, 2013
e. Final 2012 annual report due to FERC ....March 29, 2013

11. License Amendments (requiring HCP CC approval)

a. Counting Facility Modifications (Lamprey Count Station Improvements).......March 2013
b. Temporary Operational Modifications (Lamprey Ladder Operations) .... May 2013

WELLS HCP HATCHERY COMMITTEE

1. Implement 5-year Hatchery Monitoring and Evaluation (M&E) Plan

a. Ongoing implementation ....January – December 2013
b. Draft annual report for 2012 to Douglas PUD.. June 2013
c. Draft annual report to Hatchery Committee (HC) .... August 2013
d. Final annual report to HC ....October 2013
e. Draft 2014 implementation plan to HC .... August 2013
f. HC approval of final 2014 implementation plan ....October 2013
g. HC approved 2014 implementation plan to FERC for approval ....October 2013

2. Update 5-year M&E plan (per Wells HCP §8.5.1)

a. Draft to HC .... April 2013
b. Final to HC... June 2013
c. Approved M&E plan to FERC for approval.. August 2013

3. 2010 Broodstock Collection Protocol

a. Draft to HC: .... March 2013
b. Approval deadline:.. April 2013
c. Implementation: ....May 2013 to April 2014

4. Annual Implementation - Sockeye Fish/Water Management Tools

a. Period covered: ....Water Year 2012-2013 (October – September)
b. Water Year 2011-2012 Report and Presentation to HC: ....*to be determined*

5. Methow Steelhead Relative Reproductive Success Study

a. Implementation: .... March 2010 - December 2021
b. Final report:.. 2021/2022

6. Wells Hatchery Modernization

a. Draft Master Plan to Douglas PUD ....January 2013
b. Final Master Plan .... March 2013
c. Final Construction Drawings .... March 2014
d. Provide updates to the HC ....Monthly
e. Provide opportunities for HC input... Periodically

WELLS HCP TRIBUTARY COMMITTEE

1. **Plan Species Account Annual Contribution**
   a. $176,178 in 1998 dollars (estimated $250,000 2013 dollars).......................... January 2013

2. **Annual Report - Plan Species Account Status**
   a. Draft to Tributary Committee (TC): .... February 2013
   b. Approval deadline:.. March 2013
   c. Period covered: ....January to December 2012

3. **2013 Funding-round – General Salmon Habitat Program**
   a. Request for project pre-proposals:........................... *To be determined* (typically in March)
   b. Pre-proposals to TC: .... *To be determined* (typically in early May)
   c. Tours of proposed projects: ....*To be determined* (typically in late May)
   d. Project sponsor presentations to TC: .... *To be determined* (typically in early June)
   e. Final project proposals to TC:...............................*To be determined* (typically in late June)
   f. RTT project rating decisions:.............................. *To be determined* (typically in early July)
   g. Supplemental sponsor presentations, as necessary ....*To be determined*
   h. TC final funding decisions:......................... *To be determined* (typically before December)

4. **Small Project Program**
   a. Project review and funding Decision...January – December 2013

5. **Tributary Assessment Program**
   a. Draft final report to TC on Year 5 of 5, and all years of ORRI monitoring........ April 2013
   b. Final report to TC.. June 2013

Commissioners:
T. JAMES DAVIS
LYNN M. HEMINGER
RONALD E. SKAGEN

General Manager:
WILLIAM C. DOBBINS

Public Utility District No. 1 of Douglas County

1151 Valley Mall Parkway • East Wenatchee, Washington 98802-4497 • 509/884-7191 • FAX 509/884-0553 • www.douglaspud.org

Memorandum

TO: Wells HCP Coordinating Committee

FROM: Tom Kahler, Shane Bickford, Douglas PUD

DATE: December 26, 2012

SUBJECT: Wells Dam 2013 Juvenile Fish Bypass Operating Plan

Anticipated Juvenile Migrants during the 2013 Juvenile Fish Bypass Period

The 2013 spring and summer outmigration of naturally produced juvenile HCP Plan Species at Wells Dam will consist of offspring of adults that spawned above Wells Dam during brood years (BY) 2011 and 2012 (Table 1). The spring migration will include juvenile spring Chinook, coho, sockeye, and steelhead, and summer/fall Chinook sub-yearlings will migrate during both spring and summer bypass operations.

Table 1. Ladder counts at Wells Dam of HCP Plan Species whose progeny are anticipated to migrate through the Wells Project during the 2013 bypass period. Juvenile steelhead migrate predominantly as yearlings from the Okanogan River and as age-2 and age-3 fish from the Methow River; thus, 2009, 2010, and 2011 steelhead adult counts are included (BY 2010, 2011, and 2012, respectively).

Species	Adult Migration Year	Ladder Count	Juvenile Migration
Spring Chinook	2011	8,122	Spring
Summer/Fall Chinook	2012	46,835	Summer
Coho	2011	5,796	Spring
Sockeye	2011	111,508	Spring
Summer Steelhead	2009	25,422	Spring
Summer Steelhead	2010	12,929	Spring
Summer Steelhead	2011	12,069	Spring

Scheduled hatchery releases above Wells Dam in 2013 include yearling spring Chinook from the Methow Fish Hatchery (495,000) and the Winthrop National Fish Hatchery (WNFH; 375,000). The WNFH also will release approximately 300,000 coho. Summer Chinook yearlings will be released from the Carlton (420,000) and Similkameen (620,000) acclimation ponds. Hatchery steelhead scheduled for release above Wells Dam include approximately 150,000 fish to the Methow Basin and 100,000 to the Okanogan Basin from Wells Hatchery, and 114,000 to the Methow Basin from WNFH. In general, the hatchery yearling Chinook, coho and steelhead are scheduled for release after April 15th with Winthrop coho and Wells steelhead scheduled for release after April 20th. By mid-May, all of the yearling Chinook and coho will have been released. The steelhead releases have historically continued into late May.

2013 Juvenile Fish Bypass Operations

Operation of the bypass system throughout the 2013 season will follow the criteria contained within the Wells Dam Juvenile Dam Passage Survival Plan (Wells Juvenile Bypass Plan) found in Section 4.3 of the Wells HCP. One of the main goals of the Wells Juvenile Bypass Plan is to provide bypass operations for at least 95% of both the spring and summer migration of juvenile plan species.

From 2004 through 2011, the timing of the implementation of bypass operations was based upon an analysis of 21 years of hydroacoustic and 14 years of species composition information collected on juvenile run patterns at Wells Dam. From the data available to the Wells HCP Coordinating Committee in February 2004, they agreed that initiation of the Wells bypass system on April 12th and termination on August 26th would conservatively provide bypass operations for more than 95% of both the spring and summer migrations of juvenile Plan Species.

In 2011, Columbia Basin Research performed an analysis using seven years of passage data obtained from daily sampling at the Juvenile Sampling Facility of the Rocky Reach Juvenile Fish Bypass System to more accurately estimate the contemporary percentage of the migration of spring and summer migrants that passed during bypass operations at Wells Dam. From that analysis, the Wells HCP Coordinating Committee adjusted the starting and ending dates for bypass operations at Wells Dam, moving the starting date three days earlier to April 9 to cover early-migrating natural origin spring Chinook, and moving the ending date seven days earlier to August 19 to more accurately reflect the contemporary passage timing of the sub-yearling Chinook outmigration. Thus, for 2012, bypass operations at Wells Dam commenced at 00:00 on April 9 and ended at 24:00 hours on August 19. For accounting purposes, the end of the 2012 spring bypass season was June 13th at 24:00 hours and the beginning of the summer bypass season was June 14th at 00:00 hours.

Upon completion of the 2012 bypass season, Columbia Basin Research updated the original analysis that supported the decision by the Wells Coordinating Committee to adjust the dates of bypass operations. The updated analysis determined that the adjusted dates of bypass operations at Wells Dam in 2012 provided bypass passage for 99.96 percent of yearling Chinook, 99.86 percent of steelhead, 100 percent of sockeye, and 99.30 percent of subyearling Chinook. Based upon this high level of compliance with the HCP bypass operating criteria (exceeding the 95% bypass-passage criteria for all species), Douglas PUD proposes to commence operation of the bypass system starting at 00:00 on April 9 and to end operations at 24:00 hours on August 19. For accounting purposes, the 2013 spring bypass season will end on June 13th at 24:00 hours and the summer bypass season will begin on June 14th at 00:00 hours.

The Federal Energy Regulatory Commission (FERC) requires Douglas PUD to operate Wells Dam with sufficient automatic-gate-opening capacity in the spillway to pass the flow from a load rejection of 200 thousand cubic feet per second (kcfs), in addition to any concurrent inflows. Of the 11 spillways at Wells Dam, only spillways 3 through 9 have automated gate hoists. Thus, the seasonal installation of bypass barriers in spillways 2, 4, 6, 8 and 10, substantially reduces the automatic-gate-opening capacity of Wells Dam by reducing the capacity of each bypass spillway to 8.6 kcfs. Consequently, Douglas PUD must remove bypass barriers systematically when discharge estimates exceed certain flow thresholds, as per Table 2, sufficient to provide the necessary automatic-gate-opening flow capacity as described in the FERC approved Emergency Action Plan for the Wells Project (EAP, Appendix I). Decisions to remove bypass barriers for FERC compliance will be made each Monday (or at other times as necessary) during the bypass period and will be based on weekly forecasts of combined discharge from Chief Joseph Dam and side-flows from the Okanogan and Methow rivers (from the National Weather Service Northwest River Forecast Center [NWRFC]; http://www.nwrfc.noaa.gov/stp/stp.cgi).

Table 2. Schedule for removal of spillway flow-barriers (bypass barriers) to accommodate flood flows and load rejections.

Inflow Forecast (kcfs)	Bypass Barriers Removed
Up to 200	None
200 – 240	Spillway 6
240 – 275	Spillways 6, 8
275 – 310	Spillways 4, 6, 8
310 – 350	Spillways 4, 6, 8, 10, & preset gates 10, 11 to spill excess of 312 kcfs
350 – 400	Spillways 4, 6, 8,10, & preset gates 1, 10, 11 to spill excess of 312 kcfs
400 – 450	All spillways (2, 4, 6, 8, 10)

Juvenile Fish Bypass Operations and Clean Water Act TDG Compliance

Seasonal bypass operations generally coincide with the spring freshet, an event during which operators of hydroelectric projects must cope with flows that often exceed the hydraulic capacity of their powerhouses. When flows exceed the hydraulic capacity of the generating units, water must be passed via the spillway in what is termed "involuntary spill." Involuntary spill increases the concentration of atmospheric gases in the water below hydroelectric projects, and can result in excessive levels of total dissolved gas (TDG) that may injure fish. To minimize the potential for fish injury, the Washington Department of Ecology (WDOE) imposes TDG standards on operators of hydroelectric projects.

Extensive study of spill operations at Wells Dam and modeling exercises at the University of Iowa provide the basis for the development of annual spill "playbooks" for operations at Wells Dam aimed at achieving the WDOE standards for TDG in the Wells tailrace. From modeling and physical-spill studies over the past several years, Douglas PUD has determined that concentrating spill through the middle of the spillway and supporting that concentrated spill with turbine discharge results in the most effective minimization of TDG in the Wells tailrace. Specifically, the best TDG performance is achieved when concentrating involuntary spill through Spillway 5, and allocating additional spill, beyond the capacity of Spillway 5, to Bypass Bay 6 and then to Spillway 7, up to a maximum of 43 kcfs per spillway.

To accomplish this TDG-minimizing pattern of concentrated spill requires the removal of the bypass barriers from at least one spillway during periods with excessive involuntary spill. The removal of the bypass barriers from one bypass bay takes approximately eight hours and requires the use of a four-man mechanical crew and several gantry cranes. To comply with the TDG standards below Wells, the bypass barriers must be removed from at least one spillway whenever involuntary spill exceeds 30 kcfs and one or both of the following conditions applies: 1) prolonged (> 8 hours) involuntary spill in excess of 40 kcfs is predicted (based on forecasted tributary inflows from the NWRFC and estimated discharge from Chief Joseph Dam provided by the US Army Corps of Engineers); or 2) total spill is predicted to exceed 53 kcfs, regardless of duration. Once involuntary spill of less than 40 kcfs, for a period of at least four days is predicted, the respective bypass barriers would be reinstalled. At river flows greater than 240 kcfs, bypass barriers would be removed from additional bypass bays as described above (see Table 2) and reinstalled sequentially as appropriate.

Juvenile Fish Bypass Contingency Plan

The failure of a gate-hoist cable in a bypass spillway at Wells Dam in late August 2010 provided the impetus for the development of a contingency plan for bypass operations during similar events that could occur in the future. Under the 2010 Juvenile Fish Bypass Contingency Plan (Bypass Contingency Plan), in the event of a failure of a bypass gate or other such accident or unanticipated mechanical failure that rendered impossible normal bypass operations, Douglas PUD's initial response would follow the Wells Juvenile Bypass Plan, shutting down associated turbine units as prescribed in Section 4.3 of the Wells HCP. However, high river discharge in 2011 and 2012 highlighted the need to incorporate the consideration of TDG into the Bypass Contingency Plan, and we have modified the plan accordingly.

During periods of high river discharge, mid-Columbia hydroprojects maximize powerhouse discharge to minimize spill and associated increases in TDG. Shutting down a turbine at Wells Dam when all other turbines are loaded would increase spill by 20 kcfs, which would also increase TDG. However, losing function of one bypass unit at Wells Dam affects two turbine units; thus, shutting down both turbine units associated with the malfunctioning bypass spillway would increase spill by 40 kcfs. Therefore, Douglas PUD has modified the Bypass Contingency Plan to avert unnecessary increases in TDG from shutting turbine-units due to a mechanical failure of the bypass system.

Section 4.3 of the Wells HCP directs Douglas PUD to shut down the turbine units adjacent to the bypass spillway that is not operating due to either a lack of water or an inability to operate the bypass spillway. Under the 2010 Bypass Contingency Plan, the associated turbine units would have remained inactive until personnel at Wells Dam could determine the cause of the bypass failure and the nature of and time required for the necessary repair. Under the new Bypass Contingency Plan, if shutting down the turbines would not threaten compliance with TDG standards, Douglas PUD would shut down the associated turbine units. However, if doing so would threaten compliance with TDG standards, Douglas PUD would not shut down the associated turbines but would instead direct spill through spillways adjacent to the affected turbine units in a manner that provides bulk flow for fish passage while minimizing TDG (Figure 1, Option 1). Douglas PUD would consult the Spill Playbook (see above) to select such spill configurations, and would spill at least 10 kcfs through selected spillways to engage the submerged flip-lip as a TDG minimization measure and to provide bulk flow for fish attraction to the surface passage route. In circumstances where turbine shutdown would not jeopardize TDG compliance, Douglas PUD would shut down the associated turbine units to evaluate and repair the malfunction, but may then elect to move the bypass barriers from the inoperable bypass spillway to an adjacent, non-bypass spillway to obtain the use of an additional turbine unit (see Figure 1, options 2 and 3). The gate for that substitute bypass spillway would then be set at the standard 1-foot opening for bypass spillways and the adjacent turbine unit could be operated without constraints. This configuration would meet the intent of HCP Section 4.3 by providing bypass spill immediately adjacent to every operating turbine unit and would comply with the goal of the Total Dissolved Gas Abatement Plan.

During the repair of a bypass malfunction, Douglas PUD would daily reevaluate forecasts of Chief Joseph Dam discharge, tributary inflows, and TDG conditions, as well as repair progress, and determine which bypass option to implement.

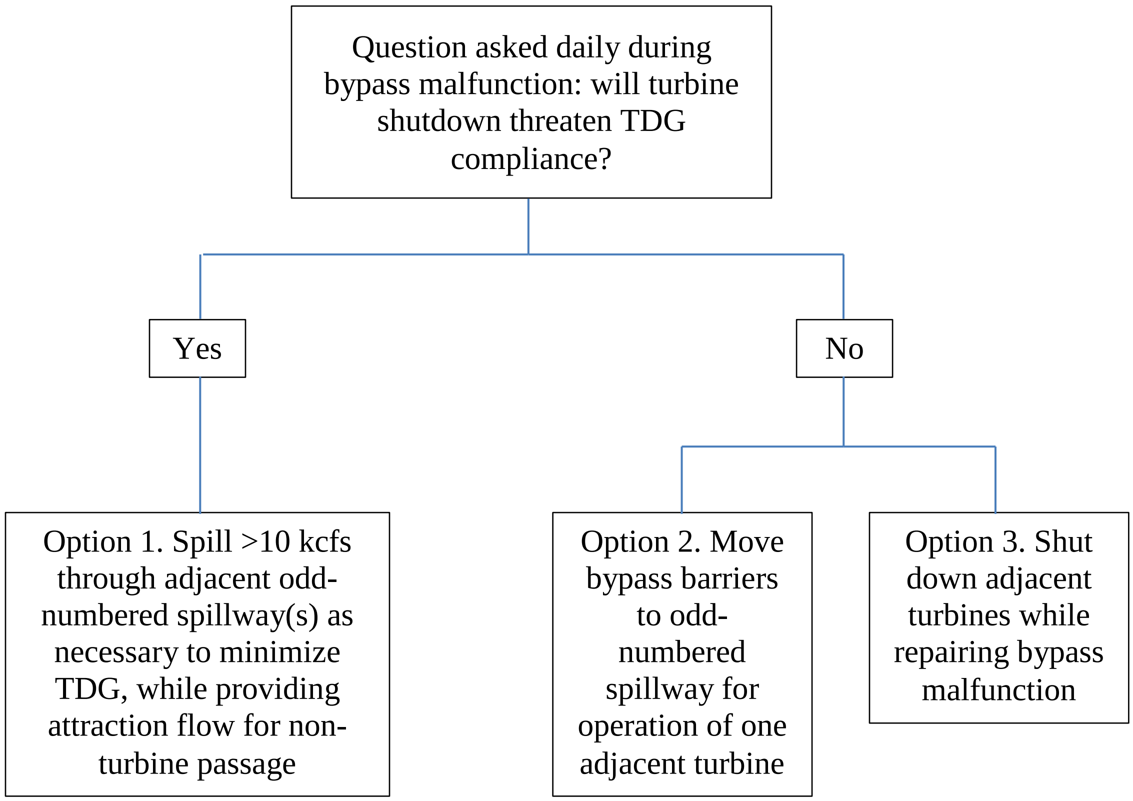


Figure 1. Evaluation flow chart for daily decisions regarding bypass, spill, and turbine operations during a bypass malfunction.

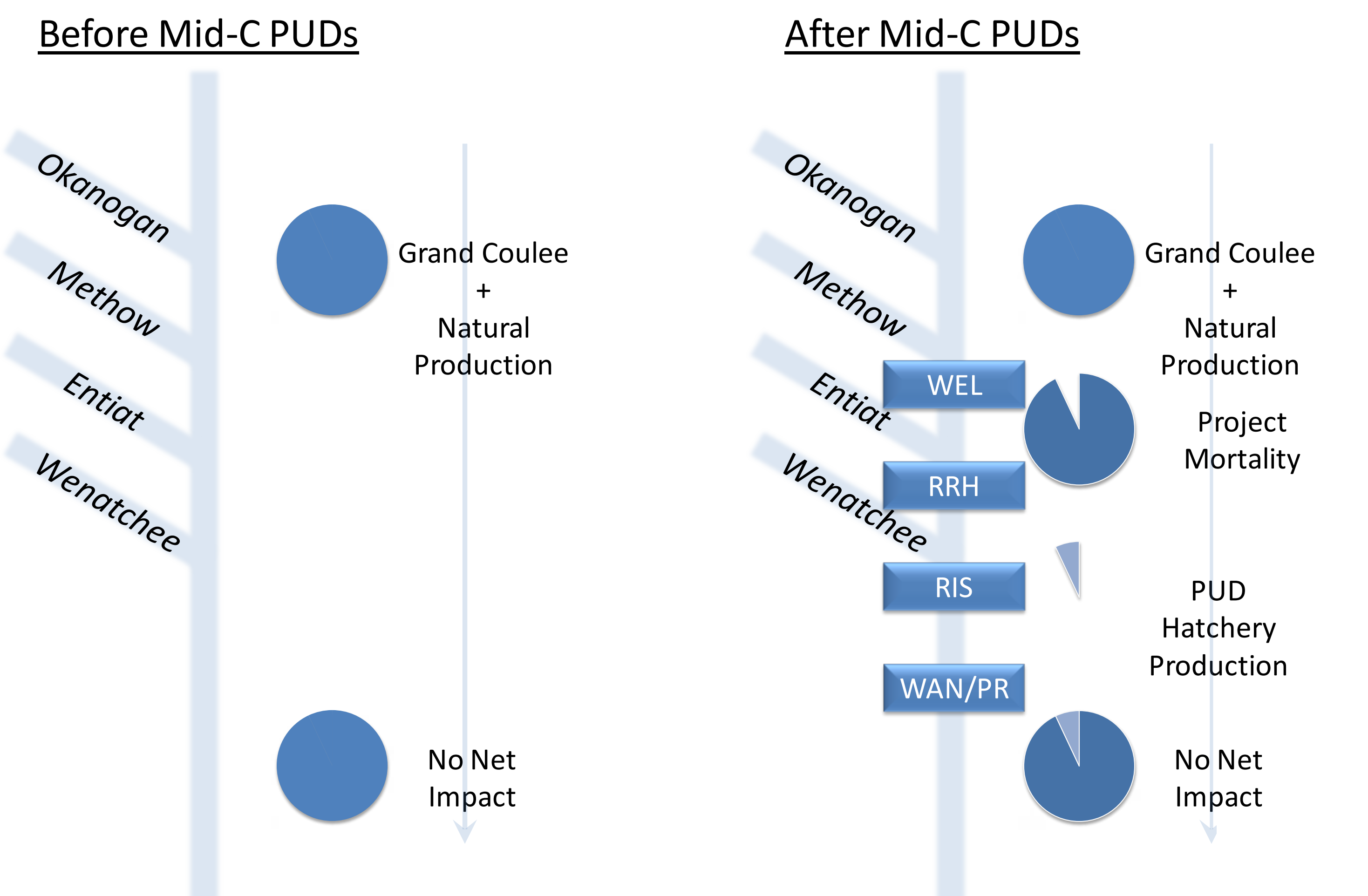
Overview of Hatchery Recalculation

Chelan and Douglas HCP Coordinating Committees

Josh Murauskas and Tom Kahler

January 2013

What is NNI?


Before Mid-C PUDs
Okanogan
Methow
Entiat
Wenatchee
Grand Coulee
+
Natural
Production
No Net
Impact
After Mid-C PUDs
Okanogan
Methow
Entiat
Wenatchee
WEL
RRH
RIS
WAN/PR
Grand Coulee
+
Natural
Production
Project
Mortality
PUD
Hatchery
Production
No Net
Impact

What is "Recalculation"

- HCPs, section 8.4.3
- Essentially:
  - More juveniles = more losses
  - Better performance = fewer losses

Methods

- “BAMP” application for wild fish
- Hatchery release targets for hatchery fish

Wild Fish Example

- Consider 9,300 wild adult returns…
- Absent mortality, 10,000 wild adults would be expected (i.e., 9,300 ÷ 93% = 10,000)
- Therefore, 700 adults needed to meet NNI
- Hatchery SAR of 0.5%, =140,000 smolts owed

Hatchery Fish Example

- Target hatchery releases represent hatchery smolts in calculations
  - 600,000 × 7% loss = 42,000 smolts owed
- "Residual" production.
  - Difference between individual mitigation and cumulative mortality offset commensurate with survival at each project…

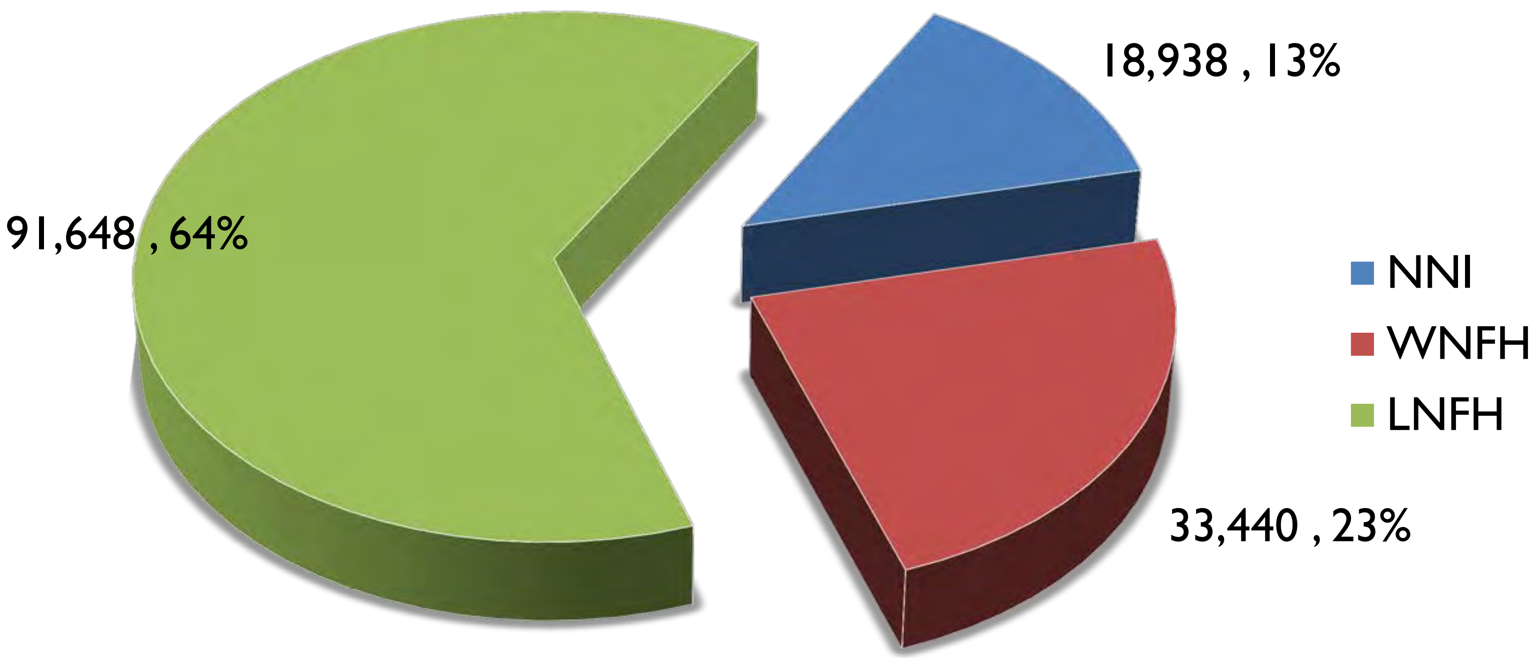
Rock Island Spring Chinook

- Wild fish:
  - 1,534 wild adult returns, smolt survival = 93.75 %
  - 102.3 adults owed for NNI
  - 0.540 % hatchery SAR
- 18,939 smolts to replace wild-origin adults

Rock Island Spring Chinook

- Hatchery fish:
  - 400K WNFH smolts × 6.25 % = 25,000 owed
    - *+ 8,440 residual production*
  - 1.2M LNFH smolts × 6.25 % = 75,000 owed
    - *+16,648 residual production*
- 125,088 smolts to replace hatchery releases

Chiwawa Spring Chinook



144,026 total

Technical issues

- Chinook runs
- “Residual” losses
- Hatchery M&E data
- Many more…

Conclusions

- Hatchery compensation plan fully implemented: facilities and production
- Projects "transparent" to smolt migration
- Continued incentive for PUDs to improve programs

Final Operating Plan for Rocky Reach Surface Collector and C2 Turbine unit during the C1Turbine unit outage in April 2013

1) RR JFB Surface Collector (SC) will utilize three additional installed SC pumps to increase attraction flow from 6,000 to 6,660 cfs into the SC entrances (3,330 cfs each side) beginning April 1, 2013.

2) The dewatering screen cleaning system will function normally under the increased entrance flow and the cleaning process should not be affected. The automated screen cleaning routine will be more frequent if increased debris load is encountered (unlikely in April).

3) Normal water velocity (Vn) through the dewatering screens in the SC channels will increase proportionally to the SC flow-rate increase, which is approx 11%. Calculations show screen velocity will increase from 0.4 fps to about 0.444 fps (an 11% increase) under the 6,660 SC flow. Water velocity will increase uniformly (no hot spots) across the entire SC dewatering screen surface area as regulated by the tuned screen baffling.

4) RR will increase turbine unit C2 flow, from its normal *soft-limit* set-point of 12.2 kcfs to a *soft-limit* flow of 15.2 kcfs during the C1 outage.

5) RR will test this operation during the normal pre-season (last week of March) marked fish releases into the surface collector/bypass to insure there are no effects on fish condition or passage. Marked fish will be recollected and observed at the RR juvenile sampling facility.

6) RR will return to its normal SC/Bypass operation if C1 work is completed early and C1 can return to service before April 30.

Newly installed 1-inch bar screen covering the opening of the Hydraulic relief-gate which protects against excessive flow in the Left Bank Fishway at Rock Island Dam. Screen will preclude adult fish from entering the hydraulic relief space from the tailrace if the gate ever opens again to discharge excess water from the fishway.

12/18/12-Revised Table to HCP CC

Juvenile, Adult, and Combined Survival Estimates at Rock Island and Rocky Reach Projects, for inclusion in 2013 HCP Comprehensive NNI Check-in Report

Table 1. Juvenile, adult, and combined survival rates for the Rock Island and Rocky Reach Projects. Adult conversion rates calculated from adult passage data for years 2010-2012 (Buchanan and Skalski, University of Washington 2012). HCP Combined Adult and Juvenile Project Survival standard is 91%.

Project	Species	Juvenile Survival	Adult Survival	Combined[6]
Rock Island	Steelhead	96.75%	99.31% [2]	**96.08%**
	Spring Chinook	93.75% [1]	99.89% [3]	**93.65%**
	Sockeye	93.27%	98.37% [2]	**91.75%**
Rocky Reach	Steelhead	95.79%	98.93% [2]	**94.77%**
	Spring Chinook	92.37% [1]	99.90% [3, 4]	**92.28%**
	Sockeye	93.59%	98.92% [5]	**92.58%**

[1] Spring-migrating, yearling Chinook salmon.

[2] Estimate does not account for fish losses due to recreational harvest in any years

[3] No recreational harvest occurred for adult spring Chinook

[4] Adult conversion rate and Combined Project Survival approved by SOA for Rocky Reach on August 30, 2011 using 2009-2011 adult spring Chinook passage data.

[5] Estimate adjusted for loss of fish from recreational harvest in 2010 and 2011, but not for harvest losses in 2012.

[6] Combined survival is the product of juvenile and adult survival estimates (e.g., 98% × 93% = 91%).

Chelan PUD Subyearling Chinook- Proposed Path Forward

This document describes a stepwise approach for developing a comprehensive status assessment of (1) subyearling studies and biology, and (2) decisions related to the future monitoring and evaluation of subyearling Chinook survival. The ultimate goal is to create a path forward that is supported and approved by the Coordinating Committees. The individual steps are also depicted in a diagram at the end of the document.

Step 1: Review current survival study technology and applicability to Rocky Reach and Rock Island projects.

- **February 2013-Status of survival studies document:** Summarize historic subyearling survival studies including ecological, technological and analytical features as they pertain to HCP requirements. Compare and contrast current technology with presentations from 2009 subyearling summit. Examine assumptions of mark-recapture designs and caveats of violating assumptions.

Step 2: Summarize biological and ecological data to establish a baseline status assessment of summer Chinook.

- **March 2013- Summary of resident fish and predator interaction studies in Rocky Reach**: Provide literature review of potential interactions among predators and habitats within Rocky Reach. Present data on the littoral distribution and relative abundance of predator species within Rocky Reach. Present preliminary evaluation of overwater structure/dock habitat use by predators in Rocky Reach. Describe future sampling plans.
- **April 2013**-**Evalaution of carrying capacity of summer and fall Chinook in habitats above Rock Island**: Present quantitative analyses of population and productivity trends across subyearling habitats. Evaluate carrying capacity estimates and target escapement values for spawning areas. Attempt to define expectations for productivity.
- **April 2013-Summary of life history data collected from Chelan PUD hatchery M&E activities**: Present data on migration timing and abundance of subyearling juveniles.
- **April 2013**-**Review of innovations in summer Chinook hatchery programs**: Chelan is investing significant resources in hatchery technology to create higher performing smolts and more adult returns. These are expected to boost natural productivity and additional hatchery improvements are possible.
- **April 2013 Spawning Habitat Improvements in Chelan River:** Present data on new habitat provided by the Chelan River habitat project

Step 3: Make a determination if additional questions need to be answered (i.e., 2013 subyearling summit).

- **Decision Point--Adequacy of existing information?**:
  - YES- If information is adequate, identify key elements of an SOA to describe specific path forward and phase designation.
  - NO-If more information is needed; identify data gaps and process for obtaining new information. This could include planning and organization of a subyearling summit for late summer 2013 or collection of additional data.

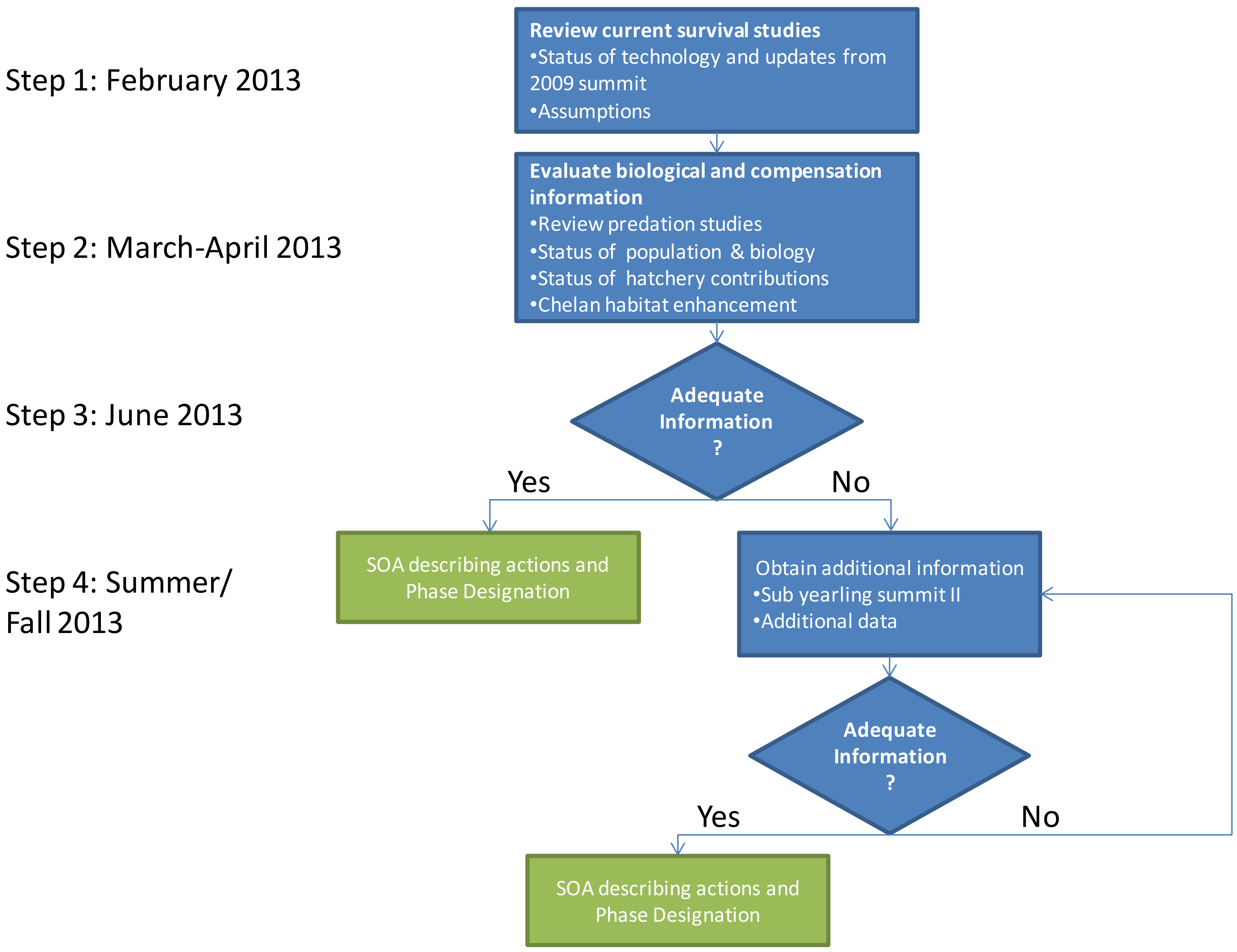
Step 4: Approve Path Forward

- **Statement of Agreement:** If adequate information exists, present draft "path forward" SOA for consideration at Coordinating Committee meeting in early summer 2013.

-or-

- **Decision Point-- Adequacy of existing information?**:
  - YES-If after consideration of new data, the Coordinating Committee determines that adequate information exists, identify key elements of an SOA to describe specific path forward.
  - NO-If more information is needed; identify data gaps and process for obtaining new information.

Diagram of Proposed Path Forward



Attachment I

2013 Rocky Reach and Rock Island
HCP Action Plan *Draft 1/16/13*

COORDINATING COMMITTEE	Jan 2013			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
Activity	1	15	31	1	15	28	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31
RR and RI 2013 Comprehensive NNI Progress Report	→ ongoing					F																														
RR and RI Subyearlyearling Chinook Path Forward	→ ongoing										D																		F							
Deliver 2012 RR Bypass Evaluation report			D					F																												
Deliver 2013 Bypass Operations plan			D						F																											
Deliver 2013 RR Bypass Evaluation Report																																		D		F
Pikeminnow long-line control programs				S											D																		C			
Pike minnow angling control programs													S																C							
Avian Predation Programs										S														C												
Piscivorous Bird Monitoring and Report										S																										F
Northern Pikeminnow Ladder Trapping RI/RR																S								C												
Deliver 2013 RI/RR Fish Passage Plan					D			F																												
Deliver 2013 RR/RI Spill Plan							D			F																										
Deliver 2013 RR/RI Spill Report																										D			F							
RR 9% Summer Spill																S							C													
RI 10% Spring spill											S*												C													
RI 20% Summer Spill																S							C													
RR Juvenile Fish Bypass Operations										S														C												
2012 HCP Annual Report							D			F																										

*Start RI spill 4/17

HATCHERY COMMITTEE	Jan 2013			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
Activity	1	15	31	1	15	28	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31
2012 Hatchery M & E Report								D								F																				
2014 Hatchery M & E Work Plans																				D					F											
M&E Request for Proposals											S									F																
Steelhead RSS Study (Juvenile Sampling and Draft Report)	→ ongoing																																	D		
Dryden Water Quality Monitoring							S						F																							
Hatchery Operations SOP Review	→ ongoing				D							F																								
Eastbank Aquifer Modeling	→ ongoing								C																											
Summer Chinook Size Targe Review																	S																			
Chelan Hatchery Raceway Rehab																	S																			
Chiwawa Acclimation Facility Office Rehab	→ ongoing																																			
Carlton Pond Lease Agreement with Grant PUD	D						F																													
Broodstock Collection													S																						C	
Hatchery Releases										S			C																							

TRIBUTARY COMMITTEE	Jan 2013			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
Activity	1	15	31	1	15	28	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31
RR and RI Plan Species Account Annual Deposit			C																																	
General Salmon Fund Project Solication Process								S												C																
General Salmon Fund Project Approval														S									C													
General Salmon Fund Project Implementation	→ ongoing																																			
Small Project Review and Appproval	S																																			C
Small Project Implemetation	→ ongoing																																			

D = Draft Document
F = Final Document
S = Start Project
C = Complete Project

A case study of adult sockeye salmon passage under intensive trapping

Josh Murauskas

Presentation to HCP Coordinating Committee

January 22nd, 2013

Tumwater trapping

2004-2010:

Trapping 100% of spring migrants

Up to ~ 40,000 adults annually

Reproductive success study

2008-2010:

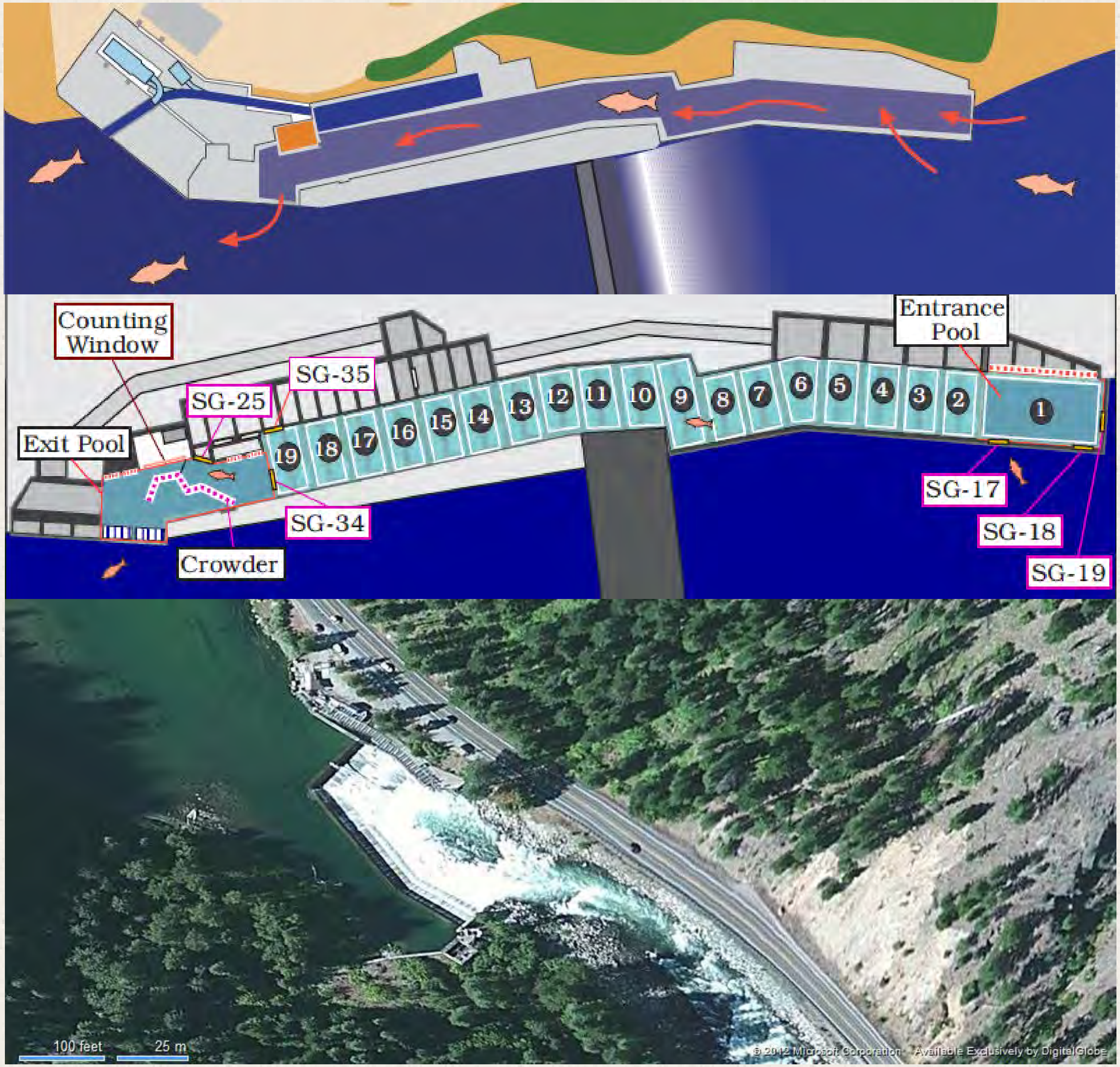
Substantial delays observed

2011-2012:

Limited trapping of sockeye

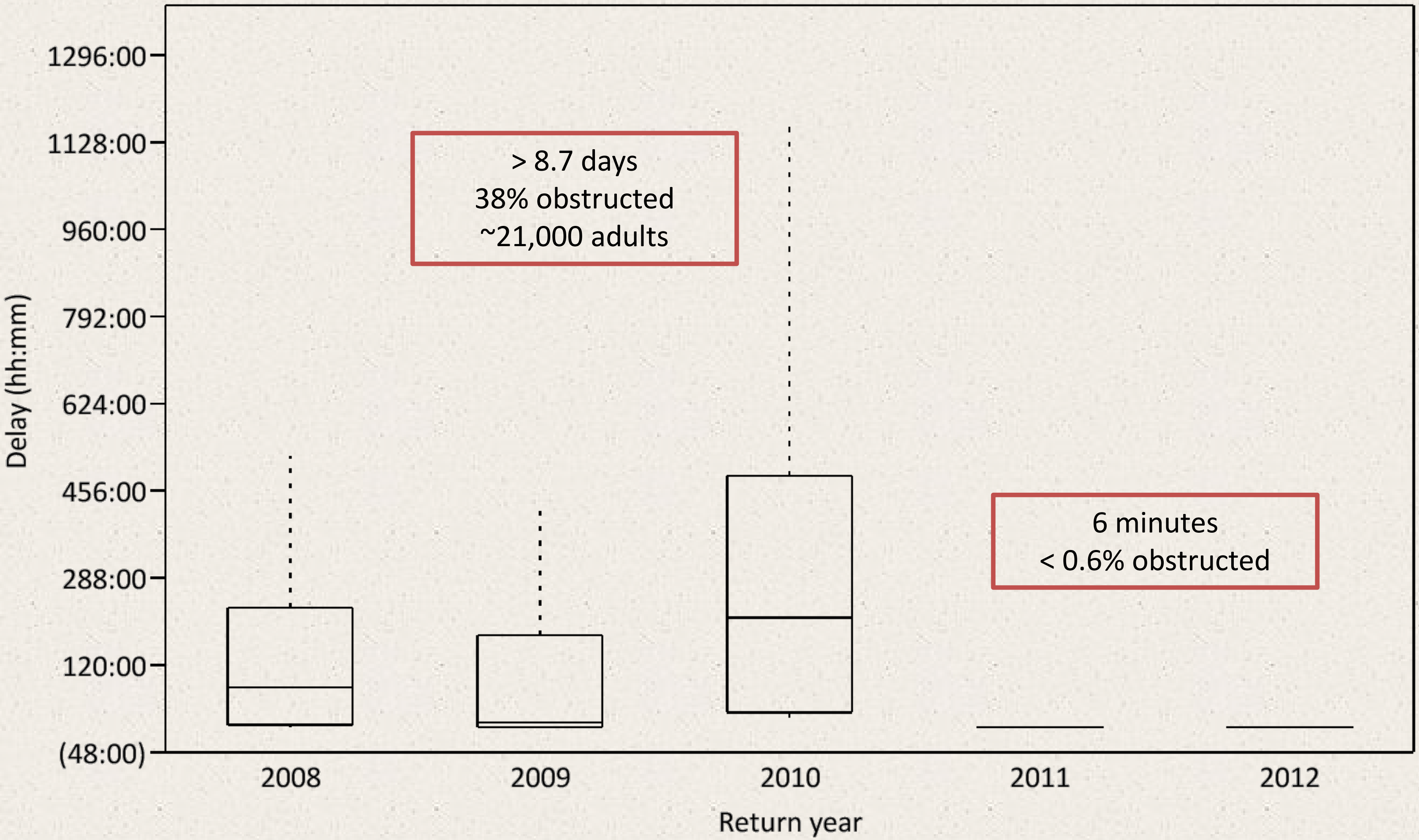
2012-2013:

Effects quantified



Attachment J

Results



Conclusions

- Trapping may have unintended consequences
- Precautions
  - *Need for trapping, risks and benefits identified*
  - *Facility design should minimize trap effects*
  - *Non-target species considered*
  - *Passage goals and effective monitoring needed*

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	March 26, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the February 26, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at the Radisson Hotel in SeaTac, Washington, on Tuesday, February 26, 2013, from 9:30 am to 11:00 am. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Lance Keller will provide the Coordinating Committees an update on the status of the re-watering of the lower adult fishway ladder at Rocky Reach Dam (Item II-D).
- Chelan PUD and Douglas PUD will prepare a draft update of the flow duration curve (Item III-B)
- Tom Kahler will provide the Coordinating Committees clean and redlined versions of the revised Douglas PUD Draft 2013 10-year No Net Impact (NNI) Comprehensive Check-in Report, along with the compiled comments, no later than 10 days prior to the Coordinating Committees' March 26, 2013 meeting (Item III-C).
- Tom Kahler will verify that the total combined capture reported in the Douglas PUD Draft 2012 Pikeminnow Program Annual Report, for pikeminnow at Rocky Reach and Wells dams, is correct (Item III-E).
- Chelan PUD and Douglas PUD will explore options for developing a shared HCP filing system and will report back to the Coordinating Committees for further discussion, prior to the Coordinating Committees' May 21, 2013 meeting (Item V-A).
- The Coordinating Committees' May 28, 2013 meeting has been rescheduled to May 21, 2013, and will be held in eastern Washington at a location that is yet to be determined (Item V-B).

DECISION SUMMARY

- Coordinating Committees representatives present approved the Statement of Agreement (SOA) for Phase III standards achieved for the combined adult and juvenile survival of steelhead, sockeye, and spring-run Chinook at Rocky Reach and Rock Island hydroelectric projects (Item II-A).
- Coordinating Committees representatives present approved the SOA that approves the Chelan PUD Final 2013 HCP Comprehensive Progress Report (Item II-B).
- Coordinating Committees representatives present approved the SOA for Wells Dam 2013 Lamprey Operations, as revised (Item III-A).

AGREEMENTS

- Coordinating Committees representatives present approved the Chelan PUD 2013 HCP Action Plan (Item II-C).
- Coordinating Committees representatives present approved the Douglas PUD 2012 Wells Post-Season Bypass Report (Item III-B).

REVIEW ITEMS

- The Douglas PUD Draft 2012 Pikeminnow Program Annual Report was distributed to the Coordinating Committees by Kristi Geris on February 12, 2013, for a 30-day review, with comments due to Tom Kahler no later than March 15, 2013.
- The Chelan PUD 2013 Rock Island and Rocky Reach Draft Fish Spill Plan was distributed to the Coordinating Committees by Kristi Geris on February 21, 2013, for review, with comments due to Steve Hemstrom no later than March 21, 2013.

REPORTS FINALIZED

- The Douglas PUD 2013 Final HCP Action Plan was distributed to the Coordinating Committees on January 23, 2013.
- The Douglas PUD 2013 Final Bypass Operations Plan was distributed to the Coordinating Committees on January 23, 2013.

- The Chelan PUD Final 2013 Comprehensive Progress Report was distributed to the Coordinating Committees on February 4, 2013.
- The Douglas PUD 2013 Final Gas Abatement Plan was distributed to the Coordinating Committees on February 6, 2013.
- The Douglas PUD 2012 Final Wells Post-Season Bypass Report was distributed to the Coordinating Committees on February 26, 2013.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda, and the following revisions were requested:

- Bob Rose requested that decision items be discussed first.
- Steve Hemstrom added a notification of Chelan PUD management changes.
- Tom Kahler requested that the Douglas PUD Subyearling Update be moved to the Coordinating Committees' March 26, 2013 meeting, and he also added a Wells Dam maintenance update.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft January 22, 2013 meeting minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to consider. Geris did note, however, one clarification regarding attaching draft and final plans to the meeting minutes. Geris clarified that draft documents are only attached to the meeting minutes when required to supplement the discussions. The reasoning is to limit the number of draft documents compiled in the annual reports. Further, any final plans and reports that are not included as a meeting attachment are appended separately to the annual reports. The draft January 22, 2013 meeting minutes were approved as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Chelan PUD

A. DECISION: Revised SOA approving Chelan PUD Adult and Juvenile Combined Survival Standard at Rocky Reach and Rock Island (Steve Hemstrom)

Steve Hemstrom recapped that Chelan PUD presented to the Coordinating Committees a table of Phase III standards achieved for the combined adult and juvenile survival of steelhead, sockeye, and spring-run Chinook at Rocky Reach and Rock Island. He said that the table was revised per the Coordinating Committees' recommendations, and that the SOA (Attachment B) that was distributed to the Coordinating Committees by Kristi Geris on January 26, 2013, is intended to document approval of the table, as revised. Coordinating Committees' representatives present approved the SOA.

B. DECISION: SOA approving Chelan PUD 2013 Rocky Reach and Rock Island HCP Comprehensive Progress Report(s) (Steve Hemstrom)

Steve Hemstrom said that the SOA approving the Chelan PUD Final 2013 HCP Comprehensive Progress Report (Attachment C) was distributed to the Coordinating Committees by Kristi Geris on February 4, 2013. Coordinating Committees' representatives present approved the SOA.

C. DECISION: Draft 2013 Rocky Reach and Rock Island HCP Action Plans (Steve Hemstrom)

Steve Hemstrom said that the Chelan PUD 2013 HCP Action Plans for Rocky Reach and Rock Island that describe activities planned for 2013 were distributed to the Coordinating Committees by Kristi Geris on January 16, 2013. He said that Chelan PUD is now requesting approval of the plans. Mike Schiewe clarified that SOAs are not typically completed for action plans; however, the Coordinating Committees do formally indicate approval of the plans. Coordinating Committees' representatives present approved the Chelan PUD 2013 HCP Action Plan.

D. Update: Rocky Reach and Rock Island Adult Fishway maintenance and return to service (Lance Keller)

Lance Keller said that after a short outage, the right ladder at the Rock Island Dam was back in service on February 1, 2013. He said that Turbine Unit 7 was also taken down for rehabilitation during this time. Keller said that next year, this ladder will be scheduled for a long outage. He said that the left ladder at the Rock Island Dam is currently being re-watered, and noted that the repairs to the concrete floor associated with the attraction flow regulating gates, as described at the Coordinating Committees' January 22, 2013 meeting, were completed and the floor is now secure. Keller said that at Rocky Reach Dam, during the re-watering of the lower ladder of the adult fishway, crews discovered that a gasket was missing from the flap gate indicator rod that is associated with the attraction water pumps for the adult fishway. He said that this gasket is currently being repaired and the re-watering will resume upon completion. Keller said that he will provide an update on the status of the re-watering as the repair is completed. (*Note: Keller notified the Coordinating Committees on February 27, 2013, that the missing gasket on the flap gate indicator rod had been repaired and the re-watering of the fishway resumed that morning; it is anticipated to have the ladder back in service by the March 1, 2013 deadline.*)

E. Notification of Chelan PUD Management Changes (Steve Hemstrom)

Steve Hemstrom notified the Coordinating Committees that Chelan County PUD's General Manager, John Janney, announced his resignation, effective August 2013.

III. Douglas PUD

A. DECISION: Draft SOA Wells Lamprey Operations 2013 (Tom Kahler)

Tom Kahler said that the SOA for Wells Dam 2013 Lamprey Operations (Attachment D) was distributed to the Coordinating Committees by Kristi Geris on February 12, 2013. Bob Rose requested that in the background section of the SOA, the word "definitively" be replaced with "better." He also suggested that the release of translocated fish be characterized as "below" Wells Dam. Kirk Truscott asked about the evaluation of potential effects on salmonid passage, as noted in the background section, and Kahler explained that Douglas PUD had Dr. John Skalski conduct an analysis of data collected during the 2009 and 2010 studies to evaluate potential impacts to salmonid passage; the results were that there were no statistically detectable effects to the treatment proposed in the 2013 study. Kahler said that he will forward Skalski's analysis to Truscott.

Coordinating Committees' representatives present approved the SOA, as revised. Kahler revised the SOA, as discussed, and provided the final SOA to Geris for distribution to the Coordinating Committees the same day.

B. DECISION: Douglas PUD Draft 2012 Post-Season Bypass Report (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2012 Wells Post-Season Bypass Report was distributed to the Coordinating Committees on January 17, 2013, by Kristi Geris for a 30-day review period, with comments due no later than Friday, February 15, 2013. He said that no comments were received. Bryan Nordlund asked about the timing of adjusting representative flow conditions by updating the flow duration curve. Steve Hemstrom said that the HCPs require that the flow duration curve is updated every 10 years. Chelan PUD and Douglas PUD agreed to prepare a draft flow duration curve update.

Nordlund also asked about the timing of fish passage operations at Rock Island Dam, and Hemstrom replied that Rock Island bypass starts no later than April 1 and spill starts on April 17. He said that these operations are outlined in the Chelan PUD Smolt Monitoring Program (SMP), and added that the start dates have never been adjusted.

Coordinating Committees' representatives present approved the Douglas PUD 2012 Wells Post-Season Bypass Report, and the final was distributed to the Coordinating Committees by Kahler the same day.

C. Discussion: Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report was distributed to the Coordinating Committees by Kristi Geris on December 27, 2012, for a 60-day review period, with comments due no later than Monday, February 11, 2013. Kahler said that comments were received from National Marine Fisheries Service (NMFS); and he added that Teresa Scott indicated via email that she had no comments to the draft report. He said that Douglas PUD has not yet received Kim Hyatt's Fish Water Management Tool weight of evidence report, but the summary is expected by the end of March 2013. Kahler said that, as Chelan PUD had done with their NNI report, Douglas PUD will provide to the Coordinating Committees a clean and redlined version of the revised Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report, along with the compiled comments, no later than 10 days prior to the Coordinating Committees' March 26, 2013 meeting. Kristi Geris agreed to contact Scott to let her know that the revised Douglas PUD Draft 2013 10-year NNI Comprehensive Check-in Report will be up for approval at the Coordinating Committees' March 26, 2013 meeting.

D. Update: Subyearling Life History / Douglas PUD Draft 2012 Subyearling Study Results Technical Memorandum (Tom Kahler)

Tom Kahler requested that this agenda item be rescheduled to the Coordinating Committees' March 26, 2013 meeting. He said that the technical memorandum summarizing 2012 Subyearling Study results was just recently completed. Mike Schiewe reminded the Committees that once the 2013 results are collected, those data will be integrated with data from 2011 and 2012 to produce a more comprehensive report.

E. Comment: Douglas PUD Draft 2012 Pikeminnow Program Annual Report (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2012 Pikeminnow Program Annual Report was distributed to the Coordinating Committees by Kristi Geris on February 12, 2013, for a 30-day review, with comments due no later than March 15, 2013. He said that in 2012, there was a declining catch, and added that this is partially due to the challenge of fishing in the Wells Dam tailrace with such high flows. He said that fish size is also declining. Lance Keller said that at Rocky Reach and Rock Island the average fish size is around 218 millimeters (mm); and he added that this has been steadily declining over recent years. Kahler said that the catch of fish 350 mm and larger declined over the first several years of the program and has now stabilized at a relatively small proportion of the annual catch. Kahler said that another notable observation from 2012 was the dramatic increase in burbot by-catch. He said that the burbot seem to be targeting pikeminnow on the line. Steve Hemstrom asked about the total combined capture at Rocky Reach and Wells dams that was reported in the draft report. He said that the figure seemed high. Kahler said that he will verify that the total combined capture reported is correct. Mike Schiewe said that the draft report will be on the Coordinating Committees' March 26, 2013 meeting agenda for approval.

F. New Total Dissolved Gas Station in Wells Reservoir (Tom Kahler)

Tom Kahler explained that total dissolved gas (TDG) concentrations in the Wells Dam forebay are often higher than would be expected based on TDG readings in the Chief Joseph Dam (CJ) tailrace. He said that currently, the CJ TDG monitoring station is located along the right-bank in the spillway zone by the CJ fish ladder, which is not picking up the powerhouse TDG along the left-bank. He said that this results in water with high concentrations of TDG bypassing the monitoring station. Therefore, Kahler said that another TDG monitoring station is being installed at Washburn Island located approximately 7 miles downstream from CJ and 23 miles upstream of Wells Dam. Kahler said that the new TDG station is located downstream of where both flow sources meet, and it will give a reading of water that is fully mixed.

G. Wells Dam Maintenance Update (Tom Kahler)

Tom Kahler said that the west fish ladder was back online on February 21, 2013, and that fishway maintenance at Wells Dam is now complete. He said that, like Chelan PUD at Rock Island, Douglas PUD typically has an extended maintenance period on one ladder and a shorter maintenance period for the other ladder, every other year. He said that this year, however, both ladders were down for an extended maintenance period, as several projects were scheduled to be completed for both ladders. Kahler said that all scheduled maintenance projects were complete.

IV. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees' meeting on February 14, 2013:

- *Washington Department of Fish and Wildlife (WDFW) Representative on the Tributary Committees*: Jeremy Cram was announced as the new WDFW representative on the Tributary Committees, and Carmen Andonaegui will serve as the alternate.
- *Review of Policies and Procedures Documents*: The Tributary Committees are refining their Policies and Procedures for Funding Projects and their Operating Procedures, including revising and updating language associated with Conservation

Easements and Acquisitions. Also, language is being added stating that all Tributary Committees-funded protection properties will allow public access.

- *Small Projects Program Application*: The Tributary Committees considered one small project from the Colville Confederated Tribes (CCT) that is titled *Okanogan Basin Stream Discharge Monitoring Project*. Sites include Loup Loup and Nine-Mile creeks. The total cost of the project is $94,924, and the sponsor requested $62,984 from HCP Tributary Funds. Tom Kahler said that the Tributary Committees requested additional information from the CCT to help inform a funding decision. He said that the information requested was provided and the Tributary Committees approved $74,985 from HCP Tributary Funds for the project.
- *Annual Deposits to the Plan Species Accounts*: Contributions to the Plan Species Accounts include: Rock Island—$690,515; Rocky Reach—$327,041; and Wells—$250,729. Kahler clarified that these amounts include this year's contributions only. He added that the Rock Island fund is becoming quite large, the Wells fund is now slightly more than one million dollars, and the Rocky Reach fund is somewhere in the middle. Schiewe noted that it may be helpful to include current fund totals in future reports. Steve Hemstrom also added that the annual contribution amounts are in 1998 dollars, and so the values are now inflated.
- *General Salmon Habitat Program Schedule*: The Tributary Committees approved the General Salmon Habitat Program schedule for 2013. Pre-proposals will be delivered to the Tributary Committees on May 7, 2013, and will be reviewed during the Tributary Committees' May 9, 2013 and June 13, 2013 meetings. Pre-proposal presentations will occur on June 12, 2013, and final proposals will be delivered to the Tributary Committees on July 12, 2013. Project tours are also scheduled for May 2013 and June 2013. The Tributary Committees will make funding decisions on August 8, 2013. Kahler said that pre-proposals will likely be narrowed down at the May 9, 2013 meeting, and that after the June 13, 2013 meeting, the Tributary Committees will likely provide sponsors with letters requesting either a full proposal or requesting that they do not provide a full proposal.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Hatchery Committees' meeting on February 20, 2013, which was hosted by Chelan PUD:

- *Hatchery And Genetic Management Plans (HGMP) Update*: Craig Busack reviewed the status of NMFS processing of the HGMPs; he also reminded the Committees about the requirements for bull trout consultations with the U.S. Fish and Wildlife Service (USFWS) for both direct and non-direct take hatchery programs. A follow-up meeting was planned to continue this discussion. (*Note: due to scheduling conflicts, a follow-up discussion is planned for the Hatchery Committees' March 20, 2013 meeting.*)
- *Wenatchee Steelhead Release Strategy*: In 2012, the survival of steelhead reared at the Chelan PUD Chiwawa Facility and released in the Wenatchee River was exceptionally low. This was the first year of the full relocation from the Turtle Rock Facility to overwinter acclimation at the Chiwawa Facility. During discussion it was noted that during the time that Turtle Rock was operational, steelhead were drop-planted directly at selected locations in the Wenatchee River; in contrast, with relocation to Chiwawa in 2012, a volitional collection and release strategy was used. Because there was no similar decline in survival for other Mid-Columbia steelhead programs in 2012, there was concern that the change to volitional release may have been a contributing factor. Accordingly, the Hatchery Committees agreed to test different release strategies in 2013.
- *Summer Chinook Brood Collection at the EBO*: Chelan PUD is working with WDFW to continue exploring the Eastbank Hatchery outfall (EBO) as a potential broodstock collection location for Chelan Falls summer Chinook brood.
- *5-Year Monitoring and Evaluation (M&E) Plan Update Discussion and Review of Draft Plan*: The Hatchery Committees are working on revisions to the hatchery M&E programs. This marks one year after completion of the last 5-year cumulative report. Chelan PUD, Douglas PUD, and Grant PUD are working jointly to develop an integrated approach for all programs in the Mid-Columbia. Comments on the draft report have been received, and the report is within one month of being complete. Once the report is finalized, the HCP PUDs will move forward to develop contracts for the coming years—likely via a request for proposal (RFP) process.

- *Update on Wells Hatchery Modernization*: Douglas PUD is expecting the Wells Hatchery Modernization Master Plan to be delivered in March 2013. The plan will be made available to the Hatchery Committees for review and comment.
- *Confidence in Estimation of Broodstock Numbers*: Greg Mackey gave a presentation on Confidence in Estimation of Broodstock Numbers. Kristi Geris will distribute the presentation to the Coordinating Committees, and Kahler said to contact Mackey with questions.
- *Run-Composition Sampling at Wells Dam for Summer Chinook*: Douglas PUD, Chelan PUD, Grant PUD, and the CCT are planning to meet to discuss proportional responsibilities for funding run-composition sampling at Wells Dam for summer Chinook.
- *Chief Joseph Hatchery M&E Presentation*: A presentation was provided by Keith Wolf about the CCT Hatchery M&E Program. He also announced the upcoming CCT's Annual Program Review Workshop scheduled for March 5 to 8, 2013. Kirk Truscott provided the Coordinating Committees with the hyperlink to the CCT's new webpage.
- *HETT Update*: Greg Mackey said that the Predation, Competition, and Disease (PCD) risk models that were written in Fortran have been crashing. Mackey is having the code reviewed.

V. HCP Committees Administration (Mike Schiewe)

A. File Sharing

Steve Hemstrom noted that the action item for Chelan PUD and Douglas PUD to explore options for developing a shared HCP filing system needs to be carried forward. Mike Schiewe recommended that this discussion be held prior to the file sharing presentation that is planned for the Coordinating Committees' May 28, 2013 meeting in eastern Washington.

B. Next Meetings

Bryan Nordlund said that the Priest Rapids Coordinating Committee's (PRCC's) May 22, 2013 meeting is also planned to be held in eastern Washington, potentially for a Pacific Northwest National Laboratory (PNNL), or other, site visit. Mike Schiewe suggested rescheduling the Coordinating Committees' May 28, 2013 meeting to May 21, 2013, to accommodate PRCC's arrangements with PNNL.

The next scheduled Coordinating Committees' meeting is March 26, 2013, to be held in person in at the Radisson Hotel in SeaTac, Washington. The April 23, 2013 meeting will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined. The Coordinating Committees' May 28, 2013 meeting has been rescheduled to May 21, 2013, and will be held in eastern Washington at a location that has yet to be determined.

List of Attachments

Attachment A	List of Attendees
Attachment B	Revised SOA approving Chelan PUD Adult and Juvenile Combined Survival Standard at Rocky Reach and Rock Island
Attachment C	SOA approving Chelan PUD 2013 Rocky Reach and Rock Island HCP Comprehensive Progress Reports
Attachment D	Draft SOA for Wells Dam 2013 Lamprey Operations

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Tom Kahler*	Douglas PUD
Bob Rose*†	Yakama Nation
Kirk Truscott*†	Colville Confederated Tribes
Bryan Nordlund*	National Marine Fisheries Service
Jim Craig*	U.S. Fish and Wildlife Service

Notes
* Denotes Coordinating Committees member or alternate
† Joined by phone

Final
Rocky Reach and Rock Island HCP Coordinating Committee
Statement of Agreement

Phase III Standards Achieved for 91% Combined Adult and Juvenile Survival
Rocky Reach and Rock Island Projects, January 2013

Agreement Statement
The Rocky Reach and Rock Island HCP Coordinating Committee (CC) has reviewed project conversion rates for adult steelhead, adult spring-run Chinook salmon, and adult sockeye salmon at the Rocky Reach and Rock Island Projects. Together with previously achieved HCP Juvenile Project Survivals, the CC approves Phase III Standards Achieved for the Combined Adult and Juvenile Survivals at Rocky Reach and Rock Island for the HCP Plan Species shown below.

Rocky Reach Adult and Juvenile Combined Survival
- Steelhead - 94.77%
- Sockeye - 92.58%

Rock Island Adult and Juvenile Combined Survival
- Steelhead - 96.08%
- Spring-run Chinook - 93.65%
- Sockeye - 91.75%

Background
The Rocky Reach and Rock Island HCP Passage Survival Plans (HCPs Section 5) require achievement of the 91% Combined Adult and Juvenile Survival Standard when both components can be measured (Table 1). Juvenile Project Survival was tested and achieved at the Rocky Reach Project from 2004 through 2011, and for the Rock Island Project in years 2007 through 2010 for yearling Chinook, steelhead, and sockeye (Table 2). Adequate numbers of PIT tagged adult fish allowed subsequent measurement of adult passage survival at Rocky Reach for spring-run Chinook in migration years 2009-2011, followed by migration years 2010-2012 for adult steelhead and sockeye. Rock Island adult passage survival was also estimated using migration years 2010-2012 (Table 1).

Table 1. HCP Juvenile, Adult, and Combined Survivals for steelhead, Chinook, and sockeye at the Rock Island and Rocky Reach Projects.

Project	Species	Juvenile Survival	Adult Survival	Combined[6]
Rock Island	Steelhead	96.75%	99.31% [2]	**96.08%**
	Spring Chinook	93.75% [1]	99.89% [3]	**93.65%**
	Sockeye	93.27%	98.37% [2]	**91.75%**
Rocky Reach	Steelhead	95.79%	98.93% [2]	**94.77%**
	Spring Chinook	92.37% [1]	99.90% [3, 4]	**92.28%**
	Sockeye	93.59%	98.92% [5]	**92.58%**

[1] Spring-migrating, yearling Chinook salmon.
[2] Estimate does not account for fish losses due to recreational harvest in any years
[3] No recreational harvest occurred for adult spring Chinook
[4] Adult conversion rate and Combined Project Survival approved for Rocky Reach Project on August 30, 2011 using 2009-2011 adult spring Chinook passage data.
[5] Estimate adjusted for loss of fish from recreational harvest in 2010 and 2011, but not for harvest losses in 2012.
[6] Combined survival is the product of juvenile and adult survival estimates (e.g., 98% × 93% = 91%)

Table 2. Study years and juvenile survival estimates used in Phase Designations at the Rock Island and Rocky Reach projects, 2004-2011. See 2013 Comprehensive Progress Report for more detailed description of individual studies.

Project	Species	Juvenile Survival	HCP Study Years
Rock Island	Steelhead	96.75%	2008, 2010 (n = 2)[1]
	Spring Chinook [1, 2]	93.75%	2007-2010 (n = 3)[1]
	Sockeye	93.27%	2007-2009 (n = 3)[1]
Rocky Reach	Steelhead	95.79%	2004-2006 (n = 3)
	Spring Chinook [2]	92.37%	2004-2005, 2010-2011 (n = 4)
	Sockeye	93.59%	2006-2009 (n = 3)

[1] Juvenile survival standards tested at the Rock Island Project under a 10% project spill level.
[2] Spring-migrating, yearling Chinook salmon.

Final
Rock Island and Rocky Reach Habitat Conservation Plans
Coordinating Committee

Statement of Agreement

Approval of Rock Island and Rocky Reach
HCPs 2013 Comprehensive Progress Report

(For Approval February 26, 2013)

Agreement Statement
The Rock Island and Rocky Reach Habitat Conservation Plans' (HCPs) Coordinating Committee (CC) has reviewed and approved Chelan PUD's 2013 Comprehensive Progress Report for the Rock Island and Rocky Reach HCPs. This report describes the status in achieving No Net Impact (NNI) for each Plan Species, at each project, and satisfies Chelan PUD's ten-year Progress Report requirement described in Section 4.8 of the HCPs.

Background
Section 4.8 of the Rocky Reach and Rock Island HCPs includes a requirement for Chelan PUD to prepare a comprehensive progress report "at the direction of the Coordinating Committee" by March 2013. More specifically:

> *"By March 2013, a comprehensive progress report shall be prepared by the District, at the direction of the Coordinating Committee assessing overall status in achieving NNI, and shall include the status of each Plan Species."* (See Sections 4.8: Progress Reports, from Rock Island and Rocky Reach HCPs)

Chelan PUD will continue to prepare Comprehensive Progress Reports on the status of NNI at successive ten-year intervals.

Wells HCP Coordinating Committee
Statement of Agreement to Modify Fishway Operations for a Lamprey Radio-telemetry Study at Wells Dam in 2013

Date of Approval:

Statement

The Wells HCP Coordinating Committee (CC) approves the request of the Wells Aquatic Settlement Work Group (ASWG) for operating the Wells Dam fishway collection galleries at a 1.0' head differential from 19:00 to 02:00 every other day during the 2013 lamprey migration. The fishway collection galleries will operate at the normal, 1.5' head differential on alternating days. These alternating operations will serve as treatments in a radio-telemetry study of lamprey dam-passage behavior that is being conducted at the request of the ASWG. The requested operations will commence on August 1st and will continue through October 7th.

Background

In 2013, Douglas PUD proposes to conduct a radio-telemetry study of Pacific lamprey at Wells Dam to evaluate, 1) their passage behavior and success through the fishways, with an emphasis on the fishway entrances and collection galleries; and, 2) their enumeration efficiency, behavior, and passage efficiency at the fish-count stations. This proposed study follows up on previous investigations of lamprey passage and entrance efficiency at the Wells Dam fishways. The Wells HCP CC approved studies in 2009 and 2010 that used Dual Frequency Identification Sonar (DIDSON) technology to observe the behavior of lamprey attempting to pass the fishway entrances under different operating conditions. The results of those studies indicated that lamprey entrance efficiency can be enhanced by reducing the collection-gallery-to-tailwater head differential from 1.5' to 1.0'. However, conclusions regarding lamprey performance under different flow velocities were drawn from DIDSON observations of only a few lamprey. Following the DIDSON studies both the HCP CC and the ASWG recognized that only an active-tag study could definitively determine lamprey response to and performance under the different fishway-entrance head-differentials. Additionally, a radio-telemetry study could inform the ASWG regarding the behavior of lamprey at the fish-count stations in each fishway. To avoid the potential of conducting an active-tag study with insufficient sample size, the radio-telemetry study proposed for 2013 will collect 125 lamprey at Bonneville and Priest Rapids dams and translocate them to Wells Dam where they will be tagged and released into the tailrace.

Analysis of salmon and steelhead passage data collected in 2009 and 2010 during the DIDSON studies indicated no significant difference in passage rates of steelhead, sockeye, Chinook, or coho with either a 1.0' or 1.5' head differential during the period from 19:00 to 02:00.

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	April 24, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the March 26, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at the Radisson Hotel in SeaTac, Washington, on Tuesday, March 26, 2013, from 9:30 am to 1:30 pm. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Coordinating Committees representatives will submit questions and comments on the Columbia River Inter-Tribal Fish Commission's (CRITFC's) annual request for tagging sockeye at Wells Dam, and associated materials, to Tom Kahler no later than April 5, 2013 (Item II-B).
- Douglas PUD and Chelan PUD will develop Gantt charts or similar graphic displays that summarize trapping activities at Wells Dam, Twisp Weir, Tumwater Dam, and the Dryden Facilities, as well as diagrams of trapping facilities at these same locations (Item II-C).
- Tom Kahler will verify the number of pikeminnow that have been reportedly captured within the Wells tailrace/Rocky Reach Reservoir from 2008 to 2013, as was reported in the Douglas PUD Draft 2012 Pikeminnow Program Annual Report (Item II-D).
- Chelan PUD will provide an updated flow duration curve for valid survival studies to Kristi Geris for distribution to the Coordinating Committees (Item III-A).
- Steve Hemstrom will provide details on the "top panel" of the Rocky Reach Dam Intake Screens to Kristi Geris for distribution to the Coordinating Committees (Item IV-B).

- Steve Hemstrom will provide fish lengths and sampling duration after fish release for the 2013 preseason tests of the Rocky Reach bypass, to Kristi Geris for distribution to the Coordinating Committees (Item IV-B).
- Steve Hemstrom will revise the 2013 Rocky Reach Juvenile Fish Bypass Operations Plan to clarify that the 20 percent descale metric used to evaluate safe bypass system passage for migrating juvenile salmon and steelhead applies to individual fish (Item IV-B).

DECISION SUMMARY

- Coordinating Committees representatives present approved the Statement of Agreement (SOA) approving the Douglas PUD Final 2013 10-year No Net Impact (NNI) Comprehensive Progress Report (Item II-A).

AGREEMENTS

- Coordinating Committees representatives present approved the Douglas PUD Final 2013 10-year NNI Comprehensive Progress Report with the expectation that the Executive Summary of the Fish and Water Management Tool (FWMT) Report from Dr. Kim Hyatt, of Department of Fisheries and Oceans Canada (DFO), will be incorporated when available (Item II-A). *(Note: based on subsequent discussions with Dr. Hyatt, the Coordinating Committees later agreed to revise the existing FWMT summary that was included in the report to reflect that those data are based on preliminary analysis. A separate FWMT Report will be released from Dr. Hyatt, when available, and will not be appended to the 10-year NNI Comprehensive Progress Report.)*
- Coordinating Committees representatives present approved the Douglas PUD 2012 Pikeminnow Program Annual Report (Item II-D).
- Coordinating Committees representatives present approved the Rocky Reach and Rock Island 2013 Fish Spill Plan (Item IV-A).
- Coordinating Committees representatives present approved the 2013 Rocky Reach Juvenile Fish Bypass Operations Plan, as revised (Item IV-B).

REVIEW ITEMS

- The 2012 Rocky Reach Juvenile Fish Bypass Draft Report was distributed to the Coordinating Committees by Kristi Geris on March 14, 2013, for a 30-day review period with comments due to Lance Keller no later than April 15, 2013.
- The draft 2012 Chelan Pikeminnow Control Report was distributed to the Coordinating Committees by Kristi Geris on March 15, 2013, for a 30-day review period with comments due to Lance Keller no later than April 15, 2013.

REPORTS FINALIZED

- The Douglas PUD 2012 Final Wells Post-Season Bypass Report was finalized and distributed to the Coordinating Committees on February 26, 2013.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. Tom Kahler added a request for approval of the Douglas PUD Draft 2012 Pikeminnow Program Annual Report.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft February 26, 2013 meeting minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes. Geris also noted two revisions that were made to the revised minutes after they were distributed to the Coordinating Committees on March 18, 2013. The minutes were revised accordingly, and the draft February 26, 2013 meeting minutes were approved, as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Douglas PUD

A. DECISION: Douglas PUD 2013 10-year NNI Comprehensive Progress Report (Tom Kahler)

Tom Kahler said that comments received on the Douglas PUD revised draft 2013 10-year NNI Comprehensive Progress Report were compiled and appended to the report, and a clean and redlined version of the draft report, along with a draft SOA approving the report, were distributed to the Coordinating Committees by Kristi Geris on March 19, 2013. Kahler said that Douglas PUD is still waiting for the Executive Summary of the FWMT Report from Dr. Kim Hyatt, of DFO, and asked if the Coordinating Committees had any concerns with approving the plan prior to incorporating Dr. Hyatt's piece. Coordinating Committees representatives agreed that they had no concerns with incorporating Dr. Hyatt's piece when available, and approved both the Douglas PUD Final 2013 10-year NNI Comprehensive Progress Report and the SOA approving the Douglas PUD Final 2013 10-year NNI Comprehensive Progress Report. *(Note 1: Kahler finalized and distributed to the Coordinating Committees the final SOA that approved the Douglas PUD Final 2013 10-year NNI Comprehensive Progress Report [Attachment B] on March 27, 2013. Note 2: based on subsequent discussions with Dr. Hyatt, the Coordinating Committees later agreed to revise the existing FWMT summary that was included in the report to reflect that those data are based on preliminary analysis. A separate FWMT Report will be released from Dr. Hyatt, when available, and will not be appended to the 10-year NNI Comprehensive Progress Report.)*

B. Annual CRITFC Request for Sockeye Tagging at Wells Dam (Tom Kahler)

Tom Kahler said that Douglas PUD has received the CRITFC's annual request for tagging sockeye at Wells Dam (Attachment C), as distributed to the Coordinating Committees by Kristi Geris on March 21, 2013. He reminded the Coordinating Committees that last year, the Committees requested that Dr. Jeff Fryer (the study's Principal Investigator) provide the Committees with a study plan with future requests and annual reports of study results prior to receiving future requests. The Committees also requested that the submittal of future requests be in time to be included in the March meeting agenda. Kahler said that the 2012 final report was not yet complete, and so instead, Dr. Fryer provided the final 2011 report and a draft 2012 progress report, which Kahler said should cover the Coordinating Committees' interests. He said that Dr. Fryer also provided a narrative of the project, and CRITFC's Endangered Species Act (ESA) (spring Chinook, steelhead, and bull trout) permits.

Kahler said that CRITFC has installed a number of passive integrated transponder (PIT) tag arrays and acoustic arrays, and noted that this year CRITFC is interested in increasing the sample size. He said that CRITFC's 2013 request includes PIT tagging and collecting scale samples from up to 800 sockeye, and additionally, acoustic tagging up to 70 sockeye and affixing temperature tags on up to 200 sockeye. *(Note: Kahler later confirmed that the 70 acoustic tags and 200 temperature tags will be subsets of the 800 sockeye sampled.)* Kahler said that sampling will likely take place from late June through early August 2013, and added that, as requested last year, tagged adults will be released upstream of Wells Dam rather than into the ladders. Kahler said that in consideration of the proposed sampling period, the Coordinating Committees will need to reach a decision no later than the Coordinating Committees' May 28, 2013 meeting.

Bryan Nordlund said that his only concern would be if the 2013 sockeye run is really small. Kahler agreed and said that reduced adult returns are expected in 2013, in comparison to previous years, due to the Testalinden Creek slide that adversely affected the rearing area in Lake Osoyoos with an influx of suspended sediment shortly after fry entered the lake. He said that even the smaller return is still expected to be larger than the historic mean. Kahler said that there is a lot of interest in what happens with the fish once they pass Wells Dam, and added that he supports the project, in general; however, he is unsure if the benefit is worth taking that many fish when the run is low. Mike Schiewe suggested that Kahler invite Dr. Fryer to a future Coordinating Committees meeting to present his studies. Kirk Truscott also requested that Dr. Fryer include Okanagan sockeye projections at Wells Dam when he submits future annual requests for sockeye tagging at Wells Dam.

Coordinating Committees representatives agreed to submit questions and comments on CRITFC's annual request for tagging sockeye at Wells Dam, and associated materials, to Kahler no later than April 5, 2013.

C. Coordination of Trapping Activities at Wells Dam (Tom Kahler)

Tom Kahler suggested that the Coordinating Committees become more involved in all discussions regarding trapping at Wells Dam. He noted that there are multiple hatchery programs that obtain broodstock in the Well Dam fishway trap; and he added that these discussions typically have taken place in the Hatchery Committees, but should have also included the Coordinating Committees, as trapping can affect passage at the dam. He said that current trapping operations at Wells Dam include: Washington Department of Fish and

Wildlife (WDFW) for some of Chelan PUD's hatchery programs as well as Douglas PUD's spring Chinook and steelhead programs; the Colville Confederated Tribes (CCT) as back-up for the Chief Joseph Hatchery (CJH) program; likely Dr. Jeff Fryer for CRITFC's sockeye study; and the Yakama Nation (YN) for their coho reintroduction program. Kirk Truscott added that Grant PUD uses Wells Dam for collecting broodstock for their Carlton program. Kahler added that U.S. Fish and Wildlife Service (USFWS) currently uses the Wells Hatchery volunteer channel to collect broodstock for their Entiat program, although not passage-related, and the YN also uses the volunteer channel for their Yakima River summer Chinook reintroduction program as well. Kahler explained that Wells Dam has ladder traps on both east and west fish ladders, and the fishway channel that leads into Wells Hatchery—the volunteer channel—is used to collect summer Chinook brood. Kahler said that Douglas PUD also occasionally receives trapping requests from random interests and those associated with research proposals; as a result, Douglas PUD is often left with the challenge of how to coordinate all of these activities.

Bryan Nordlund asked if PIT-tag detector arrays are installed in the fish ladders. Kahler replied that antenna arrays are installed in Pools 67 and 68 of both ladders and have essentially 100 percent detection. Last year antennas were installed in Pool 19 of both ladders (below the traps); however, the lower sections of both ladders (including Pool 19) have both orifice and overflow weirs, so fish could avoid detection by using the overflow weir rather than an orifice. Kahler said that the new readers powering the antennas in Pool 19 provide very good detection, and can detect fish that get close to the orifice. Nordlund said that if those tools are in place, passage can be evaluated throughout the ladders. He also suggested that because there are so many entities trapping at Wells Dam, perhaps a Gantt chart of the different trapping activities would be helpful. Truscott said that he believes that the different trapping efforts are authorized by their respective Section 10 permits; he said trapping is limited to a three-days-per-week limit. Mike Schiewe noted that when a proliferation of trapping at Tumwater Dam "flew under the radar," it resulted in significant delays. He said the vast majority of trapping at Tumwater Dam was vetted through the HCP Hatchery Committees, but according to the HCPs, fish passage is the responsibility of the Coordinating Committees. Schiewe added that the HCP Hatchery Committees should continue to vet the trapping issues, as there may be different ways to collect broodstock, but ultimately the Coordinating Committees need to review these actions as well.

Schiewe said Nordlund's suggestion to compile trapping information in the form of a Gantt chart is a good start to bring the Coordinating Committees into the discussions, and Douglas PUD and Chelan PUD agreed to develop these, or similar graphic displays, that summarize trapping activities at Wells Dam, Twisp Weir, Tumwater Dam, and the Dryden Facilities, as well as diagrams of trapping facilities at these same locations.

D. Douglas PUD Draft 2012 Pikeminnow Program Annual Report (Tom Kahler)

Tom Kahler said that the Douglas PUD Draft 2012 Pikeminnow Program Annual Report was distributed to the Coordinating Committees by Kristi Geris on February 12, 2013, and that the 30-day review period ended March 15, 2013. Steve Hemstrom had, at the February meeting, asked about the number of pikeminnow reportedly captured within the Wells tailrace/Rocky Reach Reservoir from 2008 to 2013, as was reported in the draft report, and Kahler said that he was unable to reconcile the number based on catch data from the Wells and Rocky Reach programs, and will ask the contractor to verify or correct that the number. Coordinating Committees representatives present approved the Douglas PUD 2012 Pikeminnow Program Annual Report.

E. 2012 Subyearling Study Results (Tom Kahler)

Tom Kahler gave a presentation on 2012 Subyearling Study Results (Attachment D), based on the 2012 Subyearling Life-history Study Technical Memorandum that was distributed to the Coordinating Committees by Kristi Geris on March 22, 2013. *(Note: Geris distributed the 2012 Subyearling Study Results presentation directly after the meeting on March 26, 2013.)*

Kahler reviewed 2011 and 2012 seining locations and operations, and summarized detection statistics. He noted that Gebber's Landing just downstream of the Okanogan River mouth was a particularly successful seining location. He said that fish that were too small to tag were collected at all of the seining locations throughout the tagging period, but the numbers varied substantially among locations. Average fish length varied by location and sampling week, and the proportion of larger fish increased in Wells Pool locations farther downstream. He also said that due to high variability in the observed growth rates of fish recaptured 2 to 11 days post-tagging, no statistical difference was found in growth between 2011 and 2012, as depicted on graphs on page 12 of Attachment D.

Rocky Reach Juvenile Fish Bypass (RRJFB), McNary Dam, John Day Dam, and Bonneville Dam PIT-tag detections were reviewed. Kahler noted that detection frequencies in 2012 had a more pronounced bimodal distribution for each location than observed in 2011. Travel times to RRJFB were slower in 2012 than 2011, and travel times from RRJFB to downstream detection sites were faster. In general, though, the patterns of travel times in 2012 were similar to those observed in 2011, and travel times of larger fish (i.e., greater than or equal to 87 mm) were faster than those of smaller fish (i.e., less than 87 mm); Kahler noted the difference was not as pronounced in 2012 as was the case in 2011. Kahler said the same was observed with detection rates and fish size—larger fish had higher detection rates than smaller fish in 2012; however, the difference was not as pronounced in 2012 as was observed in 2011. Kahler said that the measurement errors and natural variability in growth rates that complicated the determination of actual growth rates within the first few days following tagging affected all size classes equally. Kahler reviewed the challenges of tagging in 2012, which were similar to those found in 2011, such as, a high proportion of fish too small to tag in earlier sampling, and the reduced availability or susceptibility to capture of the largest fish. He said the inability to tag smaller fish early in the outmigration or to capture the largest fish, although common in tagging studies, suggests the tagged fish were not representative of the entire population. Lastly, Kahler reviewed length frequency of captured fish by week, as shown in a graph on page 30 of Attachment D. Kahler noted that for PIT-tag studies, Douglas PUD typically is comfortable using 70 mm fish, but according to the graph, that means almost half of the fish available during this time frame are unusable—that is, until smaller, but comparably efficient PIT tags are made available.

Kahler said that Gebber's Landing is probably a productive sampling site because the area largely consists of cobble and sand, almost no vegetation, and low slope at the mouth of a tributary supporting a large number of spawners. Truscott asked if Douglas PUD has considered offshore sampling techniques for sampling later in the year, and Kahler replied that they attempted pulling a beach seine with two boats without success, and added that they would need to try something else, such as purse seines. He said, however, that previous data collected in the Wells Dam forebay using purse seines indicated low numbers, so Douglas PUD may not want to focus efforts on that option.

Kahler said that Douglas PUD plans to continue this study in 2013, and that they will extend tagging efforts to include one additional week, as outlined in the technical memorandum. Nordlund asked if John Day Dam and Bonneville Dam bypass detection systems run year round, and Kahler replied that they run as long into the year as weather permits (e.g., down until icy conditions force closure). Kahler also noted that as spill declines, detection in the bypass increases. Teresa Scott asked about the status of the Priest Rapids Coordinating Committee's (PRCC's) recommendation for Grant PUD to convene a subyearling Chinook workshop, and Schiewe replied that their plan is to wait to see what Chelan PUD and Douglas PUD developed first. Nordlund added that Grant PUD is not planning any survival studies until they wrap up a few other ongoing projects. Hemstrom said that Chelan PUD is planning a presentation soon to compare 2009 and 2013 data and technology.

III. Chelan PUD and Douglas PUD

A. Grand Coulee Valid Study Flow Duration Curve Update (Steve Hemstrom and Tom Kahler)

Steve Hemstrom said that he started tracking down data in order to draft an update of the flow duration curve. He said that he was unable to locate the 1929 to 1978 data that were used to develop the existing curve, and discovered that those data were actually model data. He said that he combined the 1983 to 2001 data with the earlier data, and that he plans to add post-2001 flow data from Grand Coulee to calculate the new numbers. Bryan Nordlund agreed that using the 1983 to 2012 data made the most sense. Hemstrom agreed and said that he will use those data to compare to the old curve; and he added that he will provide an updated flow duration curve for valid survival studies to Kristi Geris for distribution to the Coordinating Committees.

IV. Chelan PUD

A. DECISION: Rocky Reach and Rock Island 2013 Fish Spill Plan (Steve Hemstrom)

Steve Hemstrom said that the Chelan PUD 2013 Rock Island and Rocky Reach Draft Fish Spill Plan was distributed to the Coordinating Committees by Kristi Geris on February 21, 2013, for review, with comments due no later than March 21, 2013. He said that overall, the 2013 plan is largely similar to the 2012 plan.

At Rock Island Dam, Hemstrom said that spring spill will start no later than April 17, 2013, and the dam will spill 10 percent of the daily average river flow until the beginning of summer spill, when the dam will then spill 20 percent of the daily average river flow for a duration that covers 95 percent of the summer outmigration of subyearling Chinook. Hemstrom said that the criteria to end summer spill are when subyearling counts from the Rock Island trap are 0.3 percent or less of the cumulative run total for any three out of five consecutive-day periods. He added that these spill levels have been tested in survival studies. Bryan Nordlund asked about spill shaping at Rock Island Dam, and Hemstrom reviewed the different spill levels, noting that the higher spring spill (12.5 percent) and higher summer spill (23 percent) both occur around midnight. Hemstrom said that this is the same as in 2012.

At Rocky Reach Dam, Hemstrom said that summer spill starts as soon as subyearling Chinook smolts arrive in the Rocky Reach bypass, which is typically in late-May to early-June; and he added that often times in June, the project is already spilling above the 9 percent level. Hemstrom noted that spill shaping at Rocky Reach Dam goes up to 12 percent between 0900 and 1500, i.e., the afternoon is the highest proportion of spill.

Coordinating Committees representatives present approved the Rocky Reach and Rock Island 2013 Fish Spill Plan.

B. 2012 Rocky Reach Bypass Report and 2013 Rocky Reach Bypass Operations Plan (Steve Hemstrom)

The 2012 Rocky Reach Juvenile Fish Bypass Draft Report was distributed to the Coordinating Committees by Kristi Geris on March 14, 2013, for a 30-day review period with comments due no later than April 15, 2013. Jim Craig noted that descaling in 2004, as reported in the 2012 draft report, was higher than usual but still below the threshold, and Kirk Truscott said that he would like to confirm that those levels are acceptable to move forward. Steve Hemstrom said that the acceptable descaling rates that are reported in the 2012 report are based on the 2003 Rocky Reach Juvenile Fish Bypass Operations Plan; and added that those rates can be updated, if necessary. Mike Schiewe said that the 2012 Rocky Reach Juvenile Fish Bypass Draft Report will be considered approved if no comments are received by the review period deadline.

The draft 2013 Rocky Reach Juvenile Fish Bypass Operations Plan was distributed to the Coordinating Committees by Kristi Geris on March 7, 2013; however, based on comments received from Bryan Nordlund, a revised draft plan was redistributed by Lance Keller on March 12, 2013, for review, with comments due no later than March 25, 2013. Hemstrom reviewed that the 2013 plan proposes to use three additional pumps in the RRJFB Surface Collector (SC) to increase attraction flow to 6,660 cubic feet per second (cfs) into the SC entrances; and the plan also proposes increases to the turbine unit C2 flow from its normal set-point of 12,200 cfs (12.2 thousands of cubic feet per second [kcfs]) to 15.2 kcfs during the turbine unit C1 outage. Also included in the 2013 plan were the preseason tests of the Rocky Reach bypass using marked fish releases to insure that there was no effect on fish condition or passage. Hemstrom said that these tests are conducted each spring to insure that the system is performing properly, and that this year, the fish were ventral fin-clipped and released in two locations: 1) 100 fish were released at the entrance to the RRJFB SC; and 2) 100 fish were released at the SC intake screens. He said that as requested, Keller selected the smallest fish available to evaluate the potential of impingement with the increased screen velocities. Hemstrom said that zero descale was observed in the fish that were recovered. He also said that 100 percent of the fish that were released were not recovered, and he added that this is typical. He said that 92 fish and 95 fish were collected from each location, respectively, and suggested that this could be due to predation, or that the fish could be failing to enter the system. Brian Nordlund suggested that the missing fish could be related to small fish size, and noted that flow through the bypass can be quite turbulent. Hemstrom said that he did not know the exact fish lengths, but said that he will locate them and provide that information and sampling duration, after fish release for the 2013 preseason tests of the Rocky Reach bypass, to Geris for distribution to the Coordinating Committees. Hemstrom said that 100 fish were also released into turbine unit C2 via delivery pipes; however, a top panel located on the intake screens was left open which resulted in only 14 recaptures of the 100 fish released. Hemstrom said that he will locate further details on the top panel of the Rocky Reach Dam Intake Screens and provide them to Geris for distribution to the Coordinating Committees. He said that once the top panel was closed, the test was performed again and all 100 fish were recovered.

Truscott asked about the 20 percent descale metric used to evaluate safe bypass system passage for migrating juvenile salmon and steelhead, as was described in the 2013 Rocky Reach Juvenile Fish Bypass Operations Plan, and Hemstrom said that he will revise the plan to clarify that the 20 percent descale metric used to evaluate safe bypass system passage for migrating juvenile salmon and steelhead applies to individual fish, not to the proportion of fish sampled that were descaled. Truscott also asked for clarification on "ambient descaling," and how it is assessed. Hemstrom clarified that "ambient descaling" is meant to characterize fresh, versus pre-existing descaling, which Hemstrom said is typically easy to differentiate. Schiewe added that previously descaled fish can also be evaluated under a microscope to observe presence of epidermic regrowth. Hemstrom invited Truscott to visit Rocky Reach Dam to observe the process if he would like, and Truscott said that based on the 2012 report, descaling is likely not an issue anyway. Coordinating Committees representatives present approved the 2013 Rocky Reach Juvenile Fish Bypass Operations Plan, as revised.

C. Rocky Reach and Rock Island Bypass Operation Dates (Steve Hemstrom)

Steve Hemstrom said that Bryan Nordlund had asked if the bypass at Rocky Reach Dam and Rock Island dam were ever implemented outside the typical period of April 1 through August 31. Hemstrom said that, to date, bypass at the dams have run no later than September 7, and added that the HCPs contain language to evaluate whether bypass operations cover 95 percent of passage. He said specifically, that Nordlund asked how Rocky Reach Dam and Rock Island Dam staff determine whether there are additional fish in a given run remaining to pass. Hemstrom said that operating data were reviewed for the past 10 years, and since 2003, on average, 33 fish have passed the dams during the last week of August. He added that these data were based on four 2-hour sampling periods. Nordlund explained that the reasoning for his question was to determine whether the University of Washington RealTime Model is capable of projecting late-migrating Chinook. He suggested that, in light of trying to learn more about subyearlings, this would be something to investigate. Hemstrom said that several years ago, Dr. John Skalski's group was asked to add a logarithm to the RealTime model which continues to add hypothetical fish numbers as if Rocky Reach Dam was still operating. Mike Schiewe noted that Jerry Marco had raised this same issue in the past, but that there were staffing issues that complicated extending bypass sampling. Schiewe asked if the Coordinating Committees would, again, like to consider extending the sampling period. Hemstrom said that extended sampling would need to be for 2014 because contracts are already in place for 2013. Nordlund said that as far as getting labor in place, he did not think that sampling would need to take place around the clock; however, Hemstrom said that Chelan PUD would prefer that staff were onsite. Nordlund added that this question was based on why the provision to evaluate bypass operations was included in the HCPs—not because he was particularly concerned. Hemstrom noted that as fish populations grow, the tails grow. Kirk Truscott asked if there is an opportunity to use PIT-tag arrays at the end of August, and Hemstrom noted that if the bypass is not operational, the fish would not pass the arrays. Schiewe suggested that, for now, the Coordinating Committees might consider the extended sampling period for 2014.

D. Final Rocky Reach and Rock Island Fishway Return-to-Service Information (Steve Hemstrom)

Steve Hemstrom said that the Rocky Reach fishway was re-watered and back in service on March 1, 2013. He said that the missing gasket on the flap gate indicator rod that was discussed at the Coordinating Committees' February 26, 2013 meeting has been repaired, as described in an email distributed by Lance Keller on February 27, 2013. Hemstrom said that the Rock Island left ladder was up sooner than expected, on March 8, 2013, and that all other ladders at Rock Island Dam were operational at that time.

E. Chelan PUD 2013 10-year NNI Comprehensive Progress Report: Production (Steve Hemstrom)

Steve Hemstrom said that the Chelan PUD Final 2013 10-year NNI Comprehensive Progress Report is now in final production, and asked if Coordinating Committees representatives would like hardcopies of the final report. Bryan Nordlund, Teresa Scott, and Kirk Truscott requested three copies each for National Marine Fisheries Service (NMFS), WDFW, and the CCT, respectively. Jim Craig requested two copies for the USFWS; Mike Schiewe requested two copies for Anchor QEA; and Hemstrom said that he will prepare three copies for the YN.

V. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees' meeting on March 14, 2013:

- *Review of Policies and Procedures Documents*: The Tributary Committees adopted select Salmon Recovery Funding Board (SRFB) policies and procedures to be incorporated into the Tributary Committees' Policies and Procedures document. The revised Policies and Procedures document will be shared with project sponsors during the SRFB/ Tributary Committees/Bonneville Power Administration (BPA) kick-off meeting on March 27, 2013.
- *Small Projects Program Application*: The Tributary Committees reviewed two Small Projects Program Applications: 1) *Okanogan Basin Stream Discharge Monitoring Project*; and 2) *Methow/Chewuch Shallow Groundwater Monitoring Project*. The Tributary Committees approved funding for both projects.
- *General Salmon Habitat Program Schedule*: The Tributary Committees finalized their 2013 schedule for the General Salmon Habitat Program. Pre-proposals will be delivered to the Tributary Committees on May 7, 2013; pre-proposal presentations will occur on June 12, 2013; final proposals will be delivered to the Tributary Committees on July 12, 2013; and funding decisions will be made on August 8, 2013. Steve Hemstrom noted that looking back at the past 10 years and the amount of money spent, it seems that tributary funds are still growing. He asked what happens to the balance of the funds when the HCPs end. Tom Kahler agreed that the funds are growing, and indicated that this was intentional so that funds were available for future larger, high-cost projects that have significant benefits. He added that there is a provision that explains where excess funds would go, if needed. Teresa Scott asked if the Tributary Committees are responsible for monitoring, and Kahler replied that they are not directly responsible, but that each PUD has a separate responsibility to evaluate the relative performance of projects (i.e., which projects perform as intended and which did not) that are funded by the initial contributions to the respective Plan

Species Accounts. This responsibility is funded directly by each PUD through a $200,000 Tributary Assessment Program, rather than with the Plan Species Accounts, and the respective Tributary Committees must approve measures toward the implementation of the Tributary Assessment Programs. The Wells Tributary Committee directed Douglas PUD to fund the monitoring of a large oxbow-reconnection project on the Okanagan River in Canada (final report pending) and has considered monitoring the recolonization of Shingle Creek following a dam-removal project scheduled for this summer. He also noted that the Integrated Status and Effectiveness Monitoring Program (ISEMP) focuses on monitoring efforts in the Wenatchee and Entiat basins and so the Tributary Committees did not want to overlap efforts with that program.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Hatchery Committees' meeting on March 20, 2013, which was hosted by Douglas PUD:

- *HGMP Update*: Lynn Hatcher provided an update on HGMPs. Permit 1347, which covers all non-direct take programs, will expire in October 2013, and NMFS is currently discussing options on how to efficiently package and process all programs that require new permits. Hatcher said that litigation was winding down in the Elwha, and just starting in the Sandy. There has also been discussion on the needs of bull trout consultations. The Methow HGMPs have been a continuing challenge in the *US v OR* process based on NMFS' goal of managing for a low percent hatchery origin spawners (pHOS).
- *5-Year Monitoring and Evaluation Plan Update*: A revision has been completed. There is still some interest in looking harder at the revisions, but in general, those who have been involved in the re-write are comfortable with the revised document, which will be up for approval at the Hatchery Committees' April 17, 2013 meeting. The Request for Proposal (RFP) process contracts to collect and analyze the monitoring data will be slightly different from the past, and at this time, how RFPs will be processed could be a sensitive topic. The Hatchery Committees have a Conflict of Interest Policy in place that will potentially exclude several HCP signatories from participating in proposal reviews.

- *2013 Wenatchee Steelhead Releases*: There was extremely low post-release survival of steelhead in 2012, and Chelan PUD and WDFW were asked to investigate what factors may have contributed. One potential factor was volitional release, and a study has been developed to investigate whether volitional release contributed to the low proportion of PIT-tagged steelhead detected at McNary Dam.
- *Spring Chinook HGMPs*: Joe Miller provided an outline for a revised HGMP for Chelan PUD's spring Chinook Methow program.
- *Spring Chinook Pilot at Rocky Reach*: In 2013, Chelan PUD will obtain brood from Winthrop National Hatchery; however, plans for 2014 and beyond are yet to be determined. Chelan PUD is discussing a pilot study that tests the Rocky Reach trap as a collection location, and may eventually upgrade the trap to include a sort-by-code function. At this point, however, the pilot is only focused on the functionality of the trap.
- *Draft 2013 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols*: The 2013 Broodstock Protocols are due to NMFS on April 15, 2013. This year's protocols include several new provisions resulting from recalculation, so Mike Tonseth walked through notable changes in this year's protocols. Although the protocols do not require Hatchery Committees' approval, they are reviewed by and completed in collaboration with Hatchery Committees.

VI. HCP Committees Administration (Mike Schiewe)

A. Next Meetings

The next scheduled Coordinating Committees' meeting is April 23, 2013, to be held in person at the Radisson Hotel in SeaTac, Washington. The May 21, 2013 meeting (formerly scheduled for May 28, 2013) will be held in eastern Washington at a location that has yet to be determined. The June 25, 2013 meeting will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A List of Attendees

Attachment B	Final SOA approving the Douglas PUD revised draft 2013 10-year NNI Comprehensive Progress Report
Attachment C	CRITFC's Annual Request for Tagging Sockeye at Wells Dam
Attachment D	2012 Subyearling Life-history Study Presentation

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Tom Kahler*	Douglas PUD
Kirk Truscott*†	Colville Confederated Tribes
Bryan Nordlund*	National Marine Fisheries Service
Teresa Scott*	Washington Department of Fish and Wildlife
Jim Craig*	U.S. Fish and Wildlife Service

Notes
* Denotes Coordinating Committees member or alternate
† Joined by phone

Wells HCP Coordinating Committee
Statement of Agreement to Approve the 2013 Wells Comprehensive Progress Report Assessing the Status of Achieving NNI

Date of Approval: 26 March 2013

Statement

The Wells HCP Coordinating Committee (CC) has reviewed and approved Douglas PUD's *2013 Comprehensive Progress Report: Status of Achieving NNI under the Anadromous Fish Agreement and Habitat Conservation Plan for the Wells Hydroelectric Project*. This report satisfies Douglas PUD's requirement to produce such a report by March 2013.

Background

Section 6.9 states the following regarding Douglas PUD's requirement for assessing the achievement of NNI: "By March 2013, a comprehensive progress report shall be prepared by the District [Douglas PUD], at the direction of the Coordinating Committee, assessing overall status of achieving NNI."

March 15, 2013

Tom Kahler
Public Utility District Number 1 of Douglas County
1151 Valley Mall Parkway
East Wenatchee, Washington 98801

Dear Tom:

In 2013, we are planning to once again sample sockeye salmon at Wells Dam. We hope to collect scale samples from up to 800 sockeye, all of which we will PIT tag (if they have not already been tagged). In addition, we will acoustic tag up to 70 sockeye salmon and affix temperature tags on to up to 200 sockeye salmon. We anticipate sampling from late June through early August. We will coordinate sampling activities with Wells Hatchery brood stock collection programs. Sampling personnel may include myself of CRITFC, Jennifer Miller of the CCT, and Greg Robison, Tim Jeffries, Barry Hodges, and Arlene Heemsah of the Yakama Nation.

As requested last year, I am attaching a copy of the technical report describing 2011 results, a draft progress report giving an overview of 2012 results, as well as the narrative describing this project prepared for BPA and the ISAB upon this project's inception in 2009.

Please contact me if you have any questions. Thank you for your cooperation with this study.

Sincerely,

Jeffrey Fryer

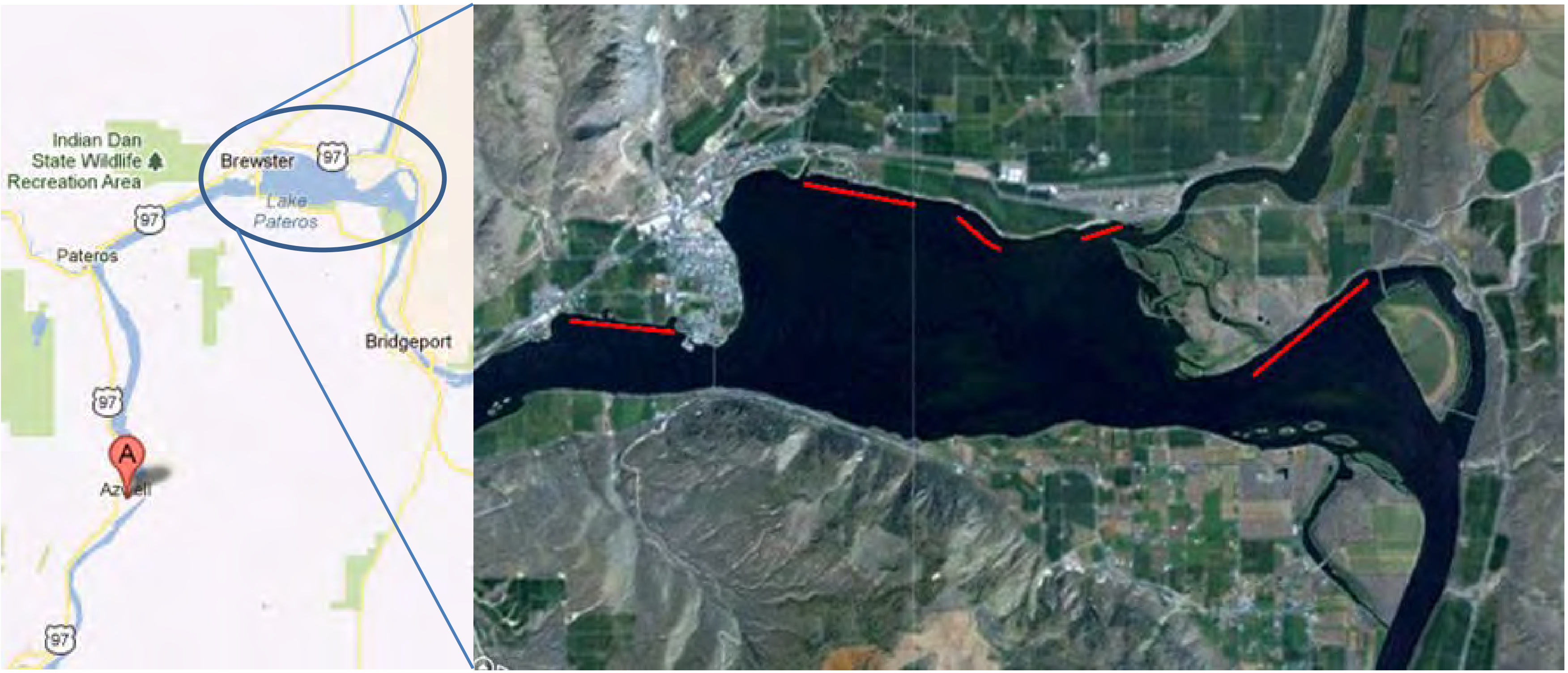
Attachment D

Comparison of 2011 and 2012 Subyearling Life-history and Migration Study Results

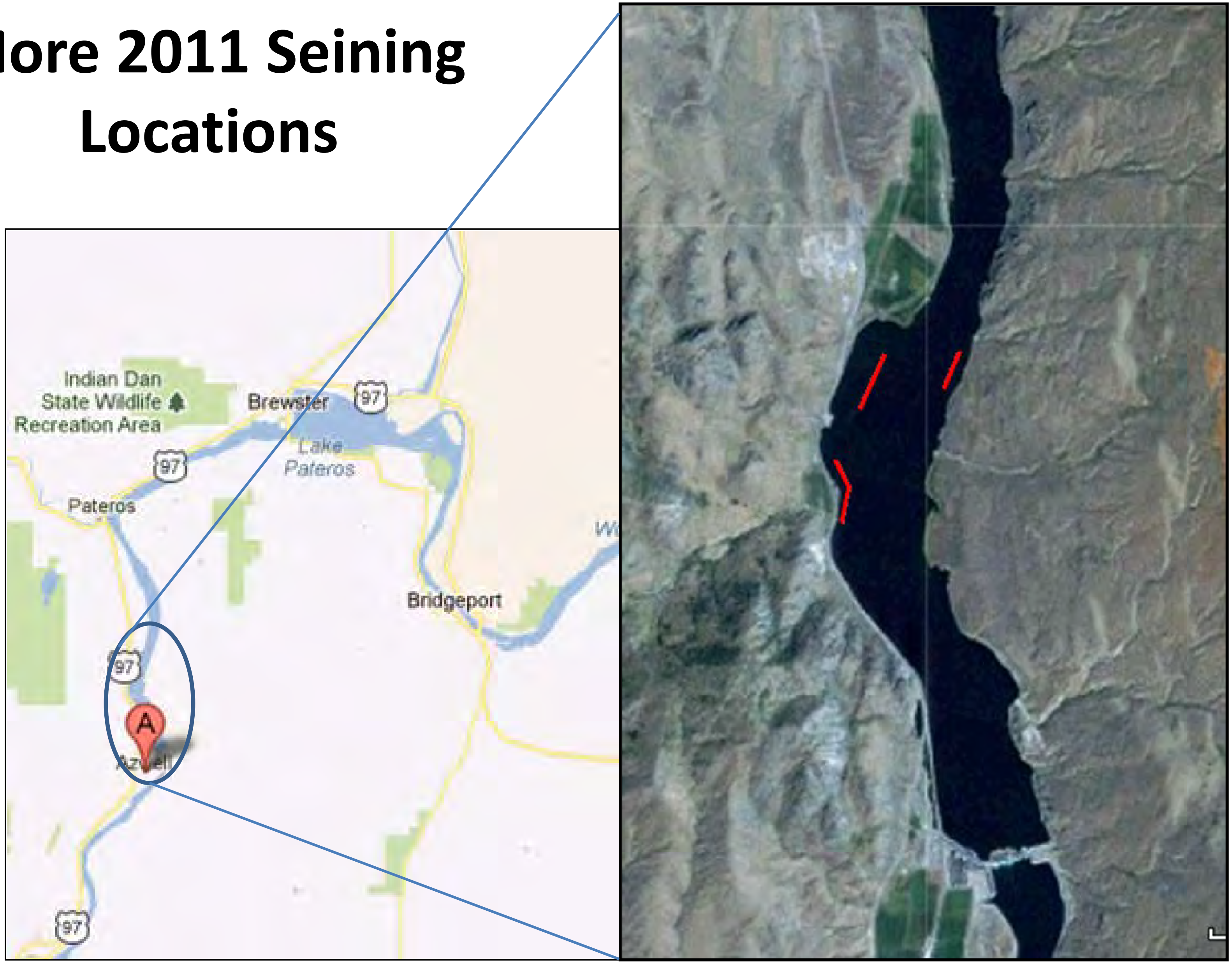
DCPUD

March 2013

2011 Seining Locations



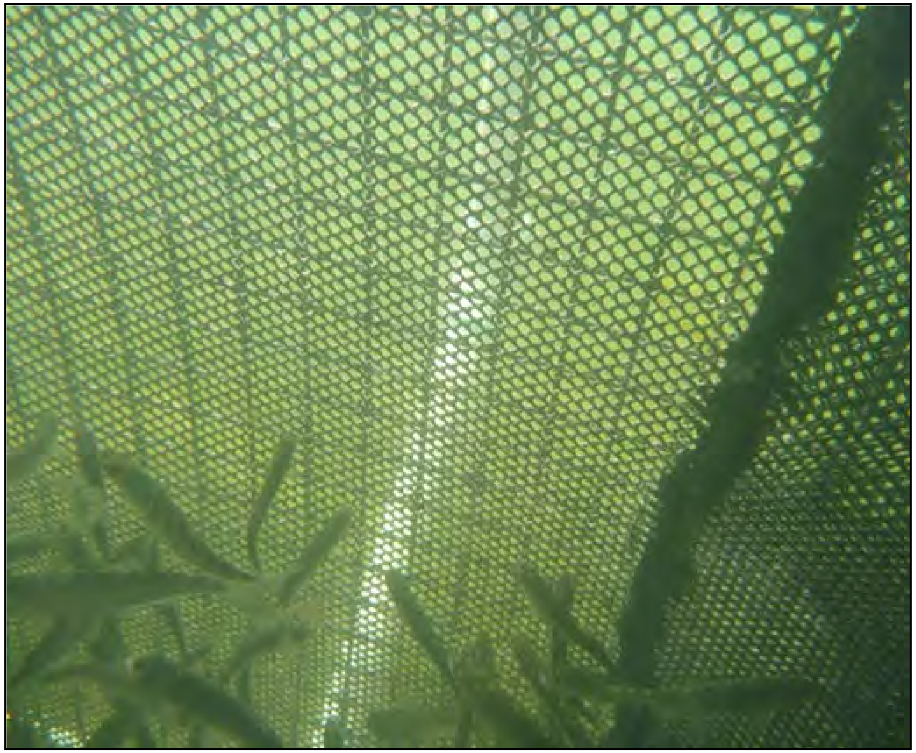
More 2011 Seining Locations



Seining Location Added in 2012

Seining

Net Pens



Summary of 2012 PIT Tagging by Week

Tag File	Tag Date	Tag/Release Site	# Records in File	# New Tagged Fish in File (= # Records - (Recaps + Shorts))	# Pre-Release Mortalities	Subsequent Mortality[1]	% Mortality	# Recaps[2]	% Recaps	# New Tagged Fish Released (= # New Tagged Fish in File - All Mortalities)	Rejected Fish Short	Rejected Fish (% Shorts)
CSM12178.GL1	6/26/2012	Gebber's Landing	2893	2662	20	3	0.9%	0	0.0%	2639	231	8.0%
CSM12178.WB1	6/26/2012	Washburn Slough	42	38	NA	0	NA	0	0.0%	38	4	9.5%
CSM12179.GL1*	6/27/2012	Gebber's Landing	1002	895	NA	0	NA	0	0.0%	895	107	10.7%
CSM12179.GL2	6/27/2012	Gebber's Landing	2599	2398	NA	0	NA	0	0.0%	2398	201	7.7%
CSM12179.WB1	6/27/2012	Washburn Slough	525	459	5	0	1.1%	0	0.0%	454	66	12.6%
CSM12180.GL1	6/28/2012	Gebber's Landing	1845	1233	7	1	0.6%	409	22.2%	1225	203	11.0%
CSM12180.WB1	6/28/2012	Washburn Slough	463	426	14	0	3.3%	0	0.0%	412	37	8.0%
CSM12181.GL1	6/29/2012	Gebber's Landing	535	407	9	0	2.2%	35	6.5%	398	93	17.4%
		Week 1 Total	***9904***	***8518***	***55***	***4***	***0.7%***	***444***	***4.5%***	***8459***	***942***	***9.5%***
CSM12185.GL1	7/3/2012	Gebber's Landing	3910	2881	16	5	0.7%	365	9.3%	2860	664	17.0%
CSM12186.GL1	7/4/2012	Gebber's Landing	1634	1363	70	1	5.2%	74	4.5%	1292	197	12.1%
CSM12187.GL1	7/5/2012	Gebber's Landing	1159	545	13	0	2.4%	404	34.9%	532	210	18.1%
CSM12187.WB1	7/5/2012	Washburn Slough	266	240	4	0	1.7%	9	3.4%	236	17	6.4%
CSM12188.GP1	7/6/2012	Gebber's Point	270	161	3	0	1.9%	10	3.7%	158	99	36.7%
		Week 2 Total	***7239***	***5190***	***106***	***6***	***2.2%***	***862***	***11.9%***	***5078***	***1187***	***16.4%***
CSM12192.WP1	7/10/2012	Wells Pool (Forebay)	1878	1758	44	0	2.5%	13	0.7%	1714	107	5.7%
CSM12193.WP1	7/11/2012	Wells Pool (Forebay)	1597	1452	12	0	0.8%	5	0.3%	1440	140	8.8%
CSM12194.WP1	7/12/2012	Wells Pool (Forebay)	2014	1411	0	0	0.0%	476	23.6%	1411	127	6.3%
CSM12195.GL1	7/13/2012	Gebber's Landing	2147	1795	24	0	1.3%	182	8.5%	1771	170	7.9%
		Week 3 Total	***7636***	***6416***	***80***	***0***	***1.2%***	***676***	***8.9%***	***6336***	***544***	***7.1%***
		Project Total	**24779**	**20124**	**241**	**10**	**1.2%**	**1982**	**8.0%**	**19873**	**2673**	**10.8%**

[1] Subsequent Mortalities (SM) are fish that were recaptured at a later date and died prior to release. They are counted as a "SM" in the file in which they were tagged.

[2] Recaptures are treated independently from mortalities. If a recaptured fish dies prior to release then the mortality is counted as a "subsequent mortality" in the original tag file.

*Fish in CSM12179.GL1 were remaining fish that were captured on 177 and not tagged on 178 due to lack of available tags. These fish were held for two nights, instead of one, prior to tagging.

Summary of 2012 PIT Tagging by Location

Tag/Release Site	Tag File	Tag Date	# Records in File	# New Tagged Fish in File (= # Records - (Recaps + Shorts))	# Pre-Release Mortalities	Subsequent Mortality[1]	% Mortality	# Recaps[2]	% Recaps	# New Tagged Fish Released (= # Records - (All Mortalities + Recaps + Shorts))	Rejected Fish Short	Rejected Fish (% Shorts)
Gebber's Landing	CSM12178.GL1	6/26/2012	2893	2662	20	3	0.9%	0	0.0%	2639	231	8.0%
	CSM12179.GL1*	6/27/2012	1002	895	0	0	0.0%	0	0.0%	895	107	10.7%
	CSM12179.GL2	6/27/2012	2599	2398	0	0	0.0%	0	0.0%	2398	201	7.7%
	CSM12180.GL1	6/28/2012	1845	1233	7	1	0.6%	409	22.2%	1225	203	11.0%
	CSM12181.GL1	6/29/2012	535	407	9	0	2.2%	35	6.5%	398	93	17.4%
	CSM12185.GL1	7/3/2012	3910	2881	16	5	0.7%	365	9.3%	2860	664	17.0%
	CSM12186.GL1	7/4/2012	1634	1363	70	1	5.2%	74	4.5%	1292	197	12.1%
	CSM12187.GL1	7/5/2012	1159	545	13	0	2.4%	404	34.9%	532	210	18.1%
	CSM12195.GL1	7/13/2012	2147	1795	24	0	1.3%	182	8.5%	1771	170	7.9%
Gebber's Landing Total			**17724**	**14179**	**159**	**10**	**1.2%**	**1469**	**8.3%**	**14010**	**2076**	**11.7%**
Washburn Slough	CSM12178.WB1	6/26/2012	42	38	0	0	0.0%	0	0.0%	38	4	9.5%
	CSM12179.WB1	6/27/2012	525	459	5	0	1.1%	0	0.0%	454	66	12.6%
	CSM12180.WB1	6/28/2012	463	426	14	0	3.3%	0	0.0%	412	37	8.0%
	CSM12187.WB1	7/5/2012	266	240	4	0	1.7%	9	3.4%	236	17	6.4%
Washburn Slough Total			**1296**	**1163**	**23**	**0**	**2.0%**	**9**	**0.7%**	**1140**	**124**	**9.6%**
Wells Pool (Forebay)	CSM12192.WP1	7/10/2012	1878	1758	44	0	2.5%	13	0.7%	1714	107	5.7%
	CSM12193.WP1	7/11/2012	1597	1452	12	0	0.8%	5	0.3%	1440	140	8.8%
	CSM12194.WP1	7/12/2012	2014	1411	0	0	0.0%	476	23.6%	1411	127	6.3%
Wells Pool (Forebay) Total			**5489**	**4621**	**56**	**0**	**1.2%**	**494**	**9.0%**	**4565**	**374**	**6.8%**
Gebber's Point	CSM12188.GP1	7/6/2012	270	161	3	0	1.9%	10	3.7%	158	99	36.7%
Gebber's Point Total			**270**	**161**	**3**	**0**	**1.9%**	**10**	**3.7%**	**158**	**99**	**36.7%**
Project Total			24779	20124	241	10	1.2%	1982	8.0%	19873	2673	10.8%

[1] Subsequent Mortalities (SM) are fish that were recaptured at a later date and died prior to release. They are counted as a "SM" in the file in which they were tagged.

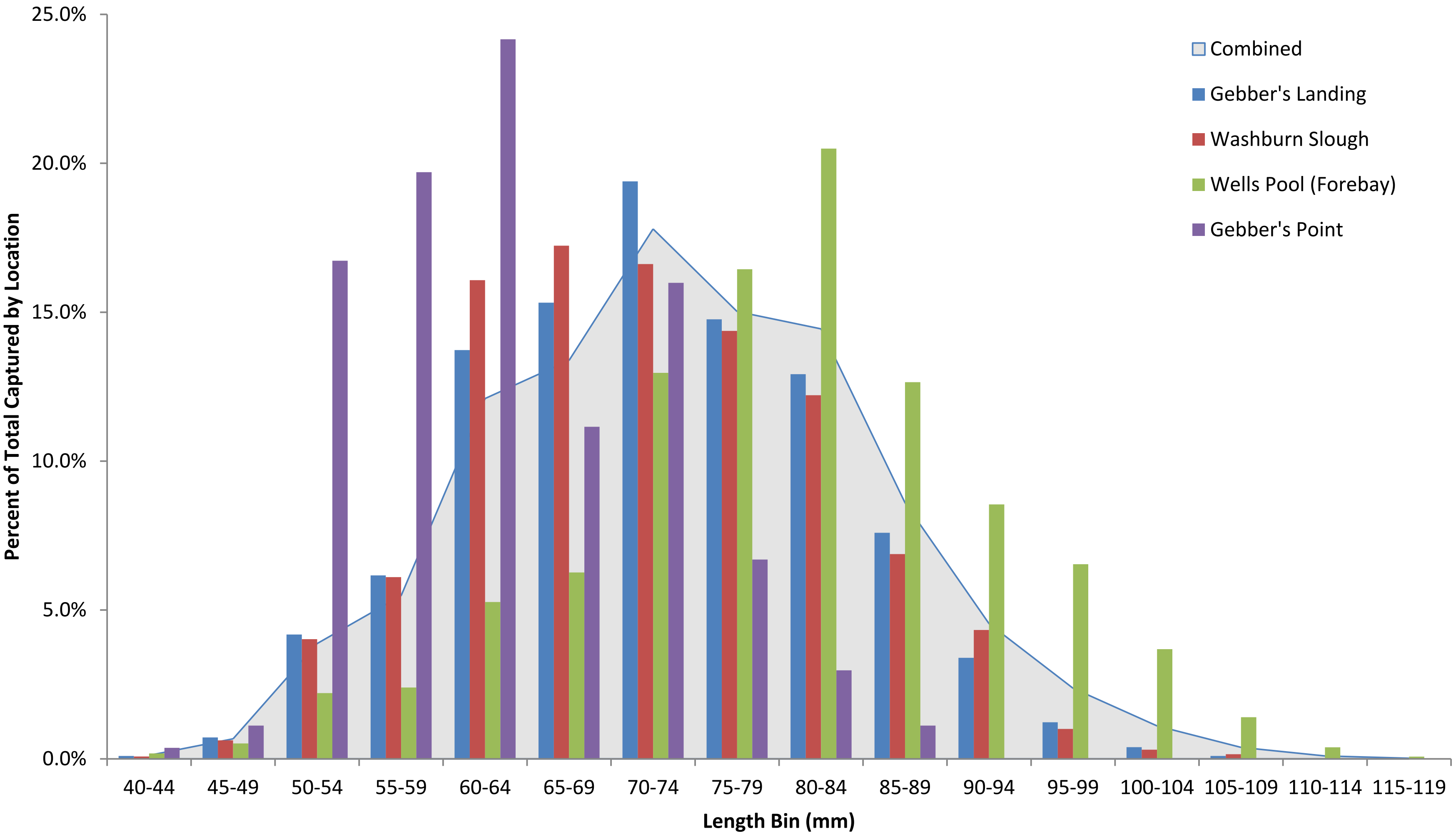
[2] Recaptures are treated independently from mortalities. If a recaptured fish dies prior to release then the mortality is counted as a "subsequent mortality" in the original tag file.

*Fish in CSM12179.GL1 were remaining fish that were captured on 177 and not tagged on 178 due to lack of available tags. These fish were held for two nights, instead of one, prior to tagging.

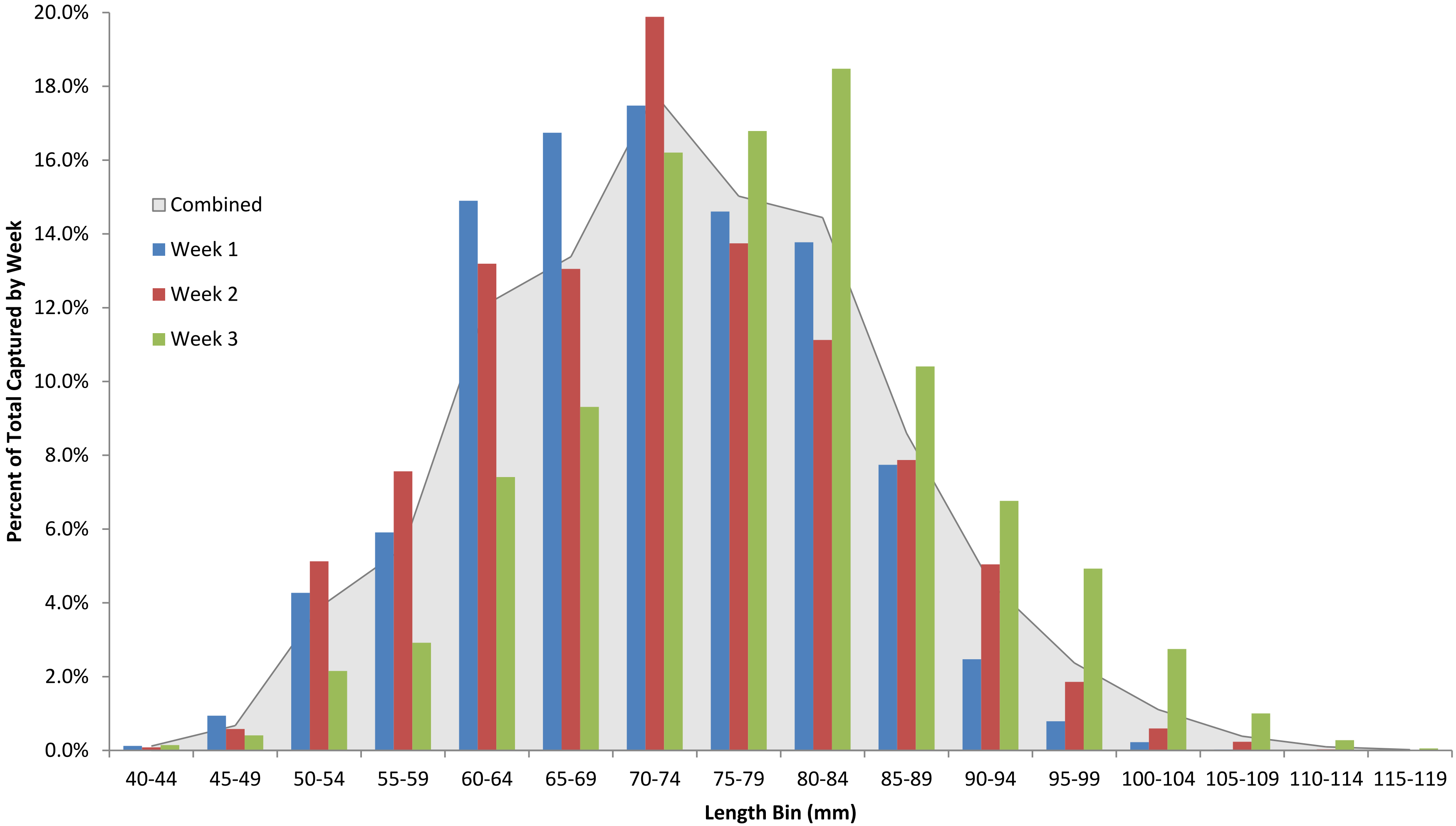
Summary Statistics

	Year	
	2011	**2012**
First Release Date	22-Jun	26-Jun
First Arrival to Rocky Reach Dam	25-Jun	30-Jun
Total Tagged and Released	13,223	19,876
Total Detected at Rocky Reach Dam	1,200	1,157
Total Detections at all Detection Sites	2,762	3,552
Unique Fish Detected at all Detection Sites	2,312	3,109
Percent Detected	17.5%	15.6%
Percent Detected at Rocky Reach Dam	9.1%	5.8%

Length Frequency of Captured Fish by Location

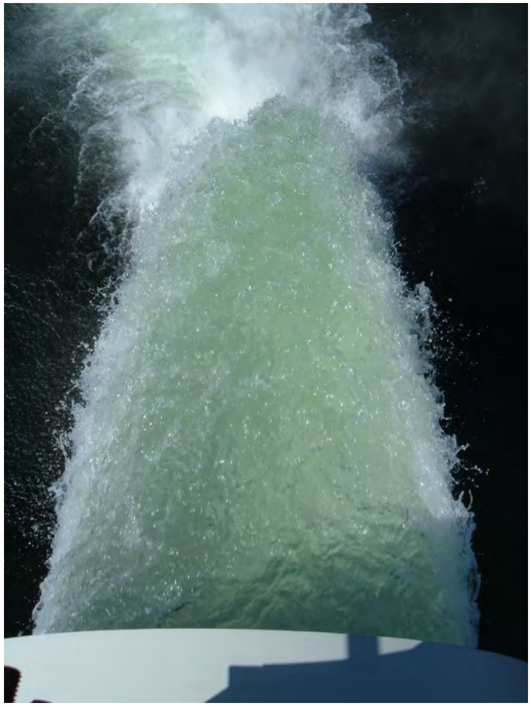


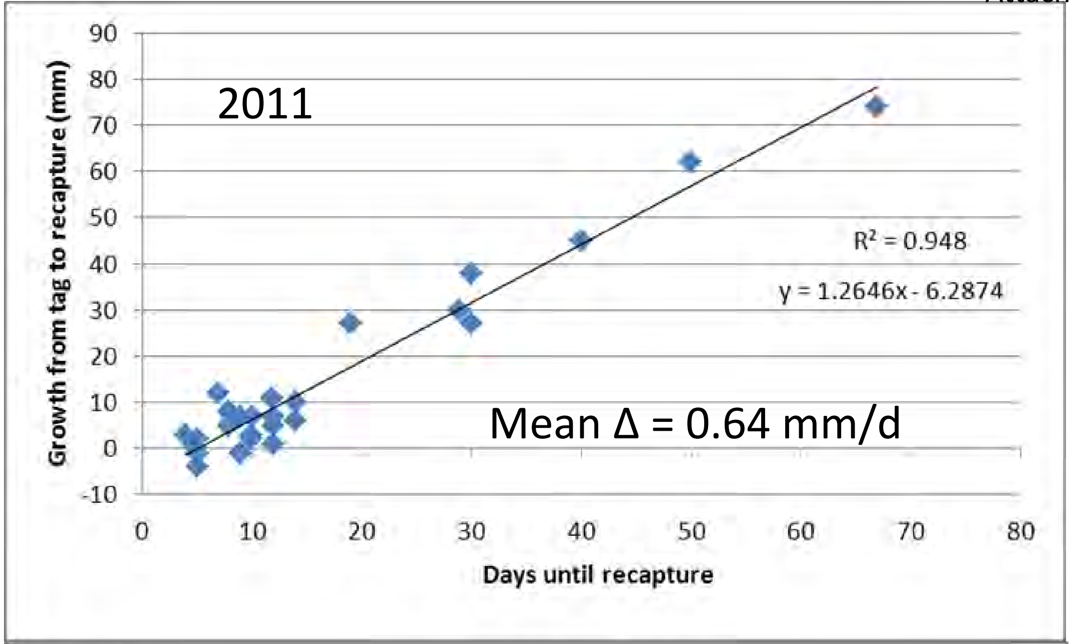
Length Frequency of Captured Fish by Week

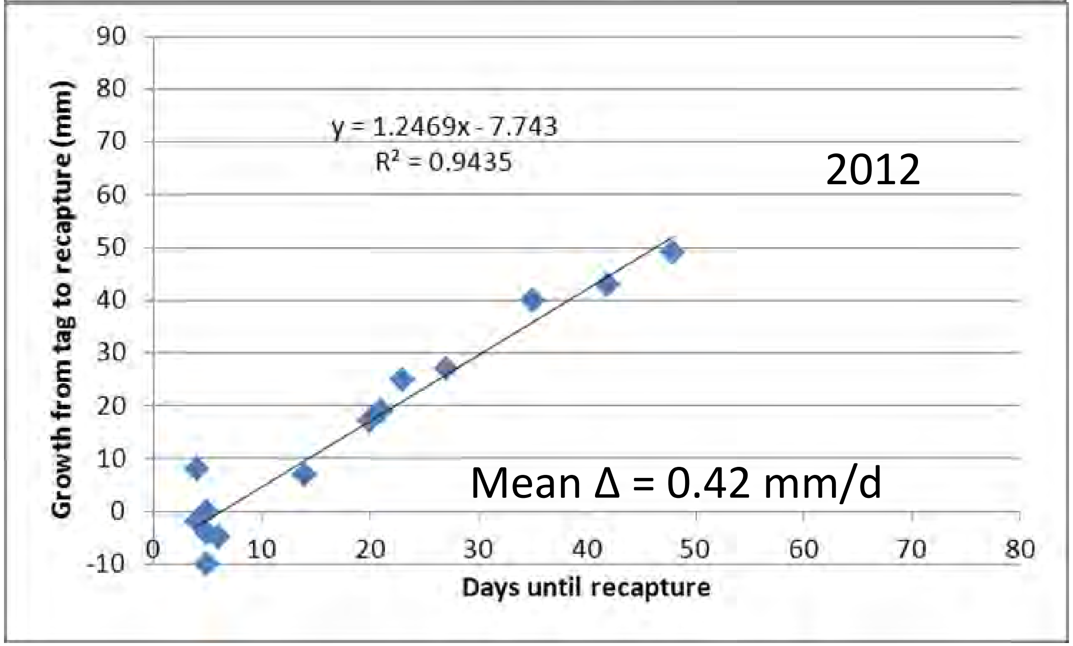


Observed Changes in Fish Length Between Tagging and Recapture at RRJFB

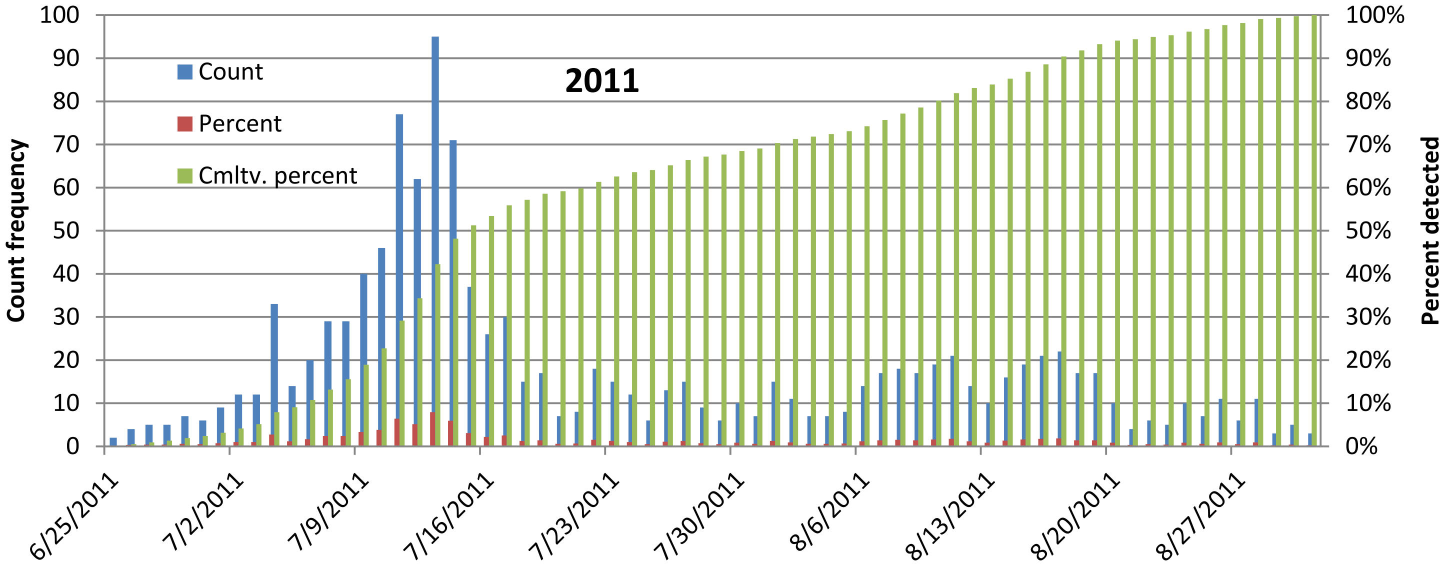
Growth was slower in 2012, but not different statistically. The outcome of the statistical comparison was strongly influenced by high variability in the observed growth rates of fish recaptured from 2 – 11 days post-tagging.

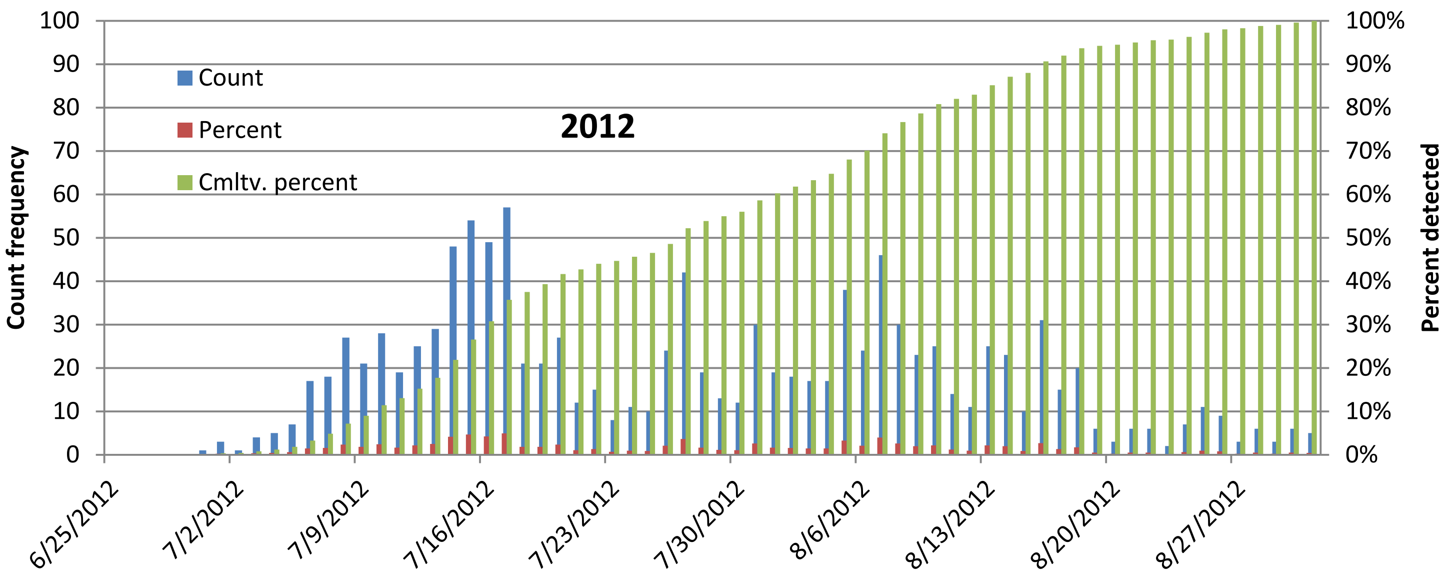




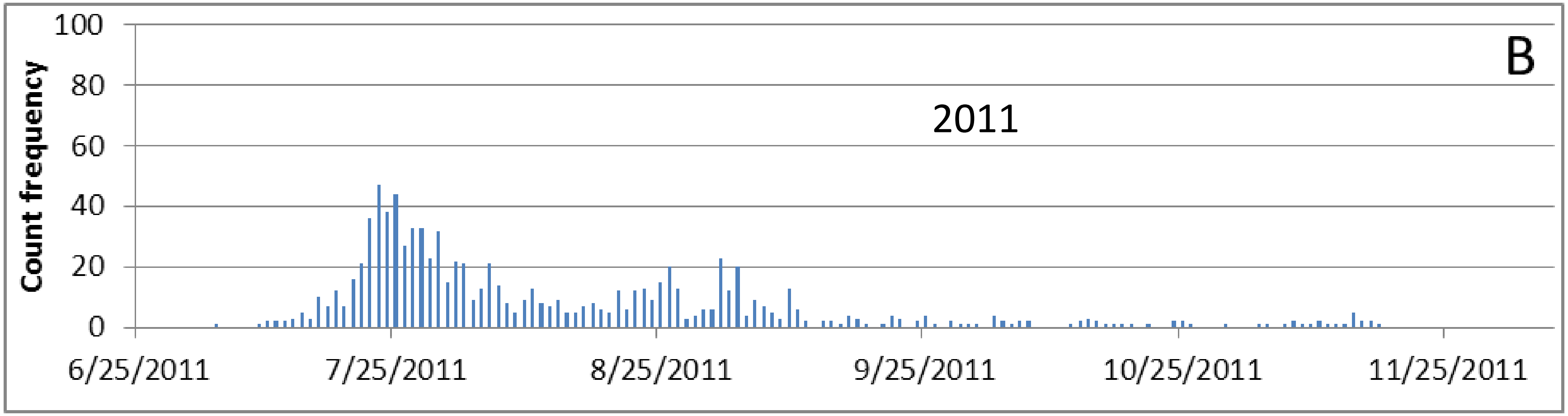


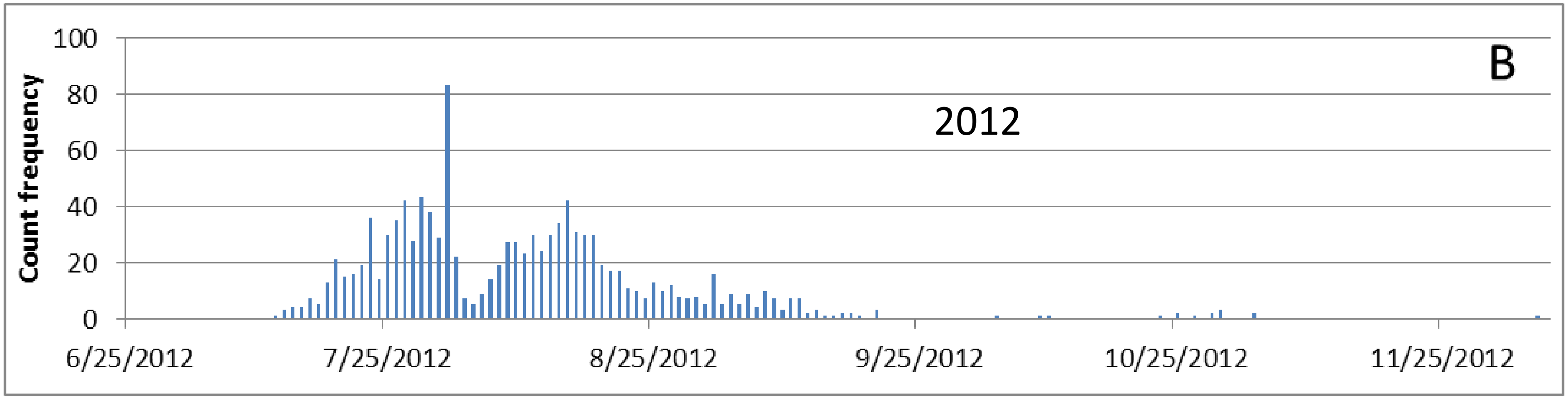
RRJFB Detections



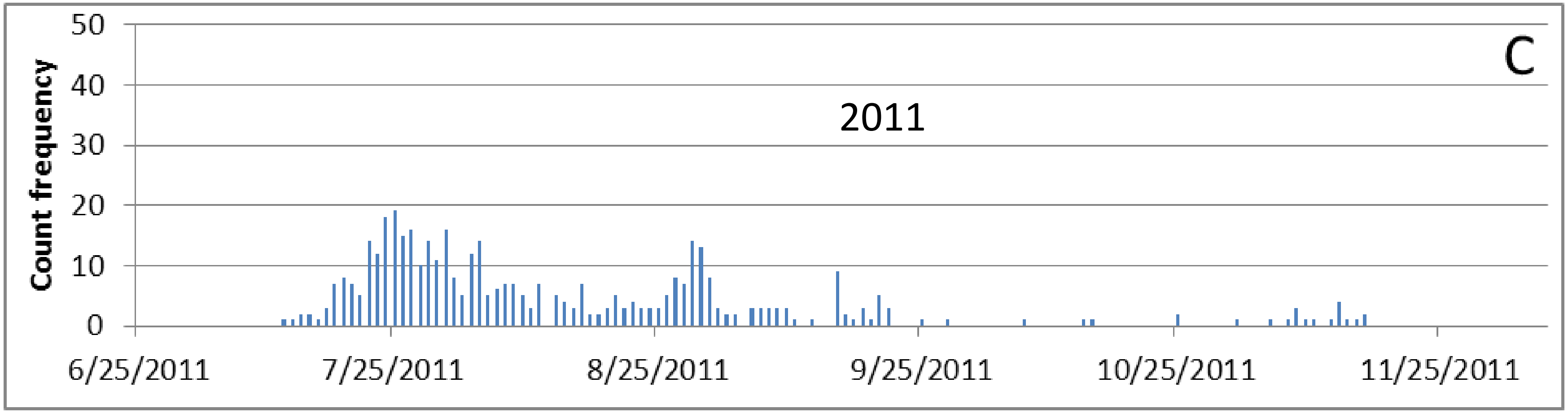


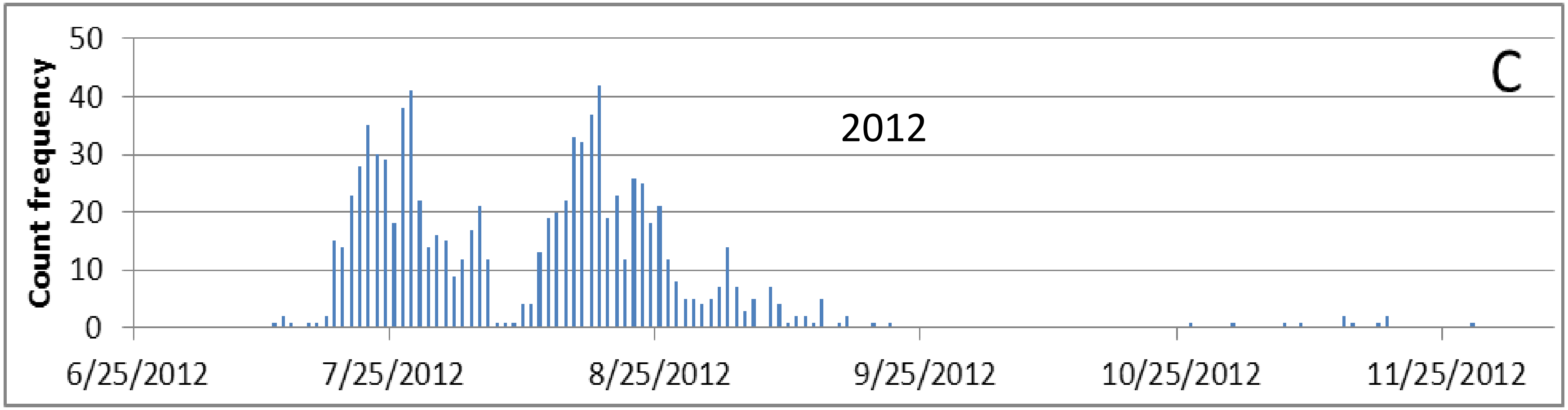
McNary Detections



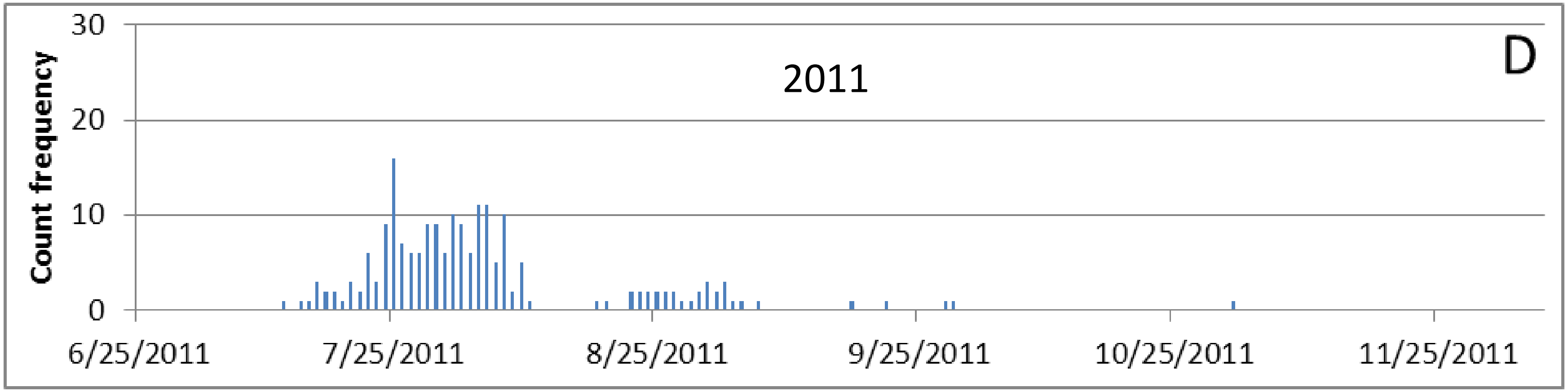


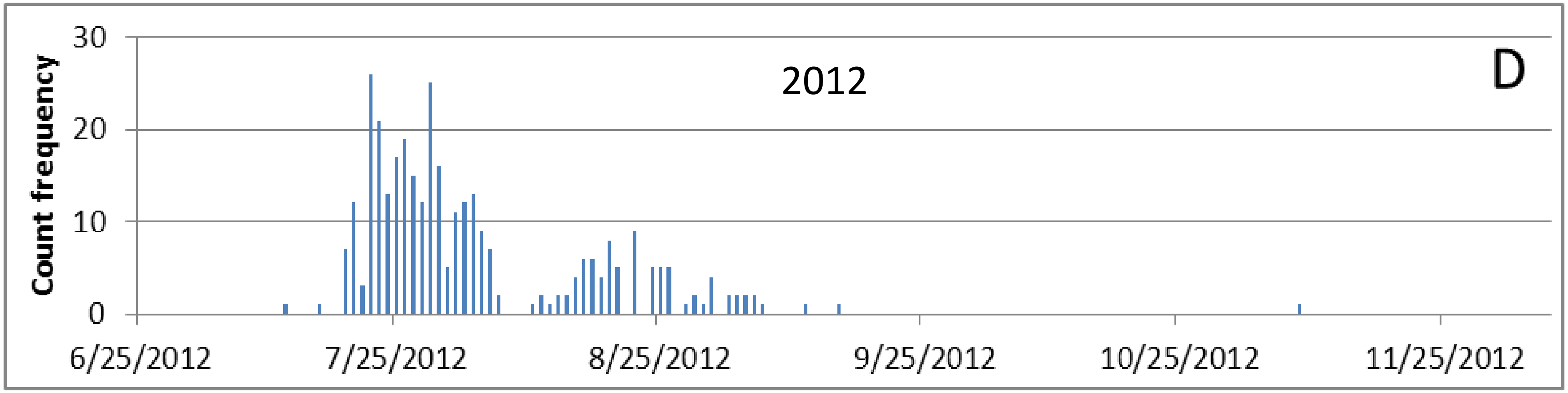
John Day Detections





Bonneville Detections





Reach-specific Travel Times (d) and Rates (km/d) from Release in Wells to Downstream Projects

2011

Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**19.7** (±0.48; n = 1185)	**4.8**						
RRH (762)			**20.1** (±0.98; n = 188)	**14.5**				
MCN (470)					**7.6** (±0.99; n = 99)	**16.2**		
JDA (347)							**2.5** (±0.29; n = 33)	**44.6**

2012

Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**24.8** (±0.44; n = 1083)	**3.8**						
RRH (762)			**15.7** (±1.04; n = 119)	**18.6**				
MCN (470)					**5.0** (±0.51; n = 118)	**24.6**		
JDA (347)							**1.75** (±0.05; n = 47)	**64.0**

Travel Times and Rates *in 2011* for Different Size Classes

	Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
≥87 mm	**Release (856)**	**4.7** (±0.41; n = 121)	**20**						
	RRH (762)			**15.78** (±3.08; n = 17)	**18.5**				
	MCN (470)					**3.23** (±0.33; n = 6)	**38.1**		
	JDA (347)							**1.92** (±0.17; n = 7)	**58.3**
<87 mm	**Release (856)**	**21.17** (±0.5; n = 1080)	**4.4**						
	RRH (762)			**20.52** (±1.02; n = 173)	**14.2**				
	MCN (470)					**7.86** (±1.05; n = 93)	**15.6**		
	JDA (347)							**2.67** (±0.37; n = 26)	**41.9**

Travel Times and Rates *in 2012* for Size Classes Compared in 2011

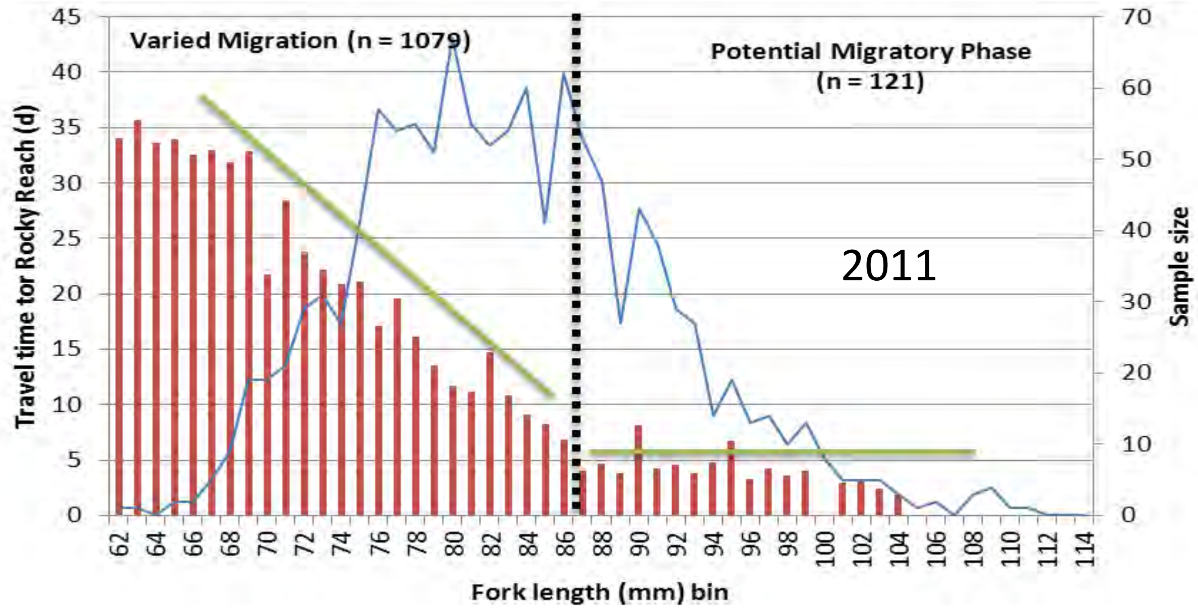
≥87 mm

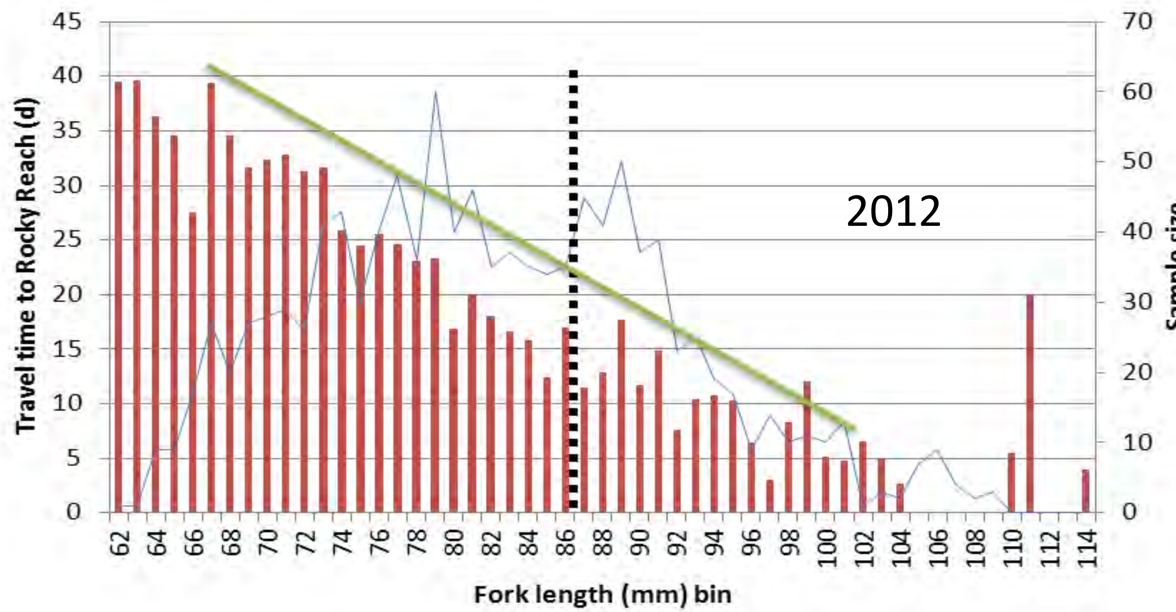
Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**11.05** (±0.7; n = 166)	**8.5**						
RRH (762)			**11.7** (±0.91; n = 15)	**25.0**				
MCN (470)					**3.06** (±0.2; n = 19)	**40.2**		
JDA (347)							**1.54** (±0.06; n = 13)	**72.7**

<87 mm

Location (River km)	RRH (762) Travel Time (d)	RRH (762) Rate (km/d)	MCN (470) Travel Time (d)	MCN (470) Rate (km/d)	JDA (347) Travel Time (d)	JDA (347) Rate (km/d)	BON (235) Travel Time (d)	BON (235) Rate (km/d)
Release (856)	**27.24** (±0.46; n = 917)	**3.5**						
RRH (762)			**16.22** (±1.18; n = 104)	**18.0**				
MCN (470)					**5.37** (±0.60; n = 99)	**22.9**		
JDA (347)							**1.82** (±0.07; n = 34)	**61.5**

Relationship Between Length at Tagging and Travel Time to RRJFB





Comparison of Travel Times to Rocky Reach Dam and Detection Rates for Two Size Classes

2011

Size range (mm)	*Number tagged*	*Number detected*	***% of size class detected at RRD***	***Mean travel time to RRD (days)***	*Std Dev*
<87	12192	1079	**8.9%**	**21.2**	16.6
≥87	1028	121	**11.8%**	**4.7**	4.5

2012

Size range (mm)	*Number tagged*	*Number detected*	***% of size class detected at RRD***	***Mean travel time to RRD (days)***	*Std Dev*
<87	16710	966	**5.8%**	**27.2**	14.1
≥87	2877	187	**6.5%**	**11.5**	8.9

Proportion of Tagged Fish Detected at any Downstream Project During Bypass Operations

2011

Size range (mm)	*Number tagged*	*Number detected*	***Proportion detected (%)***
<87	12192	2046	**16.8**
≥87	1028	271	**26.4**

2012

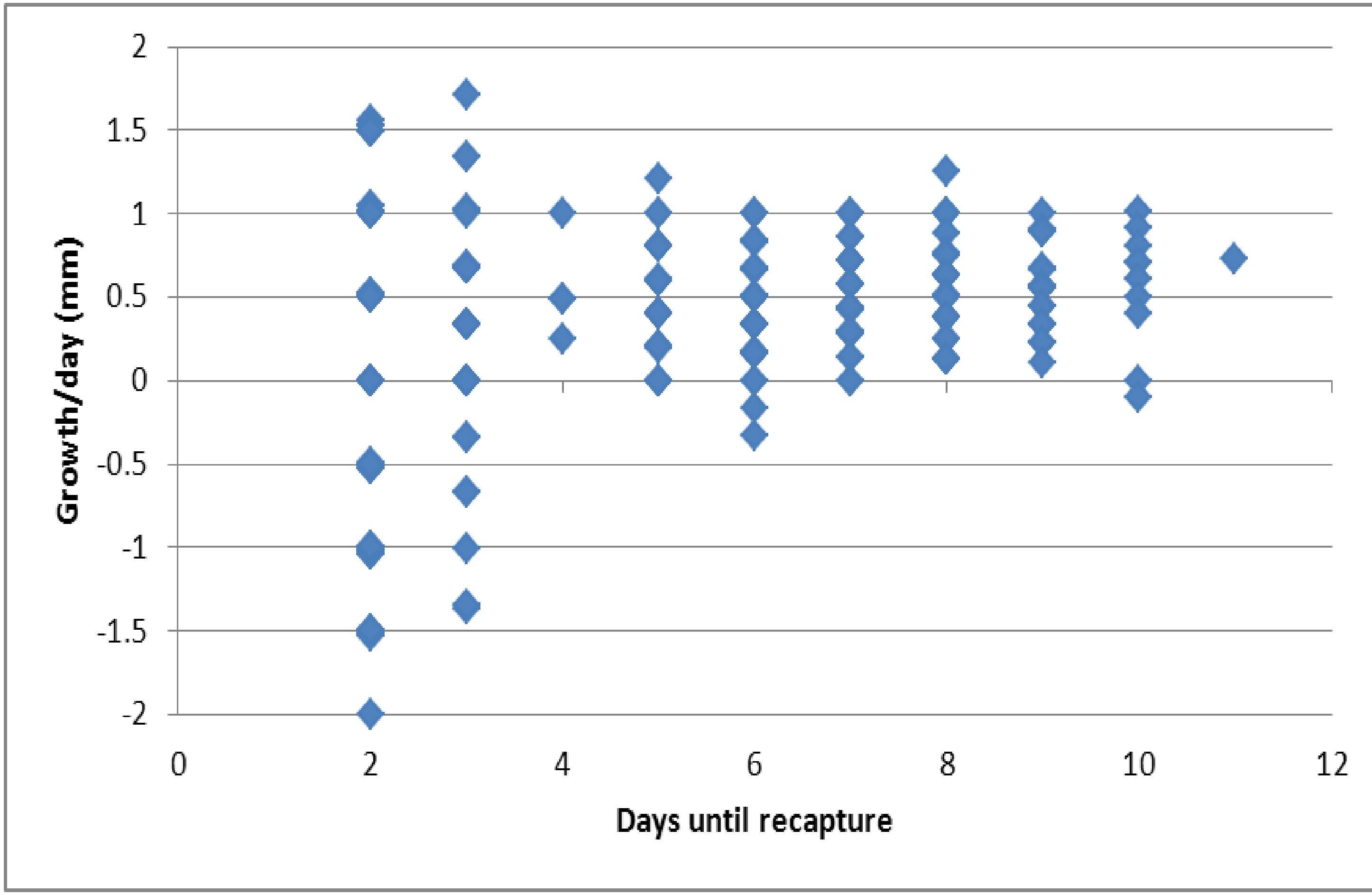
Size range (mm)	*Number tagged*	*Number detected*	***Proportion detected (%)***
<87	16970	2474	**14.6**
≥87	2877	621	**21.6**

Cost of Capture, Tagging, Holding etc., 2011

Attachment D

0.34 mm/d in growth in first 11 days following tag.

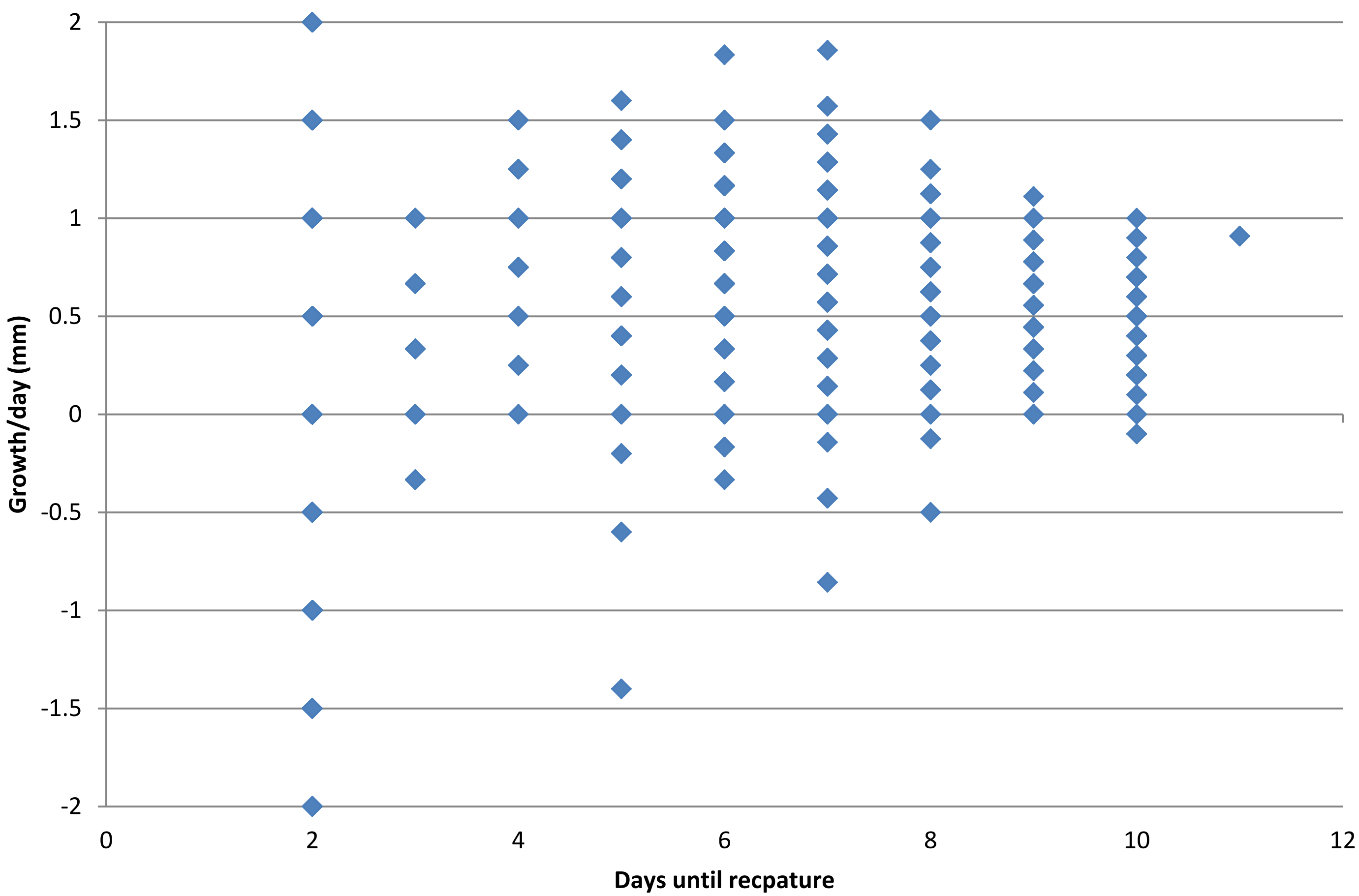
0.77-1.18 mm/d growth of run at large



Cost of Capture, Tagging, Holding etc., 2012

0.68 mm/d
for 12-17 days
post-tagging

0.15 mm/d
for 2-11 days
post-tagging

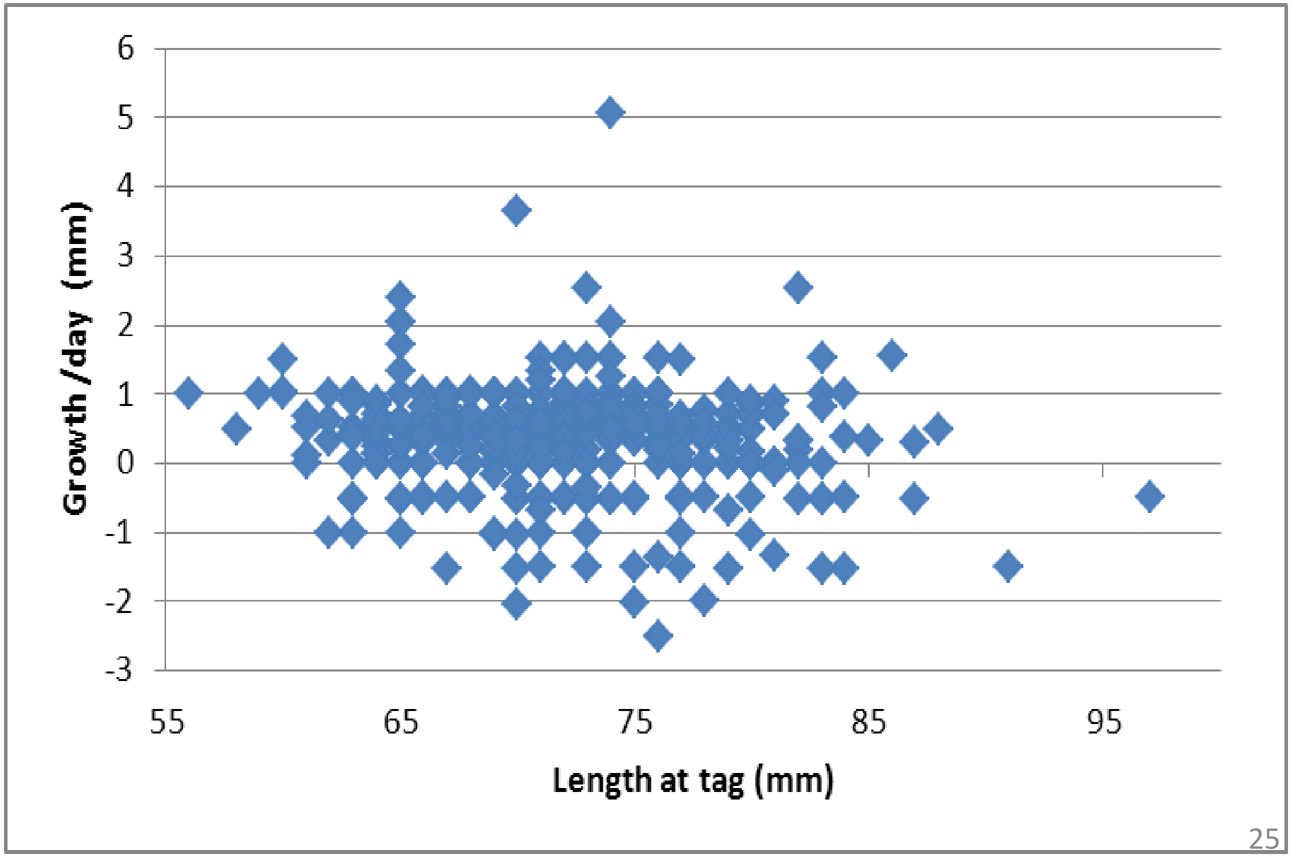


Reduced Growth Following Tagging Equally Affected all Size Classes

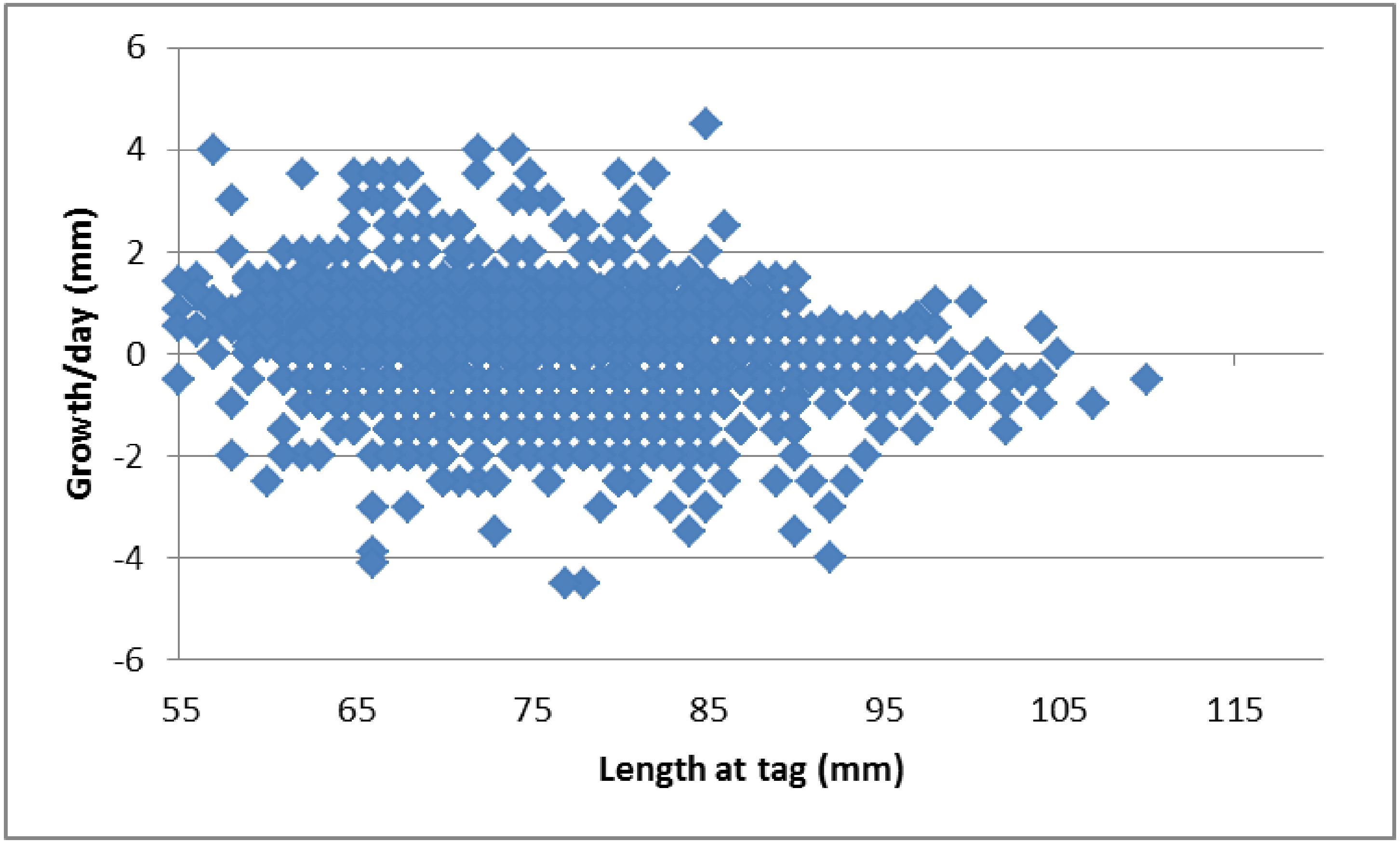
- Therefore, biological cost is associated with tagging procedure/capture/holding not tag burden
- If tag burden smaller fish would have greater cost

0.34 mm/d in growth in first 11 days following tag.

0.77-1.18 mm/d growth of run at large (untagged and tagged fish)



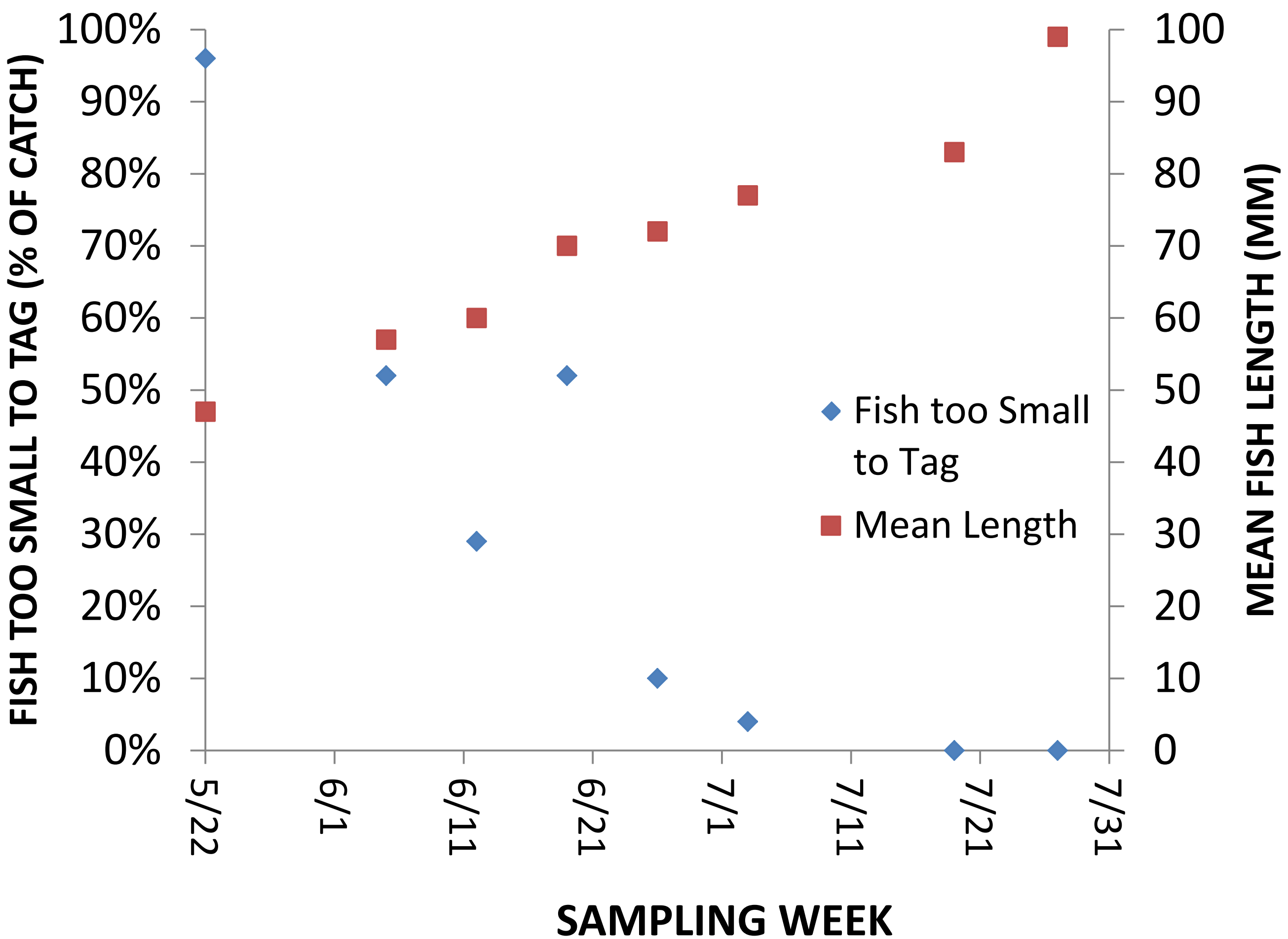
Similar Reduction in Growth for all Size Classes in 2012



Challenges of tagging/representing the entire ‘run’

In May, subyearlings were abundant and easy to catch, but nearly all were too small to tag.

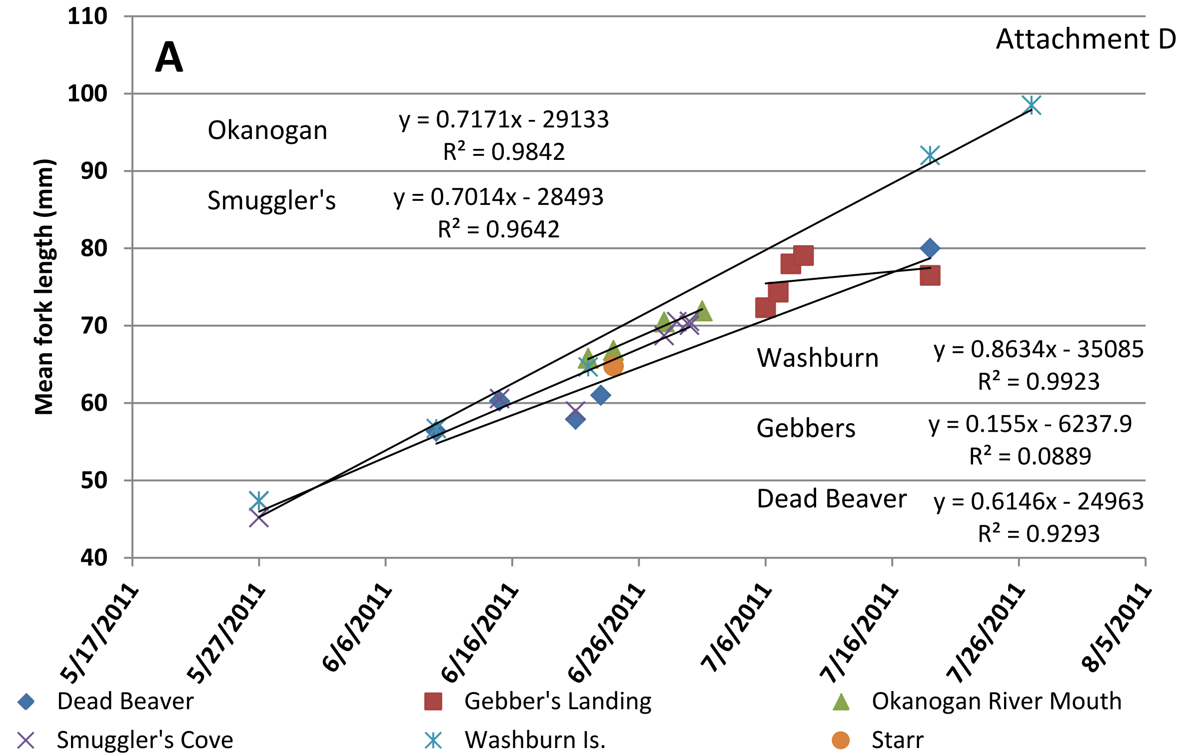
By the end of July, all fish were large enough to tag, but difficult to find.



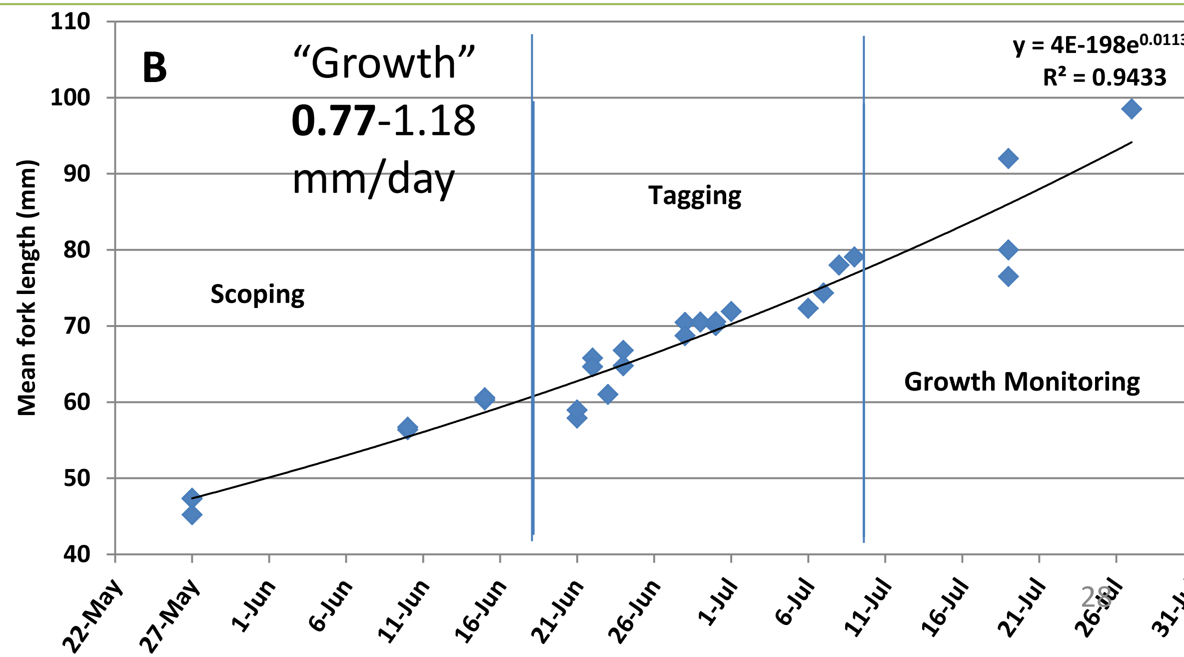
Attachment D

Size distribution of captured fish…

by location

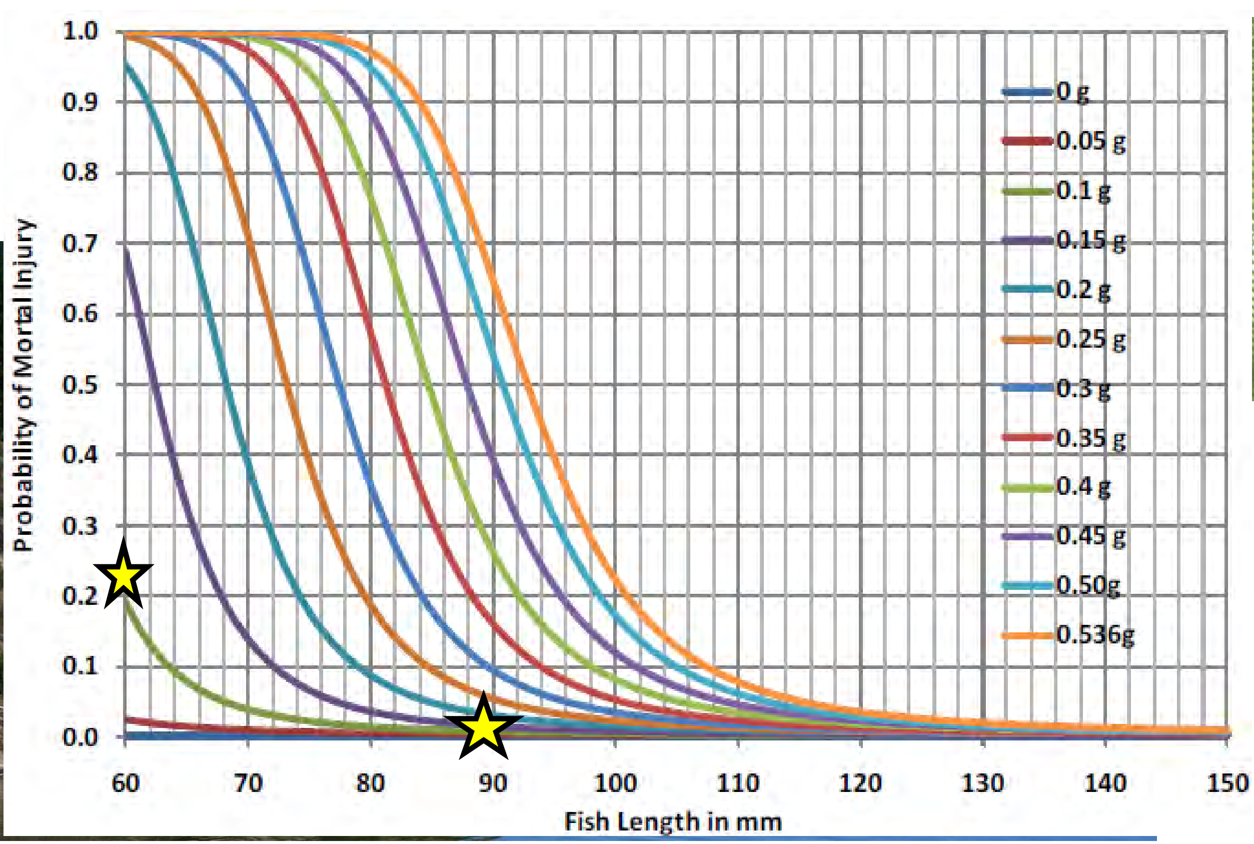


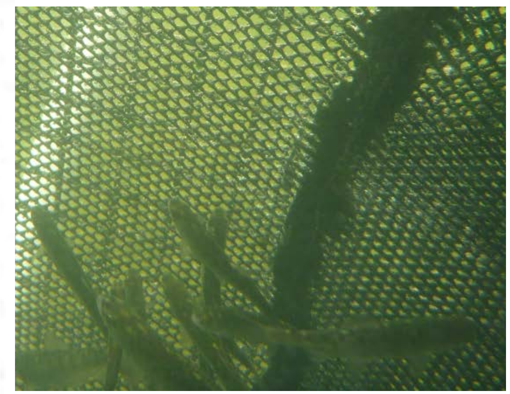
by study phase



Probability of Detection for Two Size Classes

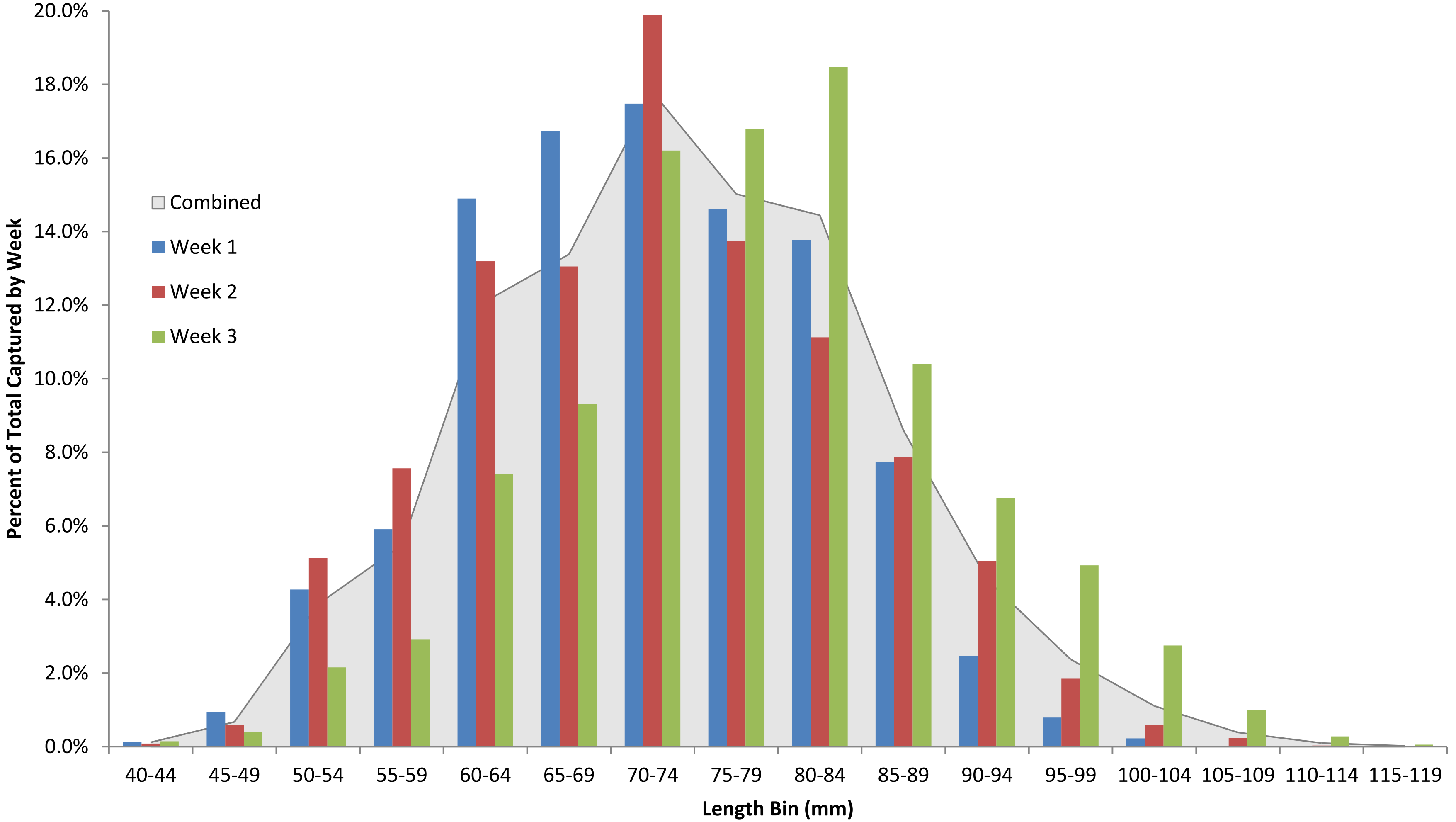
Size range (mm)	Number tagged	Number detected	Proportion detected (%)
<87	12192	2448	**20.1**
≥87	1028	313	**30.4**





One explanation…**tag burden**: Mortal injury 20% higher on a 60 mm fish vs. a 90 mm fish carrying a 0.1 g PIT tag at the same LRP.

Length Frequency of Captured Fish by Week



Life-history hypotheses

- $H1_{alt}$: Ocean-type Chinook in Wells Reservoir represent multiple life-history strategies with variable migration timing including spring and summer subyearling, spring yearling, reservoir rearing, and intermediate migration types.
- $H2_{alt}$: Subyearling Chinook tagged into the Wells Reservoir, of the size observed migrating through Wells Dam, do not actively migrate through the Wells Project.
- $H3_{alt}$: Residence time in Wells Reservoir exceeds the battery life of current acoustic tags.
- $H4_{alt}$: A portion of the study-fish population migrates during periods when downstream PIT-tag detection arrays are not operational.
- $H5_{alt}$: Subyearling Chinook released above and below Wells Dam experience different river conditions, and different survival probabilities when migrating through the control reach (Rocky Reach Reservoir).

Tagging hypotheses

- $H6_{alt}$: The fish available for capture in the Wells Project at time t_1 are not of sufficient size for tagging with 12.5 mm tags.
- $H7_{alt}$: The fish available for capture in the Wells Project are not of sufficient size for tagging with an acoustic transmitter.
- Hypothesis H8 from the 2011 Study Plan would require a lab component to the study, and we did not include a lab component. Following the finalization of the 2011 Study Plan we added the following hypothesis:
- $H9_{alt}$: The process of capture, holding, and tagging incurs a biological cost on subyearling Chinook.

Questions?

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	May 23, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the April 23, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at the Radisson Hotel in SeaTac, Washington, on Tuesday, April 23, 2013, from 9:30 am to 1:00 pm. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Lance Keller will provide the literature review on predator abundance in the Rocky Reach/Rock Island reservoir prepared by BioAnalysts to Kristi Geris for distribution to the Coordinating Committees (Item III-D).
- Chelan PUD and Douglas PUD will develop a joint Statement of Agreement (SOA) indicating progress and a path forward for subyearling life history studies under the Wells, Rocky Reach, and Rock Island Hydroelectric Projects HCPs (Item III-D).
- Steve Hemstrom will provide Gantt charts summarizing juvenile trapping activities at Tumwater and Dryden dams to Geris for distribution to the Coordinating Committees (Item III-F).
- The next scheduled Coordinating Committees' meeting is May 21, 2013 (formerly scheduled for May 28, 2013), and it will be held in eastern Washington, likely at Rocky Reach Dam (Item V-A).
- Steve Hemstrom will confirm a meeting room at Rocky Reach Dam for next month's Coordinating Committees meeting scheduled for May 21, 2013 (Item V-A).
- Tom Kahler will coordinate with the Douglas PUD information technology staff regarding their file sharing presentation scheduled for next month's Coordinating Committees meeting. Based on these discussions, Kahler will also coordinate with Jeff Fryer about possibly scheduling a presentation for the Coordinating Committees

on the Columbia River Inter-Tribal Fish Commission's (CRITFC's) sockeye studies (Item V-A).

DECISION SUMMARY

- No SOAs were approved at this meeting.

AGREEMENTS

- Coordinating Committees representatives conditionally approved CRITFC's annual request for tagging sockeye at Wells Dam, with the requirement that sockeye are also Floy-tagged (Item II-A).

REVIEW ITEMS

- The Spring Chinook Pilot Trapping Study Plan at Rocky Reach Dam was distributed to the Coordinating Committees by Kristi Geris on April 23, 2013, for review with comments and/or email approval due to Joe Miller (with copies to Geris and Mike Schiewe) no later than May 1, 2013.
- The draft 2013 Subyearling Study Plan was distributed to the Coordinating Committees by Kristi Geris on April 24, 2013, for a 30-day review with comments due to Tom Kahler no later than May 24, 2013.

REPORTS FINALIZED

- There are no reports that have been recently finalized.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda.

- Tom Kahler added a brief discussion on production requests for paper copies of the Douglas PUD 2013 10-year No Net Impact (NNI) Comprehensive Progress Report.

- Steve Hemstrom added a discussion on the Spring Chinook Pilot at Rocky Reach, and a brief update on Chelan PUD's action item from the Coordinating Committees March 26, 2013 meeting regarding trapping activities at Tumwater and Dryden dams.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft March 26, 2013 meeting minutes. Regarding the final Rocky Reach and Rock Island fishway return-to-service information, Lance Keller confirmed that the Rock Island left fish ladder was back in service on March 8, 2013. Regarding Douglas PUD's discussion on CRITFC's annual request for sockeye tagging at Wells Dam, Tom Kahler requested that the minutes reflect that CRITFC's 2013 request includes passive integrated transponder (PIT) tagging, as well as collecting scale samples from up to 800 sockeye. Kristi Geris said that all other comments and revisions received on the draft meeting minutes were incorporated, and the draft March 26, 2013 meeting minutes were approved, as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Douglas PUD

A. DECISION: Annual CRITFC Request for Sockeye Tagging at Wells Dam (Tom Kahler)

Tom Kahler recalled that in discussing CRITFC's annual request for sockeye tagging at Wells Dam at the Coordinating Committees March 26, 2013 meeting, questions arose regarding total number tagged and run size. Kahler contacted Jeff Fryer, and answers to these questions were distributed to the Coordinating Committees by Kristi Geris on March 29, 2013. Kahler summarized that the 200 temperature tags and 70 acoustic tags will be subsets of the total 800 PIT-tagged; and that Fryer's latest escapement forecast over Wells Dam is about 72,000 sockeye. Coordinating Committees representatives confirmed that this information addressed the questions. Kahler said that he had concerns about what portion of the run would be handled for tagging, and Fryer indicated that he planned to tag up to 800 with collection spread throughout the entire run, and would probably end up tagging fewer than 800, depending on run size. Kahler said that this would mean that only about 1 percent of the run would be handled, with which Douglas PUD has no issues. Bryan Nordlund said that he had the same concern, but he is okay with 1 percent. Fryer also indicated that the total number of sockeye could/would be reduced if the run size is less than expected. Kirk

Truscott requested the use of Floy tags to indicate which fish had been exposed to the anesthetic MS-222. Kahler noted that, in approving a similar request last year, conditions regarding release location and receipt of additional study information were included, and added that the requirement for Floy tags can be included in this year's request. Coordinating Committees representatives conditionally approved CRITFC's annual request for tagging sockeye at Wells Dam, with the requirement that anesthetized sockeye are also Floy-tagged and release above the dam rather than back to the ladders.

B. Douglas PUD 2013 10-year NNI Comprehensive Progress Report: Production (Tom Kahler)

Tom Kahler said that he has received requests for hard copies of the final Douglas PUD 2013 10-year NNI Comprehensive Progress Report from most Coordinating Committee members, but want to confirm the total number needed. All representatives present confirmed their requests. Bob Rose indicated that the Yakama Nation wanted two copies. Kahler said that he would also provide all Coordinating Committees representatives with an electronic copy of the 2012 HCP Annual Report via compact disc at the May meeting.

III. Chelan PUD

A. Rocky Reach Surface Collector Operations Update (Lance Keller)

Lance Keller said that, as of April 22, 2013, turbine unit C1 at Rocky Reach Dam was back online after a 4-month outage for rotor crack repair, and that Rocky Reach Juvenile Fish Bypass Surface Collector (RRJFB SC) operations are now back to normal. To compensate for potential reduced attraction, Keller said that the RRJFB SC had been utilizing additional SC pumps to increase attraction flow from 6,000 to 6,660 cubic feet per second (cfs) into the SC entrances. He said that no issues were observed with the adjusted configuration, which ran for a total of 22 days, from April 1, 2013, through April 22, 2013.

Keller recalled Chelan PUD's action item from the last Coordinating Committees meeting to provide details on the "top panel" of the Rocky Reach Dam intake screens. This action item stemmed from the results of preseason tests of the Rocky Reach bypass using marked fish released into turbine unit C2 via delivery pipes, when only 14 of 100 fish released were recaptured. Keller explained that the Rocky Reach intake screen system has three panels, and that during the off-season the top panel is left open so that passing juveniles do not get trapped in the gate well. Keller said that during the preseason tests, the open panel was accidently overlooked, and this allowed the introduced fish to escape without entering the bypass system.

B. Rock Island Dam Fish Spill Operations Initiated (Steve Hemstrom)

Steve Hemstrom said that Rock Island Dam began spring fish spill at 00:00 hours on April 17, 2013, as planned at 10 percent spill. Tracy Hillman asked when fish are released from the hatcheries, and Lance Keller replied that volitional releases started April 15, 2013, and the rest were pushed out later that same week. Mike Schiewe noted that subyearling Chinook were released from Chelan Falls Hatchery early, on April 11, 2013, due to dissolved oxygen (DO) and disease concerns. Jim Craig noted (in an email dated May 8, 2013) that spring Chinook smolts were released from Winthrop NFH on April 15-16, 2013, summer Chinook smolts were released from Entiat NFH on April 16, 2013, and spring Chinook smolts were released at Leavenworth NFH on April 23-25, 2013. Hemstrom said that additional passage data are also available on the Data Access in Real Time (DART) website.

C. Chelan PUD 2013 10-year NNI Comprehensive Progress Report: Production (Steve Hemstrom)

Steve Hemstrom said that a couple of graphics are being finalized, and then the Chelan PUD 2013 10-year NNI Comprehensive Progress Report will be ready for production. He said that the final report should be distributed before the Coordinating Committees meeting on May 21, 2013.

D. PRESENTATION(S): Subyearling Chinook NNI Path Forward (Steve Hemstrom, Lance Keller, Jeff Osborn, Josh Murauskas, Tracy Hillman)

Joe Miller introduced this topic, noting that the Coordinating Committees had requested that the PUDs continue to collect and compile information on early life history of summer/fall Chinook in the Upper Columbia and periodically evaluate the status of technology and methods for estimating dam passage survival of subyearling Chinook. He said that the following presentations address this request. Steve Hemstrom said that he will first review technology in terms of survival study limitations, and then Lance Keller will discuss predator control in the reservoir; Jeff Osborn will then present on the Lake Chelan Hydroelectric

Project, and then Josh Murauskas will present on adult returns; and lastly, Tracy Hillman will present on Monitoring and Evaluation (M&E) data used to identify factors that may be affecting productivity of summer Chinook in the Wenatchee, Methow, and Okanogan basins.

Technology

Hemstrom reviewed differences in tagging and detection technology between 2009 and the present day, as summarized in *A Review of Technology, Productivity, and Adult Returns to the Mid-Columbia River* (Attachment B), which was distributed to the Coordinating Committees by Kristi Geris on April 22, 2013. Hemstrom said that the available technology and methods are still inadequate for project-wide survival studies. He said that the mean size of subyearling Chinook in the Rocky Reach/Rock Island reservoir is smaller than the minimum recommended for tagging with available active tags. He said that although the fish tags are getting smaller, as tags miniaturize, battery life also decreases. Kirk Truscott noted that if the ping rate is reduced, battery life increases; and asked if reducing the ping rate and installing additional arrays could possibly abate this issue. Hemstrom explained that, typically, fish tags are configured to ping every 3 seconds. He said that if this configuration is doubled to every 6 seconds, it reduces detection throughout key parts of the system (i.e., dam passage routes).

Predator Control

Keller said that at the 10-year check-in point with the HCPs, the predator control program has removed 681,199 pikeminnow from the Rocky Reach/Rock Island reservoir (Attachment B, page 5). He said that, based on estimates that one pikeminnow consumes two smolts per week, more than 1.3 million smolts have been saved over the past 10 years. Craig pointed out (in an email dated May 8, 2013) that this two smolt per week estimate is likely low, however, based on observational information provided by Keller and Hemstrom. Keller and Hemstrom both mentioned that while angling for Northern pikeminnow at the dams, they observed pikeminnow puking up many smolts at a time, which implies that consumption is probably higher than two per week. Keller said that, based on fish surveys conducted at 20 sites as part of a study to evaluate overwater structures' effect on resident fish, there appears to be an abundance of resident fish in the Rocky Reach/Rock Island reservoir (as shown in a table on page 5 of Attachment B). Keller noted the inexplicable absence of smallmouth bass, and Hemstrom added that a separate resident fish study was also conducted that sampled 80 percent of the entire reservoir (i.e., including areas with no overwater structures), where only 11 smallmouth bass were captured. Keller and Hemstrom said that Chelan PUD is planning additional studies during different seasons of the year to obtain additional data. Hemstrom added that BioAnalysts also conducted a literature review on predator abundance in the Rocky Reach/Rock Island reservoir. Keller said that he will provide the literature review to Geris for distribution to the Coordinating Committees. Jeff Osborn also noted that Chelan PUD conducted creel census in different seasons and found that, in the salmon and steelhead offseason, there was very little fishing activity throughout the reservoir. Hillman noted that the most abundant fish observed during the dock study was redside shiner (as depicted in the table on page 5 of Attachment B), and he added that redside shiner use the same habitat as juvenile Chinook salmon.

Lake Chelan Hydroelectric Project

Osborn provided an overview of the Lake Chelan Hydroelectric Project (Attachment B, page 7). He explained that the project area was divided into four areas based on geomorphology, and that the Reach 4 Project was constructed to provide an additional 3 to 4 acres of spawning and rearing habitat. Spawning ground surveys from 2008 through 2012 indicate a steady increase in the number of redds in Reach 4, the Lake Chelan Hydroelectric Project tailrace, and at the confluence of the Chelan River and the Columbia River. Aerial photographs of Reach 4 after stream enhancement also show high densities of redds in the restored areas. Osborn said that Chelan PUD will continue monitoring the area throughout the life of the license.

Bryan Nordlund asked if the water is cooler in Chelan River versus the Columbia River, and Osborn replied that it depends on the season and releases from Lake Chelan. Nordlund also asked if there were any plans to provide additional vegetation cover beyond what is depicted in the photos. Osborn said that the photos in the presentation are slightly dated, and that the area now looks considerably different than in the photos. He said that five species of riparian vegetation were planted in the area, and the area is now highly vegetated. Mike Schiewe asked if many juveniles are observed rearing in the restored channel, and Osborn replied that juveniles have been observed near the engineered logjams (ELJs) that were placed in the channel as part of the restoration. Osborn added that as the season progresses, however, the juveniles tend to leave the channel. Hillman noted that juvenile summer Chinook leave the Wenatchee River when they reach a size of about 80 millimeters (mm) and this may also be the case in the Chelan River.

Adult Returns

Murauskas first reviewed *Performance of Chinook Reared in Circular Re-Use and Raceway Systems* (Attachment C), which was distributed to the Coordinating Committees by Geris on April 22, 2013, and was also presented at the 2012 Northwest Fish Culture Conference (NWFCC) in December 2012. Murauskas reviewed the rearing vessel types, and noted that one advantage of the re-use vessels is the use of less water, and a reduction of the footprint on the region's aquifer. He said that data from 2009 through 2011 indicate no statistical difference in survival to McNary Dam between smolts reared in raceways versus re-use tanks. However, re-use fish had significantly faster travel times to McNary than raceway fish did. Adult return rates of juveniles reared in re-use tanks were significantly greater and at older ages than for the raceway fish. Murauskas said that, overall, implementation of re-use vessels maximizes effectiveness at meeting mitigation goals and water quality standards. Nordlund asked if there was any explanation for the lower return rates for jacks and mini jacks from re-use rearing. Murauskas suggested it may be a related to the benefits of greater exercise and higher fitness. Tom Kahler said that one consistent predictor of residency of *Oncorhynchus mykiss* is high lipid content in juveniles, and perhaps the same is true of Chinook and the exercised fish from circular tanks have lower lipid levels than raceway fish.

Murauskas also presented *Trends in Mid-Columbia River Summer/Fall Chinook* (Attachment D), which was distributed to the Coordinating Committees by Geris on April 22, 2013. He reviewed a graph depicting summer Chinook returns at Rock Island Dam from 1933 to 2009, which showed that after implementation of the HCPs, there was an exponential increase in adult summer Chinook returns. Murauskas added that many of these fish are products of the HCP programs. Excerpts from historical fish surveys indicated that summer Chinook returns at Rock Island Dam were predicted to never be greater than those observed in 1957 (i.e., 25,624). In 2002, with the PUD programs, summer Chinook returns reached 100,318.

Productivity

Hillman reviewed *Factors Affecting the Productivity of Summer Chinook Salmon* (Attachment E), which was distributed to the Coordinating Committees by Geris prior to the meeting on April 23, 2013. Hillman said that the purpose of this work was to evaluate the M&E data to identify factors that may be limiting the productivity of summer Chinook in the Wenatchee, Methow, and Okanogan basins. Hillman reviewed available data sets, and explained that "recruits," for the purposes of this study, were defined as adults that return to spawn, fish that are harvested, plus fish collected for broodstock. He further explained that "productivity" is the ratio of recruits to spawners (R/S).

Hillman reviewed graphs for Wenatchee, Methow, Okanogan, and Hanford Reach summer Chinook populations, and noted that the black line on each graph represents R/S = 1.0. He said that if the geomean of the population is below that line, the population is not replacing itself. Conversely, if the productivity of the population is above that line, the population is growing. Hillman said that Endangered Species Act (ESA)-listed species have productivities generally below that line, and that is one reason why they are listed. The graphs indicated that the Wenatchee, Methow, and Okanogan summer Chinook populations were all highly productive with geomean productivities greater than 2.0. Hillman noted that the Hanford Reach fall Chinook population is considered to be one of the most productive populations along the Pacific Rim; and the Hanford Reach population has roughly the same average productivity as the Wenatchee, Methow, and Okanogan summer Chinook populations. He suggested that there were a few years of concern with the Wenatchee, Methow, and Okanogan summer Chinook population, but all still has R/S geomeans above 2.0.

Hillman said that because productivity among the three populations is synchronous and highly correlated, the same factors appear to be affecting each population. He investigated what variables may affect each of the populations. Hillman first analyzed density dependence in the Wenatchee, Methow, and Okanogan populations as a potential driver using three different stock-recruitment models. Models results indicated some evidence of density dependence within all three populations; however, the amount of variability in recruitment explained by the models was small. Hillman then analyzed environmental variables as possible sources of variability, including hydrosystem and hatchery metrics. Results indicated that 50 percent of the variability in Wenatchee summer Chinook productivity, and 54 percent in Methow summer Chinook productivity were explained by low average air temperature, maximum snow depth, and spring Pacific decadal oscillation. For Okanogan summer Chinook, 60 percent of the variability in productivity was explained by maximum snow depth and the proportion of hatchery-origin spawners (pHOS). Hillman concluded that climatic and ocean conditions appear to be the biggest drivers of productivity.

Mike Schiewe asked what prevented the populations from becoming so large that density dependence constrained further growth; and Hillman said that harvest is a major controlling factor. He added that when there are too many fish, productivity will be reduced, as observed in some basins such as the Chiwawa. Bob Rose asked about the relationship between smolt-to-adult returns (SARs) and travel time during downstream migration. Hillman said that the two were not included in the analysis or presentation. He said that flows may have an effect; however, the models shown in the presentation only captured those metrics that were statistically significant. He said that the analysis determined that flow was not a significant predictor of productivity; however, flow was correlated with the maximum snow depth, which was a significant predictor of productivity. He added that he thinks that is because flow affects a relatively very short phase of the life cycle.

Schiewe asked if Hillman's analyses considered variation in juvenile life history, such as yearling versus subyearling migration. Hillman replied that it did not and he did not believe enough empirical data existed, and added that he tried to address this issue by considering a 1-year and 2-year ocean metric, and yearling outmigration, but nothing significant resulted. Hillman said that there are also additional ocean indices available that could be evaluated. Based on these analyses, Murauskas asked Hillman if he thought there were any outstanding concerns about the status of summer Chinook in the Upper Columbia. Hillman said that, based on these results, there did not appear to be any.

Nordlund asked if spring Chinook productivity is related to or affected by the summer Chinook success that Hillman presented, and Hillman replied that while summer Chinook mainly spawn in the mainstem Wenatchee River, spring Chinook spawn earlier and in the headwaters. He said that, therefore, the two populations are segregated both in space and time. He further explained that summer Chinook emerge first and move immediately to the edges of the river. When juvenile spring Chinook begin coming into the Wenatchee, the summer Chinook are big enough to move into deeper and faster water, and the spring Chinook then fill the edges. In the fall, another pulse of spring Chinook arrive, and by then, the summer Chinook are mostly gone. Hillman said that there is little interaction between spring and summer Chinook. Kahler asked what happens in the Methow and Wenatchee basins, where there are zones of overlapping spring Chinook and summer Chinook habitats. Hillman replied that in those locations, there could be interactions; however, they may still be segregated based on emergence time. Hillman noted that sockeye salmon research has found that some fish are able to modify their development rate and emergence time. He suggested the same may be possible with Chinook.

Hemstrom asked, for the purposes of moving forward, whether there are other needs to be addressed in terms of subyearling survival. Miller said that the PUDs are currently in phase III additional juvenile studies, and Kahler noted that the only way to get out of this phase is to conduct a project-wide survival study. Nordlund said that, after today's presentations, he is satisfied that the technology to conduct a subyearling survival study is currently not available, and that the status of the summer Chinook stock appears relatively healthy. Chelan PUD and Douglas PUD said that they will develop a joint SOA documenting: (1) the status of evolving methods and technology needed to conduct survival studies; (2) the healthy status of Upper Columbia subyearling stocks; and (3) the commitment to continue tracking and updating the Coordinating Committees on the opportunity to conduct subyearling survival studies under the Wells, Rocky Reach, and Rock Island Hydroelectric Project HCPs.

E. Spring Chinook Pilot at Rocky Reach (Joe Miller)

Joe Miller said that Chelan PUD is considering options for future implementation of their Methow spring Chinook program, and the Rocky Reach trap has been identified as a potential option for broodstock collection. Miller said that the trap has been used historically to capture listed steelhead and bull trout without causing delays to non-target fish. He said that Chelan PUD is proposing a pilot study where the trap will be operated targeting adipose-clipped (ad-clipped) spring Chinook based on visual identification (Attachment F). The purpose of the study is to test the feasibility of visually identifying and selectively collecting spring Chinook to evaluate trap operation. Miller said that the study would be conducted over a 4-week period, with one trap event allowed per hour, a maximum of three trap events per day, and no more than five trap events per week. Passage will be monitored using existing PIT-tag arrays and PIT-tags already in the system.

As for review, Miller said that the HCP Hatchery Committees are evaluating the logistics of the trap as a collection location, and that Chelan PUD would like the Coordinating Committees' approval of the pilot from a fish passage perspective.

Josh Murauskas added that the Rocky Reach trap is unique in that, unlike other trapping facilities, it has the ability to single out and trap specific fish, as opposed to trapping several fish and potentially affecting the run at large. Jim Craig asked how much the fish would be handled, and Miller explained that this pilot will only focus on trap efficacy and that fish will not be handled at all. Bryan Nordlund noted that, in order to trap a single fish, groups of fish that are passing the trap will need to be forgone. He asked, then, if this will be limiting to meeting program goals, and Murauskas replied that the program is for approximately 61,000 fish, which requires only about 35 adults. Steve Hemstrom added that the Rocky Reach trap has been used for several studies and has successfully trapped individual fish each time. Nordlund asked whether, if the pilot proves successful, Chelan PUD plans to install a handling facility at Rocky Reach Dam. Miller replied that there are a few options that can be explored but that those details have not yet been addressed at this point in the process.

Mike Schiewe noted that the pilot has already undergone a couple of revisions, as requested by the HCP Hatchery Committees, and suggested that the Coordinating Committees review the pilot and provide email approval within a week or two. The spring Chinook Pilot Trapping Study at Rocky Reach was distributed to the Coordinating Committees by Kristi

Geris following the meeting on April 23, 2013, for review with comments and/or email approval due to Miller (with copies to Geris and Schiewe) no later than May 1, 2013.

F. Trapping Activities—Gantt Chart (Steve Hemstrom)

Steve Hemstrom said that, per Chelan PUD's action item from the Coordinating Committees meeting on March 26, 2013, a Gantt chart summarizing adult trapping activities at Tumwater and Dryden dams (Attachment G) was distributed to the Coordinating Committees by Kristi Geris on April 22, 2013. Hemstrom said that Alene Underwood also provided a Gantt chart for adult trapping activities at both dams, and Hemstrom said that he would provide electronic copies of that chart to Geris for distribution to the Coordinating Committees.

IV. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe reported that the HCP Tributary Committees did not meet in April due to lack of agenda items.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Hatchery Committees' meeting on April 17, 2013, which was hosted by Chelan PUD:

- *Revised Analytical Framework 5-Year Update*: After several months of revisions and fine-tuning of objectives (led by a smaller workgroup), the Hatchery Committees approved the Revised Analytical Framework 5-Year Update. With the revised update approved, the PUDs will now send out Requests for Proposals (RFPs) for contracting in 2014. An expert panel will be assembled to assist in the review of the proposals received.
- *Carlton Acclimation Facility Capacity Utilization SOA*: Chelan PUD received approval of the Carlton Acclimation Facility Capacity Utilization SOA for their Methow spring Chinook production. However, it is yet to be determined how far into the future Chelan PUD will use the facility for their Methow obligation.
- *Spring Chinook Pilot Trapping Study at Rocky Reach*: Hatchery Committees representatives will submit email approval of this pilot study to Chelan PUD no later than April 26, 2013.

- *Hatchery Genetic Management Plan (HMGP) Update*: National Marine Fisheries Service (NMFS) has committed to approving final permitting for the Wenatchee spring Chinook programs (Nason, White, and Chiwawa) by May 31, 2013, or June 7, 2013, at the latest. A commitment was also made to permit trapping of broodstock at Tumwater Dam no later than June 7, 2013, which also covers bull trout. The U.S. Fish and Wildlife Service (USFWS) is most concerned about the impact of a Wenatchee basin spring Chinook fishery on bull trout. These concerns are being addressed.
- *Methods for Estimating Likelihoods of Outcomes in Broodstock-Collection*: Greg Mackey conducted exploratory analysis on broodstock estimation and managing risk and expectations in broodstock collection, and now the Hatchery Committees are discussing use of this analysis in developing future broodstock protocols.
- *Dryden Update*: Alene Underwood updated the Hatchery Committees on progress made on Chelan PUD's testing and planning for Dryden Total Maximum Daily Load (TMDL) compliance.
- *Chelan Falls Summer Chinook Update*: Chelan Falls summer Chinook were released 3 to 4 days earlier than planned due to DO and bacterial gill disease (BGD) concerns.
- *Wells Hatchery Master Plan*: Greg Mackey said that Douglas PUD anticipates that the draft plan will be complete by April 30, 2013, at which time he will provide the plan to the Hatchery Committees for review. The Hatchery Committees have also requested an additional review of the engineering plans, when available.

V. HCP Committees Administration (Mike Schiewe)

A. Next Meetings

The next scheduled Coordinating Committees meeting is on May 21, 2013 (formerly scheduled for May 28, 2013); it will be held in eastern Washington, likely at Rocky Reach Dam. Steve Hemstrom will confirm that a meeting room is available at Rocky Reach Dam for the meeting. Tom Kahler said that he will coordinate with the Douglas PUD information systems staff regarding their file-sharing presentation scheduled for this Coordinating Committees meeting on May 21, 2013. Based on these discussions, Kahler said that he will also coordinate with Jeff Fryer about possibly scheduling a presentation for the Coordinating Committees on CRITFC's sockeye studies.

The June 25, 2013 and July 23, 2013 meetings will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A	List of Attendees
Attachment B	A Review of Technology, Productivity, and Adult Returns to the Mid-Columbia River
Attachment C	Performance of Chinook Reared in Circular Re-Use and Raceway Systems
Attachment D	Trends in Mid-Columbia River Summer/Fall Chinook
Attachment E	Factors Affecting the Productivity of Summer Chinook Salmon
Attachment F	Spring Chinook Pilot Trapping Study at Rocky Reach
Attachment G	Gantt chart summarizing adult trapping activities at Tumwater and Dryden dams

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Josh Murauskas	Chelan PUD
Joe Miller	Chelan PUD
Jeff Osborn	Chelan PUD
Tom Kahler*	Douglas PUD
Tracy Hillman	BioAnalysts
Kirk Truscott*†	Colville Confederated Tribes
Bob Rose*†	Yakama Nation
Bryan Nordlund*	National Marine Fisheries Service
Teresa Scott*	Washington Department of Fish and Wildlife
Jim Craig*	U.S. Fish and Wildlife Service

Notes
* Denotes Coordinating Committees member or alternate
† Joined by phone

Chelan PUD

HCP Path Forward Subyearling Chinook

A review of technology, productivity, and adult returns to the Mid-Columbia River

CHELAN COUNTY P.U.D.

April 23, 2013 - Chelan County PUD – HCP Coordinating Committee

Acoustic Telemetry Equipment
Technology Then and Now
2009:2013

- Technology still not adequate for **Project** survival study in UCR
- Fish 100 mm are bulk of study fish at RR
- Tags miniaturizing, decreasing battery life (19 d @ 3sec PRI)

2009	2013
0.65g	0.5g
31d @ 1p 4-6 sec	19 d @ 1p 3 sec

Acoustic Telemetry Equipment Technology Comparison

Smallest Tag Size Presently Tested	HTI Tags	JSATS (ATS/Lotek)	VEMCO Tags
Size	**0.5 g in air**	**0.44 g in air**	**0.65 g in air**
Battery life	**19 d, 3 PRI**	**19 d, 2 PRI**	**?**

CHELAN COUNTY P.U.D.

Survival Study Limitations
Subyearling Chinook

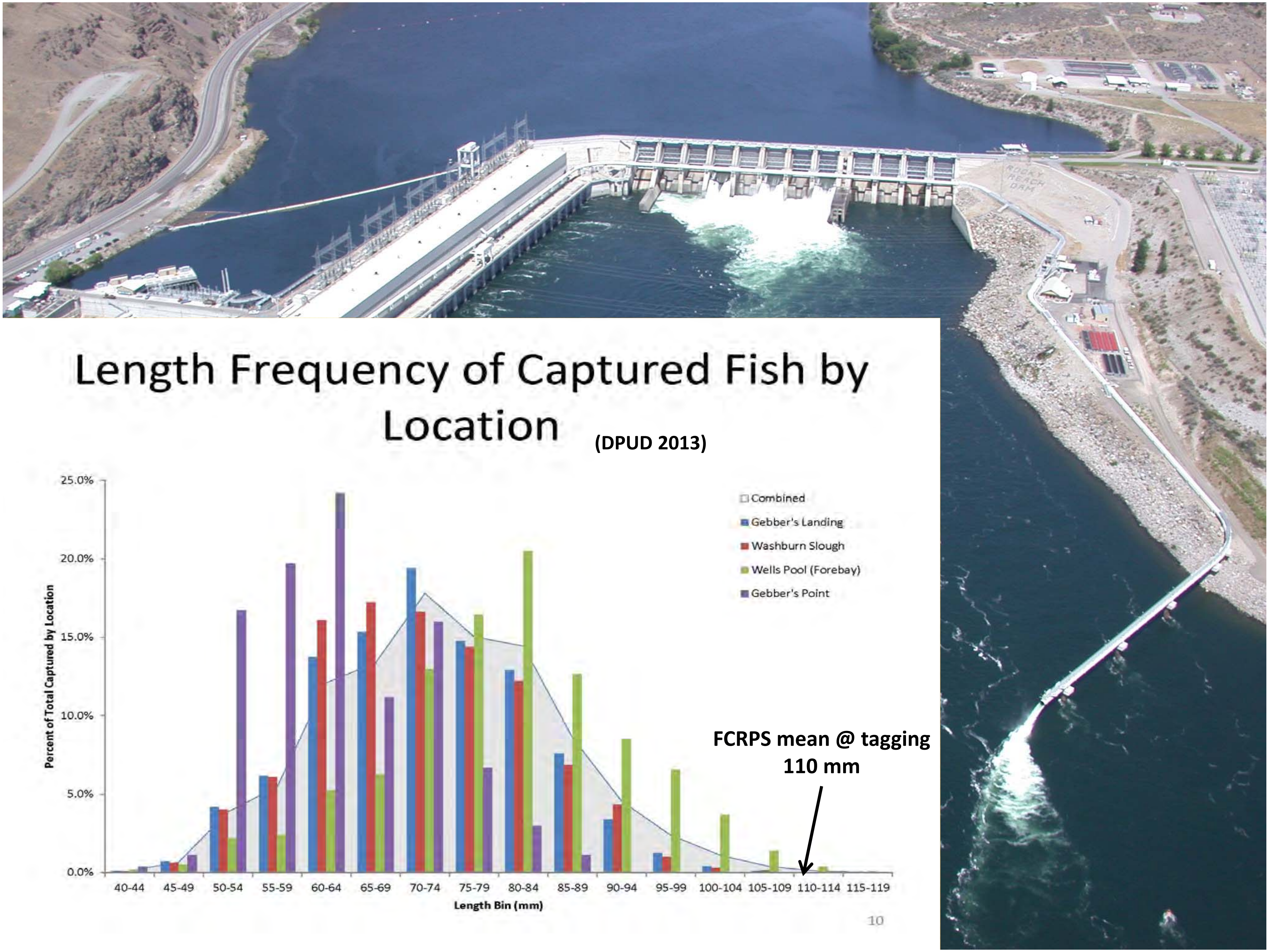
- ❑ Small subyearlings – RR mean 101.9 mm (FCRPS 110 mm @ tagging)
- ❑ RR/RI contain reservoir type fish
- ❑ Outmigration times long, ‘non-migrant’ fish present
- ❑ Long reservoirs increase potential for non-migrant bias

P.U.D.
CHELAN COUNTY

Predator Abundance

- Pikeminnow removed in first 10 years of HCP: **681,199**
- Electrofishing data from dock investigation: 20 sites

	%	#
Bluegill	0.06	1
Bridgelip sucker	0.12	2
Chinook Salmon	0.53	9
Chiselmouth	25.31	427
Sculpin	1.72	29
Carp	0.12	2
Minnow Spp.	0.18	3
Largemouth Bass	**0.24**	**4**
Smallmouth Bass	**0.0**	**0**
Longnose Sucker	0.41	7
Largescale Sucker	7.17	121
Northern Pikeminnow	21.75	367
Peamouth	10.49	177
Redside Shiner	28.99	489
Sucker Spp.	1.66	28
Tench	0.24	4
Threespine Stickleback	0.83	14
Walleye	0.06	1
Whitefish	0.06	1
Yellow Perch	0.06	1


Length Frequency of Captured Fish by Location
(DPUD 2013)
Percent of Total Captured by Location
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Combined
Gebber's Landing
Washburn Slough
Wells Pool (Forebay)
Gebber's Point
FCRPS mean @ tagging 110 mm
40-44
45-49
50-54
55-59
60-64
65-69
70-74
75-79
80-84
85-89
90-94
95-99
100-104
105-109
110-114
115-119
Length Bin (mm)
10

Lake Chelan Hydroelectric Project

Why did we construct this Project?

- Instream flow modeling indicated peak habitat at 650 cfs
- Agencies proposed 650 cfs minimum instream flow
- Minimum flow proposal reduced generation by 33 percent
- Focused on amount of habitat (3 to 4 acres) versus flow
- Developed project to provide additional 3-4 acres of spawning and rearing habitat

Study-Technology Summary

- ❑ Tag life, life history remain impediments
- ❑ Smallest summer/fall Chinook subyearlings in UCR
- ❑ Wells study noted prolonged outmigration, size bias
- ❑ Tag Technology only slightly “better” than 2009
- ✓ Are other measures available/useable to assess survival?

Lake Chelan Hydroelectric Project

Chelan River (Reach 4) Habitat Channel

Lake Chelan Hydroelectric Project

Chelan River (Reach 4) – After Stream Enhancement

Lake Chelan Hydroelectric Project

Chelan River (Reach 4) – After Stream Enhancement

Lake Chelan Hydroelectric Project

The Production Story

Summer/fall Chinook spawning ground survey data
(# of redds)

Year	Reach 4	Tailrace	Columbia River	Total
2008	NA	153	In tailrace count	153
2009	79	129	58	266
2010	115	234	49	398
2011	178	192	48	418
2012	139	231	56	426

Attachment C

Performance of Chinook reared in circular re-use and raceway systems

Josh Murauskas, Sam Dilly, Ian Adams, Todd Pearsons

2012 NWFCC

December 12, 2012

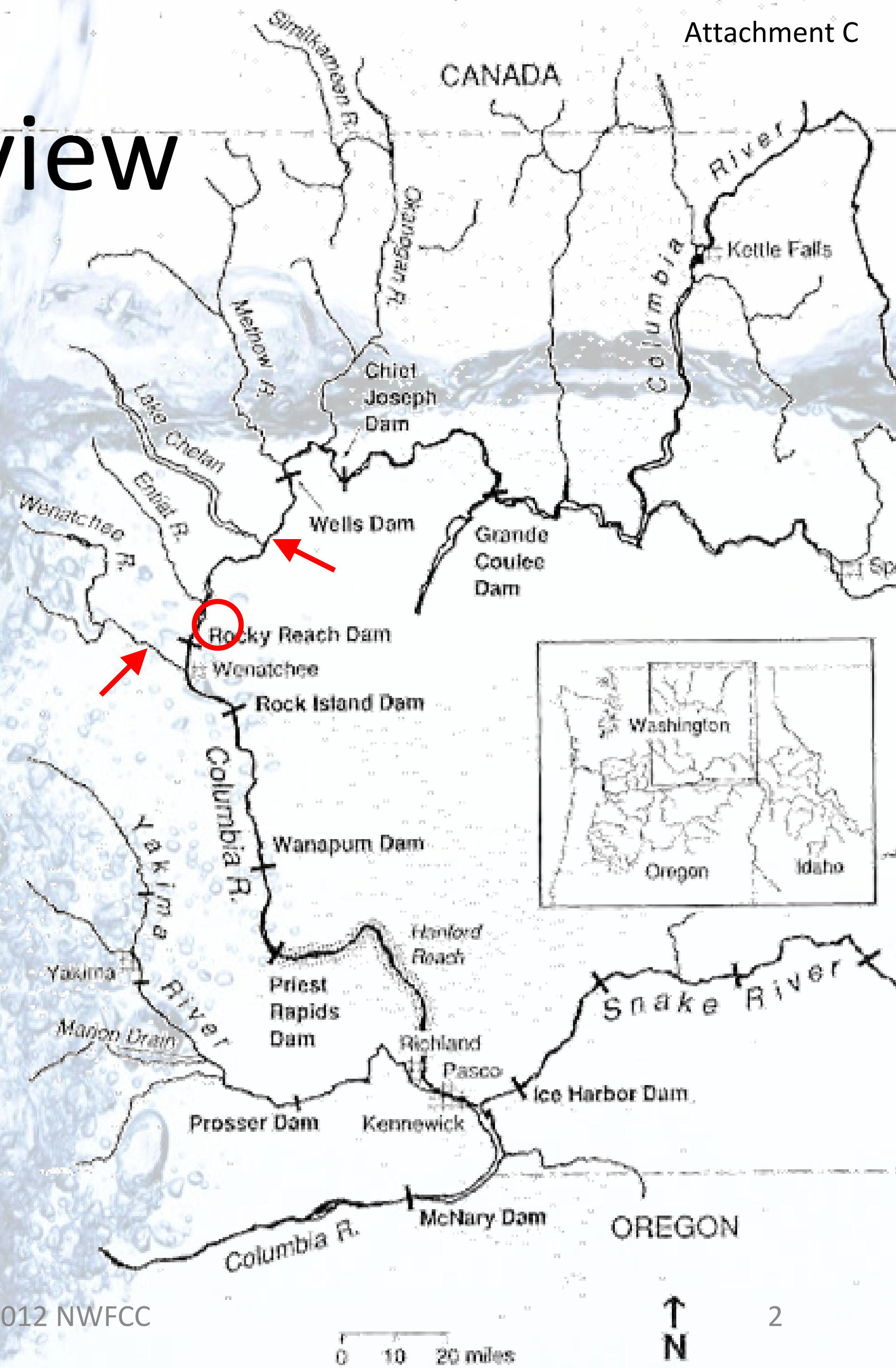
(Presented to HCP-CC, April 23rd 2013)

CHELAN COUNTY P.U.D.

Grant County PUBLIC UTILITY DISTRICT

Overview

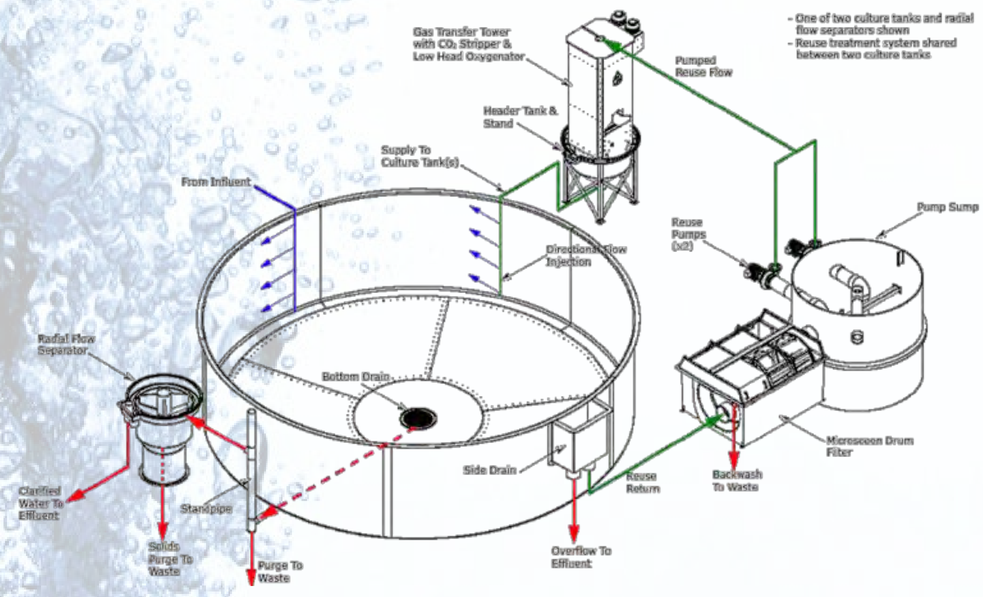
- What vessels?
- What is performance?
- How'd they do?
- Implications…



Murauskas et al. 2012 NWFCC

Rearing vessels

- Standard raceways
  - 30.5 × 3.0 m
  - 102k, 14 FPP, 0.25 DI
- Partial water re-use
  - 9 m dual-drain Cornell
  - 150k, 14 FPP, 0.25 DI
  - > 85% less water use

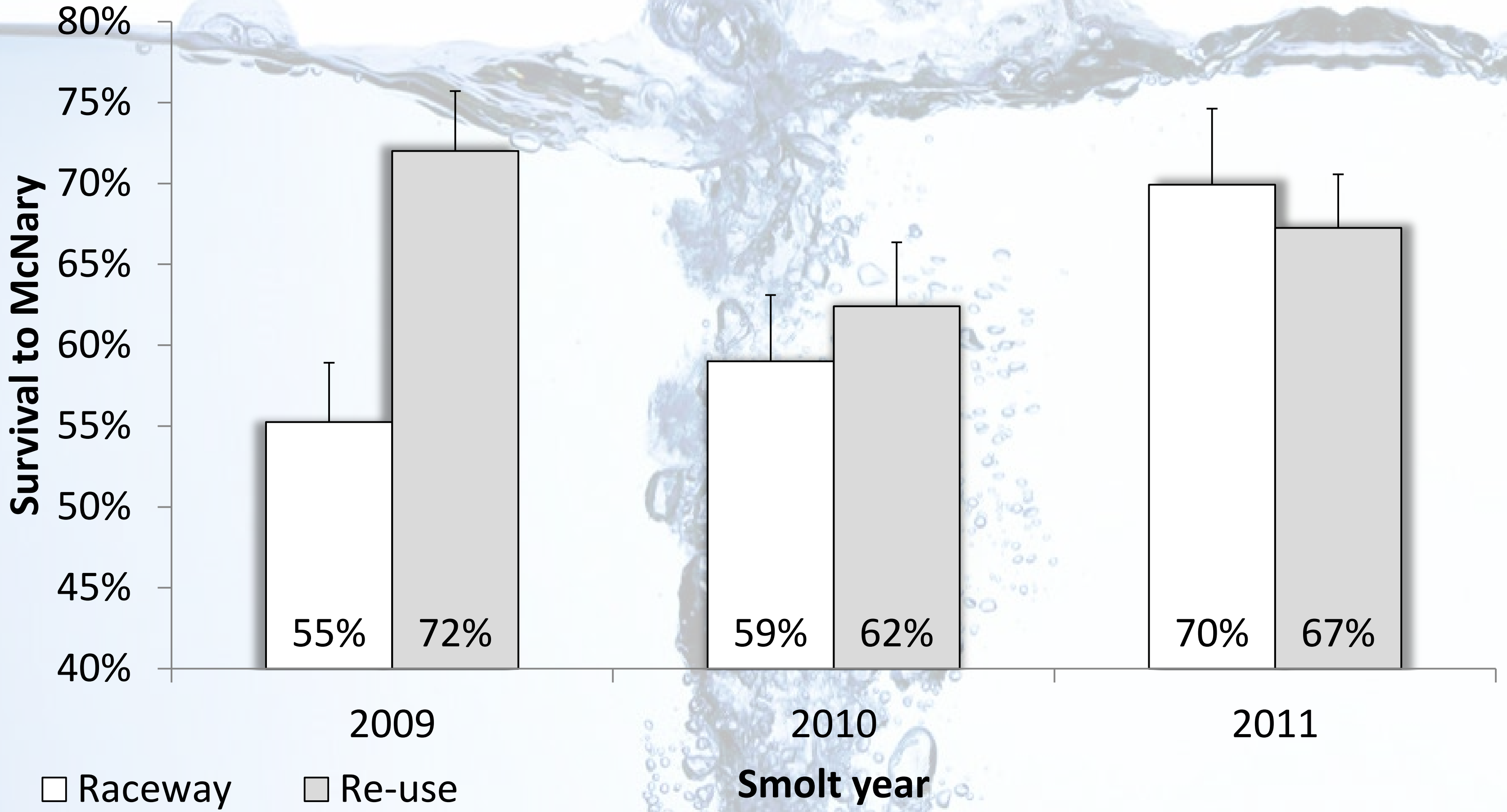


Murauskas et al. 2012 NWFCC

Performance is…

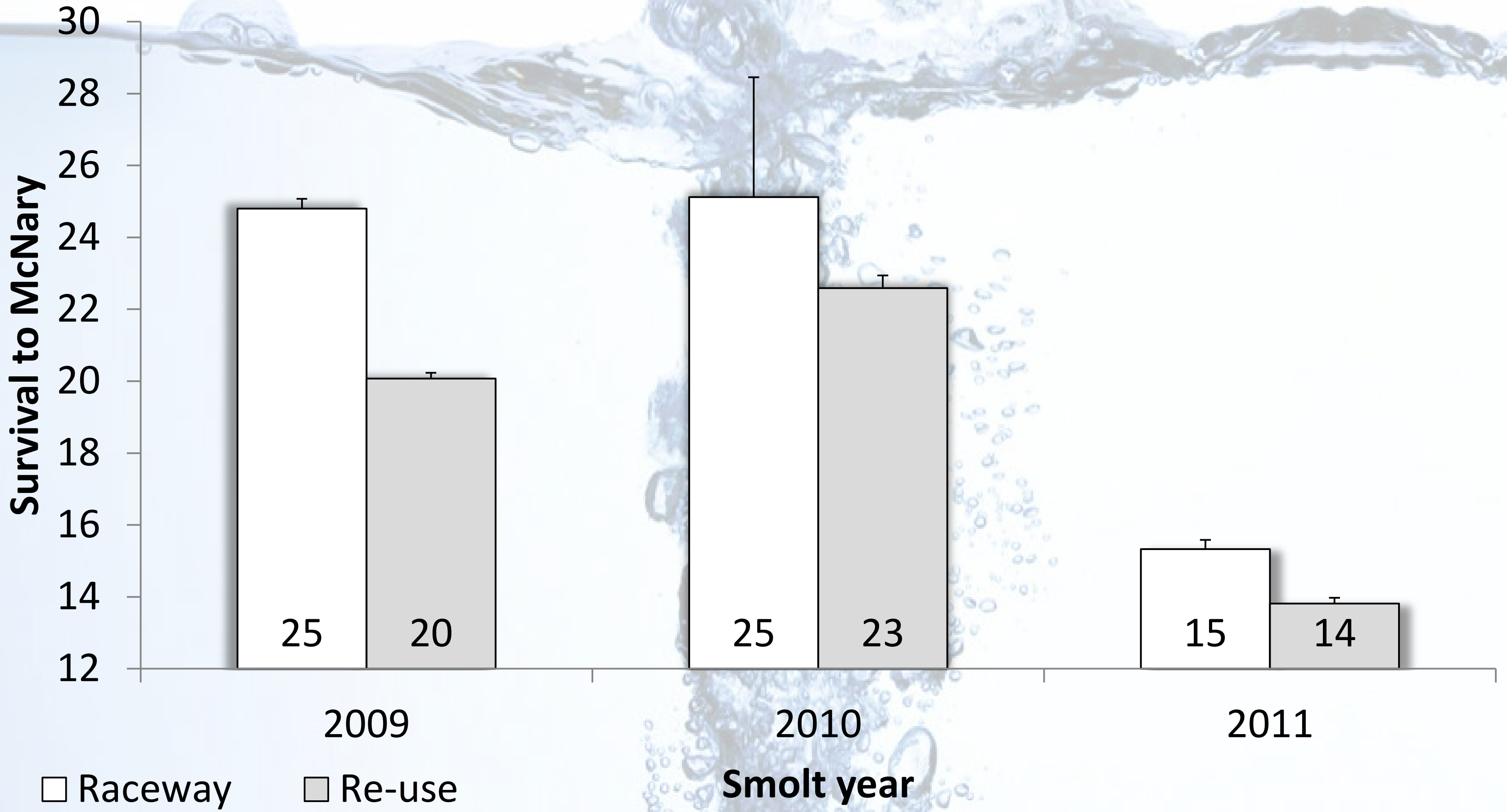
- Fish health
- Post-release survival
- Travel time downstream
- Smolt-to-adult returns
- Age structure

Survival to McNary Dam



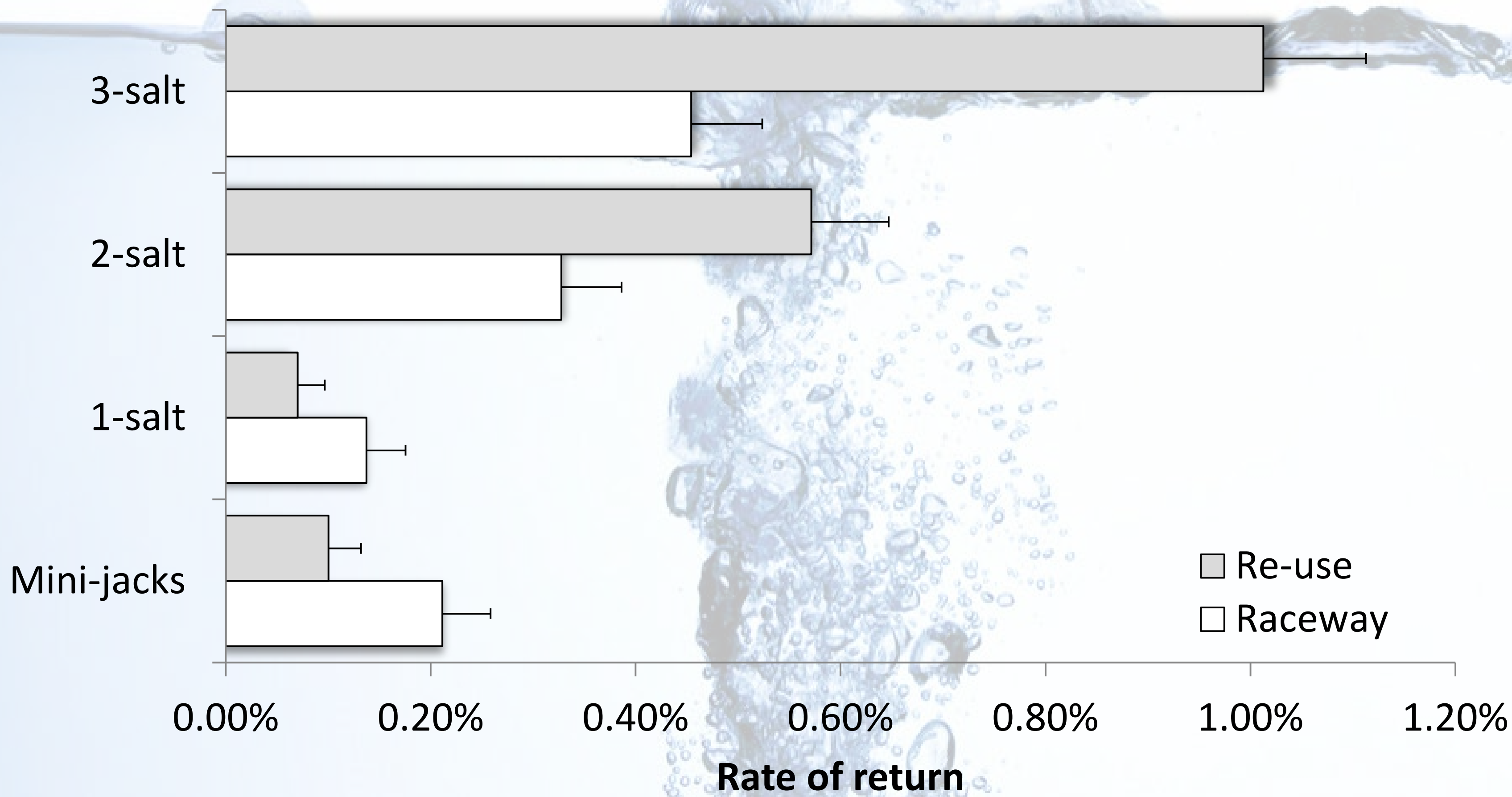
Murauskas et al. 2012 NWFCC

Travel Time to McNary Dam



Murauskas et al. 2012 NWFCC

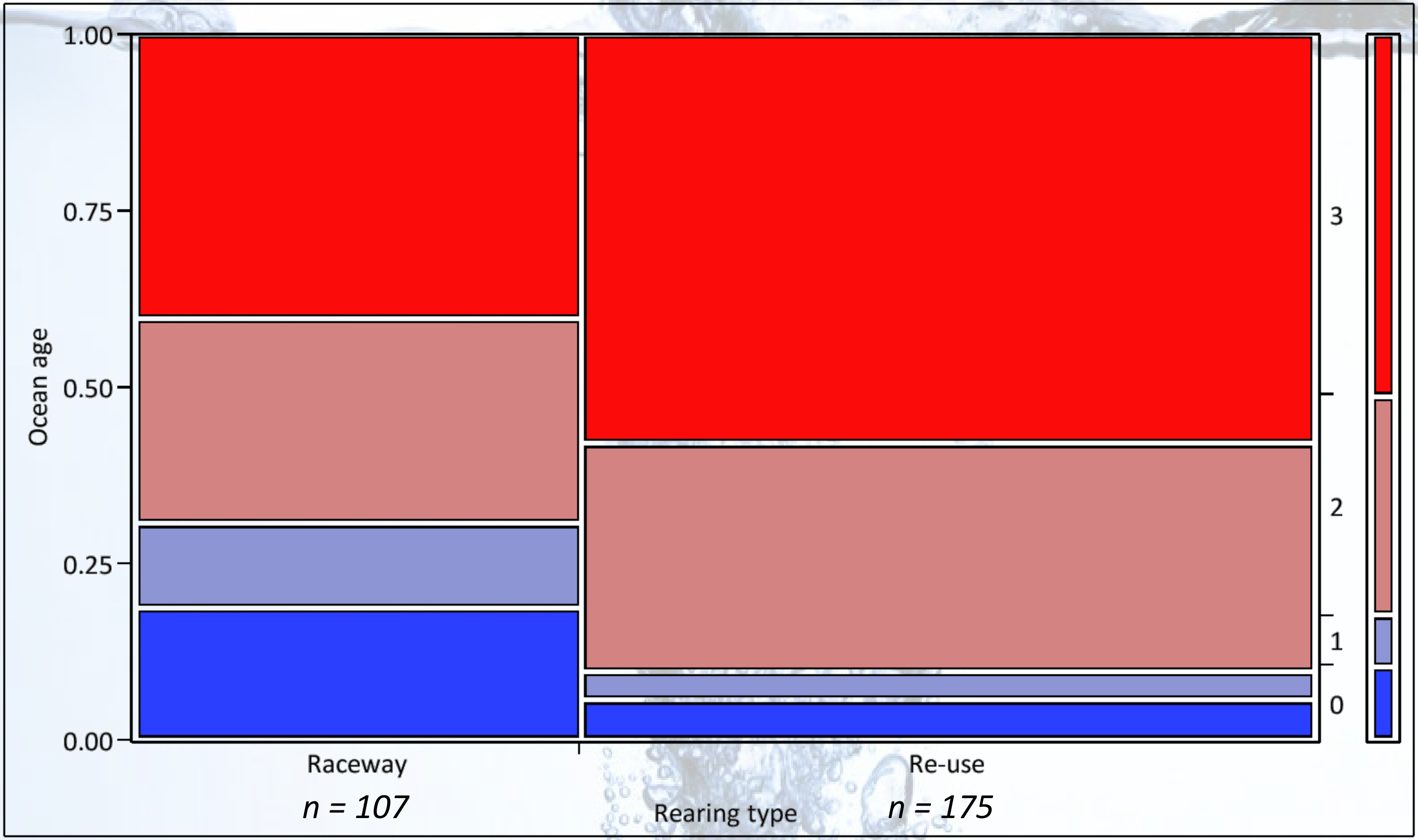
Adult returns



SAR = 0.78% vs. 1.58%

Murauskas et al. 2012 NWFCC

Age structure vs. rear type



Murauskas et al. 2012 NWFCC

$p < 0.0001$

Conclusions

- Water re-use and circular vessels
  - Healthy fish, less water consumption
- Smolt performance
  - Faster travel times, potential survival benefit
- Adult returns
  - Significantly greater survival and older ages

Implications

- Hatchery footprint
  - Water use, brood collection, smolt production
- Harvest augmentation
  - More adults, bigger fish
- Conservation
  - Greater reproductive success
  - Greater similarity to wild-origin fish

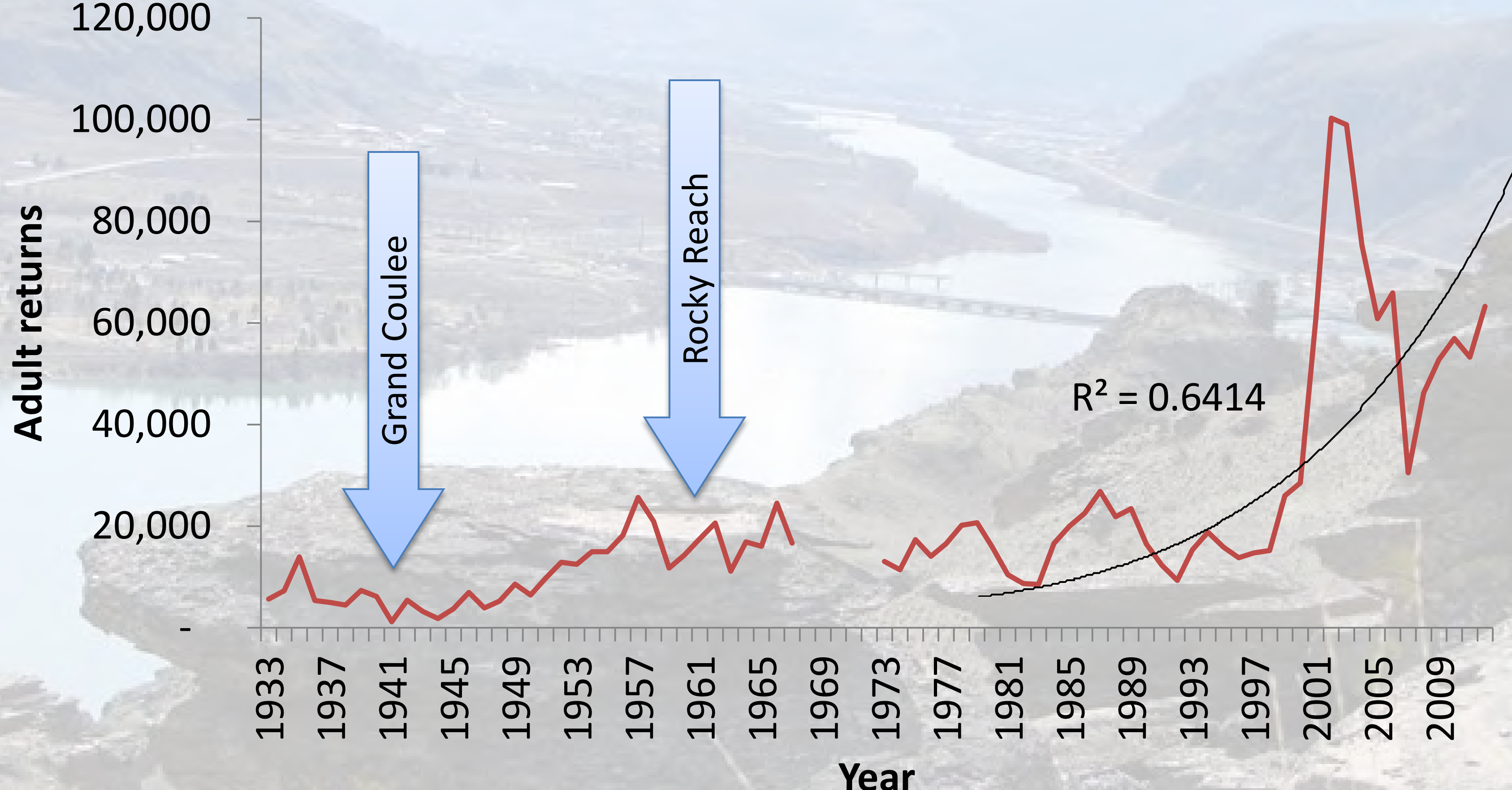
Attachment D

Trends in Mid-Columbia River Summer/Fall Chinook

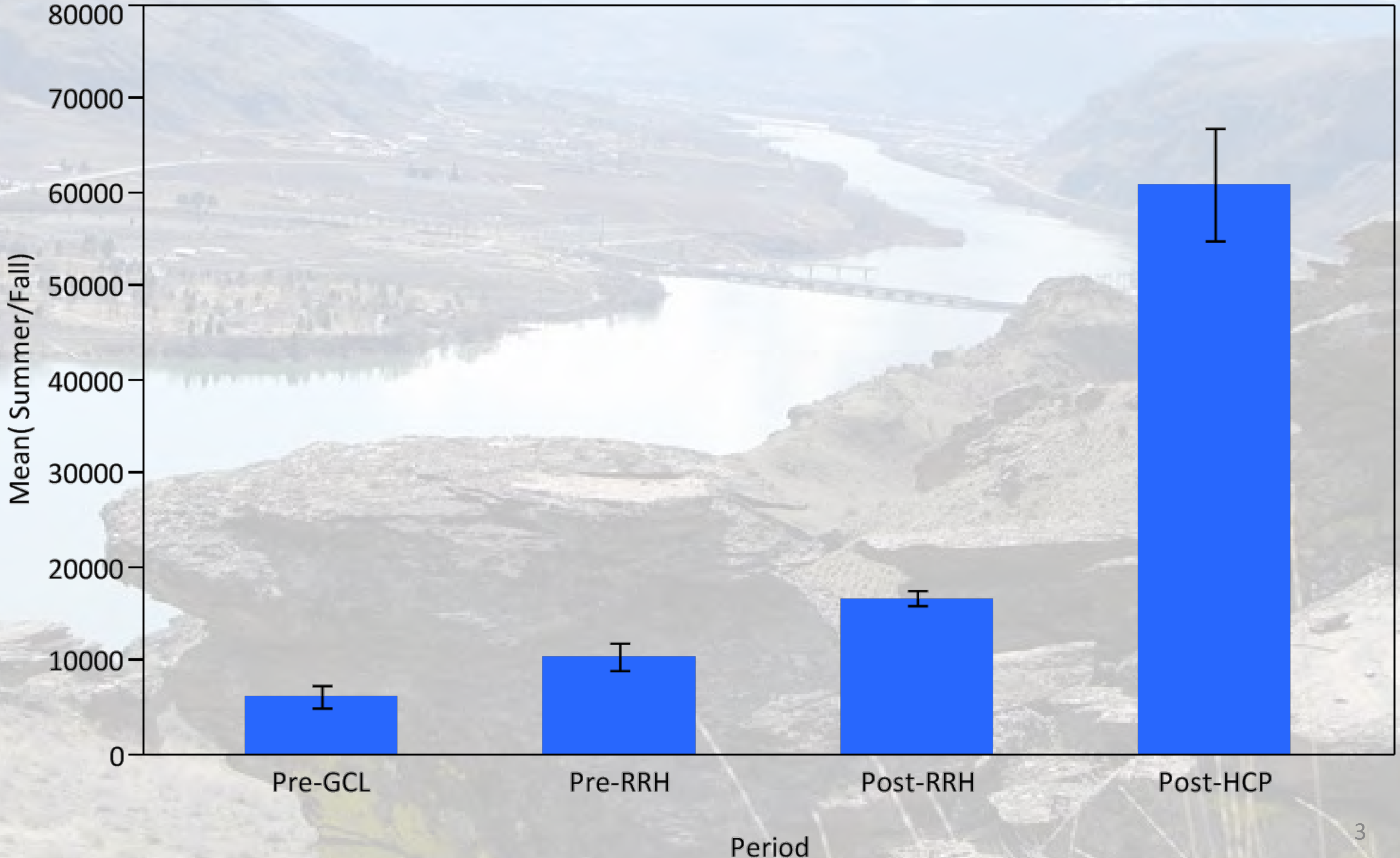
J. Murauskas

HCP-CC, April 23, 2013

Summer Chinook at Rock Island



Average returns



Historical redd counts

- Bernie D. Leman, 1959:
  - Rocky Reach Spawning Ground Surveys
  - “Restitution would be made on the basis of pre-flooding population less the post-spawning population.”

Spawning Areas and Redd Counts

Peak redd counts on the spawning grounds of the upper Columbia River area are available for the years 1956, 1957, 1958, and 1959. However, 1957 could hardly be considered as a representative year as this was the first season for The Dalles Dam which flooded out Celilo Falls with the Indian and commercial fishery that had existed there for many years. During 1957, the Bonneville chinook salmon migration was good; but the numbers had been exceeded many times. However, the chinook escapement over McNary was nearly three times as great as the previous years of record. The impact of this increase was apparent in all spawning areas above Celilo Falls. Undoubtedly, the fishery will and probably already has adjusted for a greater harvest of these salmon below Bonneville Dam or at sea. A chinook run of the late summer-fall, 1957, magnitude might never occur in this area again. Because of the before-

Leman, B.D. 1959. Rocky Reach Project spawning ground surveys. Prepared for the Public Utility District No. 1 of Chelan County.

Peak Redd Counts. Peak redd counts for the period of record are presented in Figure 3.

Figure 3. PEAK REDD COUNTS

	W D F			District		
	1956	1957	1958	1958	1959	1960
Rock Island Dam to Rocky Reach Dam	0	33	222		160	167
Rocky Reach Dam to Entiat	7	137	2	2	1	0
Entiat to Beebe Bridge	3	6	11	100	0	
Beebe Bridge to Azwell	7	44	204	200	0	[illegible]
Azwell to Methow River	0	0	0	0	0	
Methow River to Okanogan River	32	197	285		0	56
Okanogan River to Chief Joseph Dam	196	329	437		126	546

Leman, B.D. 1959. Rocky Reach Project spawning ground surveys. Prepared for the Public Utility District No. 1 of Chelan County.

"…might never occur…"

- Maximum run pre-Rocky Reach
  - 25,624 (in 1957 after inundation of Celilo)
- Maximum run post-HCP programs
  - 100,318 (in 2002, with PUD programs)

Conclusions

- Summer/Fall Chinook returns at levels not witnessed in a century
- HCP programs a significant contributor
- Programs have exceeded expectations
- NNI: *Productivity* of salmon populations

Factors Affecting the Productivity of Summer Chinook Salmon

Purpose

The purpose of this work is to use monitoring and evaluation data to identify the factors that may be limiting the productivity of summer Chinook in the Wenatchee, Methow, and Okanogan basins.

Data

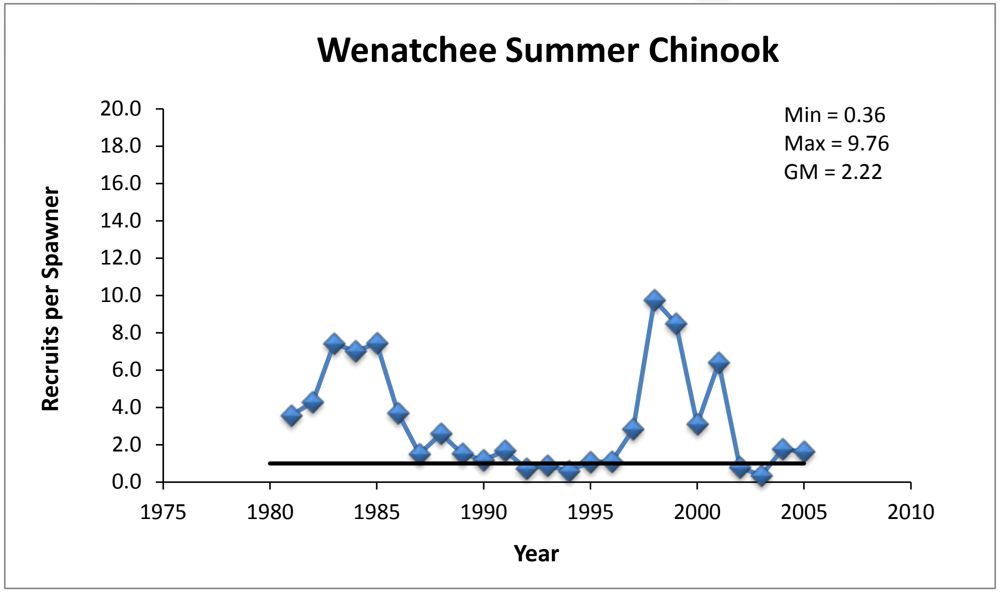
(1) Used stock and recruitment data from the 2012 Annual Report on Monitoring and Evaluation of the Chelan County Public Utility District Hatchery Programs.

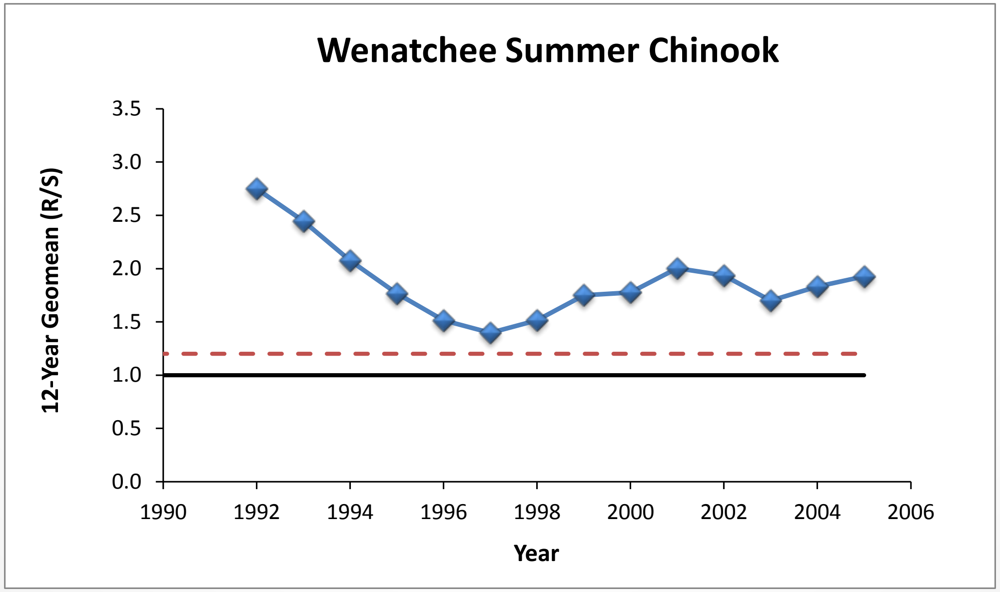
(2) Stock and Recruitment data were calculated using methods described in Miller et al. (2011). Appendix C in the Five-Year M&E Report.

Stock-Recruitment Data

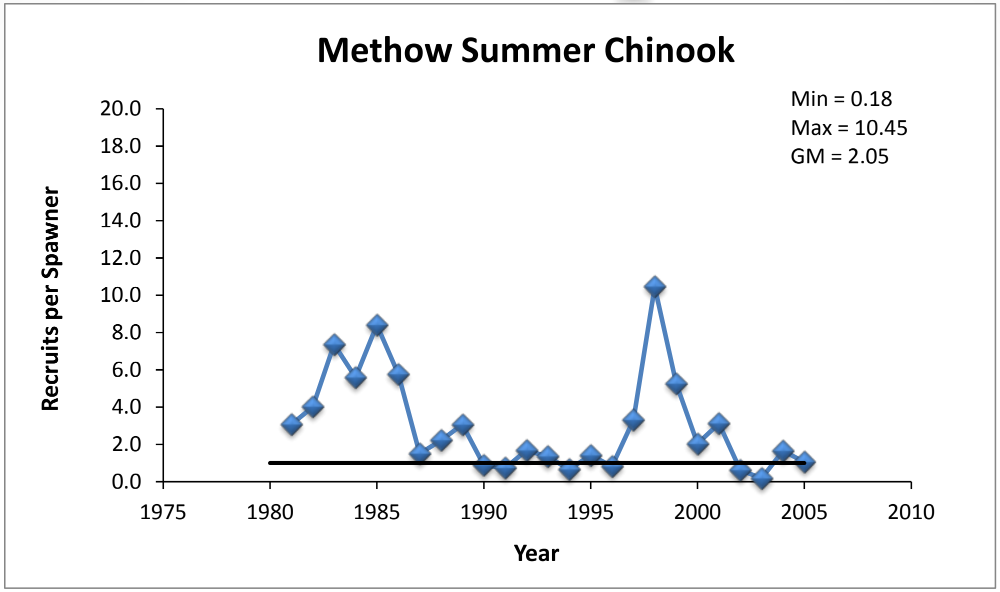
Brood year	Wenatchee			Methow			Okanogan		
	Stock	Recruits	R/S	Stock	Recruits	R/S	Stock	Recruits	R/S
1981	9,245	33,057	3.58	924	2,837	3.07	916	8,905	9.72
1982	8,964	38,461	4.29	739	2,969	4.02	475	6,942	14.61
1983	5,500	40,819	7.42	328	2,417	7.37	504	6,254	12.41
…	…	…	…	…	…	…	…	…	…
2005	8,703	14,093	1.62	2,561	2,715	1.06	8,889	15,894	1.79
Min	5,352	4,199	0.36	328	413	0.18	473	637	0.35
Max	15,723	72,740	9.76	4,630	8,658	10.45	13,857	35,972	14.61
Mean	9,378	26,483	3.26	1,271	2,757	3.05	3,222	7,479	3.56
Geomean	8,958	19,844	2.22	979	2,010	2.05	2,083	4,317	2.07

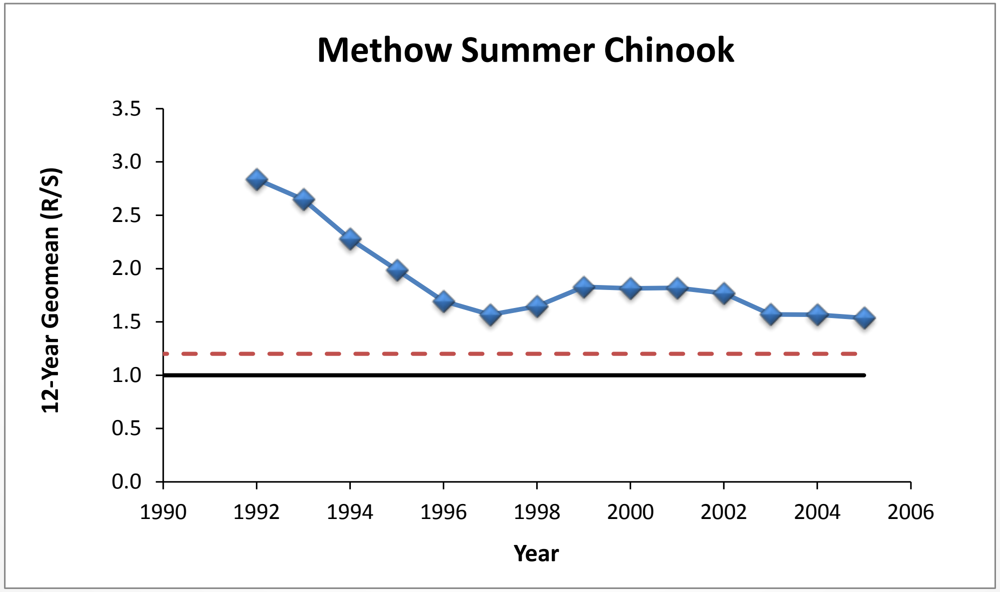
Wenatchee Population





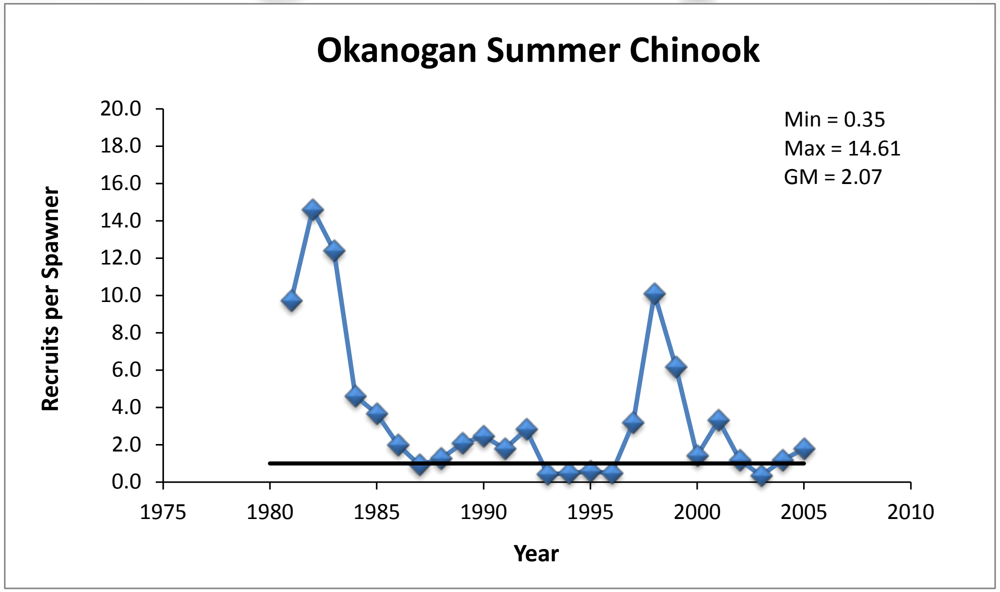
Methow Population

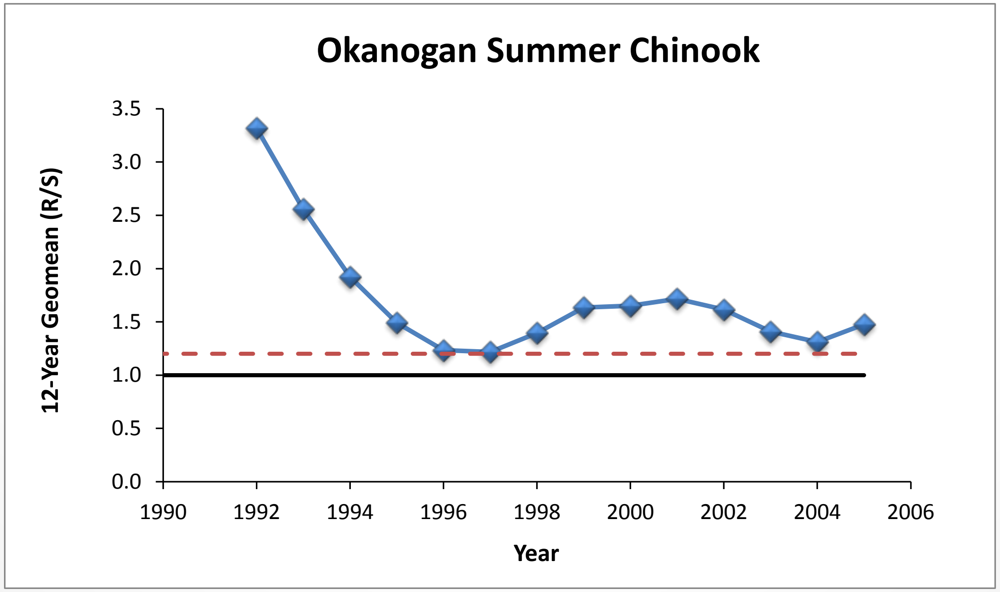




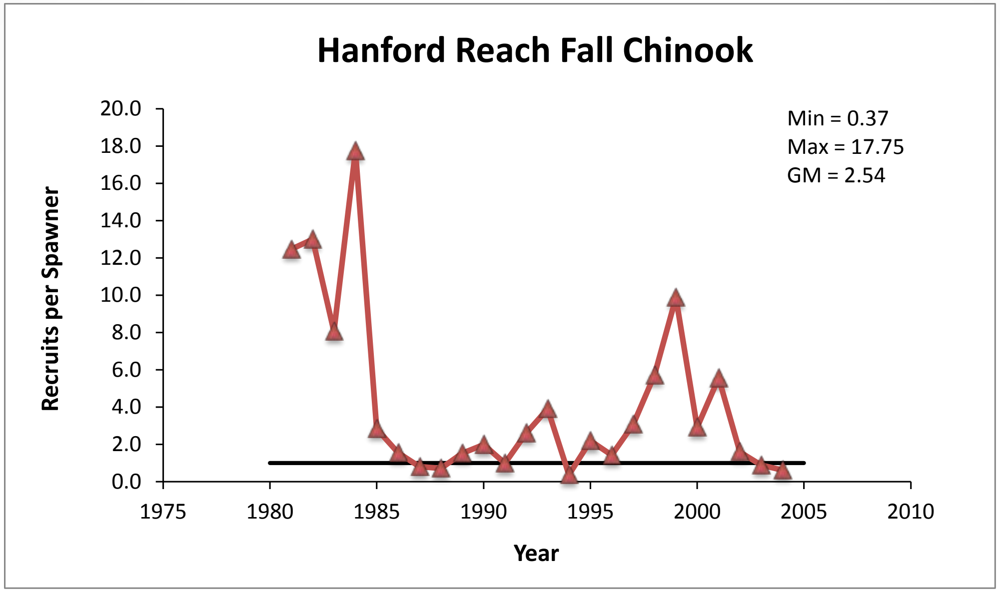
Attachment E

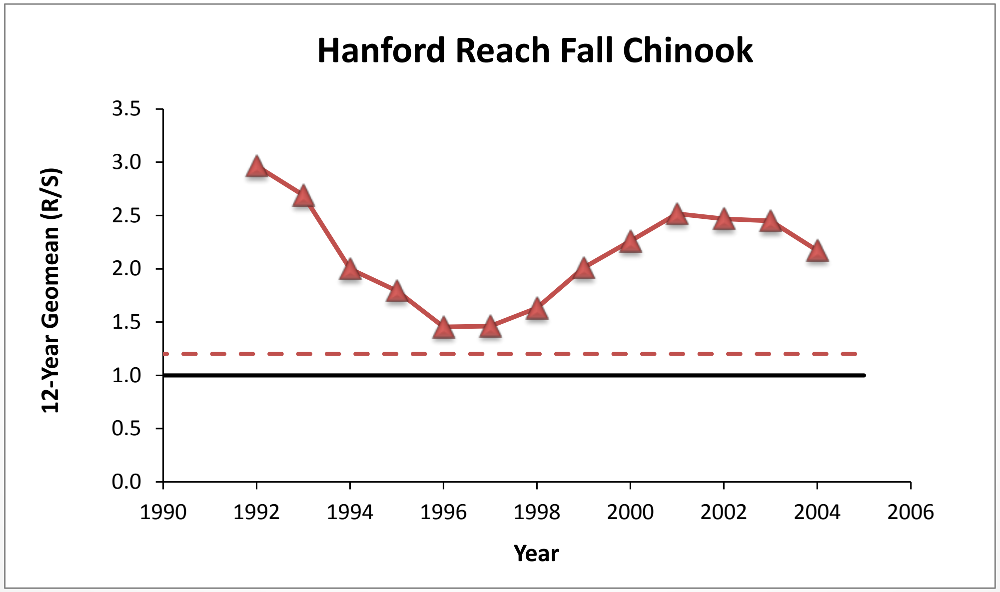
Okanogan Population





Hanford Reach





Density Dependence

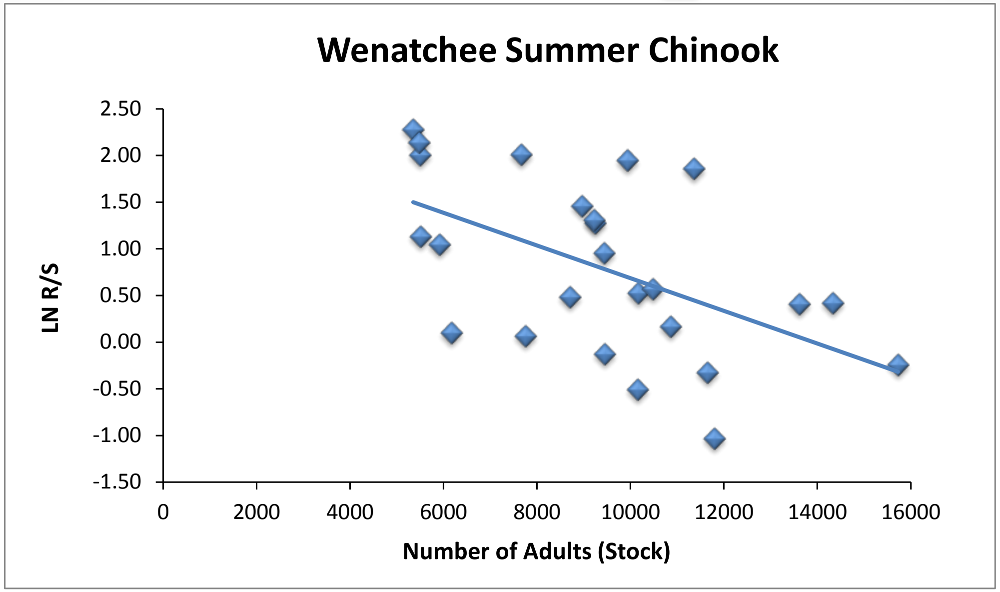
(1) How much of the variation in the time series is related to the size of the spawning stock?

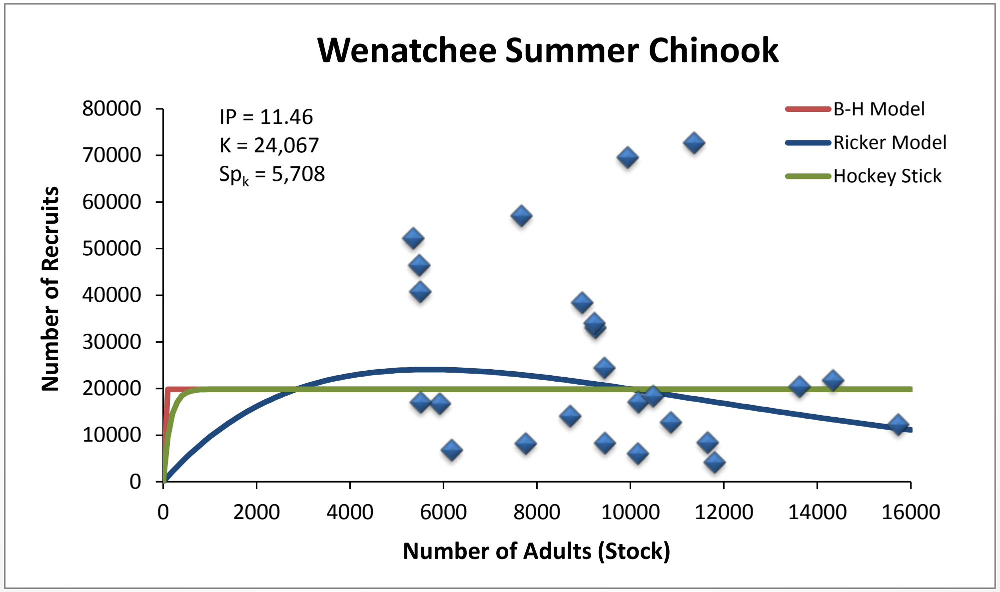
(2) Fit Ricker, Beverton-Holt, and Smooth Hockey Stick models to the stock and recruitment data.

(3) Ricker model assumes that spawning habitat is the primary factor limiting productivity.

(4) Beverton-Holt and Smooth Hockey Stick models assume that rearing habitat is the primary factor limiting productivity.

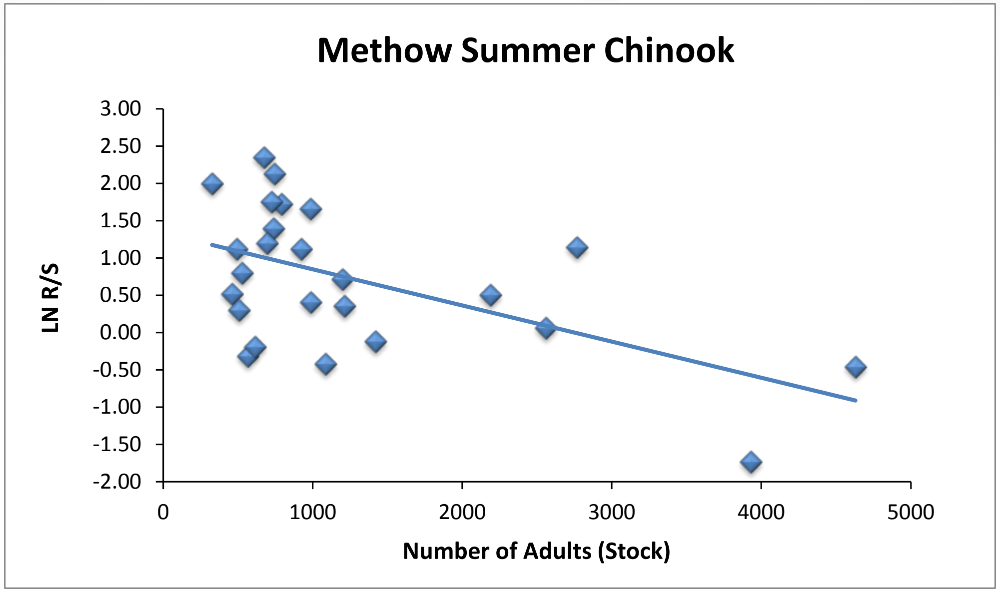
Wenatchee Population

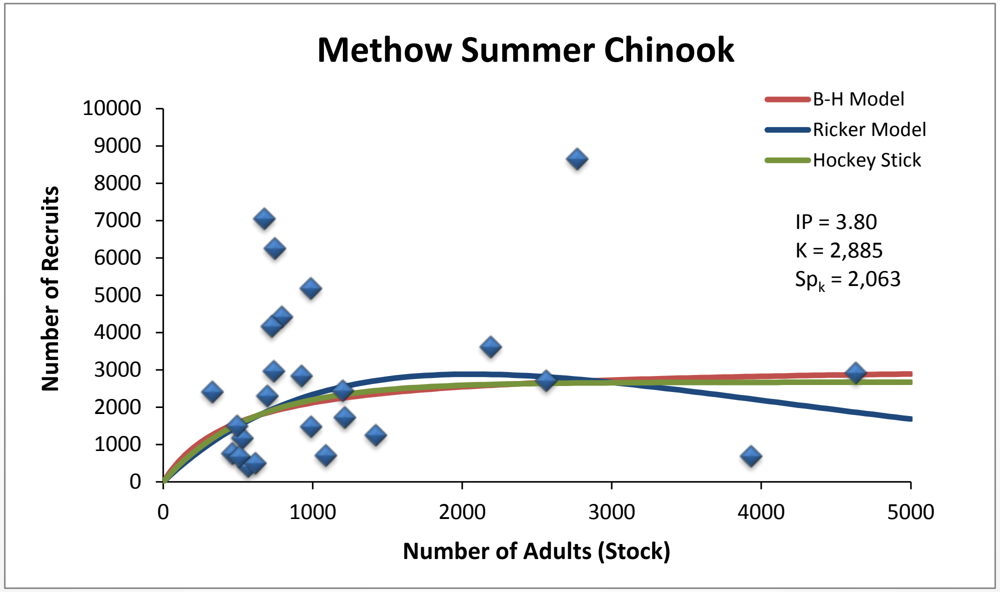




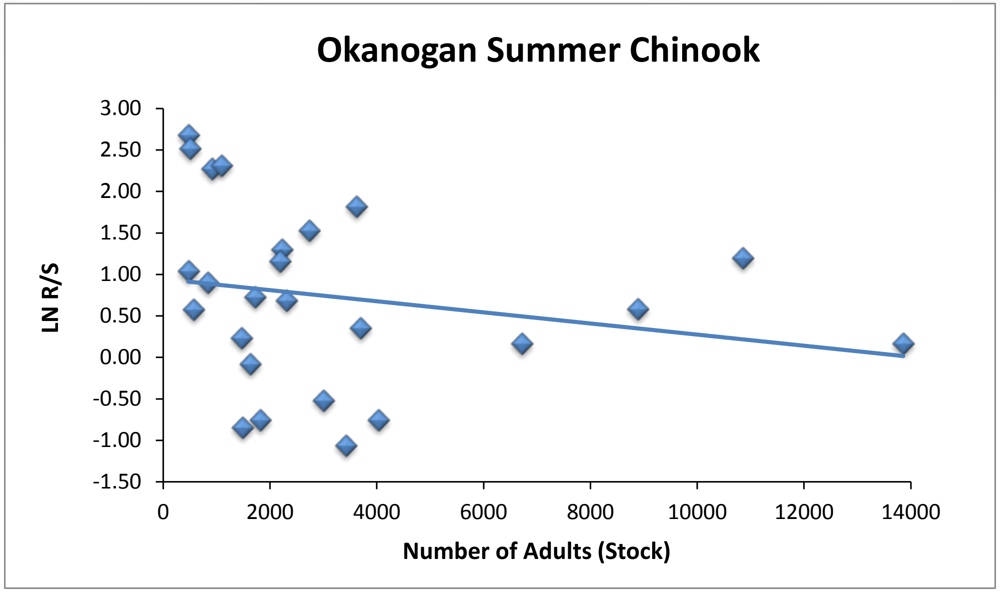
Attachment E

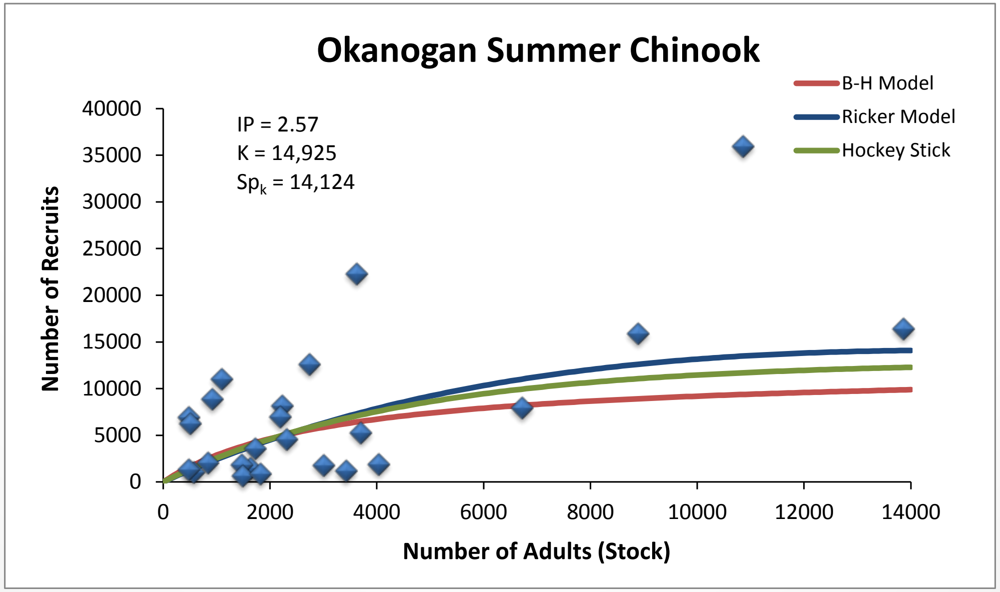
Methow Population





Okanogan Population





Environmental Variables

- **Hydrosystem metrics**
- **Hatchery metrics**
- **Climate/Ocean metrics**

Hydrosystem Metrics

- **RR and RI Mean Daily Flow (Apr-Aug)**
- **RR and RI CV Daily Flow (Apr-Aug)**
- **RR and RI Mean Daily Temp (Apr-Aug)**
- **RR and RI CV Daily Temp (Apr-Aug)**
- **RR and RI Mean Percent Spill (Apr-Aug)**
- **RR and RI CV Percent Spill (Apr-Aug)**
- **PR Mean Daily Flow (Apr-Sep)**
- **PR CV Daily Flow (Apr-Sep)**
- **PR Mean Daily Temp (Apr-Sep)**
- **PR CV Daily Temp (Apr-Sep)**
- **PR Mean Percent Spill (Apr-Sep)**
- **PR CV Percent Spill (Apr-Sep)**

Hatchery Metrics

- **Wenatchee pHOS**
- **Methow pHOS**
- **Okanogan pHOS**

Environmental Metrics

- **Maximum Snow Depth (MSD) during the year of spawning**
- **Maximum Snow Depth (MSD) during the year of freshwater rearing**
- **Columbia River Flows (CRF)**
- **Spring Pacific Decadal Oscillation (SPDO) during first year in ocean**
- **Spring Pacific Decadal Oscillation (SPDO) during second year in ocean**
- **Low Average Air Temp (LAAR) during the year of spawning**
- **Low Average Air Temp (LAAR) during the year of freshwater rearing**

Multicollinearity

- Important to examine the correlation among the 28 predictor variables
- Flow, temperature, and spill metrics were highly correlated among the three projects. PR temperature metrics were weakly correlated with RR and RI temperatures
- At a given project, flow metrics were highly correlated with spill metrics, and most flow and spill metrics were correlated with temperature metrics
- CRF was highly correlated with flow and spill metrics at the three projects
- MSD was highly correlated with flow metrics at the projects
- LAAT was highly correlated with spill metrics

Final Array of Predictors

- pHOS metrics
- Mean and CV daily temperatures at PR
- MSD(S) and MSD(R)
- CRF
- SPDO(1) and SPDO(2)
- LAAT(S) and LAAT(R)

Simple Linear Regression

Wenatchee Population:

Response variable	Predicator variable	r^2	Slope parameter	Slope SE	*F*-value	*P*-value
LN (R/S)	LAAT(R)	0.194	-0.439	0.177	5.547	0.027
Ricker residuals	LAAT(R)	0.235	-10,225.807	3,134.508	7.080	0.014

Simple Linear Regression

Methow Population:

Response variable	Predicator variable	r^2	Slope parameter	Slope SE	*F*-value	*P*-value
LN (R/S)	MSD(S)	0.152	0.429	0.165	4.105	0.055
	LAAT(R)	0.293	-0.564	0.199	9.514	0.006
Ricker residuals	None	--	--	--	--	--

Simple Linear Regression

Okanogan Population:

Response variable	Predicator variable	r^2	Slope parameter	Slope SE	*F*-value	*P*-value
LN (R/S)	MSD(S)	0.146	0.468	0.268	3.920	0.059
	MSD(R)	0.260	0.642	0.206	8.076	0.009
	LAAT(R)	0.178	-0.489	0.197	4.982	0.036
Ricker residuals	MSD(R)	0.224	3,594.349	1,062.784	6.631	0.017

Multiple Regression

Wenatchee Population:

Productivity Model was significant (*F* = 6.974; *P* = 0.002: R^2 = 0.499)
Residual Model was significant (*F* = 7.080; *P* = 0.014: R^2 = 0.235)

Response variable	Predicator variable	Coefficient	SE	*T*-value	*P*-value	Bivariate r^2
LN (R/S)	Constant	1.431	0.205	6.968	0.000	
	LAAT(R)	-0.534	0.159	-3.365	0.003	0.270
	MSD(S)	0.442	0.163	2.704	0.013	0.175
	SPDO(2)	-0.428	0.167	-2.569	0.018	0.158
Ricker residuals	Constant	11,769.099	4,068.976	2.892	0.008	
	LAAT(R)	-10,225.807	3,843.086	-2.661	0.014	0.235
	MSD(R)	3,594.349	1,395.790	2.575	0.017	0.224

Multiple Regression

Methow Population:

Productivity Model was significant (*F* = 8.065; *P* = 0.001: R^2 = 0.535)

Residual Model was not significant

Response variable	Predicator variable	Coefficient	SE	*T*-value	*P*-value	Bivariate r^2
LN (R/S)	Constant	1.371	0.207	6.619	0.000	
	LAAT(R)	-0.641	0.160	-4.005	0.001	0.355
	MSD(S)	0.453	0.165	2.747	0.012	0.167
	SPDO(2)	-0.351	0.168	-2.088	0.049	0.097
Ricker residuals	None	--	--	--	--	--

Multiple Regression

Okanogan Population:

Productivity Model was significant (*F* = 10.577; *P* = 0.000: R^2 = 0.602)
Residual Model was significant (*F* = 6.631; *P* = 0.017: R^2 = 0.224)

Response variable	Predicator variable	Coefficient	SE	*T*-value	*P*-value	Bivariate r^2
LN (R/S)	Constant	1.372	0.209	6.577	0.000	
	MSD(R)	0.677	0.174	3.889	0.001	0.287
	MSD(S)	0.546	0.169	3.219	0.004	0.197
	pHOS	-1.433	0.496	-2.888	0.009	0.158
Ricker residuals	Constant	2,522.587	1,194.525	2.112	0.046	
	MSD(R)	3,594.349	1,395.790	2.575	0.017	0.224

Summary

1. **Productivities among the three populations are synchronous and highly correlated.**

2. **The three populations are highly productive with mean productivities greater than 2.0.**

3. **Productivities for the three populations were not significantly different from Hanford Reach fall Chinook, which are considered the most productive stock along the Pacific Rim.**

4. **The 12-Year GM productivities exceed the threshold of 1.2.**

Summary

5. Although there is evidence of density dependence within the three populations, spawning stock size explained less than 10% of the variability in productivities.

6. Most of the variability in Wenatchee (50%) and Methow (54%) summer Chinook productivity was explained by low average air temperature, maximum snow depth, and spring Pacific decadal oscillation.

7. Low average air temperature explained most of the variability in Wenatchee residuals from the Ricker model. No predictors correlated with Methow residuals.

Summary

8. **Most of the variability (60%) in Okanogan summer Chinook productivity was explained by maximum snow depth and the proportion of hatchery-origin spawners.**

9. **Maximum snow depth explained most of the variability in Okanogan residuals from the Ricker model.**

Proposal to trap spring-run Chinook salmon at Rocky Reach Dam, 2013

Purpose. To pilot the use of the Rocky Reach Trap (RRT) to evaluate its efficacy for future broodstock collection or adult management efforts.

Objectives. The RRT has been used historically to capture listed steelhead and bull trout (Alexander et al. 2003; Stevenson et al. 2009) without causing delays to non-target fish. For the pilot, the RRT will be operated to target ad-clipped spring Chinook. The trap operator can target individual fish on the basis of visual identification of external marks observed at the counting window (i.e., ad clipped). There are three specific objectives of the pilot:

1) Capture Time Quantification: The primary objective is to measure the individual capture time of approximately 20 fish over a 4 week period (i.e., 5 fish /week for 4 weeks during the period of May –June (see Figure 1 for spring migration timing)) to generate basic descriptive statistics related to trap operation and passage effects for spring Chinook. Statistics will focus on "capture time" which reflects the amount of time necessary to close the pneumatic trap door to collect an individual fish and then return the door to the normal open position. Capture time statistics will include Range, Average, and Standard Deviation. These statistics will be used to evaluate the amount of time necessary to collect an individual fish, which is equivalent to the amount of time fish passage would be obstructed by the trap door for the run-at large. Based on previous trapping efforts, it is expected that an individual fish would have a capture time of less than 10 seconds, and therefore would have a minimal effect on passage at-large at Rocky Reach.

2) Qualitative Evaluation of Capture Process: Document operational procedures on video and provide access to the RRT for manager consideration. The purpose of this effort is to obtain input from managers on the best operational approach, and identify any concerns that would need to be addressed before a larger-scale pilot or implementation of adult management.

3) Analysis of passage time: Passage of spring Chinook will be monitored at Rocky Reach Dam during trap evaluation efforts using PIT tagged adult returns. The monitoring will occur using two PIT arrays within the fishway to determine fallback and/or delay, in combination with upstream detections. Passage and median travel time will be compared between trapping and non-trapping periods throughout the return.

Risk reduction. The following risk reduction measures will be implemented during the pilot:

1) Trapping will be active and a technician present at all times.

2) Individual trap events will require the visual identification of an isolated, adipose clipped Chinook in the viewing window. More specifically, the trap will only be operated when a single target fish is present and the trap will not be operated if more than one fish of the same or different species is present.

3) Only one trap event will be allowed per hour with a maximum of three trap events per day. No more than five trap events per week.

4) Fish collected in the trap will be released in the forebay of Rocky Reach, immediately adjacent to the top of the ladder. The release will not require transferring or lifting the fish. Instead, a weir door will be opened allowing the fish to exit volitionally (from the trap) out of the top of the ladder.

General Overview of Trap Design

Trap facilities at Rocky Reach are integrated with the existing fish-viewing structures within the ladder. Essentially, the fish-viewing guide wall extends upstream to the exit weir, where a pneumatically-activated gate guides fish into a collection area (Figure 2 and 3). On the other side of the pneumatic gate the collection area contains a removable capture vessel. As adult fish enter the viewing area, a technician activates the pneumatic gate, which blocks passage into the forebay and diverts the adult fish into the collection area. Using an underwater camera, the technician observes the adult fish enter the collection area, at which time the gate is closed, trapping the fish. Non-target species are allowed to exit the ladder by simply not activating the pneumatic gate. After an adult fish is contained within the collection area, either an electric or hand-operated winch raises the collection vessel from the collection area up to the work-surface platform. As the vessel emerges from the water, a wooden cover is placed on top of the vessel to reduce stress to the fish and eliminate the possibility of the fish jumping out of the vessel. Captured fish can then be anesthetized and transferred to a processing area. At the RRT, the collection vessel is moved laterally along an I-beam monorail close to the processing facility located under the roadway of the ladder.

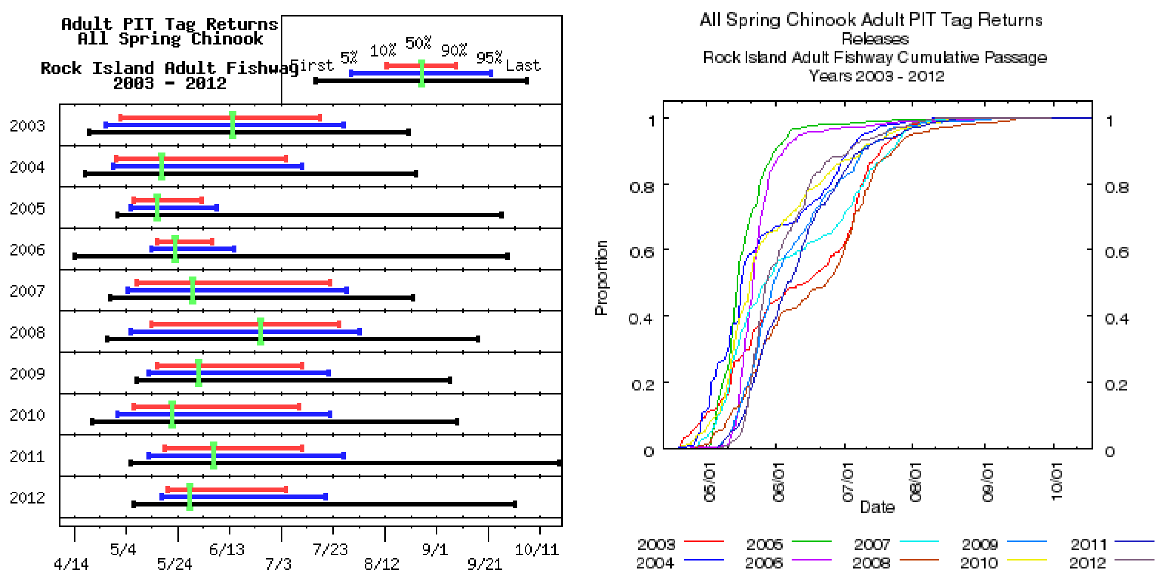


Figure 1. Historical run timing of PIT-tagged wild- and hatcher-origin spring-Run Chinook at Rock Island Dam, 2003-2012 (note that early years may be based on a limited number of adult returns).

Figure 2. Adult trapping facility at Rocky Reach Dam. The pneumatic arm (left and top right) activates a gate that guides fish into a holding vessel (bottom right, shown lifted). Trapped fish are either allowed to exit the holding vessel by opening the gate, or are lifted for processing.

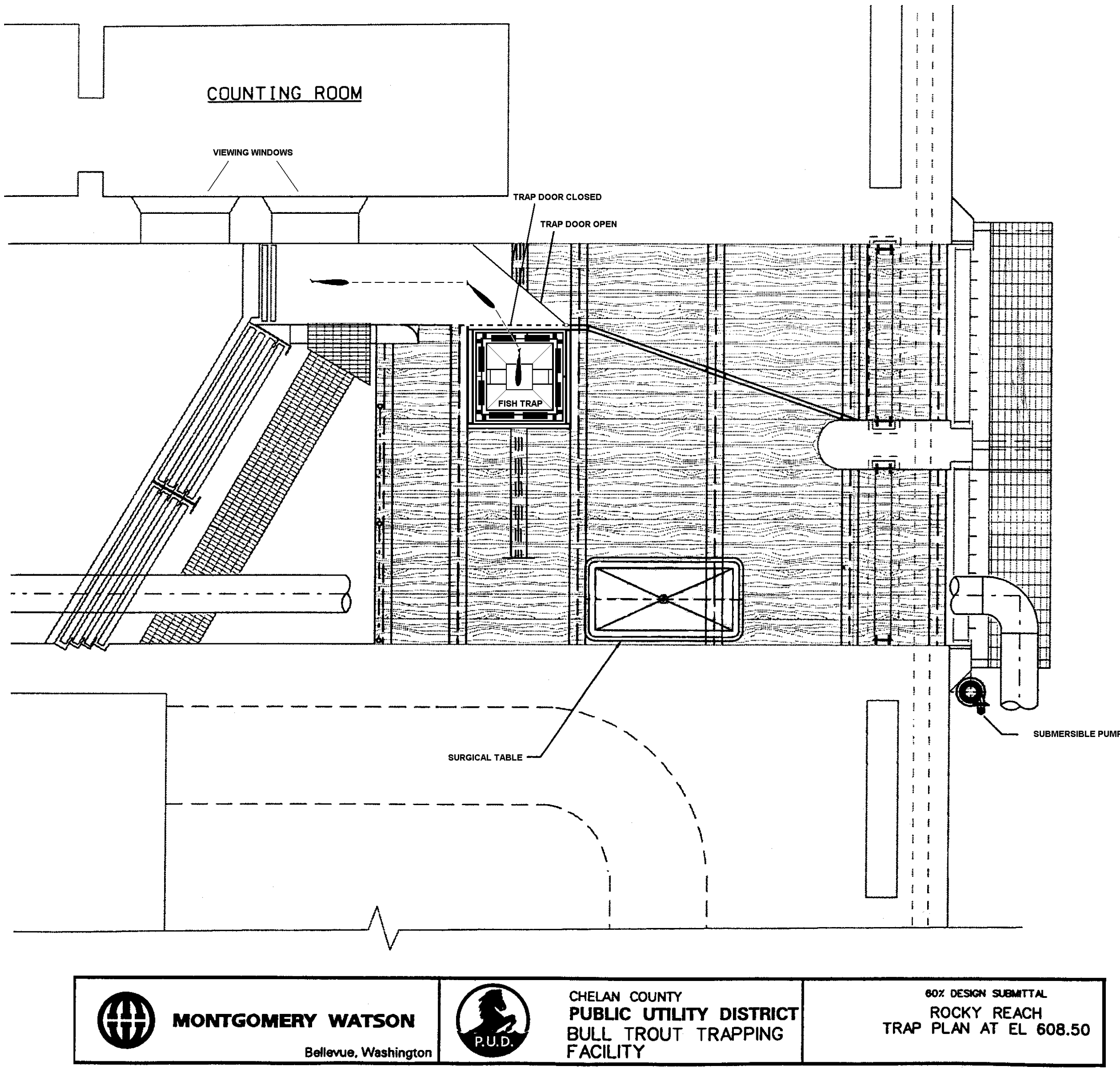


Figure 3. Rocky Reach Trap Layout

References

Alexander, R.F., C. Sliwinksi, B.L. Nass and J.R. Stevenson. An assessment of impacts associated with construction activities on adult steelhead migrating through Rocky Reach Dam, 2002. Report to Chelan PUD. LGL Limited Environmental Research Associates. Sidney, BC.

Stevenson, J.R., D.J. Snyder, and M.M. Miller. 2009. Movements of radio-tagged bull trout through Rocky Reach and Rock island dams and reservoirs: 2055-09. Summary report prepared for Chelan County Public Utility District. Wenatchee, WA.

Activities Occuring at Tumwater Dam[1]

Activity	Group Conducting Activity	Funder	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
									Month					
Steelhead Broodstock (BS) collection	WDFW	CCPUD									1-Sep		15-Nov	
Steelhead spawner escapement tagging	WDFW	CCPUD									1-Sep		15-Nov	
Sockeye spawner escapement tagging	WDFW	CCPUD							15-Jul	15-Aug				
Summer Chinook BS collection	WDFW	CCPUD							1-Jul		15-Sep			
Coho BS Collection	Yakama Nation	Yakama Nation									1-Sep		15-Nov	
Spring Chinook Reproductive Success Study	WDFW	BPA					1-May		15-Jul					
Spring Chinook Run comp	WDFW	CCPUD					1-May		15-Jul					
Steelhead pHOS Mgmt	WDFW	WDFW, CCPUD		15-Feb				15-Jun			1-Sep			15-Dec
LNFH Spring Chinook Stray Mgmt	WDFW	USFWS					1-May		15-Jul					

[1] Type and duration of activities subject to change in any given year

Activities Occuring at Dryden Dam[1]

Activity	Group Conducting Activity	Funder	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
									Month					
Steelhead Broodstock (BS) collection	WDFW	CCPUD									1-Sep		15-Nov	
Summer Chinook BS collection	WDFW	CCPUD							1-Jul		15-Sep			
Coho BS Collection	Yakama Nation	Yakama Nation									1-Sep		15-Nov	

[1] Type and duration of activities subject to change in any given year

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	June 25, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the May 21, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at Rocky Reach Dam in Wenatchee, Washington, on Tuesday, May 21, 2013, from 9:45 am to 1:00 pm. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Mike Schiewe will coordinate with Bob Rose to schedule a Comparative Survival Study (CSS) presentation for a future Coordinating Committees meeting (Item II-A).
- Steve Hemstrom will coordinate a meeting between Chelan PUD Information Technology (IT) staff and Douglas PUD Information Systems (IS) staff regarding file sharing options (Item III-A).
- Chelan PUD will revise the background language of the draft Statement of Agreement (SOA) on maintaining subyearling Chinook in Phase III (Additional Juvenile Studies) at Rock Island and Rocky Reach, per the Coordinating Committees' recommendations; and will redistribute the revised SOA that will be up for approval at the Coordinating Committees meeting on June 25, 2013 (Item IV-A).
- Mike Schiewe will brief Bob Rose on the revisions that were discussed for the draft SOA on maintaining subyearling Chinook in Phase III (Additional Juvenile Studies) at Rock Island and Rocky Reach (Item IV-A).

DECISION SUMMARY

- No SOAs were approved at this meeting.

AGREEMENTS

- There were no agreements at today's meeting.

REVIEW ITEMS

- The draft 2013 Subyearling Study Plan was distributed to the Coordinating Committees by Kristi Geris on April 24, 2013, for a 30-day review with comments due to Tom Kahler no later than May 24, 2013.

REPORTS FINALIZED

- The Douglas PUD 2012 Final Wells Post-Season Bypass Report that was approved at the Coordinating Committees meeting on March 26, 2013, was finalized and distributed to the Coordinating Committees on May 3, 2013.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Bob Rose requested that discussion of a potential CSS presentation be added at the beginning of the agenda.
- Steve Hemstrom requested that a brief moment be added to distribute final hardcopies of the Chelan PUD 2013 10-year No Net Impact (NNI) Comprehensive Progress Report.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft April 23, 2013 meeting minutes. Four outstanding comments were discussed as follows:

- Regarding the Columbia River Inter-Tribal Fish Commission (CRITFC) request to sample and tag sockeye at Wells Dam, it was clarified that Jeff Fryer indicated that the total number of sockeye tagged would be reduced if the run size is less than expected.

- Regarding the Rock Island Dam fish spill operations, Steve Hemstrom confirmed that subyearling Chinook were released from Chelan Falls Hatchery on April 11, 2013.
- Regarding trapping activities at Tumwater and Dryden dams, Hemstrom clarified that Alene Underwood provided a Gantt chart for adult—not juvenile—trapping activities at both dams.
- Regarding the Hatchery Committees update on the Spring Chinook Pilot Trapping Study at Rocky Reach, Kristi Geris clarified that the deadline for the Hatchery Committees to approve the study was purposely scheduled 5 days prior to the Coordinating Committees deadline (May 1, 2013) to approve the study.

Geris said that all other comments and revisions received on the draft meeting minutes were incorporated, and the draft April 23, 2013 meeting minutes were approved, as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Yakama Nation

A. CSS Presentation/Workshop Proposal (Bob Rose)

Bob Rose said that the CSS Annual Meeting on April 30, 2013, in Vancouver, Washington, included presentations of several topics that may be of interest to the Coordinating Committees. He suggested having a CSS presentation at a future Coordinating Committees meeting—possibly in July 2013 or August 2013. A proposal for a CSS presentation/workshop was distributed to the Coordinating Committees by Emily Pizzichemi on May 17, 2013.

Teresa Scott said that she would be interested in a CSS presentation. She noted the importance of considering basin-wide issues, and establishing and maintaining dialogue with the larger scientific community. Scott also added that materials presented may facilitate discussions of how this information fits with adaptive management of the HCPs.

Bryan Nordlund said that after speaking with Michele DeHart from the Fish Passage Center (FPC), he thinks it would be useful for the Coordinating Committees to hear a CSS presentation, and then have a separate meeting to discuss how the information fits with the HCPs. He added that there are differences between the HCP goals and objectives, and the analytical approaches used in the CSS. Steve Hemstrom agreed with Nordlund about the differences between the CSS and the HCPs. He added that the HCPs incorporate the use of objective performance standards that the CSS may not align with, and so he is cautious of some assertions put forward in the CSS. Hemstrom said, however, that the information from a CSS presentation could be beneficial.

Joe Miller said that with so much new, and sometimes conflicting, information, it is hard to know what ideas to bring to the Coordinating Committees for review. He cited, for example, a paper that was recently published in the Proceedings of the National Academy of Science (PNAS) titled, "Influence of multiple dam passage on survival of juvenile Chinook salmon in the Columbia River estuary and coastal ocean" by Rechisky, Welch, et al., on April 23, 2013, that directly contrasts with views held by the CSS investigators. Miller provided the Rechisky, Welch, et al. (2013) paper to Kristi Geris, and Geris distributed it to the Coordinating Committees on May 22, 2013. Scott also provided a FPC review of the Rechisky, Welch, et al. (2013) paper to Geris, which she distributed to the Coordinating Committees on May 23, 2013.

Jim Craig agreed that more information would be useful, and hearing a CSS presentation could contribute to a larger view and perspective. Kirk Truscott said that he is also interested in hearing a CSS presentation, and added that he thinks better science comes from seeing all views. Tom Kahler said that he is also interested in hearing about different interpretations of how the CSS and HCPs relate. He added that this is information that the Coordinating Committees should consider and understand before coming to any conclusions.

Scott said that the HCPs have a good process and that she shares the trepidation expressed by others, but she prefers addressing any questions about HCP survival studies and those reported by the CSS head on within the Coordinating Committees rather than reacting to outside questions. Mike Schiewe agreed that the HCP process has been very successful, and that a CSS presentation would be useful. He added that, like Nordlund suggested, it will be good to have a follow-up discussion, separate from the presentation, to discuss how the CSS fits with the HCPs. Scott suggested that Grant PUD be involved in the HCP discussions as well, and Schiewe replied that because Grant PUD operates under a separate (and unique) settlement agreement, they should plan to handle any follow-up separate from the

Coordinating Committees and specifically as it relates to their Settlement Agreement. Rose suggested compiling a list of related literature that is available for review, such as the Rechisky, Welch, et al. (2013) paper that Miller cited.

Nordlund said that, over the years, the National Marine Fisheries Service (NMFS) has provided Mid-Columbia PUD survival studies to DeHart upon her requests, but she has never provided any feedback. Hemstrom said that Chelan PUD has also provided a complete list of Chelan PUD's HCP survival studies to staff involved with the CSS with no feedback, and Kahler added that Douglas PUD has provided their studies, as well. Schiewe said that he will coordinate with Rose to schedule a CSS presentation for a future Coordinating Committees meeting.

III. Douglas PUD

A. PRESENTATION: SharePoint HCP Document Repository and File-sharing Site (Brian Russell and Julene McGregor)

Tom Kahler said that this presentation is the culmination of a long-term discussion on how to replace the ftp site and document repository for all HCP committees. He recalled that, at one point, Douglas PUD suggested developing a Document Management Tool (DMT) site. However, after discussing this option with the Douglas PUD IS Department (Douglas PUD IS), the idea for using a SharePoint site arose. Kahler said that Douglas PUD IS started developing a SharePoint site that could be used by all HCP committees, and as requested by the Coordinating Committees, this presentation was arranged to demonstrate the site's capabilities. Kahler introduced Brian Russell, Douglas PUD IS Supervisor, and Julene McGregor, Network Administer.

Russell said that he hoped this presentation would generate feedback on needs and expectations from the Coordinating Committees. He reviewed the main landing page for the site and said that the page contains the basic setup for any extranet site. As currently set up, the main landing page contains a list of recently modified documents, and also a HCP member contact list. Russell reminded the Coordinating Committees that the site, and therefore all information contained within the site, is password-protected. He said that different permissions can be given to different users. For example, Anchor QEA, as an administrator, would have more permissions than other users. All HCP documents can be accessed via a "Documents" link located on the sidebar on the main landing page. Under this link, sub-categories are listed that organize documents into agendas, agreements, meeting minutes, reports, and so on. Each of these categories has filter capabilities for sorting the documents by different criteria.

Mike Schiewe asked if the agreements page is set up to differentiate between informal agreements and more formal SOAs, and Russell replied that a specific filter can be developed to sort those documents. Bryan Nordlund asked if modifications can be made to the site on an "as needed" basis, and Russell replied that modifications can be made, but recommended that the changes be by consensus and thoroughly vetted to minimize unnecessary changes and confusion. Nordlund also asked if hyperlinks can be embedded within documents that link to related documents that are located elsewhere on the SharePoint site. Russell replied that this is also possible; however, he warned that if a document changes locations on the SharePoint site, the hyperlink becomes inactive (i.e., broken). He suggested, instead, adding tags to documents which allows them to be linked without embedding hyperlinks.

Teresa Scott asked about differentiating between draft and final documents, and Russell explained that a "Current State" is attached to each document which indicates the document version. Scott also asked about viewing each reviewer's tracked changes, and Schiewe replied that the current review process will stay the same; all edits received will be incorporated into the draft minutes by Kristi Geris, and only changes requiring additional discussion will be shown in tracked changes in the revised draft for approval. Scott said that she would also like to see the meeting minute attachments linked in some way to the minutes, and Russell replied that this can be achieved through tagging.

Russell explained that the SharePoint site has several methods available for searching documents, such as performing keyword searches, and filtering by author, file type, date, and so on. Documents can also be searched by the "Document editing work flow" and "version history," where previous versions of a particular document can be accessed by searching the editing history of the document. Nordlund asked about potential compatibility issues, and Russell replied that the same compatibility requirements that are contained on a respective personal computer (PC) apply to the SharePoint site. McGregor clarified that if a PC cannot open certain documents, the same documents will not be accessible via the SharePoint site on the same PC. She added that frequently used documents are typically compatible with the SharePoint site itself. Russell said that "help documents" are also saved to the SharePoint site for troubleshooting issues. Also, a keyword search manual is available that contains suggestions for different types of keyword and operator searches. Lastly, Russell explained the "document drop" where new documents can be uploaded to the SharePoint site. Scott asked if there were any historical documents (i.e., pre-HCPs) that the Coordinating Committees would like to upload to this site, and Schiewe replied that there may be a few. Kahler added that he has a few to upload to the site. Schiewe asked if documents can be associated with certain agenda items, and Russell replied that this could possibly be done through tagging.

Scott asked if Douglas PUD and Chelan PUD are both using this SharePoint system to house their respective HCP documents; and then Schiewe also asked how files will be kept separate, e.g., Douglas PUD and Chelan PUD filing requirements, Coordinating Committees' and Hatchery Committees' documents, etc. Kahler said that Douglas PUD currently keeps a separate filing system that is not shared, and Steve Hemstrom said that Chelan PUD currently does not keep a completely separate filing system. Schiewe asked Chelan PUD if they would be comfortable with keeping official records in this SharePoint system, and also asked Douglas PUD if SharePoint will be the official system for Wells Dam. Kahler replied that SharePoint will be the official system for Wells Dam, and added that, Douglas PUD will host the SharePoint extranet site for Wells Dam archiving and file-sharing purposes according to Douglas PUD license requirements—this is at no cost to any other entity. He said that currently, all HCP agendas and meeting minutes are saved to the site; however, only Douglas PUD—not Chelan PUD—agreements and SOAs are saved to the site. Joe Miller said that Chelan PUD will likely develop their own system in addition to the SharePoint site. Kahler also noted that, because the Coordinating Committees oversee the other HCP committees, the Coordinating Committees would have access to all HCP committees' documents, but not the other way around. Lastly, Kahler noted that the screen layout, or view, can be customized without changing the basic functions of the site. Russell demonstrated the different view options for the main landing page, and said that each view is unique to the user login.

Schiewe said that the next steps are for Chelan PUD to become engaged to see how they want to coordinate their filing process with this SharePoint site, and Hemstrom said that he will coordinate a meeting between Chelan PUD IT staff and Douglas PUD IS staff regarding file sharing options. Russell noted that the system is the newest version of the SharePoint software (SharePoint 2013).

IV. Chelan PUD

A. Draft Sub-yearling Chinook SOA – Continue Three Years in Phase III (Additional Juvenile Studies) (Steve Hemstrom)

Steve Hemstrom said that the draft SOA maintaining subyearling Chinook in Phase III (Additional Juvenile Studies) at Rock Island and Rocky Reach was distributed to the Coordinating Committees by Emily Pizzichemi on May 17, 2013. Hemstrom said that the SOA summarizes discussions held at previous meetings; and he noted that this SOA only pertains to Rock Island and Rocky Reach, as opposed to a joint SOA including the Wells HCP, as discussed at the Coordinating Committees meeting on April 23, 2013. Hemstrom said that Douglas PUD decided to wait on a Wells SOA until after completion of their 3-year juvenile life history study.

Kirk Truscott suggested including current constraints to conducting a survival study in the background section of the SOA, such as size of tags relative to fish size, ability to tag fish sizes representative of the entire outmigrant population, life history variation affecting model assumptions, the high degree of variation of size of fish, and so on. Truscott said that including this type of information provides a basis for comparison three years from now when subyearling survival studies are re-evaluated. Hemstrom agreed with Truscott and added that this additional information is also useful for others who are not as involved in the process. Hemstrom said that Chelan PUD will revise the background language of the draft SOA and will redistribute the revised SOA to the Coordinating Committees. Schiewe said that he will brief Bob Rose on the discussed revisions. Chelan PUD will request approval of the revised SOA at the Coordinating Committees meeting on June 25, 2013.

B. Chelan PUD 2013 10-year NNI Comprehensive Progress Report (Steve Hemstrom)

Steve Hemstrom distributed hardcopies of the final Chelan PUD 2013 10-year NNI Comprehensive Progress Report.

C. Visit Rocky Reach Right Bank Ladder Trap – Site of Rocky Reach Spring Chinook Broodstock Pilot Trapping Operation (Steve Hemstrom and Lance Keller)

Steve Hemstrom and Lance Keller led a tour of the Rocky Reach right bank ladder trap. They provided an overview of the trap operation, including a demonstration of the trap in action; and they also discussed how the trap will be utilized for the Rocky Reach spring Chinook broodstock pilot study.

V. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees meeting on May 16, 2013:

- *Small Projects Program Applications*: The Tributary Committees reviewed two Small Projects Program Applications: *Beaver Creek Late Season Well Installation Project* and *Antoine Creek Feedlot Relocation Project*. The Tributary Committees were unable to make a funding decision for the Beaver Creek proposal due to insufficient information. Tom Kahler said that regarding the Antoine Creek proposal, the Tributary Committees decided to table the proposal because Chris Fisher (CCT) thought there was a possibility that the CCT would fund the entire project. Kahler said that Fisher planned to check into this and get back to the Tributary Committees.
- *Budget Amendment*: The Wells Tributary Committee received a budget amendment request from Cascade Columbia Fisheries Enhancement Group (CCFEG) on the Methow/Chewuch Shallow Groundwater Monitoring Project. Kahler said that the Wells Tributary Committee requested and received additional information and, since then, has approved the budget amendment request.
- *General Salmon Habitat Program Pre-proposals*: The Tributary Committees are in the process of reviewing pre-proposals. Nine site visits are planned for projects located in the Okanogan, Methow, Entiat, and Wenatchee basins. The Tributary Committees

will visit project sites in the Okanogan and Methow basins on May 29 and 30, 2013, and in the Wenatchee and Entiat basins on June 5 and 6, 2013.

- *Request from the Upper Columbia Salmon Recovery Board*: The Upper Columbia Salmon Recovery Board asked the Tributary Committees if they would be interested in funding the completion of the Monitoring Plan for the Methow Basin, which is part of the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan. The Tributary Committees indicated that they were not interested.
- *Next Steps:* The next Tributary Committees meeting will be on June 13, 2013.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Hatchery Committees' meeting on May 15, 2013, which was hosted by Douglas PUD:

- *Hatchery Genetic Management Plan (HMGP) Update*: NMFS is approaching resolution on permitting some programs, while other programs are still being evaluated because of conflicting analytical results and different interpretations. The Wenatchee programs, including the Chiwawa, Nason Creek, and White River, are on track to be completed by mid-June 2013. All three programs involve broodstock collection at Tumwater Dam (TWD), and NMFS estimates having permits ready no later than June 14, 2013. Trapping is planned to begin June 17, 2013. Regarding the Methow, NMFS is still working on issues related to the size of the steelhead programs with the fishery co-managers.
- *Wells Summer Chinook HGMP*: Douglas PUD recently completed a draft HGMP for the Wells summer Chinook program. The Hatcheries Committees reviewed the proposed incorporation of up to 10 percent natural origin recruits (NORs), and supported submission of the HGMP.
- *Wells Hatchery Master Plan*: The Wells Hatchery Master Plan is out for a 60-day review. Douglas PUD is consulting with HDR Engineering, Inc. (HDR) on the modernization plans, and a meeting with HDR is being arranged to discuss the engineering plans with the Hatchery Committees. Original construction of Wells Dam was completed in 1967.

- *Spring Chinook Pilot Trapping Study at Rocky Reach update*: Chelan PUD indicated that they plan to move forward with the Rocky Reach Pilot Study. Joe Miller said that the planned trap operations may be temporarily altered due to turbid water.
- *Suggestions for a Monitoring and Evaluation (M&E) Request for Proposal (RFP) Technical Review Panel*: The Hatchery Committees discussed Chelan PUD's issuance of a M&E RFP. The Hatchery Committees discussed that they would like to be involved with ranking proposals; however, those agencies that also want to submit proposals will be conflicted out. Agencies that have no conflict of interest will be joined by recommended reviewers.

VI. HCP Committees Administration (Mike Schiewe)

A. Next Meetings

The next scheduled Coordinating Committees meeting is June 25, 2013, to be held in person at the Radisson Hotel in SeaTac, Washington. The July 23, 2013 and August 27, 2013 meetings will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A List of Attendees

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
John Ferguson	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Joe Miller	Chelan PUD
Tom Kahler*	Douglas PUD
Brian Russell	Douglas PUD
Julene McGregor	Douglas PUD
Kirk Truscott*	Colville Confederated Tribes
Bob Rose*†	Yakama Nation
Bryan Nordlund*	National Marine Fisheries Service
Teresa Scott*	Washington Department of Fish and Wildlife
Jim Craig*	U.S. Fish and Wildlife Service

Notes
* Denotes Coordinating Committees member or alternate
† Joined by phone

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	July 30, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the June 25, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at the Radisson Gateway Hotel, in SeaTac, Washington, on Tuesday, June 25, 2013, from 9:30 am to 11:30 am. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Chelan PUD will finalize the revised draft Statement of Agreement (SOA) on maintaining subyearling Chinook in Phase III (Additional Juvenile Studies) at Rock Island and Rocky Reach, as approved at the Coordinating Committees meeting on June 25, 2013, and will provide the final SOA to Kristi Geris for distribution to the Coordinating Committees (Item II-A). *(Note: Steve Hemstrom provided the final SOA on July 2, 2013, and Geris distributed the SOA to the Coordinating Committees the same day.)*
- Steve Hemstrom will provide Chelan PUD's final compiled comment letter on the Chelan County Noxious Weed Board Integrated Aquatic Vegetation Management Plan (IAVMP) to Kristi Geris for distribution to the Coordinating Committees (Item II-B). *(Note: Hemstrom provided the final comment letter on June 26, 2013, and Geris distributed the letter to the Coordinating Committees the same day.)*
- Steve Hemstrom will provide responses to Chelan PUD's final compiled comment letter on the Chelan County Noxious Weed Board IAVMP to Kristi Geris for distribution to the Coordinating Committees (Item II-B).
- Mike Schiewe will contact Keith Truscott regarding Chelan PUD's HCP file sharing options (Item II-C).

- Kirk Truscott will contact Keith Wolf regarding the feasibility of assisting Douglas PUD with their subyearling study tagging efforts (Item III-A).
- Bob Rose will finalize scheduling of a comparative survival study (CSS) presentation by the Fish Passage Center (FPC), tentatively scheduled for the Coordinating Committees meeting on August 27, 2013 (Item V-A).
- Teresa Scott and Bob Rose will develop a draft agenda for the CSS presentation by the FPC, tentatively scheduled for the Coordinating Committees meeting on August 27, 2013 (Item V-A).

DECISION SUMMARY

- The SOA maintaining Rock Island and Rocky Reach Subyearling Chinook in Phase III (Additional Juvenile Studies) for three years was approved by the Rock Island and Rocky Reach HCP Coordinating Committees representatives present (Item II-A). *(Note: Teresa Scott indicated Washington Department of Fish and Wildlife [WDFW] approval of the SOA via email on June 21, 2013.)*
- The amendment to the final SOA for Wells Dam 2013 Pacific Lamprey Operations was approved by the Wells HCP Coordinating Committee representatives present. The Committee agreed that it would suffice to simply note in the meeting minutes the approved change in start date for lamprey operations, rather than amending the final SOA (Item III-C). *(Note: Teresa Scott indicated WDFW approval of the amended SOA via email on June 21, 2013.)*

AGREEMENTS

- Coordinating Committees representatives present agreed to review the Phase III (Additional Juvenile Studies) designation for subyearling Chinook under the Wells, Rocky Reach, and Rock Island Hydroelectric Projects HCPs in January 2015 (Item II-A).
- Coordinating Committees representatives present agreed to amend the start date for research identified in the final SOA for Wells Dam 2013 Pacific Lamprey Operations, from August 1, 2013, to no earlier than July 15, 2013 (Item III-C). *(Note: Teresa Scott indicated WDFW approval to amend the SOA for Wells Dam 2013 Pacific Lamprey Operations via email on June 21, 2013.)*

REVIEW ITEMS

- "Assessment of Factors Limiting the Productivity of Summer Chinook Salmon in the Mid-Columbia River" by Hillman, Murauskas, and Hemstrom (2013), which was distributed to the Coordinating Committees on June 26, 2013, is available for review, with comments due to Steve Hemstrom (Item II-A).

REPORTS FINALIZED

- There are no reports that have been recently finalized.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Steve Hemstrom added: 1) a Rocky Reach Turbine Unit 2 (C2) outage update; and 2) a comparative survival study (CSS) presentation/workshop update.
- Bob Rose requested an update on Chelan PUD staffing.
- Kirk Truscott requested an update on the Spring Chinook Pilot Trapping Study at Rocky Reach.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft May 21, 2013 meeting minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to discuss. The draft May 21, 2013 meeting minutes were approved as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Chelan PUD

A. DECISION: Rocky Reach and Rock Island Sub-yearling Chinook SOA (Steve Hemstrom)

Steve Hemstrom said that the revised draft SOA maintaining subyearling Chinook in Phase III (Additional Juvenile Studies) at Rock Island and Rocky Reach was distributed to the

Coordinating Committees by Kristi Geris on June 24, 2013. Hemstrom said that the revised SOA incorporates comments received from Kirk Truscott and Teresa Scott, including revising the background language to focus on tag technology and limiting factors to conducting a full Project survival study; and adding to the SOA that tag technology and study design will be assessed annually. Hemstrom explained that maintaining subyearling Chinook in Phase III (Additional Juvenile Studies) for *up to three years*, as stated in the revised SOA, assumes no further technological advances are available to conduct a survival study. He said that, with regards to assessing technology and study design on an annual basis, Chelan PUD will provide a brief update, as opposed to a full presentation with multiple experts. He added, however, that in three years, a more detailed presentation will be provided. Bryan Nordlund suggested that the first annual assessment also include an update on any new information for the proportion of summer/fall Chinook that migrate as subyearlings versus as yearlings or older. Hemstrom proposed January 2015 for the first annual assessment. Tom Kahler said that Douglas PUD plans to continue collecting summer/fall Chinook life history data through at least the end of this year, and that a report will be available early next year. Kahler suggested aligning the annual assessment with the release of Douglas PUD's reports. Coordinating Committees representatives present agreed to revisit the Phase III (Additional Juvenile Studies) designation for subyearling Chinook under the Wells, Rocky Reach, and Rock Island Hydroelectric Projects HCPs in January 2015. The SOA maintaining Rock Island and Rocky Reach Subyearling Chinook in Phase III (Additional Juvenile Studies) for three years was approved by the Rock Island and Rocky Reach HCP Hatchery Committees representatives present. *(Note: Scott indicated WDFW approval of the SOA via email on June 21, 2013.)* Chelan PUD will finalize the revised draft SOA, as approved, and will provide the final SOA to Geris for distribution to the Coordinating Committees. *(Note: Hemstrom provided the final SOA [Attachment B] on July 2, 2013, and Geris distributed the SOA to the Coordinating Committees the same day.)*

Hemstrom said that the manuscript, "Assessment of Factors Limiting the Productivity of Summer Chinook Salmon in the Mid-Columbia River" by Hillman, Murauskas, and Hemstrom (2013), will soon be distributed to the Coordinating Committees and will be available for review. He said that Hillman requested that the Coordinating Committees review the report and provide comments if so inclined; however, official approval of the report by the Coordinating Committees is not being requested. Nordlund noted that this report provides good background information for Chelan PUD's subyearling SOA. *(Note: Hemstrom provided the draft report on June 26, 2013, and Geris distributed the report to the Coordinating Committees the same day.)*

B. Comments on the Chelan County Noxious Weed Board Integrated Aquatic Vegetation Management Plan (Steve Hemstrom)

Steve Hemstrom said that Chelan PUD prepared a comment letter on the Chelan County Noxious Weed Board IAVMP. The Chelan County Noxious Weed Board IAVMP and Chelan PUD's draft comments on the plan were distributed to the Coordinating Committees by Kristi Geris on June 3, 2013. National Marine Fisheries Service (NMFS) comments on Chelan PUD's draft comment letter were distributed to the Coordinating Committees by Geris on June 13, 2013. Hemstrom said that he will provide Chelan PUD's final compiled comment letter on the Chelan County Noxious Weed Board IAVMP to Geris for distribution to the Coordinating Committees. *(Note: Hemstrom provided the final comment letter [Attachment C] on June 26, 2013 following the meeting, and Geris distributed the letter to the Coordinating Committees the same day.)* Hemstrom said that the main concerns noted in the comment letter included: 1) the use of Triclopyr triethylamine (TEA); and 2) the potential effects to bull trout, sturgeon, juvenile lamprey, and other sensitive and listed species that reside in close proximity to the application area. He added that the IAVMP cited a NMFS Biological Opinion (BiOp) that addressed Triclopyr butoxyethyl ester (BEE)—not Triclopyr TEA. Bob Rose asked if Triclopyr TEA eradicates plants after one application, and Bryan Nordlund recalled that this same discussion came up not too long ago; therefore, he presumed that Triclopyr TEA requires reapplication. Hemstrom said that, if and when received, he will provide responses to Chelan PUD's comment letter to Geris for distribution to the Coordinating Committees.

C. Chelan PUD Information Technology (IT) Discussion Regarding HCP Document Repository (Steve Hemstrom)

Steve Hemstrom said that Chelan PUD is still considering HCP file sharing options. Tom Kahler said that Douglas PUD is forging ahead and populating the SharePoint site with Douglas PUD HCP documents, and Mike Schiewe said that he will contact Keith Truscott to further discuss Chelan PUD's HCP file sharing options.

D. Rocky Reach C2 Outage Update (Lance Keller)

Lance Keller recalled that at the Coordinating Committees meeting on December 11, 2012, the representatives agreed to Chelan PUD's request for a C2 outage at Rocky Reach Dam during the last week of August 2013 for the mandatory repair of the cracked rotor in the C2 unit. It was agreed that the same alternative Rocky Reach Surface Collector Operation would be employed as was approved for the Turbine Unit 1 (C1) outage in April 2013. Keller said that Turbine Unit 5 (C5) is now planned to be taken offline at the end of August 2013, and that Turbine Unit 10 (C10) is already offline, with no set return date. He said, therefore, that C2 is now scheduled to be offline January through mid-May 2014; and he added that the outage is scheduled for two weeks longer than the C1 outage earlier this year. Keller said that because no negative effects, such as impingement, descaling, or other impacts due to increased velocity, resulted from implementation of the Rocky Reach Juvenile Bypass Final Operating Plan for April 2013, Chelan PUD plans to implement the same plan, as agreed upon in December 2012.

Bryan Nordlund asked what efforts had been made to adjust the dates of the C2 outage to avoid outmigration dates, as opposed to finding ways to minimize potential effects. Steve Hemstrom said that Chelan PUD always attempts to conduct maintenance during the offseason, and that the C1 and C2 outages are anomalies. Nordlund also noted that fish size will be different in mid-May than it was during the C1 outage. Kirk Truscott asked if Chelan PUD plans to conduct similar pre-season testing of increased C1 flow with marked fish releases, and Keller replied that pre-season testing is planned and will be further discussed with the Coordinating Committees as the outage approaches.

E. Chelan PUD Staffing Update (Steve Hemstrom)

Steve Hemstrom reviewed current Chelan PUD staffing, as shown in the following table.

Staff	Department	Position	Reports to
Keith Truscott	Natural Resources	Director of Natural Resources	---
Steve Hays	---	Senior Fish and Wildlife Advisor	---
Todd West	---	---	Keith Truscott
Vacant	---	Fisheries Manager	---
Steve Hemstrom	Fisheries	Senior Biologist	Keith Truscott
Lance Keller	Fisheries	Staff 2 Biologist	Todd West
Open Position	Fisheries	Senior Fish Biologist	---
Alene Underwood	Hatchery	Hatchery Manager	Keith Truscott
Ian Adams	Hatchery	Hatchery Support	---
Jeff Osborn	Licensing	---	---
Michelle Smith	Licensing	---	---

Note:
--- = did not discuss

Hemstrom said that the former Chelan PUD Fisheries Manager, Joe Miller, and a former Chelan PUD Senior Fish Biologist, Josh Murauskas, are now both at Anchor QEA. Lance Keller explained that Ian Adams is a new hire scheduled to start July 8, 2013, to support Alene Underwood. Keller said that Adams has been Chelan PUD's contractual manager, and so he is already cognizant of Chelan PUD hatchery operations. Hemstrom said that Chelan PUD is currently recruiting additional staff; however, a Fisheries Manager position has not yet been posted. Keller added that the open Senior Biologist position closes on July 18, 2013.

F. Spring Chinook Pilot Trapping Study at Rocky Reach Update (Lance Keller)

Lance Keller reported that the Spring Chinook Pilot Trapping Study at Rocky Reach Dam was conducted for a total of 59 trapping hours over the course of 15 days. He said that 8 targeted fish were trapped out of 34 total trapping opportunities (i.e., identified adipose fin-clipped, singled-out fish). Steve Hemstrom added that there was no bycatch or incidentals. Keller said that, at the beginning of the study, issues with turbidity limited visibility from the viewing window. He said that Chelan PUD tracked observations with turbidity, camera location, and other notes regarding trapping logistics that may help improve trapping efficacy. Keller said that Chelan PUD plans to provide a summary of these findings, including documented trap times and holding times prior to release. Mike Schiewe asked whether a "non-trap" was defined as a trapping opportunity where the fish was not captured. Keller replied yes, and clarified that the fish was identified and the trap and bubbler were activated, but the fish was not captured. Bryan Nordlund asked if feedback had been received on what may have prevented trapping targeted fish. Hemstrom replied that preliminary thoughts include limited visibility—and that perhaps additional cameras could improve trapping efficacy. He added that, also, the trap door operates rather slowly. Keller also added that the closing door may cause a change in water velocity, which might startle the fish; so altering the trap door to be more porous is another option being considered.

III. Douglas PUD

A. Subyearling Study Field Work (Tom Kahler)

Tom Kahler said that over the past two years of the Wells Project Subyearling Chinook Life History Study sample dates have been selected based on pre-tagging sampling efforts that estimate when sufficient fish at a minimum fork length are present ("size scoping"). Kahler said that, typically, sampling starts in late-May, but this year, sampling started on May 10, 2013. Sampling sites included: 1) Gebber's Landing, located downstream of the confluence of the Okanogan and Columbia rivers; 2) Washburn, located near the upstream end of Cassimer Bar (also known as "Washburn Island"); and 3) Wells Dam Forebay. Kahler said that the minimum fish size for passive integrated transponder (PIT) tagging is typically about 58 to 60 millimeters (mm). He said that, on May 10, 2013, subyearling Chinook sampled at Gebber's Landing had a mean fish size of 52 mm, and only 16 percent were taggable. At the Washburn site, mean fish size was smaller at 46 mm, and 0 percent were taggable. Sampling was repeated on May 17, 2013. At Gebber's Landing, mean fish size was the same at 52 mm, but this time 26 percent were taggable. At the Washburn site, 1 percent was taggable. In the Wells Dam Forebay, mean fish size was 44 mm, and 5 percent were taggable. Kahler said that, after 11 days, subyearling Chinook sampled at Gebber's Landing had a mean fish size of 56 mm, and at that point 33 percent were taggable. At the Washburn site, mean fish size was then 55 mm, and 26 percent were taggable. Kahler said that sampling continued again on June 11 and 14, 2013. He said that, this year, there was notably high variability in fish size at sampling sites. For example, at Gebber's Landing, the percent of fish that were taggable went from 44 percent to 6 percent and then back up to 49 percent over three consecutive weeks. In the Wells Dam Forebay, there were three weeks of increasing fish size, and then a decrease. He said that Douglas PUD is interested in sampling another year to better understand the variability observed this year. Bryan Nordlund asked if fish body width and depth measurements were also collected, and Kahler replied that only length measurements have been recorded. Kahler noted that tagging could have been conducted every week that crews sampled because some fish of taggable size were collected each week—at least at the Gebber's site; however, Biomark, the company that Douglas PUD contracts for tagging, is not on standby the entire scoping period but is only under contract for a set period commencing on a date determined each year from the size scoping trips. When asked about the seining operations, Kahler said that one sampling crew typically consists of five staff with at least one boat; but he noted that the job can be accomplished with as few as four people, while six is ideal. The net pen is near the sample site, and the PIT tag crew works from a barge that is moved between tagging sites. Crews seine for three days straight each week, and then the tagging crew tags for three days straight starting the day after the first seining day. Bob Rose asked about recaptures, and Kahler replied that, typically, some recaptures are desirable for obtaining growth and location data; however, last year, there were more recaptures than preferred and so changes were made to the schedule to reduce recapture numbers. He added that he was unsure of the exact number of recaptures this year. Kirk Truscott said that Keith Wolf and his crew are tagging in the Okanogan River, and indicated that they may be available to assist Douglas PUD with their tagging effort. Kahler replied that if the Colville Confederated Tribes (CCT) is available and has mobile equipment for tagging on-site, that would be helpful; he said that a limiting factor has been the size of the tagging crew and rate of tagging. Truscott said that he will contact Wolf regarding the feasibility of assisting Douglas PUD with their subyearling study tagging efforts. Nordlund asked if the CCT still operated screw traps on the Okanogan River, and Truscott replied that, due to high water levels and debris, the CCT has not been actively tagging at the two screw traps located on the Okanogan River.

B. Wells Dam Bypass Operations (Tom Kahler)

Tom Kahler said that, compared to last year, the Wells Dam 2013 spill season has been routine. He said that barriers were pulled from Spillway Number 6 on May 23, 2013, and reinstalled on May 30, 2013, as described in an email distributed to the Coordinating Committees by Kristi Geris on May 30, 2013. Kahler said that barriers may need to be pulled again soon due to heavy rain last week; and he added that flows past Wells Dam increased from 141 thousand cubic feet per second (kcfs) on June 17, 2013, to 192 kcfs on June 23, 2013. He said that flows in the range of 180 kcfs are expected all week, with side flows of about 15 kcfs. Kahler added, as a side note, that 89 bull trout have passed Wells Dam this season, which is higher than average.

Bryan Nordlund asked if Wells Dam has experienced total dissolved gas (TDG) compliance issues this year after installing the new TDG monitoring station at Washburn Island, and Kahler replied that there have been some issues, but not during the 2012 spill season.

C. 2013 Adult Lamprey Passage and Enumeration Study (Tom Kahler)

Tom Kahler recalled that, at the Coordinating Committees meeting on February 26, 2013, the Coordinating Committees approved the SOA for Wells Dam 2013 Pacific Lamprey Operations scheduled to commence on August 1, 2013. Kahler said that Douglas PUD is now requesting that lamprey operations commence the week of July 15, 2013. An amended final SOA for Wells Dam 2013 Pacific Lamprey Operations, indicating this new proposed start date, was distributed to the Coordinating Committees by Kristi Geris on June 18, 2013. Coordinating Committees representatives present agreed to amend the start time in the final SOA for Wells Dam 2013 Pacific Lamprey Operations, from August 1, 2013, to no earlier than July 15, 2013. The Committee also agreed that it would suffice to simply note in the meeting minutes the approved change in start date for lamprey operations, rather than amending the final SOA. *(Note: Teresa Scott indicated WDFW approval to amend the SOA for Wells Dam 2013 Pacific Lamprey Operations via email on June 21, 2013.)*

D. Wells Dam Trapping Activities (Tom Kahler)

Tom Kahler said that June 26, 2013, is the last day of spring Chinook trapping at Wells Dam, and then trapping will shift to the Methow Hatchery outfall. He said that, in the meantime, trapping will continue at the Twisp weir; and added that 54 met-comps have been collected at Wells Dam, and 5 Twisp-origin adults have been collected at the Twisp Weir. Summer Chinook trapping in the Wells Dam west fish ladder for Grant PUD begins July 1, 2013. Sockeye trapping for the tagging effort by the Columbia River Inter-Tribal Fish Commission (CRITFC) also begins July 1, 2013. Summer Chinook trapping in the Wells Hatchery volunteer channel for Douglas PUD begins July 8, 2013. Kahler said that Wells Hatchery is also the Eastbank outfall's (EBO's) contingency trapping location in the event that broodstock cannot be collected at the EBO.

Kirk Truscott asked if Douglas PUD had a contingency plan in place in case the Washington State budget is not settled and WDFW is unable to start broodstock collection on July 1, 2013. Kahler replied that Douglas PUD does not have one in place, but have been strategizing with Wells Hatchery staff and are confident sufficient summer Chinook will be collected for their programs.

IV. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees meeting on June 13, 2013:

- *Small Projects Program Applications*: The Tributary Committees reviewed two Small Projects Program Applications, both from Trout Unlimited-Washington Water Projects. They elected not to fund the Beaver Creek Late Season Well Installation Project, and based on review of the application and the sponsor's response to additional questions, the Tributary Committees believed that the greatest benefit would occur if the ditch was completely shut down and the point-of-diversion removed, as described in an email from Tracy Hillman distributed to the Coordinating Committees by Kristi Geris on June 21, 2013. The Antoine Creek Feedlot Relocation Project was reviewed and tabled in May 2013 because there was a possibility that the CCT would fund the entire project. Based on benefits resulting from the proposed project, the CCT elected to fund the entire project.
- *Budget Amendments*: In May 2013, the Wells Tributary Committee was unable to approve an amendment request from Cascade Columbia Fisheries Enhancement Group (CCFEG) on the Methow/Chewuch Shallow Groundwater Monitoring Project without additional information. Following the May meeting, the Committee received the information they requested and approved the budget amendment. The Rocky Reach Tributary Committee approved an unexpected cost increase for Chelan-Douglas Land Trust on the Nason Creek Lower White Pine Alcove Acquisition Project.
- *Contract Extensions*: The Tributary Committees approved contract extensions for Trout Unlimited on the Chewuch River Instream Passage Project and on the Twisp River Well Conversion Project.

- *General Salmon Habitat Program Pre-proposals*: The Tributary Committees received 13 draft proposals for the 2013 round of the General Salmon Habitat Program, and nine were chosen for further consideration. Four projects were removed because they were either inconsistent with the intent of the Tributary Fund or did not have strong technical merit. The proposed projects are located in the Okanogan, Methow, Entiat, and Wenatchee basins.
- *Meeting Schedule Changes*: The Tributary Committees will meet on August 15, 2013, instead of August 8, 2013. Also, due to an Upper Columbia Salmon Recovery Board Science Conference on November 13-14, 2013, the Tributary Committees will meet November 15, 2013, instead of November 14, 2013.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Hatchery Committees' meeting on June 19, 2013, which was hosted by Chelan PUD. He said that members of the Priest Rapids Coordinating Committees (PRCC) were invited to the meeting to participate in discussions of shared interest.

- *Hatchery Genetic Management Plan (HMGP) Update*: NMFS provided an update on processing HGMPs, completing National Environmental Policy Act (NEPA) requirements and BiOps, and permitting for mid-Columbia hatchery programs:
  - Okanogan: Moving forward on designation of spring Chinook to be transferred from Winthrop to Chief Joseph Fish Hatchery (CJFH) for release in the Okanagan as a Section 10(j) "experimental population." Also noted that they are waiting on a steelhead HGMP from the CCT.
  - Methow: Reported that there is an emerging agreement under *U.S. v. Oregon* for steelhead and spring Chinook programs. Some confusion remains over whether the 61,000 Methow spring Chinook that Chelan PUD previously produced at Methow Hatchery (now proposed for collection at Rocky Reach; rearing at Eastbank and Carlton; and distributed acclimation) will be included in a single BiOp for the Methow programs.
  - Wenatchee: At Nason, White, and Chiwawa, the big issue is a permit for collection of broodstock at Tumwater Dam (TWD), which is already well behind schedule. The run is early this year (expect 40 percent passage by June 22, 2013). Although existing permits cover collection, returning unassigned fish to the river is not covered. NMFS promised permits by June 28, 2013, which allows trapping

and transfer to holding at Eastbank to begin June 20, 2013. A conference call check-in is scheduled for June 27, 2013.

- *CRITFC Request to Conduct Genetic Sampling for Parentage-based Tagging of Columbia River Hatchery Programs*: WDFW introduced and sponsored a proposal by CRITFC to collect and archive tissue samples from all mid-Columbia hatchery broodstock for future use in a proposed long-term parentage analyses. Uses, for example, might include determining hatchery contribution to harvest. Although many details, including who maintains the database and who has access to it, remain to be worked out, the collection was agreed to by all members of the Hatchery Committees, including the CCT. However, the CCT deferred participation until after CJFH's first few broodstock collections.
- *Wells Hatchery Master Plan Workshop*: Douglas PUD, with their contractor HDR Engineering, Inc. (HDR), is scheduling a workshop for the Hatchery Committees on the Wells Hatchery modernization master plan. This is being planned to facilitate input from the Hatchery Committees.
- *Hatchery Monitoring and Evaluation (M&E) Plan Assessment Targets*: Douglas PUD, along with Chelan and Grant PUDs, are convening a Hatchery Committees workgroup to complete development of M&E assessment targets.
- *Hatchery M&E Request for Proposal (RFP) Technical Review Panel*: Chelan PUD reviewed the schedule for submitting responses to their RFP for the Hatchery M&E program. Their program is for the Wenatchee, for which they share responsibility with Grant PUD. Proposals are due July 8, 2013, and Chelan PUD is currently taking recommendations for external scientists to provide peer review of submitted proposals.

V. HCP Committees Administration (Mike Schiewe)

A. CSS Presentation/Workshop Update

Mike Schiewe said that, in brief conversations with Bob Rose and Denny Rohr (on behalf of the PRCC), the tentative plan is to have a CSS presentation at the Coordinating Committees' meeting on August 27, 2013. Schiewe said that the Coordinating Committees will hold their regular meeting in the morning; FPC will present in the afternoon to a combined gathering of the Coordinating Committees and PRCC; and the PRCC will hold their meeting the next day (August 28, 2013), as usual. He added that, as previously discussed, follow-up discussions will be held separately as they relate to the respective HCPs and Settlement Agreement.

Schiewe recalled that the FPC requested the opportunity to talk to the Coordinating Committees, and that Teresa Scott was instrumental in making the connection. Rose said that he thinks the FPC would be interested in discussing the potential for expanding their database. Tom Kahler asked if the FPC had specified what they wanted to present, and Rose replied that he believes that the Coordinating Committees can draft the agenda. Schiewe said that the purpose of this CSS meeting is more for the FPC to present information. Rose said that he will finalize scheduling of the CSS presentation for the Coordinating Committees' meeting on August 27, 2013; and that he will coordinate with Scott to develop a draft agenda for the CSS presentation by the FPC.

B. Next Meetings

The next scheduled Coordinating Committees meeting is July 23, 2013, to be held by conference call. The meetings on August 27, 2013, and September 24, 2013, will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A	List of Attendees
Attachment B	Final SOA maintaining Rock Island and Rocky Reach Subyearling Chinook in Phase III (Additional Juvenile Studies)
Attachment C	Chelan PUD's final compiled comment letter on the Chelan County Noxious Weed Board Integrated Aquatic Vegetation Management Plan

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Tom Kahler*	Douglas PUD
Kirk Truscott*†	Colville Confederated Tribes
Bob Rose*	Yakama Nation
Bryan Nordlund*†	National Marine Fisheries Service
Jim Craig*	U.S. Fish and Wildlife Service

Notes:
* Denotes Coordinating Committees member or alternate
† Joined by phone

FINAL
Rock Island and Rocky Reach Habitat Conservation Plans
Coordinating Committees

Statement of Agreement

Maintain Rock Island and Rocky Reach Subyearling Chinook in Phase III (Additional Juvenile Studies) for up to three years

(Approved June 25, 2013)

Agreement Statement

The Rock Island and Rocky Reach HCP Coordinating Committees (CC) were presented data regarding the status of tag technology and life-history attributes for subyearling summer Chinook in the Mid-Columbia and agree that juvenile project survival measurements are not currently feasible. The CC agrees to maintain subyearling Chinook in Phase III (Additional Juvenile Studies) for up to three years (June 2016) at Rock Island and Rocky Reach and to annually assess improvements in tag technology and study design to evaluate survival study feasibility by 2016.

Background

In April, 2013, the HCP CCs were presented key information on subyearling summer Chinook including applicable advancements in active-tag technology since 2009.

Acoustic tag technology remains insufficient to conduct Project survival studies required by the HCPs. Tag miniaturization resulting in smaller batteries and reduced battery life are insufficient for full project survival estimations, with tags still too large for small run of river subyearling Chinook originating from the Mid-Columbia. These factors, in combination with yet unknown proportions of migrant vs. non-migrant juvenile fish in the population remain impediments to project survival estimations for subyearling Chinook.



PUBLIC UTILITY DISTRICT NO. 1 *of* CHELAN COUNTY
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

June 14, 2013

Mike Mackey, Coordinator
Chelan County Noxious Weed Board
400 Washington Street
Wenatchee, WA 98801

Dear Mr. Mackey,

Thank you for the opportunity to provide comments on the Integrated Aquatic Vegetation Management Plan (IAVMP or Plan) prepared by the Chelan County Noxious Weed Board.

Chelan PUD owns and operates two hydroelectric projects on the Columbia River, the Rock Island Project and Rocky Reach Project. Chelan PUD has a vested interest in the Plan as a result of the proposed use of an aquatic herbicide along the shoreline of Entiat Park within the Columbia River since the area is within the Rocky Reach Project Boundary licensed by the Federal Energy Regulatory Commission (FERC). Chelan PUD, License Forums[1], and Habitat Conservation Plan (HCP) Committee members[2] have reviewed the Plan to ensure the herbicide application pilot project is not inconsistent with resource management plans, the Habitat Conservation Plans, and other license requirements of the FERC license. Forum and HCP Committee member comments are enclosed with this letter.

Priority Considerations

- The Plan cites a NMFS Biological Opinion stating that "data suggest that Triclopyr, in the triethylamine formulation is unlikely (emphasis added) to cause significant effects to the salmonid prey base if used according to recommended application rates." Chelan PUD is concerned with the inference Triclopyr is "safe" for salmonids or "unlikely" to have a negative impact on salmonids or their prey base is concluded from data stemming from an evaluation of the ester formulation of the herbicide for terrestrial applications. The same NMFS document states that Triclopyr harms embryonic zebra fish (a common laboratory species used to evaluate survival and developmental effects on fish) at 1 mg/l concentration. The chemical proposed is Triclopyr TEA. It appears the NMFS Biological Opinion was for Triclopyr BEE. Chelan PUD would like to be assured that

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[1] Rocky Reach Fish Forum (NPS, Ecology, USFWS, Confederated Tribes of the Colville Reservation, Confederated Tribes and Bands of the Yakama Nation, WDFW, Alcoa, City of Entiat, Chelan PUD); Rocky Reach Recreation Forum (WA State Parks, Alcoa, Ecology, USFWS, BLM, NPS, City of Entiat, Chelan PUD), Rocky Reach Wildlife Forum (BLM, WA State Parks, Confederated Tribes and Bands of the Yakama Nation, Alcoa, Ecology, NPS, USFWS, Confederated Tribes of the Colville Reservation, WDFW, City of Entiat, Chelan PUD).

[2] Members of the HCP Committee include USFWS, NOAA Fisheries, Confederated Tribes of the Colville Reservation, Confederated Tribes and Bands of the Yakama Nation, WDFW, Douglas PUD, and Chelan PUD.

consultation was conducted on Triclopyr TEA. If consultation hasn't been conducted on Triclopyr TEA, we would like documentation that NMFS and USFWS have approved this form of Triclopyr.

- Evaluating the adverse effects to vertebrate and invertebrate species based on acute toxicity data using a LC50 endpoint (50% mortality of a test population) is not appropriate when considering sensitive and listed species and overall ecosystem effects. Chelan PUD agrees with the Plan's recommendation to consider toxicity endpoints that represent lowest observed effect levels or no observed effect levels. To achieve the goal of protecting sensitive and listed species, the Plan recommends a "more in-depth review of behavioral and other chronic endpoints associated with Triclopyr should be undertaken prior to conducting the study." Chelan agrees with the recommendation and further suggests the data and report be made available for consultation with those parties (NOAA, USFWS, DOE, WDFW, Tribes, and Chelan PUD) engaged in the proposed Plan.
- It appears the Plan only considers potential effects to adult migrating Pacific Lamprey, but not potential effects on juvenile lamprey rearing in RR reservoir sediments – especially probable in and around the mouth of the Entiat given that a good number of adult lamprey appear to spawn in the Entiat River (USFWS, RD Nelle). Juvenile lamprey (ammocoetes) can rear in the mud and sand of reservoirs (usually shallower areas) for 4-5 years, prior to out-migrating to the ocean. While in the mud, ammocoetes filter feed detritus (organic material) from the water column. Chelan PUD recommends the effects Triclopyr has on juvenile lamprey be evaluated prior to any field application of Triclopyr.

<u>General Comments</u>

- Entiat Park is scheduled for closure during 2014 to complete expansive park improvements and a trail project. The timing of the park closure could be beneficial to the County for application of the herbicide pilot study. However, Chelan PUD requests that the County be in close communication during planning due to potential impacts to newly vegetated shoreline areas as part of the park and trail projects.
- An irrigation pump house (intake from the Columbia River) is located at Entiat Park that provides water to a large number of users (park and orchardists). Chelan PUD requests careful consideration and evaluation of any potential impacts to this water source prior to any herbicide application.
- 2009-2012 Rocky Reach hourly flow data for the periods August and September demonstrate that the County may achieve their intent to apply and contain the herbicide in the target location during September as flows typically taper off. This data was emailed by Michelle Smith to Mike Mackey on May 30.
- In six years of Chelan PUD's radio-telemetry studies on adult bull trout entering the tributaries to spawn, all adult tagged bull trout left the main Columbia and entered the Entiat River by July 1. None spawned and exited back to the mainstem prior to October 25th. This is the best available data. If the herbicide is equally effective on the plants in the later period of the USFWS "work window", then it may make sense to take advantage of the later period to reduce effects on fish and greatly reduce unwanted dispersion (increase containment) of the chemical beyond the treatment area compared with the earlier period.
- Curly leaf pondweed is also a dominant noxious weed species found in the Columbia River that is a nuisance to boaters and swimmers. It appears Triclopyr is not selective for that species. It should be considered that even if milfoil is controlled, curly leaf pondweed may fill that space and boaters

and park users will not notice much benefit from the program. Chelan PUD noted that in Appendix B of the Plan, pg 38, it is mentioned that one of the downsides of using Triclopyr is that it is only effective against milfoil and other dicots and because it can then give other aquatic weeds an opportunity to invade the area once occupied by milfoil, it should not be a sole control strategy.

Specific Plan Comments

- Pg 3. Problem Statement, first paragraph. Chelan PUD disagrees with the statement that Eurasian milfoil is an "imminent" threat to native fish and water quality. Often a generality based on literature from lakes and other areas, aquatic macrophyte beds have not been shown to lower dissolved oxygen to levels that could have adverse effects on aquatic species in the Columbia River. A recent study completed by Chelan PUD of water quality impacts in dense aquatic vegetation showed no significant problems with dissolved oxygen.
- Pg 4. Physical Characteristics. This paragraph references a winter draw down period. The Rocky Reach reservoir is considered a "run-of-river" project and does not experience winter draw downs typically encountered with "storage" projects.
- Pg. 4 Geology and Hydrology. The following information should be corrected to read:

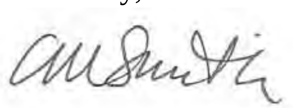
  > The regulated hourly flow of the Columbia River at the Rocky Reach Dam historically has varied between 12,000 cubic feet per second (cfs) and 390,000 cfs, after the Canadian storage projects were completed in 1973. The Rocky Reach pool, known as Lake Entiat, extends upriver 43 miles and has a surface area of approximately 8,235 acres. The pool contains 36,400 acre feet of usable storage with a maximum 4 foot drawdown.

Citation Correction

- Project Overview, first paragraph. Correct citation should be the June 1, 2001 Aquatic Habitat Mapping Study Report which is where the information shown is actually reported. The 1999 document is only the study plan.

We appreciate the opportunity to provide comments on the Integrated Aquatic Vegetation Management Plan prepared by the Chelan County Noxious Weed Board and the County's efforts to keep Chelan PUD consulted during the development and implementation of this herbicide pilot project.

Sincerely,



Michelle Smith
License and Compliance Manager
Chelan County PUD
(509) 661-4180

cc: HCP Committee and License Forum members

Enclosures: Rocky Reach License Forum and HCP Committee Comments

Summary Table of HCP and Forum Comments (actual comments are included following this summary table)				
Agency	**Name**	**Representing**	**Date**	**Comment Summary**
NOAA Fisheries	Bryan Nordlund, Scott Hecht	HCP Committee	June 13, 2013	An aquatic use of pesticides in salmonid habitats is considered high risk and should be carefully evaluated. The use of the herbicide 2,4,D contributed to a jeopardy conclusion for T/E salmonids. NMFS has consulted nationally on Triclopyr BEE forumations only, not the Triclopyr TEA forumations. BEE is not registered for aquatic uses. At the national level, NMFS has not consulted on EPA's registration of Triclopyr TEA.
Bioanalyst	Tracy Hillman	HCP Committee	June 13, 2013	Agree with Chelan PUD's comments.
Confederated Tribes of the Colville Reservation	Kirk Truscott	HCP Committee	June 5, 2013	(1) Degradation products associated with Triclopyr (Pyridine and Pyridinol) were identified as having LC50 concentrations for Chinook and rainbow trout at 2.1-4.6 mg/L and 1.5-2.1 mg/L, respectively. The Plan made no mention of sub-lethal effect concentrations for either compound, nor was the expected concentrations of these compounds at the anticipated application rate of Triclopyr included in the evaluation. These degradation products are considerably more toxic than the actual herbicide, so it would make sense that some information be provided relative to the expected concentration of these compounds at the proposed application rate of the herbicide. (2) Because Triclopyr does not bind to soils, containment could be an issue. As such, will it be

				expected that the treatment area will have an increasing concentration of the herbicide from upstream to downstream? Is so, what is the expected concentration at the lowest portion of the treatment area? This could be important relative to the potential effect to juvenile lamprey near the confluence of the Entiat River.
US Fish &Wildlife Service	Jim Craig	HCP Committee	June 3, 2013	Steve Lewis has been working with Chelan County on their IAVMP throughout this process. That combined with Chelan PUD's comment letter will suffice and no further comment.
WDFW	Teresa Scott	HCP Committee	June 3, 2013	WDFW would like to seek internal technical review. Requested names of those participating on the review team related to the IAVMP (Chelan PUD responded to this request on June 4, 2013)
WDFW	Erin Wehland	Wildlife Forum	June 12, 2013	Note that herbicidal control curlyleaf pondweed and milfoil can impact waterfowl use of the area. Parts of these aquatic plants are consumed by waterfowl. Also, submerged aquatic vegetation support aquatic invertebrate communities which are consumed by waterfowl.
WDFW	Patrick Verhey	Fish and Recreation Forums	June 13, 2013	WDFW has not been engaged in the proposed plan to date. We recommend Chelan County include WDFW in the Planning Team for future consultation on the Plan. We recommend Carmen Andonaegui, WDFW Region 2 Habitat Program Manager be included on the Planning Team.

From: Bryan Nordlund - NOAA Federal [mailto:bryan.nordlund@noaa.gov]
Sent: Thursday, June 13, 2013 8:09 AM
To: Hemstrom, Steven
Cc: Kristi Geris
Subject: Milfoil control proposal

Hi Steve - I asked our resident fish toxicologist to have a look at your letter, and here is his reply:

"Attached are brief comments. Aquatic uses of pesticides in salmonid habitats are a big deal that requires careful and extensive analyses. We have several jeopardy biological opinions where aquatic uses of pesticides weighed heavily on the overall conclusion, e.g. 2,4-D.

NMFS has consulted nationally on Triclopyr BEE formulations only, not the Triclopyr TEA formulations. It appears that the proposal is for Triclopyr TEA as Triclopyr BEE is not registered for aquatic uses. NMFS has yet to consult on these formulations nationally."

Hope that these are helpful, and thanks to CPUD for staying on top of this issue. See the attached.
Bn

Bryan Nordlund, P.E.
360-534-9338
National Marine Fisheries Service
510 Desmond Drive, Suite 103
Lacey, WA 98503

(attachment is included on next page)

Draft – Comment letter to Chelan County Noxious Weed Board regarding Integrated Aquatic Vegetation Management Plan (herbicide application in Columbia River near Entiat Park)

Draft – May 28, 2013

Chelan PUD letterhead

Mike Mackey, Coordinator
Chelan County Noxious Weed Board
400 Washington Street
Wenatchee, WA 98801

Dear Mr. Mackey,

Thank you for the opportunity to provide comments on the Integrated Aquatic Vegetation Management Plan (Plan) prepared by the Chelan County Noxious Weed Board.

Chelan PUD owns and operates two hydroelectric projects on the Columbia River, the Rock Island Project and Rocky Reach Project. Chelan PUD has a vested interest in the Plan as a result of the proposed use of an aquatic herbicide along the shoreline of Entiat Park within the Columbia River since the area is within the Rocky Reach Project Boundary licensed by the Federal Energy Regulatory Commission (FERC). Chelan PUD, License Forums[1], and Habitat Conservation Plan Committee members[2] have reviewed the Plan to ensure the herbicide application pilot project is not inconsistent with resource management plans, the Habitat Conservation Plans, and other license requirements of the FERC license.

Priority Considerations

- The Plan cites a NMFS Biological Opinion stating that "data suggest that triclopyr, in the triethylamine formulation is unlikely (emphasis added) to cause significant effects to the salmonid prey base if used according to recommended application rates." Chelan PUD is concerned with the inference triclopyr is "safe" for salmonids or "unlikely" to have a negative impact on salmonids or their prey base is concluded from data stemming from an evaluation of the ester formulation of the herbicide for terrestrial applications. The same NMFS document states that triclopyr harms embryonic zebra fish (a common laboratory species used to evaluate survival and developmental effects on fish) at 1 mg/l concentration. The chemical proposed is triclopyr TEA. It appears the NMFS Biological Opinion was for triclopyr BEE. Chelan PUD would like to be assured that consultation was conducted on triclopyr TEA. If consultation hasn't been conducted on triclopyr TEA, we would like documentation that NMFS and USFSW have approved this form of triclopyr.
- Evaluating the adverse effects to vertebrate and invertebrate species based on acute toxicity data using a LC50 endpoint (50% mortality of a test population) is not appropriate when considering sensitive and listed species and overall ecosystem effects. Chelan PUD agrees with the Plan's recommendation to consider toxicity endpoints that represent lowest observed effect levels or no observed effect levels.

Deleted: test animal

Comment [SH1]: Does this concentration correspond to concentrations anticipated by the proposed use to control milfoil? If so, it's a high concentration.

Deleted: for

Deleted: studies

Comment [SH2]: This is correct. The Biological Opinion only covered Triclopyr BEE and therefore did not evaluate aquatic uses.

Aquatic uses of pesticides in salmonid habitats is considered high risk and should be carefully evaluated. The aquatic use of the herbicide 2,4 D contributed to a jeopardy conclusion for T/E salmonids.

Comment [SH3]: At the national level NMFS has not consulted on EPA's registration of triclopyr TEA. There may be some regional consultations.

[1] Rocky Reach License Forums consist of the Rocky Reach Fish Forum, Rocky Reach Recreation Forum, Rocky Reach Wildlife Forum. Members include: list members.

[2] Members of the Habitat Conservation Plan Committee include: list members.

From: Kristi Geris [mailto:kgeris@anchorqea.com]
Sent: Thursday, June 13, 2013 9:01 AM
To: Andrew Gingerich (andrewg@dcpud.org); Bill Tweit (tweitwmt@dfw.wa.gov); Bob Rose (rosb@yakamafish-nsn.gov); 'Bryan Nordlund (bryan.nordlund@noaa.gov)'; Jim Craig (jim_l_craig@fws.gov); kirk.truscott@colvilletribes.com; Kristi Geris; Mike Schiewe; Hemstrom, Steven; Steve Parker (pars@yakamafish-nsn.gov); 'Teresa Scott (teresa.scott@dfw.wa.gov)'; 'Tom Kahler (tkahler@dcpud.org)'
Cc: beichdvb@dfw.wa.gov; Gallaher, Becky; Keith Kirkendall (Keith.Kirkendall@noaa.gov); Truscott, Keith; Keller, Lance; Lee Carlson (carl@yakamafish-nsn.gov); Shane Bickford (sbickford@dcpud.org)
Subject: FW: Milfoil control proposal

Hi HCP-CC: please see the email below from Bryan and the attached comments from NMFS on Chelan PUD's comment letter to Chelan County Noxious Weed Board regarding Integrated Aquatic Vegetation Management Plan (herbicide application in Columbia River near Entiat Park).

Thanks!
Kristi ☺

Kristi Geris

ANCHOR QEA, LLC
kgeris@anchorqea.com

From: Tracy Hillman [mailto:tracy.hillman@bioanalysts.net]
Sent: Thursday, June 13, 2013 7:50 AM
To: Hemstrom, Steven
Subject: Integrated Aquatic Vegetation Management Plan

Hi Steve,

I read through the County's Integrated Aquatic Vegetation Management Plan and your comments. You nailed it. Excellent comments, especially those related to the lack of coverage on ammocoetes. I have nothing to add.

Cheers,
Tracy

Tracy W. Hillman, Ph.D.
Senior Ecologist

BioAnalysts, Inc.
4725 N. Cloverdale Rd, Suite 102
Boise, ID 83713 USA
Tel: 208-321-0363
Cell: 208-867-2889
Fax: 208-321-0364
tracy.hillman@bioanalysts.net
www.bioanalysts.net

From: Kirk Truscott [mailto:Kirk.Truscott@colvilletribes.com]
Sent: Wednesday, June 05, 2013 1:18 PM
To: Kristi Geris; Andrew Gingerich (andrewg@dcpud.org); Bill Tweit (tweitwmt@dfw.wa.gov); Bob Rose (rosb@yakamafish-nsn.gov); 'Bryan Nordlund (bryan.nordlund@noaa.gov)'; Jim Craig (jim_l_craig@fws.gov); Mike Schiewe; Hemstrom, Steven; Steve Parker (pars@yakamafish-nsn.gov); 'Teresa Scott (teresa.scott@dfw.wa.gov)'; 'Tom Kahler (tkahler@dcpud.org)'
Cc: beichdvb@dfw.wa.gov; Gallaher, Becky; Joe Miller (Joseph.Miller@chelanpud.org); 'Josh Murauskas (josh.murauskas@chelanpud.org)'; Keith Kirkendall (Keith.Kirkendall@noaa.gov); Truscott, Keith; Keller, Lance; Lee Carlson (carl@yakamafish-nsn.gov); Shane Bickford (sbickford@dcpud.org)
Subject: RE: Chelan County Weed Board Plan for milfoil control in Rocky Reach Reservoir

Steve,

I think that the CPUD letter covers the issues pretty well. A couple of additional comments are included below.

(1) Degradation products associated with Triclopyr (Pyridine and Pyridinol) were identified as having LC50 concentrations for Chinook and rainbow trout at 2.1-4.6 mg/L and 1.5-2.1 mg/L, respectively. The Plan made no mention of sub-lethal effect concentrations for either compound, nor was the expected concentrations of these compounds at the anticipated application rate of Triclopyr included in the evaluation. I'm no herbicide guru, but these degradation products are considerably more toxic than the actual herbicide, so it would make sense that some information be provided relative to the expected concentration of these compounds at the proposed application rate of the herbicide.

(2) Because Triclopyr does not bind to soils, containment could be an issue. As such, will it be expected that the treatment area will have an increasing concentration of the herbicide from upstream to downstream? Is so, what is the expected concentration at the lowest portion of the treatment area? This could be important relative to the potential effect to juvenile lamprey near the confluence of the Entiat River.

Kirk

From: Craig, Jim [mailto:jim_l_craig@fws.gov]
Sent: Monday, June 03, 2013 2:37 PM
To: Hemstrom, Steven
Subject: Fwd: FW: Chelan County Weed Board Plan for milfoil control in Rocky Reach Reservoir

Hi Steve,

The USFWS (Steve Lewis) has been working with Chelan County on their IAVMP throughout this process. That combined with what I thought was an excellent comment letter from the PUD's Michelle Smith should suffice - we have no further comment.

Jim

From: Scott, Teresa L (DFW) [mailto:Teresa.Scott@dfw.wa.gov]
Sent: Monday, June 03, 2013 11:46 AM
To: Kristi Geris; Andrew Gingerich (andrewg@dcpud.org); Tweit, William M (DFW); Bob Rose (rosb@yakamafish-nsn.gov); 'Bryan Nordlund (bryan.nordlund@noaa.gov)'; Jim Craig (jim_l_craig@fws.gov); kirk.truscott@colvilletribes.com; Mike Schiewe; Hemstrom, Steven; Steve Parker (pars@yakamafish-nsn.gov); 'Tom Kahler (tkahler@dcpud.org)'
Cc: Gallaher, Becky; Keith Kirkendall (Keith.Kirkendall@noaa.gov); Truscott, Keith; Keller, Lance; Lee Carlson (carl@yakamafish-nsn.gov); Shane Bickford (sbickford@dcpud.org)
Subject: RE: Chelan County Weed Board Plan for milfoil control in Rocky Reach Reservoir

Steve,
The comment letter looks good from my viewpoint. However, I would like to be able to seek review from someone at WDFW having the actual technical expertise to provide a rigorous review. Is it OK for me to send this along to someone else at WDFW? Is anyone from WDFW participating in the review of the IAVMP?
T-

TERESA SCOTT
WATER RESOURCE POLICY COORDINATOR
WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
360-902-2713 TERESA.SCOTT@DFW.WA.GOV

Von,

Just wanted to note that herbicidal control curlyleaf pondweed and milfoil can impact waterfowl use of the area. Parts of these aquatic plants are consumed by waterfowl. Also, submerged aquatic vegetation support aquatic invertebrate communities which are consumed by waterfowl.

Erin Wehland
WDFW Waterfowl Specialist
1550 Alder St. NW
Ephrata, WA 98823
O: (509) 754-4624 x237
C: (509)237-4860
Erin.Wehland@dfw.wa.gov

From: Verhey, Patrick M (DFW) [mailto:Patrick.Verhey@dfw.wa.gov]
Sent: Thursday, June 13, 2013 9:53 AM
To: Pomianek, Kris
Cc: Hemstrom, Steven; Andonaegui, Carmen (DFW)
Subject: RE: Chelan County Milfoil control proposal

Kris and Steve, thanks for the opportunity to provide comments on Chelan PUDs comment letter and the Chelan Noxious Weed Board's Chelan County Milfoil control proposal. WDFW supports Chelan PUD's comments on the proposal. We offer one edit to the letter. In the second bullet item of the priority consideration section of your comment letter you note: "To achieve the goal of protecting sensitive and listed species, the Plan recommends a "more in-depth review of behavioral and other chronic endpoints associated with Triclopyr should be undertaken prior to conducting the study." Chelan agrees with the recommendation and further suggests the data and report be made available for consultation with those parties (NOAA, USFWS, DOE, WDFW, Tribes, and Chelan PUD) engaged in the proposed Plan." WDFW is in agreement with this comment; however, WDFW has not been engaged in the proposed Plan to date. We recommend Chelan County include WDFW in the Planning Team for future consultation on the Plan. If you are amenable to the idea. We recommend Chelan PUD recommend Carmen Andonaegui, WDFW Region 2 Habitat Program Manager, be included on the Planning Team in your comment letter. Carmen's e-mail address is: Carmen.Andonaegui@dfw.wa.gov

Thank you for considering WDFW's comments.

Patrick Verhey
Renewable Energy Biologist
WDFW Habitat Program
Renewable Energy Section
1550 Alder St N.W.
Ephrata, WA 98823
(509) 754-4624 ex. 213
Patrick.Verhey@dfw.wa.gov

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720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	August 28, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the July 23, 2013 HCPs Coordinating Committees Conference Call		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met by conference call, on Tuesday, July 23, 2013, from 9:30 am to 10:30 am. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Tom Kahler will provide an update on the 2013 Adult Lamprey Passage and Enumeration Study to Kristi Geris for distribution to the Coordinating Committees (Item II-B).
- Steve Hemstrom will provide an updated flow duration curve for valid survival studies using the historical1929-1978 and 1983-2001 data sets to which the new 2002-2012 dataset is added, and for comparison, also using only the 1983-2012 dataset, to Kristi Geris for distribution to the Coordinating Committees (Item III-A).
- Hemstrom will include data from the month of June in the summer study period in both updated flow duration curves (i.e., 1929-1978 dataset and 1983-2012 dataset) for valid survival studies (Item III-A).
- **The next scheduled Coordinating Committees meeting on August 27, 2013, will be held at the Radisson Hotel in SeaTac, Washington, from 9:30 am to no later than 4:00 pm** (Item V-A).

DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at today's meeting.

AGREEMENTS

- Coordinating Committees representatives present agreed to include data from the month of June in the summer study period in the updated flow duration curves for valid survival studies (Item III-A).
- Coordinating Committees representatives present agreed that questions or issues arising from the Fish Passage Center's (FPC's) Comparative Survival Study (CSS) Presentation scheduled for the Coordinating Committee's meeting on August 27, 2013, will be addressed during the September 24, 2013 meeting (Item III-B).

REVIEW ITEMS

- "Assessment of Factors Limiting the Productivity of Summer Chinook Salmon in the Mid-Columbia River" by Hillman, Murauskas, and Hemstrom (2013), which was distributed to the Coordinating Committees on June 26, 2013, is available for review, with comments due to Steve Hemstrom (Item II-A from Coordinating Committees meeting on June 25, 2013).

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. No additions or changes were requested.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft June 25, 2013 meeting minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to discuss. The Coordinating Committees members present approved the draft June 25, 2013 meeting minutes as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Douglas PUD

A. Wells Dam Bypass Operations Update (Tom Kahler)

Tom Kahler said that Wells Dam has been operating under normal bypass operations after reinstalling barriers in bypass bay number 6 on July 11, 2013, as described in an email distributed to the Coordinating Committees by Kristi Geris that same day. He said that the flow barriers were removed from bypass bay number 6 on July 1, 2013, due to high discharge at Grand Coulee Dam, above-average discharge from the Okanogan and Methow, and a period of heavy rainfall and high temperatures.

B. 2013 Adult Lamprey Passage and Enumeration Study Update (Tom Kahler)

Tom Kahler said that modified fishway operations at Wells Dam started the week of July 15, 2013, for the 2013 Adult Lamprey Passage and Enumeration Study, and that staff have started releasing tagged lamprey downstream of Wells Dam. He has not heard whether any lamprey have been detected to date, and he added that he will provide a comprehensive update on the 2013 Adult Lamprey Passage and Enumeration Study to Kristi Geris for distribution to the Coordinating Committees.

Kahler said Wells Dam counts are running about 8 to 9 days behind. Kahler explained that since April 2013, Wells Dam has been without a relief counter, and he added that a new relief counter is scheduled to start tomorrow. He said that Douglas PUD information officers that are responding to inquiries about the delay are recommending subtracting two days from Rocky Reach Dam counts until the counts at Wells Dam are up to date. Kirk Truscott asked when Douglas PUD anticipates that counts will be up to date. Kahler replied that it depends on a number of factors, such as the numbers of fish that have recently passed Wells Dam and the learning curve of the new counter. Truscott said that the delay affects the Colville Confederated Tribes (CCT) and their Chief Joseph programs, and that subtracting two days from Rocky Reach Dam counts does not account for all runs. He asked if personnel are able to work longer hours to get caught up, and Kahler replied that staff are already working 12-hour days, which is the limit for union workers. He said that staff are counting every day, and that the relief counter starting tomorrow should help, too. Bryan Nordlund asked about the possibility of Douglas PUD providing the CCT with the raw counts, and Kahler replied that a hard drive with about a month of count-window recordings is provided to Washington Department of Fish and Wildlife (WDFW) near the end of each season for their use in differentiating between summer and spring Chinook during the period when those runs overlap (mid-June to mid-July). He said, however, that even if the raw recordings were provided to the CCT, someone would still need to view them to obtain the counts. Truscott said that obtaining the recordings at this time would not be particularly helpful.

Kahler added that he and the lead Wells Dam fish counter, along with Douglas PUD technicians and engineers, met with the chief counter at Rocky Reach Dam to tour the Chelan PUD's counting system, including the lighting and count window configuration and video system. Kahler said that Douglas PUD is planning to modify the Wells Dam count system, including the recording system and count window background and lighting. He said that some modifications can be completed now, such as the lighting; however, the other changes will likely be completed during the annual winter maintenance period. Kahler said that the lessons learned at Rocky Reach and Rock Island dams will inform future improvements to the Wells Dam count system.

C. Subyearling Study Update (Tom Kahler)

Tom Kahler said that final seining efforts took place July 8-10, 2013, and that tagging operations were completed on July 11, 2013. He said that, during the final week of seining, fish were sparse and crews struggled to locate them. On the last two days of seining, crews resorted to visually scanning the water to locate schools of fish, or "sight fishing." Only 557 fish were obtained during the last full day of seining. Kahler said that the tagging phase is now complete, and that Douglas PUD is focusing on monitoring detections.

Kahler said that there has been some internal Douglas PUD discussion about conducting an additional year of tagging; however, the design and methods have yet to be determined. Based on the availability of fish this year, there has been discussion about conducting weekly tagging of smaller groups of fish, as opposed to contracting tagging efforts for pre-selected tagging dates. Kirk Truscott asked when Douglas PUD might know if they will continue tagging for another year. Kahler replied that there are still several things that need to be internally vetted in order to make this decision, including discussions about the tagging window, the intent of an additional year of tagging, what direction to take with subyearling Chinook considering the difficulties in conducting a survival study (as revealed by the study to date), whether additional data of the sort collected over the last three years are necessary, and costs associated with different types of tagging operations. Kahler said that none of these discussions have formally occurred, but that they need to soon in order to obtain equipment for mobile tagging, if necessary; and also to allow for enough time to get the logistics worked out prior to the next tagging season. However, since the 2013 study efforts wrapped up less than two weeks ago, an internal discussion on the direction of any future study will not likely occur until the fall, after preliminary review of data from this year. Truscott said that it would also be helpful for the CCT to know Douglas PUD's plans for additional tagging because it would help shape their 2014 Monitoring and Evaluation (M&E) activities. Truscott added that the CCT would not want to duplicate efforts.

Kahler said that Biomark sells a mobile tagging system that can be placed on a workboat, and could be used to tag thousands of fish over multiple weeks. Teresa Scott asked if Douglas PUD has considered Andrew Murdoch's team (WDFW staff out of the Twisp office under contract to Douglas PUD for Hatchery M&E) for assisting with tagging efforts, and Kahler replied that, yes, Douglas PUD has considered Murdoch's team each year that they have been tagging for the Subyearling Study. He added that Murdoch's team has helped Douglas PUD with collection in the past, but not with tagging. Scott asked if Douglas PUD is in touch with experts regarding sample size, and Kahler again replied that Douglas PUD engages statistical expertise as needed. He said that he appreciates these thoughts and asked that Coordinating Committees members contact him with further comments or questions.

III. Chelan PUD

A. Valid Study Flow Duration Curve Update (Steve Hemstrom)

Steve Hemstrom said that, with the recent completion of the 10-year No Net Impact (NNI) Comprehensive Check-in Report, the Rock Island and Rocky Reach HCPs require that the spring and summer period flow duration curves used to define valid survival studies must also be updated for use during the next 10 years. He recalled that, as discussed at the Coordinating Committees meeting on March 26, 2013, he was unable to locate the 1929-1978 Bonneville Power Administration (BPA) model dataset that was used to develop the existing curve, and he added that if the historical data could not be found, the Committees suggested using current flow data to calculate a new curve using a 1983-2012 dataset. Hemstrom said that, however, he had recently discovered that the National Oceanic and Atmospheric Administration (NOAA) has the 1929-1978 BPA model dataset, and it is now being sent to him. He said that once these data are received, he can incorporate an additional 10 years of data, per the HCPs, to calculate an updated flow duration curve. Teresa Scott suggested also calculating a new curve using only the most recent data, and then calculating another curve that still incorporates the older data, for comparison. Bryan Nordlund agreed that he would also like to see that comparison, as well. Hemstrom said that he will provide an updated flow duration curve for valid survival studies using the historical dataset to which the new 2002-2012 dataset is added, and for comparison, also using only the 1983-2012 dataset, to Kristi Geris for distribution to the Coordinating Committees.

Hemstrom said that he would like to revise the definition of "summer period," to include the month of June. He said that, instead of July 1 through August 15, the summer dataset would include June 1 through August 15. He noted that June is often a high flow period, and that there are typically high counts of subyearling Chinook passing Rocky Reach Dam in June. Nordlund said the key is to make sure that the curve is inclusive of 95 percent of the summer outmigration window, and Hemstrom agreed, but said studies would be difficult for summer Chinook because they migrate over a 90-day period. Scott added that even 90 days may be a conservative figure because summer Chinook may migrate during the winter. She said that, at some point, we need to determine where 95 percent ends on this long tail. She added that she agrees that including June in the summer dataset is important, and she also recommended re-evaluating the August 15 date at some point. Hemstrom said that the summer spill window typically starts the first week of June, and he added that, last year, summer spill started May 27, 2012. He added that June is almost always included in the spill season at Rocky Reach and Rock Island dams. Nordlund agreed that including June in the summer period makes sense. The Coordinating Committees representatives present agreed to include data from the month of June in the summer study period in the updated flow duration curves for valid survival studies; and Hemstrom said that he will follow up and include data from the month of June in the summer study period in both updated flow duration curves (i.e., datasets of 1929-1978 and 1983-2001 originally used, and the updated 1983-2012 dataset alone).

B. Fish Passage Center's Comparative Survival Study Presentation – Coordinating Committee's August 27, 2013 meeting (Steve Hemstrom)

Mike Schiewe said that Bob Rose and Teresa Scott have arranged for the FPC to present a CSS Presentation the afternoon of the Coordinating Committees' meeting on August 27, 2013, in SeaTac, Washington. A draft agenda was distributed to the Coordinating Committees by Kristi Geris on July 18, 2013. The agenda included: 1) an overview of the CSS (background and findings); 2) an overview of Upper Columbia findings; and 3) an overview of the potential to improve Upper Columbia data. Schiewe said that the FPC will present to a combined gathering of the Coordinating Committees and the Priest Rapids Coordinating Committee (PRCC), with subsequent discussions held separately as they relate to the respective HCPs and Settlement Agreement. The Coordinating Committees will have this subsequent discussion during their September 24, 2013 meeting.

Steve Hemstrom reminded the Coordinating Committees about their previous discussions regarding addressing their questions or concerns in response to the presentation during the regular September Coordinating Committees meeting. He asked if the PRCC had the same approach. Schiewe said that he cannot speak for the PRCC; however, based on conversations with Denny Rohr, the PRCC also plans to hold subsequent discussions following the meeting. Schiewe also said that he encourages the Coordinating Committees members to ask questions for clarification, and that ultimately, based on subsequent discussions in September, the Committees can then decide if and how to respond.

Hemstrom expressed concern that discussions about the potential to improve Upper Columbia data may propose actions that would ultimately become the responsibilities of the PUDs, and Schiewe replied that, if that is the case, the PUDs would still need to agree to the proposed actions. Scott noted the potential for meaningful and helpful discussions about improving Upper Columbia data, so long as the discussions remain about the technical points, and not about funding.

Coordinating Committees representatives present agreed that questions or issues arising from the FPC's CSS Presentation will be addressed during the September 24, 2013 meeting of the Coordinating Committees.

IV. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe reported that the HCP Tributary Committees did not meet in July due to lack of agenda items. The next meeting will be on August 15, 2013, when final proposals submitted for the General Salmon Habitat Program will be evaluated.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Hatchery Committees' meeting on July 17, 2013, which was held by conference call:

- *Hatchery M&E Request for Proposal (RFP) Update and 2014 Hatchery M&E Implementation Plan Schedule*: Alene Underwood, the Chelan PUD Hatchery Program Manager, provided an update on the Chelan PUD Hatchery M&E RFP process for obtaining a new contractor for their 2014 and beyond Hatchery M&E Program. Chelan PUD and Grant PUD share responsibilities in the Wenatchee River basin; and therefore, both PUDs are involved in the decision-making. The RFP closed in early July 2013. Three proposals were received, which are currently being internally evaluated to determine a path forward. The proposals that are determined to be complete will be reviewed by a panel consisting of Hatchery Committees members without a conflict of interest, along with outside experts that were recommended by the Hatchery Committees. In consideration of the current status of the RFP process, Chelan PUD discussed that their 2014 M&E Implementation Plan could be delayed slightly until September or October 2013.
- *Methow Spring Chinook Hatchery Genetic Management Plan (HGMP) Update*: Chelan PUD said that they are within about a week of completing their draft Methow Spring Chinook HGMP for their 61,000 obligation in the Methow. A shortened 14-day review period was approved by the Hatchery Committees in efforts to meet the October 2013 deadline.
- *Wells Hatchery Master Plan Workshop*: Douglas PUD, with their contractor HDR Engineering, Inc. (HDR), scheduled a workshop on August 21, 2013, to facilitate input from the Hatchery Committees on the Wells Hatchery modernization master plan.
- *Potential Acclimation Locations for Chelan PUD Methow Spring Chinook (specifically as it relates to the Chewuch River)*: The Yakama Nation (YN) introduced the potential to acclimate Chelan PUD's Methow spring Chinook in the

Chewuch Pond. This process would involve either co-acclimation, or net-divided acclimation, along with the YN's coho salmon acclimation. The Hatchery Committees supported the YN's request to continue planning for this arrangement in 2015.

- *Next Meetings*: The next Hatchery Committees meeting is scheduled for August 21, 2013, and will include the Wells Hatchery Master Plan Workshop in the afternoon. Dr. Kim Hyatt of British Columbia Fisheries and Oceans, Canada (DFO), may also provide an annual update on the Sockeye Reintroduction Program.

V. HCP Committees Administration (Mike Schiewe)

A. Next Meetings

Mike Schiewe said that the next scheduled Coordinating Committees meeting on August 27, 2013, will be held at the Radisson Hotel in SeaTac, Washington, from 9:30 am to no later than 4:00 pm. He said that the FPC allocated up to 3 hours for their CSS presentation (scheduled to start at 1:00 pm); however, they did not anticipate needing the entire 3 hours.

The meetings thereafter are scheduled for September 24, 2013, and October 22, 2013, and will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A List of Attendees

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Tom Kahler*	Douglas PUD
Kirk Truscott*	Colville Confederated Tribes
Bryan Nordlund*	National Marine Fisheries Service
Jim Craig*	U.S. Fish and Wildlife Service
Teresa Scott*	Washington Department of Fish and Wildlife

Notes:
* Denotes Coordinating Committees member or alternate

ANCHOR QEA
720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	September 24, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the August 27, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at the Radisson Gateway Hotel, in SeaTac, Washington, on Tuesday, August 27, 2013, from 10:00 am to 4:00 pm. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Chelan PUD will summarize available data on fish passage at Rocky Reach Dam during the "off-season" winter months, and provide these data to Kristi Geris for distribution to the Coordinating Committees (Item II-B).
- Chelan PUD will evaluate the potential to extend fish counts at Rocky Reach Dam into the "off-season" winter months, starting winter 2014/2015 (Item II-B).
- Chelan PUD will evaluate the potential to complete the 2013/2014 winter maintenance on the Rocky Reach Right Fishway Ladder prior to the usual March 1 deadline (Item II-B).
- Chelan PUD will finalize the Rock Island and Rocky Reach Draft 2013 Fish Spill Report, and provide the final report to Kristi Geris for distribution to the Coordinating Committees (Item II-C).
- Steve Hemstrom will provide an updated flow duration curve for valid survival studies using the 1929-1977 dataset to which the 1983-2012 dataset is added, and for comparison, also using only the 1983-2012 dataset, to Kristi Geris for distribution to the Coordinating Committees no later than the September 24, 2013 meeting (Item II-D). *(Note: Hemstrom will also include data from the month of June in the summer study period in both updated flow duration curves, as agreed to at the Coordinating Committees conference call on July 23, 2013.)*

DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at today's meeting.

AGREEMENTS

- Coordinating Committees representatives present agreed to extend the 2013/2014 winter maintenance work period at Rocky Reach Dam by one month; rather than beginning January 2, 2014, the new start will be December 2, 2013, to allow more time to complete required work (Item II-B).

REVIEW ITEMS

- "Assessment of Factors Limiting the Productivity of Summer Chinook Salmon in the Mid-Columbia River" by Hillman, Murauskas, and Hemstrom (2013), which was distributed to the Coordinating Committees on June 26, 2013, is available for review, with comments due to Steve Hemstrom (as discussed at the Coordinating Committees meeting on June 25, 2013).

REPORTS FINALIZED

- There are no reports that have been recently finalized.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. Tom Kahler added an update on the Douglas PUD 2013 Adult Lamprey Passage and Enumeration Study, and also a review of the HCP Coordinating Committees' Chairperson.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft July 23, 2013 conference call minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to discuss. The Coordinating Committees members present approved the draft July 23, 2013 conference call minutes as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Chelan PUD

A. Rock Island Right Bank Fishway Outage, Auxiliary Water System Pump Repair, Off-season Upgrades (Steve Hemstrom and Lance Keller)

Lance Keller recalled that in 2010, a fish attendant discovered fish entering the large attraction water reservoir adjacent to the right bank fishway via a missing metal vertical vane in the auxiliary water system (AWS) picket-barrier that separates the two areas at Rock Island Dam. He said that since that time, annual inspections included a "ping" test to detect damaged infrastructure. Despite not detecting any obvious damage to the vanes, a fish attendant again found sockeye in the same location as they were detected in 2010, as described in an email that was distributed to the Coordinating Committees by Kristi Geris on July 23, 2013.

Keller said the sockeye salmon were all small, and similar in size. He said that a recent analysis by Jeff Fryer (Columbia River Inter-Tribal Fish Commission [CRITFC]) indicated a 42% jack rate of sockeye detected at Bonneville for 2013 (also described in an email that was distributed to the Coordinating Committees by Geris on July 25, 2013). Keller said that Fryer's analysis was consistent with staff observing smaller fish in the AWS space—entering through a space too small for larger sockeye and summer Chinook. He added that, because mainly smaller sockeye appeared to have entered the space, fishway staff expected to find a "bow" in the metal vertical vanes that make up the picket-barrier instead of a complete vane missing, as was the case in 2010.

Keller said that the right bank fishway was taken offline July 24 to 25, 2013, and staff identified a bowed vane in the picket-barrier, as suspected. Rock Island Dam engineers and fishway crews riveted a bracket to the bowed picket-vane where the sockeye entered, as seen in a photograph (Attachment B) that was distributed to the Coordinating Committees by Geris on August 5, 2013. Keller said that the picket vanes are made of aluminum, and are not apparently rigid enough under high flow conditions. He added that, while they are firm now, they are fatiguing over time allowing excessive flex during periods of warmer water temperatures. He said that Rock Island Dam engineers are working on a long-term fix in the form of a top-to-bottom replacement of the picket-barrier panels and vanes.

Keller reminded the Coordinating Committees that each year at Rock Island Dam, a comprehensive inspection and overhaul is performed on one of the three fish ladders. He said that, coincidently, this year the overhaul is planned for the right ladder; however, due to the size and scale of the repair, Rock Island Dam engineers say that engineering the fix will take an additional year to plan and install. He said that, this year, Rock Island Dam engineers plan to reinforce the weaker areas, and that the permanent replacement will be implemented during the 2014/2015 winter maintenance outage. Keller noted that the structure to be replaced has multiple panels, and is about 25 feet tall, and in one section, 15 feet wide. He also noted that on July 24, 2013, during the initial dewatering, three adult summer Chinook (two wild and one adipose [ad] fin-clipped) and one adult steelhead were rescued from the upper portion of the adult fishway. He said that, in total, 251 sockeye salmon, 16 summer Chinook, 3 rainbow trout, and a number of resident fish were rescued; and that a total of 31 sockeye mortalities were recovered from the AWS space.

Bryan Nordlund said that, based on a video of the inspection that Chelan PUD provided to the National Marine Fisheries Service (NMFS), it appeared that the picketed panels included steel cross-members and aluminum vanes, which, Nordlund said, differentially expand because of the dissimilar metals, creating tension in the aluminum vanes. He further offered his opinion that a cyclic tension over the years would weaken the softer aluminum vanes. Therefore, Nordlund recommended that Rock Island Dam engineers consider all stainless steel vanes and support structure for the replacement. Nordlund also recommended considering replacing the 1-inch spacing with 5/8-inch spacing that will also prevent lamprey from passing into the AWS space. Steve Hemstrom said that smaller spacing is being considered to the extent that it will not cause hydraulic changes. Nordlund said that the key is keeping the percent open area in the replacement structure nearly the same as the percent open area in the existing structure—then the hydraulics should not change much. He also suggested that a perforated plate would be worth considering as a replacement for the existing system, since it can serve the same purpose as the vanes and still maintain the same surface area. Perforated plate is available in a wide variety of percentage open area, thicknesses, and hole dimensions and geometry. Nordlund offered his assistance to Chelan PUD with the re-design of the AWS diffuser system.

Keller said that directly following the picket vane repair, a failing output bearing was detected on the main shaft of one of three attraction water pumps, also in the right bank adult fishway at Rock Island Dam, as described in an email that was distributed to the Coordinating Committees by Mike Schiewe on August 8, 2013. Keller said that the pump was taken out of service for repair on August 6, 2013, and replacement bearings were ordered. He said that, in the interim, in order to achieve the differential criteria at the right adult fishway entrances with only two pumps operating, one of the right bank tailrace entrances was closed. Keller explained that this entrance is located at the end of the tailrace training wall where the spillway and powerhouse meet. Repairs were complete and the right bank adult fishway returned to normal operation and criteria on August 12, 2013, as described in an email that was distributed to the Coordinating Committees by Geris that same day. Keller said that replacement bearings will now be stocked at the facility in case similar repairs are needed.

B. Rocky Reach Adult Fishway – Request for Earlier End-of-season Outage For Maintenance (December 2013) (Lance Keller)

Lance Keller recalled that last year, Chelan PUD requested an earlier than usual winter maintenance outage date at Rocky Reach Dam in order to repair a cracked rotor in Turbine Unit 1 (C1). The purpose of the change was to ensure Chelan PUD could return the unit back to service prior to the 2013 spring outmigration. Keller said that this year, Turbine Unit 2 (C2) is in need of the same repair. Additionally, he said that Turbine Unit 10 (C10) is completely offline due to internal hydraulic issues that caused an adjustment of the blade, which in turn resulted in the unit shutting down because it could not stay in sync. Turbine Unit 6 (C6) is also down for rotor repair, which followed the Turbine Unit 5 (C5) outage. Keller said that once C6 is back online, work can start on C2. He said that work on C2 should be complete by the end of April 2014; however, in order to allow enough time to complete this work, Rocky Reach staff have requested starting the winter maintenance period on December 2, 2013, instead of the usual January 2 start date. Keller reminded the Committees that the C1 outage performed in the last maintenance period, for the same repairs, lasted from the beginning of the year until April 22, 2013. He added that the maintenance period for fishways typically ends March 1— so, the requested 2013/2014 fishway maintenance period for C2 would start December 2, 2013, and end March 1, 2014.

Steve Hemstrom indicated that there tend to be few adult fish passing the dam during the winter months because the water is so cold, but acknowledged that empirical data is lacking. Jim Craig said that most coho and steelhead numbers decrease by mid-November. Bryan Nordlund said that he is less concerned about passage in December, but suggested that there may be a benefit to re-opening the ladder by early February because listed steelhead may be migrating to tributary streams after wintering in reservoirs. Hemstrom said that routine ladder maintenance also needs to occur, which typically takes until March 1. He said, however, that he will evaluate the potential to complete the 2013/2014 winter maintenance on the Rocky Reach Right Fishway Ladder prior to the usual March 1 deadline. He also said that he will compile any existing data on fish passage at Rocky Reach Dam during the "off-season" winter months, and he will evaluate the potential to extend fish counts at Rocky Reach Dam into the off-season winter months, starting winter 2014/2015.

Coordinating Committees representatives present agreed to Chelan PUD's proposal to extend the Rocky Reach Dam 2013/2014 winter maintenance work outage by one month, changing from a beginning date of January 2, 2014, to a beginning date of December 2, 2013, to allow more time to complete required work.

C. Rock Island and Rocky Reach Draft 2013 Fish Spill Report (Steve Hemstrom)

Steve Hemstrom reviewed Chelan PUD's 2013 HCP Preliminary Rocky Reach and Rock Island Fish Spill Report (Attachment C) that was distributed to the Coordinating Committees by Kristi Geris on August 26, 2013. Teresa Scott asked how the cumulative index count is calculated, and Hemstrom explained that the count starts when the first subyearling Chinook is identified passing the dam, and ends on August 31 when the bypass operation ends. He noted spill ends when 95% of the run is estimated to have passed. Scott asked about involuntary spill at Rock Island and Rocky Reach, and also if spill records differentiate between types of spill (i.e., required spill, voluntary spill, involuntary spill, etc.). Hemstrom said that spill types can be differentiated using the known spill percentage (i.e., 9% at Rocky Reach for summer spill) the day-average total river flow and the day-average total spill flow shown on the Data Access in Real Time (DART) website.

Hemstrom reviewed Tables 1 and 2 on page 2 of Attachment C. Bob Rose asked if there were any correlations between adult returns and smolt monitoring index numbers, and Hemstrom replied that he was unaware of any such relationship. He added that Chelan PUD has not calculated predictive smolt to adult survival ratios (SARs) based on fish sampled. Bryan Nordlund noted the almost 50% reduction in juvenile steelhead counts from the Rocky Reach bypass, and asked if the recalculation of hatchery program sizes might be the cause. Mike Schiewe replied that the recalculated release numbers will be in effect starting in 2014, and added that 2013 was the first year of brood collection for the recalculated programs. Nordlund asked if the Rocky Reach Juvenile Fish Bypass Surface Collector (RRJFB SC) was operating regularly throughout the entire 2013 spill season. Hemstrom said that the bypass started April 1, 2013, and that the RRJFB SC was not fully operational until April 21, 2013; he added that this fact may have affected the counts as well. Keller said that, according to DART, the first steelhead was detected at Rocky Reach on April 3, 2013, and double-digit numbers were not detected until late-April, which implies that the RRJFB SC outage was likely not a major driver for the lower steelhead counts.

Hemstrom said that Chelan PUD will finalize the Rock Island and Rocky Reach Draft 2013 Fish Spill Report, and provide the final report to Geris for distribution to the Coordinating Committees.

D. Valid Study Flow Duration Curve Preparation (Steve Hemstrom)

Steve Hemstrom said that he recently received the 1929-1978 Bonneville Power Administration (BPA) model dataset from NMFS that was used to develop the existing Valid Study Flow Duration Curve. Hemstrom reminded the Coordinating Committees that the existing curve was calculated using both the 1929-1978 BPA model dataset and empirical data from 1983 to 2001. He said that he has not yet updated the curve, but plans to provide an updated flow duration curve for valid survival studies using the 1929-1978 dataset to which the 1983-2012 dataset is added, and for comparison, also using only the 1983-2012 dataset. He noted, however, the uncertainty surrounding potential changes in Canadian water storage and the Columbia River Treaty. Bryan Nordlund suggested the value of recalculating the curve after terms of the Columbia River Treaty are settled. Hemstrom said that the curve only needs updating every 10 years; and Nordlund replied that it was his understanding that the curve could be adjusted at any time in the event that existing conditions change. Teresa Scott asked about data from 1979 to 1982, and Hemstrom replied that data were not recorded for those years. He said that this absence of data was also noted in the HCPs.

Hemstrom said that he will provide the updated flow duration curves to Kristi Geris for distribution to the Coordinating Committees no later than the September 24, 2013 meeting. *(Note: Hemstrom will also include data from the month of June in the summer study period in both updated flow duration curves, as agreed to at the Coordinating Committees conference call on July 23, 2013.)*

E. Chelan County Noxious Weed Board Plan for Application of Milfoil Control Chemical in Rocky Reach (Steve Hemstrom)

Steve Hemstrom said that, as discussed at the Coordinating Committees' meeting on June 25, 2013, Chelan PUD submitted a comment letter to the Chelan County Noxious Weed Board (the Weed Board) regarding their Integrated Aquatic Vegetation Management Plan (IAVMP) and, specifically, regarding the proposed pilot application of Triclopyr triethylamine (TEA) near the mouth of the Entiat River. Hemstrom said that the purpose of Chelan PUD's letter was to relay concerns from Chelan PUD and the HCP Coordinating Committees, and facilitate continuing discussion regarding the possible effects of Triclopyr TEA. He reminded the Coordinating Committees that the IAVMP cited a NMFS Biological Opinion (BiOp) that addressed Triclopyr butoxyethyl ester (BEE)—not Triclopyr TEA; and that Chelan PUD is recommending due diligence for the application of Triclopyr TEA. Hemstrom said that during a joint call attended by Chelan PUD, Washington State Department of Ecology (Ecology), and the Weed Board regarding Chelan PUD's comment letter, the Weed Board showed lack of interest to address additional questions or comments on the IAVMP, or on the proposed use of Triclopyr TEA. Hemstrom said that the proposed application date for the herbicide is fall 2014. He said that Chelan PUD is concerned by the Weed Board's lack of response to their concerns.

Teresa Scott asked if consultation with NMFS and the U.S. Fish and Wildlife Service (USFWS) is required, and Bryan Nordlund replied that he is looking into that. He explained that with herbicides, there are nationwide consultations; and added that the U.S.

Environmental Protection Agency (USEPA) and NMFS have been in disagreement regarding the regulation of pesticides. Nordlund said that he agrees there needs to be consultation, but how it gets done is another question. He added that he would discuss an "advisement letter," with a NMFS fish toxicologist stationed in his office (but assigned to NMFS nationally) as an interim measure preceding completion of consultation with USEPA, but ultimately the decisions on pesticide consultation will be made at the national level. Scott said that she contacted regional staff at the Washington Department of Fish and Wildlife (WDFW), and was told that whatever they had the power to do has been done. Mike Schiewe said that there must be a federal nexus for a Section 7 consultation to be required, and that Chelan County apparently does not have that nexus. He suggested that USEPA probably approved the use of Triclopyr TEA, and he is unsure that there is anything further that the Coordinating Committees can do at the Chelan County level.

III. Douglas PUD

A. Wells Dam Fish Counts Update (Tom Kahler)

Tom Kahler said that Wells Dam fish counts are still behind. He said that it is impractical to hire another counter since a new relief counter is currently being trained, and the 2012 relief counter is now full time. He said that the number of fish passing the dam has decreased, so counts are catching up. He said that there have been issues with similar sized fish of multiple species (minijack Chinook, jack sockeye, and resident species) repeatedly passing back and forth through the count window, which requires additional time to sort through which fish need to be counted and which can be ignored. Bryan Nordlund suggested that this behavior might be related to passage conditions caused by the recent count window diffuser modifications. Kahler said he did not know, and that next year Douglas PUD plans to have two relief counters, as well as different video and lighting systems. Lance Keller noted that Chelan PUD is also slightly behind on fish counts due to restrictions on overtime.

B. Wells Dam Bypass Operations Update (Tom Kahler)

Tom Kahler said that Wells Dam bypass operations concluded on August 19, 2013, at midnight, as described in an email distributed to the Coordinating Committees by Kristi Geris that same day.

C. Subyearling Study Update (Tom Kahler)

Tom Kahler said that there have been 3,280 detections of subyearling Chinook so far this year. He said that the total tagged this year was about 17,000 fish. Kahler reviewed counts at different detection locations, and noted that subyearlings are still being detected at Rocky Reach, with 1,975 detections to date. Kahler said that monitoring will continue, and he added that he has not yet had a chance to begin analyzing these data. Steve Hemstrom asked about mean travel times, and Kahler replied that he will distribute details on mean travel times following the meeting. *(Note: Kahler provided a brief summary of mean travel times to Kristi Geris on August 28, 2013, which she distributed to the Coordinating Committees the same day.)*

D. Fisheries and Oceans Canada Report – Effectiveness of the Fish Water Management Tool as No Net Impact Compensation Vehicle (Tom Kahler)

Tom Kahler said that Dr. Kim Hyatt is planning to develop his report on the Fish Water Management Tool (FWMT) into three peer-reviewed journal articles. Kahler said that the first article, which he has already reviewed, focuses on the modeling and how it addresses noncompliance with the Okanagan Basin Agreement, and the next two articles will describe the weight of evidence supporting the benefits of the FWMT, as Hyatt presented to the Priest Rapids Coordinating Committee Hatchery Subcommittee (PRCC HSC) and HCP Hatchery Committees at their combined session on August 22, 2013. Kahler said that preparations of the papers are behind schedule, and they will not likely be available until the end year.

E. 2013 Adult Lamprey Passage and Enumeration Study Update (Tom Kahler)

Tom Kahler said that the Yakama Nation (YN) provided lamprey for the study, and that 101 lamprey were passive integrated transponder (PIT)-tagged and radio-tagged, and an additional 5 lamprey were PIT-tagged only. He said that 9 PIT-tagged and radio-tagged lamprey were released directly into each ladder (18 total), and he added that fish released in the ladders have all been detected by the upper ladder detection arrays. He said that, due to delays in reporting counts (see Item III-A), up-to-date total lamprey counts are not available; but he did report that 17 lamprey have been counted at the window as of August 17, 2013. Kahler said that the fish released below the dam do not appear to be approaching the dam, and they appear to be dropping further downstream of the release location. He said that, to date, there are insufficient data collected to determine fishway entrance efficiency. Lance Keller asked where lamprey were released downstream of the dam, and Kahler replied that 83 lamprey were released at the downstream end of Carpenter Island, about 1.5 miles downstream of the dam. Mike Schiewe said that Douglas PUD plans to have preliminary results available by fall 2013, and that a final report, prepared with LGL Limited Environmental Research Associates, will be available by spring 2014.

F. Review of the HCP Coordinating Committees' Chairperson (Tom Kahler)

Tom Kahler said that the review of the HCP Coordinating Committees' Chairperson, Mike Schiewe, and supporting staff, Kristi Geris, was positive. He added that the Coordinating Committees also acknowledged other Anchor QEA staff who have helped support the HCP Coordinating Committees throughout the years. He said that the only suggestion was to coordinate more with Denny Rohr and the PRCC HSC to synchronize discussion items of mutual interest.

IV. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees' meeting on August 20, 2013:

- *2013 General Salmon Habitat Program Proposals*: The Tributary Committees completed their review of proposals received for the General Salmon Habitat Program, and tentatively approved funding for seven projects; all of which were partial funding requests. The Cascade Columbia Fisheries Enhancement Group (CCFEG) submitted four of nine proposals received—three were funded. The Chelan County Natural Resource Department (CCNRD) submitted two of nine proposals received—one was funded. The remaining proposals received and funded were from Chelan-Douglas Land Trust (CDLT), Okanogan Conservation District (OCD), and Trout Unlimited – Washington Water Project (TU-WWP). Total Tributary Committees contributions equaled $1.12 million. Current Tributary Committees balances include $4 million in the Rock Island fund, $1.6 million in the Rocky Reach fund, and $1.5 million in the Wells fund. Bryan Nordlund asked why CCNRD's Icicle-Peshastin Irrigation District Pump Exchange was not funded, and Tom Kahler replied that there were numerous issues, including a lower-cost competing proposal.

- *Contract Extension Request*: The Rock Island Tributary Committee approved a contract extension request from the CCNRD on the Wenatchee Levee Removal and Riparian Restoration Project.
- *Review of the Tributary Committees Chairperson*: The Tributary Committees agreed unanimously to retain Tracy Hillman as the Chairperson for the next 3-year period.
- *Upper Columbia Salmon Recovery Board Request*: The Tributary Committees elected to contribute $3,000 ($1,000 from each of the administrative allowances) of the Plan Species Accounts to help sponsor the 2013 Upper Columbia Science Conference on November 13 and 14, 2013.

Schiewe said that, this month, the Hatchery Committees held a three-part meeting beginning with their regular monthly meeting on the morning of August 21, 2013, which was held at Douglas PUD. He said that the afternoon was dedicated to a presentation by Douglas PUD and HDR Engineering, Inc. (HDR) on the modernization of Wells Hatchery. Schiewe said that the Hatchery Committees reviewed the Wells Hatchery Modernization Master Plan, and had requested a presentation by HDR. He said that, in general, discussions were well-received, and that another opportunity for the Hatchery Committees to provide input will be at the 30% design stage. Lastly, on the morning of August 22, 2013, the Hatchery Committees met in a joint session with the PRCC HSC to receive an update on sockeye programs presented by the Okanagan Nations Alliance (ONA) and Fisheries and Oceans Canada (DFO). Schiewe said that Dr. Kim Hyatt's presentation was similar to what was presented to the Coordinating Committees at their meeting on August 28, 2012. He said ONA staff reported that construction has started on the new Kl cp'elk' stim Fish Hatchery in Penticton, British Columbia; the plan is to begin rearing sockeye in fall 2014. He added that production is expected to be about 5 million fry at the facility. Schiewe then updated the Coordinating Committees on the following actions and discussions that occurred at the Hatchery Committees' meeting on the morning of August 21, 2013:

- *Hatchery Genetic and Management Plan (HGMP) Update*: NMFS is now focusing on processing all permits for the Mid- and Upper-Columbia. In the Okanogan, designation of spring Chinook as a Section 10(j) experimental population has been delayed. The goal after designation is to move juveniles from Winthrop to Chief Joseph Hatchery (CJH) for grow out and for release in the Okanogan. This designation was expected to be completed this year, but the deadline was not met. As a result, Winthrop National Fish Hatchery (NFH) will release 100,000 to 150,000 subyearling spring Chinook in the Methow this fall to get under capacity. The permitting for the 10(j) designation is now expected to be completed by mid-March 2014. The Okanogan steelhead HGMP and Biological Assessment (BA) for the Section 10 permits are expected to be completed by January 20, 2014. In the Methow, most issues have been settled among *U.S. v. Oregon* parties. They are moving forward with a single BiOp for spring Chinook and steelhead, which is expected to be complete in January 2014. Douglas PUD noted that the current Methow steelhead Section 10 permit expires October 2, 2013, and expressed concern that they will endure a period of not being permitted. It was suggested that if formal consultation is already underway, the program is still covered under the existing permit. NMFS is being asked to provide a letter confirming that this is true. In the Wenatchee, everything is on track to finish by October 22, 2013. A single BiOp will be submitted for steelhead and Chinook, and bull trout consultations are on schedule with USFWS.

- *Hatchery Monitoring and Evaluation (M&E) Appendices – Meeting of the PUDs*: Greg Mackey agreed to develop draft tables for inclusion in the Hatchery M&E Plan Appendices, for Hatchery Committee review.
- *Hatchery M&E Update*: Chelan PUD announced that they received one full proposal in response to the Chelan PUD Hatchery M&E RFP. It is unlikely that they will convene a review panel, as previously discussed. They plan to have an Implementation Plan ready for Hatchery Committees' review no later than October 2013.
- *Methow Spring Chinook HGMP Update*: Chelan PUD's 2015 release plan includes collecting 2013 broodstock at Winthrop, rearing at Eastbank, overwintering at Carlton, and likely co-acclimating with coho at Chewuch Pond. Chelan PUD is developing a HGMP for that program, which will soon be available for Hatchery Committees' review.
- *Live Spawning Twisp River Steelhead Broodstock*: The YN provided an update on their Steelhead Kelt Reconditioning Program. They are working through fish health concerns, and are discussing potentially moving the program from Winthrop NFH to the Methow Fish Hatchery, or possibility to Wells Hatchery. Current funding ends in

2017, and Keely Murdoch indicated that continued funding will likely depend on the success of the program.

- *Chief Joseph Hatchery Brood Collection*: The Colville Confederated Tribes (CCT) reported that spring Chinook broodstock was successfully transferred from Leavenworth NFH to CJH, and that they anticipate meeting full summer Chinook brood for natural and hatchery stocks (i.e., 60% of 700,000). The CCT also reported security issues at CJH which resulted in the theft of 42 brood; purse seine collections in the following days were successful in collecting replacement fish.

V. HCP Committees Administration (Mike Schiewe)

A. Next Meetings

The next scheduled Coordinating Committees meeting is September 24, 2013, to be held in person at the Radisson Hotel in SeaTac, Washington. The meetings on October 22, 2013, and November 26, 2013, will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

VI. Fish Passage Center

A. Comparative Survival Study: Introduction and Snake River Basin Results (Jack Tuomikoski)

Mike Schiewe welcomed the Fish Passage Center (FPC) and PRCC HSC. Jack Tuomikoski (FPC) presented an introduction to the Comparative Survival Study (CSS), reviewed Snake River Basin Results, as included in the 2012 CSS Report, and provided an overview of recent CSS workshops. Tuomikoski's presentation (Attachment D) was distributed to the Coordinating Committees by Kristi Geris on August 28, 2013.

<u>Introduction</u>

Tuomikoski said that the CSS was initiated in 1996 by states, tribes, and USFWS to estimate survival of selected life stages of Chinook salmon and steelhead in the Snake and Columbia rivers. He said that the study uses PIT-tag detection data, and that data used are from fish tagged specifically for the CSS, and also from other studies. Tuomikoski said that, since its inception, the CSS project has been independently reviewed and modified a number of times, including reviews by the Independent Scientific Advisory Board (ISAB) and the Independent Scientific Review Panel (ISRP). Tuomikoski reviewed the temporal and spatial coverage of the CSS, noting that the Snake River Basin has been monitored for more than 18 years and has many more CSS tag and release sites than the Mid- and Upper Columbia; and, therefore, much more is known about stocks in the Snake River Basin than in the Columbia basins (in terms of the CSS). Tuomikoski said that smolt survival estimates developed under the CSS inform understanding of the effectiveness of rearing habitat actions and hydrosystem actions; and adult success in the CSS informs understanding of harvest management, hydrosystem actions, estuary habitat actions, and transportation effects. He said that Snake River SARs in the CSS are calculated from Lower Granite Dam while Mid- and Upper Columbia SARs are calculated from McNary Dam. Tuomikoski said that the CSS provides the region with long-term indices and comparisons of SARs, as well as addressing management questions related to hydropower operations, and hatchery and habitat evaluations.

Snake River Basin 2012 CSS Report

Tuomikoski reviewed Snake River Chinook and steelhead SARs. He noted the high correlation between hatchery and wild Chinook SARs, which, he said, indicated that hatchery and wild Chinook seem to be responding similarly. He reviewed juvenile survival results, including the results of finer-scale analyses, as requested by ISAB. Consistencies included faster emigration and lower mortality when water transit time is reduced and spill levels are high; for steelhead, a correlation between increased surface passage structures and decreased fish travel times; and increases in mortality rates over the season. Tuomikoski reviewed Snake River transport-to-in-river survival ratios (TIR), which, he said, were used to evaluate transportation programs for Snake River stocks. He said that results indicate that as in-river survival increases, TIR decreases, and he added that, on average, the success rate for transported fish was 90% of that for their in-river counter parts. Steve Parker asked how the CSS defines "straying," and Tuomikoski replied that because the CSS is based on PIT-tag data within each sub-basin, a stray is considered any fish that enters and does not leave the system. He said, however, that this does not account for such factors as recreational harvest. Tuomikoski said that data regarding age at maturity for spring and summer Chinook were developed as monitoring tools and to inform harvest management. He said that results indicated that age at maturity and jack percentage of Chinook in the Snake River and Mid- and Upper Columbia basins were influenced by both stock and year factors.

Recent Workshops

Tuomikoski summarized discussions from CSS workshops that were held in 2011 and 2013. He said that, in 2011, the workshop focused on determining the relative importance of various factors in determining salmon and steelhead survival rates. Factors discussed included Federal Columbia River Power System (FCRPS) operations, freshwater and ocean conditions, and fish attributes. The workshop also focused on building tools that evaluate and optimize FCRPS operations to meet Northwest Power and Conservation Council (NPCC) SAR objectives. Key findings included multiple lines of evidence indicating the existence of delayed hydrosystem mortality; freshwater and marine survival increases with increased water velocity, increased spill, and lower percent transported; and the fact that the current FCRPS configuration results in a limited ability to increase water velocity. Notwithstanding this latter limitation, there is the opportunity to further manage spill combined with surface passage to reduce powerhouse passages.

Tuomikoski said that the 2013 CSS Workshop focused on the review of a draft design for a management experiment to increase the amount of voluntary spill at FCRPS projects, as well as on recommendations to strengthen the proposed experiment. Tuomikoski reviewed the experimental design, spill scenarios and objectives, and prospective tools. He said that models that have been fit to the empirical data will be used to generate the distribution of SARs for a range of river and ocean conditions and two spill scenarios; and then distributions will be summarized relative to desired goals. He said that the projections suggest that spill of 115/120% total dissolved gas (TDG), or higher, would reduce the risk of very low SARs (less than 1.0%), and increase the likelihood of SARs greater than 2.0%.

Russell Langshaw questioned only using increased spill amounts in the experimental design, and suggested also including reduced spill amounts in order to refine the models. Michele DeHart replied that, in recent years, there have not been many low spill years, and that the purpose of the experiment would be to reflect what is currently happening. She added that this is a monitoring program for a lifecycle study, and it is not meant to be a study about flows.

B. Comparative Survival Study: SARs and Juvenile Metrics of Upper Columbia Stocks (Robin Ehlke)

Robin Ehlke (WDFW) reviewed SARs and Juvenile Metrics of Upper Columbia Stocks, as included in the 2012 CSS Report. Ehlke's presentation (Attachment E) was distributed to the Coordinating Committees by Kristi Geris on August 28, 2013. Ehlke reviewed the CSS objectives for Upper Columbia stocks, and noted their similarity to CSS objectives for Snake River stocks. She described the Upper Columbia mark groups, which include a Wenatchee Basin group, an Entiat-Methow aggregate, a Wenatchee-Entiat-Methow aggregate, and three groups marked at Rock Island Dam. She also reviewed a map depicting CSS tag and release sites in the Upper Columbia River Basin. Ehlke reviewed Upper Columbia juvenile and adult metrics. She noted that Upper Columbia McNary to Bonneville SARs, as calculated for the CSS, do not include or account for juvenile mortality occurring through the Upper Columbia to McNary Dam; and therefore, these SARs are biased high. She reviewed Rock Island to McNary juvenile survival, noting that survival for steelhead was slightly higher than for Chinook. She also reviewed Rock Island to McNary juvenile passage metrics and environmental conditions, again noting the similarities to Snake River stocks. Findings included decreased fish travel time with increased flow and with Julian date; decreased instantaneous mortality for Chinook with increased spill levels at Wanapum and Priest Rapids, and increased instantaneous mortality for steelhead with increase in Julian date; and increased reach survival with increased flow and spill. Ehlke reviewed graphs depicting wild and hatchery Chinook McNary to Bonneville SARs, wild and hatchery steelhead McNary to Bonneville SARs, and wild and hatchery Chinook and steelhead Rock Island to Bonneville SARs. Results indicated that overall Upper Columbia McNary to Bonneville SARs for 2000 to 2010 Chinook were highly correlated with spring Chinook SARs from the Mid-Columbia and with spring/summer Chinook SARs from the Snake River. Steve Parker noted that in the graphs depicting wild and hatchery Chinook and steelhead McNary to Bonneville SARs, the average SARs for wild and hatchery stocks are not on the same time series, which gives the impression that hatchery stocks are not faring as well. Ehlke said that, over time, the averages are still similar. She added, however, that the graphs will be revised to be on the same time series to avoid confusion. Ehlke reviewed graphs comparing Upper Columbia stocks with Snake River stocks, and she noted that those data indicate that SARs in the Upper Columbia are generally lower than in the Snake. Lastly, Ehlke reviewed conclusions, specifically noting that increases in the numbers of mark groups and detection sites would strengthen the data.

C. Comparative Survival Study: Discussion (All)

Jack Tuomikoski said that data for the Mid- and Upper Columbia Basins are based on about 4,000 to 5,000 PIT tags, which, Robin Ehlke added, is a small sample size compared to the Snake River Basin. Michele DeHart also added that any increase in PIT tag data in the Mid- and Upper Columbia Basins would help analyses in those basins.

Tom Kahler questioned the way stocks with different SARs were compared in the Mid- and Upper Columbia River and Snake River basins, and Ehlke replied that increased marked groups will improve the accuracy of those comparisons. Kahler asked which release group was numerically dominant in the SARs calculations, and Tuomikoski replied that Leavenworth was, with 15,000 detections per year. Russell Langshaw questioned the accuracy of the reported hatchery M&E SARs, noting that he believes those values should be higher. DeHart said that those values can always be re-evaluated. She said that the analyses are based on PIT tag data that were retrieved from the PIT Tag Information System (PTAGIS), and she added that additional data can be folded into the analyses, if available. Kahler noted that SARs for USFWS hatchery fish are already inherently low, and that increasing the mark rate of those fish will only exacerbate lower SARs. DeHart reminded Kahler that the CSS is a monitoring program, and that the purpose is to reflect what is actually happening. She said that if Leavenworth plays a significant role in low SARS, then that needs to be reflected. Mike Schiewe suggested developing Leavenworth-only SARs. DeHart said that, ultimately, she hopes to have enough data to separate all stocks. She said that the only reason for aggregate stocks is because, currently, there are not enough PIT tags.

Steve Parker noted the similarities in increased SARs for Columbia River and Snake River steelhead in 2008; and DeHart recalled that 2008 was a high flow and high spill year, as well as a good ocean year. Parker then noted the distinct split in reach survival for Columbia River and Snake River steelhead in 2008, which, he noted, did not make sense when considered with the similar increased SARs in 2008. DeHart explained that the information in the Snake River Basin is more developed compared to that in the Columbia River Basin, largely due to the low number of tags in the Columbia River Basin.

Steve Hemstrom noted that high uncontrolled spill years, notably 2008, 2011, and 2012, were not consistently reflected in all graphs. DeHart said that this discrepancy could be due to other factors such as high TDG years and wind power-related issues. Kirk Dodson said that high TDG years also did not seem to be consistently reflected in the graphs. DeHart said that the focus in the Upper Columbia has been on the past 3 years, and that those data may not have been incorporated yet.

DeHart reminded everyone that survival data can be found on the FPC website, and that those data can be used to see how hatchery SARs are calculated.

Bob Rose asked what it would take to go from a monitoring program to the proposed experiment to test increased spill levels, and he asked what the ideal number of fish would be to test these variables. DeHart said that the FPC is currently working with ESSA Technologies Ltd. to assess how large the mark group would have to be. She said that the experiment is a work in progress, and that elements such as representative mark group sizes and duration are yet to be determined.

Bill Tweit said that the CSS appears to evaluate project survival differently than the HCPs, and he asked if there were plans to compare the seemingly different assessments. Hemstrom said that, in terms of a tagging comparison, because the CSS is based on PIT-tag data only, and the HCPs are based on both PIT-tag and acoustic tag data, the two are not comparable due to the substantial differences in tagging methods. Erin Cooper suggested that, because the rejection rate for acoustic tags is much higher for reasons such as size and disease, only the largest, healthiest fish are tagged. She said that PIT-tagged fish are more representative of the run, and also include fish that would be included in an acoustic study, while the reverse is not true. Tweit said that the limitations of acoustic tag studies have been recognized, and that a lot of work has been done to account for those biases. Cooper noted that acoustic tag studies are also limited range studies, and therefore, are not representative of the ocean. DeHart said that acoustic tags are used for project survival, and the CSS informs the entire life cycle, so they cannot be readily compared. She added that, initially, performance standards at projects were based on the premise that ocean survival and project survival were independent of each other; however, she said, this premise has been found to be untrue. She said that, for this reason, the entire life cycle needs to be considered. Kahler noted that HCP survival studies are paired-release studies, and the CSS releases are not; additionally, Douglas PUD's PIT-tag-based survival studies account for tag shed and tagging mortalities, whereas for most of the fish used in the CSS analyses, tag shed and tagging mortalities are not accounted for. Participants acknowledged the inappropriateness of comparisons between HCP survival study results and CSS reach survival results.

Langshaw asked how hydrosystem-related mortalities are separated from freshwater conditions. Tuomikoski said that several factors affect juvenile survival, which are evaluated when they come back as adults. He said that often the factors are spill and flow. DeHart said that those analyses have been run on Snake River fish, as described in the 2012 CSS Report. Langshaw said that he read the 2012 CSS Report but did not see how the two were separated out. DeHart said that analyses are different, year to year, based on specific requests; and Langshaw suggested that these types of details should be a regular feature included in the annual reports.

Langshaw noted that the CSS emphasizes the importance of spill and water transit time; however, transport results are not very strong. He also asked why survival is so low, if the relationship between freshwater and the ocean is strong. DeHart said that low survival is due to delayed mortality with transported fish. She added that a recent analysis indicates delayed mortality through hydro passage. Tweit suggested that transport still makes sense when in-river conditions are poor.

Patrick Wyena Sr. asked if predation was accounted for in the CSS when calculating powerhouse mortalities, and DeHart replied that all reach analyses incorporate mortalities by predation. Tuomikoski said that, because the CSS evaluates overall survival, predation is not individually parsed out. DeHart added that individual predation data can be incorporated into CSS models if there is interest in looking at those data. Hemstrom suggested incorporating the Rock Island avian data.

Bryan Nordlund asked how well the CSS reflects the run at large. DeHart said that she believes there are sufficient data for the Snake River, but suggested that data could be greatly improved in the Mid- and Upper Columbia River basins. Nordlund replied that he was thinking more in terms of, incrementally, how hatchery and wild stocks are evaluated, and he added that he believes evaluations can be fine-tuned. He said that, for example, if Leavenworth production affects the run at large, but only 1 or 2 Leavenworth fish are detected at Rock Island, and the other fish are coming from other tributaries, they are not equally weighted. DeHart said that the only way to improve that is to increase marking.

Parker said that a comparison of SARs in the Snake and Upper Columbia may just reflect differences in SARs in hatchery and wild fish, as Kahler noted earlier. He added that these differences may incorrectly imply differences in hydropower systems or in hatchery versus wild fish. DeHart said that obtaining wild fish data is a more difficult process, and she added that the FPC worked with Idaho Fish and Game to improve wild data in the Snake River Basin by installing several traps in the area.

Parker asked if there are enough wild fish in the Upper Columbia to estimate reach-specific survival of populations. Tuomikoski said that smolt SARs to the first dam can be obtained; however, there are not enough fish to obtain subsequent survivals. Parker expressed doubt that people will be convinced that hatchery and wild SARs are comparable. He said that the concern is that low SARs in hatchery fish will decrease SARs in aggregate Upper Columbia populations, and he added that he would like to determine if there is a way to calculate SARs without wild fish. DeHart said that the only wild fish marking takes place in the Wenatchee, and she added that there are also some PIT-tagged wild fish in the Entiat and Methow.

Teresa Scott asked if the FPC is asking the PUDs if there is a way to increase tagging; and DeHart replied that the FPC believes that the PUDs know best what is available and what the options are. She added that Parker brought up a good point—is it feasible to tag a large number of wild fish? Tweit suggested combining tag technologies. Parker suggested PIT-tagging enough wild fish to at least calculate reach-specific survivals. He said that this may show a ratio of wild-to-hatchery performance through the system. DeHart said that tagging wild populations in the Snake River would be a huge effort, and that it only gets harder to obtain juvenile survival downstream because of fish mortalities.

Nordlund said that since the inception of the HCPs, he has carefully tracked counts in the Upper Columbia, and adult counts for every species at Priest Rapids Dam, and likely Rock Island, Rocky Reach, and Wells dams as well, have markedly increased; and wondered how those counts reconcile with poor SARs calculated by the CSS study. He said it seems apparent that there are holes somewhere in the SAR estimates. Hemstrom also noted the high sockeye SARs based on Dr. Kim Hyatt's work, and he added that sockeye are the farthest migrating fish in the Upper Columbia.

Kahler asked if a power analysis has been run to determine what sample size is needed for a good SAR estimate, and Tuomikoski replied that 50,000 typically is enough for a robust estimate. Tuomikoski added that what was presented today represented smaller marked sizes, and that 50,000 would provide stronger transport and in-river data.

Denny Rohr thanked the HCP Coordinating Committees for hosting the FPC presentation, and thanked everyone for participating.

List of Attachments

Attachment A	List of Attendees
Attachment B	Photograph of the Repaired Rock Island Dam Right Bank Auxiliary Water System and Fishway
Attachment C	Chelan PUD's 2013 HCP Preliminary Rocky Reach and Rock Island Fish Spill Report
Attachment D	Comparative Survival Study: Introduction and Snake River Basin Results
Attachment E	SARs and Juvenile Metrics of Upper Columbia Stocks

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Denny Rohr†	D. Rohr & Associates, Inc.
Michele DeHart†	Fish Passage Center
Jack Tuomikoski†	Fish Passage Center
Erin Cooper†	Fish Passage Center
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Tom Kahler*	Douglas PUD
Curt Dotson†	Grant PUD
Russell Langshaw†	Grant PUD
Tom Dresser†	Grant PUD
Bob Rose*	Yakama Nation
Steve Parker†	Yakama Nation
Patrick Wyena Sr.†	Wanapum Elder
Bryan Nordlund*	National Marine Fisheries Service
Scott Carlon†	National Marine Fisheries Service
Jim Craig*	U.S. Fish and Wildlife Service
Teresa Scott*	Washington Department of Fish and Wildlife
Robin Ehlke†	Washington Department of Fish and Wildlife
Bill Tweit†	Washington Department of Fish and Wildlife

Notes:
* Denotes Coordinating Committees member or alternate
† Joined for the Fish Passage Center Comparative Survival Study Presentation

Attachment B

Chelan PUD
Rocky Reach and Rock Island HCPs
Preliminary Draft 2013 Fish Spill Report

2013 ROCKY REACH

Rocky Reach Summer Spill

Target species:	Subyearling Chinook
Spill target percentage:	9% of day average river flow
Spill start date:	5 June, 0001 hrs
Spill stop date:	21 August, 2400 hrs
Percent of run with spill:	97.1% (est. on 8/26 for 8/21)
Cumulative index count:	22,034 subyearling Chinook (as of 26 August)
Summer spill percentage:	11.73% (9% plus 2.74% forced spill 5 June – 21 August)
Avg river flow at RR:	153,805 cfs (5 June - 21 August)
Avg spill rate at RR:	18,044 cfs (5 June - 21 August)
Number of spill days:	78

2013 ROCK ISLAND

Rock Island Spring Spill

Target species:	Yearling Chinook, steelhead, sockeye
Spill target percentage:	10% of day average river flow
Spill start date:	17 April, 0001 hrs
Spill stop date:	4 June, 2400 hrs (immediate increase to 20% summer spill)
Percent of run with spill:	**Yearling Chin 98.25%; steelhead 98.23%; sockeye 98.81%**
Cumulative index count:	28,324 Yearling Chins**;** 15,099 Steelhead**;** 25,111 sockeye
Spring spill percentage:	**12.51%** (10% plus 2.51% forced spill 17 April – 4 June)
Avg river flow at RI:	175,634 cfs (17 April - 4 June)
Avg spill flow at RI:	21,977 cfs (17 April - 4 June)
Total spill days:	49

Rock Island Summer Spill

Target species:	Subyearling Chinook
Spill target percentage:	20% of day average river flow
Spill start date:	5 June, 0001 hrs
Spill stop date:	18 August, 2400 hrs
Percent of run with spill:	**Subyearling Chinook 97.21%** (est. on 8/26 for 8/18)
Cumulative index count:	17,107 subyearling Chinook (as of 8/26)
Summer spill percentage**:**	**20.0%** (5 June- 18 August)
Avg river flow at RI:	158,962 cfs (5 June - 18 August)
Avg spill flow at RI:	31,734 cfs (5 June - 18 August)
Total spill days:	75

Juvenile Index Counts 2003-2013 from the Rocky Reach Juvenile Fish Bypass and Rock Island Bypass Trap, Smolt Monitoring Program (SMP) 1 April – 31 August.

Table 1. Rocky Reach Juvenile Bypass index sample counts, 2003-2013

Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sockeye	71,683	30,935	17,575	239,185	169,937	136,206	40,758	724,394	67,879	384,224	199,497
Steelhd	10,585	6,433	5,821	4,329	4,532	8,721	6,309	4,931	5,683	4,902	2,528
Yearling Chinook	13,918	53,946	27,611	23,461	18,080	38,394	18,946	33,840	24,400	95,207	29,018
Subyrlng Chinook	172,392	20,062	10,978	19,996	13,496	11,820	11,944	59,751	17,246	5,774	22,034*

* Count Not Complete

Table 2. Rock Island Smolt Monitoring Program index sample counts, 2003-2013

Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sockeye	10,312	7,114	1,991	34,604	16,410	38,965	4,926	37,404	18,697	46,788	25,111
Steelhead	15,507	10,735	15,974	26,930	18,482	22,780	17,636	17,194	28,408	16,957	15,099
Yearling Chinook	15,355	12,574	14,797	37,267	23,714	22,562	9,225	11,802	26,407	25,759	28,324
Subyrlng Chinook	25,916	23,563	18,710	27,106	15,686	15,940	8,189	23,205	27,397	27,298	17,107*

* Count Not Complete

Attachment D

Comparative Survival Study

Introduction and Snake River Basin Results

Jack Tuomikoski

27th Aug, 2013

- **Introduction to CSS**

- **Snake River Basin Results**
    - 2012 report
    - Recent Workshops Summary

- **Upper Columbia Results (Robin)**
    - 2012 report

Background

- **Initiated in 1996 by states, tribes & USFWS to estimate survival rates at various life stages**
  - **Designed to assess** hydrosystem operations on state, tribal, and federal fish hatcheries and LSRCP
  - **PATH:** "can transportation . . . compensate for the effect of the hydrosystem?"
  - **NPCC** has established the need to collect annual migration characteristics including survival
  - **NOAA biological opinions** require research, monitoring and evaluation

Background

- **Management-oriented large scale monitoring**
  - Observational study
  - Aligned with basin wide monitoring needs (RME)

- **GOALS**

1. Quantify the efficacy of transportation

   ***Develop a more representative control group**

2. Compare survival rates within and across species

3. Establish long term data set

Background

- **CSS data is derived from PIT tags**
  - **Tagged specifically for CSS**
  - **Cooperative marking**

    ***reduce costs/handling, eliminate duplication**
  - **Groups marked specifically for other studies**

Background

- **Collaborative scientific process was implemented for study design and to perform analyses**

- **CSS project independently reviewed and modified a number of times**
  - **Draft report posted – Aug 31st**
  - **ISAB, ISRP and other entities**

History of ISAB/ISRP Reviews of CSS

1997 – **ISAB** First review

1998 – **ISAB** Extend to other species
& life history types (Steelhead)
nonparametric bootstrap approach

2002 – **ISRP** Additional evaluate bootstrap,
compare with likelihood methods,
Monte Carlo simulator evaluation

History of ISAB/ISRP Reviews of CSS

2003 – **ISAB** *Review of flow augmentation*

"understanding of the relation between reach survival, instantaneous mortality, migration speed, and flow"

2006 – **ISAB** *Review of 2005 CSS report*

1) "finer scale analyses of the relationships between survival and specific operational actions or environmental features"

2) Develop a ten year summary report

History of ISAB/ISRP Reviews of CSS

2007 – **ISAB/ISRP** *Review CSS "10-year" report*

1) continue coordination

cost savings/ avoid redundancy

2) Evaluate if PIT tag SARs are less than run reconstruction SARs

2009 – **ISAB** *Tagging Report*

Compare CSS SARs with Run Reconstruction SARs

>2009 **ISAB** *annually reviews CSS reports*

The CSS is a joint project of the state & tribal fishery managers and the USFWS

DESIGN

- WDFW, CRITFC, USFWS, ODFW, IDFG

IMPLEMENTATION & TAGGING

- FPC: Logistics, coordination
- PTAGIS: Raw Data; FPC: Reports, Estimates

DATA PREPARATION & ANALYSIS

- CSS Oversight Committee
- Fish Passage Center

REGIONAL REVIEW

- Draft on BPA & FPC websites
- Regional Public Review; ISAB, ISRP, FPAC, NMFS, etc.

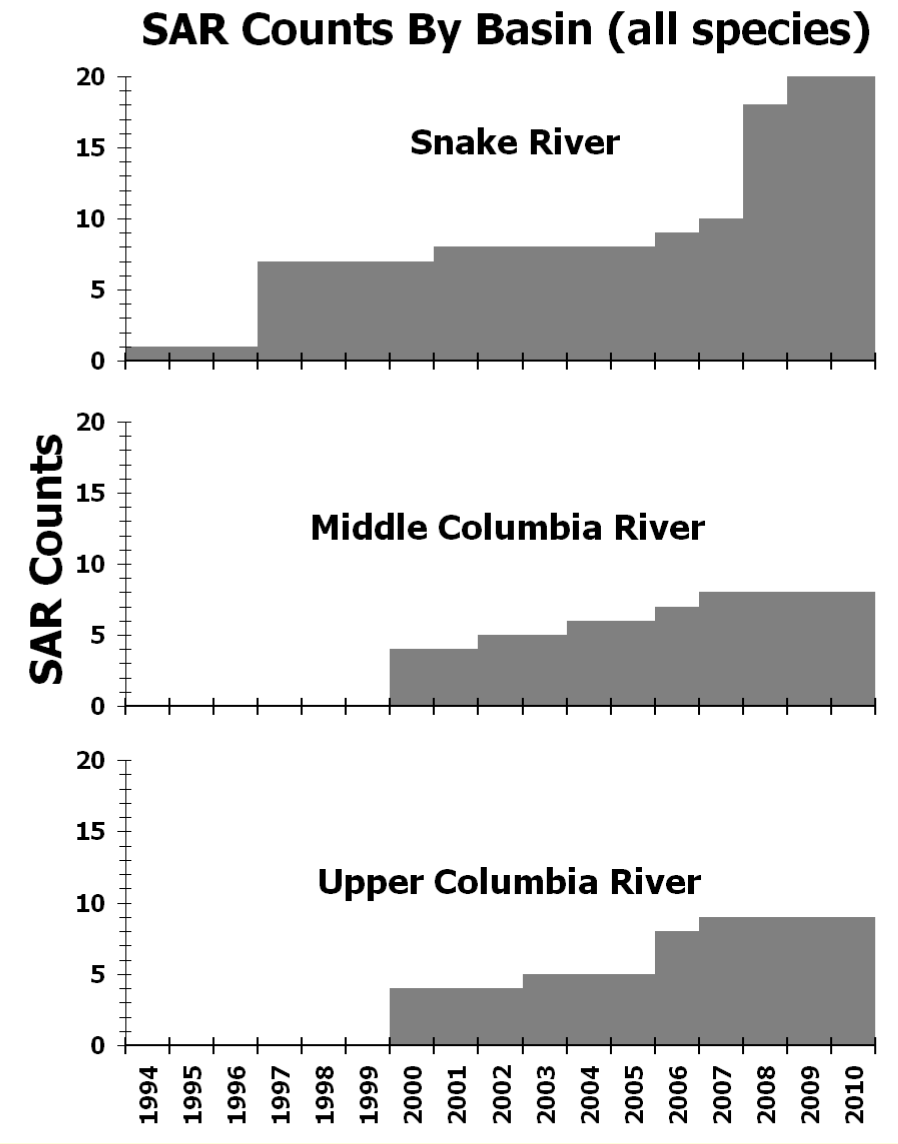
FINAL REPORT

- Posted on BPA & FPC websites

TEMPORAL COVERAGE

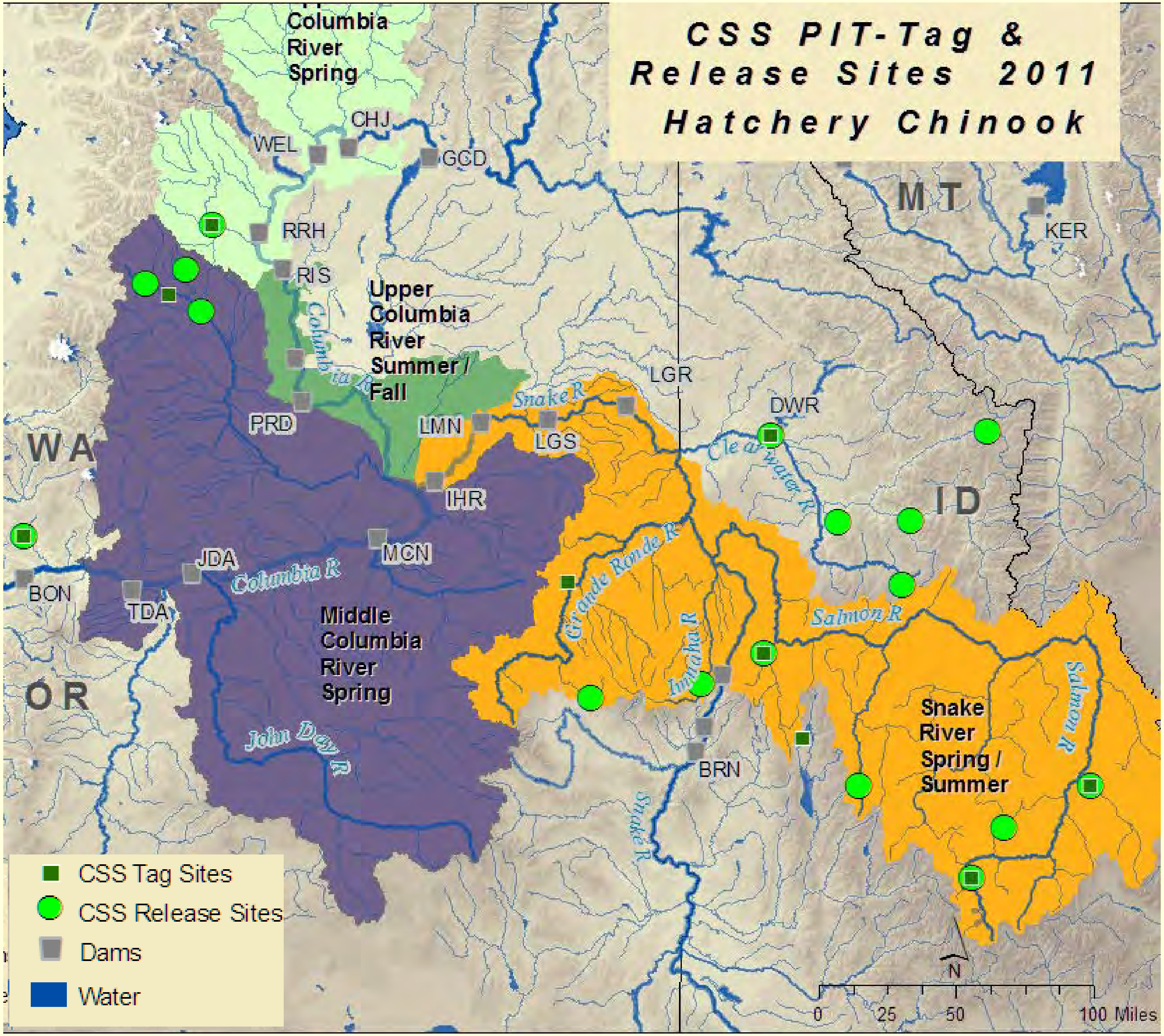
Attachment D

- Snake River
  - ~20 stocks over 18 yrs
    - sp/su/fall Chinook, steelhead, sockeye
- Middle Columbia River
  - Begin in 2000 [BOA detect]
  - ~ 9 stocks
- Upper Columbia River
  - Begin in 2000 [BOA detect]
  - ~8 stocks



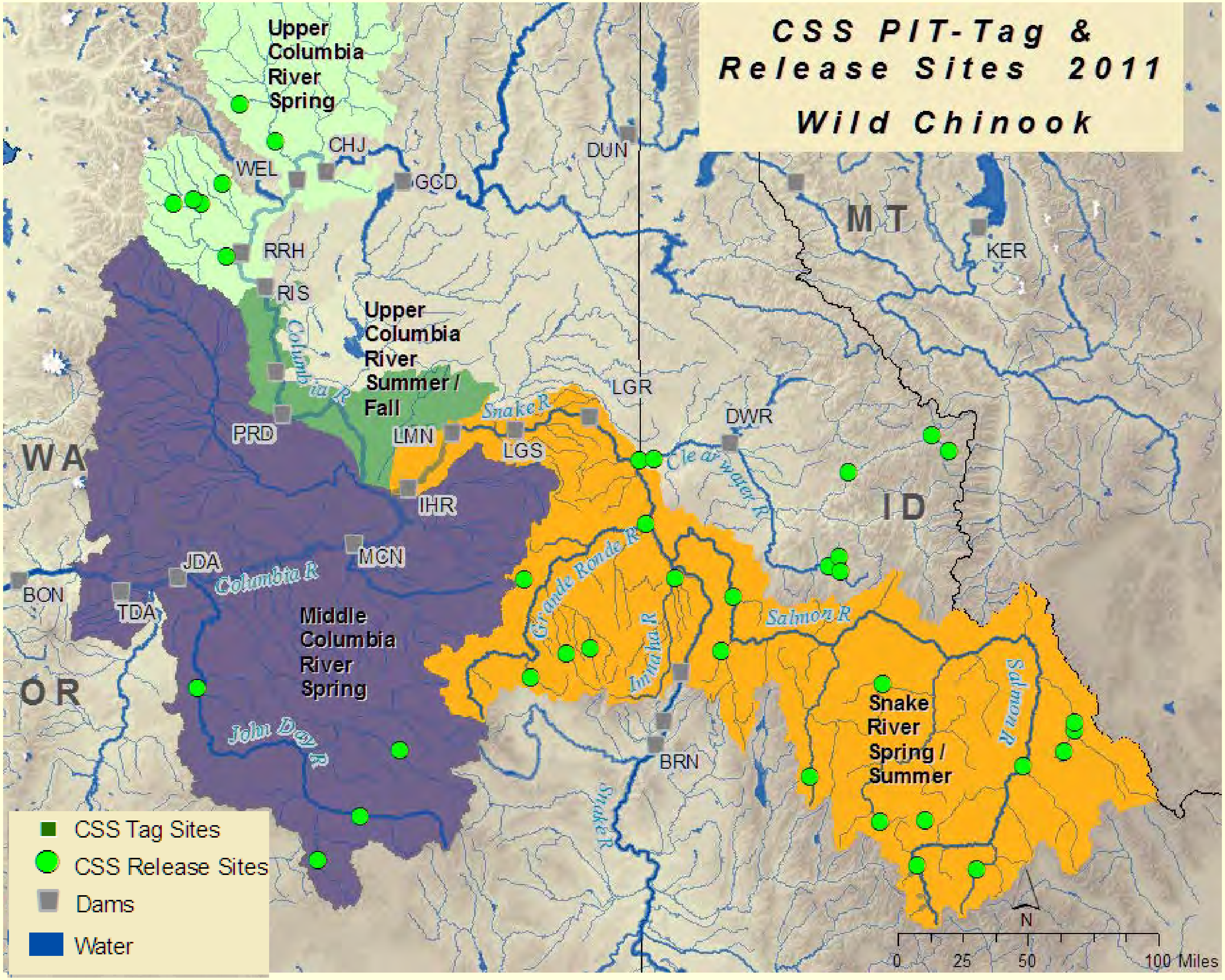
Spatial Coverage: Hatchery Chinook

Attachment D



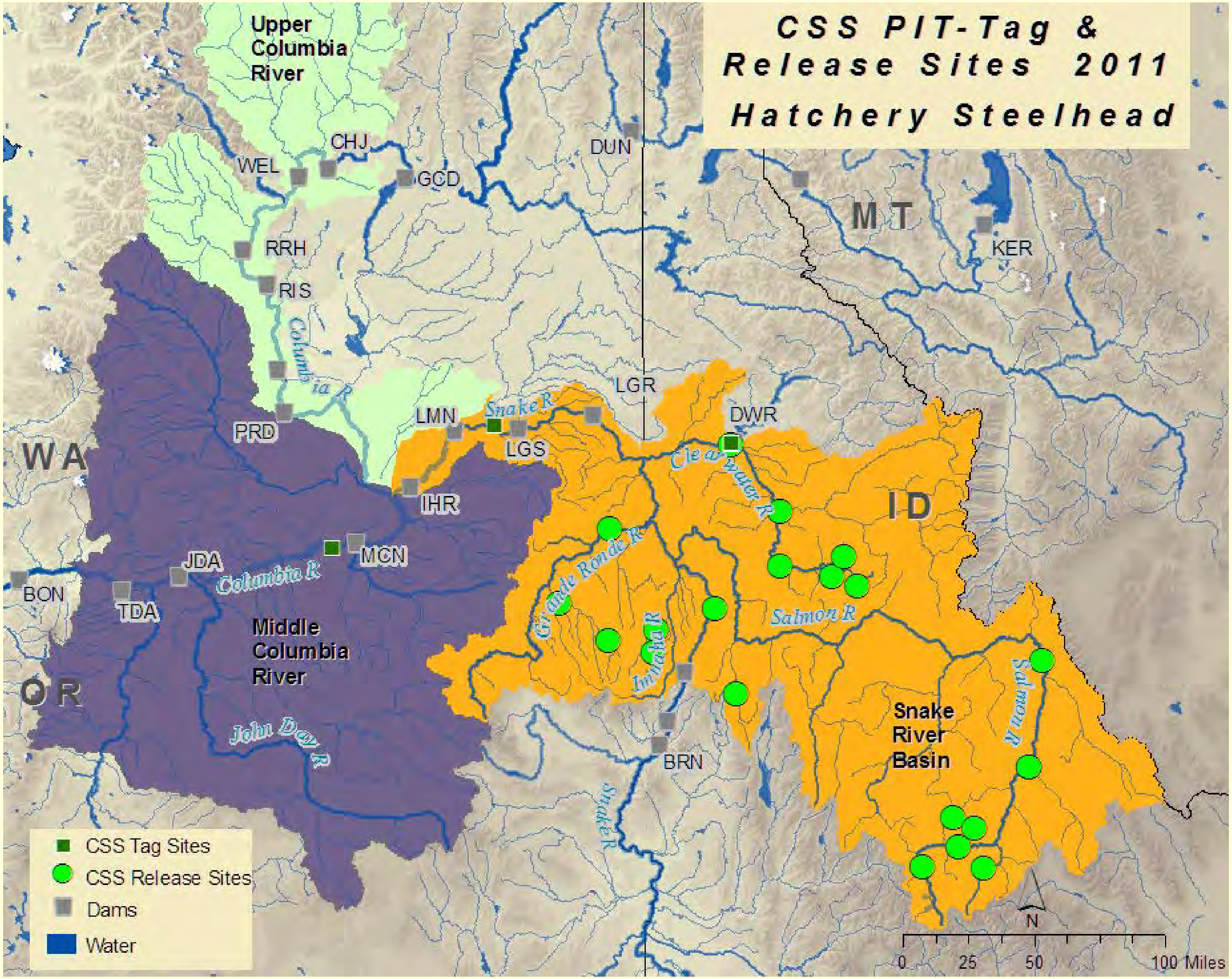
Spatial Coverage: Wild Chinook

Attachment D



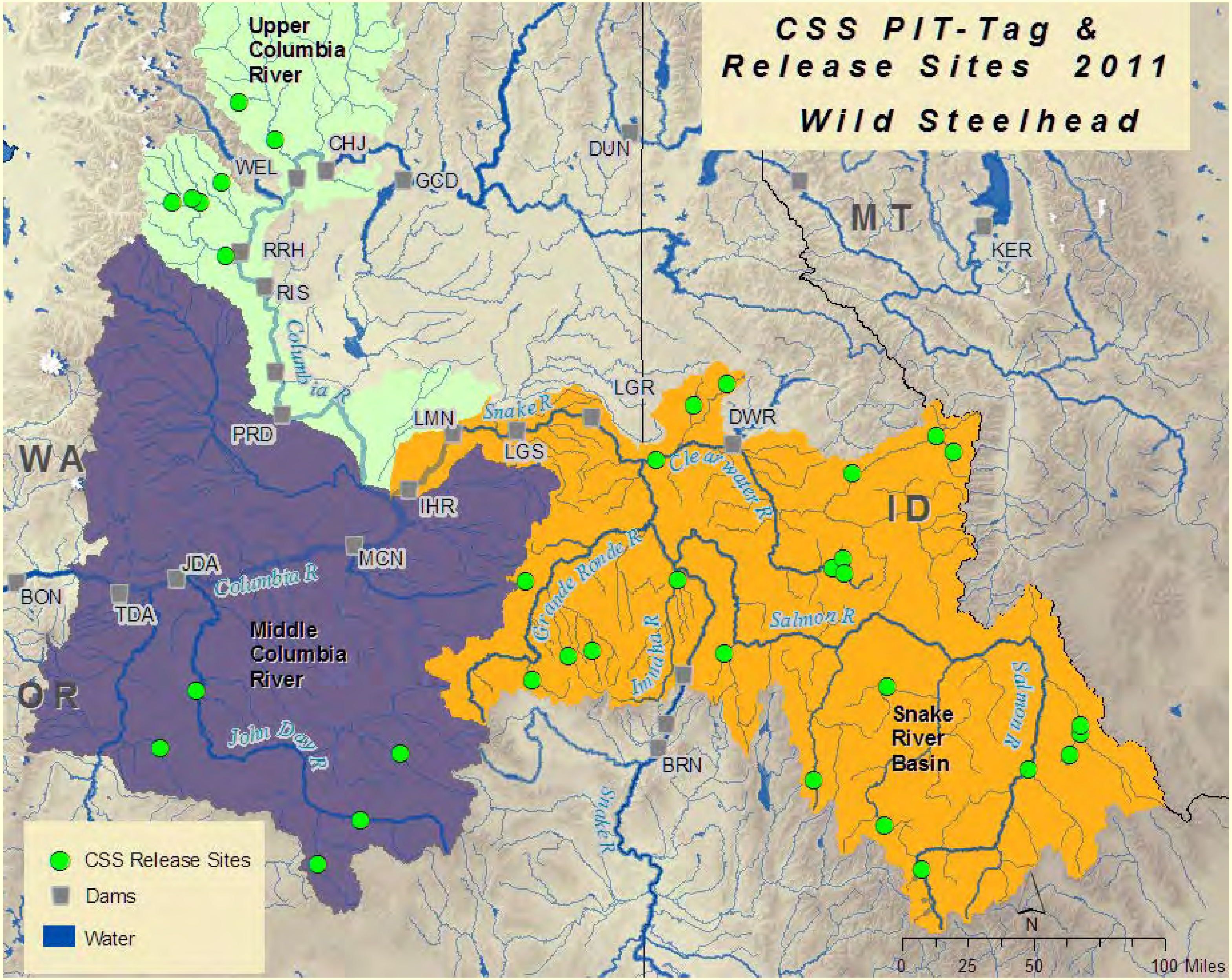
Spatial Coverage: Snake River Hatchery Steelhead

Attachment D



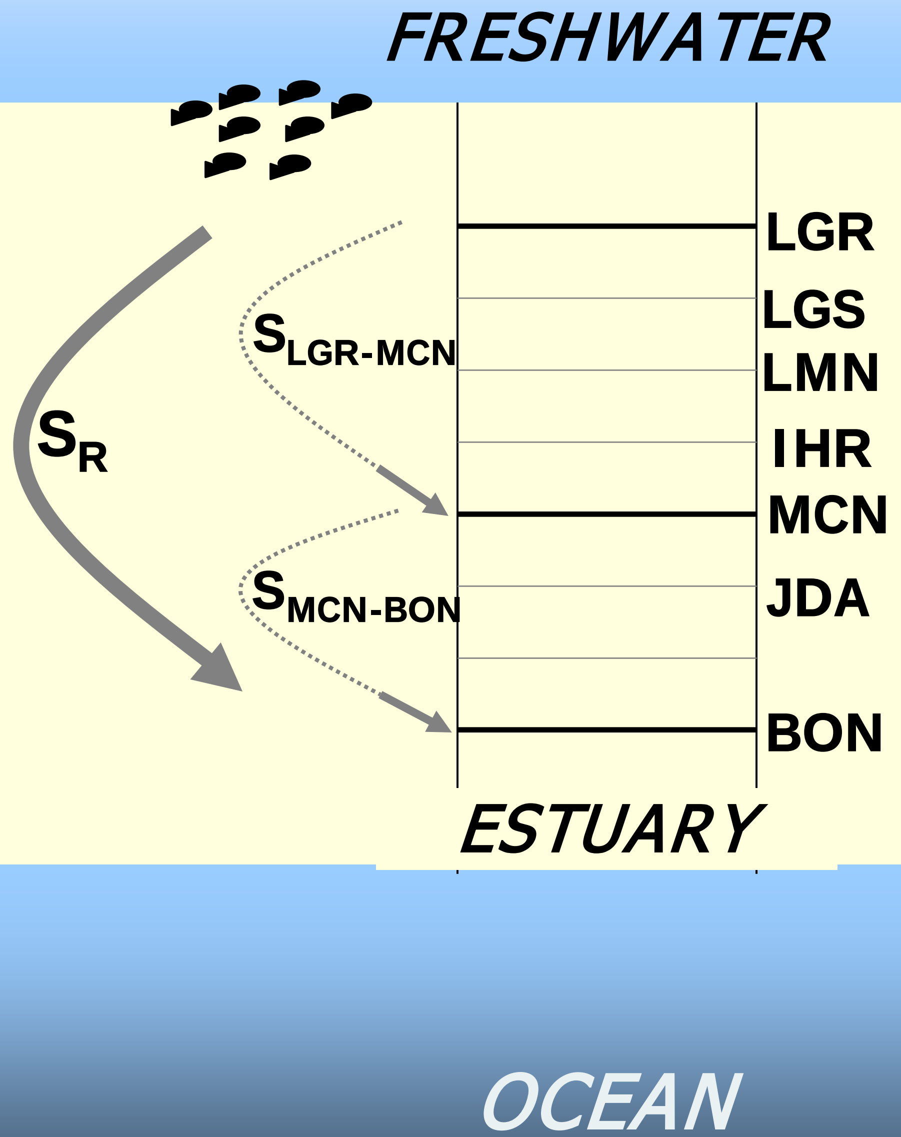
Spatial Coverage: Wild steelhead

Attachment D



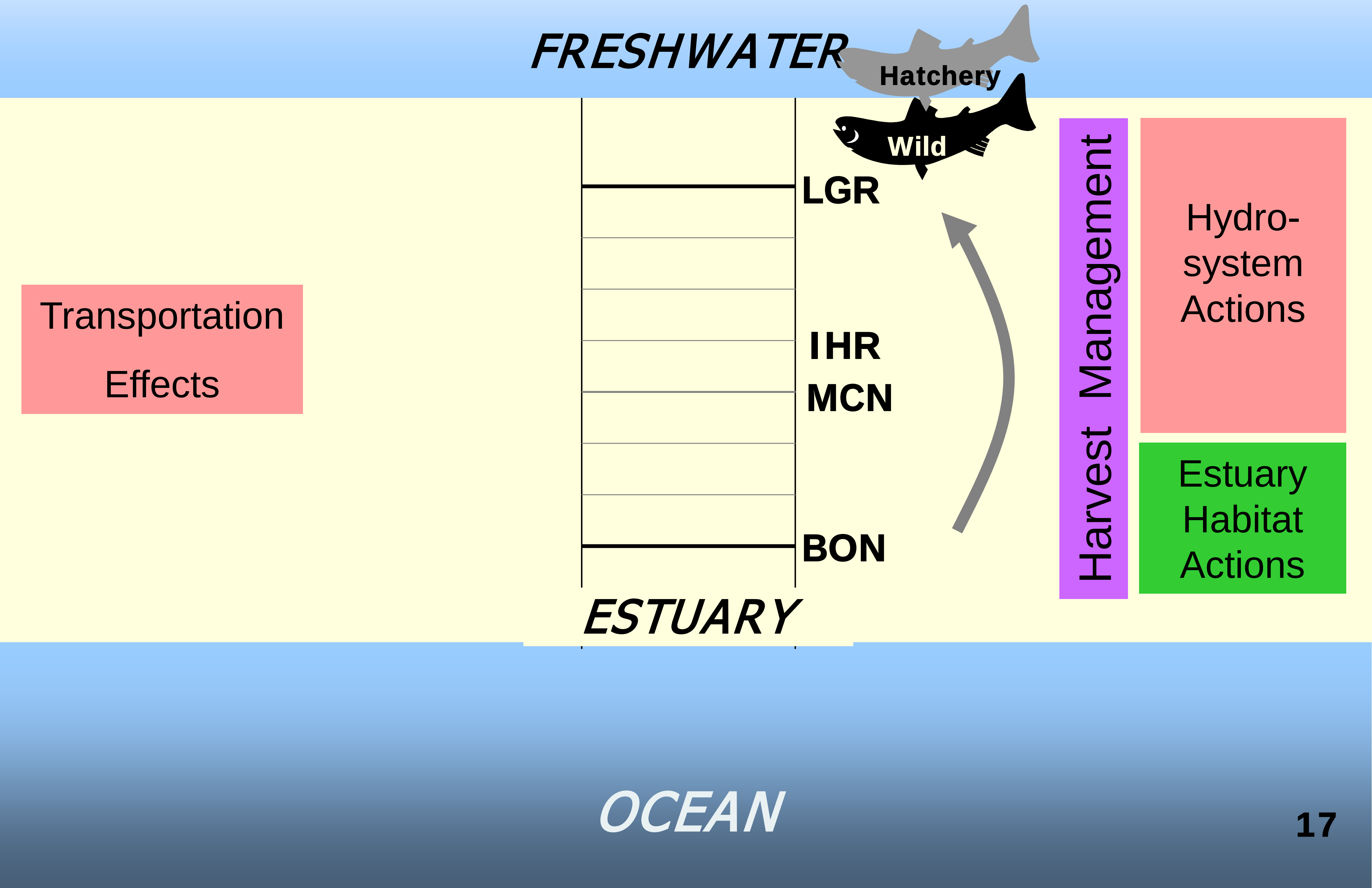
Smolt Survival

Rearing Habitat Actions

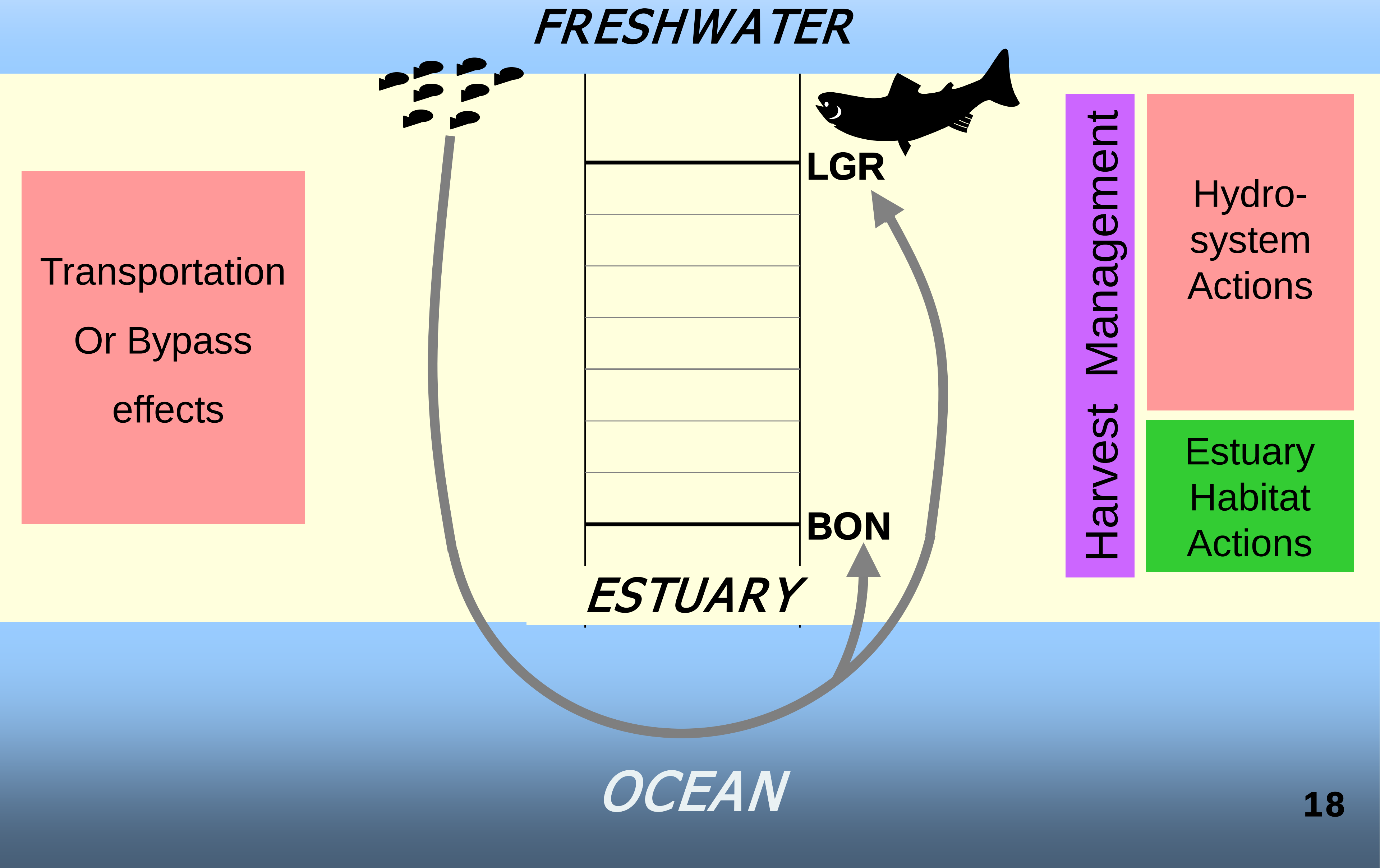


Hydro-system Actions

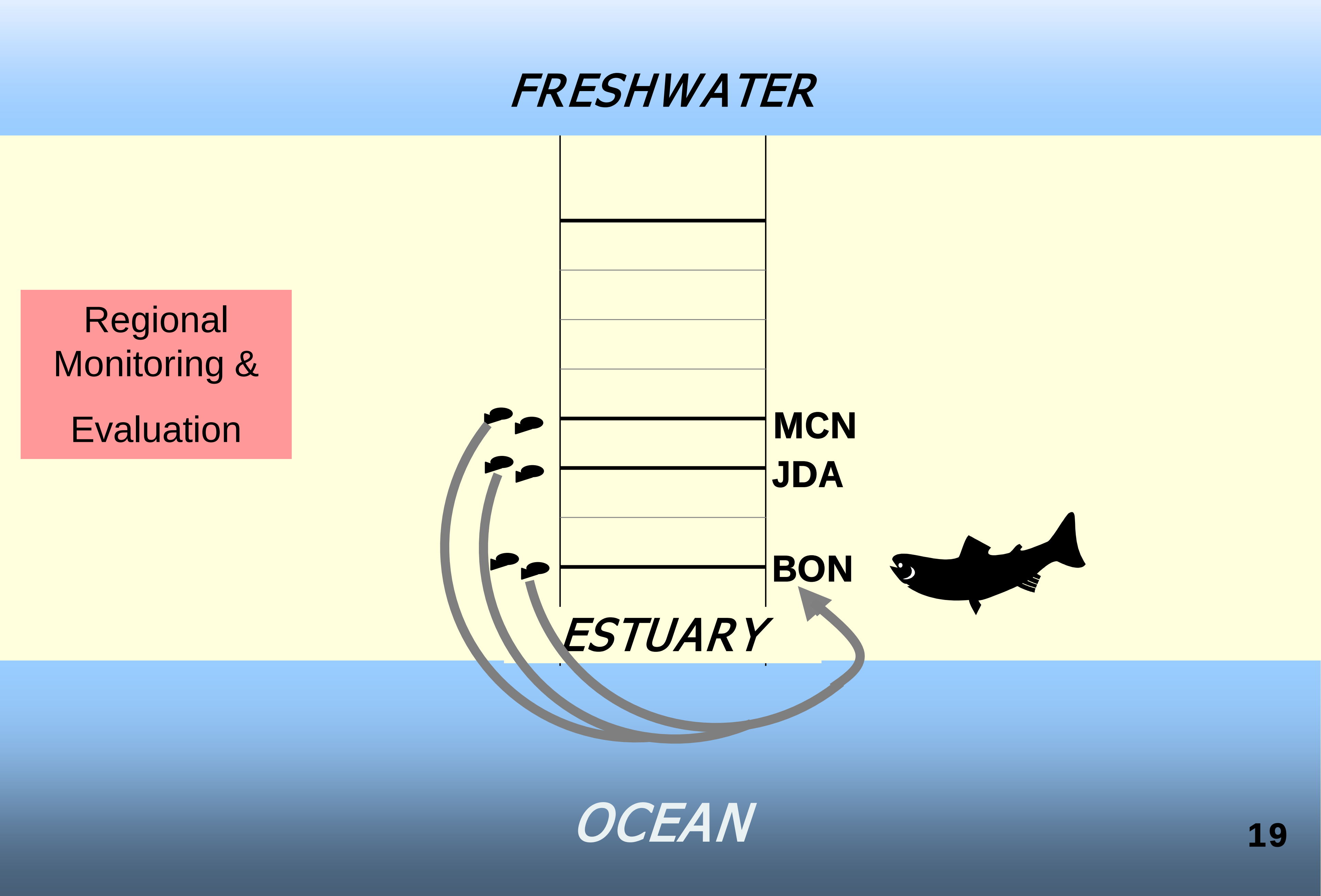
Adult Success



SNAKE RIVER SARS



Mid and Upper Columbia R. SARS



What does CSS provide for the region?

- **Information easily accessible and transparent**
  - *CSS PIT-tags accessed by any PTAGIS users, including fisheries managers, researchers, and academics*
- **Long term indices (identify bottlenecks)**
  - *Travel Times*
  - *In-river Survival Rates*
  - *In-river SARs by route of passage*
  - *Transport SARs*
  - *Adult success, conversion*
- **Comparisons of SARs**
  - *Transport to In-River*
  - *NPCC Regional SAR goal*
  - *By geographic location*
  - *By hatchery group*
  - *Hatchery to Wild*
  - *Chinook to Steelhead*

What does CSS provide for the region?

- **Long term consistent information collaboratively designed and implemented**

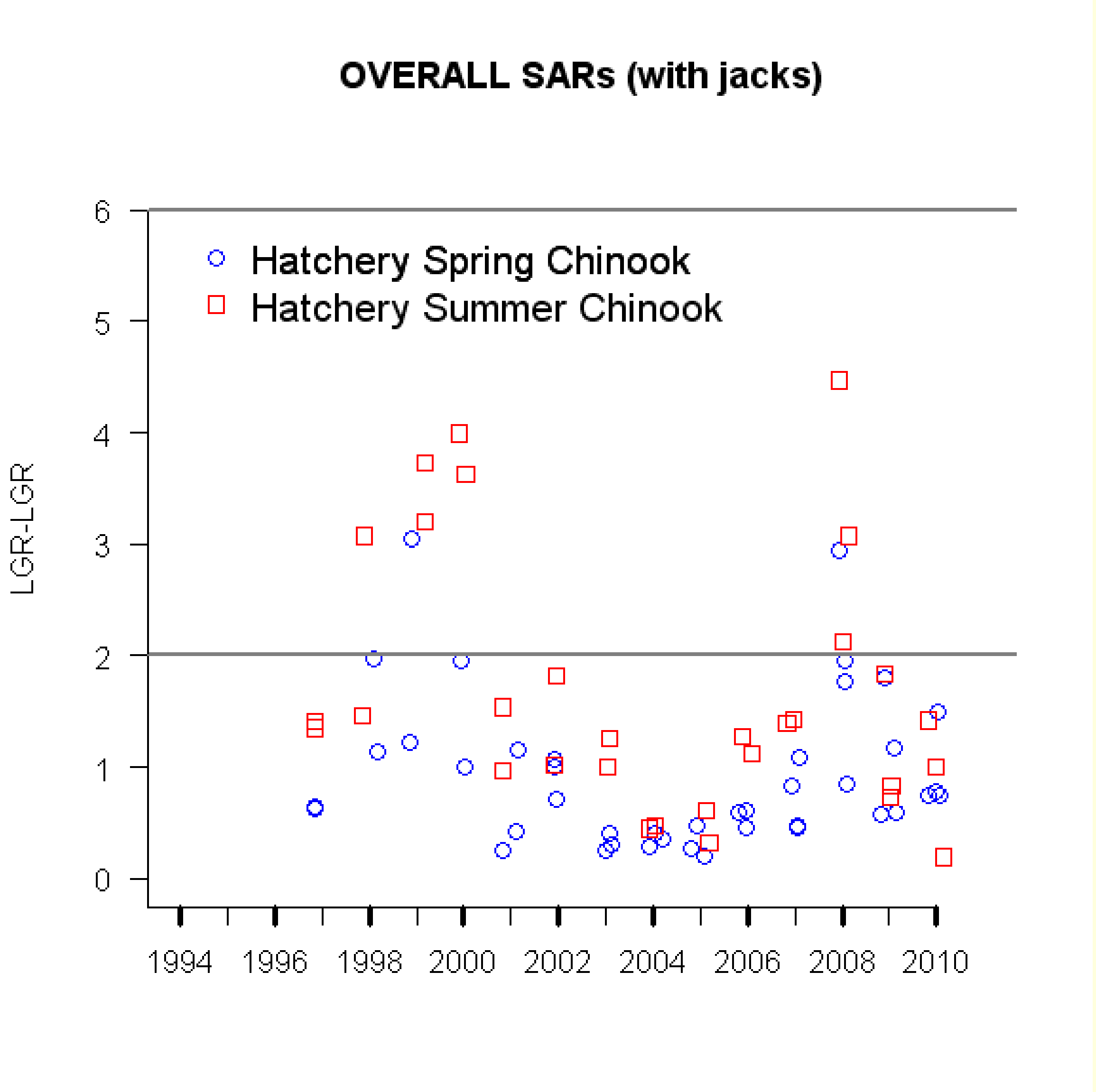
- **Management questions**
  - hydropower operations
  - hatchery evaluations
  - habitat evaluations

Attachment D

Snake River Basin
2012 CSS Report

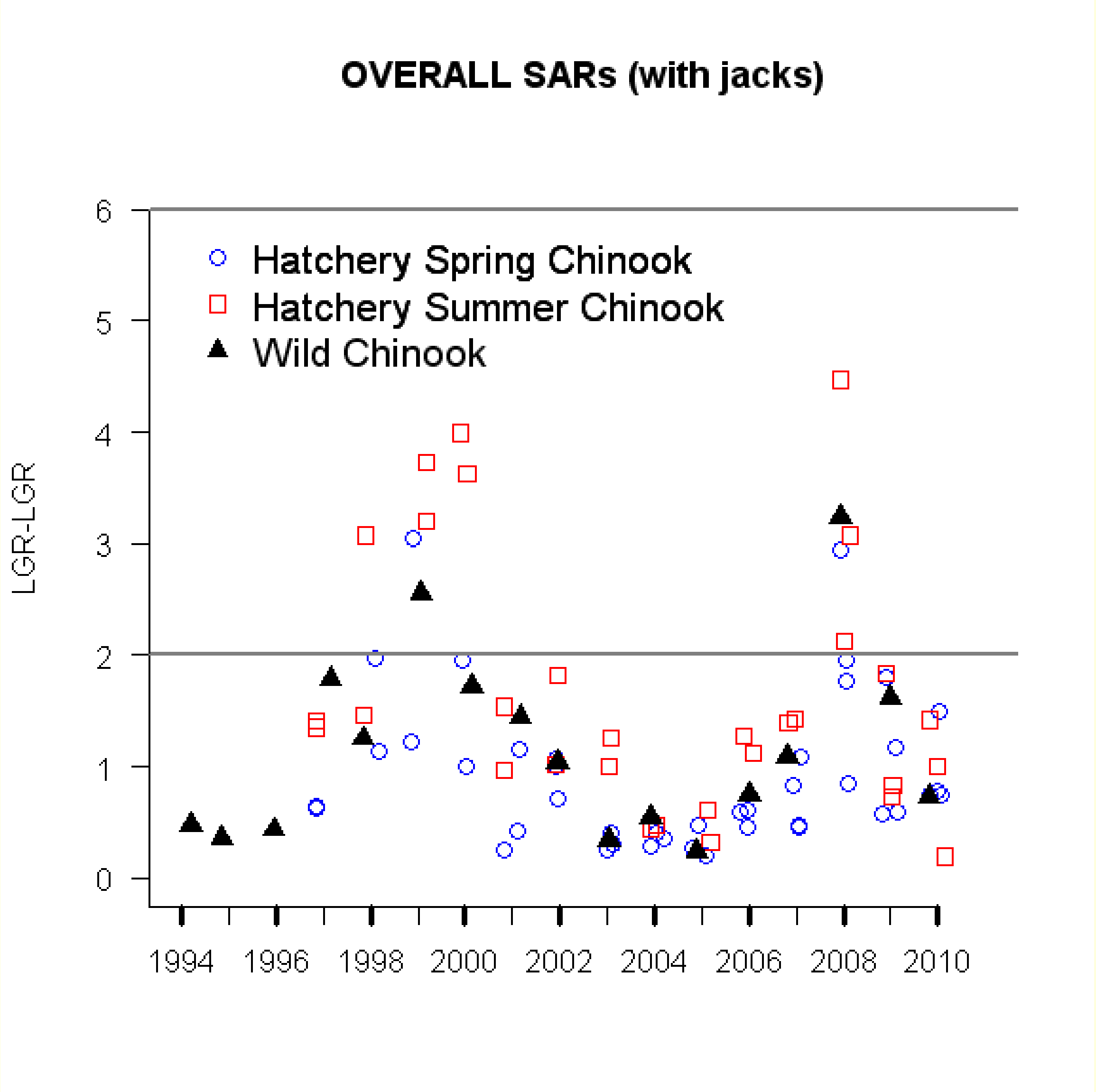
Snake River Chinook SARs

- **Hatchery Chinook**
  - **5 spring**
  - **3 summer**
- **Summer > Spring**
- **Highly correlated**
- **1999, 2000, 2008 > 2%**



Snake River Chinook SARs

- Hatchery Chinook
  - 5 spring
  - 3 summer
- Summer > Spring
- Highly correlated
- 1999, 2000, 2008 > 2%
- Wild Chinook
  - similar results

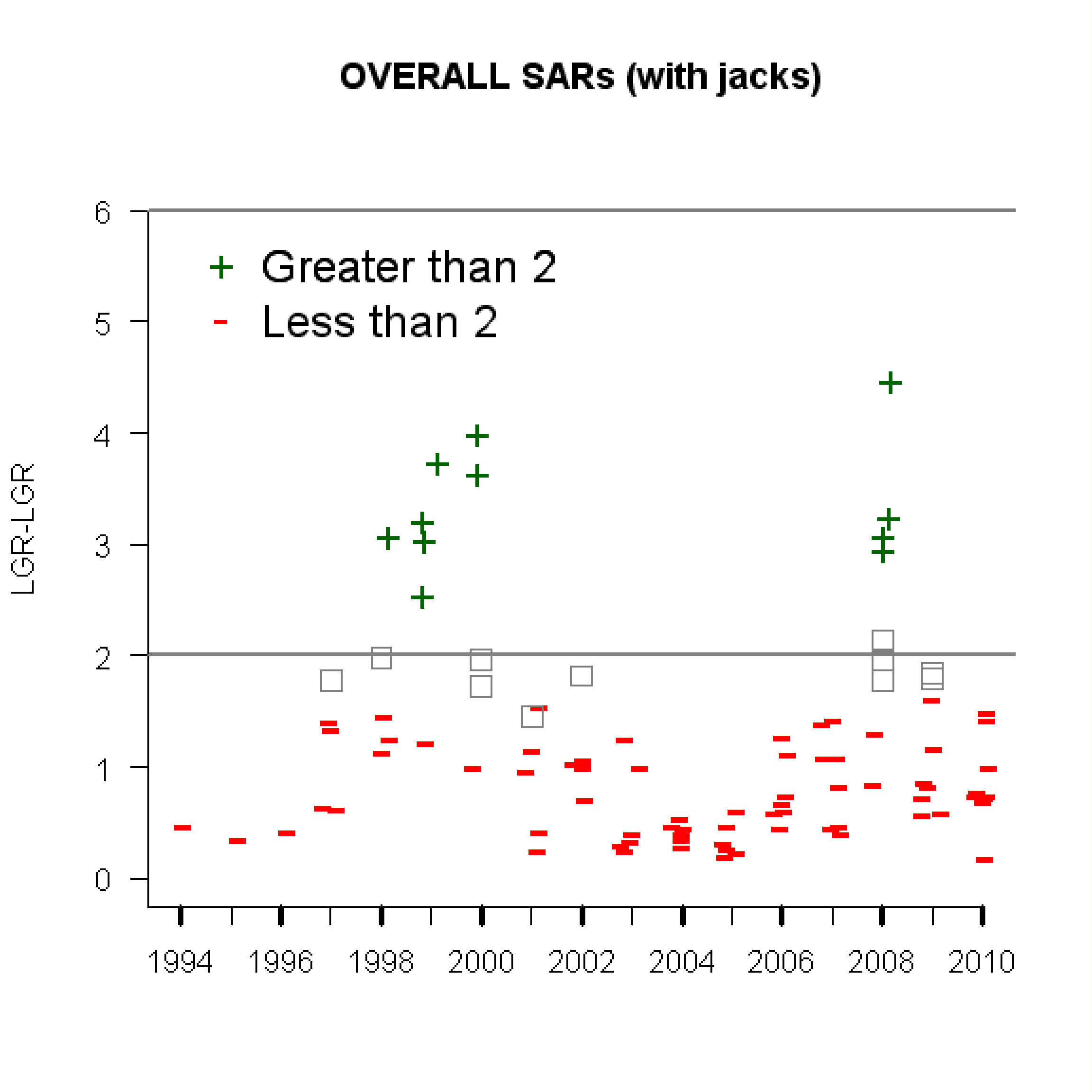


CSS Results: Chinook SARs

11.5% SARs > 2

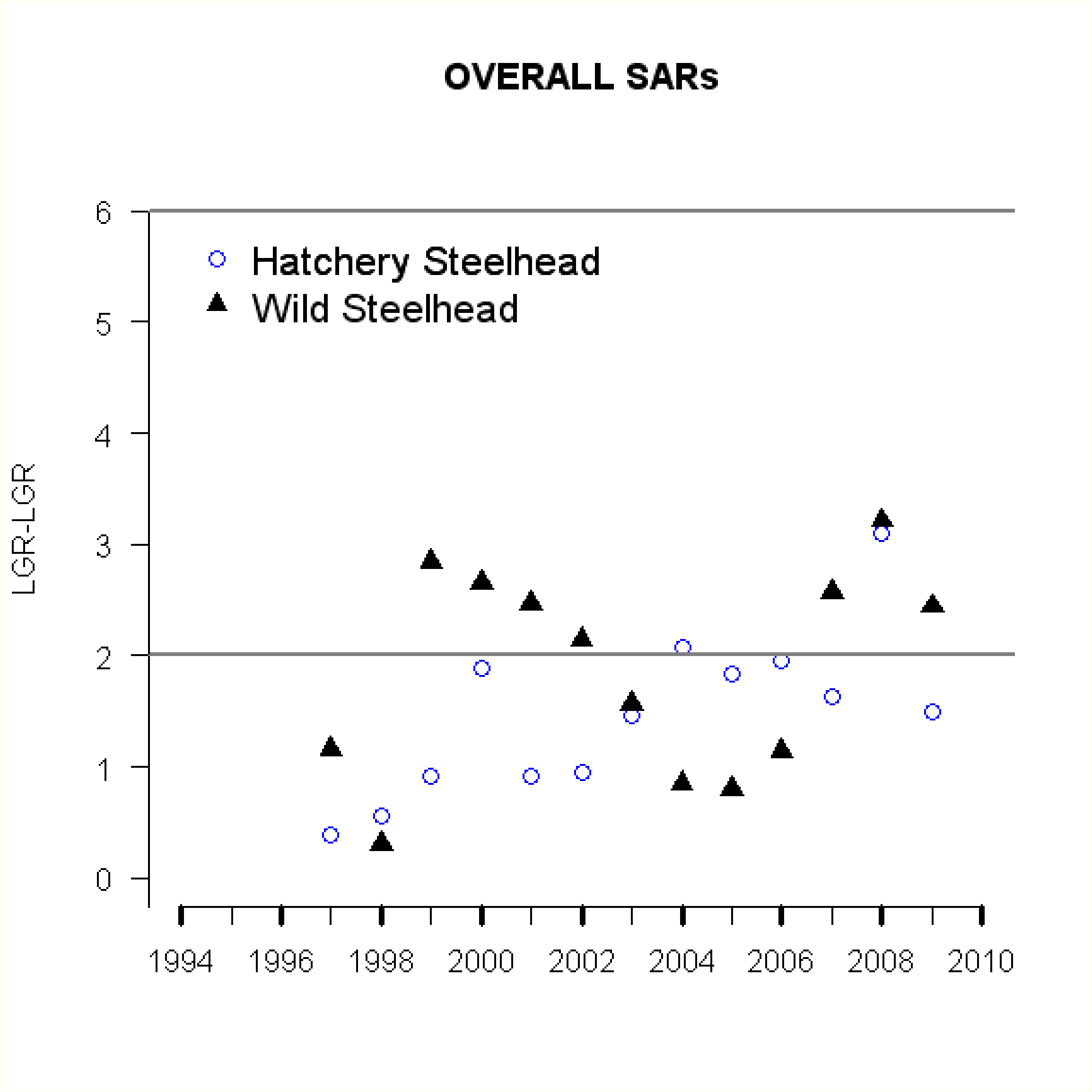
77% SARs < 2

11.5% SARs = NS



Snake River Steelhead SARs

- Less correlated than Chinook stocks
- 2008* Highest in time series

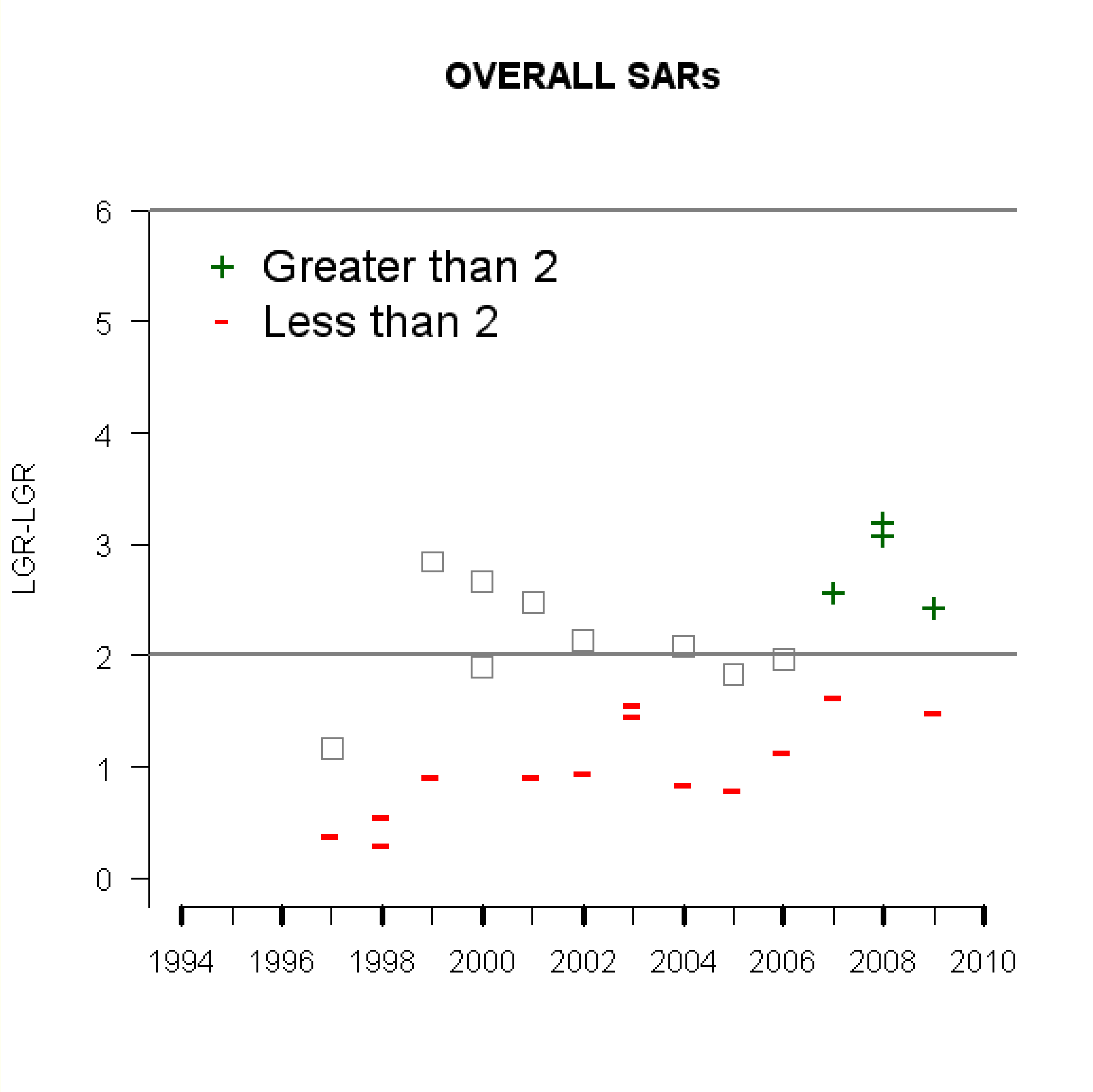


Snake River Steelhead SARs

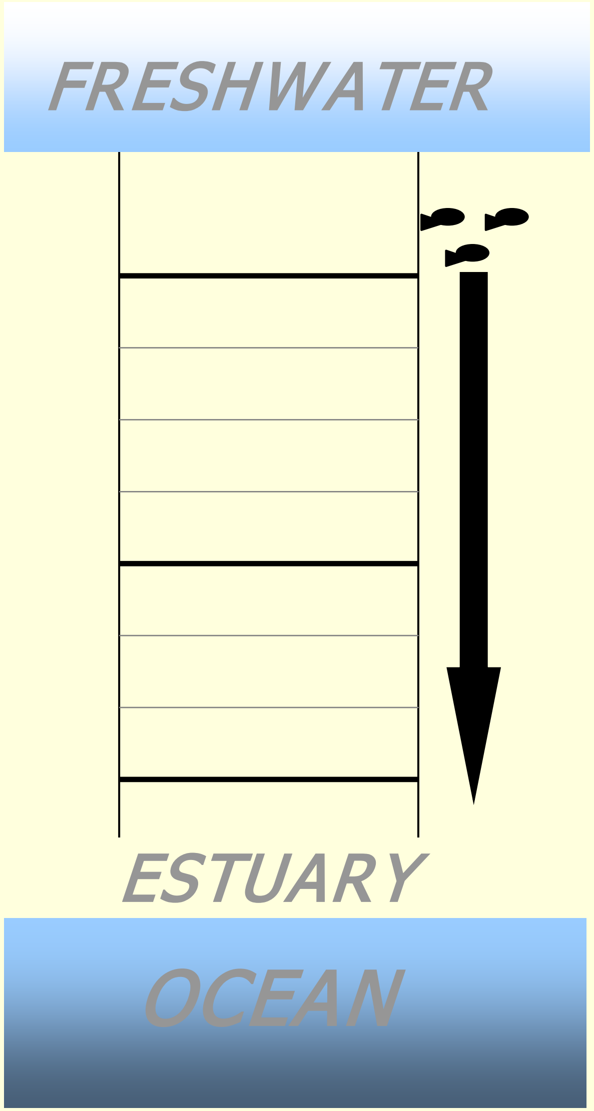
15% SARs > 2

50 % SARs < 2

35% SARs = NS

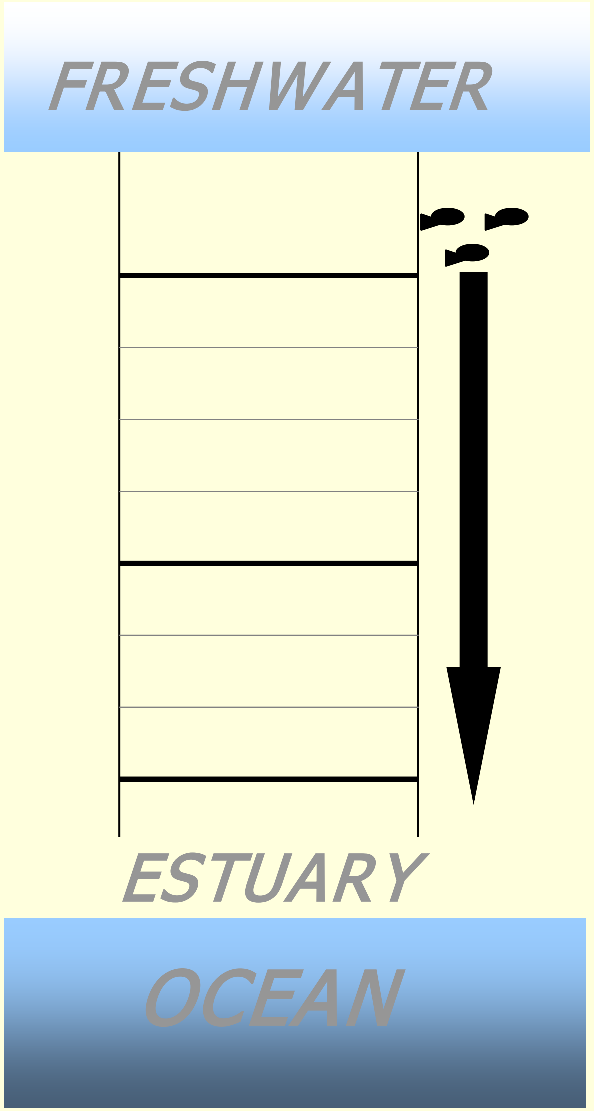


Juvenile Survival



- **Component of RM&E**
- **Long Term dataset of annual juvenile metrics**
  - **Emigration rate**
  - **Arrival time at dams**
  - **Juvenile survival**
- **Finer scale analyses: response to ISAB comment**

Juvenile Survival: Finer-Scale Analyses



- Simultaneous processes:
  - Migration (FTT) & Mortality
- If we can predict these, we can predict survival
- GOAL: evaluate effects of operational and environmental features

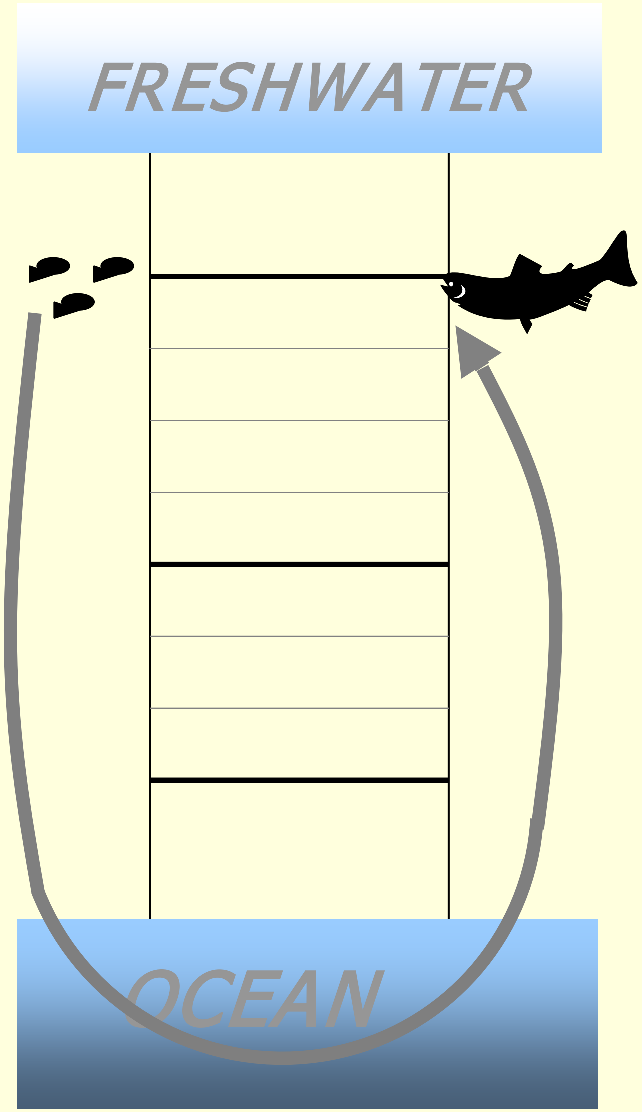
Juvenile Survival: Finer-Scale Analyses

- Multiple regression model factors
  - Seasonality (Julian Day)
  - Temperature
  - Turbidity
  - Average Percent Spill
  - Surface Passage Structures (TSW, RSW)
  - Water Transit Time (WTT, days)
  - Hatchery Composition

Juvenile Survival: Finer-Scale Analyses

- **Consistent Patterns:**
  - **Fish emigrate faster and mortality is lowest when Water Transit Time is reduced and spill levels are high**
  - **For steelhead, as surface passage structures have increased in number, fish travel times have decreased**
  - **Mortality rates tend to increase over the season**

Snake River TIR

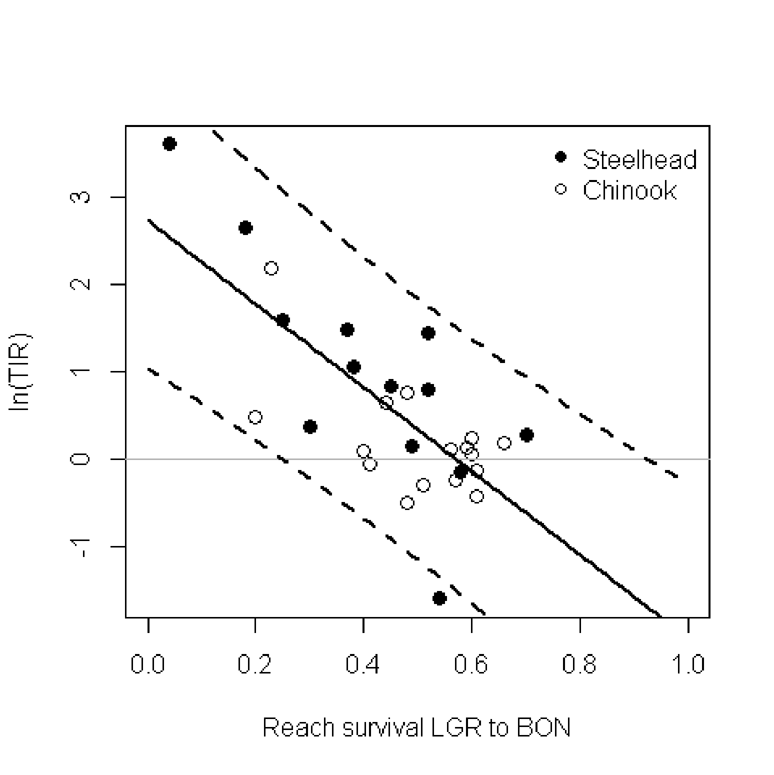


- Used to evaluate transportation program for Snake River stocks
- TIR is a Ratio of SARs:

  Transported ÷ Inriver

TIR vs. in-river surv.

- **Relative effectiveness of transport is related to in-river survival**
- **As in-river survival increases, TIR decreases**
- **When in-river surv ~ 57%, transport will not be beneficial (for wild stocks)**



- **There is room to improve in-river survival**
  - **increased spill or water velocity**
  - **limited potential to improve transport**

Snake River
Adult Success and Straying

- The success rate for transported was 90% of that for their in-river counter parts (on average)

- Transported steelhead strayed about 4.5% and in-river strayed at 0.4% (11:1)
  - Deschutes and John Day
  - This is a large out-of-basin population as compared to total natural spawner abundance
    - Hatchery strays identified as limiting factor to recovery of John Day and Deschutes River stocks (NOAA 2009 Mid C. St. Recovery Plan)

- Transported hatchery Chinook strayed about 0.7% and in-river strayed 0.03% (23:1)
  - Columbia above SR confluence

Age at Maturity for sp/su Chinook

- Developed as monitoring tool and to inform harvest management
    - Update in 2012 report, 7 additional stocks (16 total) and one more year of data
- Age at maturity and jack percentage of Chinook in Snake River and Middle/Upper Columbia were influenced by both stock and year factors
    - A common sibling model across all stocks may not perform well
- No strong association between age at maturity and transport history for Snake River stocks

Attachment D

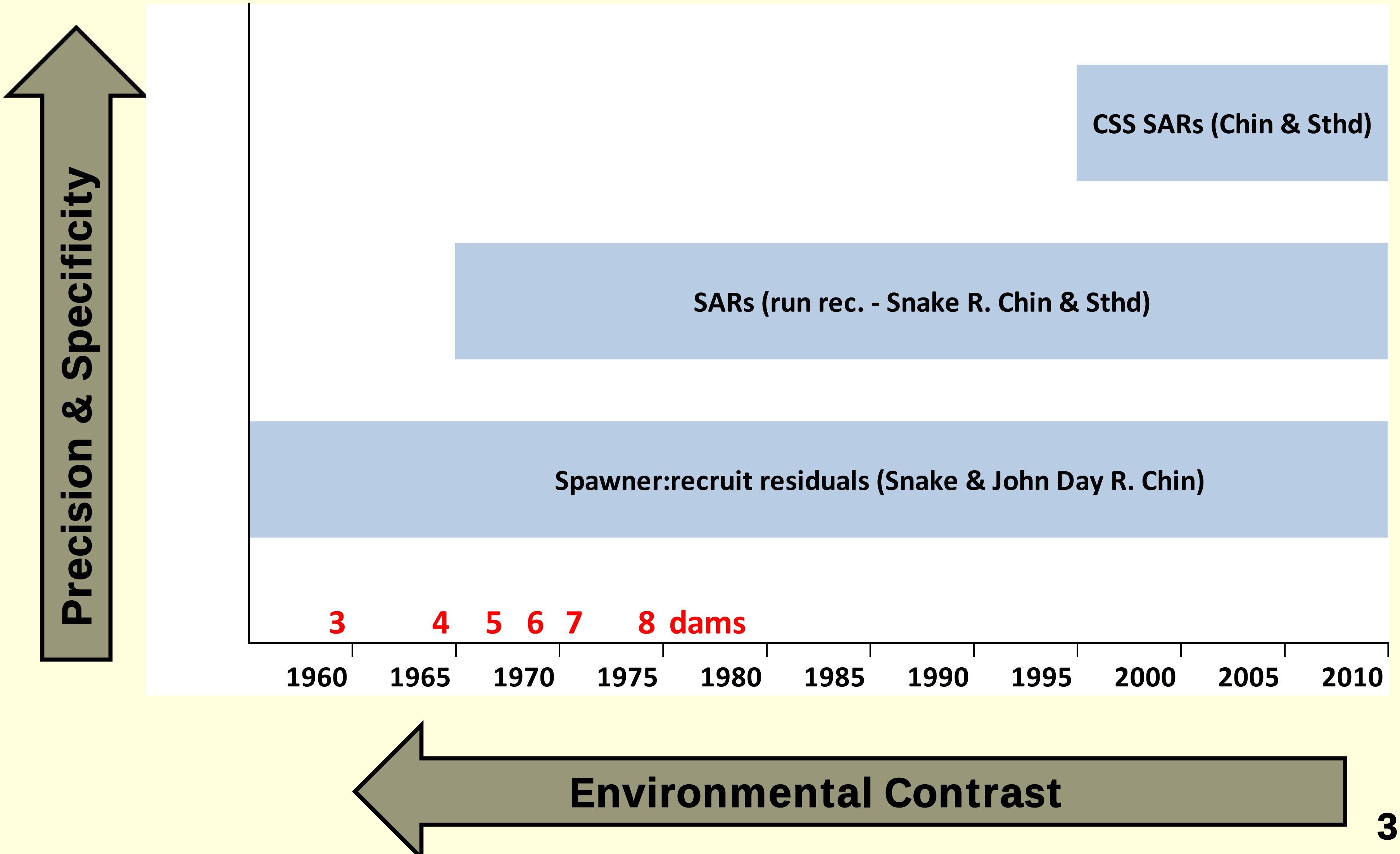
Recent Workshops

Recent Workshops

- **Workshop (July 26th-28th, 2011)**
  - **GOALS:**
    - **Relative importance of various factors in determining salmon & steelhead survival rates? FCRPS operations, freshwater/ocean conditions, fish attributes**
    - **Build tools that evaluate & optimize FCRPS operations to meet NPCC SAR objectives?**
    - Opportunity for leading researchers and professionals to compare results which broadens scope of review of CSS work
  - 27 scientists, US & Canada, 9 agencies, 3 universities & ESSA
  - Facilitated by ESSA Technologies Ltd.

Approach

Weight of evidence Multiple lines of evidence for relative importance of major factors influencing survival rates

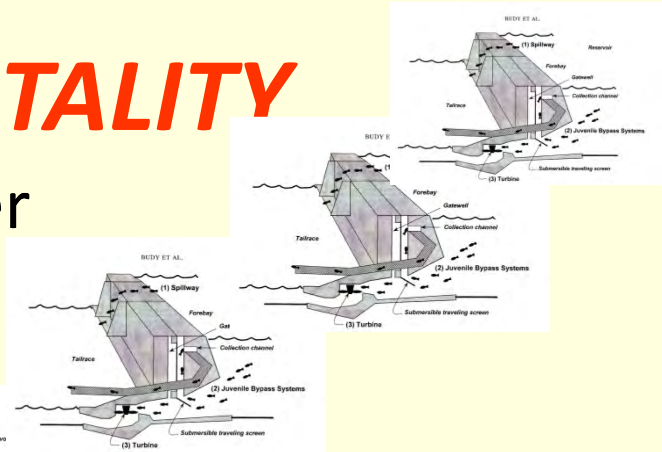


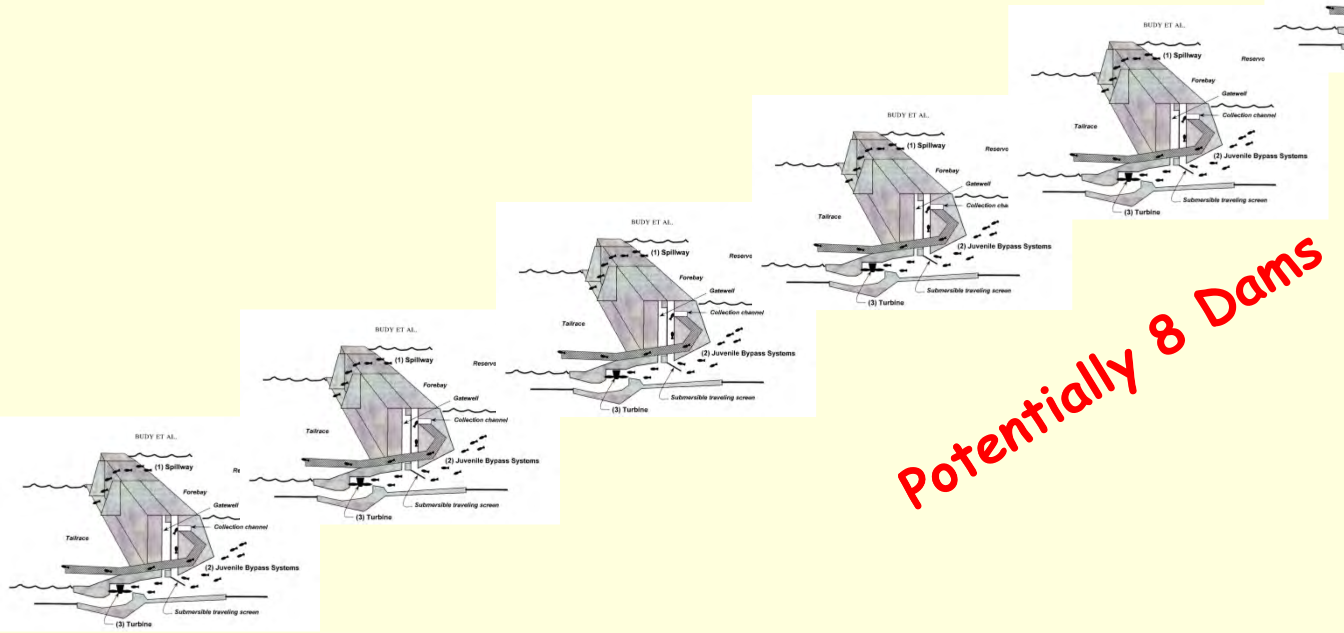
Key Concepts:

Is there evidence linking estuary and early-ocean mortality to the migration experience through the hydrosystem?

DELAYED Hydrosystem MORTALITY

- Similar concept to smoking/lung cancer





Delayed Hydrosystem Mortality

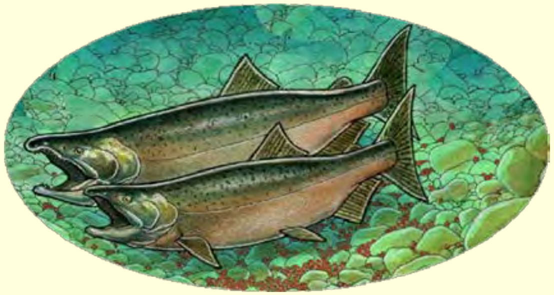
- Multiple lines of evidence-
  - 3 fold decline in marine survival rate for Chinook
  - 2 fold decline in marine survival rate for Steelhead

- **CSS Workshop 2011**
  - *"The evidence presented for … delayed mortality arising from earlier experience in the hydrosystem is strong and convincing."*
  - *" It is difficult to imagine how [other factors] would align so well both in time and space with the establishment of the hydro system."*

Summary Workshop 2011

Attachment D

- Survival (in freshwater and marine) increases:
  - faster water velocity
  - increased spill
  - lower % transported



- Current FCRPS configuration:
  - Little ability to speed water velocity
  - Opportunity to further manage spill combined with surface passage to reduce powerhouse passages

- Promising conservative approach - management experiment to evaluate improvements to SARs by increasing managed spill

Recent Workshops

- **Workshop (March 7th-8th, 2013)**
  - GOALS:
    - **Review a draft design for a management experiment to increase the amount of voluntary spill at FCRPS projects**
    - **Provide recommendations to strengthen the proposed experiment**
    - Opportunity for leading researchers and professionals to share and compare recent results
  - 20 attendees from agencies and universities
  - Facilitated by ESSA Technologies Ltd.

What is experimental design?

Plan* for measuring *response* to a *treatment

- ***Treatment* = increase in spill for fish passage**
- ***Response* = change in survival**
- ***Monitoring Plan* = implement CSS methods**

Elements of “good” experimental design

- **Large change (perturbation)**
- **High precision of measured response variable**
- **High degree of replication**
- **Minimize and account for confounding factors**

Spill Scenarios Objectives

- Identify physical or biological limitations at each project
- Describe the spill caps for various scenarios in terms of total dissolved gas

Spill Scenarios

1. 2008 BiOp spill

2. Spill to present TDG standards:
   115% Forebay and 120% Tailrace

3. Spill to 120% Tailrace

4. Spill to 125% Tailrace

Prospective Tools

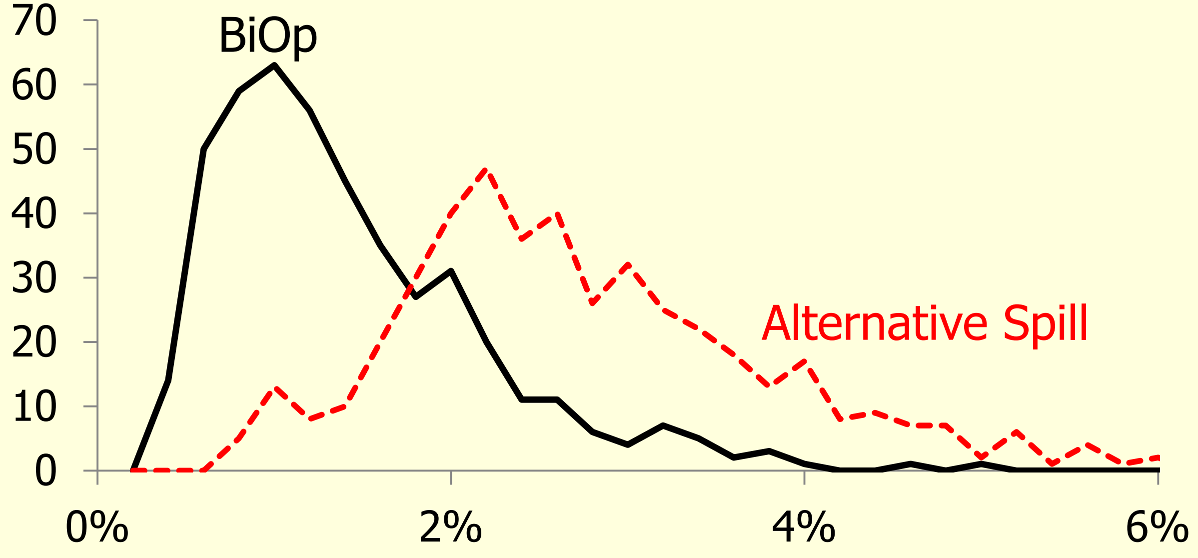
Used models that have been fit to the empirical data

And project SARs with potential management changes

- Across four release cohorts
- Three flow levels (low, medium, high)
- Four operations (BIOP, 115/120, 120, 125)
- Variable Ocean conditions (PDO from **1900-2012)**

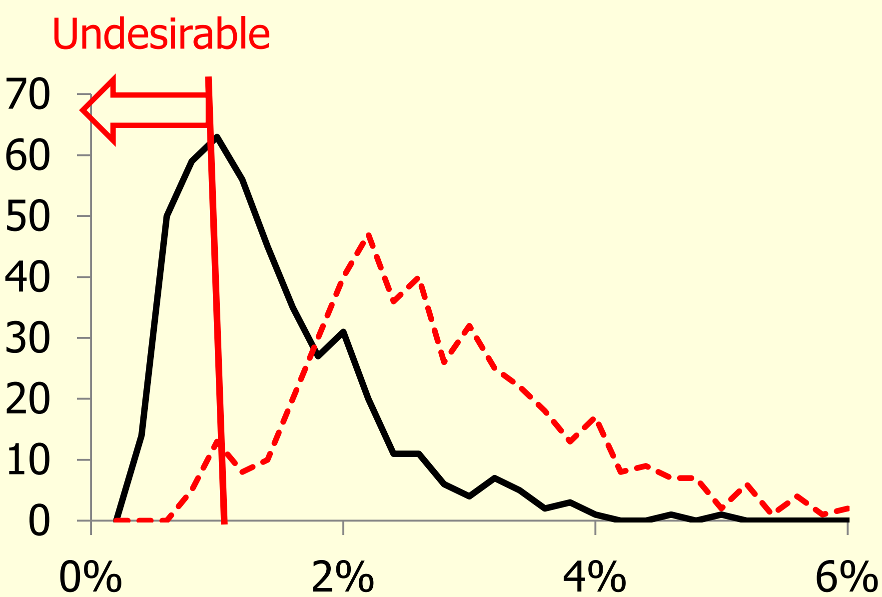
Prospective tools

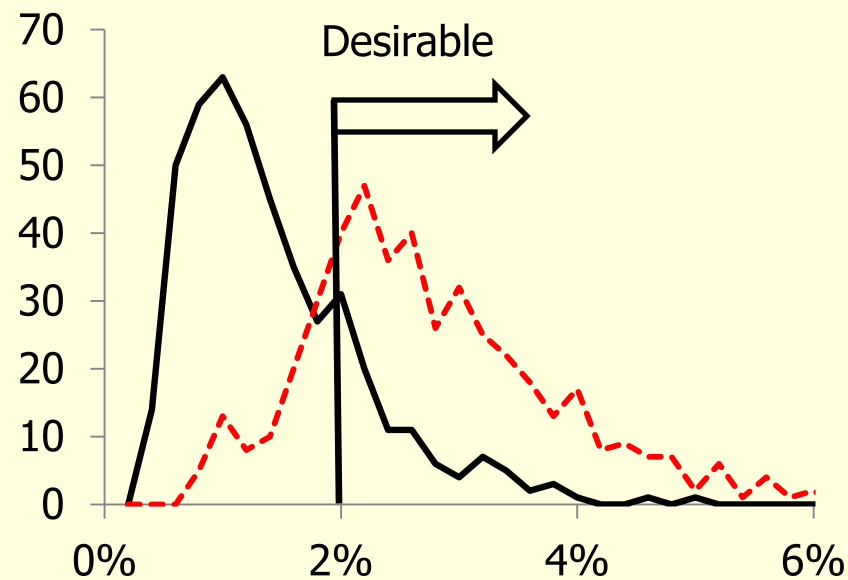
- Generate distribution of SARs for range of river and ocean conditions and two spill scenarios



Prospective tools

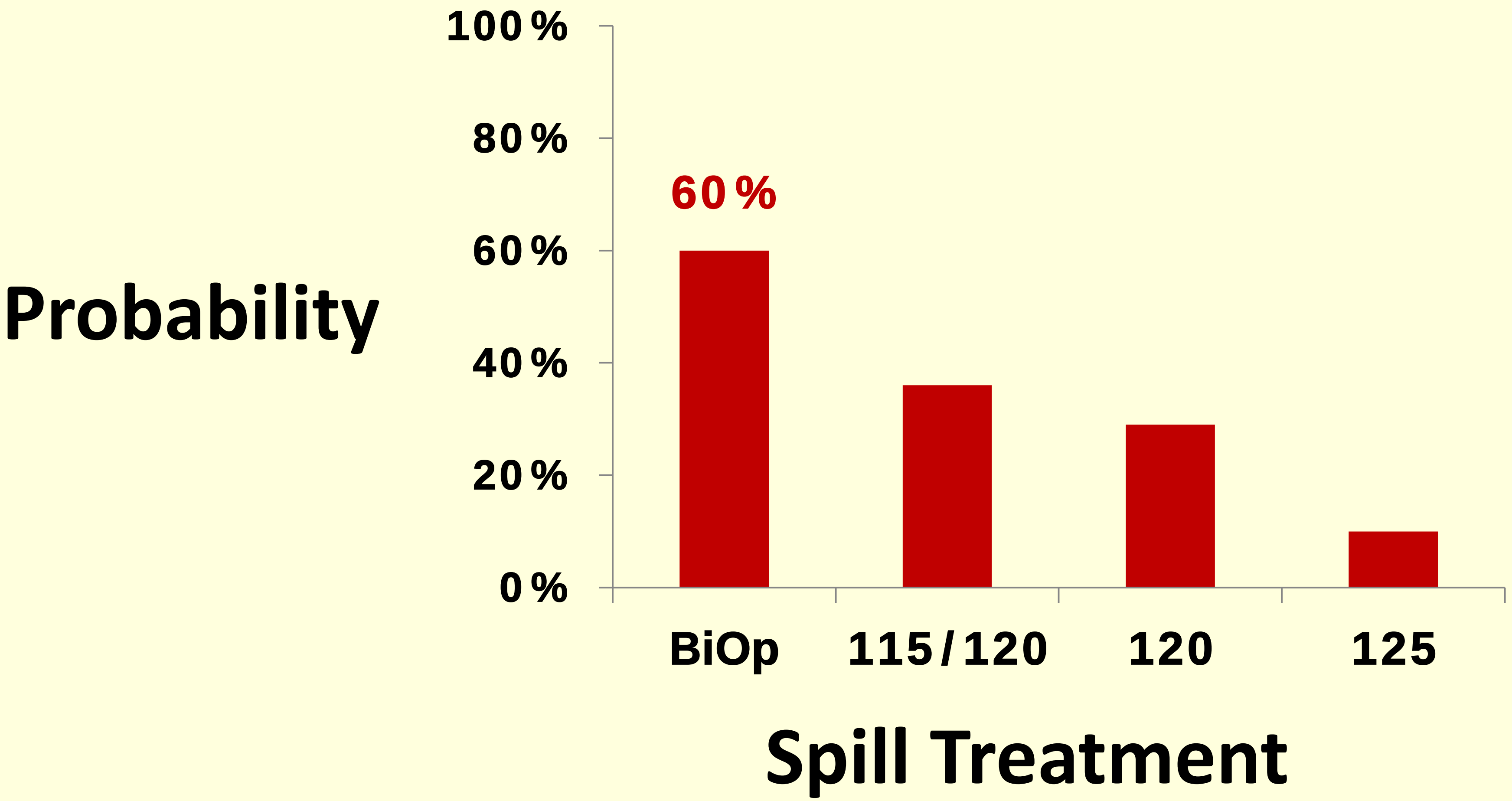
- Summarize distributions relative to desired goals:
  - Avoid undesirable SARs < 1%
    - (linked to viability)
  - Achieve desirable SARs > 2%
    - (NPCC goal)



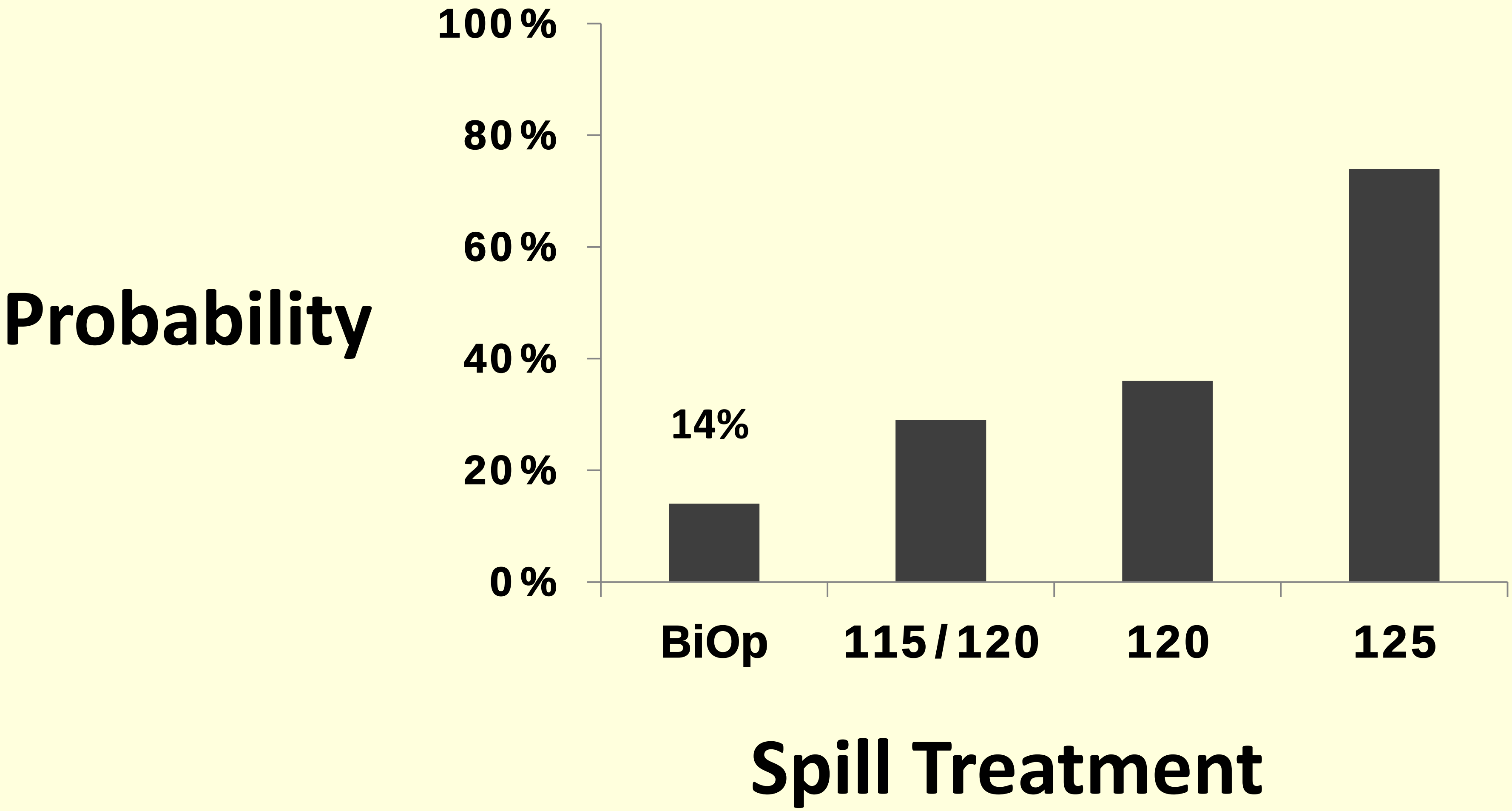


Attachment D

Chinook – Undesirable (< 1% SAR)



Chinook – Desirable (> 2% SAR)



Workshop Comments and Recommendations

1) SARs were most critical response to consider

- Compare new SAR with simulations
- Compare new SAR against model predictions
- Compare new SARs against previous 'analog' year with similar flow, spill and/or PDO conditions?
- Use all available SAR comparisons to evaluate change

Workshop Comments and Recommendations

1) SARs were most critical response to consider

2) Use multiple sources of data to evaluate change

- fish travel time
- juvenile survival
- ocean survival
- stock-recruit residuals
- run-reconstruction SARs

Workshop Comments and Recommendations

1) SARs were most critical response to consider
2) Use multiple sources of data to evaluate change

3) Update and refine model parameters over time to determine whether associations are changing

Workshop Comments and Recommendations

1) SARs were most critical response to consider
2) Use multiple sources of data to evaluate change
3) Update and refine model parameters

4) Assess how increased spill will affect detection efficiency and the precision of SARs
   - New spillway detectors will increase detections

Workshop Comments and Recommendations

1) SARs were most critical response to consider
2) Use multiple sources of data to evaluate change
3) Update and refine model parameters
4) How increased spill will affect detection eff. & SAR

5) Improve communication of differences between spill scenarios and terminology for different audiences

Workshop Comments and Recommendations

1) SARs were most critical response to consider
2) Use multiple sources of data to evaluate change
3) Update and refine model parameters
4) How increased spill will affect detection eff. & SAR
5) Improve communication for different audiences

6) Given variability in ocean and flow conditions, probably need > five years to achieve desired learning

Summary:

- Experimental design = a work in progress
  - CSS Workshop final report with independent reviewer comments ~ Summer 2013
- Definition of spill scenarios for simulations based on what appears technically possible with current FCRPS configuration
- Not part of any existing implementation plan or current BiOp consultation

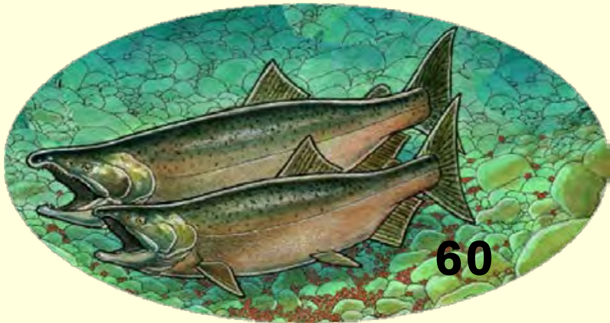
Summary:

- Projections suggest spill to 115/120 or higher would:
  - reduce risk of very low SARs (<1.0%)
  - increase likelihood of SARs >2%

    (<u>lower end</u> of NPCC goal)

Summary:

- Simulations are encouraging in terms of:
  - expected response (conservation benefit)
  - likelihood of detecting response (learning)



Attachment D

SARs and Juvenile Metrics of Upper Columbia Stocks

Robin Ehlke

Aug 27th 2013

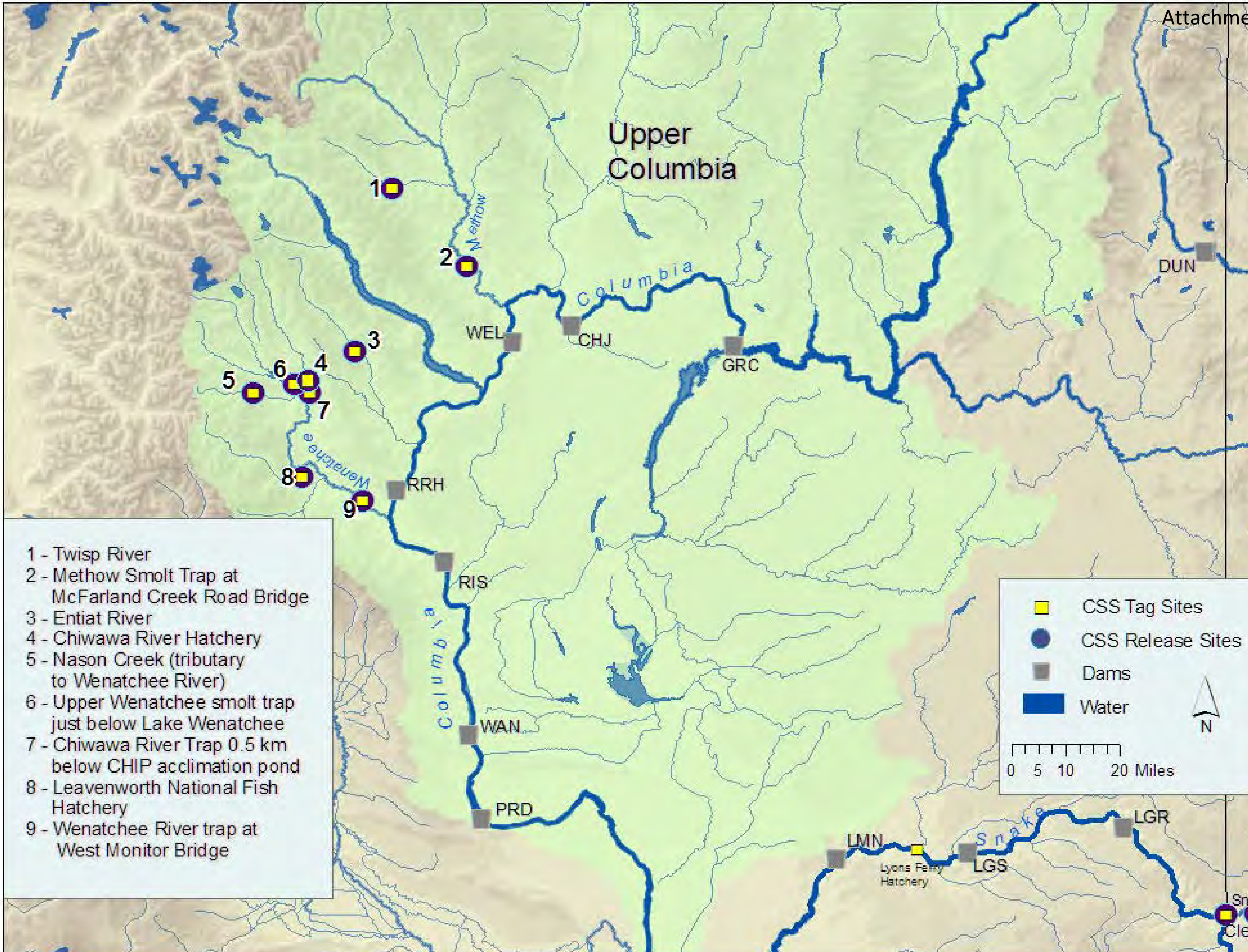
CSS Objectives
Upper Columbia

- Establish long term survival estimates over the full life-cycle of upper Columbia stocks
- Develop Smolt to Adult Return rates (SARs) from the upper-most dam
- Develop estimates of ocean survival rates
- Use additional mark groups as they come available

Upper Columbia Mark Groups

- Five Basin-Specific Groups
  - Wenatchee Basin
    - Hatchery spring Chinook (Leavenworth)
    - Wild Chinook
    - Steelhead (hatchery/wild Cross)
  - Entiat-Methow aggregate
    - Wild Chinook
  - Wenatchee-Entiat-Methow aggregate
    - Wild Steelhead
- Three Groups marked at Rock Island Dam
  - Yearling Chinook, subyearling Chinook, steelhead
  - All three are hatchery/wild aggregates

Attachment E



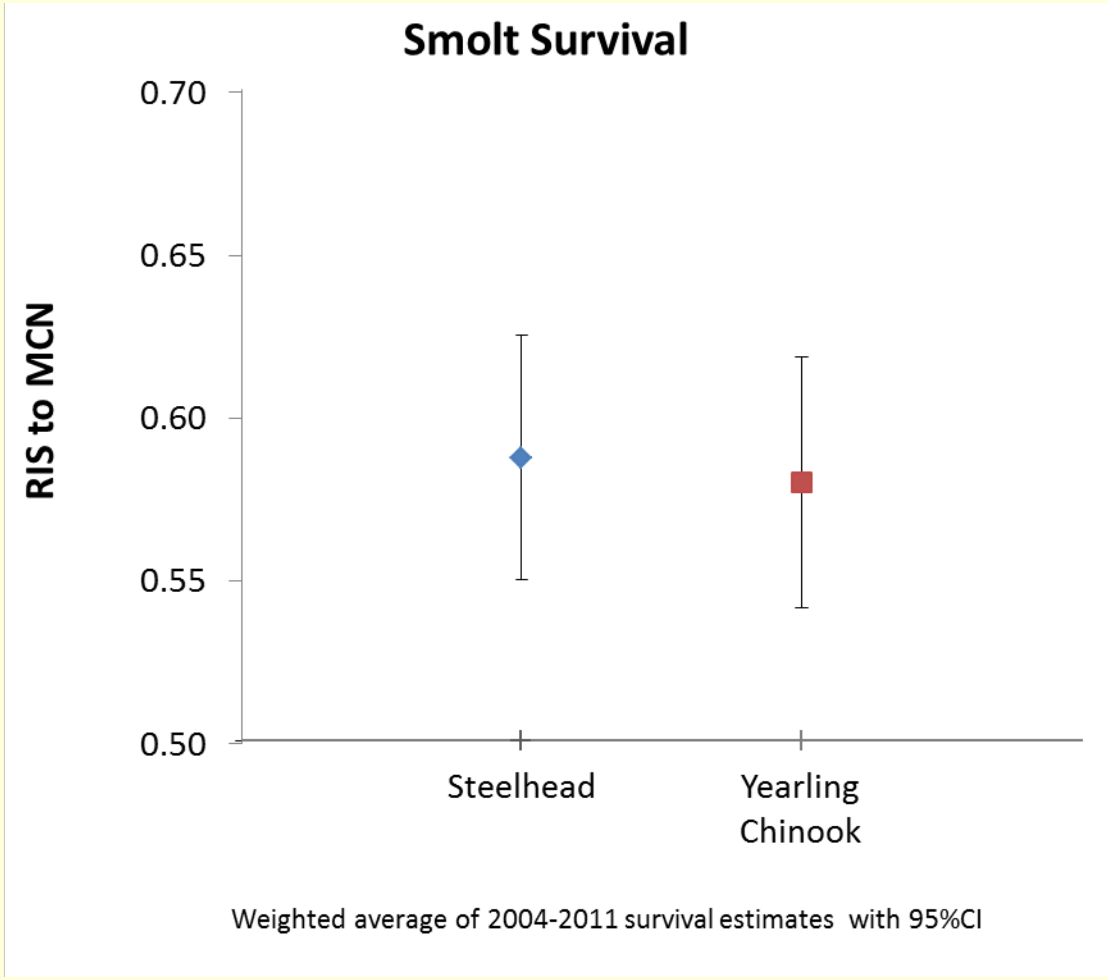
Upper Columbia Juvenile and Adult Metrics

- Juvenile passage metrics, travel time, instantaneous mortality and survival from Rock Island to McNary Dam
- Smolt to Adult Return rates
- Incorporated detection capability at Rocky Reach Dam
- Report analyses of passage metrics and SARs relative to environmental variables

Smolt to Adult Return

- Upper Columbia Smolts from McNary Dam to Bonneville Dam
  - MCN to BON SARs do not include or account for juvenile mortality occurring through the Upper Columbia to McNary Dam
  - For this reason the MCN to BON reported SARs are biased high
  - As an example, for Wenatchee the SARs would be ~ 58% of reported if RIS to MCN juvenile survival were taken into account

Rock Island to McNary Juvenile Survival



- Steelhead survive slightly better than Chinook
- Typically both species' survival is less than 60%.
- A large component of life-cycle is not represented in MCN to BON SARs

Juvenile Passage RIS-MCN Metrics/Environmental conditions

- Fish Travel Time
  - Faster with higher flow and with Julian date
- Instantaneous Mortality
  - Decreased for Chinook as spill levels increased at Wanapum and Priest Rapids
  - Increased for steelhead with increase in Julian date
- Reach Survival
  - Increased with higher flow and spill

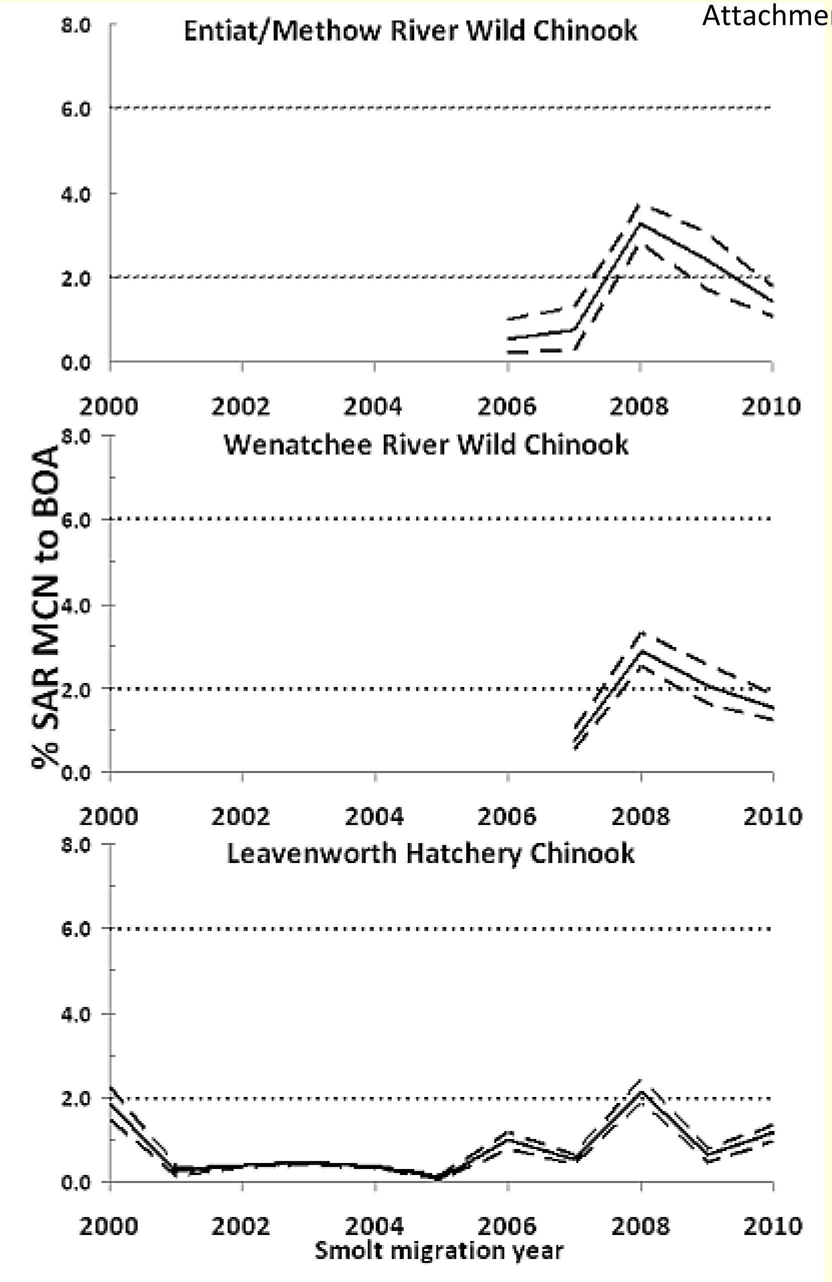
Wild and Hatchery Chinook SAR MCN to BON

Entiat / Methow R. Wild Chinook
- SARs averaged 1.35% (0.5%-3%)
- Enter Columbia River upstream of Rocky Reach Dam

Wenatchee River Wild Chinook
- SARs averaged 1.62% (0.8%-3%)
- Enter the Columbia River upstream of Rock Island Dam

Leavenworth Hatchery Chinook
- SARs averaged 0.58%
- Enter the Columbia River upstream of Rock Island Dam

All Groups
- Exceeded 2% in 2008
- Do not include Upper Columbia reach
- 2010 data does not include 3-salt fish



Attachment E

Wild and Hatchery Chinook SAR MCN to BON

Entiat / Methow R. Wild Chinook
- SARs averaged 1.35% (0.5%-3%)
- SARs less when calculate from Rocky Reach back to Bonneville Dam

Wenatchee River Wild Chinook
- SARs averaged 1.62% (0.8%-3%)
- Enter the Columbia River upstream of Rock Island Dam

Leavenworth Hatchery Chinook
- SARs averaged 0.58%
- Enter the Columbia River upstream of Rock Island Dam

All Groups
- Exceeded 2% in 2008
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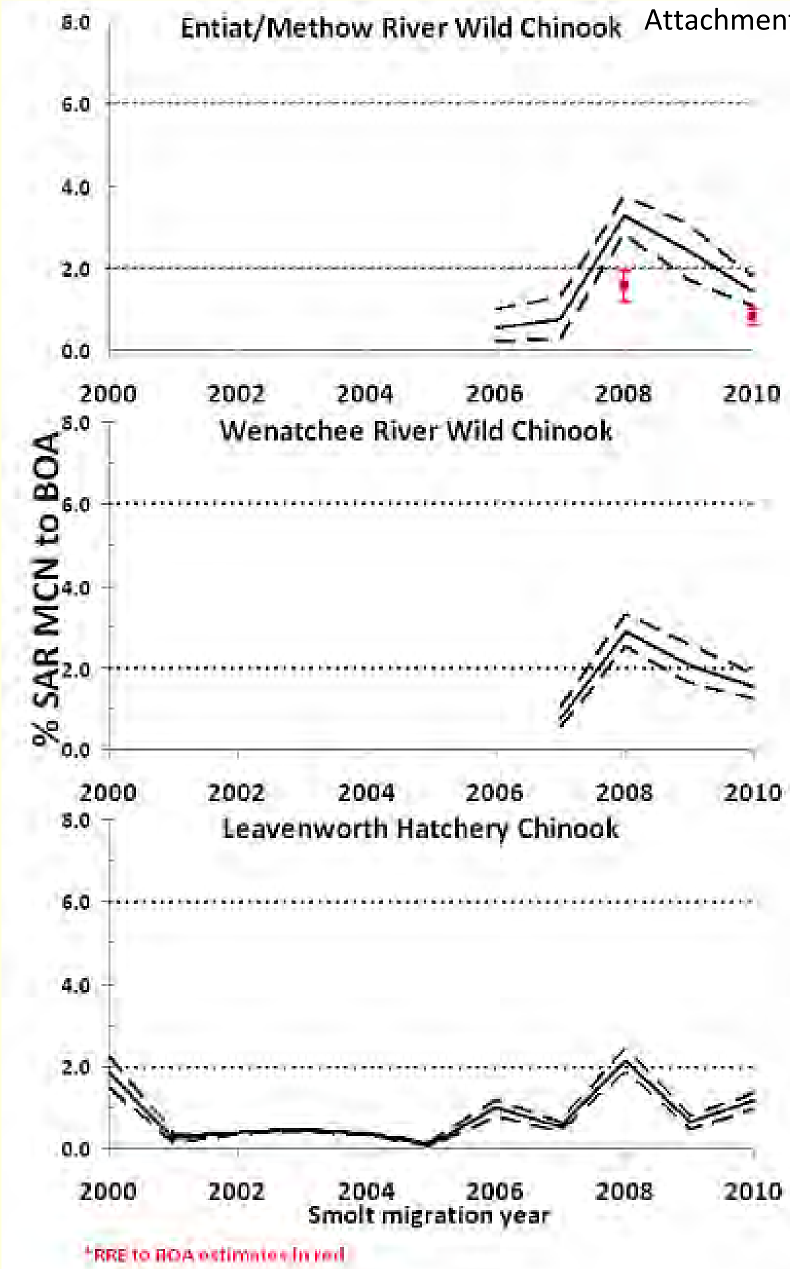
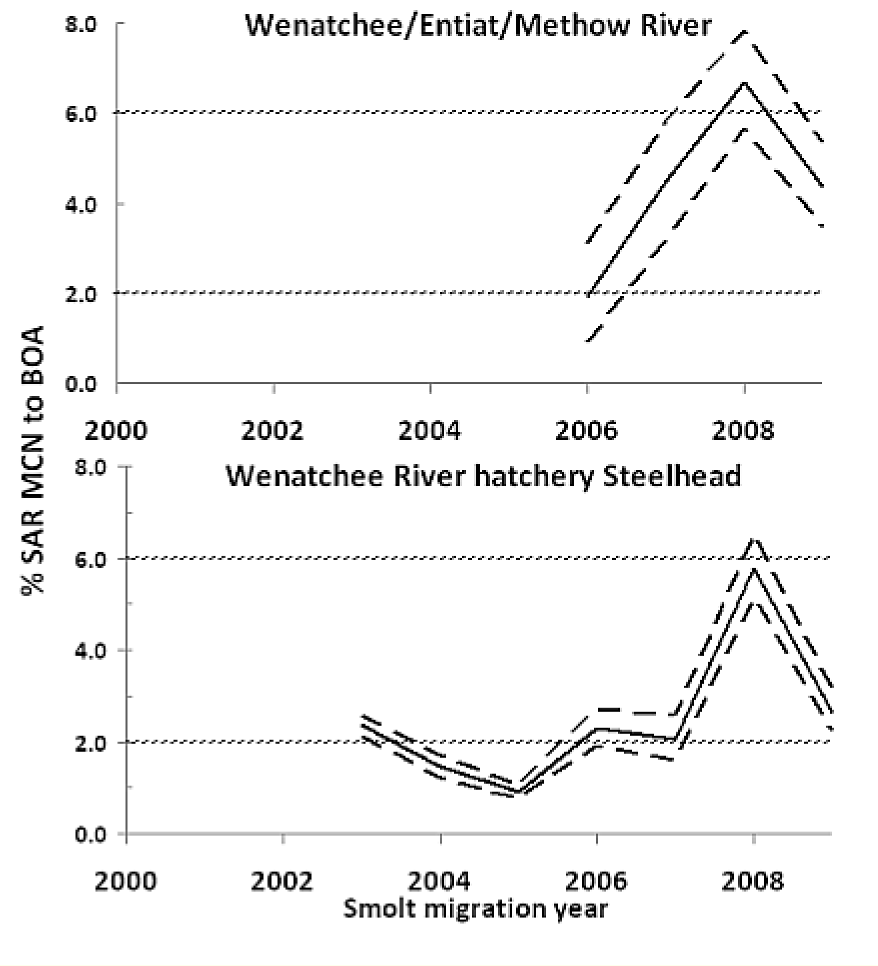


Wild and Hatchery steelhead SAR MCN to BON

Wild Steelhead
- SARs averaged 3.97%
- Aggregate mark group - Wenatchee, Entiat and Methow stocks
- Upper Columbia reach not included

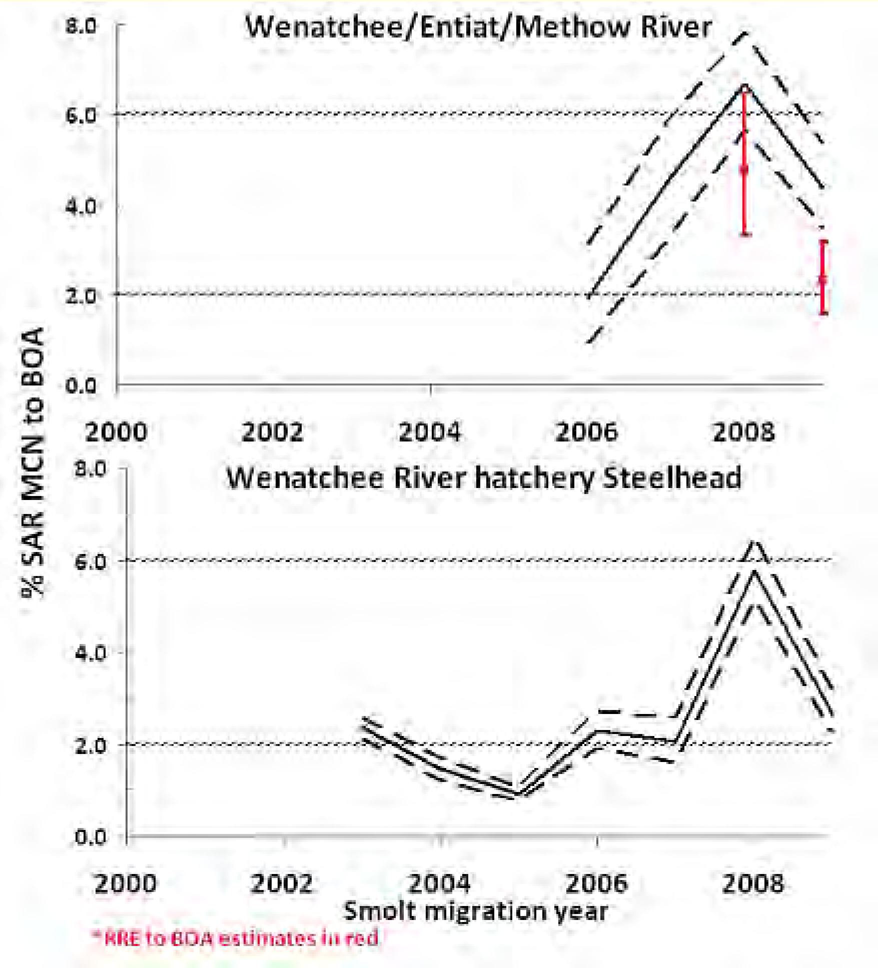
Hatchery Steelhead
- SARs averaged 2.16%
- Wenatchee basin
- Upper Columbia reach not included



Wild and Hatchery steelhead SAR MCN to BON

Wild Steelhead
- SARs averaged 3.97%
- SARs less when calculate from Rocky Reach back to Bonneville Dam (Entiat and Methow stocks)

Hatchery Steelhead
- SARs averaged 2.16%
- Wenatchee basin
- Upper Columbia reach not included



Chinook and Steelhead SAR RIS to BON

Hatchery / Wild Yearling Chinook

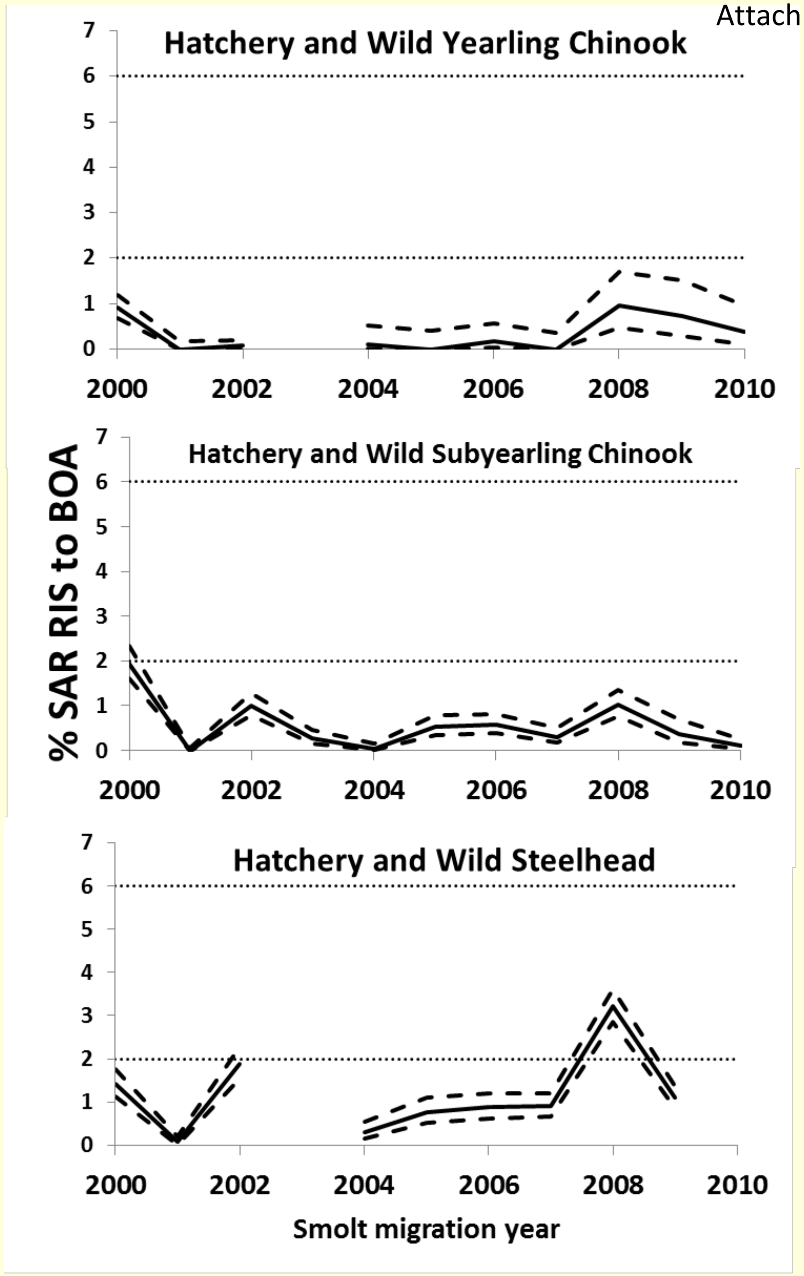
- SARs averaged 0.3%
- Bypass inoperable during spring of 2003 – no data

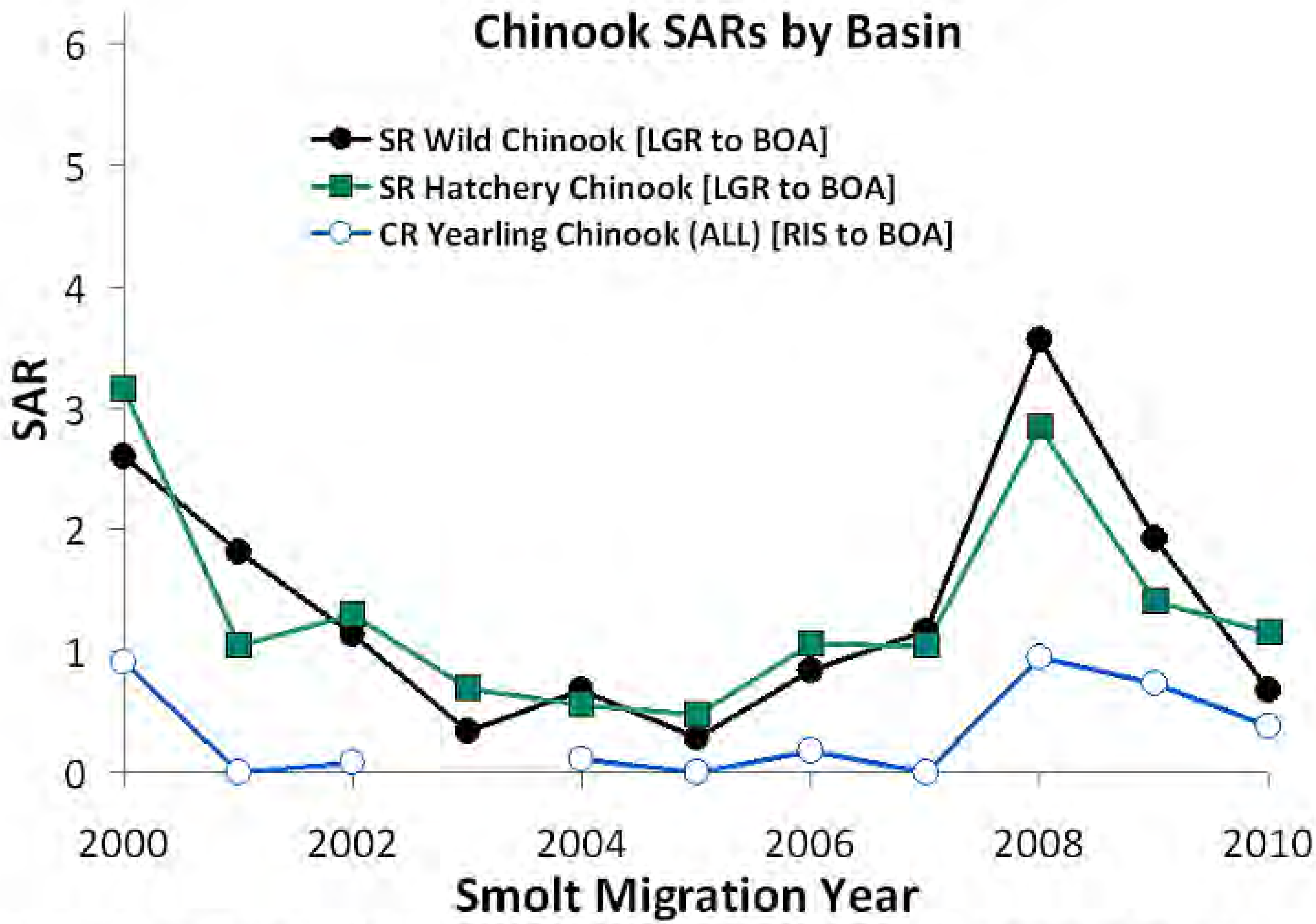
Hatchery / Wild Subyearling Chinook

- SARs averaged 0.6%

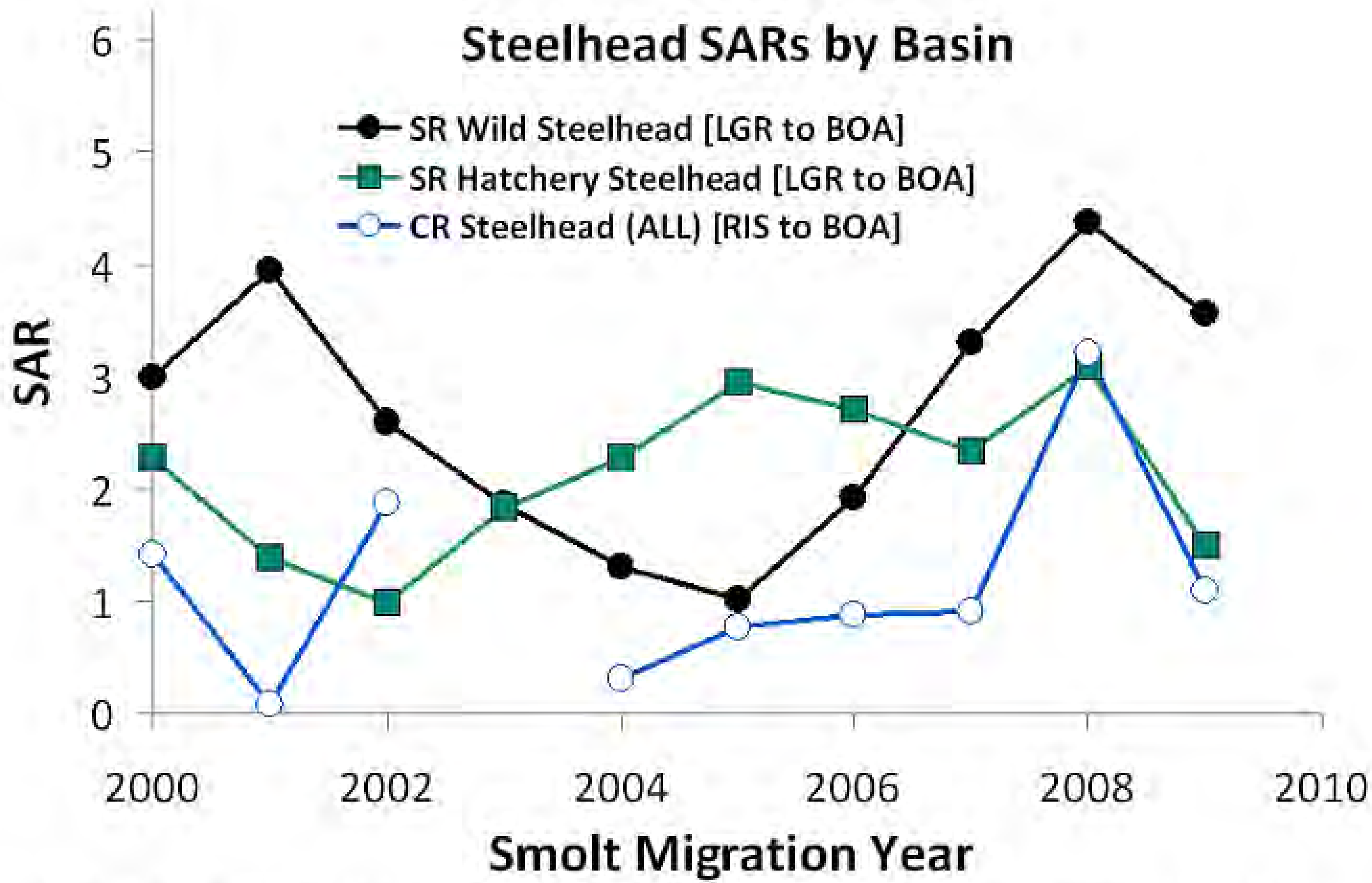
Hatchery / Wild Steelhead

- SARs averaged 1.17%
- Bypass inoperable during spring of 2003 – no data



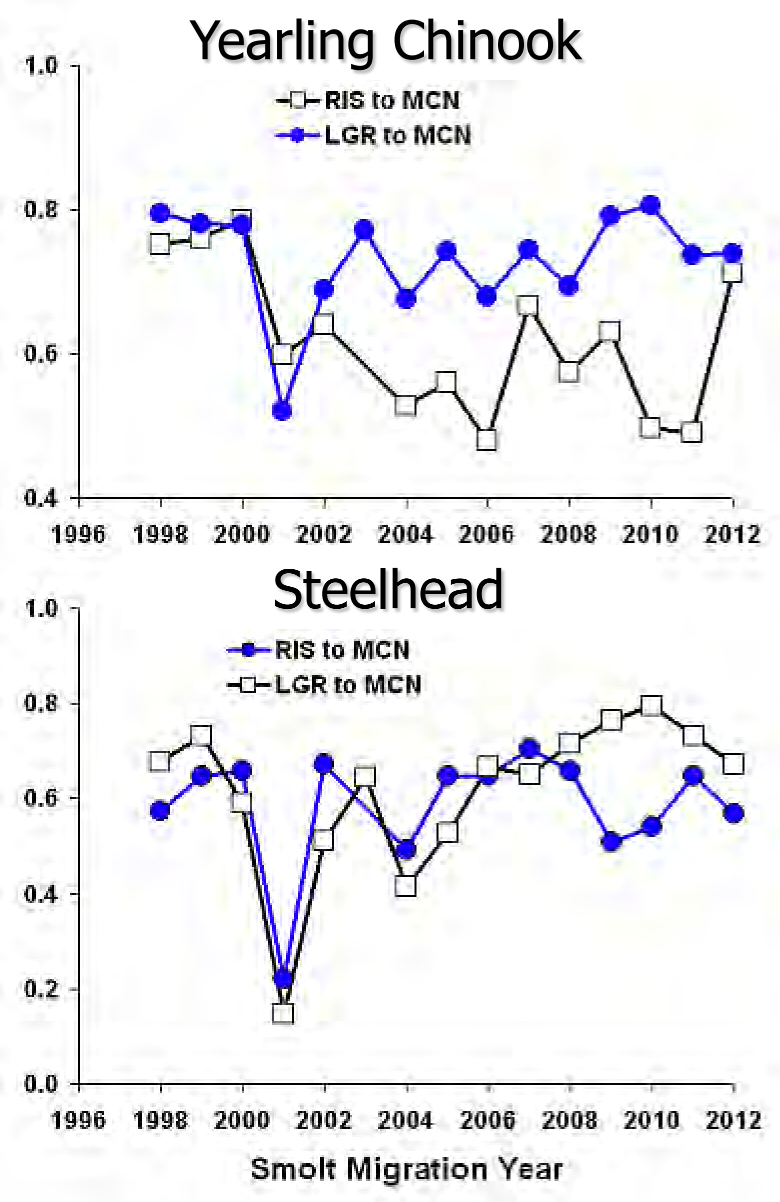


* SR hatchery Chinook 2000-2010 are averages of all hatchery specific estimates that year
LGR to BOA is ~286 miles [7 dams]
RIS to BOA is ~ 308 miles [6 dams]

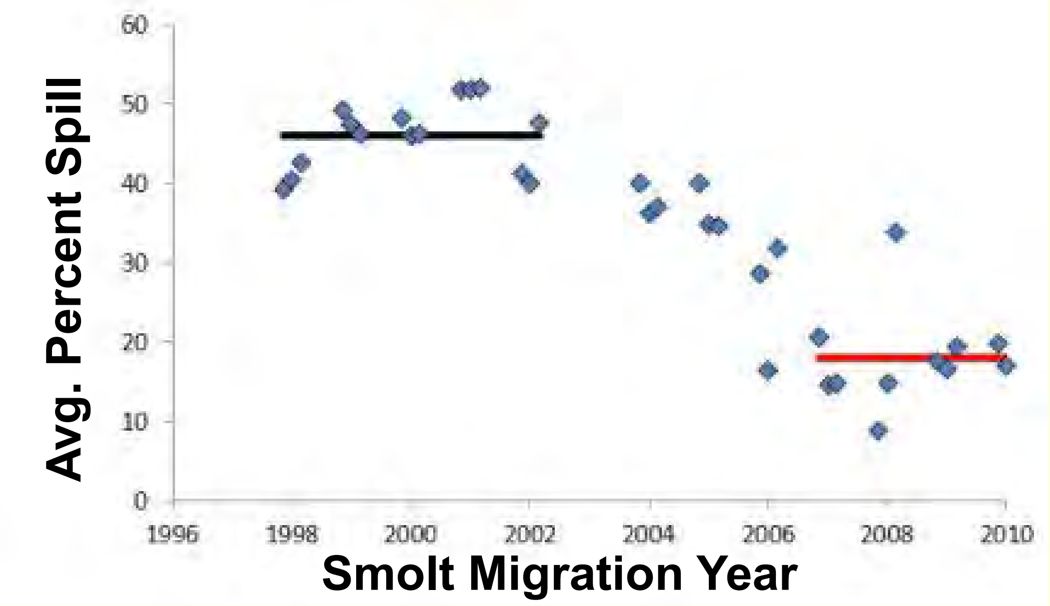


' SR hatchery steelhead 2000-2009 are averages of all basin specific estimates that year
LGR to BOA is ~286 miles [7 dams]
RIS to BOA is ~ 308 miles [6 dams]

Reach Survival Comparison of Juvenile Salmon: Snake River to Upper Columbia Stocks (FPC report)



Average Percent Spill at Wanapum and Priest Rapids Dams



Conclusion

- The Overall Upper Columbia MCN-BON SARs for 2000-2010 Chinook were highly correlated with spring Chinook SARs from the Middle Columbia and with spring/summer Chinook SARs from the Snake River
- Indication that upper Columbia stocks have similar responses to shared in-river and ocean life-cycle experiences.
- Upper Columbia stocks also showed similar patterns of response to environmental variables when compared to mid Columbia and Snake River Stocks

Conclusion

- Collaboration and coordination with other Upper Columbia specific marking efforts increases cost effectiveness and the benefits to the region
- Monitoring the effect of hydro system passage on Upper Columbia groups from existing marking is value added for managers
- Increase in the number of mark groups/tags and the number of detection sites would strengthen the data.
- Recent increase in USFWS marked hatchery steelhead and Chinook will be available for future years (Winthrop, Entiat)


The End

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	October 22, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the September 24, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at the Radisson Gateway Hotel, in SeaTac, Washington, on Tuesday, August 27, 2013, from 9:30 am to 12:00 pm. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Chelan PUD will incorporate average spill levels (i.e., a "spill line") in the graphs included in the draft Rock Island and Rocky Reach 2013 Fish Spill Report, and provide the revised draft report to Kristi Geris for distribution to the Coordinating Committees. Chelan PUD will be requesting approval of the revised draft report at the Coordinating Committees' conference call on October 22, 2013 (Item II-A).
- Steve Hemstrom will provide an updated flow duration curve for valid survival studies, using the 1929 to 1977 dataset to which the 1983 to 2012 dataset is added, and for comparison, also using only the 1983 to 2012 dataset, to Kristi Geris for distribution to the Coordinating Committees (Item II-C). *(Note: Hemstrom will also include data from the month of June in the summer study period in both updated flow duration curves, as agreed to at the Coordinating Committees' July 23, 2013, conference call.)*
- Coordinating Committees representatives will provide comments and/or approval of the Wells Dam Water Quality Attainment Plan (WQAP) via email to Tom Kahler (with copy to Kristi Geris) no later than October 9, 2013 (Item III-A). *(Note: Coordinating Committees members provided no specific comments on the WQAP by the comment deadline, nor did they request additional time for review.)*

- Tom Kahler will investigate options to streamline the Coordinating Committees' review and approval process of Douglas PUD non-HCP documents that require Coordinating Committees consultation by the Federal Energy Regulatory Commission (FERC) under the new Wells license (Item III-A).
- Tom Kahler will revise the draft 2013 Wells Dam Post-Season Bypass Report, as requested by the National Marine Fisheries Service (NMFS), and will provide the revised draft report to Kristi Geris for distribution to the Coordinating Committees. Douglas PUD will request approval of the revised draft report at the Coordinating Committees' conference call on October 22, 2013 (Item III-B).
- The Coordinating Committees' meeting on October 22, 2013, will be held via conference call (Item V-C).
- The Coordinating Committees' meeting on November 26, 2013, is rescheduled to November 19, 2013, and will be held in person at the Radisson Hotel in SeaTac, Washington (Item V-C).
- The Coordinating Committees' meeting on December 24, 2013, is rescheduled to December 17, 2013, and will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined (Item V-C).
- Tom Kahler will contact Jeff Fryer about providing a presentation to the Coordinating Committees on the Columbia River Inter-Tribal Fish Commission's (CRITFC's) sockeye studies at the Coordinating Committees' meeting on November 19, 2013 (Item V-C).
- Mike Schiewe will contact Denny Rohr regarding the Coordinating Committees' remaining 2013 meetings arrangements (Item V-C).

DECISION SUMMARY

- No Statements of Agreement were approved at today's meeting.

AGREEMENTS

- Chelan PUD agreed to extend fish counts at Rocky Reach Dam into the "off-season" winter months in 2014/2015 (Item I-A).
- Coordinating Committees representatives present agreed to hold their meeting on October 22, 2013, by conference call (Item V-C).

- Coordinating Committees representatives present agreed to reschedule their meeting from November 26, 2013, to November 19, 2013, which will be held in person at the Radisson Hotel in SeaTac, Washington (Item V-C).
- Coordinating Committees representatives present agreed to reschedule their meeting from December 24, 2013, to December 17, 2013, which will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined (Item V-C).

REVIEW ITEMS

- "Assessment of Factors Limiting the Productivity of Summer Chinook Salmon in the Mid-Columbia River" by Hillman, Murauskas, and Hemstrom (2013), which was distributed to the Coordinating Committees on June 26, 2013, is available for review, with comments due to Steve Hemstrom (as discussed at the Coordinating Committees meeting on June 25, 2013).
- Kristi Geris sent an email to the Coordinating Committees on August 28, 2013, notifying them that the draft Wells Dam WQAP is available for review. As discussed at today's meeting, comments and/or approval of the draft plan are due to Tom Kahler (with copy to Geris) no later than October 9, 2013 (Item III-A). *(Note: Coordinating Committees members provided no specific comments on the WQAP by the comment deadline, nor did they request additional time for review.)*

REPORTS FINALIZED

- There are no reports that have been recently finalized.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Steve Hemstrom added updates on two Chelan PUD action items from the last Coordinating Committees meeting on August 27, 2013; and also an update on Chelan PUD staffing.

- Mike Schiewe added a follow-up discussion on the Fish Passage Center's (FPC's) Comparative Survival Study (CSS) Presentation.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft August 27, 2013 conference call minutes. Kristi Geris said there was one outstanding comment remaining to be discussed regarding the discussion following the FPC's CSS Presentation. Steve Hemstrom had noted the high sockeye smolt-to-adult ratios (SARs) based on Dr. Kim Hyatt's work, and added that sockeye are the *highest* migrating fish in the Upper Columbia. Hemstrom clarified sockeye are the *farthest* migrating fish in the Upper Columbia. The Coordinating Committees members present approved the draft August 27, 2013, conference call minutes as revised. Kirk Truscott approved the revised draft minutes via email on September 23, 2013. Geris will finalize the meeting minutes and distribute them to the Committees.

B. Action Items Review (Mike Schiewe)

Action items from the last Coordinating Committees meeting on August 27, 2013, and follow-up discussions were as follows: *(Note: italicized item numbers below correspond to agenda items from the August 27, 2013 meeting.)*

- *Chelan PUD will summarize available data on fish passage at Rocky Reach Dam during the "off-season" winter months, and provide these data to Kristi Geris for distribution to the Coordinating Committees (Item II-B).*
  Steve Hemstrom said that he spoke with Rocky Reach Dam staff and found that little "off-season" work has been conducted, and only specific to bull trout; and that other species were not tabulated. He spoke with the only remaining counter from the bull trout work, but the counter could not specifically recall observing other fish.
- *Chelan PUD will evaluate the potential to extend fish counts at Rocky Reach Dam into the "off-season" winter months, starting winter 2014/2015 (Item II-B).*
  Steve Hemstrom said that Chelan PUD will extend fish counts at Rocky Reach Dam into the "off-season" winter months in 2014/2015.

II. Chelan PUD

A. 2013 Rock Island and Rocky Reach Fish Spill Report (Steve Hemstrom)

Steve Hemstrom said that the final draft 2013 Rock Island and Rocky Reach Fish Spill Report (Attachment B) was distributed to the Coordinating Committees by Kristi Geris on September 20, 2013. He said that charts were added to provide a visual depiction of daily passage and index counts, including when spill started and ended; and he added that these charts will be included in spill reports from this point forward. He reviewed 2013 Rocky Reach summer spill, and noted that the Data Access in Real Time (DART) database can be queried to obtain daily spill averages in cubic feet per second. Bryan Nordlund suggested incorporating a range of collection efficiencies, or bypass efficiencies, into the report, which could then be used to calculate outmigration data. Lance Keller noted that the index counts are based on 2-hour daily sampling events, where collection is representative of the entire day. Therefore, to incorporate such data, the entire index would need to be expanded. Nordlund said he had hoped that some form of a juvenile index would provide some estimation of whether the adult returns are as expected. He said, however, that it now appears impractical to include these data.

Schiewe noted the Rocky Reach summer spill percentage (i.e., 11.73%) is off target (i.e., 9%), and suggested incorporating a “spill line” into the charts to convey forced spill. Hemstrom agreed a spill line would help clarify certain data, and said that he would incorporate average spill levels (i.e., a “spill line”) in the graphs included in the draft Rock Island and Rocky Reach 2013 Fish Spill Report, and provide the revised draft report to Geris for distribution to the Coordinating Committees.

Nordlund noted the spike in subyearling Chinook outmigration in June followed by a larger outmigration in July, and asked if this is normal. Hemstrom replied that it is, and Keller added that the initial pulse was likely attributed to hatchery releases; and noted that DART is a good resource to look more closely at those numbers. Schiewe also added that it seems these data should align with Douglas PUD’s data from their subyearling study as well, and Tom Kahler confirmed that they do.

Hemstrom reviewed 2013 Rock Island spring and summer spill, and noted that spring spill continued directly into summer spill, with no interruption in spill. He also noted the 2-day flatline in juvenile index counts in August when the Rock Island Right Adult Ladder was dewatered to repair the bowed vane in the picket-barrier leading to the auxiliary water system space. Keller also noted the dip around July 4, and explained that it was due to trap complications. Hemstrom said that Chelan PUD is planning to run the bypass longer next year, but the exact duration is yet to be determined.

Chelan PUD will request approval of the revised draft 2013 Rock Island and Rocky Reach Fish Spill Report at the Coordinating Committees' conference call on October 22, 2013.

B. Chelan County Noxious Weed Board Plan for Application of Milfoil Control Chemical in Rocky Reach Reservoir, 2014 (Steve Hemstrom)

Steve Hemstrom said that Chelan PUD and the Washington State Department of Ecology (Ecology) met by conference call to discuss concerns about the Chelan County Noxious Weed Board's proposed pilot application of Triclopyr triethylamine (TEA) near the mouth of the Entiat River. Hemstrom said that Ecology shares the same concerns regarding potential impacts to summer and fall Chinook salmon and lamprey. He said that Chelan County does not yet have approval to carry out the pilot application of TEA, and explained that the County has been operating under a feasibility grant, but application requires a separate grant. He said the Ecology indicated that if there are too many issues surrounding the application of TEA, then the permit would not be granted. Hemstrom added that he believes Ecology would be the agency to award the grant. Hemstrom said that he will keep the Coordinating Committees updated as more develops.

C. Valid Study Flow Duration Curve Preparation (Steve Hemstrom)

Steve Hemstrom said that the updated flow duration curve for valid survival studies is almost complete. He requested to carry forward his action item to provide an updated flow duration curve for valid survival studies, using the 1929 to 1977 dataset to which the 1983 to 2012 dataset is added, and for comparison, also using only the 1983 to 2012 dataset, to Kristi Geris for distribution to the Coordinating Committees. *(Note: Hemstrom will also include data from the month of June in the summer study period in both updated flow duration curves, as agreed to at the Coordinating Committees' July 23, 2013, conference call.)*

D. Chelan PUD Staffing Update (Steve Hemstrom)

Steve Hemstrom announced that Chelan PUD has selected a replacement biologist to fill the position formerly held by Josh Murauskas. Hemstrom said that Catherine Willard, previously with the U.S. Forest Service Entiat Ranger District, will start September 30, 2013. He said that Willard will also support Alene Underwood with HCP Hatchery Committees' project work.

III. Douglas PUD

A. DECISION: Wells Dam Water Quality Attainment Plan (Tom Kahler)

Tom Kahler said that the draft Wells Dam WQAP was distributed to the Coordinating Committees by Kristi Geris on August 28, 2013. He said the WQAP is one of several non-HCP documents drafted and reviewed by Andrew Gingerich and the Aquatic Settlement Workgroup (SWG), but that now also require Coordinating Committees consultation under the new FERC license. Kahler said historically, these types of documents have not required Coordinating Committees' review and added that this one in particular addresses meeting water quality standards for Washington State. He said the WQAP needs to be reviewed and approved, and finalized in the meeting minutes prior to submitting the final document to FERC by the end of October 2013. Mike Schiewe noted that this document has been reviewed by the Aquatic SWG and is up for approval at the October 9, 2013, meeting. He added that Pat Irle, the Aquatic SWG Technical Representative for Ecology, did not flag any issues while discussing the draft plan at the last Aquatic SWG meeting.

Kahler reviewed key components of the plan, including measures to improve total dissolved gas (TDG) models, alternatives analyses, and TDG management strategies. Schiewe noted the ongoing issues in the Wells Forebay due to incoming TDG, which Ecology has been forthright in recognizing that Douglas PUD has limited ability to control. Schiewe said that, although not written in a Washington Administrative Code, it has been verbally agreed to by Ecology that if the forebay TDG is out of compliance, as long as the project does not add TDG, the project is still considered in compliance. He also noted that additional TDG monitoring stations were recently installed that will hopefully provide more representative readings of incoming TDG.

Bryan Nordlund suggested streamlining the Coordinating Committees' review and approval process of all of these FERC-required non-HCP documents, as opposed to reviewing and approving each individually. Schiewe agreed and suggested that Douglas PUD put together PowerPoint presentations to review the key components of each document. Kahler said that the FERC license does not specifically state that Coordinating Committees' approval is required; rather, the opportunity to review is required. Schiewe said that, except for NMFS, Coordinating Committees members can always defer to their Aquatic SWG Technical Representative counterpart. Jim Craig suggested approving the draft WQAP by email, and dovetailing the Coordinating Committees' approval with the Aquatic SWG's next meeting. Coordinating Committees representatives agreed to provide comments and/or approval of the Wells Dam WQAP via email to Kahler (with copy to Geris) no later than October 9, 2013; and Kahler said that he will investigate options to streamline the Coordinating Committees' review and approval process of Douglas PUD non-HCP documents that require Coordinating Committees consultation according to the FERC license.

B. Draft 2013 Wells Dam Post-Season Bypass Report (Tom Kahler)

Tom Kahler said that the draft 2013 Wells Dam Post-Season Bypass Report (Attachment C) was distributed to the Coordinating Committees by Kristi Geris on September 23, 2013. He recalled that in 2011, John Skalski and Richard Townsend of Columbia Basin Research conducted analyses on bypass migration at Wells Dam. Based on those analyses, the Coordinating Committees agreed that beginning in 2012, Wells bypass operations for spring outmigration would be changed from beginning April 12 to beginning April 9; and from ending August 26 to ending August 19. He said that 2013 was the second year of implementing these bypass operation changes, and noted that Douglas PUD achieved the HCP requirement to provide bypass operations during 95% of the juvenile salmon and steelhead migration passing Wells Dam. He said further, that as described in Table 2 in Attachment C, bypass routes were provided for at least 98% of each plan species' migrations.

Bryan Nordlund asked if average travel times as described in Table 1 of Attachment C were based on Chelan PUD's acoustic tag studies. Kahler replied that they were except for the yearling Chinook data, which were based on the Douglas PUD 2010 survival verification study; and subyearling Chinook, for which they used the travel times for steelhead and sockeye. Kahler said that he would revise the text describing Table 1 to reflect that average travel times were based on passive integrated transponder (PIT) tag studies for yearling Chinook, and acoustic tag studies of steelhead and sockeye for the other species. Kahler also acknowledged that those data on yearling Chinook are not representative of the run at large; however, he explained that they were used because the estimate is conservative.

Mike Schiewe asked for clarification of the meaning of the last column in Table 3 of Attachment C. Kahler explained that the value listed in the last column represents the amount of time (days) that the actual start date (second column) could have been adjusted and the 95% standard would still have been achieved. For example, in 2013, bypass operations could have started at 00:00 hours on April 10, and 98% coverage of the yearling Chinook outmigration would have still been achieved, but waiting until April 11 would have resulted in not achieving the 95% standard. In other words, at some point on April 10 enough fish migrated through Wells that had we waited until the April 11 to start the bypass operations we would have missed too large a proportion of the run to achieve the 95% standard.

Nordlund asked, regarding Table 3 of Attachment C, if the date by which the first 5% passed (fifth column) is modeled data, and Kahler replied that it is. Teresa Scott asked if those are modeled data, then why are the cumulative proportions not all 5%? Kahler explained that the cumulative count includes the entire day (i.e., 24 hours), but bypass dates always start at 00:00 hours.

Kahler said that he will revise the draft 2013 Wells Dam Post-Season Bypass Report, as requested by NMFS, and will provide the revised draft report to Geris for distribution to the Coordinating Committees. Douglas PUD will request approval of the revised draft report at the Coordinating Committees' conference call on October 22, 2013.

IV. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe reported that the HCP Hatchery Committees did not meet in September due to the limited number of people available to attend. He said that a conference call is scheduled for October 7, 2013, to discuss time-sensitive agenda items, including:

- *Live-Spawning Twisp River Steelhead Broodstock Update*: The Yakama Nation (YN) plans to discuss live-spawning Twisp River steelhead for the YN Steelhead Kelt Reconditioning Program. The program is currently located at Winthrop National Fish Hatchery, and the YN has expressed interest in the Methow Fish Hatchery for live-spawning and early-rearing. The program is funded through the next few years through Columbia River Fish Accords funds; however, there is reluctance about the risk of transmitting disease. Bob Rogers of the Washington Department of Fish and Wildlife (WDFW) will be on the call to discuss potential fish health issues.
- *Hatchery and Genetic Management Plans Update*: In the midst of all of the permitting issues, there was potential that certain steelhead programs would go uncovered. NMFS agreed to provide letters extending existing permits. Tom Kahler confirmed that NMFS recently provided a letter to all applicable programs extending the current permits. He added that no end date was specified on the extension.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees' meeting on September 23, 2013:

- *Budget Amendment*: The Wells Tributary Committee approved a $25,000 increase in funding for Trout Unlimited on the Twisp River Well Conversion Project. A recent system test found that the system was unable to produce the desired production of 150 gallons per minute. The driller and hydrogeologist said that the well will produce the required production if it is deeper. The additional funds will be used to deepen the well.
- *Contract Extension*: The Wells and Rocky Reach Tributary Committees granted a one year, no cost contract extension to the Okanagan Nation Alliance for the Shingle Creek Fish Passage Project.
- *General Salmon Habitat Program Projects*: Four projects selected to receive Plan Species Account funds were not selected to receive matching funds from the Salmon Recovery Funding Board (SRFB). Tom Kahler said there were some really high-priced projects that reduced the total number of SRFB-funded projects in this funding round relative to previous funding rounds. The Chelan County Natural Resource Department asked for additional clarity on the rejection of the Icicle-Peshastin Irrigation District Pump Exchange Project, and Kahler explained that there were too many concerns with the proposed project that had not been satisfactorily addressed

by the project sponsor. Jim Craig added that Icicle-Peshastin did not want to be encumbered by pumping costs.

- *Okanagan Project Tours*: The Tributary Committees will tour habitat restoration projects in Canada on October 9 and 10, 2013.
- *Next Steps*: The next Tributary Committees meeting will be on November 15, 2013.

V. HCP Committees Administration

A. Fish Passage Center's Comparative Survival Study Presentation Follow-Up (Mike Schiewe)

Mike Schiewe said that Bob Rose recently spoke with Michele DeHart of the FPC; however, he could not attend the meeting today because he was meeting with contractors at the Marion Drain sturgeon facility.

Teresa Scott recalled the FPC's estimates that fish passage at dams only represent a sliver of the entire life cycle process. She said based on this estimate, she would be hard-pressed to ask more of the PUDs when, for example, ocean conditions are a major driver for returns.

Bryan Nordlund said that, compared to numbers calculated by the HCPs at each project, he was surprised by the survival numbers that the FPC presented. He said he then realized that the CSS numbers are "limited," and represent only a composite fraction of what is really returning to the upper Columbia River, versus a statistically valid study on a project. Nordlund recalled several years back when a group of fish released in the Yakima River did poorly, and the CSS reported that it was due to passage issues in the Columbia River. He said another thing he had a hard time reconciling were the poor SARs that were presented, when there are such high counts at the dams. Nordlund said there were several limitations in their analyses, and they presented them as if they were dam operations. He said that CSS data were also presented in a recent article in the *NW Fishletter* that discussed the current status of the Federal Columbia River Power System Biological Opinion, which Nordlund said reflected the same incompleteness that was presented to the Coordinating Committees.

Jim Craig said that he appreciates the opportunity to learn about the CSS; however, there were many unverified assumptions. He added that the Independent Scientific Review Panel also provided a review suggesting problems with the analyses. Craig said he believes that the claims the CSS are advocating are premature given the minimal data they have, and added that he feels more comfortable with the PUD survival estimates.

Nordlund said that he was unclear on why the FPC cannot analyze all of the PIT-tag data, when everything is available in the PIT-Tag Information System (PTAGIS). He added that he wondered what they were really asking for. Nordlund said that he is curious about the 2010 PIT-tag studies and what those SARs look like. Tom Kahler said that he started looking through those data; however, he was not evaluating SARs. Rather he was looking at differences between the treatment and control groups; which, Kahler added, would show delayed mortality effects. Nordlund asked if returning minijacks were tracked, and Kahler replied that they were, and were excluded from the data analysis (i.e., “censoring”). Kahler also noted that the FPC sampling at Rock Island was not representative of the run at large because of the condition of fish likely to be entrained into an unscreened gatewell.

Schiewe said that he briefly spoke with Denny Rohr about follow-up discussions at the Priest Rapids Coordinating Committee Hatchery Sub Committee (PRCC HSC) meeting, and Rohr indicated that discussions were, for the most part, ongoing. Nordlund said that, based on conversations within the PRCC following the FPC’s CSS presentation, the PRCC feels that they may need to develop a formal response. He added that Grant PUD has been publicizing how successful their programs are, and now the CSS is claiming poor SARs. Nordlund said that the PRCC may develop a document distinguishing the sources of those data, and how they may or may not fit with project survival estimates.

Scott said that WDFW is considering modifying TDG standards to accommodate an increase in the gas cap, and added that she is uncertain of the implications this would have in terms of a spill experiment. Schiewe asked if this meant that the U.S. Army Corp of Engineers would be granted a permanent waiver, opposed to the typical annual waiver. Scott replied that she believes this means the level of the waiver would be increased; i.e., the waiver will still be on an annual basis, but ground rules for an experiment would be established. Scott said that the details have not yet been discussed, but WDFW is doing their due diligence at this point of the process. Scott also noted that Oregon State has a completely different rule process. Kahler asked whether for dams on the Washington-Oregon border, the rules go by the most conservative standard. Schiewe recalled the huge body of information that was developed in the 1970s about the cumulative effects of high gas—a time when high TDG was impacting returning adult salmon. Schiewe said that he would hope that those data should be considered. Nordlund asked how WDFW is consulting with Ecology, and Scott replied that WDFW was recently invited to participate in a meeting with Ecology to discuss what needs to be completed in terms of process. She said that this meeting would be composed of a staff group to discuss process-wise options to present to the directors. She said that those 1970s data would be considered, experts would be consulted, and risks and conditions would be discussed. Scott noted that the experts consulted would likely include members of the HCP Coordinating Committees.

Steve Hemstrom said he thought it would be difficult for Ecology to prove that increased spill will increase survival or benefit SARs. He said that it will also be difficult to prove the benefit of increasing spill will outweigh the detriment of TDG. Nordlund also noted that since all project passage systems are different, and spillway passage survival at each project is different, he did not understand how the proposed FPC study using a blanket uniform spill percentage could be construed to optimize juvenile fish survival for the Columbia River. Lance Keller noted the potential for adverse impacts on adults, and added that juveniles are just as important as adults, but mathematically for SARs, adults weigh heavier.

Scott agreed with Craig's sentiments that while the CSS has a lot of data on the Snake River, it is unrealistic to expect to be at the same stage on the Upper Columbia. She recalled two questions presented by the FPC: 1) can the PUDs help those involved in the CSS better understand the PIT-tagged groups that are available to increase the sample size in Upper Columbia; and 2) can the PUDs do anything to increase the number of tags in the Upper Columbia. Scott suggested that keeping communication lines open about these things may be helpful. Schiewe noted WDFW's fairly extensive presence in Central Washington in the Chiwawa and the Methow, and suggested that if WDFW is interested in assisting those groups, there are staff in those areas who should be able to communicate and coordinate on data.

Schiewe said that at this point, there is a lot of concern that conclusions are being drawn that people are not comfortable with and noted that Rose will also want to weigh in on the discussion when he is available.

B. HCP Coordinating Committees Distribution List (Mike Schiewe)

The Coordinating Committees revisited the restrictions for the HCP Coordinating Committees distribution list, and the Coordinating Committees representatives present agreed to maintain the distributions lists as previously prescribed.

C. Next Meetings (Mike Schiewe)

Mike Schiewe said that Denny Rohr requested that the Coordinating Committees reschedule their October 22, 2013, meeting to October 29, 2013, to accommodate the PRCC HSC's schedule. Schiewe suggested instead of rescheduling the meeting, holding the meeting by conference call. Coordinating Committees representatives present agreed to hold their meeting on October 22, 2013, by conference call.

Schiewe reviewed the remaining 2013 Coordinating Committees meeting schedule; to accommodate the holidays, he suggested rescheduling the November and December meetings one week in advance of the typical meeting dates. He also suggested holding the November meeting in person, and the December meeting either by conference call or in person, as is yet to be determined. Coordinating Committees representatives present agreed to reschedule their meeting from November 26, 2013, to November 19, 2013, to be held in person at the Radisson Hotel in SeaTac, Washington; and to reschedule their meeting from December 24, 2013, to December 17, 2013, which will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined. Schiewe said that he will contact Rohr regarding the Coordinating Committees' remaining 2013 meetings arrangements.

Tom Kahler said that Jeff Fryer contacted him about providing a presentation on CRITFC's sockeye studies at the next Coordinating Committees' in-person meeting. Kahler said that he will contact Fryer about possibly presenting at the Coordinating Committees' meeting on November 19, 2013.

<u>Remaining 2013 Coordinating Committees' meeting schedule:</u>

- The next scheduled Coordinating Committees meeting is October 22, 2013, to be held by conference call.
- The meeting on November 19, 2013, will be held in person at the Radisson Hotel in SeaTac, Washington.
- The meeting on December 17, 2013, will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A	List of Attendees
Attachment B	Chelan PUD's Final Draft 2013 HCP Preliminary Rocky Reach and Rock Island Fish Spill Report
Attachment C	Draft 2013 Wells Dam Post-Season Bypass Report

Attachment A
List of Attendees

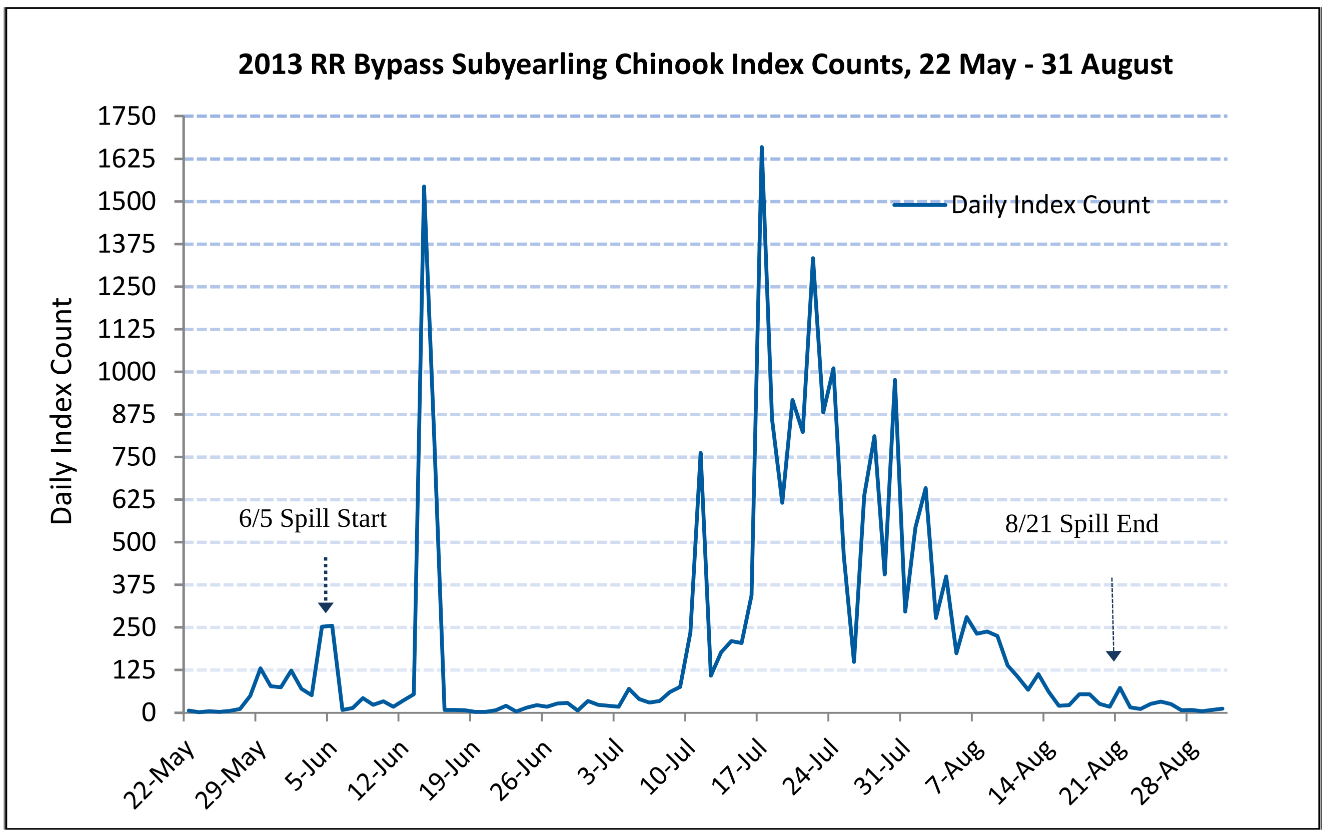
Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Tom Kahler*	Douglas PUD
Bryan Nordlund*	National Marine Fisheries Service
Jim Craig*	U.S. Fish and Wildlife Service
Teresa Scott*†	Washington Department of Fish and Wildlife

Notes:
* Denotes Coordinating Committees member or alternate
† Joined by phone

Chelan PUD
Rocky Reach and Rock Island HCPs
Final 2013 Fish Spill Report

<u>2013 ROCKY REACH</u>
Summer Spill

Target species:	Subyearling Chinook
Spill target percentage:	9% of day average river flow
Spill start date:	5 June, 0001 hrs
Spill stop date:	21 August, 2400 hrs
95% Est. passage date:	10 August
Est. % of run with spill:	97.81% on 21-August (estimated as of 31 August)
Cumulative index count:	22,073 subyearling Chinook (as of 31 August)
Summer spill percentage:	11.73% (9%, plus 2.74% forced spill 5 June – 21 August)
Avg river flow at RR:	153,805 cfs (5 June - 21 August)
Avg spill rate at RR:	18,044 cfs (5 June - 21 August)
Number of spill days:	78



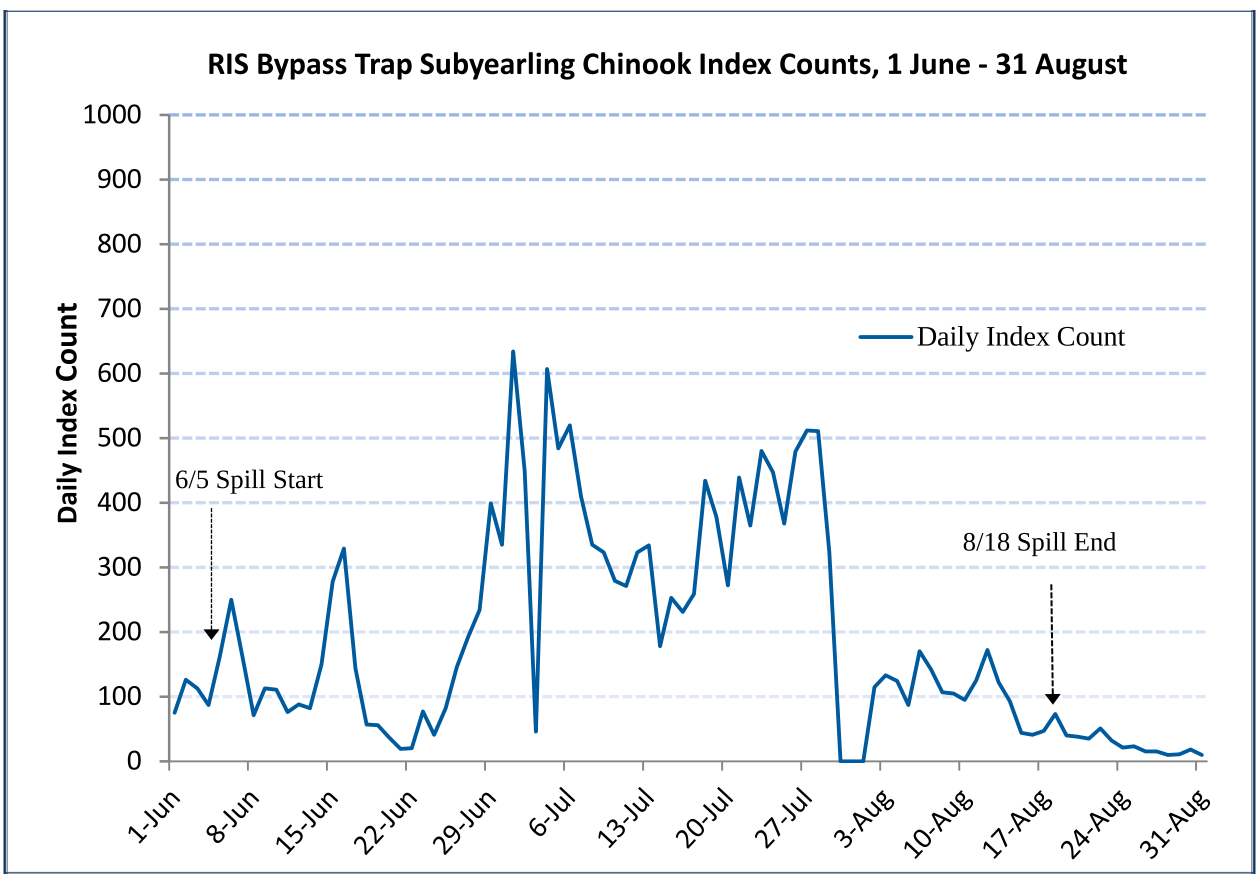
2013 ROCK ISLAND

Spring Spill

Target species:	Yearling Chinook, steelhead, sockeye
Spill target percentage:	10% of day average river flow
Spill start date:	17 April, 0001 hrs
Spill stop date:	4 June, 2400 hrs (immediate increase to 20% summer spill)
Percent of run with spill:	**Yearling Chin 98.25%; steelhead 98.23%; sockeye 98.81%**
Cumulative index count:	28,324 Yearling Chins**;** 15,099 Steelhead**;** 25,111 sockeye
Spring spill percentage:	**12.51%** (10% plus 2.51% forced spill 17 April – 4 June)
Avg river flow at RI:	175,634 cfs (17 April - 4 June)
Avg spill flow at RI:	21,977 cfs (17 April - 4 June)
Total spill days:	49

Summer Spill

Target species:	Subyearling Chinook
Spill target percentage:	20% of day average river flow
Spill start date:	5 June, 0001 hrs
Spill stop date:	18 August, 2400 hrs
95% Est. passage date:	12 August
Percent of run with spill:	**Subyearling Chinook 95.18%** (estimated as of 31-August)
Cumulative index count:	17,170 subyearling Chinook (as of 31 August)
Summer spill percentage**:**	**20.08%** (5 June- 18 August)
Avg river flow at RI:	158,962 cfs (5 June - 18 August)
Avg spill flow at RI:	31,734 cfs (5 June - 18 August)
Total spill days:	75



Juvenile Index Counts 2003-2013 from the Rocky Reach Juvenile Fish Bypass Sampling Facility and Rock Island Bypass Trap Smolt Monitoring Program (SMP) 1 April – 31 August.

Table 1. Rocky Reach Juvenile Bypass index sample counts, 2003-2013

Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sockeye	71,683	30,935	17,575	239,185	169,937	136,206	40,758	724,394	67,879	384,224	**199,497**
Steelhead	10,585	6,433	5,821	4,329	4,532	8,721	6,309	4,931	5,683	4,902	**2,528**
Yearling Chinook	13,918	53,946	27,611	23,461	18,080	38,394	18,946	33,840	24,400	95,207	**29,018**
Subyrlng Chinook	172,392	20,062	10,978	19,996	13,496	11,820	11,944	59,751	17,246	5,774	**22,073**

Table 2. Rock Island Smolt Monitoring Program index sample counts, 2003-2013

Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sockeye	10,312	7,114	1,991	34,604	16,410	38,965	4,926	37,404	18,697	46,788	**25,111**
Steelhead	15,507	10,735	15,974	26,930	18,482	22,780	17,636	17,194	28,408	16,957	**15,099**
Yearling Chinook	15,355	12,574	14,797	37,267	23,714	22,562	9,225	11,802	26,407	25,759	**28,324**
Subyrlng Chinook	25,916	23,563	18,710	27,106	15,686	15,940	8,189	23,205	27,397	27,298	**17,170**

Summary of 2013 Juvenile Fish Bypass Operations at Wells Hydroelectric Project
23 September 2013

Douglas PUD operated the Wells bypass system in 2013 as guided by the Wells HCP Coordinating Committee-approved *2013 Bypass Operating Plan.* The plan was intended to provide non-turbine passage during 95 percent of the juvenile Plan Species migration passing Wells Dam. Bypass operations were initiated on April 9 at 00:00 hours, and operated continuously until terminated at 24:00 hours on August 19, for a total of 133 days.

The *2013 Bypass Operating Plan* included measures for complying with Federal Energy Regulatory Commission (FERC) requirements for maintaining minimum automatic-gate-opening capacity under the *Wells Project Emergency Action Plan* and Washington Department of Ecology (Ecology) requirements for compliance with total dissolved gas (TDG) standards as directed by the FERC-approved *Total Dissolved Gas Abatement Plan* for the Wells Project. Compliance with the requirements of both of these plans was achieved by systematic removal of bypass barriers under increasing discharge as described in the *2013 Bypass Operating Plan*. The strategy for compliance with Ecology's TDG standards included the concentration of spill through adjacent spillways at the center of Wells Dam and spilling over the discharge from active turbine units. To implement these compliance measures as described in the *2013 Bypass Operating Plan*, Douglas PUD removed bypass barriers from Spillway 6 on May 23 and reinstalled them on May 30; then removed them again on July 1 and reinstalled them on July 11.

Based on analysis conducted by John Skalski and Richard Townsend of Columbia Basin Research (Appendix A), Douglas PUD achieved the HCP requirement to provide bypass operations during 95 percent of the juvenile salmon and steelhead migration passing Wells Dam by providing bypass passage during 98.29 percent of the yearling Chinook migration, 99.21 percent of the steelhead migration, 99.99 percent of the sockeye migration, 100 percent of the coho migration, and 99.33 percent of the sub-yearling Chinook migration passing Wells Dam in 2013.

Appendix A

Analysis of Proportion of Outmigration Affected by Bypass Operations at Wells Dam, 2005-2013

Analysis of Proportion of Outmigration Affected by Bypass Operations at Wells Dam, 2005-2013

Prepared for:

Public Utility District No. 1 of Douglas County
1151 Valley Mall Parkway
East Wenatchee, Washington 98802 - 4497

Prepared by:

John R. Skalski
Richard L. Townsend

Columbia Basin Research
School of Aquatic and Fishery Sciences
University of Washington
1325 Fourth Avenue, Suite 1820
Seattle, Washington 98101-2509

16 September 2013

Outmigration has been monitored at the juvenile sampling facility at Rocky Reach Dam for four stocks of salmonids (yearling and subyearling Chinook, steelhead, and sockeye) from 2005 onward. Coho were added this year, using the detections at Rocky Reach of PIT-tagged fish. The proportion of each stock covered by the bypass operations at Wells Dam can be estimated using the historical daily counts at Rocky Reach, and adding the travel time from Wells to Rocky Reach Dam. Table 1 has the average travel times, based 2010 acoustic-tag studies, for yearling Chinook, steelhead and sockeye. Due to a dearth of PIT-tag and acoustic-tag studies performed with subyearling Chinook and Coho, travel time was assumed to be 2 days.

Table 1: Average travel times from Wells tailrace to Rocky Reach Dam.

Stock	Travel time
Yearling Chinook	5 days
Subyearling Chinook	2 days
Steelhead	2 days
Sockeye	2 days
Coho	2 days

Plots of the annual cumulative proportion of the outmigration for spring migrants (yearling Chinook, steelhead, sockeye, and coho), and the subyearling Chinook in the summer had fairly consistent start and end dates at Rocky Reach (Figure 1). The timing of bypass operations for the spring outmigration at Wells from 2004 through 2011 was from 00:00 12 April – 24:00 13 June of each year for the "spring" spill season, and from 00:00 14 June – 24:00 26 August for the "summer" spill season. For 2012 and beyond, the Wells Habitat Conservation Plan (HCP) Coordinating Committee approved the modification of the timing of bypass operations at Wells Dam as follows: bypass operations commenced at 00:00 on April 9 and continued through 24:00 on August 19. This current timing of bypass operations will continue annually, unless modified as a result of future investigations that demonstrate an inadequacy of these dates at providing bypass passage for 95% of both spring- and summer-migrating Plan Species at Wells Dam. Table 2 has the estimated proportion of the annual outmigration covered by the spring, summer, and total bypass operations from 2005 through 2013. Steelhead, sockeye, coho, and subyearling Chinook are estimated to have greater than 98% of their annual outmigration pass through Wells Dam during one or both of the two periods covered by bypass operations for the most recent nine years of record. For yearling Chinook, being the earliest arriving stock, proportion covered ranged from 94.49% to 99.96% over the period of record. To assess the effectiveness of the selected start date for spring bypass operations, Table 3 has the date that, with hindsight, the spring bypass operations should have started to achieve 95% coverage of the yearling Chinook outmigration for that year. These dates ranged from 9 April to 3 May. For the two years when yearling Chinook coverage was less than 95%, bypass starting dates should have been 9 and 11 April, respectively, instead of 12 April.

Similarly, Table 4 compares the actual date of bypass termination with the date on which bypass operations covered 95% of the subyearling Chinook outmigration. In each year, an earlier termination of bypass operations would have been possible without jeopardizing the achievement of the HCP standard of providing a bypass route for ≥ 95% of outmigrating subyearling Chinook. During the nine years analyzed, the 95% HCP standard was achieved 4 to 32 days prior to the actual date on which bypass operations were terminated.

Table 2. Total proportion of each stock's migration affected by bypass operations (spring, summer) at Wells Dam, based on travel times from Wells to Rocky Reach Dam, the cumulative proportion of the annual migration of each stock at Rocky Reach, and the start and stop dates of Wells bypass operations.

		Annual migration proportion								
	Proportion passed	2005	2006	2007	2008	2009	2010	2011	2012	2013
Spring Outmigration	**Yearling Chinook**									
	prior to spring Bypass Ops period	0.0528	0.0259	0.0551	0.0025	0.0116	0.0067	0.0085	0.0004	0.0171
	during spring Bypass Ops period	0.9455	0.9559	0.9154	0.9972	0.9827	0.9917	0.9910	0.9996	0.9823
	during summer Bypass Ops period	0.0017	0.0.182	0.0296	0.0002	0.0056	0.0016	0.0005	0.0001	0.0006
	after Bypass Ops period	0	0	0	0	0	0	0	0	0
	Total Covered by Bypass ops	**0.9472**	**0.9741**	**0.9449**	**0.9975**	**0.9884**	**0.9933**	**0.9915**	**0.9996***	**0.9829**
	Steelhead									
	prior to spring Bypass Ops period	0.0015	0.0101	0.0066	0.0009	0.0019	0.0045	0.0190	0.0014	0.0079
	during spring Bypass Ops period	0.9903	0.9762	0.9887	0.9901	0.9965	0.9763	0.9513	0.9885	0.9847
	during summer Bypass Ops period	0.0081	0.0137	0.0042	0.0089	0.0016	0.0188	0.0297	0.0101	0.0074
	after Bypass Ops period	0	0	0.0004	0.0001	0	0.0004	0	0	0
	Total Covered by Bypass ops	**0.9985**	**0.9899**	**0.9930**	**0.9990**	**0.9981**	**0.9951**	**0.9810**	**0.9986**	**0.9921**
	Sockeye									
	prior to spring Bypass Ops period	0	0	0	0	0	0	0	0	0
	during spring Bypass Ops period	0.9983	0.9984	0.9998	0.9972	0.9957	0.9992	0.9923	0.9995	0.9990
	during summer Bypass Ops period	0.0017	0.0016	0.0001	0.0028	0.0043	0.0008	0.0077	0.0005	0.0009
	after Bypass Ops period	0	0	0	0	0	0	0	0	0.0001
	Total Covered by Bypass ops	**1.0000**	**1.0000**	**0.9999**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**0.9999**
	Coho									
	prior to spring Bypass Ops period									0
	during spring Bypass Ops period									0.9910
	during summer Bypass Ops period									0.0090
	after Bypass Ops period									0
	Total Covered by Bypass ops									**1.0000**
Summer Outmigration	**Subyearling Chinook**									
	prior to spring Bypass Ops period	0	0	0	0	0	0	0	0	0
	during spring Bypass Ops period	0.1937	0.1894	0.2136	0.1266	0.1029	0.5212	0.5628	0.5871	0.1670
	during summer Bypass Ops period	0.8022	0.8077	0.7847	0.8620	0.8882	0.4723	0.4331	0.4059	0.8263
	after Bypass Ops period	0.0041	0.0029	0.0017	0.0113	0.0089	0.0064	0.0041	0.0070	0.0067
	Total Covered by Bypass ops	**0.9959**	**0.9971**	**0.9983**	**0.9887**	**0.9911**	**0.9936**	**0.9959**	**0.9930**	**0.9933**

***Proportions not summing to 1 are due to round-off error.**

Table 3. Comparison of the actual start date for spring bypass operations at Wells Dam each year, versus the start date necessary to have covered at least 95% of the yearling Chinook outmigration that year. Operations are assumed to begin at 00:00 for the date listed.

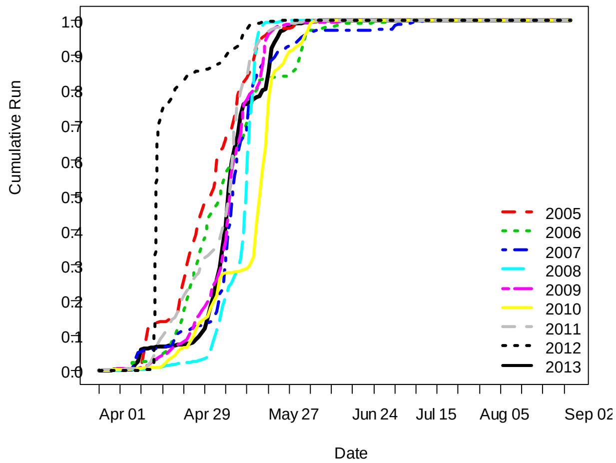
Migration Year	Actual Date	Cumulative proportion passed before 00:00	Proportion Covered by Bypass Ops	Date by which the first 5% passed	Cumulative proportion passed before 00:00	Bypass Ops would have Covered this Proportion	# Days before or after actual date to get 95%
2005	April 12	0.0528	0.9472	April 11	0.0039	0.9961	1 before
2006	April 12	0.0259	0.9741	April 18	0.0468	0.9532	6 after
2007	April 12	0.0551	0.9449	April 9	0.0243	0.9757	3 before
2008	April 12	0.0025	0.9975	May 3	0.0406	0.9594	21 after
2009	April 12	0.0116	0.9884	April 19	0.0436	0.9564	7 after
2010	April 12	0.0067	0.9933	April 22	0.0410	0.9590	10 after
2011	April 12	0.0085	0.9915	April 15	0.0446	0.9554	3 after
2012	April 9	0.0004	0.9996	April 15	0.0115	0.9885	6 after
2013	April 9	0.0171	0.9829	April 10	0.0240	0.9760	1 after

Table 4. Comparison of the actual stop date for summer bypass operations at Wells Dam each year, versus the stop date necessary to have covered at least 95% of the subyearling Chinook outmigration that year. Operations are assumed to end at 24:00 for the date listed.

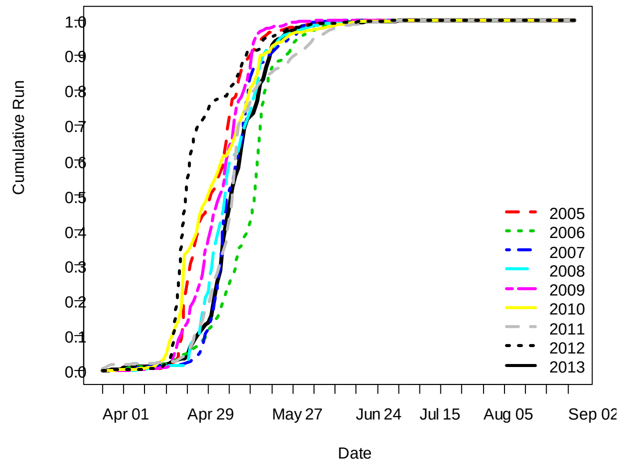
Migration Year	Actual Stop Date	Cumulative proportion passed by 11:59:59 PM	Date on or before the last 5% passed	Cumulative proportion passed by 11:59:59 PM (Bypass Ops would have Covered this Proportion)	# Days before actual date to get 95%
2005	August 26	0.9959	August 3	0.9525	23
2006	August 26	0.9971	August 2	0.9524	24
2007	August 26	0.9983	August 11	0.9538	15
2008	August 26	0.9887	August 19	0.9502	7
2009	August 26	0.9911	August 22	0.9709	4
2010	August 26	0.9936	August 10	0.9537	16
2011	August 26	0.9959	July 25	0.9528	32
2012	August 19	0.9930	July 29	0.9502	22
2013	August 19	0.9933	August 7	0.9592	12

Figure 1. Passage dates at Rocky Reach Dam for spring and summer migrating stocks, 2005-2013. Cumulative proportions are based on the expanded counts obtained from sampling daily from 1 April – 31 August (or through 4 September in 2008).

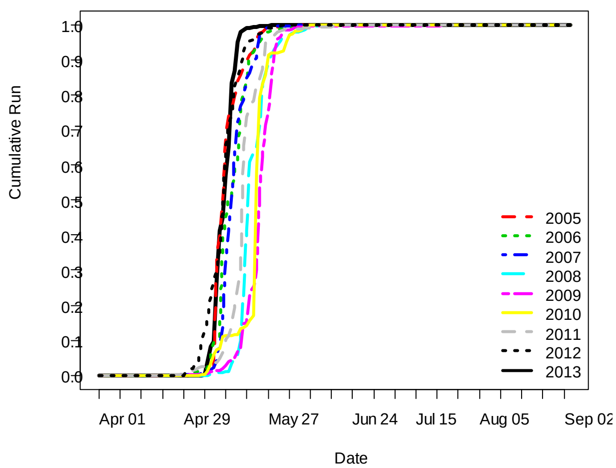
a. Yearling Chinook



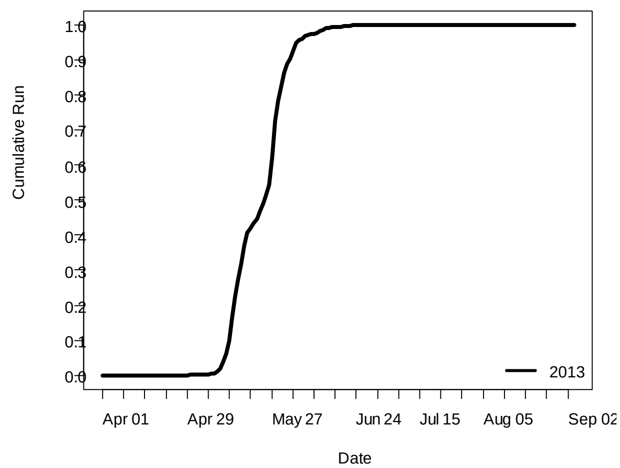
b. Steelhead



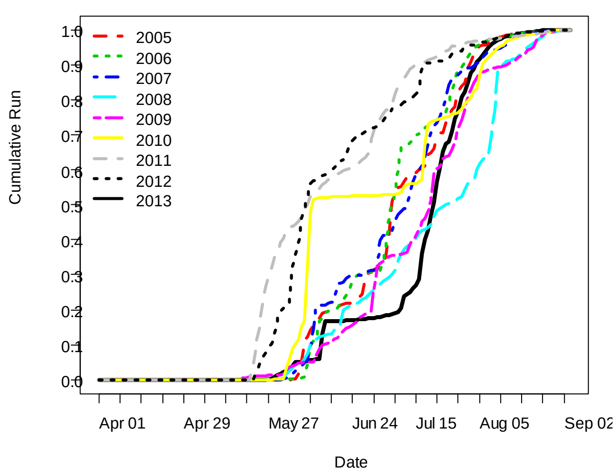
c. Sockeye



d. Coho



e. Subyearling Chinook



ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	November 19, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the October 22, 2013 HCPs Coordinating Committees Conference Call		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met by conference call on Tuesday, October 22, 2013, from 9:30 am to 11:30 am. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Washington Department of Fish and Wildlife (WDFW) will provide an official letter designating the current WDFW HCP Coordinating Committees representation to Kristi Geris for the administrative record (Item II-A).
- Lance Keller will provide unmarked yearling Chinook index counts at Rocky Reach for periods prior to April 17, to Kristi Geris for distribution to the Coordinating Committees (Item III-A).
- Steve Hemstrom will provide the raw data used to develop the original and updated flow duration curves for valid survival studies to Kristi Geris for distribution to the Coordinating Committees (Item III-B).
- Steve Hemstrom will review the calculations used to develop the updated flow duration curve for valid survival studies, for discussion at the Coordinating Committees' meeting on November 19, 2013 (Item III-B).
- **The next Coordinating Committees' meeting will be on November 19, 2013, and will be held in person at the Radisson Hotel in SeaTac, Washington (Item VI-A).**

DECISION SUMMARY

- The Coordinating Committees representatives present approved the Rock Island and Rocky Reach 2013 Fish Spill Report, as revised (Item III-A).
- The Coordinating Committees representatives present approved the 2013 Wells Dam Post-Season Bypass Report, as revised (WDFW abstained citing their recent changes in HCP representation) (Item IV-A).

AGREEMENTS

- Chelan PUD agreed to incorporate a graphic for Rock Island spring spill in future Rock Island and Rocky Reach Fish Spill Reports (Item III-A).

REVIEW ITEMS

- There are no documents that are currently out for review.

REPORTS FINALIZED

- The final Wells Hydroelectric Project Spill Prevention Control and Countermeasure Plan was filed with the Federal Energy Regulatory Commission (FERC) on October 15, 2013, and was distributed to the Coordinating Committees by Kristi Geris on October 17, 2013.
- The final Wells Hydroelectric Project Water Quality Attainment Plan (WQAP), which was approved by the Coordinating Committees on October 9, 2013, was filed with FERC on October 21, 2013, and was distributed to the Coordinating Committees by Kristi Geris on that same day.
- The final 2013 Wells Dam Post-Season Bypass Report, which was approved by the Coordinating Committees on October 22, 2013, was distributed to the Coordinating Committees by Kristi Geris on that same day.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. Jeff Korth requested a WDFW HCP Coordinating Committees representation update.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft September 24, 2013 meeting minutes. Kristi Geris said that a second revised draft was distributed to the Coordinating Committees on October 18, 2013, which included edits received from Bryan Nordlund (tracked in redline strikeout). Geris said that all other comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to discuss. The Coordinating Committees members present approved the draft September 24, 2013 meeting minutes, as revised; WDFW abstained citing recent changes in their HCP representation. Geris will finalize the meeting minutes and distribute them to the Committees.

II. WDFW

A. WDFW HCP Coordinating Committees Representation Update (Jeff Korth)

Jeff Korth, WDFW Region 2 Fish Program Manager, announced that he will replace Teresa Scott as the WDFW HCP Coordinating Committees representative. He said he has been following correspondences with Bill Tweit and Scott in the HCP Tributary Committees, and that he has also been on the Coordinating Committees' distribution list for a couple of weeks now. He said that WDFW will provide an official letter designating the current WDFW HCP Coordinating Committees representation to Kristi Geris for the administrative record.

III. Chelan PUD

A. DECISION: Rock Island and Rocky Reach 2013 Fish Spill Report (Steve Hemstrom)

Steve Hemstrom said that the revised draft 2013 Rock Island and Rocky Reach Fish Spill Report (Attachment B) was distributed to the Coordinating Committees by Kristi Geris on October 11, 2013. He noted that for summer spill, a daily spill percentage line was added to the graphics in the report, as requested by the Coordinating Committees at the meeting on September 24, 2013. He explained that daily average spill levels are based on estimated discharge at Chief Joseph Dam (CJD) from the day before. For example, if CJD discharges 160,000 cubic feet per second (160 kcfs), 20% of that is calculated to determine that Rocky Reach should spill 32 kcfs. He said that these estimates are not always accurate, which explains the variance in the daily spill percentage lines as depicted on the graphics. He said, for example, that data from this month indicate that CJD estimates were off for about 9 days straight. He said that CJD estimates and actuals are continually tracked, so that spill at Rocky Reach can be modified to compensate for these errors in estimations.

Mike Schiewe asked about the period on the Rocky Reach graphic from mid-June to the first week of July where the spill line spiked and subyearling passage (counts at the Rocky Reach Bypass sampling facility) went down; he noted that immediately following the spike in spill, the passage went back up. He asked if the spike in spill reflected added flow, which pushed fish into the reservoir; or if it was a case where fish passed via spill and did not show up in the bypass count. Hemstrom said that both could be possible, and Lance Keller also noted that volitional hatchery releases ended about then, which means that all fish remaining were forced out at that time.

Kirk Truscott asked if the U.S. Army Corps of Engineers is consistent in any way with regards to discharges out of CJD (e.g., typically discharge greater or less than estimated, etc.); and Hemstrom replied that they are not consistent from day to day. He said that Chelan PUD does the best they can to catch up the next day; or, for example, spill at Rocky Reach will be increased if daily estimates at CJD have been too low, to prepare for spilling the right percentage of the anticipated additional water.

Truscott noted that a graphic is included for Rock Island summer spill, but not for spring spill, and he requested that, in future spill reports, a graphic be included for spring spill. Chelan PUD agreed to incorporate a graphic for Rock Island spring spill in future Rock Island and Rocky Reach Fish Spill Reports. Truscott also asked if there is a way to delineate between spring Chinook and steelhead natural origin recruits (NORs) and hatchery origin recruits (HORs) in the bypass counts. He added that he is particularly interested in evaluating spill protection for spring Chinook NORs. Keller said that there are data for marked and unmarked migrants, which are combined before uploading to the Data Access in Real Time (DART) database. He said that he will provide unmarked yearling Chinook index counts at Rocky Reach for periods prior to spill start on April 17, to Geris for distribution to the Coordinating Committees. Hemstrom asked if there are spring Chinook HORs that are adipose fin (ad)-present, and Tom Kahler replied that there are, but they are also wired. Keller said that neither Rocky Reach nor Rock Island interrogate for coded wire tags (CWTs); they only look for ad-present and no-clipped. He added that scanning for CWTs is not performed because doing so requires additional handling and time. He also added that at Rocky Reach, lengths are only obtained on the first 100 fish of each species. Keller noted that the objectives of the bypass are to obtain run times, monitor spill coverage, and provide study fish for survival studies; and also instantaneous data on descaling and mortalities are obtained. Truscott concluded, then, that the only way to differentiate between spring Chinook NORs and HORs would be to scan for CWTs; and Keller added that the other option would be to make proportional assumptions based on fin clips.

The Coordinating Committees representatives present approved the Rock Island and Rocky Reach 2013 Fish Spill Report, as revised.

B. Valid Study Flow Duration Curves (Steve Hemstrom)

Steve Hemstrom said that the 2013 Valid Study Flow Duration Curve Updates (Attachment C) were distributed to the Coordinating Committees by Kristi Geris on October 11, 2013. He reviewed page 1 of the document, and explained that the goal was to include enough background information to serve as a stand-alone document, including information about the purpose and history of the HCP valid study flow duration curve, and a description of those data used to develop both the original curve and the updated curves. Hemstrom said that he will provide the raw data used to develop the original and updated flow duration curves for valid survival studies to Geris for distribution to the Coordinating Committees.

Hemstrom reviewed Table 1 and Figure 1 in Attachment C, which he explained represent the original spring period HCP valid study flow duration curve. He noted that the 10th percentile flow is 205,381 cfs, and the 90th percentile flow is 100,523 cfs; and so flows between those levels would be a valid flow in a study. Hemstrom then reviewed Table 2 and Figure 2, which represent an updated spring period HCP valid study flow duration curve using both modeled and actual data; he noted the 10th percentile flow of 296,117 cfs and the 90th percentile flow of 103,410 cfs. He said that, lastly for the spring period, Table 3 and

Figure 3 represent an updated HCP valid study flow duration curve using only actual data, and he noted the 10th percentile flow of 181,635 cfs, and the 90th percentile flow of 90,325 cfs. Hemstrom noted that the updated curves were developed using the last 11 years of data (i.e., 2002 through 2012), as opposed to 10 years of data, as outlined in the HCPs. He also noted Table 7 on the last page of Attachment C, which provides a comparison of the original and updated spring period HCP valid study flow duration curve parameters.

Bryan Nordlund asked about the difference in high end flows in Tables 1 and 2, and said he was finding it difficult to reconcile the difference based on only 11 years of data. Hemstrom agreed and suggested that the difference was due to the recent high flow years. Nordlund said a few high flow years still would not explain the large difference. He noted, for example, the top flow in Table 1 of 255,259 cfs, and then noted that after adding only 11 years of record (i.e., Table 2), there are 20 flows greater than 250,000 cfs. Nordlund noted similar differences in the summer period HCP valid study flow duration curve (i.e., Tables 4, 5, 6, and 8). Hemstrom agreed that the numbers did not seem correct, and said that he will review the calculations used to develop the updated flow duration curve for valid survival studies, for discussion at the Coordinating Committees' meeting on November 19, 2013. Nordlund speculated that perhaps different means were used to develop the original and updated curves; for example, a mean for an entire period versus daily means.

Nordlund said that these data are useful, and he noted that the reason for bringing these data before the Coordinating Committees is to obtain this type of technical review of the results. Schiewe said that this topic will be revisited at the Coordinating Committees' meeting on November 19, 2013.

C. Rocky Reach Turbine Unit Outages (Lance Keller)

Lance Keller recalled that Turbine Unit 10 (C10) at Rocky Reach Dam has been offline for maintenance. He said that mechanic crews have now discovered a deep hairline crack in a stainless steel rod that delivers oil to the servo motor, as described in an email that was distributed to the Coordinating Committees by Kristi Geris on October 4, 2013. Keller explained that the servo motor adjusts the angle of the turbine blades in response to changing river flow and fluctuating load requests; and added that Turbine Unit 8 (C8), Turbine Unit 9 (C9), and Turbine Unit 11 (C11) all have the same stainless steel rod design as part of the servo motors. He said that Rocky Reach engineers evaluated the situation and made the decision to take C8, C9, and C11 out of service. Keller noted that having 4 of 11 units at Rocky Reach out of service at the same time impacts a number of routine powerhouse operations. He said that the lower small units will compensate for the units that are out of service, and added that Rocky Reach engineers are currently working on an interim fix in order to get all large units, except C10 (i.e., full powerhouse), back online by March 2014. He said that C10 may be back online as late as August 2014; and once C10 is back online, engineers will go back into the larger units for a permanent fix. He said that the estimated completion date for all permanent fixes is December 2017.

Keller recalled discussing at the Coordinating Committees' meeting on June 25, 2013, that Turbine Unit 2 (C2) at Rocky Reach was scheduled to be offline from January through mid-May 2014 for a mandatory repair of the cracked rotor. He said that outage has since been delayed, and it is now scheduled for the second part of 2014. Keller added that the outage will be outside of the spring juvenile migration period, and that he and Steve Hemstrom have been coordinating with Rocky Reach engineers about minimizing possible effects to fish passage.

Keller said that he will keep the Coordinating Committees up to date as plans move forward.

IV. Douglas PUD

A. DECISION: 2013 Wells Dam Post-Season Bypass Report (Tom Kahler)

Tom Kahler said that the revised draft 2013 Wells Dam Post-Season Bypass Report was distributed to the Coordinating Committees by Kristi Geris on October 11, 2013. He said that comments received from the National Marine Fisheries Service (NMFS) regarding the source of the travel-time numbers (as discussed at the Coordinating Committees' meeting on September 24, 2013) were addressed in the revised draft. Bryan Nordlund agreed that his comments were adequately addressed.

The Coordinating Committees representatives present approved the 2013 Wells Dam Post-Season Bypass Report, as revised (WDFW abstained citing recent changes in their HCP representation). The final 2013 Wells Dam Post-Season Bypass Report (Attachment D) was distributed to the Coordinating Committees by Geris following the meeting on October 22, 2013.

B. Wells Dam Fish Counts (Tom Kahler)

Tom Kahler announced that fish counts at Wells Dam are now up to date. He said that staff caught up on counts on the evening of October 9, 2013, as distributed to the Coordinating Committees by Kristi Geris on October 8, 2013. He said that Wells Dam staff is now working towards improving fish count efficiency for next year, including improvements to the count window and lighting, and improved camera and recording technology (i.e., installing a high-definition system that will enable quicker fish identification). He said that new fish counters will be hired and trained by May 2014.

Kahler recalled the issue with similar sized fish repeatedly passing back and forth through the count window causing difficulties in counting. He said he discussed the issue with Bryan Nordlund, and they determined that the only change in 2013 from previous years is the installation of the grated surfaces and ramp to improve lamprey enumeration for the 2013 Adult Lamprey Passage and Enumeration Study. Particularly, there is a ramp descending from the upstream side of the count window that Nordlund explained could possibly be causing uneven hydraulics and flow separation through the count window area. Kahler said that recordings of the count window indicate that, so far, no lamprey are actually using the upstream ramp to exit the count window; and so there are now discussions about possibly removing the ramp during the 2013/2014 winter maintenance period. Kahler indicated that decisions related to infrastructure modifications to the count window area affecting lamprey will be discussed first with the Aquatic Settlement Work Group (SWG).

C. Coho Broodstock Trapping (Tom Kahler)

Tom Kahler said that each fall, the Yakama Nation (YN) uses the Wells Dam east and west fish ladders to trap coho for their Methow reintroduction efforts. He said that, typically, trapping is conducted concurrent with WDFW's steelhead trapping efforts. Kahler said that this year, however, WDFW conducted limited steelhead trapping in the ladders because part of the program will rely on broodstock trapped in the Twisp River and part was obtained from the Wells Hatchery outfall, reducing the number needed from the ladders. He said that once WDFW concluded trapping, the YN continued their efforts. Kahler said that the coho run has not materialized as anticipated. He said that 51,000 have passed Bonneville Dam, only 3,000 have passed Priest Rapids Dam, and only about 300 have passed Wells Dam. He said the YN was growing concerned about obtaining enough broodstock, and so they started trapping 7 days per week (as per their Endangered Species Act [ESA] permits), and they started trapping at the Wells Hatchery outfall as well. Kahler said that the YN's preferred trapping locations are the Winthrop Hatchery and Methow Hatchery outfalls, and collection in the Wells Dam ladders and at the Wells Hatchery outfall were intended to fill any shortfalls in collections from those preferred upstream locations. He said that if enough brood are trapped at the upstream locations, brood obtained from the lower locations will be returned to the river. Kahler also noted current seismicity evaluations (including borings) being conducted along the east embankment. He said there was concern that the boring efforts may interfere with trapping in the east ladder; however, no issues have been reported.

D. 2013 Adult Pacific Lamprey Passage and Enumeration Study (Tom Kahler)

Tom Kahler said that radio-tagged lampreys are continuing to be tracked. He said that by mid-November, the battery life in all radio tags will have expired, at which time analysis of the telemetry data will begin. He said that passive integrated transponder (PIT) tags are also being tracked as they pass PIT-tag arrays, and that 14 of the 110 study lampreys have been detected in the Methow. No lampreys have been detected in the Okanogan. He said that some lampreys have been detected downstream of Wells Dam, and one was detected in the Rocky Reach fish ladder. He said that about 30% of the lampreys are still unaccounted for. He said that no issues have been observed with lampreys passing through the Wells Dam count window, and he added that lampreys observed have mostly been free swimming through the area. Kahler said that the reduced fishway entrance head differential (lamprey operations) set up for the study concluded on October 7, 2013, per the study plan. A final report is expected to be ready by spring 2014.

V. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe reported that the HCP Tributary Committees did not meet in October; the update by Tracy Hillman was distributed to the Coordinating Committees by Kristi Geris on October 21, 2013. Schiewe said that some Tributary Committees members attended a tour of habitat restoration projects on the Okanagan River in Canada on October 9 and 10, 2013. He said that the Wells Tributary Committee also approved a request from the Washington Water Project of Trout Unlimited to extend the Twisp River Well Conversion Project contract. The sponsor requested the extension due to a lack of available contractors, the onset of winter, and the fact that the irrigation system has been drained and will not be turned on until spring; and the extension would give the sponsor time to complete the project when the system is turned on in the spring.

Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last HCP Hatchery Committees' meeting on October 16, 2013. Schiewe noted that the Hatchery Committees also held a conference call on October 7, 2013, after their September meeting was canceled due to limited availability for participation. The conference call focused on a time-sensitive YN agenda item regarding their Twisp River Steelhead Live Spawning Plan Statement of Agreement (SOA), as further discussed below:

- *DECISION: Twisp River Steelhead Live Spawning Plan SOA*: This SOA is a part of the YN's Steelhead Kelt Reconditioning Program that was started a few years ago under Columbia River Basin Accords funding. The YN seek to recondition females from Douglas PUD's Twisp steelhead program, which would necessitate live spawning of those fish at the Methow Hatchery, and there were fish health concerns regarding the potential impacts of components of the program to the HCP spring Chinook and steelhead programs currently at Methow Hatchery. WDFW Fish Health Staff determined that the YN's program would not significantly affect the HCP programs currently at Methow Hatchery; and a lengthy list of risk-reducing measures was developed, including procedures to follow if Infectious Pancreatic Necrosis Virus (IPNV) is detected. WDFW Fish Health Staff are drafting a letter indicating that risk to HCP programs would be minimal if the risk protocols are followed. This letter will be packaged with the final draft SOA and the risk protocols, and delivered to Douglas PUD and the Hatchery Committees for approval via email consent. A preliminary vote indicated that the Hatchery Committees are on board with the proposed program. Discussions with NMFS still need to take place, especially because ESA-listed species are involved (due to the government shut-down, Lynn Hatcher has not been available to participate in these discussions). *(Note: the final package was distributed to the Hatchery Committees by Kristi Geris on October 22, 2013.)*

- *Expanded Acclimation in the Methow*: The YN is requesting the Hatchery Committees' approval for the use of the Chewuch Pond for co-acclimation of the YN's coho salmon production and Chelan PUD's Methow spring Chinook production. They have also expressed interest in using supplementation programs to recolonize habitat that is currently being underutilized.
- *Non-Target Taxa of Concern (NTTOC) Update:* NTTOC analyses evaluate the effects of hatchery programs on other native species in the basin. These analyses have been ongoing for several years, and are being addressed using a risk model that Todd Pearsons and Craig Busack developed. A few bugs have been identified in the model code, which slowed progress, but analyses that can be run are now almost complete. The original plan was to establish an outside panel to review the model results; however, Greg Mackey volunteered to first compile a draft report summarizing the results for the Hatchery Committees to review, and then a decision will be made whether further actions are needed. Evaluating hatchery programs' effects on other native species in the basin is one of ten Monitoring and Evaluation (M&E) objectives, and the NTTOC analyses were an effort to address that objective.
- *Hatchery M&E Plan Tables*: Greg Mackey developed draft Hatchery M&E Appendices tables for the Hatchery Committees review. Hatchery Committees' approval of the draft tables will be requested at the next Hatchery Committees' meeting on November 20, 2013.
- *Twisp Steelhead Relative Reproductive Success 2012 Genotyping Report Update*: Douglas PUD announced that they have received data from WDFW, and that the final Twisp Steelhead Relative Reproductive Success 2012 Genotyping Report was distributed to the Hatchery Committees by Kristi Geris on September 9, 2013. Approval of the report was not requested; rather, the report is just for information. Nucleotide polymorphic loci (SNPs) were used to analyze family relationships.
- *Summer Chinook Egg Request*: The Hatchery Committees representatives present agreed to a Chelan PUD request for 3,500 summer Chinook salmon eggs for use in an ongoing egg-fry survival study in Reach 4 of the lower Chelan River. The study is led by Steve Hays.
- *Draft Chelan PUD 2014 M&E Implementation Plan*: Chelan PUD is in the final stages of completing their Chelan PUD 2014 M&E Implementation Plan. Similar to what

has occurred in the past, Chelan PUD will contract with WDFW to collect field data, and BioAnalysts will complete the analyses and reporting.

VI. HCP Committees Administration

A. Next Meetings (Mike Schiewe)

Mike Schiewe said that the next scheduled Coordinating Committees' meeting is November 19, 2013, to be held in person at the Radisson Hotel in SeaTac, Washington. He said that Tom Kahler arranged for Jeff Fryer to provide a presentation on the Columbia River Inter-Tribal Fish Commission's (CRITFC's) ongoing sockeye studies.

The December 17, 2013 and January 28, 2014 meetings will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A	List of Attendees
Attachment B	Chelan PUD's Final 2013 HCP Rocky Reach and Rock Island Fish Spill Report
Attachment C	2013 Valid Study Flow Duration Curve Updates
Attachment D	Revised Draft 2013 Wells Dam Post-Season Bypass Report

Attachment A
List of Attendees

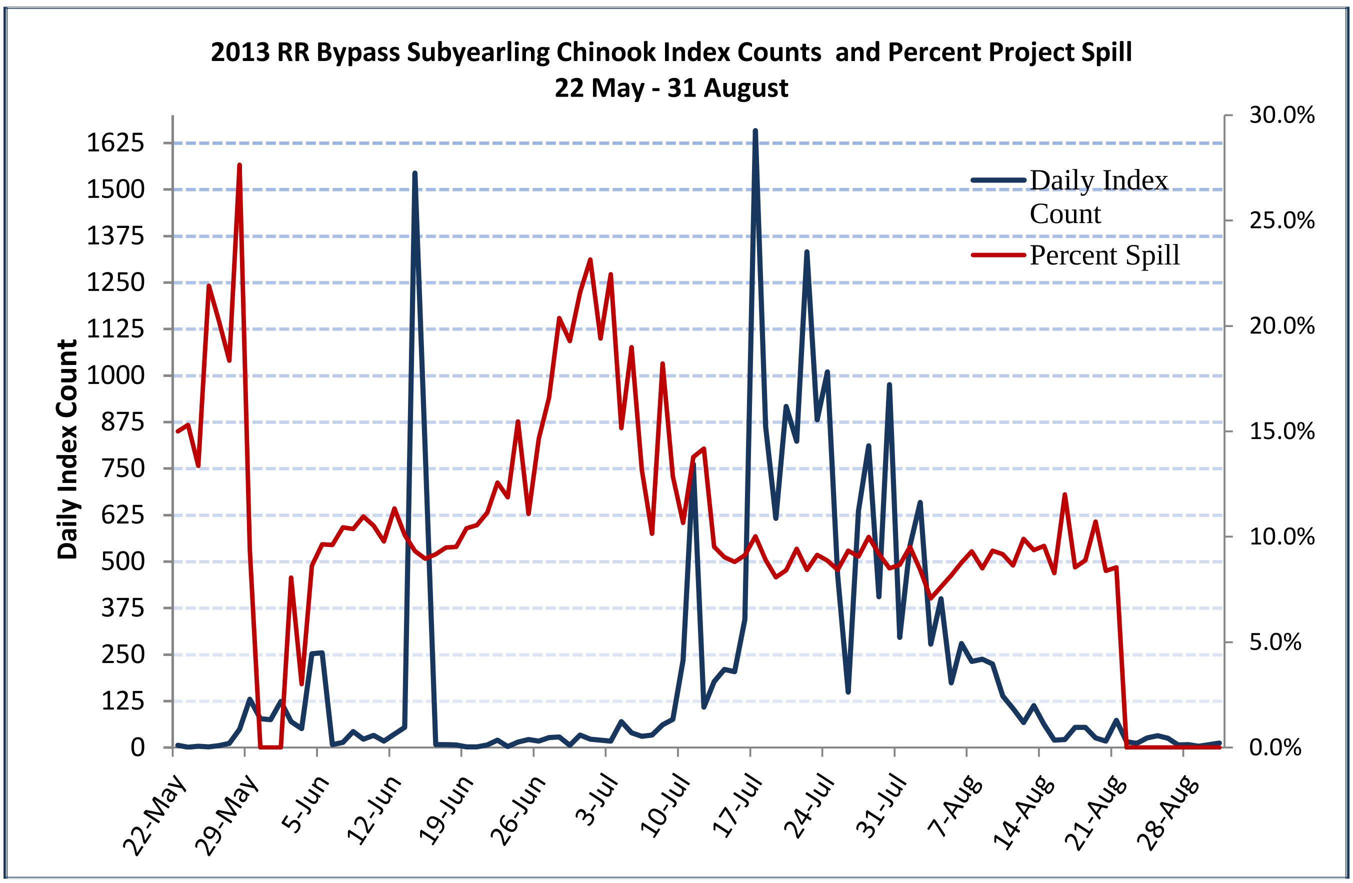
Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Tom Kahler*	Douglas PUD
Bryan Nordlund*	National Marine Fisheries Service
Jim Craig*	U.S. Fish and Wildlife Service
Jeff Korth	Washington Department of Fish and Wildlife
Kirk Truscott*	Colville Confederated Tribes

Notes:
* Denotes Coordinating Committees member or alternate

Chelan PUD
Rocky Reach and Rock Island HCPs
Final 2013 Fish Spill Report

<u>2013 ROCKY REACH</u>
Summer Spill

Target species:	Subyearling Chinook
Spill target percentage:	9% of day average river flow
Spill start date:	5 June, 0001 hrs
Spill stop date:	21 August, 2400 hrs
95% Est. passage date:	10 August
Est. % of run with spill:	97.81% on 21-August (estimated as of 31 August)
Cumulative index count:	22,073 subyearling Chinook (as of 31 August)
Summer spill percentage:	11.73% (9%, plus 2.74% forced spill 5 June – 21 August)
Avg river flow at RR:	153,805 cfs (5 June - 21 August)
Avg spill rate at RR:	18,044 cfs (5 June - 21 August)
Number of spill days:	78



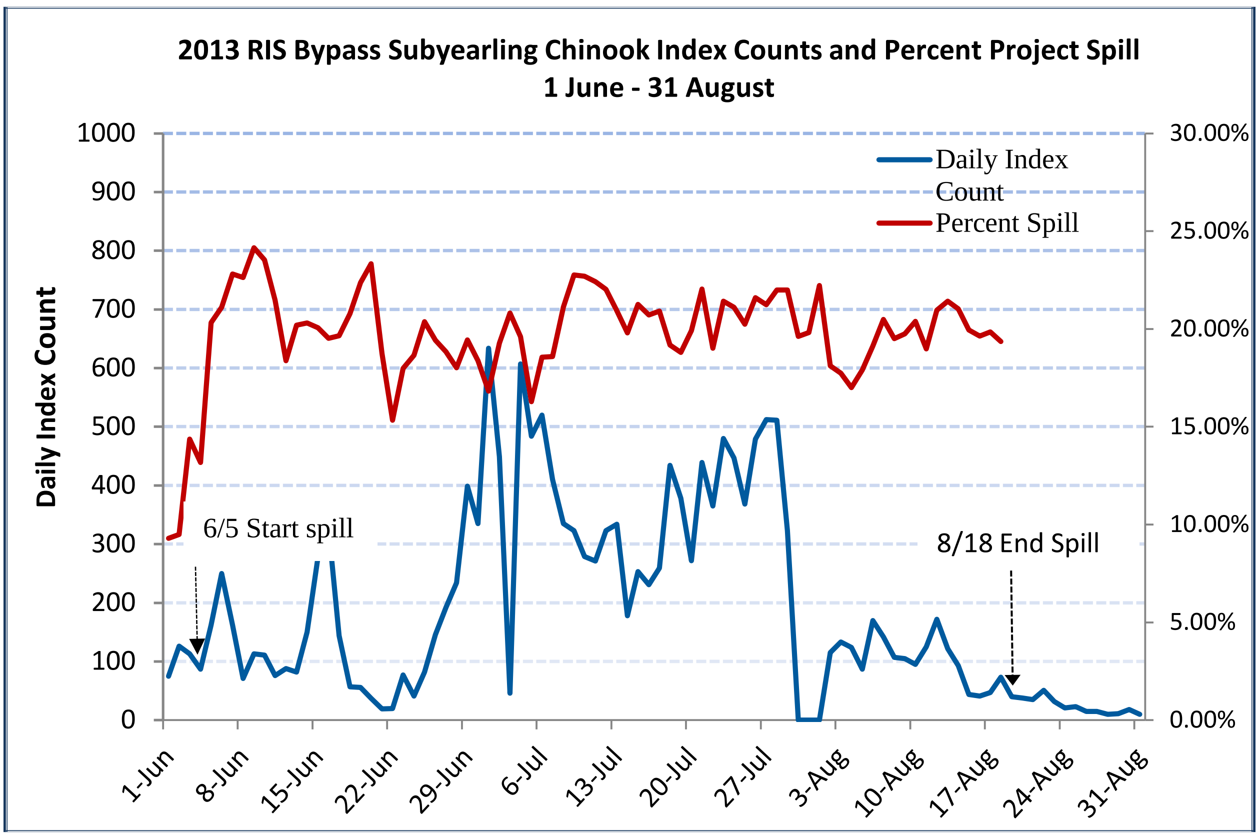
2013 ROCK ISLAND

Spring Spill

Target species:	Yearling Chinook, steelhead, sockeye
Spill target percentage:	10% of day average river flow
Spill start date:	17 April, 0001 hrs
Spill stop date:	4 June, 2400 hrs (immediate increase to 20% summer spill)
Percent of run with spill:	**Yearling Chin 98.25%; steelhead 98.23%; sockeye 98.81%**
Cumulative index count:	28,324 Yearling Chins; 15,099 Steelhead; 25,111 sockeye
Spring spill percentage:	**12.51%** (10% plus 2.51% forced spill 17 April – 4 June)
Avg river flow at RI:	175,634 cfs (17 April - 4 June)
Avg spill flow at RI:	21,977 cfs (17 April - 4 June)
Total spill days:	49

Summer Spill

Target species:	Subyearling Chinook
Spill target percentage:	20% of day average river flow
Spill start date:	5 June, 0001 hrs
Spill stop date:	18 August, 2400 hrs
95% Est. passage date:	12 August
Percent of run with spill:	**Subyearling Chinook 95.18%** (estimated as of 31-August)
Cumulative index count:	17,170 subyearling Chinook (as of 31 August)
Summer spill percentage:	**20.08%** (5 June- 18 August)
Avg river flow at RI:	158,962 cfs (5 June - 18 August)
Avg spill flow at RI:	31,734 cfs (5 June - 18 August)
Total spill days:	75



Juvenile Index Counts 2003-2013 from the Rocky Reach Juvenile Fish Bypass Sampling Facility and Rock Island Bypass Trap Smolt Monitoring Program (SMP)
1 April – 31 August.

Table 1. Rocky Reach Juvenile Bypass index sample counts, 2003-2013

Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sockeye	71,683	30,935	17,575	239,185	169,937	136,206	40,758	724,394	67,879	384,224	**199,497**
Steelhead	10,585	6,433	5,821	4,329	4,532	8,721	6,309	4,931	5,683	4,902	**2,528**
Yearling Chinook	13,918	53,946	27,611	23,461	18,080	38,394	18,946	33,840	24,400	95,207	**29,018**
Subyrlng Chinook	172,392	20,062	10,978	19,996	13,496	11,820	11,944	59,751	17,246	5,774	**22,073**

Table 2. Rock Island Smolt Monitoring Program index sample counts, 2003-2013

Species	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sockeye	10,312	7,114	1,991	34,604	16,410	38,965	4,926	37,404	18,697	46,788	**25,111**
Steelhead	15,507	10,735	15,974	26,930	18,482	22,780	17,636	17,194	28,408	16,957	**15,099**
Yearling Chinook	15,355	12,574	14,797	37,267	23,714	22,562	9,225	11,802	26,407	25,759	**28,324**
Subyrlng Chinook	25,916	23,563	18,710	27,106	15,686	15,940	8,189	23,205	27,397	27,298	**17,170**

2013 Valid Study Flow Duration Curve Updates for the Rocky Reach and Rock Island HCPs

DRAFT 10/10/13

HCP Valid Study Flows

The Rocky Reach and Rock Island HCPs use mean outflows from Grand Coulee Dam (GCL) to determine river flow ranges that constitute valid study flows for spring and summer juvenile survival studies. Spring and summer study periods are defined in the HCPs as April 16-May 31 (spring), and July 1-August 15 (summer). Valid flows for a study fall between the average 10^{th} and 90^{th} percentile flows from Grand Coulee Dam. For the HCPs' 10-year HCP Comprehensive Progress review, the HCP Coordinating Committee (HCP CC) must update the flow duration curves with GCL outflows from the first decade of HCP implementation to insure flow conditions are representative. In addition to adding 10 years of GCL ouflows to the existing data set, the HCP CC requested that June be added (previously June was excluded) into the summer study period because monitoring at the Rocky Reach Juvenile Bypass (http://www.cbr.washington.edu/inseason) shows a significant proportion of subyearling summer Chinook migrate past Rocky Reach and Rock Island dams (RRH avg 38.6%, range 17.45 - 71.65%, 2005-2013) in June each year. With the inclusion of June, the new HCP summer study period is June 1 - August 15.

Original flow data sets from GCL and resulting duration curves used both "modeled" and actual GCL outflow data. Modeled flow data came from Bonneville Power Administration's HYDSIM Model (00FSH-26 BASE CASE-1995 FCRPS BiOp) http://www.bpa.gov/power/pgf/HydrPNW.shtml. The HYDSIM flow regulation model uses historic observed flows and applies an updated hydro regulation (year 2000 level of water development for operating rules - upstream storage, flood control, discharge) to produce estimated GCL outflows from 1929-1978. Both the modeled outflows and actual observed flows, 1983-2001, were used in the original HCP data set. Water years 1979-1982 were not used, however, because they were not representative and not part of the modeled record. For the 2013 update, the HCP CC requested analyses of flows with and without historic BPA modeled flow data to evaluate new study flows for next 10-year HCP period (2013-2023). Multiple duration curves were constructed for spring and summer periods using the following sets of Grand Coulee outflow data:

1) Spring - BPA modeled flow data 1929-1978 for GCL, combined with actual outflow data (DART) 1983-2012;
2) Spring - GCL actual outflow data only, 1983-2012;

1) Summer- BPA modeled flow data 1929-1977, including June, and observed data 1983-2012;
2) Summer- GCL actual observed data only including June, 1983-2012

[1]The summer period is 1929-1977 because *August 1978* is not included in the period of record and was not modeled

Original and updated HCP spring valid flow ranges are shown below Tables 1-3 and Figures 1-3 below. The actual GCL outflow data used in the flow durations is compiled from Columbia Basin Research, Data Access in Real Time (DART). http://www.cbr.washington.edu/dart/query/river_graph_text). Summer period valid study flow duration curves are shown in Tables 4-6, and Figures 4-6. Summary table (Table 8, Table 9) is included which compares the resulting flow ranges for each of the four duration curves prepared.

HCP Spring Study Period

Table 1. *Original* HCP spring study period flows and exceedence percentiles calculated from BPA modeled Grand Coulee Dam outflow 1929-1978, and observed flows for the period April 16-May 31, 1983-2001.

Summary Table of BPA modeled data (1929-1978) and actual GCL Dam out flow data (1983-2001).		
Spring Flow Rank	Percentile	April 16 - May 31 Mean Flows
1	1.4%	255,259
7	**10.1%**	**205,381**
18	25.7%	169,289
35	50.0%	135,423
53	75.7%	117,402
63	**89.9.%**	**100,523**
69	98.6%	51,389

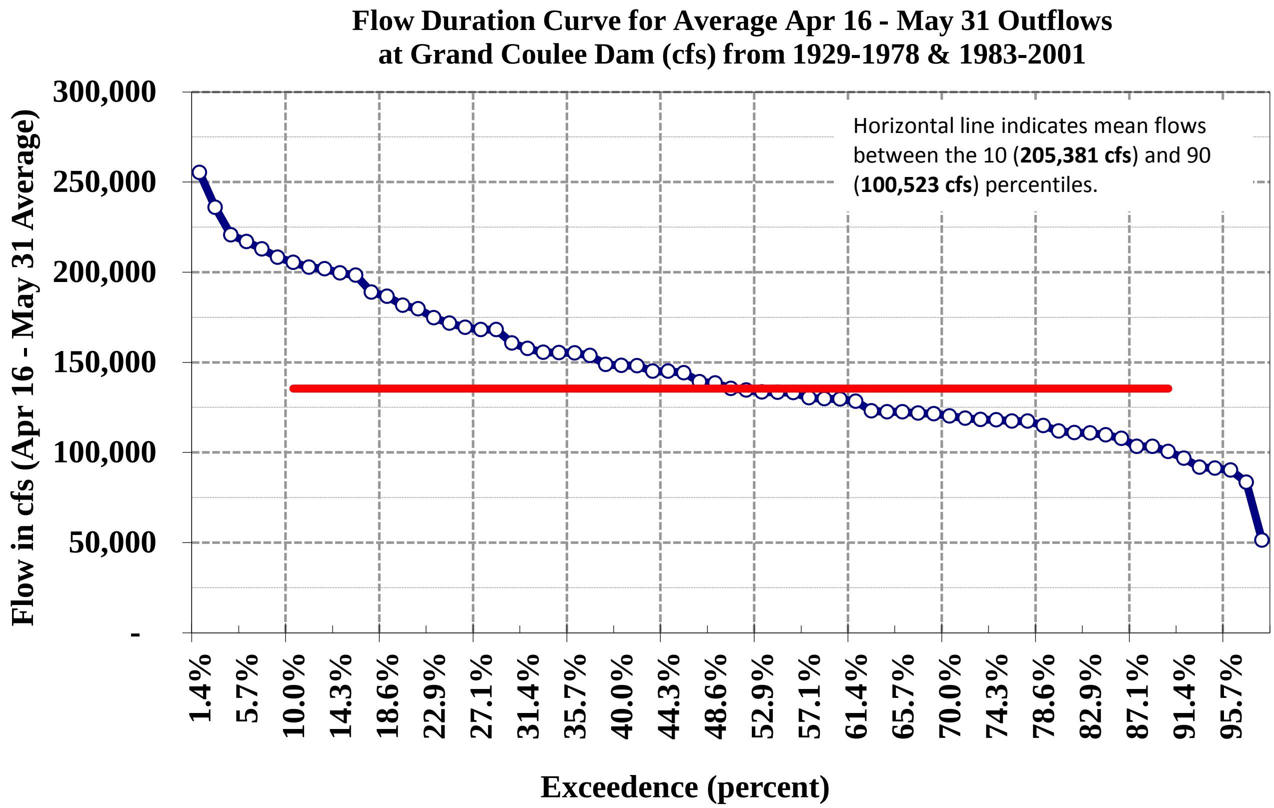


Figure 1. *Original* HCP valid study flow duration curve constructed using Grand Coulee outlfow for the period April 16-May 31, 1929-1978 and 1983-2001 for Rocky Reach and Rock Island HCP spring studies. The tenth percentile flow is 205,381 cfs and the ninety percentile flow is 100,523 cfs.

Table 2. Updated HCP spring period (April 15-May 31) valid study flows and exceedence percentiles calculated from actual Grand Coulee Dam outflows, 1983-2012, and Grand Coulee modeled (year 2000 level of water development) outflows, 1929-1978.

Updated Grand Coulee Mean outflow (cfs) and Exceedence Values		
Spring Flow Rank	Exceedence Percentile	Apr 16-May 31 Mean Flow
1	0.0%	347,214
4	5.0%	312,247
8	**10.0%**	**296,117**
20	25.0%	250,740
40	50.0%	179,959
60	75.0%	131,705
72	**90.0%**	**103,410**
76	95%	96,777
80	100.0%	51,389

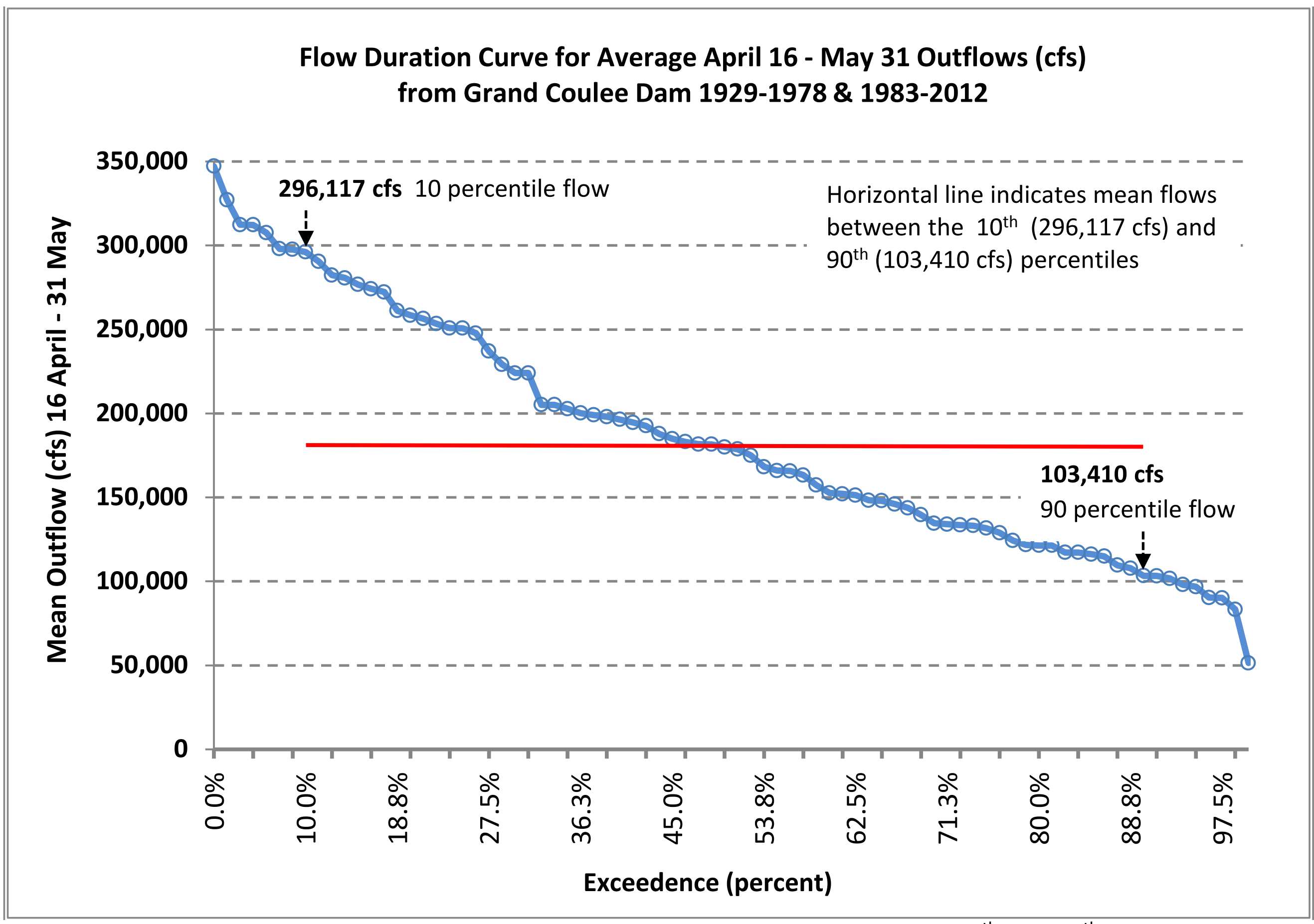


Figure 2. Updated Grand Coulee Dam mean spring outflow duration curve with 10th and 90th percentile exceedence flows for spring period, April 16 - May 31, 1929-1978, and 1983-2012.

Table 3. HCP spring period (April 15-May 31) flows and exceedence percentiles calculated from Grand Coulee Dam mean actual outflows, 1983-2012.

Ranked mean outflow (cfs) from Grand Coulee and exceedence values for April 16-May 31, 1983-2012.		
Spring Flow Rank	Exceedence Percentile	Apr 16-May 31 Mean Flow
1	0.0%	202,798
2	6.7%	181,665
3	**10.0%**	**181,635**
7	23.3%	146,043
15	50.0%	121,424
22	73.3%	103,410
27	**90.0%**	**90,325**
29	96.7	83,374
30	100.0%	51,389

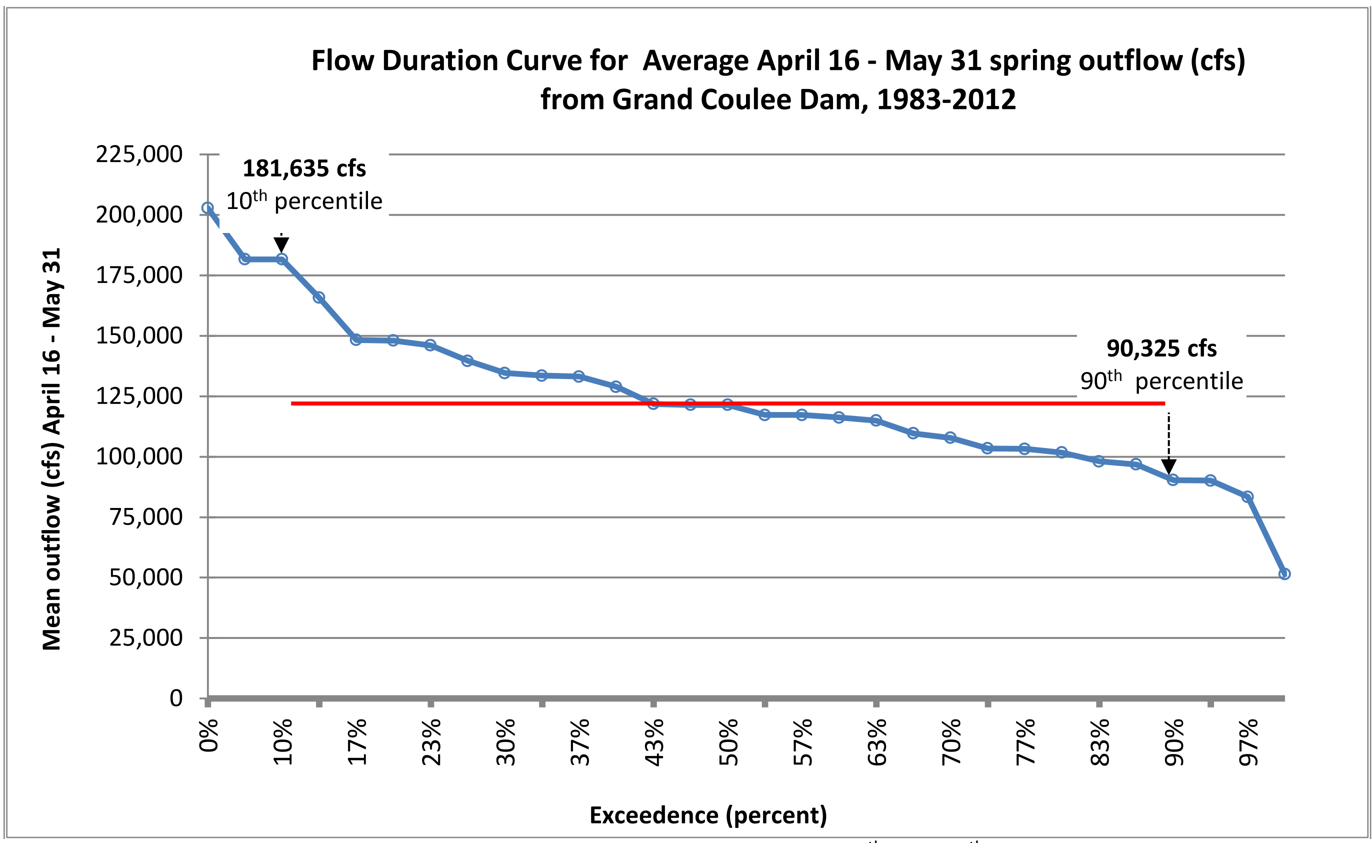


Figure 3. Grand Coulee Dam mean spring outflow duration curve with 10th and 90th percentile exceedence flows for the spring period, April 16-May 31, 1983-2012.

HCP Summer Study Period

Table 4. *Original* HCP summer period (July 1 – August 15) valid study flows and exceedence percentiles calculated from modeled Grand Coulee Dam outflow data 1929-1977, and actual flows from 1983-2001.

Summary Table of BPA modeling (1929-1977) and actual flow data (1983-2001).		
Summer Flows Rank	Percentile	Jul1-Aug15 Mean Flows
1	1.4%	192,888
7	**10.1%**	**164,905***
18	26.1%	140,831
35	50.7%	119,087
52	75.4%	90,010
62	**89.9%**	**76,318***
68	98.6%	55,388

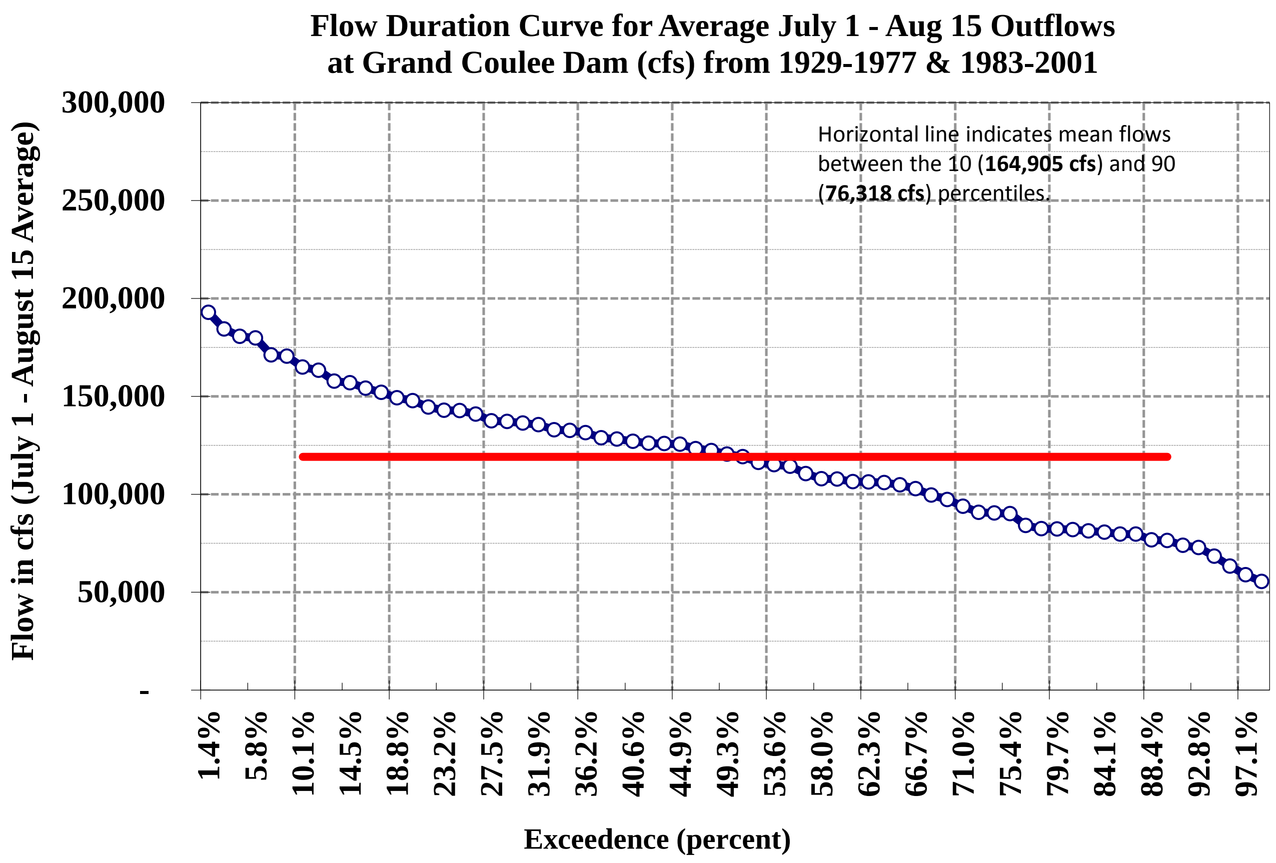


Figure 4. *Original* HCP valid study flow duration curve constructed using Grand Coulee modeled outflow data July 1-August 15, 1929-1977 and actual outflows 1983-2001 for Rocky Reach and Rock Island HCP summer studies. The ten percentile flow is 164,905 cfs and the ninety percentile flow is 76,318 cfs.

Table 5. Updated HCP summer period (June 1-August 15) valid study flows and exceedence percentiles calculated from actual Grand Coulee Dam outflows, 1983-2012, and modeled (year 2000 level of water development) outflows, 1929-1977.

Updated Grand Coulee Mean outflow (cfs) and Exceedence Values		
Spring Flow Rank	Exceedence Percentile	June 1-Aug 15 Mean Flow
1	0.0%	346,294
4	5.1%	314,267
8	**10.1%**	**290,712**
20	25.3%	240,393
40	50.6%	177,764
59	74.7%	133,641
71	**89.9%**	**103,902**
75	94.9%	88,282
79	100.0%	64,481

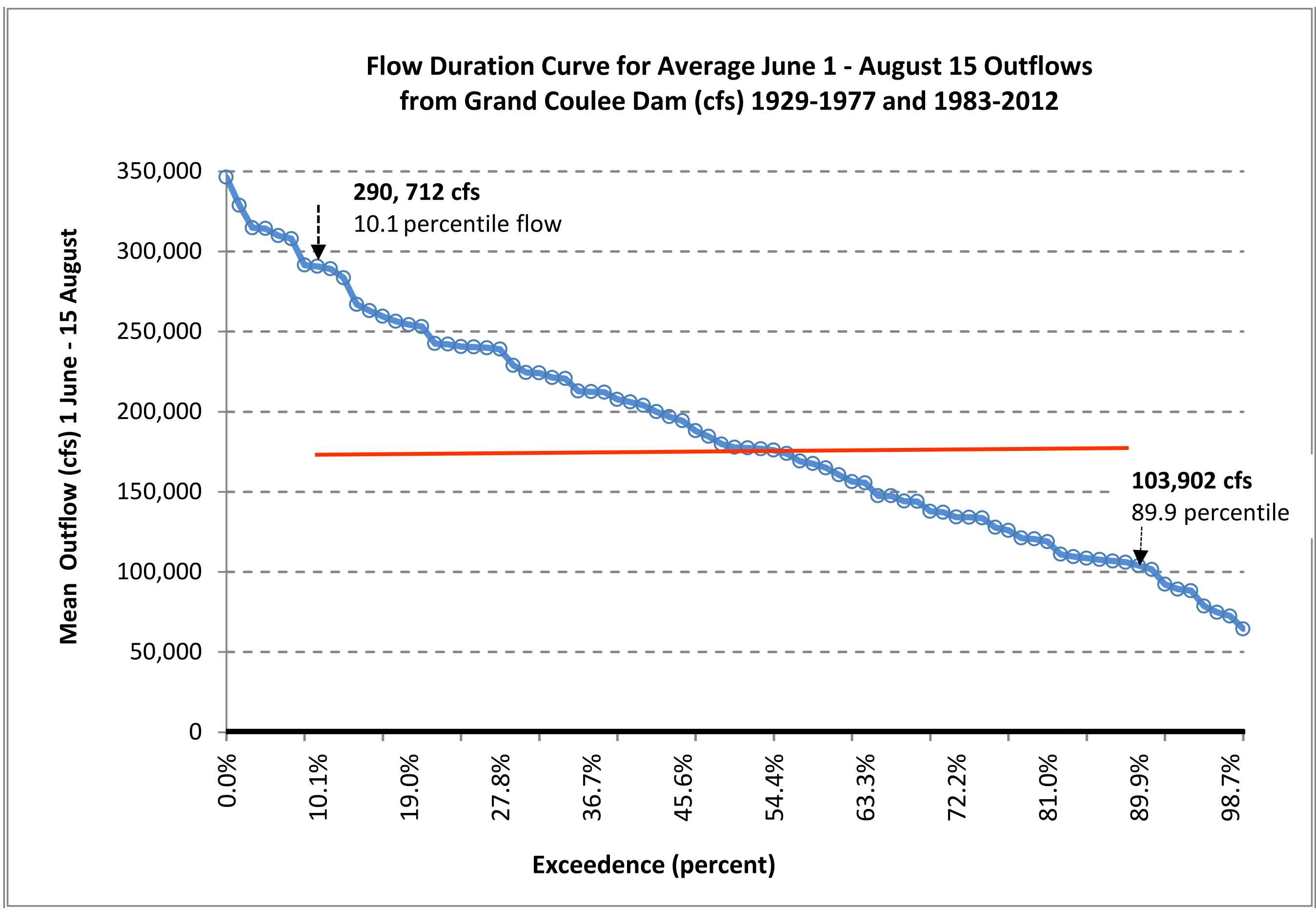


Figure 5. Updated GCL summer outflow duration curve, June included, with 10th and 90th percentile exceedence flows for the period 1929 - 1977, and 1983 - 2012.

Table 6. Updated HCP summer period flows and exceedence percentiles calculated from actual Grand Coulee Dam outflows (including June) for the period June 1 – August 15, 1983-2012.

Ranked mean outflow (cfs) from Grand Coulee Dam and exceedence values from for June 1-Aug 15, 1983-2012		
Summer Flow Rank	Exceedence Percentile	June 1-Aug 15 Mean Flow
1	0.0%	212,868
2	6.7%	196,866
3	**10.0%**	**194,276**
8	26.7%	144,009
15	50.0%	118,924
23	76.7%	101,521
27	**90.0%**	**78,684**
29	96.7.0%	72,463
30	100.0%	64,481

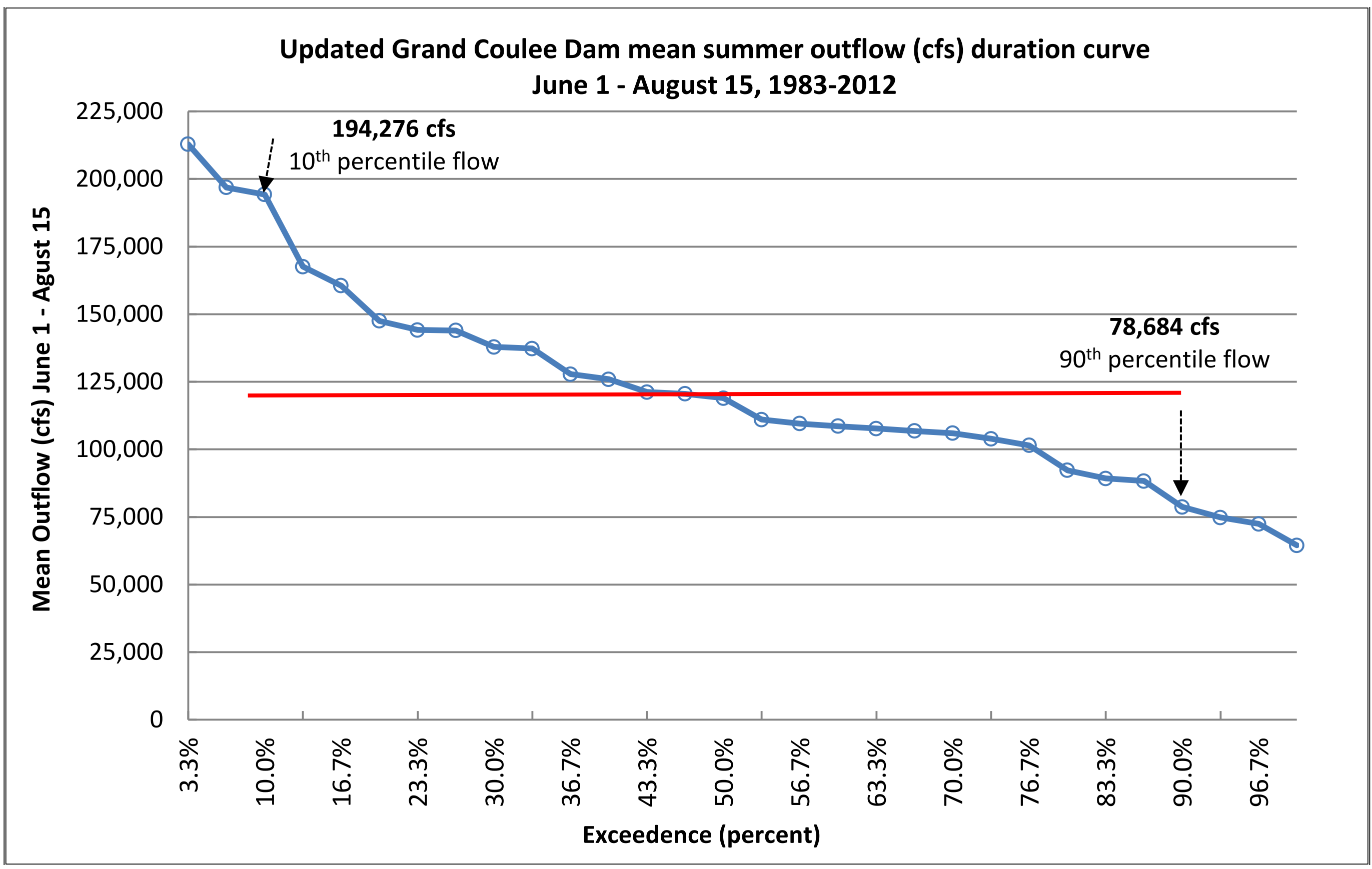


Figure 6. Grand Coulee Dam mean summer outflow duration curve, June flow included, with 10th and 90th percentile exceedence values for the summer period, June 1 – August 15, 1983-2012.

Summary

Comparison of resulting flow duration curves with and without inclusion of BPA modeled flow data (1929-1978) for GCL is shown in Table 7 (spring) and Table 8 (summer). Exclusion of 50-years of modeled outflows drives the differences in resulting valid study flow ranges, as might be expected. The number of years and run-off cycles captured in the modeled flow data likely captures a greater range of environmental variability with respect to flow. With modeled flows included, the original HCP flow duration curves contained 69 and 68 years of mean flow for spring and summer periods, respectively, while the newly updated curves contain 80 and 79 years in the spring and summer periods, respectively. Updated curves which exclude the modeled Grand Coulee outflow years contain only the last 30 years (1983-2012) to capture the same flow variability in spring and summer study periods.

Table 7. Comparison of original and updated *spring period* HCP valid study flow duration curve parameters.

Spring Study Period	**Original Duration Curve**	**Updated Curve Modeled + Actual Flows**	**Updated Curve Actual Flows**
Years in flow analysis	1929-78; 83-2001	1929-1978; 1983-2012	1983-2012
# Years in data set	69	80	30
Modeled data used?	YES	YES	NO
June flow in analysis?	NO	NO	NO
10th percentile flow (cfs)	205,381	296,117	181,635
50th percentile flow (cfs)	135,423	179,959	121,424
90th percentile flow (cfs)	100,523	103,410	90,325

Table 8. Comparison of original and updated *summer period* HCP valid study flow duration curve parameters.

Summer Study Period	**Original Duration Curve**	**Updated curve Modeled + Actual Flows**	**Updated curve Actual Flows**
Years in flow analysis	1929-1977, 1983-2001	1929-1977, 1983-2012	1983-2012
# Years in data set	68	79	30
Modeled data used?	YES	YES	NO
June flows in analysis?	NO	YES	YES
10th percentile flow (cfs)	164,905	290,712	194,276
50th percentile flow (cfs)	119,087	177,764	118,924
90th percentile flow (cfs)	76,318	103,902	78,684

Summary of 2013 Juvenile Fish Bypass Operations at Wells Hydroelectric Project
11 October 2013

Douglas PUD operated the Wells bypass system in 2013 as guided by the Wells HCP Coordinating Committee-approved *2013 Bypass Operating Plan.* The plan was intended to provide non-turbine passage during 95 percent of the juvenile Plan Species migration passing Wells Dam. Bypass operations were initiated on April 9 at 00:00 hours, and operated continuously until terminated at 24:00 hours on August 19, for a total of 133 days.

The *2013 Bypass Operating Plan* included measures for complying with Federal Energy Regulatory Commission (FERC) requirements for maintaining minimum automatic-gate-opening capacity under the *Wells Project Emergency Action Plan* and Washington Department of Ecology (Ecology) requirements for compliance with total dissolved gas (TDG) standards as directed by the FERC-approved *Total Dissolved Gas Abatement Plan* for the Wells Project. Compliance with the requirements of both of these plans was achieved by systematic removal of bypass barriers under increasing discharge as described in the *2013 Bypass Operating Plan*. The strategy for compliance with Ecology's TDG standards included the concentration of spill through adjacent spillways at the center of Wells Dam and spilling over the discharge from active turbine units. To implement these compliance measures as described in the *2013 Bypass Operating Plan*, Douglas PUD removed bypass barriers from Spillway 6 on May 23 and reinstalled them on May 30; then removed them again on July 1 and reinstalled them on July 11.

Based on analysis conducted by John Skalski and Richard Townsend of Columbia Basin Research (Appendix A), Douglas PUD achieved the HCP requirement to provide bypass operations during 95 percent of the juvenile salmon and steelhead migration passing Wells Dam by providing bypass passage during 98.29 percent of the yearling Chinook migration, 99.21 percent of the steelhead migration, 99.99 percent of the sockeye migration, 100 percent of the coho migration, and 99.33 percent of the sub-yearling Chinook migration passing Wells Dam in 2013.

Appendix A

Analysis of Proportion of Outmigration Affected by Bypass Operations at Wells Dam, 2005-2013

Analysis of Proportion of Outmigration Affected by Bypass Operations at Wells Dam, 2005-2013

Prepared for:

Public Utility District No. 1 of Douglas County
1151 Valley Mall Parkway
East Wenatchee, Washington 98802 - 4497

Prepared by:

John R. Skalski
Richard L. Townsend

Columbia Basin Research
School of Aquatic and Fishery Sciences
University of Washington
1325 Fourth Avenue, Suite 1820
Seattle, Washington 98101-2509

16 September 2013

Outmigration has been monitored at the juvenile sampling facility at Rocky Reach Dam for four stocks of salmonids (yearling and subyearling Chinook, steelhead, and sockeye) from 2005 onward. Coho were added this year, using the detections at Rocky Reach of PIT-tagged fish. The proportion of each stock covered by the bypass operations at Wells Dam can be estimated using the historical daily counts at Rocky Reach, and adding the travel time from Wells to Rocky Reach Dam. Table 1 has the average travel times based on Douglas PUD's 2010 PIT-tag study for yearling Chinook, and acoustic-tag studies for steelhead and sockeye. Due to a dearth of PIT-tag or acoustic-tag studies performed with subyearling Chinook and Coho, travel time was assumed to be 2 days.

Table 1: Average travel times from Wells tailrace to Rocky Reach Dam.

Stock	Travel time
Yearling Chinook	5 days
Subyearling Chinook	2 days
Steelhead	2 days
Sockeye	2 days
Coho	2 days

Plots of the annual cumulative proportion of the outmigration for spring migrants (yearling Chinook, steelhead, sockeye, and coho), and the subyearling Chinook in the summer had fairly consistent start and end dates at Rocky Reach (Figure 1). The timing of bypass operations for the spring outmigration at Wells from 2004 through 2011 was from 00:00 12 April – 24:00 13 June of each year for the "spring" spill season, and from 00:00 14 June – 24:00 26 August for the "summer" spill season. For 2012 and beyond, the Wells Habitat Conservation Plan (HCP) Coordinating Committee approved the modification of the timing of bypass operations at Wells Dam as follows: bypass operations commenced at 00:00 on April 9 and continued through 24:00 on August 19. This current timing of bypass operations will continue annually, unless modified as a result of future investigations that demonstrate an inadequacy of these dates at providing bypass passage for 95% of both spring- and summer-migrating Plan Species at Wells Dam. Table 2 has the estimated proportion of the annual outmigration covered by the spring, summer, and total bypass operations from 2005 through 2013. Steelhead, sockeye, coho, and subyearling Chinook are estimated to have greater than 98% of their annual outmigration pass through Wells Dam during one or both of the two periods covered by bypass operations for the most recent nine years of record. For yearling Chinook, being the earliest arriving stock, proportion covered ranged from 94.49% to 99.96% over the period of record. To assess the effectiveness of the selected start date for spring bypass operations, Table 3 has the date that, with hindsight, the spring bypass operations should have started to achieve 95% coverage of the yearling Chinook outmigration for that year. These dates ranged from 9 April to 3 May. For the two years when yearling Chinook coverage was less than 95%, bypass starting dates should have been 9 and 11 April, respectively, instead of 12 April.

Similarly, Table 4 compares the actual date of bypass termination with the date on which bypass operations covered 95% of the subyearling Chinook outmigration. In each year, an earlier termination of bypass operations would have been possible without jeopardizing the achievement of the HCP standard of providing a bypass route for ≥ 95% of outmigrating subyearling Chinook. During the nine years analyzed, the 95% HCP standard was achieved 4 to 32 days prior to the actual date on which bypass operations were terminated.

Table 2. Total proportion of each stock's migration affected by bypass operations (spring, summer) at Wells Dam, based on travel times from Wells to Rocky Reach Dam, the cumulative proportion of the annual migration of each stock at Rocky Reach, and the start and stop dates of Wells bypass operations.

		Annual migration proportion								
	Proportion passed	2005	2006	2007	2008	2009	2010	2011	2012	2013
Spring Outmigration	**Yearling Chinook**									
	prior to spring Bypass Ops period	0.0528	0.0259	0.0551	0.0025	0.0116	0.0067	0.0085	0.0004	0.0171
	during spring Bypass Ops period	0.9455	0.9559	0.9154	0.9972	0.9827	0.9917	0.9910	0.9996	0.9823
	during summer Bypass Ops period	0.0017	0.0.182	0.0296	0.0002	0.0056	0.0016	0.0005	0.0001	0.0006
	after Bypass Ops period	0	0	0	0	0	0	0	0	0
	Total Covered by Bypass ops	**0.9472**	**0.9741**	**0.9449**	**0.9975**	**0.9884**	**0.9933**	**0.9915**	**0.9996***	**0.9829**
	Steelhead									
	prior to spring Bypass Ops period	0.0015	0.0101	0.0066	0.0009	0.0019	0.0045	0.0190	0.0014	0.0079
	during spring Bypass Ops period	0.9903	0.9762	0.9887	0.9901	0.9965	0.9763	0.9513	0.9885	0.9847
	during summer Bypass Ops period	0.0081	0.0137	0.0042	0.0089	0.0016	0.0188	0.0297	0.0101	0.0074
	after Bypass Ops period	0	0	0.0004	0.0001	0	0.0004	0	0	0
	Total Covered by Bypass ops	**0.9985**	**0.9899**	**0.9930**	**0.9990**	**0.9981**	**0.9951**	**0.9810**	**0.9986**	**0.9921**
	Sockeye									
	prior to spring Bypass Ops period	0	0	0	0	0	0	0	0	0
	during spring Bypass Ops period	0.9983	0.9984	0.9998	0.9972	0.9957	0.9992	0.9923	0.9995	0.9990
	during summer Bypass Ops period	0.0017	0.0016	0.0001	0.0028	0.0043	0.0008	0.0077	0.0005	0.0009
	after Bypass Ops period	0	0	0	0	0	0	0	0	0.0001
	Total Covered by Bypass ops	**1.0000**	**1.0000**	**0.9999**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**1.0000**	**0.9999**
	Coho									
	prior to spring Bypass Ops period									0
	during spring Bypass Ops period									0.9910
	during summer Bypass Ops period									0.0090
	after Bypass Ops period									0
	Total Covered by Bypass ops									**1.0000**
Summer Outmigration	**Subyearling Chinook**									
	prior to spring Bypass Ops period	0	0	0	0	0	0	0	0	0
	during spring Bypass Ops period	0.1937	0.1894	0.2136	0.1266	0.1029	0.5212	0.5628	0.5871	0.1670
	during summer Bypass Ops period	0.8022	0.8077	0.7847	0.8620	0.8882	0.4723	0.4331	0.4059	0.8263
	after Bypass Ops period	0.0041	0.0029	0.0017	0.0113	0.0089	0.0064	0.0041	0.0070	0.0067
	Total Covered by Bypass ops	**0.9959**	**0.9971**	**0.9983**	**0.9887**	**0.9911**	**0.9936**	**0.9959**	**0.9930**	**0.9933**

***Proportions not summing to 1 are due to round-off error.**

Table 3. Comparison of the actual start date for spring bypass operations at Wells Dam each year, versus the start date necessary to have covered at least 95% of the yearling Chinook outmigration that year. Operations are assumed to begin at 00:00 for the date listed.

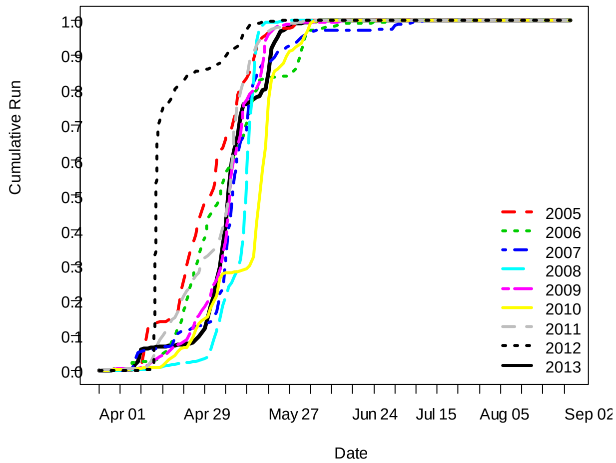
Migration Year	Actual Date	Cumulative proportion passed before 00:00	Proportion Covered by Bypass Ops	Date by which the first 5% passed	Cumulative proportion passed before 00:00	Bypass Ops would have Covered this Proportion	# Days before or after actual date to get 95%
2005	April 12	0.0528	0.9472	April 11	0.0039	0.9961	1 before
2006	April 12	0.0259	0.9741	April 18	0.0468	0.9532	6 after
2007	April 12	0.0551	0.9449	April 9	0.0243	0.9757	3 before
2008	April 12	0.0025	0.9975	May 3	0.0406	0.9594	21 after
2009	April 12	0.0116	0.9884	April 19	0.0436	0.9564	7 after
2010	April 12	0.0067	0.9933	April 22	0.0410	0.9590	10 after
2011	April 12	0.0085	0.9915	April 15	0.0446	0.9554	3 after
2012	April 9	0.0004	0.9996	April 15	0.0115	0.9885	6 after
2013	April 9	0.0171	0.9829	April 10	0.0240	0.9760	1 after

Table 4. Comparison of the actual stop date for summer bypass operations at Wells Dam each year, versus the stop date necessary to have covered at least 95% of the subyearling Chinook outmigration that year. Operations are assumed to end at 24:00 for the date listed.

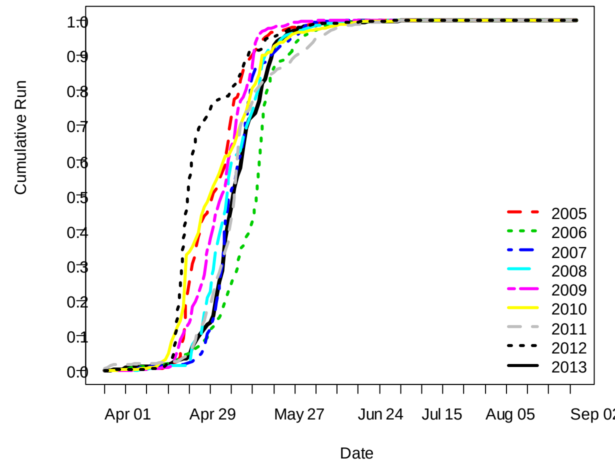
Migration Year	Actual Stop Date	Cumulative proportion passed by 11:59:59 PM	Date on or before the last 5% passed	Cumulative proportion passed by 11:59:59 PM (Bypass Ops would have Covered this Proportion)	# Days before actual date to get 95%
2005	August 26	0.9959	August 3	0.9525	23
2006	August 26	0.9971	August 2	0.9524	24
2007	August 26	0.9983	August 11	0.9538	15
2008	August 26	0.9887	August 19	0.9502	7
2009	August 26	0.9911	August 22	0.9709	4
2010	August 26	0.9936	August 10	0.9537	16
2011	August 26	0.9959	July 25	0.9528	32
2012	August 19	0.9930	July 29	0.9502	22
2013	August 19	0.9933	August 7	0.9592	12

Figure 1. Passage dates at Rocky Reach Dam for spring and summer migrating stocks, 2005-2013. Cumulative proportions are based on the expanded counts obtained from sampling daily from 1 April – 31 August (or through 4 September in 2008).

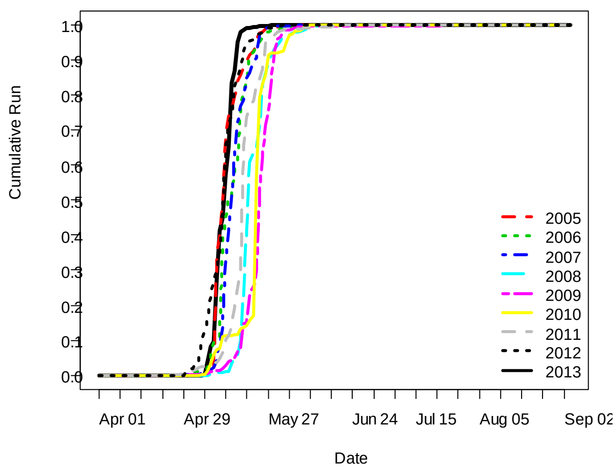
a. Yearling Chinook



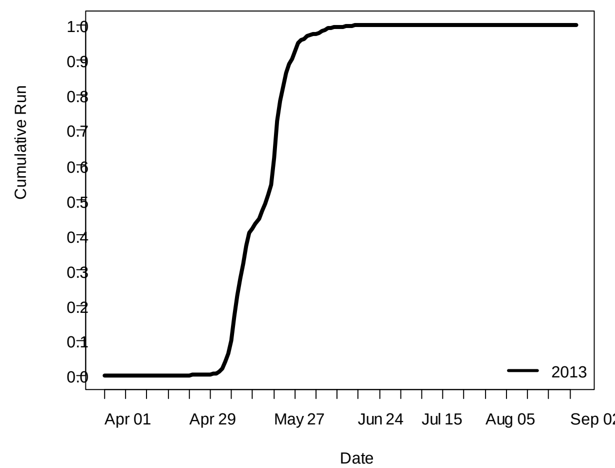
b. Steelhead



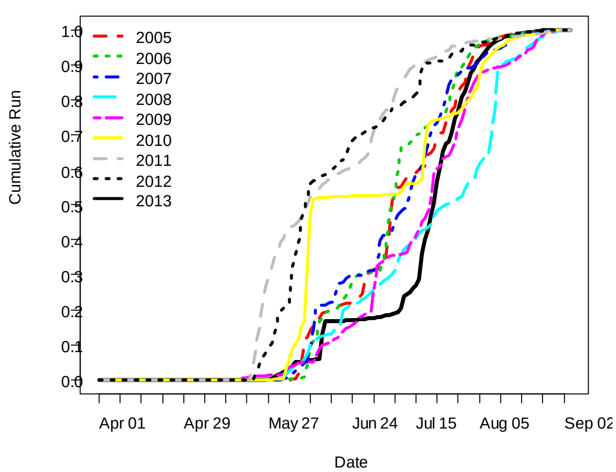
c. Sockeye



d. Coho



e. Subyearling Chinook



ANCHOR QEA
720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	December 19, 2013
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the November 19, 2013 HCPs Coordinating Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met at the Radisson Gateway Hotel, in SeaTac, Washington, on Tuesday, November 19, 2013, from 9:30 am to 12:30 pm. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Washington Department of Fish and Wildlife (WDFW) will provide a letter designating a new WDFW HCP Coordinating Committees representative to Kristi Geris for the administrative record (carried forward from the Coordinating Committees meeting on October 22, 2013; Item I-A).
- Chelan PUD will provide a summary analysis of passage percentages for each turbine unit at Rocky Reach Dam to Kristi Geris for distribution to the Coordinating Committees (Item III-A).
- The updated flow duration curves for valid survival studies will be discussed at the Coordinating Committees meeting on December 17, 2013 (Item III-B).
- **The next Coordinating Committees meeting will be on December 17, 2013, and will be held by conference call (Item VI-A).**

DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at this meeting.

AGREEMENTS

- The Coordinating Committees representatives present agreed to the removal of the upstream ramps located at the Wells Dam count windows (Item II-C).

REVIEW ITEMS

- Kristi Geris sent an email to the Coordinating Committees on November 19, 2013, notifying them that the draft 2014 Wells Bypass Operating Plan is available for review for a 60-day period, with comments due to Tom Kahler no later than January 17, 2014 (Item II-E).

REPORTS FINALIZED

- There are no reports that have been recently finalized.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. The following additions were requested:

- Lance Keller added: 1) a discussion on the unmarked yearling Chinook index counts at Rock Island for periods prior to April 17; and 2) an update on Rock Island Dam Ladder maintenance.
- Tom Kahler added a discussion on potential modifications to the Wells Dam count window area.

A. Action Items Review (Mike Schiewe)

Action items from the last Coordinating Committees meeting on October 22, 2013, and follow-up discussions were as follows: *(Note: italicized item numbers below correspond to agenda items from the October 22, 2013 meeting.)*

- *WDFW will provide a letter designating a new WDFW HCP Coordinating Committees representative to Kristi Geris for the administrative record (Item II-A).*

Jeff Korth indicated via email on November 18, 2013, that WDFW has not yet determined the new alternate; and so the official letter will be delayed until December 2013. This action item will be carried forward.

- *Lance Keller will provide unmarked yearling Chinook index counts at Rock Island for periods prior to April 17, to Kristi Geris for distribution to the Coordinating Committees (Item III-A).*
  Keller provided the index counts as requested to Geris on November 18, 2013, and Geris distributed them to the Coordinating Committees that same day. Keller said that he will discuss this further during today's meeting.
- *Steve Hemstrom will provide the raw data used to develop the original and updated flow duration curves for valid survival studies to Kristi Geris for distribution to the Coordinating Committees (Item III-B).*
  Hemstrom provided these data to Geris, which she distributed to the Coordinating Committees on November 19, 2013.
- *Steve Hemstrom will review the calculations used to develop the updated flow duration curve for valid survival studies, for discussion at the Coordinating Committees meeting on November 19, 2013 (Item III-B).*
  The updated flow duration curves for valid survival studies will be discussed at the Coordinating Committees meeting on December 17, 2013.
- *The next Coordinating Committees meeting will be on November 19, 2013, and will be held in person at the Radisson Hotel in SeaTac, Washington (Item VI-A).*
  Observed.

B. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft October 22, 2013 conference call minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to discuss. She added that Bryan Nordlund and Jeff Korth approved the revised draft minutes via email on November 12, 2013 and November 18, 2013, respectively. The Coordinating Committees members present approved the draft October 22, 2013 conference call minutes, as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Douglas PUD

A. PRESENTATION: CRITFC Sockeye Studies (Jeff Fryer)

Jeff Fryer's presentation, titled "Columbia River Inter-Tribal Fish Commission (CRITFC) Sockeye Accords Project (2009-2013)" (Attachment B), was distributed to the Coordinating Committees by Kristi Geris during the meeting on November 19, 2013. Fryer's presentation included an overview of study goals, methods, and project participants. He focused on the results from 2009, 2010, and 2011; and he also reviewed objectives and preliminary results from 2012 and 2013. Methods employed included extensive use of passive integrated transponder (PIT) tags, but also included tracking studies using Juvenile Salmon Acoustic Telemetry System (JSATS) acoustic tags, among others.

Fryer reviewed 2009 results (slides 5 through 16, Attachment B). He said that 838 sockeye salmon were PIT-tagged. He reviewed the percentage of tagged sockeye salmon detected at upstream dams, and also sockeye escapement based on PIT tag detections and visual fish counts at mainstem dams. Fryer noted the differences in escapement estimates based on 2009 PIT tag detections versus visual fish ladder counts. Travel times between dams and delay times at dams were reviewed. Fryer noted the extended delay times in 2009 at Tumwater Dam. He reviewed stock and age composition estimates, and he said that age sampling at Wells Dam is biased because smaller fish are not as easily trapped. He said there have been discussions about installing a screen to help trap smaller fish. Fryer reviewed the 2009 acoustic receiver locations, and also the numbers of sockeye salmon acoustically tagged at Wells Dam that were detected at upstream receivers. He noted that in 2009, inexperienced taggers may have affected results.

Fryer reviewed 2010 results (slides 17 through 23, Attachment B). As for 2009, Fryer presented a graphic depicting the percentage of tagged sockeye salmon detected at upstream dams. He reviewed two tables that described passage problems experienced at Tumwater Dam. He explained that after PIT tag detection arrays were installed in the White River and lower Wenatchee River, the effects of delays at Tumwater Dam were more apparent. Fryer reviewed 2010 acoustic receiver sites and results. He said that sockeye tend to prefer holding in Osoyoos Lake; however, when temperatures in the Okanogan River exceed their thermal preferences, sockeye tend to stay in the Wells Pool. He added that the Similkameen River is the least preferred holding location, and that sockeye holding there typically do not appear to survive. Mike Schiewe asked why 30% of the sockeye are traveling up the Similkameen then. Fryer explained that during certain times of the year, the Similkameen is cooler than the Okanogan, making it more attractive to sockeye. Fryer reviewed 2010 tagging effects, noting that multiple tags had greater effects on fish survival. Lastly, for 2010, Fryer said that PIT tag antennas were also installed in Zosel Dam fishways; however, because flows have been so high since 2010, limited data have been obtained.

Fryer reviewed 2011 results (slides 24 through 30, Attachment B). He said that 767 sockeye salmon were PIT-tagged. PIT tag detections, delay times, and tagging effects were reviewed. He noted that these data indicate that fish tagged and released later in the season did not do as well as fish that were tagged and released earlier. Fryer compared PIT-tagged sockeye that were not detected at dams between 2006 and 2011; and he noted the high detection efficiency at Wells and Tumwater dams. Lastly, for 2011, Fryer reviewed last detection sites and detection by release ladder at Wells Dam. Fryer said he found it interesting that several sockeye were detected in both ladders, and Tom Kahler said that this occurs with other salmonid species as well at Wells Dam.

Fryer reviewed the work conducted in 2012 (slides 31 through 53, Attachment B), including PIT-tagging more than 3,000 adult sockeye and 600 juvenile sockeye, and acoustic tagging 60 adult sockeye. He noted that out of 1,600 adult sockeye PIT-tagged at Bonneville Dam, none were detected in the Snake River. He added that among the 1,600 PIT-tagged at Bonneville, three genetically tested to be Snake River fish. Fryer reviewed stock and age composition estimates, Okanagan Basin acoustic receiver sites, tagging effects, and detection sites. He said that the Columbia River Inter-Tribal Fish Commission (CRITFC) has been expanding locations of receivers into the Wells Pool, and that they would like to install more receivers upstream near Chief Joseph Dam. He said, however, that logistically they do not have the equipment to do so. Fryer reviewed fallback rates, noting the high rates at Rocky Reach, Wells, and Lower Granite for fish tagged as juveniles. He also reviewed PIT tag visual count estimates, and tabulated abundance, harvest, and escapement numbers based on PIT tag estimates. He reviewed genetics work, impacts to fisheries, and Bonneville to McNary conversion rates. He said that in terms of conversion rates, rates were higher for sockeye

PIT-tagged as adults than those PIT-tagged as juveniles. Lastly, for 2012, Fryer reviewed tagging effects and sockeye harvest comparisons.

Fryer reviewed some slides showing 2013 data, including upstream survival of sockeye acoustic-tagged at Wells Dam, and then he reviewed conclusions.

Kahler asked about the hours in which nighttime passage is monitored at Bonneville, and Fryer replied that they monitor for 18 hours per day. Rose asked if CRITFC is conducting limnological studies, and Fryer said they just started; however, they do not yet have results. Kirk Truscott said that WDFW recently installed a PIT-tag array on the Okanogan River at river kilometer (rkm) 24.9, and he noted that this will provide another PIT tag assessment from Wells to the lower Okanogan. Kahler said that National Marine Fisheries Service (NMFS) is also installing PIT-tag arrays in the Columbia River estuary, and Fryer said the issue with that is that fish will only be detected if they are migrating near the surface. He added that there is a lot of boat traffic through that area as well.

Fryer said that he and Josh Murauskas are working on developing a paper on Tumwater Dam passage issues, and Lance Keller added that Bryan Nordlund is also an author on the paper. Fryer added that in early 2014, he will be providing a similar request to the Coordinating Committees to continue the sockeye salmon tagging studies. Schiewe thanked Fryer for the presentation.

B. Wells Dam PIT Tag Detection System Upgrades (Tom Kahler)

Tom Kahler said that the current readers in the PIT tag detection system at Wells Dam are the original readers that were installed along with the original system, and he added that Biomark is now phasing them out. He said in early 2014, the old readers will be replaced by new FS2020 readers, which have faster read times. The new FS2020 readers will reduce the likelihood of missed detections.

C. Potential Modifications to the Wells Dam Count Window Area (Tom Kahler)

Tom Kahler recounted his discussions with Bryan Nordlund regarding smaller fish repeatedly passing back and forth through the count window, and the potential causes for this behavior. They concluded that the behavior might be related to the upstream ramps descending from the count window to the fish ladder floor that were installed to improve lamprey passage for the 2013 Adult Lamprey Passage and Enumeration Study. Kahler said that Nordlund suggested that the ramp descending on the upstream side of the count window is likely causing uneven hydraulics and flow separation through the count window area, and Nordlund suggested removing the upstream ramp on both ladders. Kahler said that count window video footage was reviewed, and no lamprey were observed using the ramps to pass through the area (i.e., lamprey were free-swimming through the area).

Mike Schiewe said that this topic was also discussed at the Douglas PUD Aquatic Settlement Work Group (SWG) meeting last week. He said the Aquatic SWG was told that based on Nordlund's recommendation, the Coordinating Committees would likely recommend removing the ramps. Kirk Truscott asked how many lampreys have been observed passing through the count window, and Kahler said there have been approximately 20 observations. Truscott asked if impacts to salmon have been observed, and Kahler said that he has not observed fish having difficulty passing the count window, but has observed jacks, mini-jacks and resident fish affected by the uneven hydraulics once they have successfully passed the count window and are holding in the large corner pool upstream of the window. Kahler added that smaller fish are predominantly the affected fish, seemingly caught by surprise by the accelerating flow as they get too close to the upstream end of the window slot and they get sucked back through the window slot before they can respond. Larger fish seem capable of bursting away from the accelerating flow and thus do not get washed back through the window repeatedly. He also said that in the past, he has observed schools of resident fish and mini-jacks holding in the corner pool just upstream of the count window, and he suggested that those fish are the ones that move back and forth through the count window.

The Coordinating Committees representatives present agreed to the removal of the upstream ramp located at the Wells Dam count window.

D. Wells Hatchery Rebuild Update (Tom Kahler)

Tom Kahler said that the Hatchery Committees have been tracking this item; however, he also wanted to alert the Coordinating Committees of progress. He said that HDR Engineering, Inc., the consultant for the rebuild, presented plans to the Hatchery Committees in August 2013, and the Hatchery Committees were given the opportunity to provide input on the plans. He said that since that time, design development has been moving forward and 30% design is almost complete. Kahler noted that all comments need to be received prior to completing 30% design, which is projected to be complete in December 2013. He said that current efforts are focused on the water system, and he added that engineers are making sure that all wells that feed the hatchery are operating at their highest potential, so that the correct water budget can be established for the design. He also added that a new well is being drilled on Carpenter Island (i.e., Well 16b). Kahler encouraged Coordinating Committees' representatives to contact their Hatchery Committees' representative with questions.

E. Wells Dam 2014 Bypass Plan (Tom Kahler)

Tom Kahler said that the draft Wells Dam 2014 Bypass Operating Plan is essentially the same as the 2013 plan, only in a different format. He said he anticipates no changes to the total dissolved gas (TDG) operations and that there were no changes to the Emergency Action Plan, which includes a directive from the Federal Energy Regulatory Commission mandating the threshold discharge at which bypass barriers must be removed. Kristi Geris sent an email to the Coordinating Committees following the meeting on November 19, 2013, notifying them that the draft 2014 Wells Bypass Operating Plan is available for review for a 60-day period, with comments due to Kahler no later than January 17, 2014. Douglas PUD will be requesting approval of the draft plan at the Coordinating Committees meeting on January 28, 2014.

III. Chelan PUD

A. Rocky Reach Turbine Unit Outages (Lance Keller)

Lance Keller said that, currently, five turbine units are down for maintenance at Rocky Reach Dam. These include four large units (i.e., Turbine Units 8, 9, 10, and 11 [C8, C9, C10, and C11]) and one small unit (i.e., Turbine Unit 6 [C6]). He recalled that Turbine Unit 2 (C2) was also scheduled to be offline for repair from January to May 2014; however, due to the four large units being offline, repairs for C2 are now scheduled for July 2014. Keller noted that this new C2 schedule will be outside of the spring juvenile migration period; and added that the same alternative Rocky Reach Surface Collector Operation will be implemented as approved for the Turbine Unit 1 (C1) outage in April 2013.

Keller said that the rotor crack repair on C6 is scheduled to be complete by December 20, 2013, and repairs on the four larger units will follow. He said that Rocky Reach engineers plan to make interim fixes on the large units while the units are in full steep position, so that the units can still handle 23,000 cubic feet per second (23 kcfs). He said that because the monitoring equipment is located on C11, repairs will first be implemented on that unit. He said that C11 is already dewatered, and the interim fix is anticipated to be completed by January 31, 2014. He said repairs to C9 will then follow, and this unit is scheduled to be back online by February 28, 2014; and then C8 repairs will follow that, with that unit scheduled to be back online by March 31, 2014. He said that by April 1, 2014, a full powerhouse should be back online with the exception of C10. He said that based on the performance of the other larger units, the same interim fix may be applied to C10, in which case C10 would be back online by August 2014. Permanent fixes for C8, C9, C10, and C11 are anticipated to require six months per unit, and should be complete by fall 2018.

Keller recalled that at the Coordinating Committees meeting on August 27, 2013, the Coordinating Committees agreed to extend the 2013/2014 winter maintenance work period at Rocky Reach Dam from beginning January 2, 2014, to the new start date of December 2, 2013, to allow more time to complete required work. Keller said that the plan is to now have the ladders open through December 2013, so winter maintenance at Rocky Reach Dam will start at the usual start date of January 2.

Mike Schiewe asked how old the units are (i.e., were the failures premature?). Keller replied that they were premature and were caused by an engineering flaw. He said the servo rod in each larger unit is three times thinner than it should be. Jim Craig asked if any lubricant leaked into the river, and Keller replied that he does not believe so. He added, however, that oil was found around the generator shaft and metal shavings were found in a strainer. He also added that the engineers are investigating what level of stress on the unit occurs during the start and stop operations.

Keller noted that Turbine Unit 1 (C1) through Turbine Unit 7 (C7) are operating at full capacity, and C8, C9, and C11 will be operating at 23 kcfs in time for the fish migration; and so the only possible hole is located at the top of the powerhouse. He said that once the permanent fixes are underway, one large unit can be brought back online every six months. He said the engineers have been instructed to keep each unit as close to peak efficiency as possible; however, this is somewhat limited in order to maintain control of the unit. Kirk Truscott asked if there is a way to estimate potential decreases in powerhouse or project-level survival due to the changes in powerhouse operations. Keller said that Chelan PUD is not anticipating a decrease. He said there are little data on passage for individual units, and he added that, in the past, data were combined for two units. He said that Steve Hemstrom cited a study indicating that the bulk of fish pass through Turbine Unit 4 (C4) and Turbine Unit 5 (C5). Truscott asked if Keller could provide a summary analysis of passage percentages for each turbine unit at Rocky Reach Dam, and Keller said that he would provide those data to Kristi Geris for distribution to the Coordinating Committees.

B. Valid Study Flow Duration Curves (Lance Keller)

Lance Keller said that the revised 2013 Valid Study Flow Duration Curve Updates were distributed to the Coordinating Committees by Kristi Geris prior to the meeting on November 19, 2013. He said that the raw data were received in the form of multiple tables, and when Steve Hemstrom reviewed his original calculations that were discussed at the last Coordinating Committees meeting on October 22, 2013, he realized that incorrect data were used, which resulted in the outliers as discussed at the meeting. Those errors were corrected and the outliers were removed. Because Hemstrom was unable to attend today's meeting, the updated flow duration curves for valid survival studies will be discussed at the Coordinating Committees meeting on December 17, 2013.

C. Unmarked Yearling Chinook Index Counts at Rock Island for Periods Prior To April 17 (Lance Keller)

Lance Keller said that, per Chelan PUD's October 22, 2013 Action Item, unmarked yearling Chinook index counts at Rock Island for periods prior to April 17 (Attachment C) were provided to Kristi Geris on November 18, 2013, which she distributed to the Coordinating Committees on that same day. Keller noted that the smolt numbers were expanded numbers; and explained that Chelan PUD enters the 24-hour fish counts at Rock Island into Data Access in Real Time (DART), and DART expands those numbers based on flow in the powerhouse. He reviewed that 163 (expanded) adipose (ad)-present spring Chinook passed Rock Island Dam prior to spill, with a total of 2,704 (expanded) estimated for a season total, and equaled a little more than 6% of the total ad-present (expanded) run. He also reviewed ad-clipped and total data, and noted that ad-clipped fish detected at Rock Island represented only 1% of the total ad-clipped (expanded) run. Mike Schiewe asked where the ad-clipped fish would be coming from, and Keller replied they would be coming from either the Methow or Twisp. Tom Kahler confirmed that Methow fish were released after April 17, and Twisp and Metcomp fish were released from April 18 to 30, 2013. Keller also noted that last year the Chelan Falls Facility ran into issues and released fish early on April 11, 2013; and that according to the Fish Passage Center, Chiwawa released on April 16, 2013. Kirk Truscott confirmed with Keller than these data include yearling Chinook only, and Keller said that is correct. Jim Craig noted that the Entiat has also been releasing summer Chinook; and Keller clarified that these data also include Chinook "ones." Truscott said that a season total of 2,704 fish did not make sense to him when Methow Hatchery releases approximately 400,000 to 500,000 fish. He asked if these data represented fish passing the dam, or only the bypass station; and Keller confirmed these data are for fish passing Rock Island Dam. Truscott and Keller agreed to discuss the data further offline. Keller later clarified that counts at the Rock Island trap are index counts used to estimate species run timing—not an absolute passage number at Rock Island.

D. Rock Island Dam Ladder Maintenance (Lance Keller)

Lance Keller said that ladder maintenance at Rock Island Dam will start in December 2013. He reminded the Coordinating Committees that there are three ladders at Rock Island Dam, so when one or two ladders are down for maintenance, one ladder can still remain in service. He also reminded the Committees that every third year, a longer, more comprehensive inspection is performed on each ladder. He said that this year, the longer outage will be performed on the right ladder, beginning December 2, 2013. Keller said this longer outage will provide enough time for Rock Island Dam engineers to install interim fixes on the picket-barrier, as discussed at the Coordinating Committees meeting on August 27, 2013; and the permanent fix is still scheduled for implementation during the 2014/2015 winter maintenance outage. Keller said that maintenance on the left ladder is scheduled for January 2, 2014, through January 24, 2014, and middle ladder maintenance is scheduled for January 27, 2014, through February 14, 2014. He said that by mid-February, all three ladders at Rock Island Dam should be back in service.

IV. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees meeting on November 15, 2013:

- *Wenatchee Levee Removal and Riparian Restoration Budget Amendment*: The Chelan County Natural Resources Department requested a budget amendment to move funds from contract labor to sponsor salaries and benefits. The Rock Island Tributary Committee requested more information prior to making a decision.
- *Methow/Chewuch Groundwater Monitoring Scope Change and Budget Amendment*: The Cascade Columbia Fisheries Enhancement Group requested a scope change and budget amendment to conduct a pump-drawdown test to measure groundwater quantity and recharge. The Wells Tributary Committee requested more information prior to making a decision.
- *Similkameen Habitat Design Information Request*: The Okanogan Conservation District asked the Rocky Reach Tributary Committee to recommend a width for the required riparian buffer zone for the Similkameen River Mile (RM) 3.8 Habitat Design Project. Tom Kahler said that an email poll was circulated to Rocky Reach Tributary Committee representatives, and that no one recommended less than 100 feet.
- *Okanagan Project Tours*: The Tributary Committees reviewed and discussed the Okanagan project tours that took place in October, and they were pleased with the progress that is occurring at each of the projects.
- *Next Steps*: The next Tributary Committees meeting will be held on December 12, 2013, if needed.

Schiewe said that the next Hatchery Committees meeting is scheduled to be held on November 20, 2013, at Douglas PUD in East Wenatchee, Washington. He said that other recent Hatchery Committees discussions are as follows:

- *October 7, 2013 conference call*: The Hatchery Committees held a conference call to discuss the Yakama Nation's (YN's) Twisp River Steelhead Live Spawning Plan SOA. Schiewe explained that components of the YN's steelhead live-spawning program will be housed at the Methow Hatchery, which raised some questions regarding fish health risks. He said the Hatchery Committees relied on WDFW Fish Health Staff to conduct a risk assessment and provide a formal endorsement. The risk assessment focused primarily on risk of disease transmission among programs at the hatchery, and was judged minimal; the program was approved by the Hatchery Committees. Schiewe said that there were also some funding issues between the YN and Douglas PUD involving covering costs. He said Keely Murdoch indicated that the program is funded by the Accords through 2017; and by that time, there should be a better understanding of whether or not the program will continue and perhaps require permanent arrangements. Bob Rose asked how disease could be transmitted. Tom Kahler expanded on the discussion noting that WDFW would collect females from Douglas PUD's Twisp Weir, which would be live spawned and the progeny early reared at Methow Hatchery, and the YN would recondition the live-spawned females at the Winthrop National Fish Hatchery. He added that the fish health concern is that the steelhead may have Infectious Pancreatic Necrosis Virus (IPNV); therefore, maternal family units need to be held in isolation at Methow rather than being aggregated and reared at Wells Hatchery. They need to be reared for 60 days in discrete family units until each family can be screened to determine whether they are infected with IPNV. Schiewe added that there was also the issue of how many fish need to be destroyed if the disease is detected. Rose asked how many tanks would be used, and Kahler said there will be about 13 to 14 tanks with each tank holding a maternal family. He added that if disease is detected, every fish associated to that cross will need to be destroyed. Schiewe said there has been a lot of discussion and questions concerning risk, particularly because Endangered Species Act (ESA)-listed spring Chinook and steelhead are located at this hatchery and could be exposed to IPNV.

- *November 6, 2013 conference call*: The Hatchery Committees convened a conference call to discuss the draft Chelan PUD 2014 Hatchery Monitoring and Evaluation (M&E) Implementation Plan. Schiewe said that this discussion will continue at the Hatchery Committees meeting on November 20, 2013. He said the draft plan involves Grant PUD and also involves the development of an "approved" carrying capacity estimate for the Wenatchee basin, with the idea that this information could be used in future recalculations of hatchery production. He said the Joint Fishery Parties agreed to the importance of agreeing on an estimate of carrying capacity, but do not support being locked into how it is used. Schiewe noted that the Chelan PUD hatchery mitigation program and M&E program are required under the HCP and that Grant PUD's responsibilities are covered in their Settlement Agreement. Chelan PUD and Grant PUD are trying to work out similar details for their Wenatchee Basin programs, but in the end there may be differences because of the differences among programs and different committees that must approve them. Rose asked if the methods and data used to develop carrying capacity estimates have been agreed upon, and Schiewe replied that several monitoring activities have been discussed (such as snorkeling surveys and juvenile traps), but there are still questions regarding how the estimates would be calculated. He added that there are different perspectives about how the carrying capacity estimates should be used, which has created some tension. Rose asked if these discussions could inform habitat restoration efforts, and Kirk Truscott said that it would be difficult to assign increase in carrying capacity to specific habitat restoration efforts. He added, however, that these data may provide trend information that can be coupled with longer-term implementation of habitat projects.

V. HCP Committees Administration

A. Next Meetings (Mike Schiewe)

Mike Schiewe said that the next scheduled Coordinating Committees meeting is December 17, 2013, to be held by conference call. The January 28, 2014 and February 25, 2014 meetings will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A	List of Attendees
Attachment B	CRITFC Sockeye Accords Project (2009-2013) Presentation
Attachment C	Unmarked Yearling Chinook Index Counts at Rock Island for Periods Prior To April 17

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Jeff Fryer	Columbia River Inter-Tribal Fish Commission
Lance Keller*	Chelan PUD
Tom Kahler*	Douglas PUD
Jim Craig*	U.S. Fish and Wildlife Service
Kirk Truscott*†	Colville Confederated Tribes
Bob Rose*	Yakama Nation

Notes:
* Denotes Coordinating Committees member or alternate
† Joined by phone

CRITFC Sockeye Accords Project (2009-2013)

Jeffrey K. Fryer
Columbia River Inter-Tribal Fish Commission

Background

- Goal of Columbia Basin Accords project to expand knowledge on factors limiting production of Okanogan and Wenatchee sockeye salmon stocks.
- The project took over the PIT tagging of sockeye at Bonneville Dam (originally funded by the Pacific Salmon Commission Southern Fund) to assess adult sockeye salmon migration, timing, escapement, age composition, stock composition, length composition, mortality, and fallback rates.

Methods (Limiting Factors)

- Installed PIT tag array at OKC (2010) and Zosel Dam fishways (2011)
- Wells adult sockeye PIT, acoustic, and temperature tagging (2009)
- Canadian Acoustic receiver network (2009)
- U.S. Acoustic receiver network (2010)
- Juvenile sockeye acoustic trawl and limnology surveys of Lake Wenatchee to compare with Osoyoos Lake (2010).
- Juvenile Okanogan sockeye JSATS (2010), PIT tagging (2012)
- Priest Rapids adult sockeye PIT tagging (2012 only)

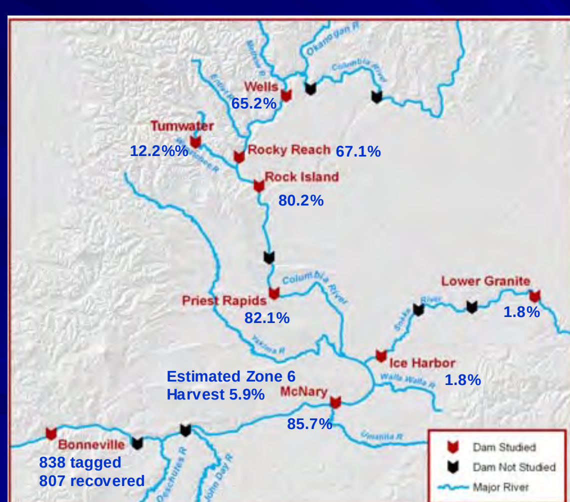
Project Participants

- Okanagan Nation: (Canadian acoustic network, OKC, juvenile work, technical assistance on U.S. work)
- Canada DFO: (Wenatchee Acoustic Trawl Survey, technical assistance of Dr. Kim Hyatt, Margot Stockwell, Paul Rankin, Rick Ferguson, and others)
- Yakama Nation: WEL, TUF, PRD sampling, Lake Wenatchee surveys
- Colville Tribe: Wells Acoustic tagging and sampling, PRD, U.S. acoustic monitoring, Zosel
- Biomark: OKC and Zosel installation and maintenance, McIntyre?

2009 Results

- PIT tagged 838 sockeye salmon out of the 850 we sampled as part of our PSC stock identification project.
- Sampling was halted on July 10 when we found we exceeded our Snake River sockeye ESA take (12 fish were detected at Snake River dams). Only 3% of the sockeye passed after this date.

Percentage of tagged sockeye salmon detected at upstream dams in 2009



Sockeye Escapement at Mainstem Dams as estimated using PIT tags and Visual Fish Counts in 2009

Dam	PIT Tag Estimate	Visual Fish Ladder Count	% difference
Bonneville		177823	
McNary	148750	121672	22.3%
Priest Rapids	142486	153466	-7.2%
Rock Island	139142	162830	-14.5%
Rocky Reach	116454	133106	-12.5%
Wells	113170	134937	-16.1%
Tumwater	21212	16076	31.9%
Ice Harbor	3056	867	252.5%
Lower Granite	3056	1219	150.7%

Travel time between dam pairs

Dam pair	Dis-tance (km)	Median time (days)	2009 Median travel time (km/day)	2008 Median travel time (km/day	2007 Median travel time (km/day)	2006 Median travel time (km/day)
Bonneville-McNary	231	5.1	45.2	40.3	47.3	46.1
McNary-Priest Rapids	167	4.0	41.4	36.4	34.3	37.2
Priest Rapids-Rock Island	89	3.1	28.7	28.2	24.5	22.6
Rock Island-Rocky Reach	33	1.1	29.1	30.7	21.3	24.4
Rock Island-Tumwater	73	2.2	29.6	6.3		
Rocky Reach-Wells	65	11.2	6.5	29.3	28.2	22.7
Bonneville-Rock Island	487	12.7	38.2	34.7	35.1	34.9
Bonneville-Wells	585	26.0	21.6	32.5	32.8	32.2

Time spent at mainstem dams

		Taking more than 12 hours (%)			
Dam	Minutes (median)	**2009**	**2008**	**2007**	**2006**
Bonneville	58	5.7%	6.9%	15.8%	6.8%
McNary	0	2.1%	1.4%	1.8%	3.2%
Priest Rapids	5	1.2%	0.6%	2.4%	2.4%
Rock Island	3	1.1%	0.3%	1.2%	1.8%
Rocky Reach	2	1.5%	1.0%	1.2%	2.7%
Wells	3	2.1%	0.8%	1.7%	4.8%
Tumwater	159	41.4%	62.1%		

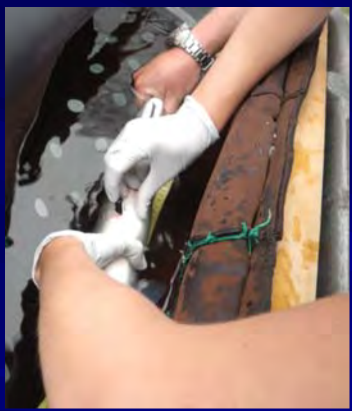
Stock Composition Estimates

Statistical Week	Wenatchee (%)	Okanogan (%)	Snake (%)
23	0.0%	100.0%	0.0%
24	1.6%	98.4%	0.0%
25	16.0%	84.0%	0.0%
26	22.2%	74.7%	3.1%
27	8.2%	88.1%	3.7%
28	11.3%	87.1%	1.6%
Composite	15.1%	82.6%	2.3%
	1.6	1.5	0.6
Dam Counts (WEN=RIS-RRH)	17.8%	79.9%	
Dam Counts (WEN=Tumwater)	9.6%	88.1%	

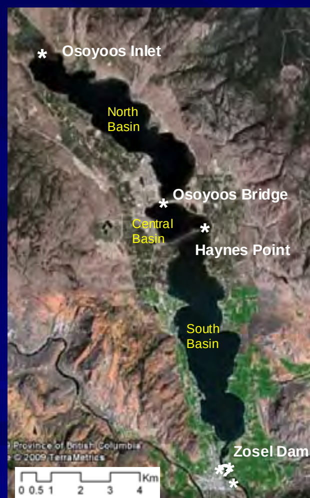
2009 Age Composition Estimates

	Age					
	1.1	1.2	1.3	2.1	2.2	2.3
Wenatchee PIT tag		87.7 4.4	4.8 2.9		5.5 3.2	2.0 1.5
Wenatchee-Tumwater		90.3 1.8	1.0 0.6		8.6 1.7	0.1 0.1
Okanogan PIT Tag	7.4 1.0	86.4 1.4	0.7 0.4	2.3 0.7	3.2 0.8	
Bonneville Dam	7.1 0.8	87.4 1.1	0.5 0.2	1.7 0.5	3.1 0.6	0.1

Acoustic and Temperature Tagging at Wells Dam



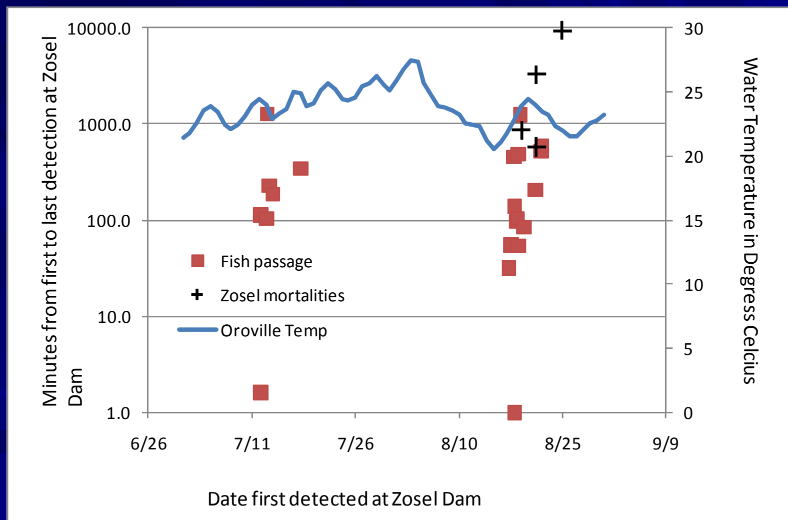
2009 Acoustic Receiver Sites



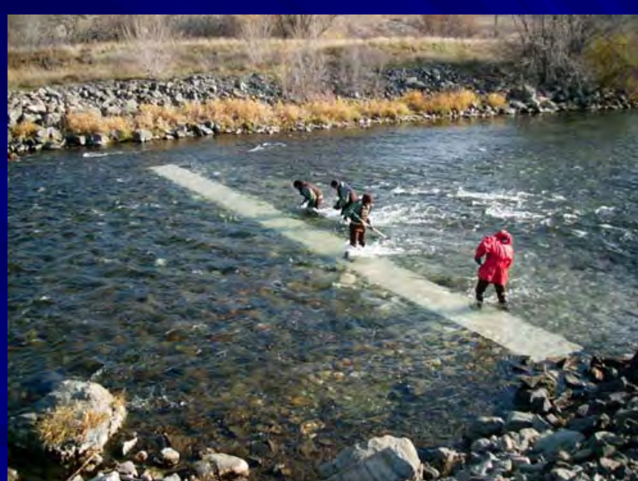
Number of sockeye salmon acoustic tagged at Wells passing upstream receivers

Week	Dates	N	Passed Zosel	Passed Haynes Point	Passed Osoyoos Bridge	Passed Osoyoos Inlet[a]
28	7/6,7,8	29	58% (17)	52% (15)	48% (14)	31% (9)
29	7/13,14	11	55% (6)	55% (6)	55% (6)	36% (4)
30	7/21	10	20% (2)	0%	0	0
All Weeks		50	50% (25)	42% (21)	40% (20)	26% (13)

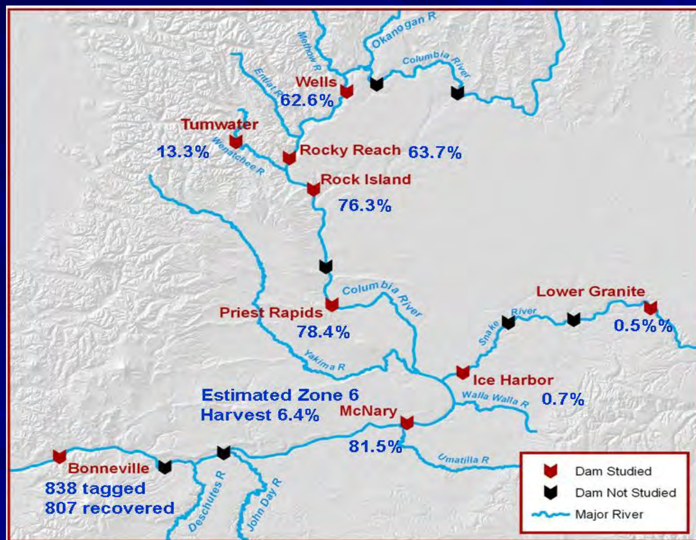
Oroville, WA water temperatures and time spent passing Zosel Dam



VDS 3 PIT tag antenna installation



2010

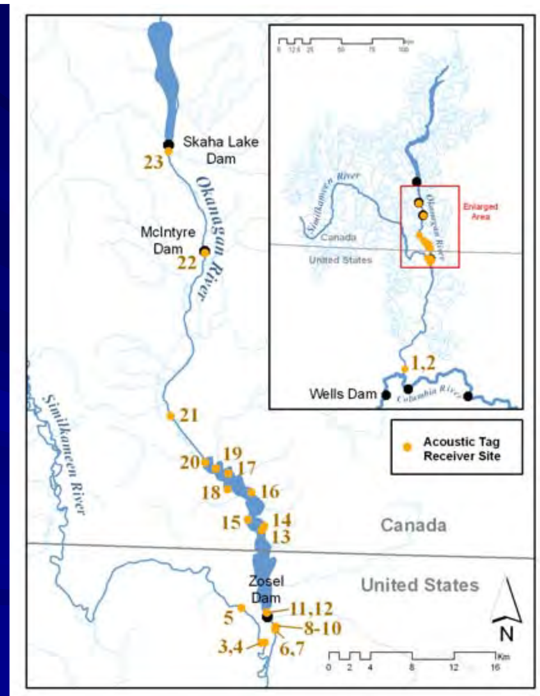


2010 Tumwater Passage Problems

		Number and Percentage Subsequently Detected by Site			
Tumwater Dam Antenna	Total Last detected	Middle Wenatchee River	Little Wenatchee	White River	Rocky Reach Dam
Upper	74	1 (1.4%)	3 (4.1%)	27 (36.5%)	--
Lower	37	--	--	--	2 (5.4%)
Total	111	1 (0.9%)	3 (2.7%)	27 (24.3%)	2 (1.8%)

		Mean Passage Delay (days) at Tumwater Dam Based on Subsequent Detections			
Tumwater Dam Antenna	Total Last detected	Downstream	Upstream	Not Detected	All Fish
Upper	74	--	6.0	6.5	6.2
Lower	37	17.4	--	19.8	19.7
Total	111	17.4	--	13.7	10.7

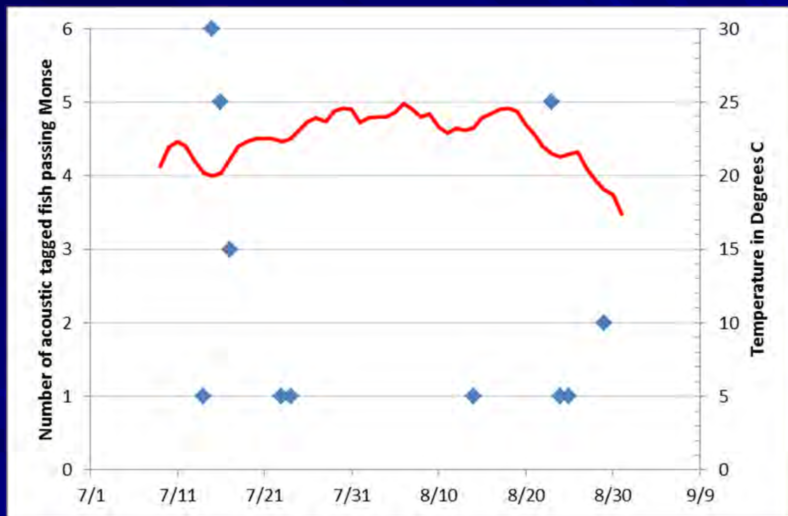
2010 Acoustic Network



2010 Acoustic Results

Statistical Week Tagged	Number Tagged	% Passing Monse Bridge	% Passing Haynes Point	% Passing OKC	% in Similk-ameen	Median Days to Monse Bridge	Median Days to Haynes Point	Median Days to OKC
27	15	100.0%	100.0%	71.4%	7.1%	NA	12.7	89.9
28	15	93.3%	93.3%	80.0%	66.7%	NA	6.9	82.1
29	16	100.0%	75.0%	50.0%	37.5%	2.2	5.7	76.3
30	12	66.7%	50.0%	41.7%	16.7%	34.2	37.6	67.4
31	6	83.3%	66.7%	50.0%	0.0%	28.7	32.3	69.2
Overall	64	90.5%	79.4%	60.3%	30.2%	4.1	8.9	81.3

Okanogan River Temperature and Number of Detections at Monse Receivers in 2010.



2010 Tagging Effects

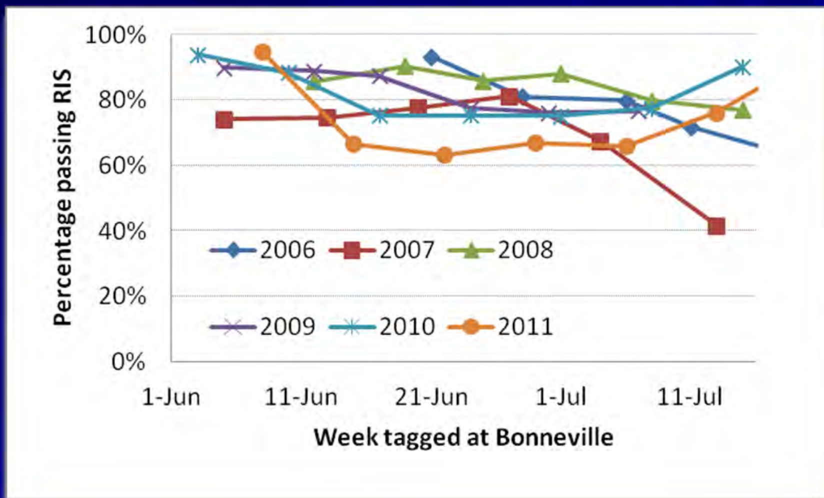
	Tags Deployed				
Week	Temp+PIT	Temp+PIT +Acoustic	Acoustic+ PIT	PIT only	Bon PIT
27	--	--	93.3%	90.0%	86.1%
28	73.3%	85.7%	62.5%	89.0%	85.7%
29	33.3%	50.0%	41.7%	66.3%	79.7%
30	42.9%	33.3%	44.4%	40.6%	35.4%
31	45.5%	0.0%	60.0%	55.6%	62.2%
Weighted	55.1%	63.4%	54.7%	73.7%	75.8%
Total Tagged	37	15	47	301	413

PIT Tag antennas also installed in Zosel Dam fishways in 2010.

2011 Results

- PIT tagged 767 sockeye salmon out of the 768 we sampled as part of our PSC stock identification project.
- Sampling was halted on July 19 when we found we exceeded our Snake River sockeye ESA take. (Five fish were detected at Snake River dams). Only 1.6% of the run passed Bonneville Dam after this date.

Percentage of fish tagged at Bonneville detected at Rock Island Dam



Time spent at mainstem dams

		Taking more than 12 hours (%)					
Dam	Minutes (median)	**2011**	**2010**	**2009**	**2008**	**2007**	**2006**
Bonneville	56	3.0%	6.1%	5.7%	6.9%	15.8%	6.8%
McNary	0	5.9%	2.2%	2.1%	1.4%	1.8%	3.2%
Priest Rapids	6	1.9%	1.2%	1.2%	0.6%	2.4%	2.4%
Rock Island	4	2.4%	0.8%	1.1%	0.3%	1.2%	1.8%
Rocky Reach	1	3.7%	2.1%	1.5%	1.0%	1.2%	2.7%
Wells	3	5.5%	2.5%	2.1%	0.8%	1.7%	4.8%
Tumwater	6	12.6%	72.1%	41.4%	62.1%		
Wells Tagged at Wells	5	7.8%					

PIT Tagged sockeye "missed" at dams 2006-2011

				Sockeye				
Dam	2011	2011 9 mm	2010	2009	2008	2007	2006	2008 8.5 mm
Bonneville	1.8%	3.3%	0.7%	0.6%	0.4%	2.1%	0.2%	1.7%
McNary	2.1%	20.5%	4.0%	5.0%	10.1%	6.5%	3.1%	18.2%
Priest Rapids	0.4%	5.7%	0.4%	0.3%	0.3%	0.8%	0.0%	33.7%
Rock Island	5.6%	40.0%	6.4%	2.6%	6.9%	6.8%	1.3%	57.7%
Rocky Reach	1.4%	8.8%	0.5%	0.0%	0.2%	0.7%	12.3%	28.3%
Wells	0.0%	0.0%	0.0%					
Tumwater	0.0%	0.0%	0.0%					

Estimated conversion rate from Wells Dam to OKC of PIT, acoustic, and temperature tagged sockeye salmon in 2011

		Location and Tags Deployed			
Week	Weekly % passing Wells Dam	Bonneville PIT Tagged (12 mm)	Wells PIT only	Wells PIT+ Acoustic	Wells PIT+Temp
28	4.9%	50.0%	100.0%	57.1%	61.5%
29	24.8%	80.0%	81.6%	66.7%	74.6%
30	39.5%	86.7%	73.5%	83.3%	82.0%
31	23.4%	71.4%	61.9%	66.7%	47.5%
32	7.5%	76.2%	26.7%	18.2%	0.0%
Weighted		76.3%	70.6%	69.2%	65.0%
Sample Size		548	341	60	201

Last detection site for sockeye tagged at Wells Dam in 2011

Week	Wenatchee River	Rocky Reach	Wells Dam	Methow River	Zosel Dam	OKC
28	0	0	8	0	0	13
29	1	0	27	0	0	89
30	3	1	34	0	0	135
31	0	4	66	1	1	120
32	1	4	41	1	2	14
	5	9	176	2	3	371

Detections by release ladder at Wells Dam

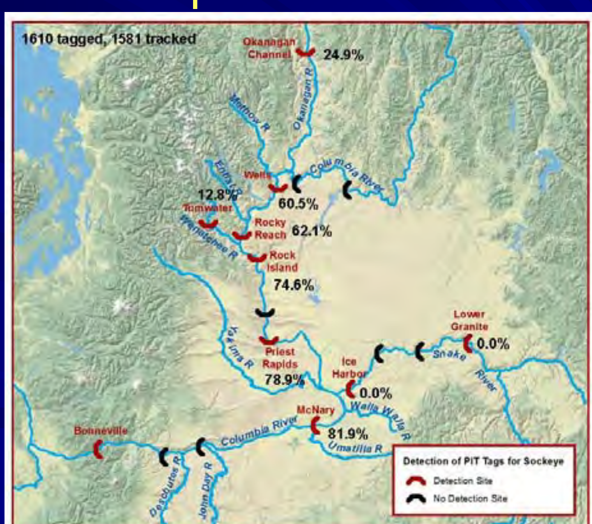
Wells Release Site	N	% at opposite Wells ladder	Detections at WEA	Detections at OKC	% subsequently detected at Wells	% subsequently detected at OKC
East Bank	521	13.4%*	491	325	94.2%	62.4%
West Bank	68	7.4%*	67	46	98.5%	67.6%
Upstream	13	-	-	7	-	53.8%
Unweighted Total	603		558	378	92.7%	62.8%

- 6 out of 403 (1.5%) of Bonneville tagged sockeye were detected at both ladders.

2012 work

- PIT tagged over 1600 adult sockeye at Bonneville Dam, 744 at Wells, and over 700 at Priest Rapids Dam (CCT).
- All Wells-tagged fish required to be released in forebay.
- Acoustic tagged 60 adult sockeye at Wells and deployed 27 receivers between Wells and Penticton
- ONA PIT tagged over 600 juvenile sockeye at Skaha Falls and deployed JSATS tags and receivers
- Identified the stock of over 1500 sockeye sampled at Bonneville Dam using genetics
- ATS and limnology surveys at Lake Wenatchee
- Maintenance of OKC and Zosel PIT tag antennas

Percentage of tagged sockeye salmon detected at upstream dams in 2012



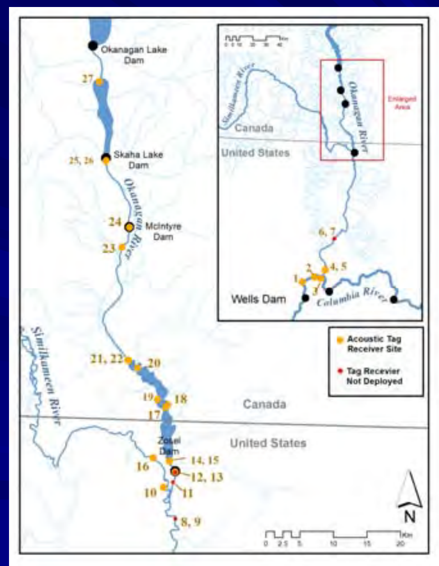
Stock Composition Estimates

Statistical Week	Wenatchee (%)	Okanogan (%)	Snake (%)
23	4.9%	95.1%	
24	5.3%	95.1%	
25	8.8%	91.2%	
26	13.8%	86.2%	
27	20.6%	79.4%	
28	22.2%	77.8%	
29	15.5%	84.5%	
30	5.0%	95.0%	
Composite	17.6%	82.4%	
Dam Counts (WEN=RIS-RRH)	11.6%	88.4%	
Dam Counts (WEN=Tumwater)	16.3%	83.7%	

2012 Age Composition Estimates (%)

	Age					
	1.1	1.2	1.3	2.1	2.2	2.3
Bonneville Dam	1.3%	95.9%	1.1%	0.4%	1.3%	
Wenatchee (BON PIT tag)		91.2%	8.8%			
Wenatchee (PRD PIT)		93.1%	7.8%			
Okanagan (PRD PIT)	1.1%	95.4%	2.5%	0.4%	0.9%	
Okanagan PIT Tag	1.8%	95.9%	0.1%	0.5%	1.6%	
Okanagan-Wells Dam	0.1%	85.1%	14.5%		0.3%	

Okanagan Basin Acoustic Receiver Sites



(Preliminary) estimated conversion rate from Wells Dam to OKC of PIT, acoustic, and temperature tagged sockeye salmon in 2012

	Location and Tags Deployed			
Week past Wells Dam	Bonneville PIT Tagged	Priest Rapids PIT + Floy tagged	Wells PIT + Floy tagged	Wells PIT+ Floy + Acoustic tagged
27	29.6%	62.5%	40.4%	60.0%
28	45.7%	43.4%	40.5%	41.7%
29	39.8%	45.3%	46.8%	35.7%
30	32.6%	39.4%	29.5%	28.6%
31	51.1%	51.7%	61.4%	60.0%
32	57.1%	36.4%		
Weighted	41.4%	44.1%	41.8%	38.8%
Sample Size (past WEL)	1001	562	709	60
CCT releases (to OKC)		66.7% (24)	38.2% (34)	
ONA fisheries (morts)		8.5%	11.8%	8.5%

Percentage of acoustic tagged sockeye salmon passing points in Okanagan Basin

Week	N	Monse	Zosel Dam	Osoyoos Lake North Basin	OKC
27	10	100.0%	100.0%	100.0%	70.0%
28	12	75.0%	66.7%	66.7%	41.7%
29	14	85.7%	85.7%	85.7%	42.9%
30	14	85.7%	85.7%	85.7%	42.9%
31	10	50.0%	50.0%	50.0%	60.0%
		79.9%	76.3%	76.3%	43.8%

Data available in real-time resulted in the Osoyoos Lake fishery being cut off one week early, cutting harvest by an estimated 50,000 fish.

Fallback Rates in 2012

Dam	Adults Tagged at Bonneville	Adults Tagged at Priest Rapids	Tagged as Juveniles
Bonneville	0.4%	NA	4.6%
McNary	2.5%	NA	1.9%
Priest Rapids	1.2%	0.8%	2.0%
Rock Island	1.1%	1.6%	2.4%
Rocky Reach	7.9%	8.2%	15.6%
Wells	1.3%	2.3%	13.0%
Tumwater	0.5%	3.3%	0.4%
Zosel	0.0%	0.0%	33.3%
Ice Harbor			10.6%
Lower Granite			31.7%

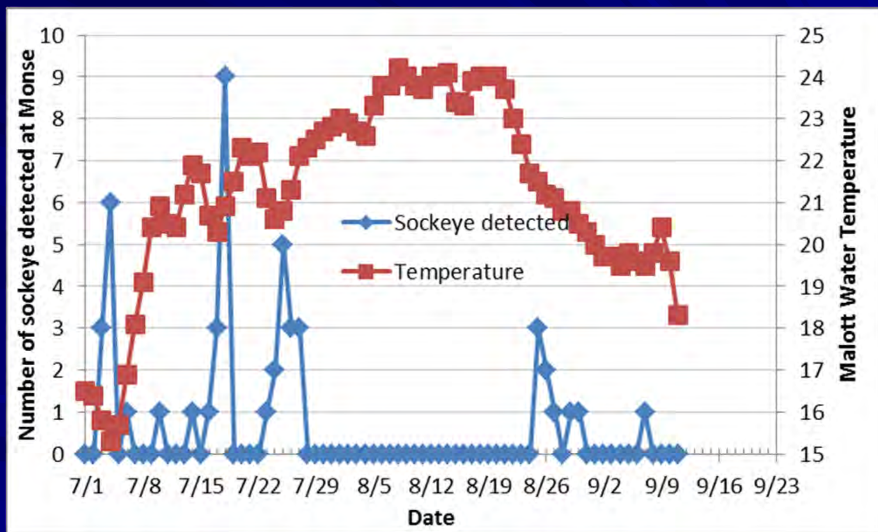
PIT tag visual count estimates in 2012

Site	Visual Count	PIT tag estimate	Missed	Fall-back	Night Passage	Adjusted Visual Count	Adjusted PIT tag estimate	% Difference between adjusted counts
Bonneville	515,673		1.82%	4.6%	2.05%	514,482	513,096	
McNary	364,147	424,805	1.56%	2.5%	6.0%	382,122	422,682	10.6%
Priest Rapids	408,258	398,505	0.16%	1.2%		403,159	396,513	-1.6%
Rock Island	410,614	386,452	4.38%	1.1%		406,028	384,521	-5.3%
Rocky Reach	363,297	322,250	0.70%	7.9%		334,447	320,639	-4.1%
Wells	326,084	313,566	0.00%	1.2%		322,175	311,999	-3.2%
Tumwater	66,520	66,272	0.00%	0.5%		66,177	65,941	-0.4%
OKC array		145,317					144,591	

Where did 517,154 sockeye go?

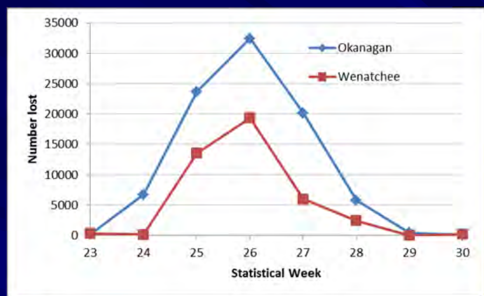
Reach	Estimated abundance at reach start	Harvest	Escape-ment	Estimated abundance at reach end	Unaccounted (missing)
Below Bonneville	517,154	4058		513,096	NA
Bonneville-McNary	513,096	46,281	100	422,682	44,033
McNary-Priest Rapids	422,682		10,453	396,513	15,716
Priest Rapids-Rock Island	396,513	2,663		384,521	9,330
Rock Island-Rocky Reach	384,521	134		320,639	-872
Rocky Reach-Wells	320,639	1547		305,744	7,094
Wells-Zosel	305,744	38,930		242,885	70,326
Zosel-OKC	242,885	63,100		144,591	-8,941
OKC array	136,117		93,400		55,185
Tumwater	64,619	12,100	28,500		24,019
Totals		**168,813**	**132,453**		**215,888**
Percentage		**32.6%**	**25.6%**		**41.8%**

Sockeye passing Monse acoustic receivers and Okanogan River water temperatures

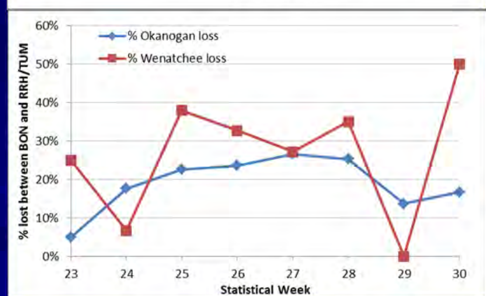


Genetics Work

- Genotyped 1535 sockeye sampled at Bonneville Dam
- Only 4 sockeye “misclassified”
  - 2 Okanogan sockeye (one a 57%er last detected at Tumwater dam)
  - Wenatchee sockeye (one at RRH, one at Wells)
- Genetics data suggested a Bonneville Dam stock composition of 19.6% Wenatchee, 80.3% Okanogan, and 0.2% Snake River compared to PIT tag data estimate of 17.6% Wenatchee, 82.4% Okanogan.
- This suggests that mortality between Bonneville and Rocky Reach/Tumwater was 23.3% for the Okanogan stock and 30.9% for the Wenatchee stock.



Number lost by week (at Bonneville) by stock



Percentage lost by week (at Bonneville) by stock

Impact of Fisheries

- Colville purse seine fishery in 2012 harvested 4.1% of sockeye and released Floy-tagged fish.
  - 24 Priest Rapids tagged fish released, 67% of which were subsequently detected at OKC (compared to 44.1% for all PRD tagged fish)
  - 34 Wells tagged fish released, 38.2% of which were subsequently detected at OKC (compared to 41.8% for all Wells tagged fish)

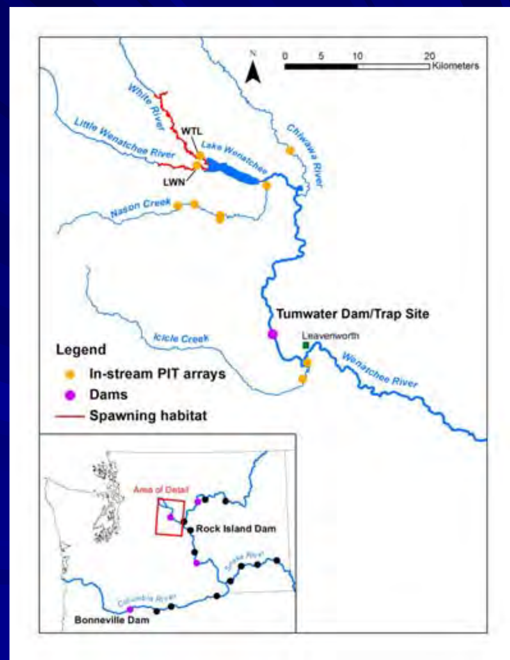
Okanagan Falls Juvenile PIT tagging-2012

Period	Survival	SE	Travel time	SE
Release to Rocky Reach	0.5365	0.0768	7.79	0.20
Rocky Reach to McNary	1.1556	0.4376	3.92	0.22
McNary to John Day	0.8765	0.6464	2.33	0.18
John Day to Bonneville	0.2750	0.2360	1.47	0.06
Overall	0.1494	0.0844	15.52	0.62

Bonneville-McNary Conversion Rates 2012

Tag location	Tag life stage	Stock	N at Bonneville	% Detected at McNary
Bonneville	Adults	Mixed	1612	83.0%
Bonneville	Adults	Wenatchee	290	74.5%
Bonneville	Adults	Okanogan	1320	85.2%
Rock Island	Juveniles	Mixed	107	73.8%
Wenatchee R	Juveniles	Wenatchee W/H	256	74.7%
Eastbank	Juveniles	Wenatchee Hatchery	150	68.9%

Wenatchee Basin



2012 Tumwater-Spawning Grounds

Tag location	Tag life stage	Marked	N at Tumwater	% Detected at WTL and LWN
Bonneville	Adults	No	194	45.4%
Priest Rapids	Adults	**Yes**	138	39.6%
Tumwater	Adults	**Yes**	960	42.2%
Rock Island	Juveniles	No	78	32.1%
Wenatchee R	Juveniles	No	111	36.7%
Eastbank	Juveniles	No	174	32.6%

Summary of PIT tag impacts from Wells to OKC

				Fisheries	
Year	Tag location	Metric	Impact	Tribal (selective)	Sport (?)
2010	Wells	Wells-OKC	2.8%	5.6%	<3.7%
2011	Wells	Wells-OKC	4.9%	0.7%	<2.6%
2012	Wells	Wells-OKC	-1.0%	4.1%	<12.7%
2012	Priest Rapids	Wells-OKC	-6.5%	4.1%	<12.7%

Summary of Wells-OKC tag impacts

			Fisheries	
Year	Regime	Impact	Tribal (selective)	Sport (?)
2010	Floy+Temp+PIT	27.3%	5.6%	<3.7%
2010	Floy+Acoustic+PIT	27.8%		
2010	Floy+Temp+Acoustic+PIT	16.4%		
2011	Floy+Temp+PIT	13.3%	0.7%	<2.6%
2011	Floy+Acoustic+PIT	7.8%		
2012	Floy+Acoustic+PIT	6.3%	4.1%	<12.8%

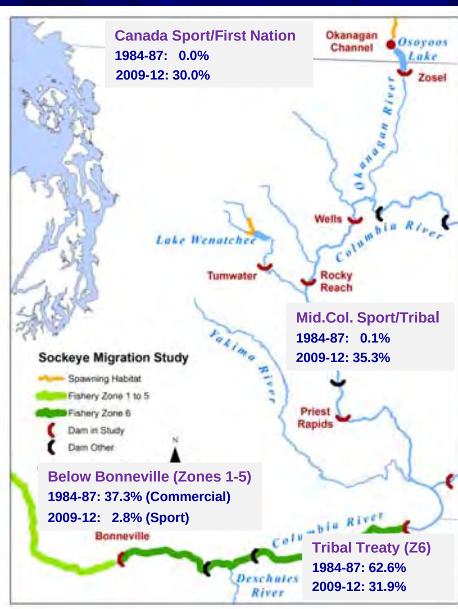
Caveats

- Tag impact also includes sampling impact which may differ from site to site. (Priest Rapids, Tumwater, and Bonneville traps require less handling than Wells and have recovery areas with volitional release.)
- Sockeye tagged at Wells and Tumwater dams are more mature than those at Priest and Bonneville, possibly affecting survival.
- Tagging at Priest Rapids and Wells also includes Floy tagging which may lead to additional tagging impacts. In addition, this opens up the issue of fishery selectivity.
- Traps at dams may also be selective for some particular trait which may affect comparisons. (For instance, the Wells trap selects for larger sockeye.)

Distribution of Columbia Basin sockeye harvest in 1984-87 and 2009-12

	1984-87	2009-12
Mean Run	123,500	316,400
Harvest Rate	39.1%	23.5%

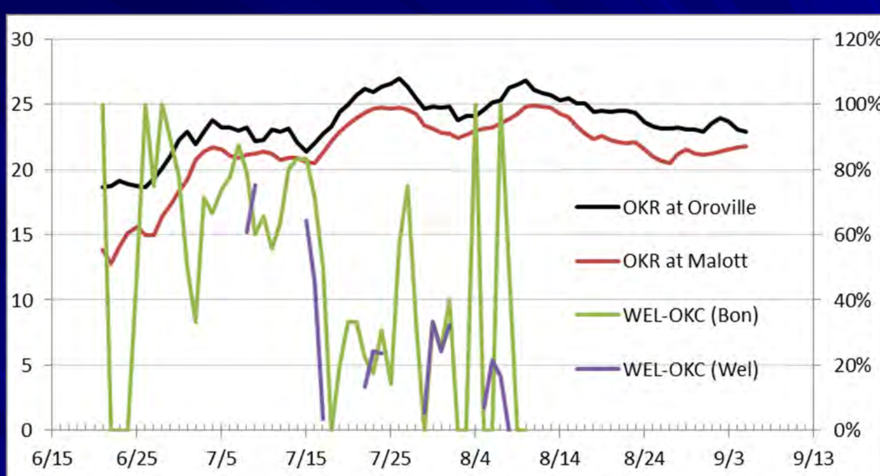
	1984-87	2009-12
Commercial	37.1%	0.3%
Sport	0.0%	20.7%
Tribal	62.9%	79.0%



Comparison of stock composition estimates in 2012

	Method	Location of Estimate	% Okanagan	% Wenatchee
A	PIT tags deployed at Bonneville Dam	Rocky Reach and Tumwater dams	83.4%	17.6%
B	PIT tags deployed at Priest Rapids Dam	Rocky Reach and Tumwater dams	80.3%	19.7%
C	GSI on Bonneville samples	Bonneville Dam	80.4%	19.6%
D	GSI on Bonneville samples combined with PIT detections	Rock Island Dam	82.1%	17.9%
E	Visual dam counts taking the Rock Island-Rocky Reach difference as Wenatchee	Rock Island Dam	**88.5%**	**11.5%**
F	Visual dam counts taking Tumwater as Wenatchee	Rocky Reach and Tumwater dams	83.8%	16.2%
G	Method E using adjusted visual counts in Table 38	Rocky Reach Dam	82.4%	17.6%
H	Method F using adjusted visual counts in Table 38	Rocky Reach/Tum	84.7%	15.3%

WEL-OKC conversion rate 2013 by date at Wells vs Okanogan River temperature



Upstream Survive of Sockeye Acoustic Tagged at Wells Dam in 2013

Week	N	Pateros	Brewster	Monse	Pump Station	Central Basin	Okanogan Mouth	Highway 97	McIntyre	OK Falls
28	10	100.0%	90.0%	90.0%	90.0%	90.0%	80.0%	50.0%	30.0%	0.0%
29	14	100.0%	92.9%	92.9%	57.1%	57.1%	42.9%	21.4%	0.0%	0.0%
30	14	100.0%	100.0%	71.4%	64.3%	57.1%	50.0%	28.6%	21.4%	7.1%
31	15	100.0%	100.0%	73.3%	33.3%	33.3%	20.0%	6.7%	0.0%	0.0%
32	8	100.0%	100.0%	37.5%	25.0%	25.0%	25.0%	12.5%	12.5%	0.0%
Weighted total		100.0%	93.2%	85.6%	72.6%	71.3%	60.7%	35.7%	18.6%	1.2%

Conclusions and Future

- Finished year 5 of 10 year project.
- Adult Tagging at Wells and Bonneville dams is expected to continue.
- As PIT tag infrastructure continues to grow, I'd like to replace (expensive) acoustic tagging with PIT tagging. However, we likely need detection at the Highway 3 Bridge in Osoyoos.
- Acoustic trawl survey for juvenile abundance in Lake Wenatchee will continue as will limnology work.
- Will continue to assist in juvenile PIT tagging effort.
- Paleolimnology work and McIntyre Dam PIT tag detection planned.
- 2009-2011 reports available at www.critfc.org. 2012 available soon.

Attachment C

2013 Rock Island expanded counts for ad-present (unmarked) and ad-clipped (marked) Spring Chinook at RIBT

Date	Ad-present*	% of ad-present run Run	Ad-clipped	% of ad-clipped Run	Total	% Run
1-Apr	0	0.00%	1	0.00%	1	0.00%
2-Apr	2	0.07%	1	0.00%	3	0.01%
3-Apr	14	0.52%	0	0.00%	14	0.05%
4-Apr	13	0.48%	1	0.00%	14	0.05%
5-Apr	8	0.30%	0	0.00%	8	0.03%
6-Apr	4	0.15%	0	0.00%	4	0.01%
7-Apr	4	0.15%	0	0.00%	4	0.01%
8-Apr	10	0.37%	0	0.00%	10	0.04%
9-Apr	9	0.33%	0	0.00%	9	0.03%
10-Apr	13	0.48%	2	0.01%	15	0.05%
11-Apr	9	0.33%	0	0.00%	9	0.03%
12-Apr	24	0.89%	0	0.00%	24	0.08%
13-Apr	15	0.55%	11	0.04%	26	0.09%
14-Apr	5	0.18%	107	0.41%	112	0.39%
15-Apr	21	0.78%	116	0.45%	137	0.48%
16-Apr	12	0.44%	40	0.15%	52	0.18%
Total	**163**	**6.03%**	**279**	**1.08%**	**442**	**1.55%**
Season Total (Apr. 1-Aug 31)	**2704**		**25853**		**28557**	

*** Ad-present may contain both hatchery and wild origin Spring Chinook**

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Coordinating Committees	**Date:**	January 28, 2014
From:	Michael Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the December 17, 2013 HCPs Coordinating Committees Conference Call		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Coordinating Committees met by conference call, on Tuesday, December 17, 2013, from 9:30 am to 11:30 am. Attendees are listed in Attachment A of these meeting minutes.

ACTION ITEM SUMMARY

- Chelan PUD will check on the use of the Battelle Pacific Northwest National Laboratory (PNNL) turbine passage model to help inform the interim fix planned for the Rocky Reach Dam turbine units (Item II-A).
- Chelan PUD will provide their new valid flow duration curves and a brief summary describing the underlying data and the calculation methods used for discussion at the Coordinating Committees meeting on January 28, 2014 (Item II-B).
- Chelan PUD will prepare a draft Chelan PUD 2014 Rocky Reach and Rock Island HCP Action Plan for review prior to the Coordinating Committees meeting on January 28, 2014 (Item IV-A).
- Douglas PUD will provide the draft Wells Dam 2014 Gas Abatement Plan (GAP) and Bypass Operating Plan (BOP) for review prior to the Coordinating Committees meeting January 28, 2014; approval will be requested at the January meeting (Item IV-B).

DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at this meeting.

AGREEMENTS

- No agreements were discussed at this meeting.

REVIEW ITEMS

- Kristi Geris sent an email to the Coordinating Committees on December 17, 2013, notifying them that the draft 2014 Well Dam GAP and BOP are available for review with comments due to Tom Kahler no later than January 17, 2014 (Item IV-B).
- Kristi Geris sent an email to the Coordinating Committees on December 17, 2013, notifying them that the draft Douglas PUD 2014 Wells HCP Action Plan is available for review. Douglas PUD will be requesting approval of the draft action plan during the Coordinating Committees meeting on January 28, 2014 (Item IV-A).

REPORTS FINALIZED

- There are no reports that have been recently finalized.

I. Welcome

Mike Schiewe welcomed the Coordinating Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Chelan PUD added an update on the large unit turbine repairs at Rocky Reach Dam.
- Chelan PUD and Douglas PUD added a joint update on HCP document storage.
- Douglas PUD added an overview of highlights from the recent U.S. Army Corps of Engineers (USACE) Anadromous Fish Evaluation Program (AFEP) Annual Review.

A. Meeting Minutes Approval (Mike Schiewe)

The Coordinating Committees reviewed the revised draft November 19, 2013 meeting minutes. Mike Schiewe said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to discuss. Lance Keller indicated that Chelan PUD had a few additional revisions to incorporate in the draft November 19, 2013 meeting minutes. He said he would provide those revisions to Kristi Geris via email. The Coordinating Committees members present conditionally approved the draft November 19, 2013 meeting minutes, pending incorporation of Chelan PUD's final edits. *(Note: Keller provided Chelan PUD's final edits to Geris on December 19, 2013, and Geris finalized and distributed the November 19, 2013 meeting minutes to the Coordinating Committees the same day.)*

II. Chelan PUD

A. Rocky Reach Passage Route Proportions (Lance Keller)

Lance Keller reviewed the handout summarizing passage percentages of fish through the units at Rocky Reach (Attachment B) that was distributed to the Coordinating Committees by Kristi Geris on December 16, 2013. He noted that, as described in Tables 1, 2, and 3 of Attachment B, fewer fish pass via the upper units (i.e., C8, C9, C10, and C11), which are the units that are being repaired.

<u>Large Unit Turbine Repairs at Rocky Reach</u>

Keller said that the interim fix, which will be made to the four upper units, will involve fixing the blades at a selected steep angle that were determined to be the most efficient at full river flow (23,000 cubic feet per second [23 kcfs]) on the unit curve; this steep angle also provides the safest position, minimizing cavitation and minimizing the risk of turbine runaway. A fact sheet on the large unit repair at Rocky Reach Dam (Attachment C) was distributed to the Coordinating Committees by Geris on December 16, 2013. Keller said that fixing the blades at a steep angle will allow all of the units to operate during the fish passage season this year (with the exception of C10). Chelan PUD is considering a range for fixing these blades of 28.65 to 30.65 degrees. Bryan Nordlund suggested that Chelan PUD check with Battelle PNNL regarding the turbine passage model that was developed for Grant PUD and used by them in their evaluation of turbines at the Priest Rapids Project. Steve Hemstrom agreed to check on the use of this Battelle PNNL turbine passage model to help inform the interim fix planned for the Rocky Reach Dam turbine units.

B. Valid Study Flow Duration Curves (Steve Hemstrom)

Steve Hemstrom updated the Coordinating Committees on the progress of updating the new flow duration curves. He recalled that Grand Coulee outflow data were used from 1929 to 1978 and 1983 to 2001 to calculate the new spring and summer periods. He said that the spring period is defined as April 16 to May 31, and that the new summer period is defined as

June 1 to August 15. Hemstrom recalled that the original summer period calculation had been defined as July 1 to August 15; however, the Coordinating Committees agreed to include June in the new summer period curves. The following table summarizes the new 10% and 90% flows for the spring and summer periods as compared to the previous flows:

	Flow (kcfs)			
	10%		90%	
Season	**New**	**Original**	**New**	**Original**
Spring	202.785	205.381	98.141	100.523
Summer	184.746	164.905	101.165	76.318

Hemstrom said that Chelan PUD will provide the new valid flow duration curves and a brief summary describing the underlying data and the calculation methods used, for discussion at the Coordinating Committees meeting on January 28, 2014.

III. Chelan PUD and Douglas PUD

A. HCP Document Storage (Steve Hemstrom and Tom Kahler)

Steve Hemstrom said that Keith Truscott and Shane Bickford discussed the use of a single SharePoint site for storage and retrieval of HCP Coordinating Committees, Hatchery Committees, and Tributary Committees documents. He said they agreed in principle to use the site being developed by Douglas PUD, pending discussion and agreement by Chelan PUD upper managers. Tom Kahler said that the Douglas PUD Information Systems (IS) staff has already developed a SharePoint Extranet solution for the Wells Aquatic Settlement Workgroup (SWG), and that a similar web based repository is being developed for the HCP committees. Kahler said that, as required by their Federal Energy Regulatory Commission (FERC) license, Douglas PUD has already begun populating a SharePoint site with all the shared HCP documents (e.g., agendas, meeting minutes, Wells SOAs, etc.), and that it would be more efficient for Anchor QEA and for Committee members to have all of the Chelan PUD and Douglas PUD HCP Committee documents located on one site. He said access to the SharePoint site is password-protected for Committee members only. Once Committee documents are made final then the FERC license requires that they be made available to the public via the Douglas PUD home page. Kahler said that he will arrange for Douglas PUD IS staff to provide a demonstration and briefing at the Coordinating Committees meeting on January 28, 2014.

IV. Douglas PUD

A. Douglas PUD 2014 Wells HCP Action Plan (Tom Kahler)

Tom Kahler said that he distributed the draft Douglas PUD 2014 Wells HCP Action Plan to the Coordinating Committees prior to the meeting on December 17, 2013. He requested that members review the draft and provide him with any edits prior to the Coordinating Committees meeting on January 28, 2014, when Douglas PUD will be requesting approval of the draft plan. He said that sections on hatchery activities and tributary activities will be reviewed by the Hatchery Committees and Tributary Committees, respectively.

Chelan PUD agreed to prepare a draft Chelan PUD 2014 Rocky Reach and Rock Island HCP Action Plan for review prior to the Coordinating Committees meeting on January 28, 2014 meeting.

B. Draft Wells Dam 2014 GAP (Tom Kahler)

Tom Kahler said that the draft Wells Dam 2014 GAP will be distributed to the Coordinating Committees for review later today or tomorrow. *(Note: Kahler provided the draft plan to Kristi Geris on December 17, 2013, which she distributed to the Coordinating Committees the same day.)* He said the draft GAP is related to the draft BOP, which Geris distributed to the Coordinating Committees for review on November 19, 2013, for a 60-day review period with comments due to him no later than January 17, 2014. He said the two plans outline dam operations for 2014. He said the draft GAP is already being reviewed by the Aquatic SWG; however, the Wells Project FERC license requires that the HCP Coordinating Committees also be given the opportunity to review the plan along with their review of the draft BOP. Kahler said that Douglas PUD will be requesting approval of both documents (or in the case of the GAP, acknowledgment of the opportunity to review and comment) at the Coordinating Committees meeting on January 28, 2014 meeting.

C. USACE's AFEP Meeting Highlights (Tom Kahler)

Tom Kahler reported that there were several studies reported on during the AFEP Annual Review Meeting that was held in Walla Walla, Washington, earlier this month that he thought would be of interest to the Coordinating Committees. He provided an overview of select AFEP topics in the context of the U.S.–Canada Columbia River Treaty.

Kahler said that recent studies have reported that in years of high river discharge ocean species such as anchovies are pushed out of the Columbia River estuary, thereby exposing salmonid migrants to relatively greater depredation by Caspian terns and cormorants nesting on East Sand Island. He said that under more normal discharge events, those marine species offer alternative prey items to the avian predators, somewhat buffering the salmonids from depredation. He suggested that U.S. parties to the treaty negotiations should consider this finding when modeling the proposed higher magnitude freshet.

Kahler said that the other study result that warrants consideration in the Columbia River treaty negotiations is that in an analysis of all the acoustic-tag studies of survival for yearling Chinook and steelhead at Bonneville, survival generally increased with discharge, but decreased at the highest discharge values tested. He said that the sample size was smallest in this highest discharge category, so the error bars were large. Nevertheless, he said that results could reveal some unanticipated mortality factors at Bonneville that emerge under the highest discharge events. He said that both of these first two findings might be considered in reviewing the Comparative Survival Study (CSS) spill study.

Kahler also discussed some findings with direct implications for the proposed CSS spill study. He said that, first, in evaluating adult conversion rates through the Federal Columbia River Power System (FCRPS) projects, researchers observed that high spill volumes and high total dissolved gas (TDG; specifically at McNary) reduced conversion rates. Kahler said that this observation highlights the need to carefully consider the adult migration side of the smolt-to-adult-ratio (SAR) equation when deciding whether or how to implement the CSS study. He said that other factors reducing conversion rates were high temperatures and fish injuries from encounters with nets, but most notable was the unreported harvest. He said that both radio telemetry (RT) and passive integrated transponder (PIT) studies found that most of the loss of adults can be attributed to unreported harvest between Bonneville and McNary (mostly the Bonneville pool), with approximately 45% of the tagged sockeye and 50% of the tagged Chinook last detected at Bonneville, or in the reservoir. He said that aside from the implications for the CSS studies, these results confirm what has been observed for years in monitoring PIT tags. He said that this loss artificially reduces SAR estimates for Mid-

Columbia stocks, and he added that adult conversion rates stabilize upstream of McNary, with high conversion rates between upper Columbia River dams.

Kahler said that other studies reported that smolts in good condition avoided bypass systems in the FCRPS, while fish in fair and poor condition were more likely to be bypassed. He said that these results emphasize the limited applicability of the CSS survival and SAR calculations based on fish captured in the Rock Island bypass sampling facility. He said that another study reported decreased survival for fish in poor condition, and specifically noted the significantly lower survival to McNary of Rock Island steelhead with fin damage. Kahler recommended considering this finding when deciding on marking strategies that involve fin clipping (other than adipose fins). Kirk Truscott said that fin condition may represent an underlying problem with fish health in general, and thus observed differences in survival may reflect differences in fish condition rather than an effect of fin condition.

Lastly, Kahler described the reports on the development of the injectable Juvenile Salmonid Acoustic Telemetry System (JSATS) tags. He said there are now injectable JSATS tags; however, the tags are large, requiring an 8-gage needle. He said that studies have found that insertion via a 3-millimeter (mm) incision without suturing produced higher survival and lower tag shed than using the needle. He said that the tags have short battery life and still are not small enough for subyearlings in the upper Columbia. He said the tags are being tested with acceptable results in fish as small as 85 mm fork-length; however, developers are not yet ready to declare 85 mm as the new minimum fish size instead of the current 95 mm length. He said that tag life is 20 to 26 days.

V. Hatchery and Tributary Committees Update (Mike Schiewe)

Mike Schiewe updated the Coordinating Committees on the following actions and discussions that occurred at the last Tributary Committees meeting on December 13, 2013:

- *Wenatchee Levee Removal and Riparian Restoration Budget Amendment*: The Chelan County Natural Resources Department (NRD) requested a budget amendment to move $7,000 from contract labor to sponsor salaries and benefits to help navigate the Water Conservancy Board process and to ensure that the landowner can replace any potential lost water from another source. The Rock Island Tributary Committee denied the budget amendment because the Committee believes the landowner should be working with an expert in water law to inform the decision. The Committee was also concerned that the purpose of this further investigation is so that the water owner can avoid relinquishing any portion of his existing water right, when reducing the volume of water withdrawn from the Wenatchee River was the basis of Committee approval of the project in the first place.

- *Methow/Chewuch Groundwater Monitoring Scope Change and Budget Amendment*: The Cascade Columbia Fisheries Enhancement Group requested a scope change and budget amendment to conduct a pump-drawdown test in two or three locations to measure groundwater quantity and recharge on the Burns-Garrity property. The Wells Tributary Committee approved the scope change and budget modification.
- *Silver Protection Project Time Extension*: Washington Department of Fish and Wildlife (WDFW) requested a contract extension from the original end date of December 31, 2013, to December 31, 2014, in order to explore opportunities related to ensuring the permanent preservation and enhancement of salmonid habitat on the properties. The Rocky Reach and Wells Tributary Committees approved the contract extension.
- *Nason Creek Upper White Pine (UWP) Floodplain Reconnection – PUD Powerline Reconnection Alternatives Analysis Time Extension and Scope Change*: The Chelan County NRD requested a contract extension and scope change to add additional tasks given that Chelan PUD supports moving the powerlines. The Rock Island Tributary Committee approved the contract extension and scope change.
- *Chewuch River Permanent Instream Flow Project Budget Amendment*: Trout Unlimited requested a budget amendment to move $1,838.71 from "Indirect/Overhead/Administration" to "Contract Labor" because of an accounting error. The Rocky Reach Tributary Committee approved the budget amendment.
- *Mission Creek Fish Passage Project Time Extension*: Cascade Conservation District requested a time extension because of fires in the Mission Creek watershed during 2012. The time extension will include additional time needed to secure the necessary permits for the project. The Rock Island Tributary Committee approved the contract extension.
- *Next Steps*: The next Tributary Committees meeting will be held on January 9, 2014.

Schiewe said that the Hatchery Committees will meet tomorrow on December 18, 2013. He said that the Hatchery Committees approved the Chelan PUD 2014 Hatchery Monitoring and Evaluation (M&E) Implementation Plan during their meeting on November 20, 2013, and they are expected to approve the Douglas PUD 2014 Hatchery M&E Implementation Plan during the December 18 meeting. He said that the Hatchery Committees are also planning to discuss Chelan PUD's Wenatchee Basin sockeye monitoring activities, plans for meeting their Methow spring Chinook obligation for 61,000 smolts after this coming year, and the status of their Methow spring Chinook Hatchery and Genetic Management Plan (HGMP). Schiewe said that the National Marine Fisheries Service (NMFS) will also be providing an update on processing of new permits for all the Upper Columbia River hatchery programs, which they are steadily making progress on.

VI. HCP Committees Administration

A. Next Meetings (Mike Schiewe)

Mike Schiewe said that the next scheduled Coordinating Committees meeting is January 28, 2014, to be held in person at the Radisson Hotel in SeaTac, Washington. The February 25, 2014, and March 25, 2014 meetings will be held either by conference call or in person at the Radisson Hotel in SeaTac, Washington, as is yet to be determined.

List of Attachments

Attachment A	List of Attendees
Attachment B	Passage Percentages of Fish through the Units at Rocky Reach
Attachment C	Fact Sheet on the Large Unit Repair at Rocky Reach Dam

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Steve Hemstrom*	Chelan PUD
Lance Keller*	Chelan PUD
Tom Kahler*	Douglas PUD
Jim Craig*	U.S. Fish and Wildlife Service
Bryan Nordlund*	National Marine Fisheries Service
Jeff Korth*	Washington Department of Fish and Wildlife
Kirk Truscott*	Colville Confederated Tribes
Bob Rose*	Yakama Nation

Notes:
* Denotes Coordinating Committees member or alternate

Table 1. Combined percent of hydroacoustic detected fish passing through the individual turbine units at Rocky Reach Dam from April 1 through May 31 2003 (mean flow = 118 kcfs).

Passage Route	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**	**C11**
Passage %	**18.3%**	**22.9%**	**13.2%**	**13.0%**	**7.9%**	**8.2%**	**7.0%**	**2.6%**	**2.4%**	**2.4%**	**2.0%**

Table 2. Route specific passage percentages for acoustic-tagged yearling Chinook and Steelhead for 2003 at Rocky Reach.

Passage Route	2003 Yearling Chinook Study-Wide Passage % (spill/no spill)	2003 Steelhead Study-Wide Passage % (spill/no spill)
Surface Collector	43.32%	50.94%
Bypass Screens	9.89%	7.36%
Units 1-11	34.03%	32.13%
Spillway	12.76%	9.57%
Mean Study Flow	118.0 kcfs	118.0 kcfs

Table 3. Route specific passage percentages for acoustic-tagged yearling Chinook and Steelhead over multiple years at Rocky Reach.

Passage Route	2005 Steelhead Study-Wide Passage % (spill/no spill)	2010 Yearling Chinook Study-Wide Passage % (day/night)	2011 Yearling Chinook Study-Wide Passage % (day/night)
Surface Collector	67.53%	48.35%	31.3%
Bypass Screens	6.28%	5.22%	5.72%
Units 1 and 2	6.06%	15.52%	5.60%
Units 3-11	17.97%	30.91%	52.38%
Spillway	2.16%	0.00%	4.99%
Mean Study Flow	113.0 kcfs	109.7 kcfs	208 kcfs

Fact sheet
Rocky Reach Large Unit Repair

Dec. 16, 2013

- March 2013 – Unit C-10 is taken out of service due to the appearance of oil around the generator shaft and metal shavings were found in a strainer;
- August 2013 – C-6 was taken out of service for planned rotor maintenance;
- Sept. 23, 2013 – Units C-8, C-9, and C-11 were taken out of service when a crack was found in the rod on Unit C-10 that operates the servo motor. All four generating units have the same design; and the C-10 design issues are likely present in units C-8, C-9, and C-11;
- Dec. 5 Unit C-6 was returned to service two weeks ahead of schedule. This allowed for additional generation during a high demand period with energy prices in the $80 - $90/MWh range;
- Unit C-11 was placed in testing mode Dec. 14 and it will continue to be monitored. C-11 is scheduled to come back online in the temporary, fixed blade configuration either on or before Jan. 31, 2014;
- Unit C-9 is scheduled to have a temporary, fixed blade repair and be brought back online by Feb. 28, 2014;
- Unit C-8 is scheduled to have a temporary, fixed blade repair and be brought back online by March 31, 2014;
- Unit C-10 is scheduled to return to service Aug. 31, 2014, with a longer-term repair, however the PUD has decided to return C-10 to service with an interim fixed blade repair similar to the other large units. This could allow C-10 to be back in production earlier;
- The proposed operating angle for the fixed blades on unit C-11 is approximately 31 degrees or full steep position. The blade angle was selected to be the most efficient at full river flow (23 kcfs) on the unit curve, which is also the safest position. The blade angles for the other three units are being assessed to provide the safest optimal angle and have not been selected. Performance and stability testing on C-11 also will help in determining the proper angle for the remaining units;
- It is the District's desire to eventually restore all four units to Kaplan (variable pitch blade) service. The final repair schedule for returning C-8 - C-11 to the desired Kaplan condition is currently planned through the fall of 2018 and is variable dependent on fabrication and delivery of repair components.

APPENDIX B
HABITAT CONSERVATION PLAN HATCHERY COMMITTEES 2013 MEETING MINUTES AND CONFERENCE CALL MINUTES

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	February 21, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the January 16, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees meeting was held at Douglas PUD headquarters in East Wenatchee, Washington, on Wednesday, January 16, 2013, from 9:30 am to 1:00 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Kristi Geris will verify with Bill Gale the final revisions to the revised December 12, 2012 Hatchery Committees meeting minutes, regarding edits to a statement that Gale made during Chelan PUD's discussion on Methow spring Chinook production (Item I).
- The Hatchery Monitoring and Evaluation (M&E) working group will provide the revised Analytical Framework 5-Year Update to the Hatchery Committees for review prior to the February 20, 2013 meeting of the Hatchery Committees (Item III-A).
- Craig Busack will provide Kristi Geris with the National Marine Fisheries Service (NMFS) Production Advisory Committee (PAC) briefing documents on the draft Methow spring Chinook and steelhead Hatchery and Genetic Management Plans (HGMPs), for distribution to the Hatchery Committees (Item IV-A).
- Chelan PUD will draft a study plan to test Methow spring Chinook broodstock collection at the Rocky Reach Trap; the study would potentially involve trapping, tagging, and genetic testing at Priest Rapids Dam, and monitoring at the Rocky Reach Dam Fish Trap (Item VI-A).
- Kristi Geris will set up a WebEx meeting for 11:00 am on Monday, January 28, 2013, for the Colville Confederated Tribes (CCT), Chelan PUD, Douglas PUD, and Grant

PUD to discuss run-composition sampling at Wells Dam for summer Chinook upstream of Wells Dam (Item VIII-A).
- Mike Tonseth will provide Kristi Geris summer Chinook broodstock collection estimates for discussion during the run-composition sampling WebEx meeting scheduled for January 28, 2013, for distribution to the Hatchery Committees (Item VIII-A).

STATEMENT OF AGREEMENT DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at this meeting.

AGREEMENTS

- The Hatchery Committees approved the Douglas PUD 2013 HCP Action Plan, as revised (Item II-A).
- The Hatchery Committees agreed that the revised Hatchery M&E Analytical Framework 5-Year Update will consolidate and replace both the former Hatchery M&E Analytical Framework and Conceptual Framework (Item III-A).
- The Hatchery Committees agreed to extend the current HCP Hatchery Committees Conflict of Interest Policy, which was originally approved in November 2010, for two additional years (Item IX-A).

REVIEW ITEMS

- The updated revised draft Analytical Framework 5-Year Update was redistributed to the Hatchery Committees on January 25, 2013, with comments due to Greg Mackey no later than February 14, 2013.

FINALIZED REPORTS

- The Douglas PUD 2013 M&E Implementation Plan was finalized and distributed to the Hatchery Committees on December 28, 2012.
- The Chelan PUD 2013 M&E Work Plan was finalized and distributed to the Hatchery Committees on January 10, 2013.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and reviewed the agenda. The following revisions were made to the agenda:

- Keely Murdoch added: 1) an update on the Yakama Nation (YN) Steelhead Kelt Reconditioning Program; and 2) a follow-up discussion on the spring Chinook/steelhead conversion from the Lake Wenatchee Sockeye Program.
- Greg Mackey requested an update on 2013 broodstock protocols.
- Kirk Truscott added a follow-up discussion on run-composition sampling at Wells Dam for summer Chinook.
- Schiewe added a follow-up discussion on the HCP Hatchery Committees Conflict of Interest Policy.

The revised draft December 12, 2012 meeting minutes were reviewed. Kristi Geris said that there were four edits remaining to be discussed.

- Regarding Chelan PUD's action item, which was to discuss with the YN the potential use of upper Methow basin acclimation sites for Chelan PUD's BY2013 Methow spring Chinook production, Mike Tonseth said that Chelan PUD was to engage the YN about the feasibility of installing temporary adult weirs at the remote acclimation locations. Murdoch said that weir construction was indeed the focus of their discussion, and the action item was revised to state this. Murdoch also added that installing weirs seemed technically feasible; however, she is unsure if the neighboring land owners will be supportive of this proposal. She suggested that Goat Wall Pond might be the most feasible location. Murdoch also noted that the YN has finished developing the Multi-species Acclimation Plan, and will hopefully distribute the plan to the Hatchery Committees for review by the end of the week.
- Regarding Chelan PUD's discussion on Methow production, it was clarified that Bill Gale said the U.S. Fish and Wildlife (USFWS) needed Methow hatchery- *(not natural-)* origin fish trapped in the Winthrop National Fish Hatchery (NFH) volunteer channel for the Winthrop NFH program. Geris said that she will verify the revision with Gale prior to finalizing the December 12, 2012 meeting minutes.
- Regarding the USFWS/NMFS discussion about assessing the ecological impact of Leavenworth Fish Hatchery (FH) releases on non-target taxa of concern (NTTOC), it was clarified by Mackey that the model does not quantify residuals, but rather

estimates the likelihood and magnitude of ecological interactions (*not the likelihood of residuals*).

- Regarding the CCT discussion on Chief Joseph Hatchery (CJH) updates, Mike Tonseth clarified that he was asking about CCT's plans to conduct the run-composition sampling at Wells Dam for summer Chinook upstream of Wells (*not composition sampling for Methow origin Chinook*). The draft minutes were revised accordingly.

Geris said that all other comments and revisions received on the draft meeting minutes were incorporated. The Hatchery Committees members present approved the December 12, 2012 meeting minutes, as revised.

Murdoch requested that action items from the previous month's Hatchery Committees meeting be discussed at the beginning of each meeting. Schiewe agreed. Actions items from the last Hatchery Committees meeting on December 12, 2012, and follow-up discussions are as follows:

- *Tonseth will send the proposal for broodstock collection at Tumwater Dam for Grant PUD's Nason Creek spring Chinook program to Geris for distribution to the Hatchery Committees after the proposal has been vetted in the Priest Rapids Coordinating Committee Hatchery Subcommittee (PRCC HSC; Item I).*
  Murdoch said that a formal proposal had not yet been developed due to an outstanding Priest Rapids Coordinating Committee (PRCC) decision that will hopefully be resolved at their January 22, 2013 meeting. She said that the general concept of the proposal had been discussed; however, the details are still undecided. She explained that because natural-origin broodstock are needed for both the Chiwawa and Nason Creek programs, the JFP is proposing to collect returning adults from Tumwater Dam for both programs. She said that all fish would be moved to Eastbank FH for genetic sampling and sorting. She said that the total production at both facilities would stay the same; however, the numbers of natural origin fish would be expected to vary over time. Schiewe noted that this proposal suggests a shift in terms of where Chiwawa gets broodstock, and will therefore, require Hatchery Committees approval.
- *Mackey will distribute to the Hatchery Committees updates to the Analytical Framework for M&E PUD Hatchery Programs (Item II-B).*

Josh Murauskas distributed the updates to the Hatchery M&E Workgroup on December 28, 2012. Another revised version will be distributed to the entire Hatchery Committees, per the January 16, 2013 meeting action item.

- *Joe Miller will contact Grant PUD about the potential to overwinter acclimate Chelan PUD Methow spring Chinook production at the Carlton facility in 2013 (Item III-A).*
  Alene Underwood said that discussions are underway between Chelan PUD and Grant PUD.
- *Miller will contact Craig Busack regarding drafting concurrence letters to authorize collection of Methow spring Chinook broodstock using a modified parental based tagging (PBT) approach, and out-of-basin rearing facilities—both for brood year (BY) 2013 only (Item III-A).*
  Tonseth said that discussions are underway.
- *Chelan PUD will discuss with the YN the potential use of upper Methow basin acclimation sites for Chelan PUD's BY2013 Methow spring Chinook production, to include installation of temporary adult weirs at the remote acclimation locations (Item III-A).*
  Chelan PUD said that discussions are underway and that an update will be provided at today's meeting.
- *Chelan PUD will draft a study plan to test Methow spring Chinook broodstock collection at the Rocky Reach Trap; the study would potentially involve trapping, tagging, and genetic testing at Priest Rapids Dam, and monitoring at the Rocky Reach Dam Fish Trap (Item III-A).*
  Chelan PUD said that an update will be provided at today's meeting.
- *Gale will discuss with USFWS staff the potential to collect, spawn, incubate, and early rear Chelan PUD's Methow spring Chinook at Winthrop NFH in 2013, and he will also propose a meeting for USFWS, Washington Department of Fish and Wildlife (WDFW), and Chelan PUD staff to review opportunities before the January 16, 2013 Hatchery Committees meeting (Item III-A).*
  Underwood said that discussions are underway and an update will be provided soon.
- *Gale will distribute to the Hatchery Committees the draft terms and conditions that incorporate non-target taxa of concern (NTTOC) analyses as M&E measures in the Leavenworth NFH Complex draft Biological Opinions (BiOps; Item IV-A).*

Geris distributed the draft terms and conditions to the Hatchery Committees on December 12, 2012.

- *Truscott will coordinate internally to arrange a presentation on the CCT's CJH M&E Plan for a future Hatchery Committees meeting (Item VI-A).*
  Truscott said that CCT is planning a presentation for the February 20, 2013 meeting of the Hatchery Committees.
- *Geris will re-circulate the Conflict of Interest Policy Agreement amongst the Hatchery Committees members (Item VII-B).*
  Geris distributed the agreement to the Hatchery Committees on December 18, 2012.

II. Douglas PUD

A. Draft Douglas PUD 2013 HCP Action Plan (Tom Kahler)

Tom Kahler said that Douglas PUD develops an HCP Action Plan each year. The draft Douglas PUD 2013 HCP Action Plan (Attachment B) was distributed to the Hatchery Committees by Kristi Geris on December 26, 2012. Kahler said that the Wells HCP Tributary Committee has already reviewed and approved the tributary portion of the action plan and that he is now looking for comments and approval from the Hatchery Committees on the hatchery portion of the action plan. He said that once approval is obtained from these two committees, the draft plan will be presented to the HCP Coordinating Committees for final approval. The following revisions were made to Attachment B:

- Item 1e – "August 2013" was revised to read "July 2013."
- Item 1f – "October 2013" was revised to read "September 2013."
- Item 1g – This item was deleted.
- Item 3 – "2010 Broodstock Collection Protocol" was revised to read "2013 Broodstock Collection Protocol."
- Item 3b – "Approval deadline" was revised to read "NMFS submission deadline."

The Hatchery Committees approved the Douglas PUD 2013 HCP Action Plan, as revised.

III. Douglas PUD and Chelan PUD

A. Updating the PUD M&E Plans (Greg Mackey and Josh Murauskas)

Greg Mackey said that the revised Analytical Framework 5-Year Update is ready for review by the Hatchery Committees. *(Note: Josh Murauskas distributed the revised Analytical Framework 5-Year Update to the Hatchery M&E Workgroup on December 28, 2012; Mackey distributed an updated revised Analytical Framework 5-Year Update to the entire Hatchery Committees on January 25, 2013).* Mike Tonseth reminded the Hatchery Committees about the agreement reached at the December 12, 2012 meeting of the Hatchery Committees regarding protocols and timeline for developing, reviewing, and approving the annual M&E Implementation Plans, where it was decided that approval by Hatchery Committees of the annual M&E Implementation Plans needs to occur in the summer preceding implementation (draft to the Committees for review by July 1, 2013), and that a timeline needs to be established based on the PUDs contracting processes.

Mackey reviewed the revised update, and said that comments discussed at the Hatchery M&E working group meetings were incorporated into the revised plan. He said that it was agreed to keep the plan goal- and objective-oriented. He said that the content of the plan was rearranged (though nothing was deleted) to improve the sequencing of the document, with the most important objectives presented first and supporting objectives presented in a logical order according to biological and analytical processes. He also said that there were several revisions to explanatory text to improve clarity (i.e., concepts that were mentioned in the previous plan are now more explicit in the revised plan). He said that charts and tables were also added to improve the organization of the plan. Mackey noted that some redundancy now exists due to edits, but that this can be addressed with further revisions, as needed. Murauskas noted that safety net programs did not exist when the original document was developed and that the revised plan now includes the safety net programs and explains how these programs have different objectives. Mike Schiewe suggested including a glossary to help define these and other concepts up front.

Mackey said that this document is a revision of the Hatchery M&E Analytical Framework, and Schiewe noted that it is important to ensure that the Hatchery M&E Analytical Framework, the Hatchery M&E Conceptual Framework, and the Hatchery M&E Annual

Plans do not contradict each other. Mackey said that, for simplicity, developing a single document that supersedes both the Hatchery M&E Analytical Framework and the Hatchery M&E Conceptual Framework is the preferred route of those that have worked on updating the plan. Keely Murdoch noted that the only reason both documents exist is because after the Hatchery M&E Conceptual Framework was completed, the Hatchery M&E Analytical Framework was developed to describe analytical elements that the former plan did not include. The Hatchery Committees agreed that the revised Hatchery M&E Analytical Framework 5-Year Update will consolidate and replace both the former Hatchery M&E Analytical Framework and Conceptual Framework.

Mike Tonseth suggested including appendices for management targets; for example, an appendix with information on the proportion of hatchery-origin spawners (pHOS) management targets could be included. Murdoch noted that management targets pending agreement in the committees should not be included in an appendix unless certain values were not specified because the Hatchery Committees would still need to approve them. Mackey agreed with the idea of appendices and said that "to be determined (TBD)" could be inserted as applicable.

Mackey said that the Hatchery M&E Workgroup would like to have the draft plan available for a 60-day review in February 2013, with the final available by April 2013. He said that the Hatchery M&E Workgroup will redistribute the updated revised Analytical Framework 5-Year Update to the Hatchery Committees for review prior to the February 20, 2013 meeting of the Hatchery Committees.

IV. NMFS

A. Methow HGMPs and Hatchery Litigation Updates (Craig Busack)

Craig Busack summarized NMFS progress toward completing their review of Wenatchee and Methow basin HGMPs and the associated Biological Opinions (BiOps). He said that the draft HGMPs for Methow steelhead (Winthrop and PUD/state) and Methow spring Chinook (Winthrop and PUD/state) programs are currently under review, as are HGMPs for the Leavenworth spring Chinook and Entiat spring Chinook BiOps. He said the Entiat summer Chinook BiOp is under final review with completion expected in about two weeks. Busack noted that the NMFS final review process will now take longer than in the past due to greater scrutiny by the National Oceanic and Atmospheric Administration General Counsel (NOAA GC).

Busack explained that in November 2012, the Wild Fish Conservancy, The Conservation Angler, the Federation of Fly Fishers Steelhead Committee, and the Wild Steelhead Coalition filed a lawsuit against NMFS, USFWS, Olympic National Park, and representatives of the Lower Elwha S'Klallam tribe for allegedly supporting hatchery programs in the Elwha River without adequate Endangered Species Act (ESA) coverage. He explained that the foci of the litigation included several regulatory issues, but that of particular note to the Hatchery Committees was the need to address ecological interaction between hatchery- and naturally-produced fish. Busack said that as a result of this litigation, the NOAA attorneys are looking at everything with a fine-toothed comb, which means more revisions. Lynn Hatcher added that this is creating a mushroom effect that is impacting everything in the Mid-Columbia. Busack said that NMFS is developing a new BiOp template that will hopefully save time in the future.

Continuing with his update on the schedule for issuing new hatchery program permits, Busack said that the Chiwawa spring Chinook and Wenatchee steelhead draft section 10 permits are expected to be ready for review by late January or early February. He also said that Hatcher is developing the section 10(j) for the Okanogan spring Chinook permit. Hatcher explained that designation as an experimental population under Section 10(j) relaxes the prohibitions against take. He said that an Environmental Assessment (EA) needs to be developed and permits need to be completed so that when the fish enter the water in 2014, they will have the experimental tag and label. Kirk Truscott added that a HGMP was developed in addition to a section 10(j) because Okanogan spring Chinook remain endangered while they are still in the irrigation rearing ponds. Hatcher said that NMFS is reviewing the HGMP now, which he noted is likely sufficient; and he added that Busack is proceeding with the consultation process.

Busack said that with regard to the Methow HGMPs, NMFS has been working with the operators to determine the potential to reduce pHOS in the Methow Basin, and has received supplemental information documents associated with the Methow HGMPs that include pHOS analyses. He said that after several discussions with Steve Parker (YN), Parker has mixed feelings about the HGMPs, but it is time to request input from the PAC and ultimately the U.S. v. Oregon Policy Group. Busack said that he is currently developing letters of sufficiency for the four Methow HGMPs. Busack said that he will provide Kristi Geris with these briefing documents for distribution to the Hatchery Committees.

Busack indicated that he believed that the production levels in the HGMPs are consistent with the Columbia River Fish Management Plan (U.S. v. Oregon), but that these will be a focus of the PAC review. Keely Murdoch said that she thought the new no net impact (NNI) production numbers were already approved. Mike Tonseth clarified that PAC is reviewing all program modifications, and that those changes have not yet been formally adopted in the program; although, they are consistent with their agreements. Busack added that NNI numbers are only reported in the supporting documents on adult management. He said that a goal of the HGMPs is to show the reader how the program will be run, and if there is confusion, explain the intent. Busack said that, regarding what to expect with the PAC proceedings, he guessed that PAC would first hold discussions with the Small Group at U.S. v. Oregon, and then meet with the larger Columbia River Inter-Tribal Fish Commission (CRITFC) group. Tonseth added that the NNI production levels will go to the Policy Group, but as an update, not as a decision item.

Tonseth asked when NMFS expected to publish the Methow HGMPs in the Federal Register for their 30-day review. Hatcher said that NMFS can process the HGMPs prior to PAC approval; however, that if there is a problem with PAC, it will delay the Federal Register Notice (FRN). Tonseth noted that consultations cannot occur until the FRN is published.

V. WDFW

A. Broodstock Protocol Update (Mike Tonseth)

Mike Tonseth said that WDFW is developing the draft 2013 Broodstock Protocols. He said that the final draft may not be ready by the March 20, 2013 meeting of the Hatchery Committees, but that a draft document should be available for review. Greg Mackey requested that the final 2013 document be distributed to the Hatchery Committees as soon as it is available; and Mike Schiewe suggested copying the Hatchery Committees on the version that goes to NMFS. Mackey asked if interim protocols, or protocols specific to a particular operator could be developed in the event that other programs delay the final 2013 protocols; and Tonseth responded that he hesitates to have multiple protocols. Schiewe suggested that WDFW keep the Hatchery Committees updated as changes are made to the draft protocols and as program details are worked out. He suggested that any changes could be highlighted in track changes.

VI. Chelan PUD

A. Methow Spring Chinook (Josh Murauskas)

Josh Murauskas said that Chelan PUD, USFWS, and WDFW have finalized arrangements to meet Chelan PUD's spring Chinook production for 2013. Mike Tonseth said that USFWS agreed to accommodate broodstock collection, holding, and incubation for 61,000 Chelan PUD spring Chinook. Eyed eggs would be moved to Eastbank Hatchery for initial rearing. Murauskas said that discussions on how to meet production for 2014 and beyond are still ongoing. Tonseth said that there are concerns with using the Rocky Reach Dam Fish Trap and the potential impact that this may have on spring Chinook returning to the Entiat River. He said that there are also ongoing discussions about permit limitations to implement the PBT approach using genetic stock identification (GSI) markers at Priest Rapids Dam. Chelan PUD said that they will carry forward their action item from the December 12, 2012 meeting of the Hatchery Committees to draft a study plan to test Methow spring Chinook broodstock collection at the Rocky Reach Trap, which may involve trapping, tagging, and genetic testing at Priest Rapids Dam, and monitoring at the Rocky Reach Dam Fish Trap.

VII. Yakama Nation

A. YN Steelhead Kelt Reconditioning Program Update (Keely Murdoch)

Keely Murdoch said that the YN has been discussing with WDFW, USFWS Fish Health, and Douglas PUD the feasibility of live-spawning natural-origin steelhead (females) from the Twisp River so as to recondition them to spawn again in the wild. She said that the YN had discussed with Douglas PUD the possibility of incorporating an isoincubation facility into the plans for the Wells Hatchery modernization; however, it has turned out that this option was not financially feasible. She said that the YN is discussing alternative opportunities with the

USFWS Fish Health Unit. Regarding the consideration of an off-site rearing alternative, Tom Kahler said that rearing fish offsite would address only some of the fish health concerns, and Murdoch noted that the fish would still need to be kept separate until testing for Infectious Pancreatic Necrosis Virus (IPNV) can be completed. Mike Tonseth explained that samples are typically taken for testing at 30 days after swim up, and it takes an additional 30 days to obtain results; this means that the fish need to be held 60 days in isolation. Murdoch said that the Hatchery Committees would need to decide whether or not to keep the progeny of individual females separate or in pairs (i.e., progeny of one female per tank or progeny of two females per tank).

Murdoch acknowledged that there would be several decisions that the Hatchery Committees would need to discuss prior to moving forward; however, she said that the YN wanted to provide an update on current progress and ongoing discussions.

B. Spring Chinook/Steelhead Conversion from the Lake Wenatchee Sockeye Program (Keely Murdoch)

Keely Murdoch reminded the Hatchery Committees about the YN proposal to convert 40,000 Lake Wenatchee sockeye to spring Chinook, instead of steelhead (as was specified in the 2011 SOA on hatchery recalculation). She said that WDFW is discussing this proposal internally and has not yet made a decision. Murdoch said that the YN just wanted to remind the Hatchery Committees that these discussions are ongoing and that the proposal is something that they will eventually ask the Hatchery Committees to weigh in on once again. Mike Tonseth concurred that discussions have been ongoing; however, he indicated that it was doubtful that an agreement would be reached prior to 2013 broodstock collection. Murdoch said that NMFS expressed support of the proposal as long as the numbers are compliant with the HGMP. She added that, as far as permitting, she does not foresee any impact.

VIII. CCT

A. Run-Composition Sampling at Wells Dam for Summer Chinook (Kirk Truscott)

Kirk Truscott said that summer Chinook sampling at Wells Dam was discussed at the December 12, 2012 meeting of the Hatchery Committees, but that this option was left unresolved. Mike Tonseth added that, historically, the Wells sampling was used to collect information on Upper Columbia River summer Chinook run-composition. Tonseth said that with the termination of some prior production agreements and re-calculation of PUD production levels, Chelan PUD no longer has an Upper Columbia River summer Chinook obligation at Carlton Ponds. Tonseth said that run-composition sampling for summer Chinook upstream of Wells is still needed, if only for the Grant PUD program. He said that in order to avoid a data gap, the Hatchery Committees need to address who will be collecting these data.

Truscott explained that CCT did not include participation in this activity in their M&E Plan because run-composition sampling includes aggregate population sampling. Underwood noted that Grant PUD needs to be a part of this discussion as well. Josh Murauskas asked if a sample power analysis has been performed to determine the number of fish that would need to be sampled; and he added that these obligations could possibly be satisfied with broodstock collection for Carlton. Tonseth estimated that approximately 500 adults may be needed for sampling; and he added that information collected on the spawning grounds is inherently biased to older fish and is not a reliable substitute. He indicated that he did not know whether Grant PUD's Carlton collection would provide sufficient information to satisfy what is needed. He added that information regarding fish length, scales, marks, presence/absence of coded-wire tags (via wand), fin clips, and gender would need to be collected as well. Tonseth said that if this option is not adequate, questions to be answered about the sampling include: who will perform it, what is the division of labor for it, and who will fund it. He added that Grant PUD is ultimately responsible for collecting for their program. Murauskas asked why the data were important and what decisions they informed; no one was able to respond with any detail. Truscott asked if these data could be obtained during the purse seine collections that the CCT conduct. Greg Mackey asked how mainstem spawners are differentiated in these samples; Tonseth said that they are not identifiable and hence the sample is considered an aggregate population.

Mike Schiewe said that WDFW, Chelan PUD, CCT, Douglas PUD, and Grant PUD need to decide how to move forward. He noted that this is a Hatchery M&E Program; however, it is not geographically defined by the program. Tonseth said that historically, all parties have supported run-composition sampling at Wells Dam, and that if a change to sampling locations is proposed, the change needs to meet everyone's needs and Hatchery M&E Plans. Kristi Geris said that she will set up a WebEx meeting for 11:00 am on Monday, January 28, 2013, for WDFW, CCT, Chelan PUD, Douglas PUD, and Grant PUD to discuss run-composition sampling at Wells Dam for summer Chinook upstream of Wells Dam; and Tonseth said that he will provide Geris summer Chinook broodstock collection estimates for discussion during the run-composition sampling meeting.

IX. HCP Administration

A. Conflict of Interest Policy (Mike Schiewe)

Mike Schiewe said that the HCP Hatchery Committees Conflict of Interest Policy has run its 2-year course, and that it is now time to consider renewing the policy for the next 2 years. Schiewe said that since the current policy has not yet been applied, he proposed extending it for the next 2 years. He reminded the Hatchery Committees that the policy, originally approved in November 2010, underwent development and revisions through a course of about 2-to-3 meetings. The Hatchery Committees agreed to extend the current HCP Hatchery Committees Conflict of Interest Policy for two additional years.

B. Next Meetings

The next scheduled Hatchery Committees meetings are on February 20, 2013 (Chelan PUD office); March 20, 2013 (Douglas PUD office); and April 17, 2013 (Chelan PUD office).

List of Attachments

Attachment A – List of Attendees
Attachment B – Draft Douglas PUD 2013 HCP Action Plan

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Josh Murauskas*	Chelan PUD
Alene Underwood	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Todd Pearsons†	Grant PUD
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Lynn Hatcher*	National Marine Fisheries Service
Craig Busack*††	National Marine Fisheries Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Todd Miller†	Washington Department of Fish and Wildlife
Charlie Snow†	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

†† Joined by phone for the Methow HGMPs and Hatchery Litigation Updates discussion

FINAL 2013 ACTION PLAN
WELLS HCP

WELLS HCP COORDINATING COMMITTEE

1. **Juvenile Fish Bypass Plan**
   a. Draft to Coordinating Committee (CC) .... December 2012
   b. CC comments to DCPUD .... January 2013
   c. Submit to FERC for approval .... February 2013
   d. Draft report to CC .... November 2013

2. **2013 NNI Progress Report (per Wells HCP §6.9)**
   a. Douglas submits Draft NNI Progress Report to the CC .... December 2012
   b. Report deadline .... March 2013

3. **Predator Control Programs**
   a. Draft 2012 pikeminnow report to HCP CC .... January 2013
   b. Final 2012 pikeminnow report integrated into HCP Annual Report .... March 2013
   c. Pikeminnow removal – Wells Project........ March – November 2013
   d. Draft 2013 pikeminnow report to DCPUD........ January 2014
   e. Draft 2013 pikeminnow report to HCP CC .... March 2014
   f. Avian predator hazing at Wells........ October 2012 – May 2013
   g. 2012-2013 hazing memo to PUD .... June 2013
   h. 2012-2013 hazing memo to HCP CC .... July 2013
   i. 2012-2013 hazing memo integrated into 2013 HCP Annual Report........ March 2014

4. **Sub-yearling Chinook Life-history Study**
   a. 2011 draft report to HCP CC .... December 2012
   b. 2011 final report to HCP CC .... February 2013
   c. Presentation of 2012 data analysis to HCP CC........ December 2013
   d. Update study plan for 2013........ January-April 2013
   e. Tag and release study fish........ June-July 2013
   f. Monitor study fish........ through life cycle
   g. 2011-13 draft report to CC........ December 2013
   h. 2011-13 final report .... April 2014

5. **Annual Monitoring of Juvenile Migration Run Timing**
   a. 2013 Skalski analysis of index data from RR........ September 2013
   b. 2013 draft of Skalski's report to DCPUD........ October 2013
   c. 2013 final report presented to CC........ November 2013

6. **Fish Passage and Count-station Maintenance**
   a. Install grating around count station in the east ladder .... December 2012
   b. Install grating around count station in the east ladder .... January 2013

7. FDX/HDX PIT-tag Detection System Installation

a. Install system in Pool 19 of east ladder .... December 17-20, 2012

8. Fishway Outage Schedule for Fishway Inspection, Maintenance, and Fishway Projects

a. East Fishway .... December 4, 2012 – January 18, 2013
b. West Fishway... January 21 – February 21, 2013

9. Lamprey Passage and Enumeration Study

a. Study plan .... February 2013
b. Conduct head-differential test and efficiency study .... July – October 2013
c. Draft report.. November 2013
d. Final report.. February 2014

10. HCP Annual Report

a. Draft 2012 annual report to DCPUD for review.. January 16, 2013
b. Draft 2012 annual report to CC for 30-day review................................... February 8, 2013
c. CC comments due to Anchor QEA... March 6, 2013
d. Final 2012 annual report to DCPUD .... March 22, 2013
e. Final 2012 annual report due to FERC .... March 29, 2013

11. License Amendments (requiring HCP CC approval)

a. Counting Facility Modifications (Lamprey Count Station Improvements)....... March 2013
b. Temporary Operational Modifications (Lamprey Ladder Operations) .... May 2013

WELLS HCP HATCHERY COMMITTEE

1. Implement 5-year Hatchery Monitoring and Evaluation (M&E) Plan

a. Ongoing implementation ....January – December 2013
b. Draft annual report for 2012 to Douglas PUD.. June 2013
c. Draft annual report to Hatchery Committee (HC) .... August 2013
d. Final annual report to HC ....October 2013
e. Draft 2014 implementation plan to HC .... August 2013
f. HC approval of final 2014 implementation plan ....October 2013
g. HC approved 2014 implementation plan to FERC for approval ....October 2013

2. Update 5-year M&E plan (per Wells HCP §8.5.1)

a. Draft to HC .... April 2013
b. Final to HC.. June 2013
c. Approved M&E plan to FERC for approval.. August 2013

3. 2010 Broodstock Collection Protocol

a. Draft to HC: .... March 2013
b. Approval deadline:... April 2013
c. Implementation: ....May 2013 to April 2014

4. Annual Implementation - Sockeye Fish/Water Management Tools

a. Period covered: ....Water Year 2012-2013 (October – September)
b. Water Year 2011-2012 Report and Presentation to HC: ....*to be determined*

5. Methow Steelhead Relative Reproductive Success Study

a. Implementation: .... March 2010 - December 2021
b. Final report:.. 2021/2022

6. Wells Hatchery Modernization

a. Draft Master Plan to Douglas PUD .... January 2013
b. Final Master Plan .... March 2013
c. Final Construction Drawings .... March 2014
d. Provide updates to the HC ....Monthly
e. Provide opportunities for HC input... Periodically

WELLS HCP TRIBUTARY COMMITTEE

1. Plan Species Account Annual Contribution
   a. $176,178 in 1998 dollars (estimated $250,000 2013 dollars).......................... January 2013

2. Annual Report - Plan Species Account Status
   a. Draft to Tributary Committee (TC): .... February 2013
   b. Approval deadline:.. March 2013
   c. Period covered: ....January to December 2012

3. 2013 Funding-round – General Salmon Habitat Program
   a. Request for project pre-proposals: .... *To be determined* (typically in March)
   b. Pre-proposals to TC: .... *To be determined* (typically in early May)
   c. Tours of proposed projects: ....*To be determined* (typically in late May)
   d. Project sponsor presentations to TC: .... *To be determined* (typically in early June)
   e. Final project proposals to TC:..............................*To be determined* (typically in late June)
   f. RTT project rating decisions:............................. *To be determined* (typically in early July)
   g. Supplemental sponsor presentations, as necessary ....*To be determined*
   h. TC final funding decisions:......................... *To be determined* (typically before December)

4. Small Project Program
   a. Project review and funding Decision ....January – December 2013

5. Tributary Assessment Program
   a. Draft final report to TC on Year 5 of 5, and all years of ORRI monitoring .... April 2013
   b. Final report to TC.. June 2013

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	March 21, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the February 20, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Chelan PUD headquarters in Wenatchee, Washington, on Wednesday, February 20, 2013, from 9:30 am to 2:45 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Chelan PUD will draft a study plan to test Methow spring Chinook broodstock collection at the Rocky Reach Trap (Item I).
- Bill Gale will provide U.S. Fish and Wildlife Service's (USFWS) Entiat National Fish Hatchery (NFH) and Leavenworth NFH Biological Assessments (BAs) and Biological Opinions (BiOps) to the Hatchery Committees as examples of consultation materials for bull trout (Item II-A).
- Craig Busack and Bill Gale will provide Kristi Geris with a list of people who should be invited to the discussion on hatchery and genetic management plans (HGMPs) for non-listed programs and the need for bull trout consultations (Item II-A).
- Kristi Geris will distribute a Doodle Poll for a 1-hour discussion on the status of HGMPs for non-listed programs (Item II-A).
- Josh Murauskas and Chris Moran will provide a proposal for evaluating release strategies for the Wenatchee Steelhead Program, including a consideration of how the release strategy for steelhead would affect the Chiwawa spring Chinook program, no later than one week prior to the Hatchery Committees March 20, 2013 meeting (Item III-A).
- Josh Murauskas will distribute to the Hatchery Committees an updated revised draft

Analytical Framework 5-Year Update with comments received to date that have been incorporated (Item IV-A).

- Josh Murauskas will distribute a Doodle Poll to the Hatchery Committees to schedule a Hatchery Monitoring and Evaluation (M&E) Workgroup meeting to prepare the final revised draft Analytical Framework 5-Year Update for Hatchery Committee review (Item IV-A).
- Greg Mackey will provide the Wells Hatchery Modernization Master Plan to the Hatchery Committees for review, when available (Item V-C).
- Chelan PUD, Douglas PUD, Grant PUD, and the Colville Confederated Tribes (CCT) will meet to discuss proportional responsibilities for funding run-composition sampling at Wells Dam for summer Chinook; and Chelan PUD will provide an update on the discussions at the Hatchery Committees' March 20, 2013 meeting (Item VI-A).
- Keith Wolf will provide Kristi Geris with CCT's Chief Joseph Hatchery (CJH) M&E presentation materials for distribution to the Hatchery Committees (Item VI-B).

STATEMENT OF AGREEMENT DECISION SUMMARY

- No Statements of Agreement (SOA) were approved at this meeting.

AGREEMENTS

- No agreements were discussed at this meeting.

REVIEW ITEMS

- The draft residual steelhead manuscript *Ecologic and demographic costs of releasing non-migratory juvenile hatchery steelhead in the Methow River, Washington* was distributed to the Hatchery Committees on February 19, 2013, for a 60-day review with comments due to Charlie Snow no later than April 22, 2013.

FINALIZED REPORTS

- The Yakama Nation (YN) Expanded Acclimation Plan was finalized and distributed to the Hatchery Committees on January 29, 2013.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and reviewed the agenda. The following revisions were made to the agenda:

- Lynn Hatcher added an update on the Nason Creek Hatchery permit timeline.
- Josh Murauskas added an update on spring Chinook brood collection at the Eastbank Hatchery outfall (EBO).
- Greg Mackey added a Wells summer Chinook HGMP update to the National Marine Fisheries Service (NMFS) HGMP agenda item; and he also added a Hatchery Evaluation Technical Team (HETT) update.
- Kirk Truscott added an update on run-composition sampling at Wells Dam for summer Chinook.

The revised draft January 16, 2013 meeting minutes were reviewed. Kristi Geris said that after the revised minutes were distributed to the Hatchery Committees on February 12, 2013, NMFS provided clarification on two pending items under their discussion on Methow HGMPs and Hatchery Litigation Updates. Geris said that Hatcher clarified that: 1) the draft Mid-Columbia HGMPs currently under review include draft HGMPs for Methow steelhead and Methow spring Chinook programs; and 2) the review period for Methow HGMPs in the Federal Register will be 30 days. Responding to a question from Mackey, Mike Tonseth clarified that during run-composition sampling at Wells Dam, all fish are screened for presence-absence of coded-wire tags. Geris said that she will revise the minutes to reflect this clarification. The Hatchery Committees m embers present approved the January 16, 2013 meeting minutes, as revised.

Action items from the last Hatchery Committees meeting on January 16, 2013, and follow-up discussions were as follows:

- *Geris will verify with Bill Gale the final revisions to the revised December 12, 2012 Hatchery Committees meeting minutes, regarding edits to a statement that Gale made during Chelan PUD's discussion on Methow spring Chinook production (Item I).* Geris said that she received Gale's approval via email on January 18, 2013, prior to distributing the final meeting minutes to the Hatchery Committees.

- *The Hatchery M&E working group will provide the revised Analytical Framework 5-Year Update to the Hatchery Committees for review prior to the February 20, 2013 meeting of the Hatchery Committees (Item III-A).*
  The updated revised draft Analytical Framework 5-Year Update was redistributed to the Hatchery Committees on January 25, 2013.
- *Craig Busack will provide Geris with the NMFS Production Advisory Committee (PAC) briefing documents on the draft Methow spring Chinook and steelhead HGMPs, for distribution to the Hatchery Committees (Item IV-A).*
  Geris said that Busack provided the documents and that they were posted to the ftp site and distributed to the Hatchery Committees on January 22, 2013.
- *Chelan PUD will draft a study plan to test Methow spring Chinook broodstock collection at the Rocky Reach Trap (Item VI-A).*
  Murauskas said that Chelan PUD is discussing the logistics of trapping fish at the existing trap, and added that trapping summer Chinook is being considered to test the functionality of the trap. He said that Chelan PUD still plans to provide the Hatchery Committees with a proposal prior to conducting any work.
- *Geris will set up a WebEx meeting for 11:00 am on Monday, January 28, 2013, for the CCT, Chelan PUD, Douglas PUD, and Grant PUD to discuss run-composition sampling at Wells Dam for summer Chinook upstream of Wells Dam (Item VIII-A).*
  Geris said that the meeting was scheduled as discussed.
- *Tonseth will provide Geris summer Chinook broodstock collection estimates for discussion during the run-composition sampling WebEx meeting scheduled for January 28, 2013, for distribution to the Hatchery Committees (Item VIII-A).*
  Tonseth provided these estimates on January 17, 2013.

II. NMFS

A. HGMP Update (Craig Busack)

Craig Busack updated the Hatchery Committees on several topics, including the timeline for review and current status of Mid-Columbia hatchery programs HGMPs, and the requirements for consultations on non-direct take hatchery programs. Busack began by noting that the draft Okanogan section 10(j) sufficiency letter will be sent for CCT review tomorrow. He said that the Methow spring Chinook and steelhead sufficiency letters are on hold pending resolution of comments received from the YN and USFWS on HGMP supplemental materials or supporting documents. Once these comments are addressed and differences are resolved, the Methow spring Chinook and steelhead sufficiency letters will be finalized. He indicated that no revisions will be made to the actual HGMP themselves, but that revisions only relate to the supporting documentation that includes new data collected after the HGMPs were originally submitted. Busack reported that the Wenatchee steelhead and Chiwawa spring Chinook draft BiOps are almost complete and will be sent for agency review after National Oceanic and Atmospheric Administration General Council (NOAA GC) legal review. He said that a new draft BiOp for the Nason Creek Hatchery Program will be out in early March 2013, and added that this is only the BiOp—not National Environmental Policy Act (NEPA) documentation. Kirk Truscott asked when a permit for the Nason Creek program will be required; Mike Tonseth responded that a permit will be needed by early May 2013. Busack also noted that the Leavenworth NFH spring Chinook and Entiat NFH spring Chinook draft BiOps are still in final review. He reminded the Hatchery Committees that the NMFS final review process is now taking longer than in the past due to greater scrutiny by the NOAA General Counsel (GC). He said that the Leavenworth spring Chinook and Entiat spring Chinook draft BiOps were originally anticipated to be completed this week; however, they have been delayed by further revisions.

Busack asked Truscott about the status of the Okanogan steelhead HGMP, to which Truscott replied that the CCT are still working on a draft. Busack said that NMFS needs a draft soon to stay on schedule. He also indicated that NMFS needs the draft Mid-Columbia coho HGMP and any revisions completed by March 2013. He also indicated that NMFS is requesting up-to-date information on all non-direct take programs because Permit 1347 (which covers those programs) is about to expire. NMFS is planning to issue a supplemental BiOp rather than issue a new BiOp and is completing the NEPA process again. Nonetheless, Busack said that this would require updating previous information. He said that NMFS already has a summer Chinook HGMP from Grant PUD, but they still need summer and fall Chinook HGMPs from Chelan PUD and Douglas PUD. Mackey asked about the nature of the new information and level of detail that NMFS would being requiring in the HGMPs. Alene Underwood added that Chelan PUD was under the impression that they were not required to submit a full HGMP. Busack replied that the requirement for a full HGMP was still under internal discussion, and a determination should be reached next week. He added that if a full HGMP is required, NMFS would like them as streamlined as possible.

Mackey asked about the timeline for completing a new HGMP, and asked if the Hatchery Committees' review process could be expedited to facilitate submitting a new HGMP to NMFS as soon as possible. He said he anticipated that the program descriptions would remain largely the same. Mike Schiewe asked if a 30-day review period would suffice; Busack replied that in order to finish the process by October 2013, and if a new NEPA is not required, then receiving the new HGMP within the next few months would be acceptable. Tonseth noted that permit 1347 coverage is primarily for brood collection and release, and he added that brood collection will be complete by mid-September 2013 and juvenile releases will not take place until spring 2014. He said, therefore, that a new permit is not technically needed until April 2014—Busack agreed, but added that he would still like to try to meet the October 2013 deadline.

Lastly, Busack said that he wanted to alert the Hatchery Committees about the need for bull trout consultation requirements associated with the non-direct take HGMP consultations. He explained that if a program needs a section 10 permit from NMFS, Biological Assessments (BAs) also need to be completed and approved by USFWS for bull trout and any other USFWS-listed species. This consultation is typically required to be complete before NMFS issues the section 10 permits. Busack clarified that development of BAs for USFWS-listed species is not NMFS' responsibility, and he recommended that the BAs are developed in coordination with USFWS in order to ensure that the documents meet USFWS' expectations. Busack explained that NMFS wrote a BA for Snake River Fall Chinook because USFWS agreement was needed quickly. He added that NMFS is still revising it to satisfy USFWS expectations. Bill Gale asked why NMFS is responsible for consultations with USFWS. Busack explained that when NMFS completes a section 10 consultation and issues a permit that NMFS becomes the action agency. He explained that for NMFS-listed species, NMFS consults with itself, and for USFWS-listed species, NMFS consults with USFWS. NMFS has no responsibility with respect to USFWS-listed species. Gale said that he can provide USFWS Entiat NFH and Leavenworth NFH BAs and BiOps to the Hatchery Committees as examples of consultation materials for bull trout. Busack suggested setting up a Hatchery Committees conference to further discuss needed input for HGMPs for summer/fall Chinook non-direct take programs. Gale and Busack agreed to provide Kristi Geris with a list of NMFS and USFWS staff that should be included in the conference call, and Geris will distribute a Doodle Poll to establish a time and date for a 1-hour discussion.

III. Chelan PUD

A. Wenatchee Steelhead Release Strategy (Josh Murauskas)

Josh Murauskas reviewed that, as discussed at the Hatchery Committees' November 14, 2012 meeting, hatchery steelhead smolts released into the Wenatchee River experienced an unprecedented and significant reduction in the combined probability of migration and survival in 2012. Murauskas said that the cause of these poor results will be difficult to discern because of many concurrent changes to program. He noted that the 2012 releases were the first after relocating the program from Turtle Rock to the Chiwawa Facility and after implementation of new release techniques. Murauskas said that based on 2012 steelhead survival results, Chelan PUD is advocating reverting back to the release strategy that was performed prior to 2012. A paper on the release strategy for hatchery-origin steelhead in the Wenatchee River Basin (Attachment B) was distributed to the Hatchery Committees by Kristi Geris on February 19, 2013.

Mike Tonseth noted that the previous release strategy (drop planting in the Wenatchee directly from Turtle Rock) was the only strategy available prior to relocating the program—not because it was preferred. Murauskas added, however, that the previous release strategy was also three times as successful. He also noted that residualism did not appear to be an issue in 2012 because less than one-tenth of a percent of passive integrated transponder (PIT) tags were detected after July 1, 2012, and that committee-approved population estimates of resident Oncorhynchus mykiss (O. mykiss) are low (e.g., Hillman et al. reports). He also noted that the smaller release groups and delayed releases that result from volitional releases may negate the desired benefits. Tonseth cautioned also that there are several factors that influence these results, such as differences in the behavior of hatchery-by-hatchery (HxH) and wild-by-wild (WxW) hatchery populations. He suggested that a larger sample size is needed prior to making any conclusions. Bill Gale noted that in Figure 5 of Attachment B (i.e., survival of juvenile steelhead under the new release strategy in 2012 by release group [circular vessels]), the non-migrant group migrated at a higher rate than typical; and Tonseth added that the term "non-migrant" needs to be carefully defined. Charlie Snow commented that hatchery operations can influence migration rates. Kirk Truscott suggested that releases from circular tanks need to be considered separately from releases out of raceways because they are reared differently, and, in 2012, releases from circular tanks were intentionally delayed. Tonseth said that in 2012, the raceway fish survived at a slightly higher rate than those from circular tanks. Mike Schiewe noted that this may be a good opportunity to develop a more rigorous study, and suggested testing different rearing strategies to gather empirical data. Keely Murdoch said that she would be supportive of conducting further testing prior to making a decision, and also recommended testing both HxH and WxW in each test group. Alene Underwood explained that Chelan PUD would like the Hatchery Committees to approve a new release strategy in time for 2013 releases, and Murauskas added that they also do not want the same results as last year. Murauskas also added that bird predation increases by May. He said that a recent query indicated that about 1,555 Wenatchee steelhead PIT tags have been collected from area bird colonies, and added that those are from later releases. Schiewe suggested that Chelan PUD should have a proposal ready for review by the Hatchery Committees' March 20, 2013 meeting, and Tonseth recommended that Chelan PUD consider impacts to the Chiwawa spring Chinook program. Murauskas said that he and Chris Moran will provide a proposal for evaluating release strategies for the Wenatchee Steelhead Program, including a consideration of how the release strategy for steelhead would affect the Chiwawa spring Chinook program, no later than one week prior to the Hatchery Committees' March 20, 2013 meeting.

B. Summer Chinook Brood Collection at the Eastbank Outfall (EBO) (Josh Murauskas)

Josh Murauskas said that Chelan PUD and WDFW are working to complete preparations to utilize the EBO as the primary broodstock source for the Chelan Falls summer Chinook program. Mike Tonseth added that summer Chinook broodstock collection at the EBO will be included in the 2013 Broodstock Protocols for Chelan Falls' broodstock collection. Chris Moran said that Chelan PUD and WDFW were also discussing potentially tagging fish and wiring the outfall to see how many and what type of fish are around the outfall. Murauskas added that the EBO might turn out to be a useful tool for stray management.

IV. Chelan PUD, Douglas PUD, and Grant PUD

A. 5-Year M&E Plan Update Discussion and Review of Draft Plan (Josh Murauskas and Greg Mackey)

Greg Mackey said that the updated revised draft Analytical Framework 5-Year Update was redistributed to the Hatchery Committees on January 25, 2013, with comments due no later than February 14, 2012. Mackey said that he received comments from Tracy Hillman, Andrew Murdoch, and Keely Murdoch. Andrew Murdoch's comments on the draft plan were distributed to the Hatchery Committees on February 15, 2013, and Keely Murdoch's comments on the draft plan were distributed to the Hatchery Committees on February 19, 2013. Josh Murauskas said that all comments received have now been incorporated into the draft plan, and he said that after he incorporates Chelan PUD comments, he plans to redistribute the revised draft plan to the Hatchery Committees for additional review. Mackey suggested scheduling another Hatchery M&E Workgroup meeting to decide on language and edits based on comments received. He added that most of the comments received were clarifications to explanatory text, and that not many significant changes were received.

Mike Tonseth noted that many of the substantial changes (e.g., revisions to the hypotheses) were reconciled during the last Hatchery M&E Workgroup meeting. Mackey said that a glossary and index were incorporated into the revised draft that was distributed on January 25, 2013, and he noted that those items still need to be further populated. Mike Schiewe reminded the Hatchery Committees that the target is to complete this plan by April 2013, prior to contracting for future years. Murauskas confirmed that the draft plan is on schedule to meet that deadline. Mackey said that a revised draft will be available for review prior to the Hatchery Committees' March 20, 2013 meeting, and then final comments and edits can be addressed prior to the Hatchery Committees' April 17, 2013 meeting, when the plan will be up for approval. Murauskas said that he will distribute a Doodle Poll to the Hatchery Committees to schedule a Hatchery M&E Workgroup meeting to prepare the final revised draft Analytical Framework 5-Year Update for Hatchery Committee review.

V. Douglas PUD

A. HETT Update (Greg Mackey)

Greg Mackey reminded the Hatchery Committees that when he was running the Predation, Competition, and Disease (PCD) risk models for Douglas PUD hatchery programs, he encountered problems when hatchery fish are smaller in size than wild fish, which resulted in the program crashing. Mackey said that he is having the code reviewed by a computer programmer to determine what type of effort would be involved to pinpoint the error. Once this information is available, future actions regarding the PCD Risk model can be decided upon.

B. Confidence in Estimation of Broodstock Numbers (Greg Mackey)

Greg Mackey said that he had recently completed exploratory work on broodstock calculations and summarized the work in a PowerPoint presentation on managing risk and expectations in broodstock collection (Attachment C), which was distributed to the Hatchery Committees by Kristi Geris on February 19, 2013. Mackey reviewed the basic broodstock calculation used to determine broodstock needed to produce a target production value. He noted that variability exists for each parameter used to calculate broodstock numbers, and this variability can be incorporated into broodstock calculations. He explained that using a deterministic approach would result in occasionally collecting too few, or too many broodstock, resulting in 10 percent less than the target production value may result in failing to meet mitigation obligations; whereas, broodstock numbers resulting in 10 percent greater than the target production value will likely result in overages. He then presented findings from a modeling exercise that explored the frequency at which a given program may be over or under acceptable bounds of production. Mackey noted that different programs may have a different emphasis on target production values (i.e., some programs may have an emphasis on not being below the lower 10 percent bound, versus others that may have an emphasis on meeting the target production value). He also noted that minimal changes to small programs, such as adding one female to the Twisp River spring Chinook program, could be significant in terms of resulting production values within, or outside, of the plus-or-minus 10-percent range. Mackey concluded that knowledge of these concepts and of the probability of possible outcomes can allow for more informed and effective management of broodstock collection. Kirk Truscott also recommended being aware that biases exist in brood collected data versus brood spawned data. Keely Murdoch said that the YN adapts their strategies based on data received in order to address variability in the YN's coho program. Mackey noted that a deterministic approach provides a number based on average conditions, while a probabilistic approach provides the number of broodstock needed, but also provides the likelihood of different, unintended outcomes, which managers can use to make better informed decisions. He said that he may develop a white paper on the results, and explore how this can inform future broodstock protocols.

C. Update on Wells Hatchery Modernization (Greg Mackey)

Greg Mackey said that Douglas PUD has been working with HDR Engineering, Inc., on planning for the modernization of the Wells Hatchery facility; and he added that Grant PUD has also been involved. Mackey said that the master plan is nearing completion (due March 2013); the plan will include a review and assessment of current infrastructure. He said that a groundwater well field assessment is also being conducted as part of bioprogramming to evaluate water needs for Wells Hatchery operations. He said that some of the wells may need to be upgraded. Mackey clarified that the facility is not undergoing a full rebuild, but it will be upgraded, as needed. He said that there are three major upgrades planned, including: 1) a new incubation building for anadromous programs (the existing incubation building will be used for the white sturgeon program and resident trout); 2) installation of fiberglass circular tanks for the Twisp and Okanogan steelhead programs; and 3) upgrades to the volunteer channel trap. Mackey said that a spawning facility will be developed that is integrated with the adult trapping and holding facility; however, those details are not yet worked out. Existing infrastructure such as the dirt ponds and Bureau ponds will be retained. He said that the next step will be to begin the design drawings, which he said should take about one year; and once completed, Douglas PUD will go out to bid for construction. He said that construction could potentially take a couple of years, as needed, to schedule around existing programs at the facility. Mackey said that once the Wells Hatchery

Modernization Master Plan is complete, he will provide the plan to the Hatchery Committees for review.

Keely Murdoch asked about the Hatchery Committees' opportunity to comment and approve the plan. Mackey said that all upgrades will meet or exceed current standard WDFW rearing requirements. Mackey said that Douglas PUD did not intend to seek Hatchery Committees' approval because the modifications are not for the purpose of improving program performance, but rather they are upgrading the facility because of aging infrastructure. Bill Gale said that the Hatchery Committees have commented on these types of plans in the past, and he asked Mackey what role he thought, if any, that the Hatchery Committees had in this modernization process. Mackey said that Douglas PUD is already meeting program targets, therefore, upgrades to Wells Hatchery is not a matter for the Hatchery Committees to approve. Gale replied that the Hatchery Committees have a role in how Hatchery mitigation is met—not just when targets are not being met. Schiewe said that once the master plan is complete, it will be available to the Hatchery Committees for review; and the Hatchery Committees' role in approving the plan can be further discussed at that time. Mackey agreed that upon review of the master plan by the Hatchery Committees, Douglas PUD will consider input from the Hatchery Committees. Tonseth said that he just wants to make sure that WDFW has enough time to review any proposed modifications, if needed, and to make sure program obligations will be met.

VI. CCT

A. Run-Composition Sampling at Wells Dam for Summer Chinook (Kirk Truscott)

Kirk Truscott reviewed the need for run-composition sampling for summer Chinook upstream of Wells Dam. He said that based on Josh Murauskas' power analysis that was distributed to the Hatchery Committees on February 5, 2013, a minimum of 38 adults from each group (hatchery and wild) is needed for sex and age analysis. Truscott also recalled that Mike Tonseth calculated that a sample size of roughly 500 fish will be needed for Carlton brood collection efforts. Tonseth said that given these numbers, the only issue that remains is how the sampling effort will be funded. Chelan PUD, Douglas PUD, Grant PUD, and the

CCT agreed to meet to discuss proportional responsibilities for funding run-composition sampling at Wells Dam for summer Chinook. Murauskas said that Chelan PUD will provide an update on the discussions at the Hatchery Committees March 20, 2013 meeting.

B. CJH M&E Presentation (Kirk Truscott/Keith Wolf)

Keith Wolf introduced himself and distributed to the Hatchery Committees a supplemental packet of CJH M&E information (Attachment D) including: 1) a glossary of terms and variables; 2) an overview of the CJH program; 3) highlights from the draft 2013 CJH Implementation Plan (not included in Attachment D); 4) CJH 2013 spring, summer, and fall Chinook production summary (also not included in Attachment D, but previously distributed to the Hatchery Committees on September 14, 2012); and 5) the CJH Annual Program Review (APR) agenda. Wolf said that he will provide Kristi Geris with all CJH presentation materials for distribution to the Hatchery Committees (*Note: Wolf provided the CJH presentation materials to Geris on February 21, 2013, which were distributed to the Hatchery Committees on the same day; the CJH M&E presentation is included in these meeting minutes as Attachment E*).

Wolf presented an overview of the CJH Research, Monitoring, and Evaluation (RM&E) Programs, including a workflow diagram, and program assumptions and principles. Kirk Truscott noted that the CJH program is not a typical hatchery program. He said that instead, the program focuses heavily on meeting natural escapement, percent hatchery origin spawners (pHOS), and proportion of natural influence (PNI) values in the Okanogan Basin. Wolf shared a picture of the Okanogan adult fish weir and said that there are plans to upgrade the weir this year, including modification of the shape of the weir to facilitate more efficient trapping, installation of additional cameras, and an increase in trap size. Wolf said that the weir will be monitored to ensure that impingement does not occur with the new design. He said that a newly installed PIT tag array is located approximately one mile downstream of the weir. Todd Pearsons asked what the purpose of this weir is, and Wolf replied that it is primarily for managing genetics and stock composition. Wolf added that broodstock collected at this weir have a higher likelihood of being Okanogan fish. Truscott said that the weir also serves an adult management purpose. Truscott said that other collection locations include the purse seine, tangle nets, and Wells Dam. Tonseth noted that CJH may not be a suitable location to collect natural origin brood, and Truscott said that the priority 2013 collection location is the purse seine. He said that if the broodstock quota is not being met by about August, other options will be investigated to collect the balance. Wolf said that the weir would be the last option for broodstock collection.

Wolf reviewed the CJH capture, tagging, and genetics programs. He said that in 2012, the CCT experimented with a new smolt trap that was not very successful. He said that trapping occurred at night, and all species were monitored. Tonseth asked if steelhead parr were PIT tagged, and Wolf replied that they are at the Omak facility; however, they are not PIT tagged at CJH. Tonseth asked if PIT tagging steelhead parr has been considered at CJH, and Wolf replied that it has been considered; however, trapping can only occur up to a certain flow, and there is high flow at CJH. Truscott said that the CCT is not planning to PIT tag steelhead in 2013. Wolf reviewed juvenile sampling objectives and said that the CCT were working on a new statistical approach to run regression analyses for abundance estimates.

To finish his presentation, Wolf reviewed the CJH field offices and acclimation sites. He said that details on tagging are well documented in the APR, and that adult fish management, data management, and other presentations and reports are available online at the CCT website. Lastly, Wolf encouraged Hatchery Committees members to attend the CJH APR in March 2013.

VII. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees meetings are on March 20, 2013 (Douglas PUD office); April 17, 2013 (Chelan PUD office); and May 15, 2013 (Douglas PUD office).

List of Attachments

Attachment A List of Attendees

Attachment B	Release Strategy for Hatchery-Origin Steelhead in the Wenatchee River Basin
Attachment C	Managing Risk and Expectations in Broodstock Collection Presentation
Attachment D	CJH M&E Supplemental Packet
Attachment E	Chief Joseph Hatchery M&E Presentation

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Josh Murauskas*	Chelan PUD
Alene Underwood*	Chelan PUD
Greg Mackey*	Douglas PUD
Todd Pearsons†	Grant PUD
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Keith Wolf	Colville Confederated Tribes
Lynn Hatcher*†	National Marine Fisheries Service
Craig Busack*††	National Marine Fisheries Service
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Chris Moran†	Washington Department of Fish and Wildlife
Jayson Wahls	Washington Department of Fish and Wildlife
Charlie Snow	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

†† Joined by phone for the HGMPs Update

Release strategy for hatchery-origin steelhead in the Wenatchee River Basin

J.G. Murauskas
Natural Resources Department, Chelan Public Utilities District, Wenatchee, WA

Summary–Hatchery steelhead smolts released annually into the Wenatchee River experienced an unprecedented and significant reduction in the combined probability of migration and survival in 2012 (≤ 55% compared to 2006-2011 averages). The decreased survival was in response to the relocation of the program and implementation of new release techniques advocated by fishery managers. While many variables may have influenced results, the release strategy likely compromised smolt survival without demonstrating any ability to screen fish that will fail to migrate. On account of these results, in addition to the absence of empirical data suggesting a preponderance of resident hatchery steelhead in the Wenatchee River Basin, a release strategy consistent with successful practices used in the past is recommended for 2013. This includes a forced release of all groups in early May, at the discretion of the hatchery staff. Further deviations from traditional practices should be properly vetted as described in the Rock Island and Rocky Reach Habitat and Conservation Plans.

Background discussion–Hatchery steelhead smolts *Oncorhynchus mykiss* are released annually at three locations in the Wenatchee River Basin (Basin) as mitigation for construction and operation of the Rock Island and Rocky Reach hydroelectric projects. Production targets were initially set at 400,000 smolts with the signing of the Rock Island and Rocky Reach Habitat and Conservation Plans (HCPs) in 2004 but have since been reduced to 247,300 smolts beginning with the 2012 releases. The program size allowed fishery managers to relocate the production to the Chiwawa Rearing Ponds (Chiwawa), an overwinter acclimation facility located at the confluence of the Wenatchee and Chiwawa rivers. The relocation from the former overwinter acclimation site on the mainstem Columbia River – Turtle Rock Island – was implemented in order to reduce stray rates of returning adults by extending the imprinting period in spawning tributaries.

Despite stray rates of returning adults from the past acclimation site, survival of hatchery steelhead smolts released in the Basin has been statistically greater and more consistent compared to other programs in the region (Figure 1). Within the Basin, survival is greatest for Wenatchee River mainstem releases compared to those in Chiwawa River and Nason Creek (Figure 2), though results may be confounded by brood origin (e.g., progeny of wild-origin brood are typically smaller and released in the upper Basin). Nonetheless, survival of hatchery-origin steelhead in the Basin has been greater than other programs and extremely consistent among locations, regardless of environmental conditions, such as outflow or temperature.

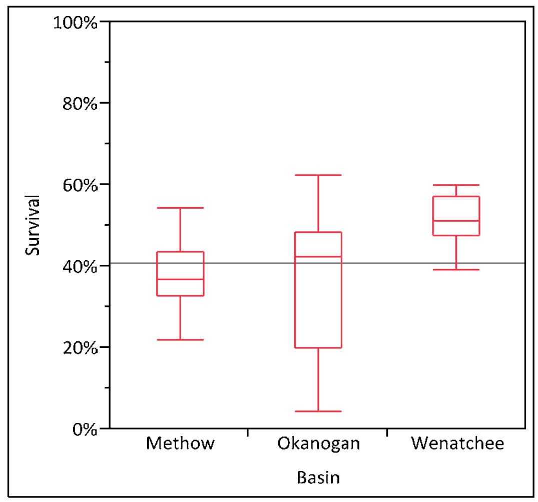


Figure 1. Box plot depicting the distribution of juvenile survival (to McNary Dam) of hatchery-origin steelhead released in the mid-Columbia River Basin tributaries, 2000-2010.

In addition to relocating the steelhead program to overwinter within the Basin, new operational release strategies were implemented in 2012. Specifically, smolts were provided the opportunity to volitionally exit their rearing vessel over a several week period. The fish that exited were considered to be displaying migratory behavior and were subsequently released into Nason Creek, Chiwawa River, or the mainstem Wenatchee River. Juvenile steelhead that remained at the end of the volitional release period were deemed non-migrants and released into the mainstem Wenatchee River. The intention of this strategy was to minimize the potential for resident *O. mykiss* in the Basin. The most significant changes resulting from this approach included more release groups, more handling, a reduced number of fish in each release group, and a prolonged release period spanning several weeks.

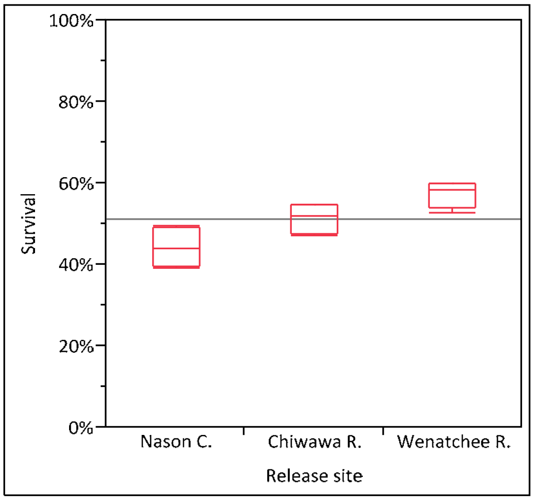


Figure 2. Box plot depicting the distribution of juvenile survival (to McNary Dam) of hatchery-origin steelhead released in the Wenatchee River Basin and tributaries, 2000-2010.

Monitoring data from the 2012 steelhead releases in the Basin showed a significant and unprecedented reduction in smolt survival to McNary Dam (Figure 3). The decreases from recent six-year averages ranged up to 55% for the largest release group in the Wenatchee River. Such dramatic reductions in survival were not expected given the favorable river conditions in 2012, and were also not observed in releases from other programs in the region (Murauskas, unpublished data).

Preliminary evidence suggests a few factors contributed to the decreased survival in 2012. Among these variables, the number of fish in each release group had the most significant effect on survival to McNary Dam. That is, the number of fish in each release group was positively correlated with survival for all releases ($p < 0.01$). Release groups with fewer fish performed poorly, even in the circular vessels that demonstrated exception survival in the past (Figure 4). Release date may have had an additional negative influence on survival: releases on May 8th survived at rates more than double those observed in releases from May 16th. However, given the negative influence of the smaller release groups, no statistical difference was detected among release time. Survival observed in groups released later in the month of May have performed poorly in the past (Murauskas, unpublished data) and are inconsistent with the natural migration of steelhead in the Basin. Smolt trapping efforts from the Wenatchee River (Monitor) between 2000 and 2010 indicate that the migration timing of wild steelhead smolts is May 4th on average (± 0.3 days SE), with a greater proportion of fish leaving prior (e.g., a negative skew). In comparison, hatchery-origin steelhead smolts captured at Monitor were observed May 11th (± 0.1 days SE) on average and were less variable and normally distributed compared to wild counterparts.

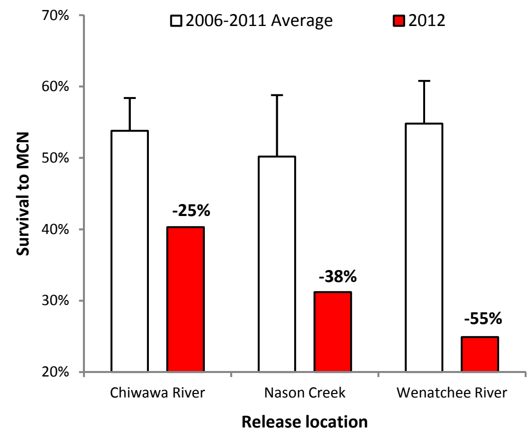


Figure 3. Juvenile survival (to McNary Dam) of hatchery-origin steelhead released in the Wenatchee River Basin and tributaries in 2012 relative to average survival observed between 2006 and 2011.

Other factors that may have influenced survival in 2012 include overwinter acclimation, brood origin, and size at release. No data suggest that overwinter acclimation could have affected survival. Several other programs are successfully overwintered and the highest smolt survival ever observed in steelhead released in the mid-Columbia River Basin (> 70% to McNary Dam) was from a group of steelhead overwintered at Chiwawa in circular vessels in 2010. Likewise, brood in 2012 was 100% wild-origin. While progeny of wild-origin brood may be smaller compared to progeny of hatchery-origin brood, these releases have performed well in the past (see Nason Creek releases above, comprised of 100% progeny of wild fish) and no evidence suggests this accounts for the decreased survival in 2012. Lastly, fish size was smaller in 2012. Releases from the large raceway were reported to average 12 fish per pound (FPP) and releases from the circular vessels were reported to average 8 FPP. While these were smaller than the targeted 6 FPP, they were not particularly different than releases in the past. Considering that the smolts reared in circular vessels were within the range of sizes observed in the past, it is possible that size could explain some of the variation observed in survival. However, survival to McNary Dam of the larger smolts released in the Wenatchee River, while greater than smaller smolts, were also extremely poor (28.8% ± 2.4% vs. 20.7% ± 2.3%, respectively).

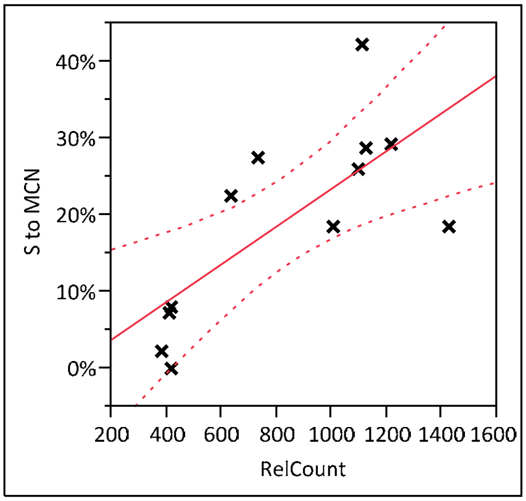


Figure 4. Survival to McNary Dam by number of fish in each release group of steelhead reared in circular vessels at Chiwawa in 2012 (p = 0.007). Release count represents PIT-tagged fish only, but is representative of the total group size assuming equal distribution of PITs.

The purpose for a volitional release strategy was to screen out non-migratory steelhead. Survival estimates from fish deemed to be migratory and non-migratory in 2012 showed that the release strategy was not effective. For example, in the fish reared in circular vessels, the last two releases on May 16th showed higher survival for "non-migratory" fish compared to those deemed migratory, and that release had a greater survival than the average survival of all volitional groups (n = 7, totaling 7,567 fish; Figure 5). The raceway-reared fish showed similar results, with downstream survival of fish deemed non-migratory showing no statistical difference than the average performance of the four volitional release groups. The last volitional release group and fish stocked into Blackbird Pond surprisingly had higher survival than the remaining volitional groups, though these differences were not significant (Figure 6).

Despite the intent behind the new release strategy, no evidence of excessive resident *O. mykiss* in the Basin exists. For example, a data query of steelhead PIT-tagged by Chelan PUD and released into the Basin (HUC = 17020011) between 2007 and 2011 (n=174,274) show that 0.1% of hatchery releases were detected anywhere in the system after July 1st and prior to their return as adults (Murauskas, unpublished data). Conversely, 2.9% of wild-origin fish are detected in the Basin after July 1st – a 25-fold increase compared to hatchery fish. While many of the wild-origin fish are tagged as parr and may not migrate the year they are tagged at the smolt traps, these results provide evidence that the likelihood of hatchery fish remaining in the Wenatchee River Basin is low. In addition, few resident *O. mykiss* are observed during monitoring and evaluation efforts that occur in the Wenatchee River Basin – none of which have been confirmed to be of hatchery origin (T. Hillman, personal communication). Exceptional survival to McNary Dam Wenatchee River Basin steelhead program is further evidence that the probability for resident *O. mykiss* is low.

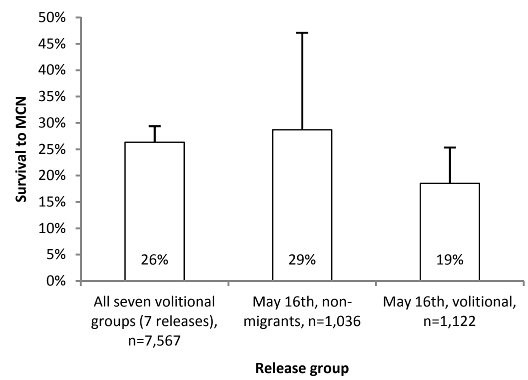


Figure 5. Survival of juvenile steelhead under new release strategy in 2012 by release group (circular vessels).

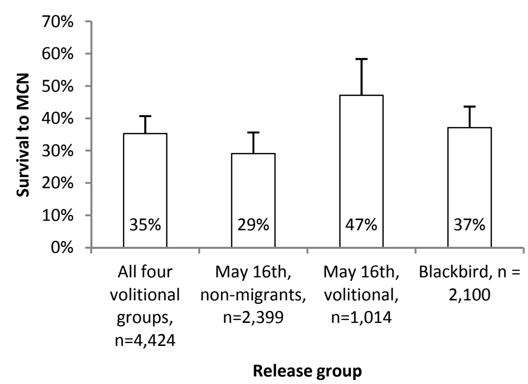


Figure 6. Survival of juvenile steelhead under new release strategy in 2012 by release group (raceways).

Attachment C

Managing Risk and Expectations in Broodstock Collection

Greg Mackey
Douglas PUD
HCP Hatchery Committee
February 2013

Broodstock Calculation

Basic Broodstock Calculation

Number of Females Collected X Pre-Spawn Survival X BKD Culling Survival X Fecundity X Egg to Release Survival = Smolts

Number of Females Collected → Assume 1:1 Sex Ratio → + Number of Males Collected = Total Broodstock

Attachment C

Broodstock Calculation

Data Sources

Number of Females Collected X Pre-Spawn Survival X BKD Culling Survival X Fecundity X Egg to Release Survival = Smolts

Pre-Spawn Survival	BKD Culling Survival	Fecundity	Egg to Release Survival
2011 M&E: Recent 5-Years	2011 M&E: Recent 5-Years	2011 M&E: Recent 10-Years	2011 M&E: Recent 5-Years

Broodstock Calculation

Example

55 females	X	0.979 pre-spawn survival	X	0.814 cull survival	X	3,702 fecundity	X	0.837 egg to release survival	=	135,000 smolts

Assume 1:1 Sex Ratio

+ 55 males = 110 broodstock

Broodstock Calculation

Example

55 females	X	0.979 pre-spawn survival sd = 0.09	X	0.814 cull survival sd = 0.133	X	3,702 fecundity sd = 201	X	0.837 egg to release survival sd = 0.037	=	135,000 smolts

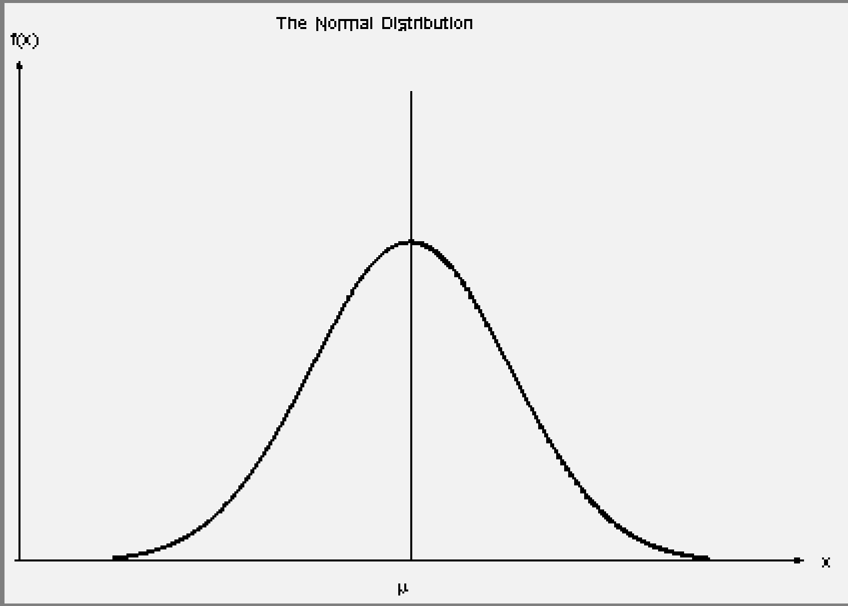
Assume 1:1 Sex Ratio

\+ 55 males = 110 broodstock

Attachment C

Normal Distribution

50 % above the mean
50% below the mean



Broodstock Calculation

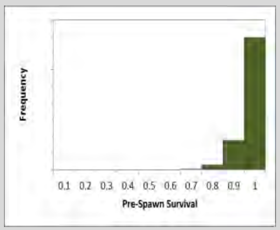
How often would a parameter be outside of the +/- 10% range?

55 females	X	0.979 pre-spawn survival sd = 0.09	X	0.814 cull survival sd = 0.133	X	3,702 fecundity sd = 201	X	0.837 egg to release survival sd = 0.037	=	135,000 smolts
		16.0 %		51.5 %		6.1 %		2.5 %		

Broodstock Calculation

Example of Uncertainty

55 females X



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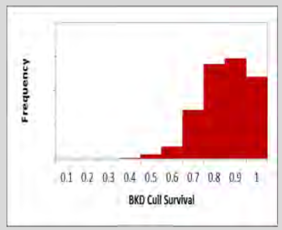

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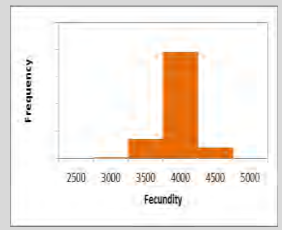
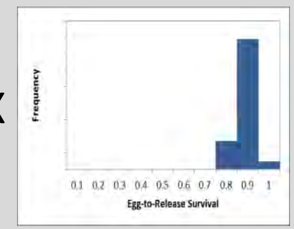


X



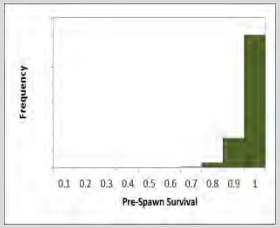
= 135,000 smolts +/- 95% CI

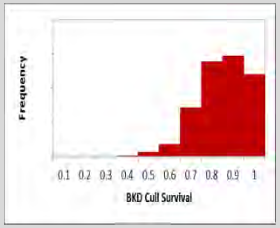
Assume 1:1 Sex Ratio

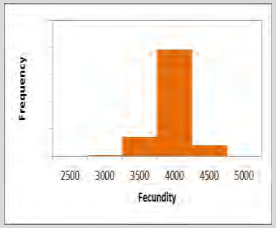
+ 55 males = 110 broodstock

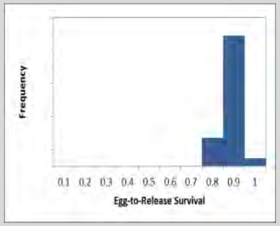
Broodstock Calculation

We can model this







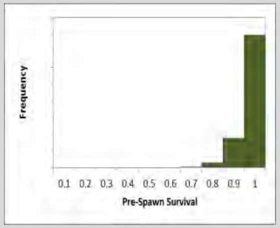


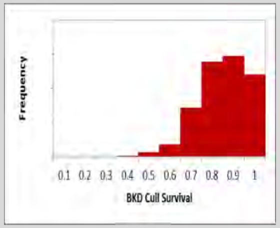
Random Draw

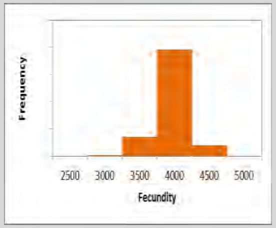
How many females? X Pre-Spawn Survival X BKD Culling Survival X Fecundity X Egg to Release Survival = 135,000 smolts +/- 95% CI

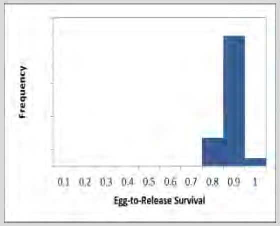
Repeat and Test Critical Values for Varying Numbers of Broodstock

Target Production Value
+10 % Production Value
- 10 % Production Value









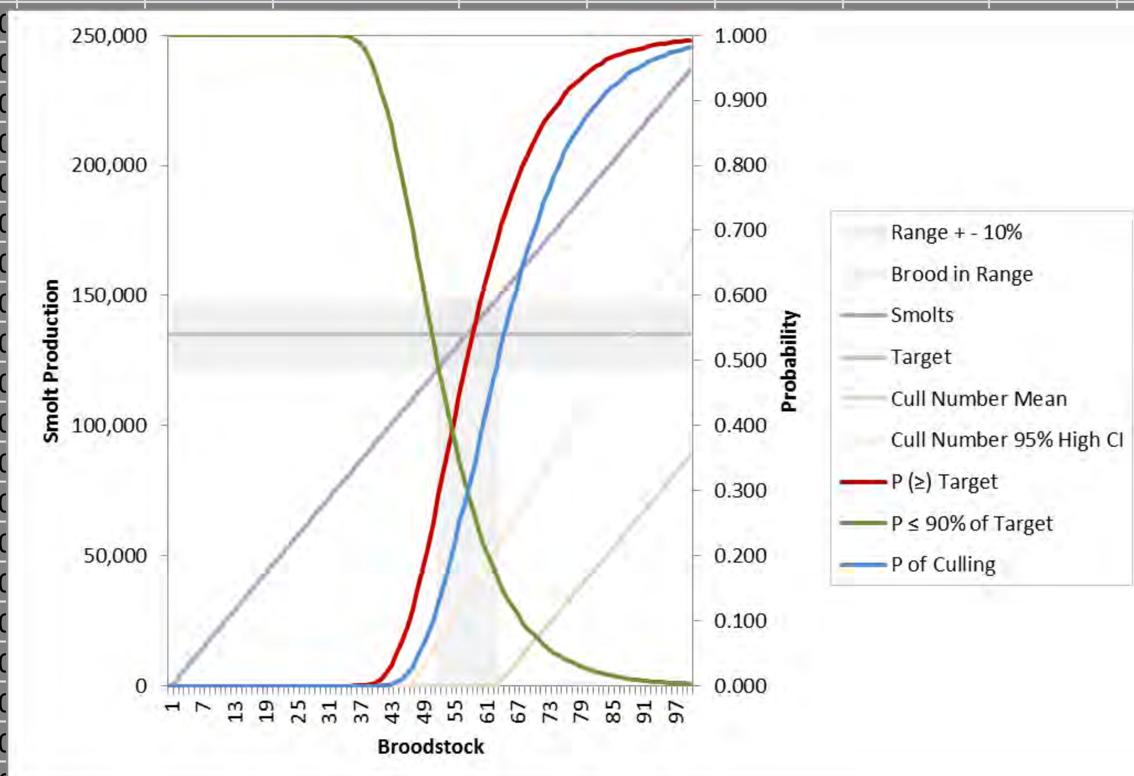
Random Draw

How many females? X Pre-Spawn Survival X BKD Culling Survival X Fecundity X Egg to Release Survival = 135,000 smolts +/- 95% CI

Attachment C

Results

Basic Broodstock Calculation



82,421	135,000	121,500	148,500	71,909	183,507,823	45,905	98,076	0	10,000		0.000	62	Fail
85,717	135,000	121,5									0.000	64	Fail
89,014	135,000	121,5									0.000	66	Fail
89,014	135,000	121,5									0.000	68	Fail
92,311	135,000	121,5									0.000	70	Fail
95,608	135,000	121,5									0.000	72	Fail
98,905	135,000	121,5									0.000	74	Fail
102,202	135,000	121,5									0.001	76	Fail
105,498	135,000	121,5									0.003	78	Fail
108,795	135,000	121,5									0.005	80	Fail
108,795	135,000	121,5									0.010	82	Fail
112,092	135,000	121,5									0.019	84	Fail
115,389	135,000	121,500	148,500	100,586	350,039,814	64,557	136,701	321	10,000		0.032	86	Fail
118,686	135,000	121,500	148,500	102,990	365,828,451	66,179	139,879	481	10,000		0.048	88	Fail
118,686	135,000	121,50									0.067	90	Fail
121,982	135,000	121,50									0.090	92	Fail
125,279	135,000	121,50									0.117	94	Fail
125,279	135,000	121,50									0.148	96	Fail
128,576	135,000	121,50									0.180	98	Fail
131,873	135,000	121,50									0.214	100	Fail
135,170	135,000	121,50									0.252	102	Fail
138,466	135,000	121,50									0.293	104	Meets Targ
141,763	135,000	121,50									0.332	106	Meets Targ
141,763	135,000	121,50									0.372	108	Meets Targ
145,060	135,000	121,50									0.411	110	Meets Targ
148,357	135,000	121,50									0.448	112	Meets Targ
151,654	135,000	121,50									0.487	114	Meets Targ
154,951	135,000	121,50									0.523	116	Meets Targ
158,247	135,000	121,50									0.559	118	Meets Targ
161,544	135,000	121,50									0.590	120	Meets Targ
161,544	135,000	121,50									0.622	122	Meets Targ
164,841	135,000	121,50									0.652	124	Meets Targ
168,138	135,000	121,50									0.681	126	Meets Targ
171,435	135,000	121,50									0.709	128	Fail
174,731	135,000	121,500	148,500	153,208	792,956,223	98,938	207,384	7,330	10,000		0.733	130	Fail

Key Concepts

1. Meet Program Target
2. Under -10% Bound: Fail to meet mitigation obligations
3. Over +10% Bound: Deal with overages – mine wild fish, culling etc.

These are likely to be competing objectives

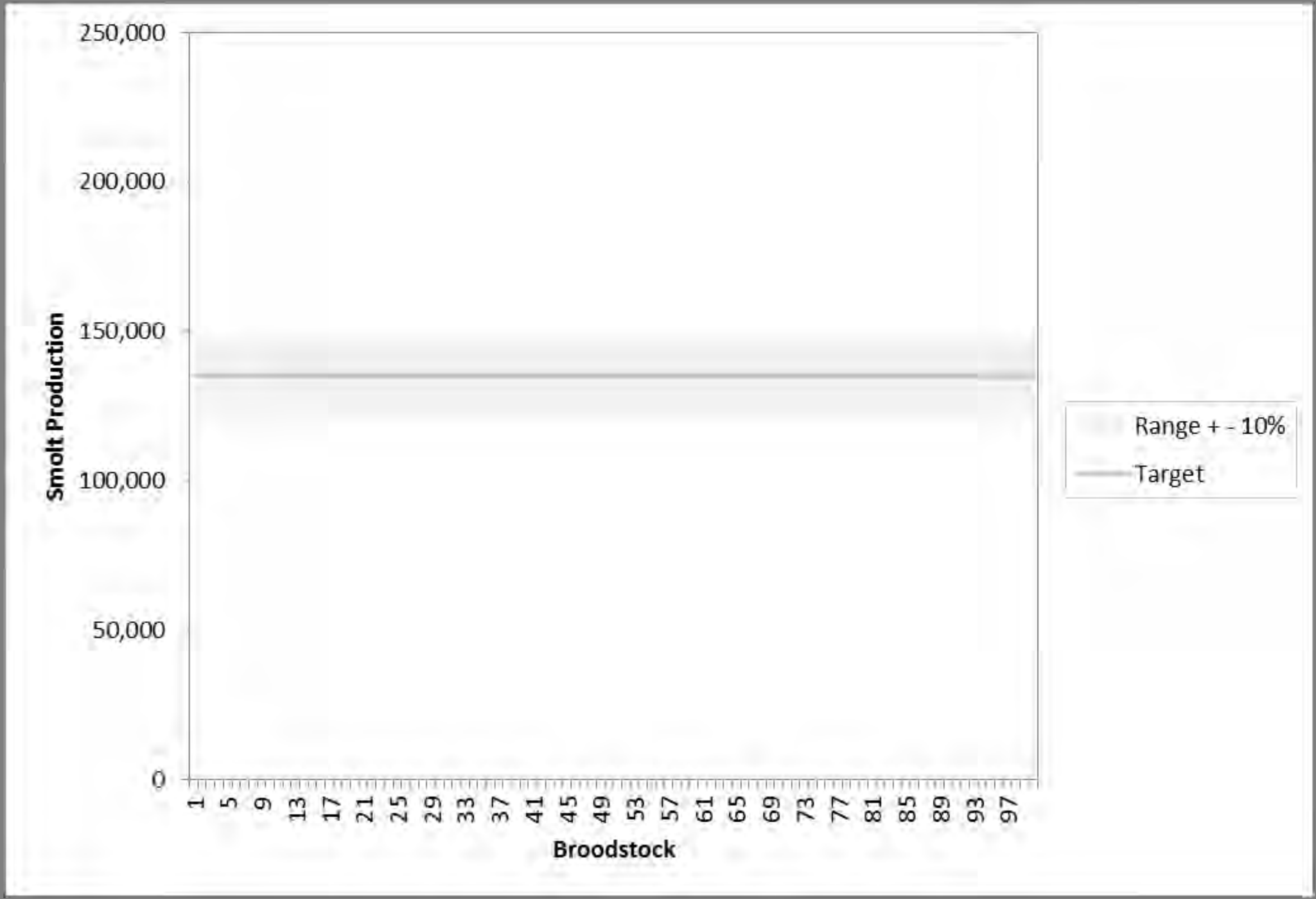
Key Concepts

1. Conservation Program
   a. Emphasis on not being below lower 10% bound
   b. Avoid mining wild brood
2. Safety-Net Program
   a. Emphasis on meeting program
   b. Avoid overages
3. Harvest Program
   a. Emphasis on meeting program
   b. Overages on non-listed species easier to deal with

Attachment C

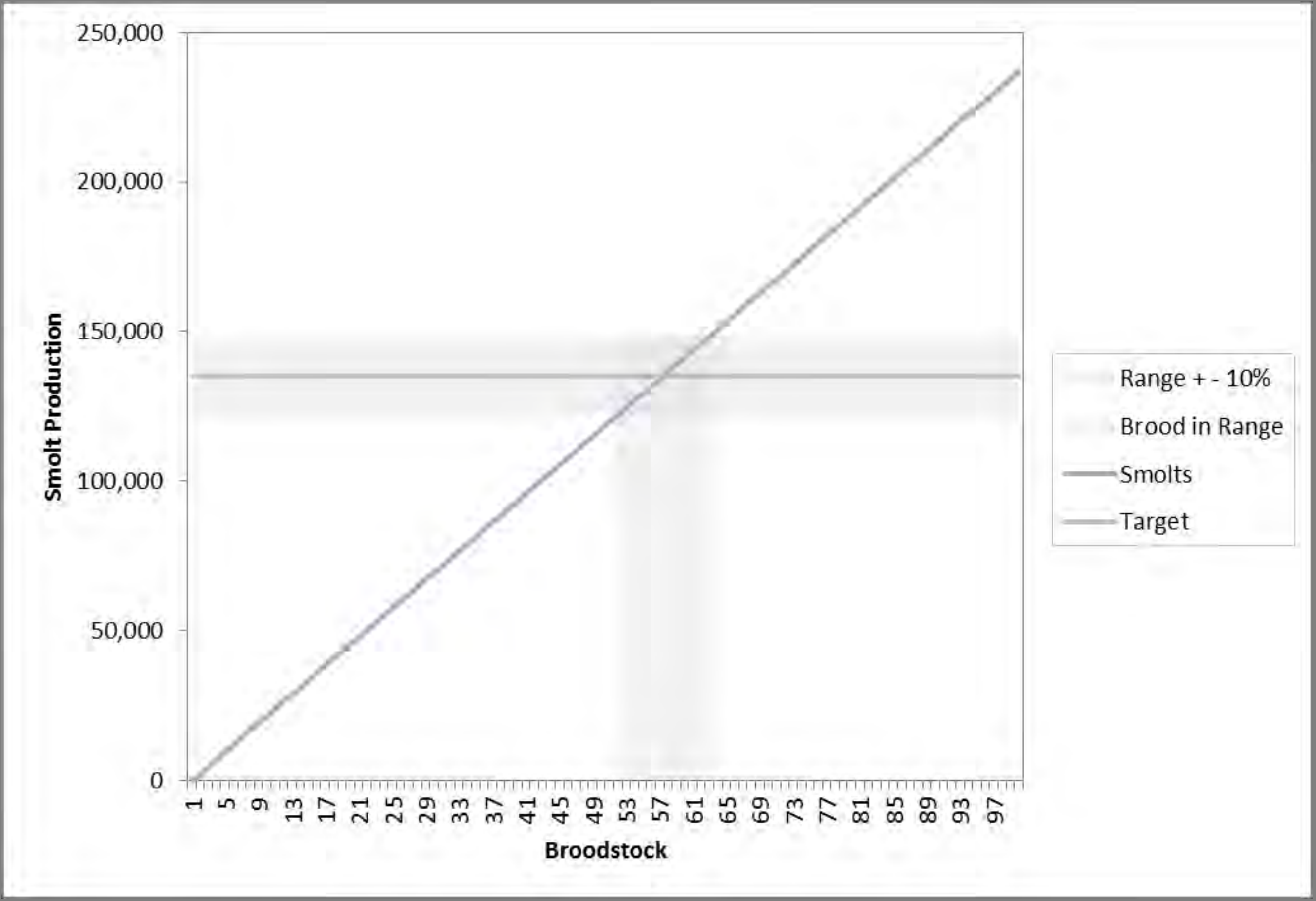
Results

Targets



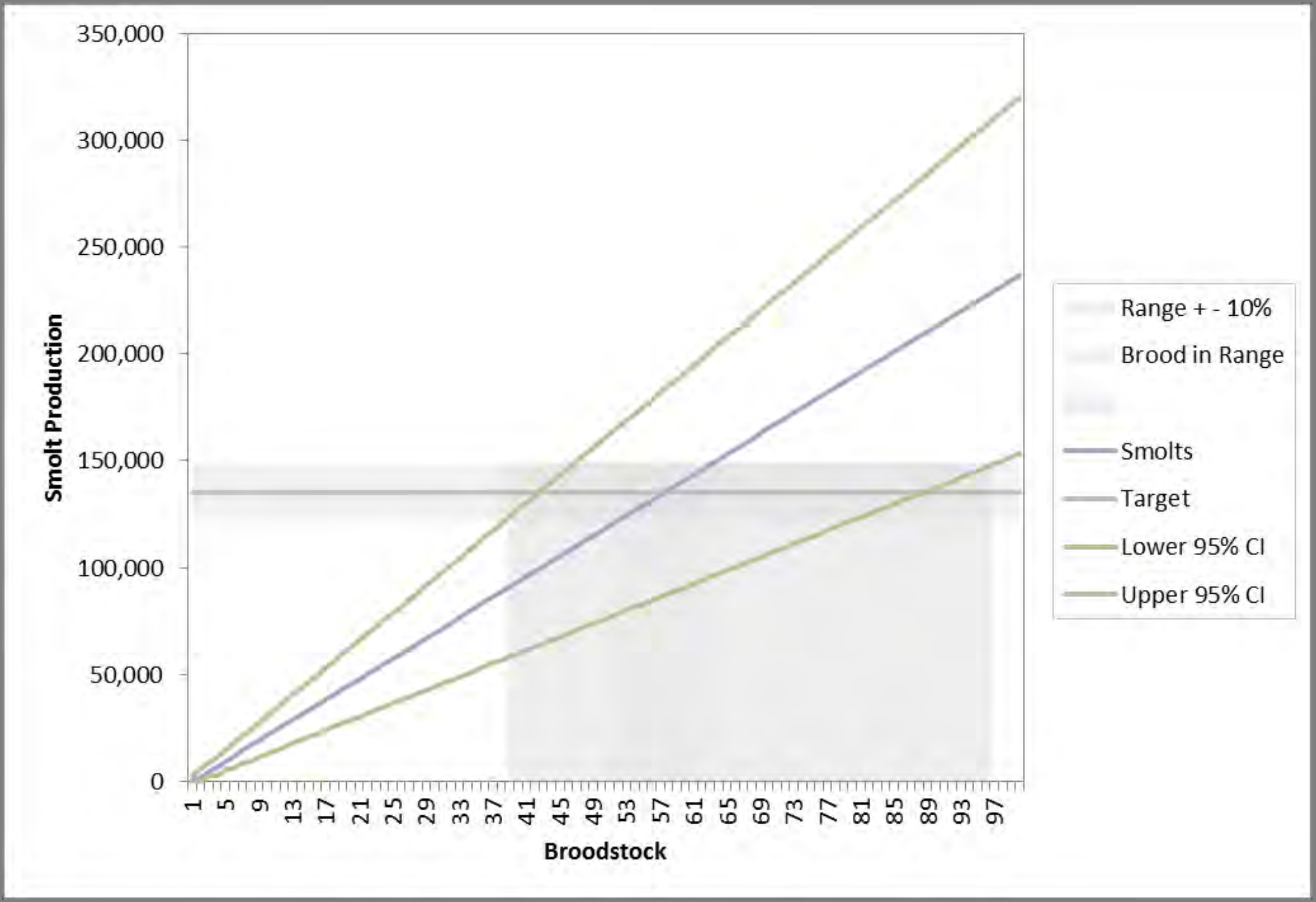
Results

Mean Response with Targets



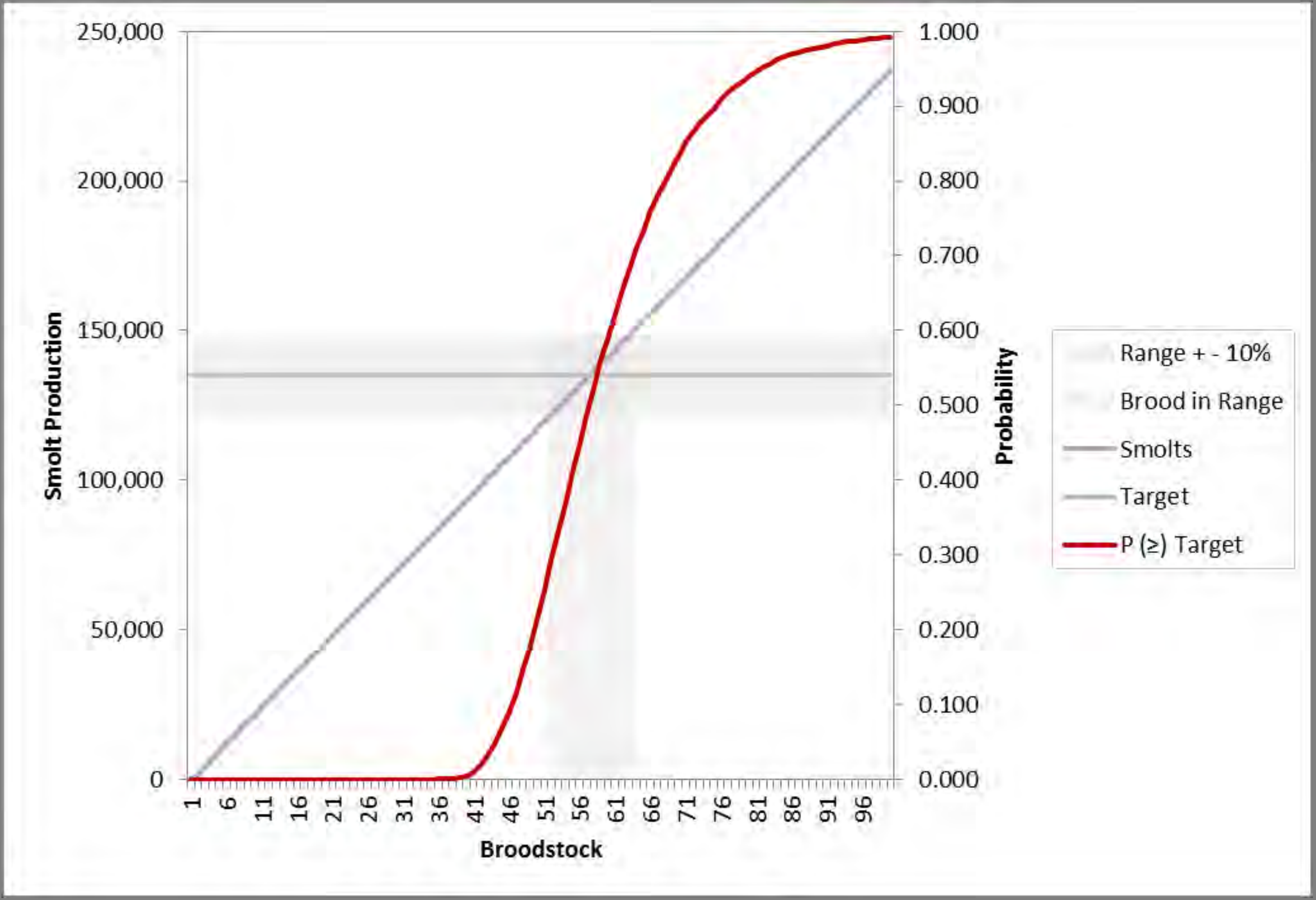
Results

Mean Response with Targets



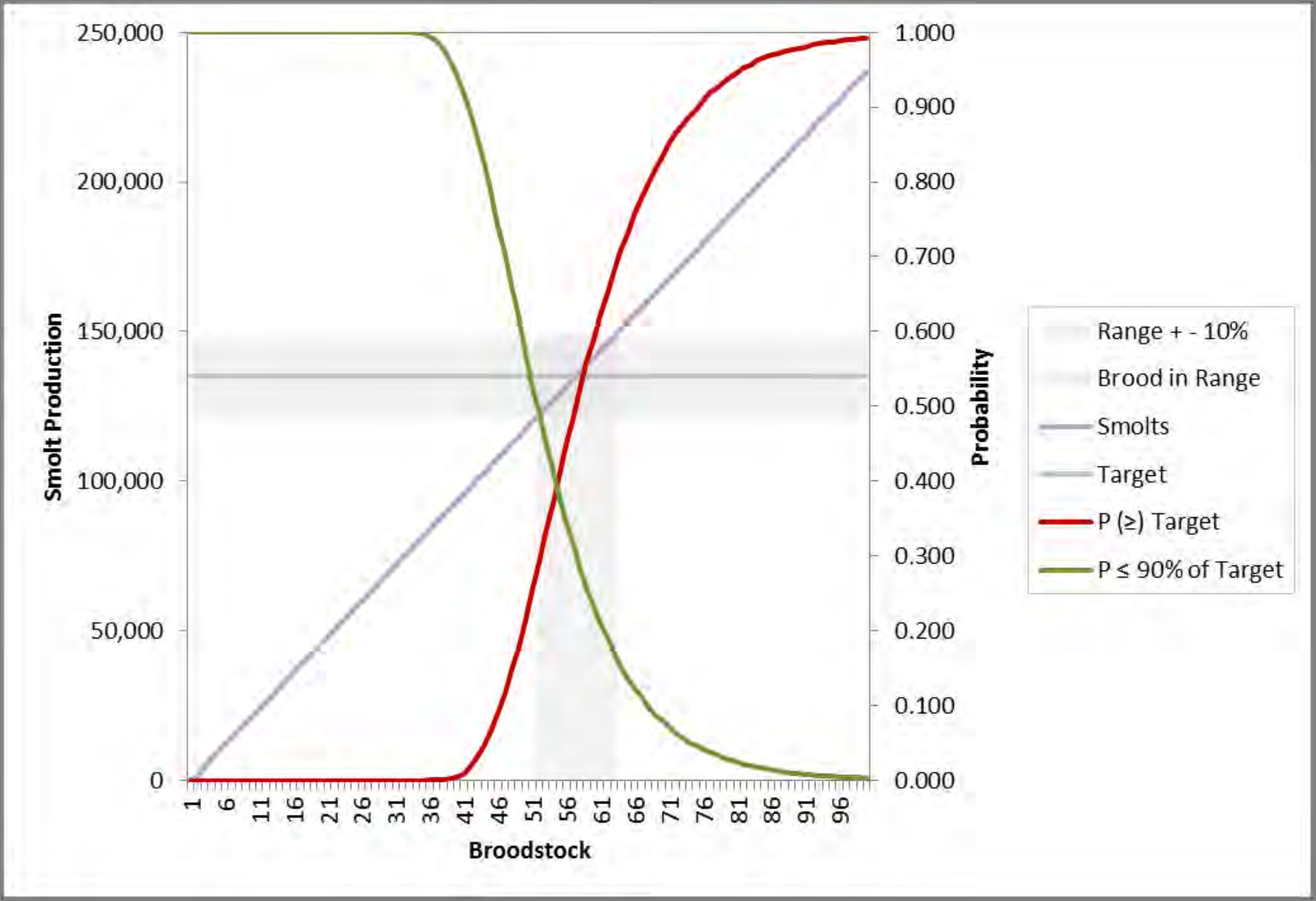
Results

Probability of Meeting Target



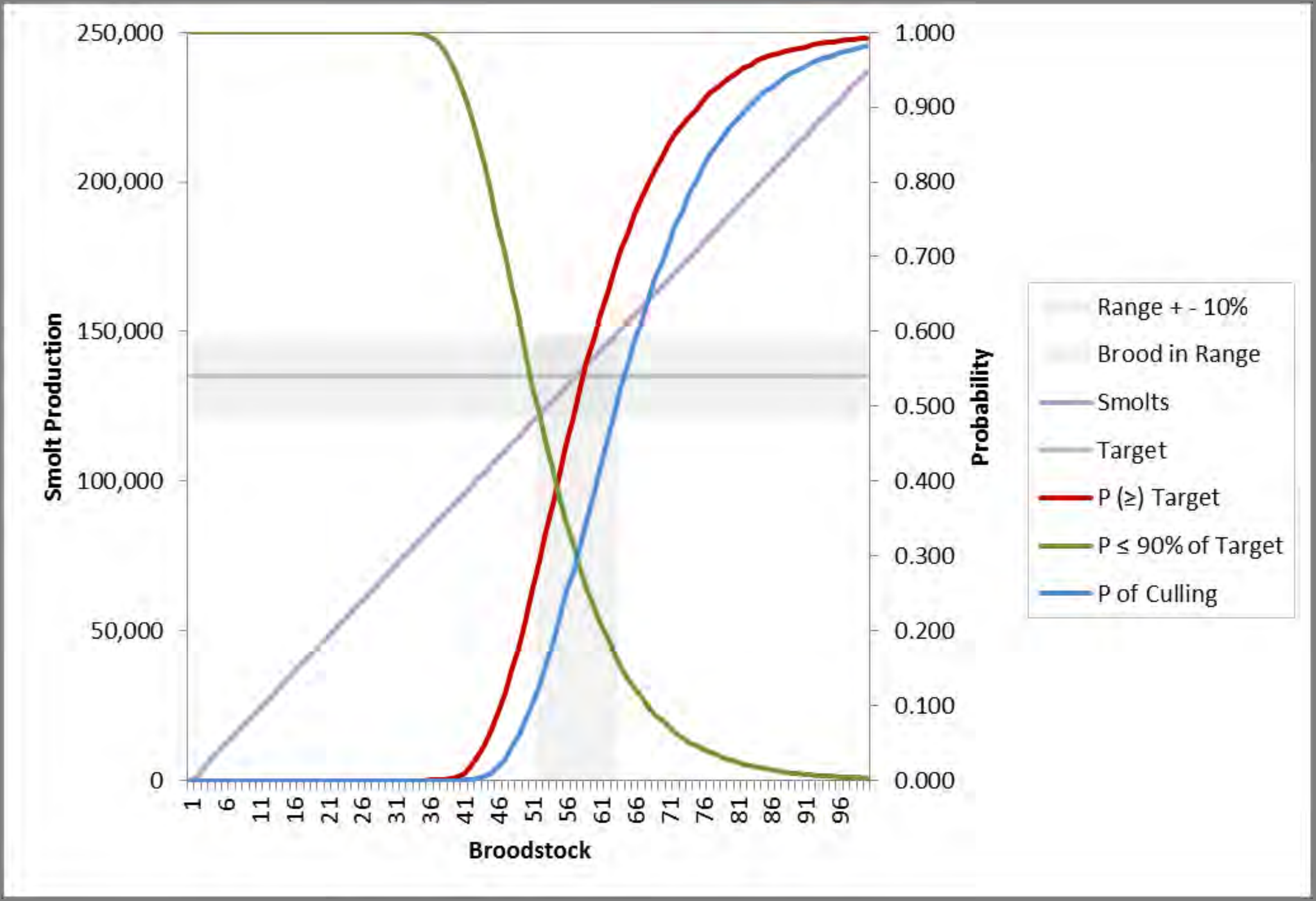
Results

Probability of Below -10% Target



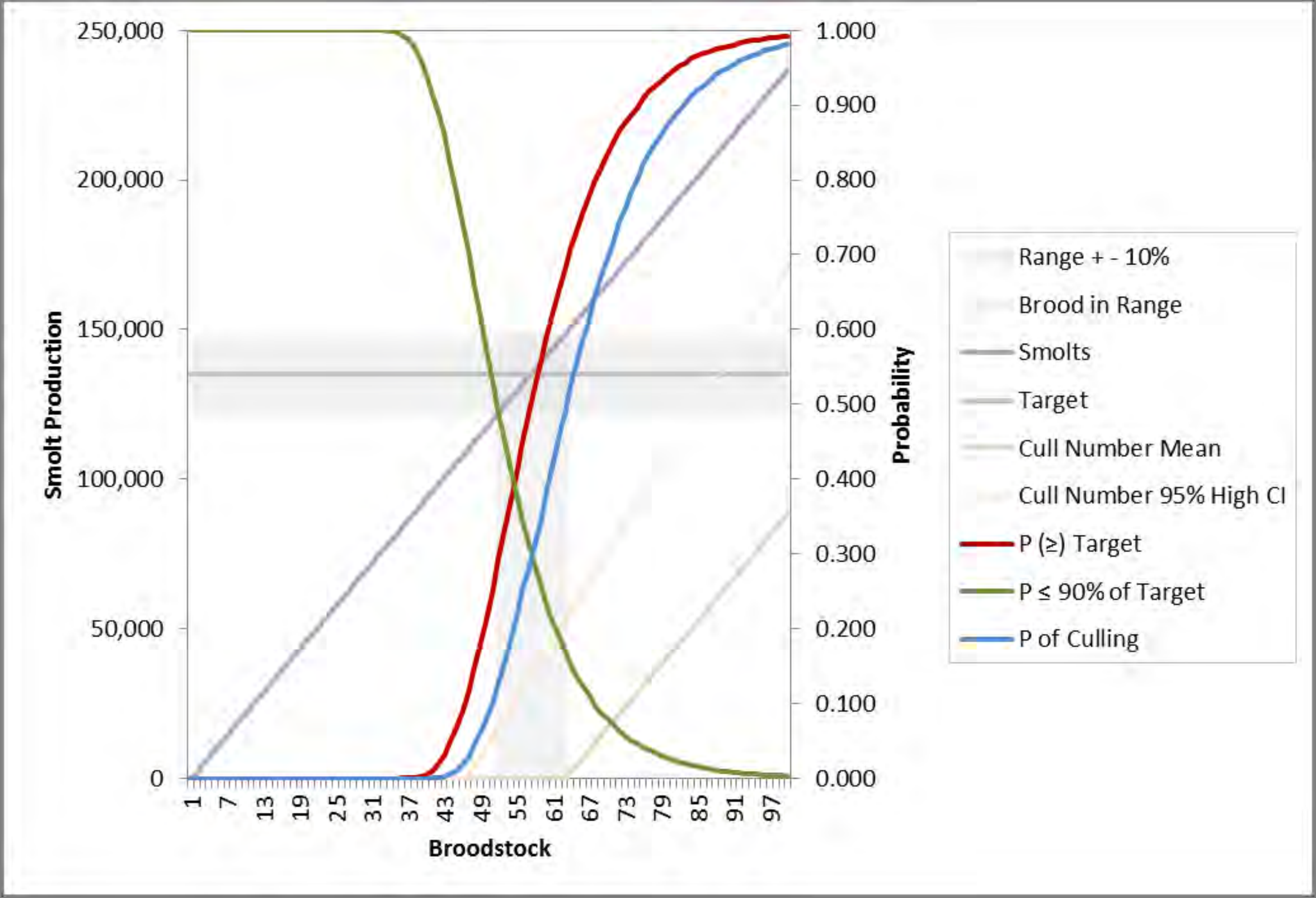
Results

Probability of Exceeding +10% Target



Results

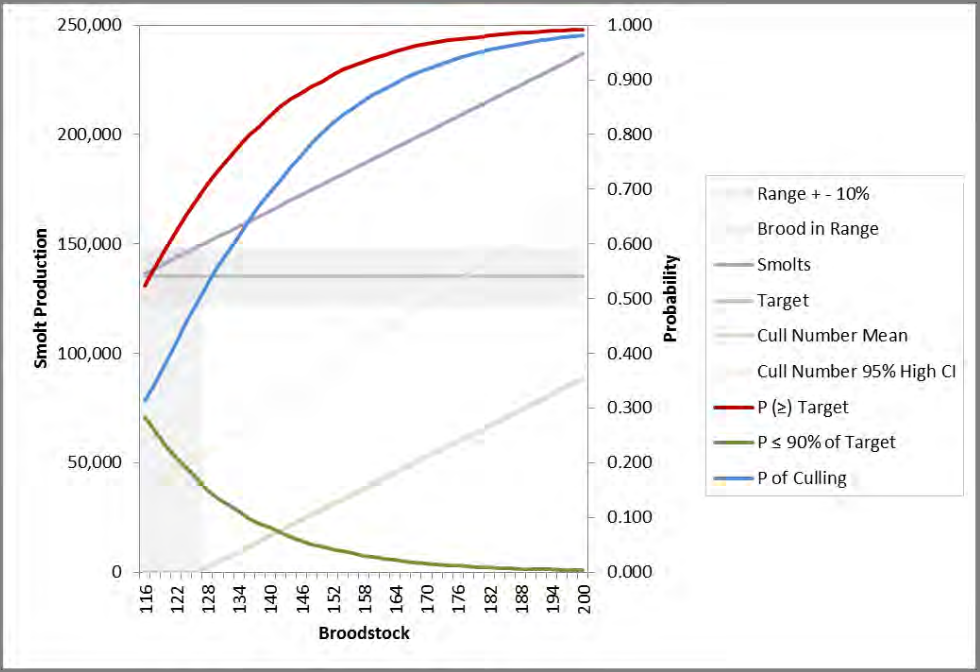
Probability of Exceeding +10% Target
Number to Cull at Mean and Upper 95% CI Response



Programs

Methow Spring Chinook- Conservation

P ≥ Target	Broodstock	Mean Production	Lower 95% CI	Upper 95% CI	P ≤ 90% of Target	P of Culling
0.500	116	136,471	87,768	185,024	0.284	0.313
0.600	122	143,636	92,654	194,686	0.210	0.419
0.700	128	150,811	97,239	204,397	0.151	0.526
0.800	138	162,765	104,829	220,491	0.088	0.671
0.900	152	179,506	115,741	242,856	0.042	0.821
0.990	194	229,721	148,660	310,106	0.005	0.975



Attachment C

Programs

Methow Spring Chinook- Conservation

1. Choose some targets for the program
   - Meet program 80% of the time
   - Overages less than 33% of time
   - Under program less than 5% of the time

Programs

Methow Spring Chinook- Conservation

P ≥ Target	Broodstock	Mean Production	Lower 95% CI	Upper 95% CI	P ≤ 90% of Target	P of Culling
0.500	116	136,471	87,768	185,024	0.284	0.313
0.600	122	143,636	92,654	194,686	0.210	0.419
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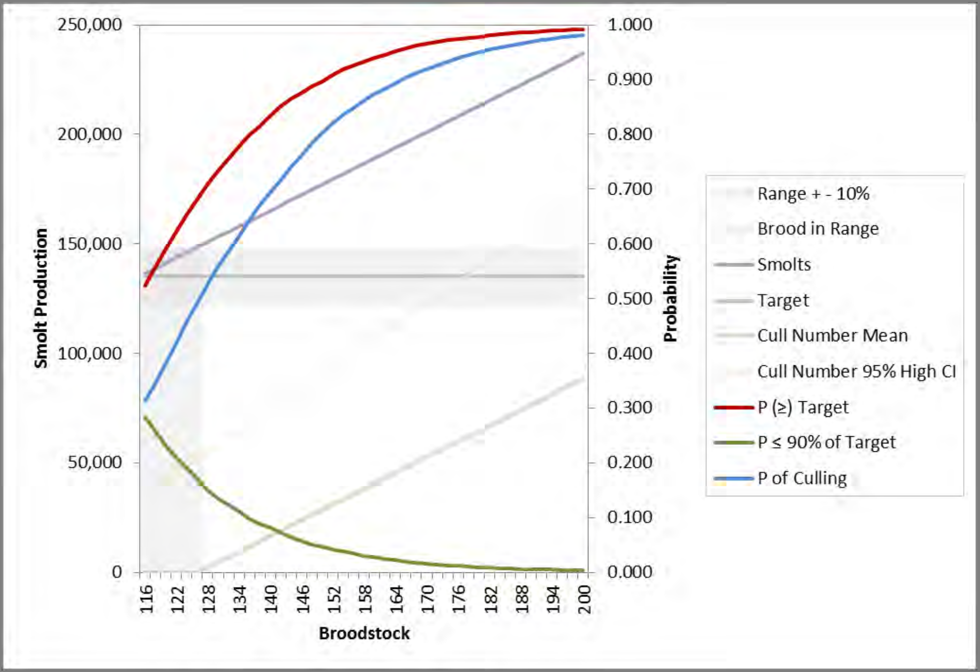

Attachment C

Programs

Methow Spring Chinook - Conservation

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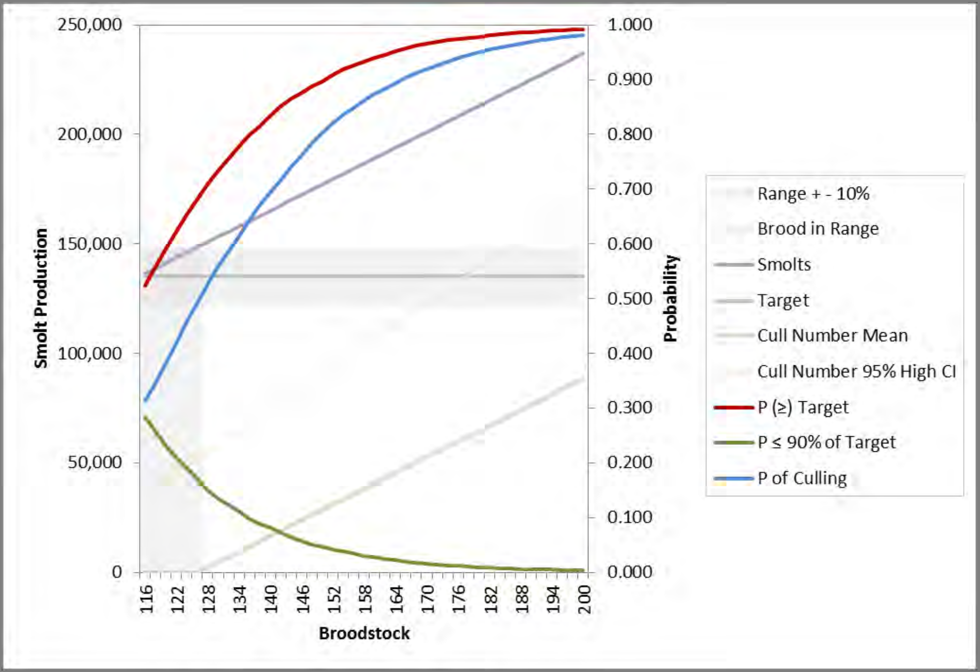
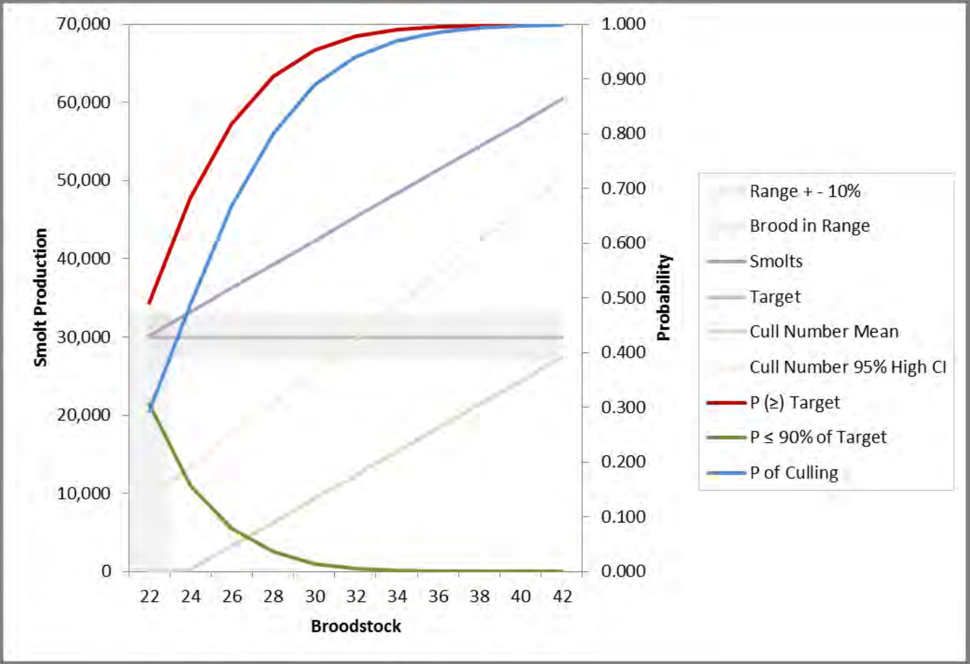


Programs

Twisp Spring Chinook - Conservation

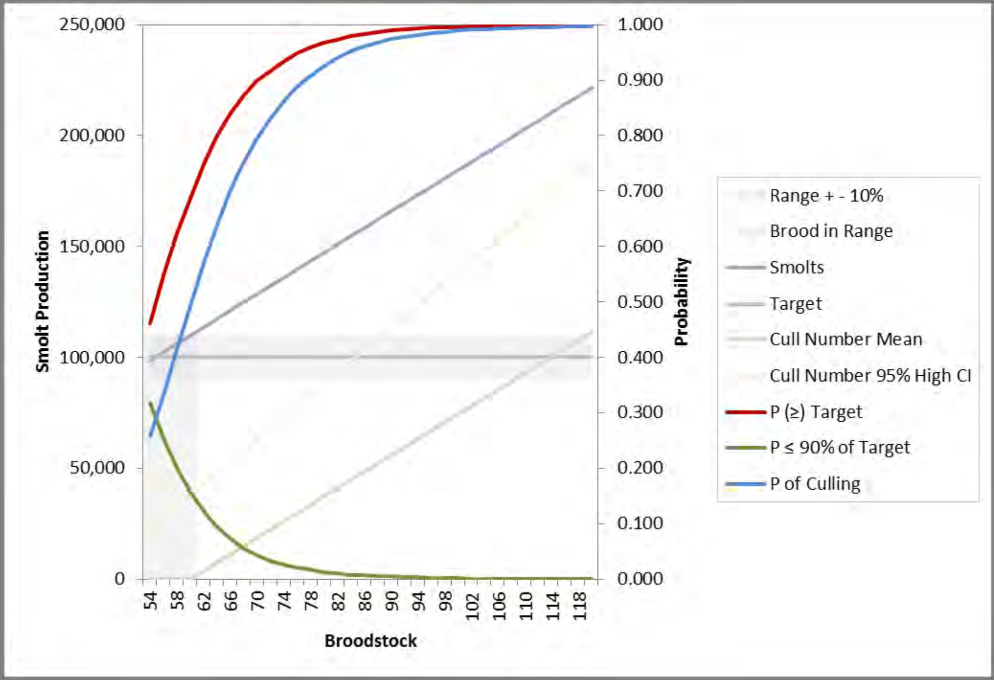
P ≥ Target	Broodstock	Mean Production	Lower 95% CI	Upper 95% CI	P ≤ 90% of Target	P of Culling
0.500	22	30,177	19,950	42,248	0.306	0.293
0.600	24	33,229	21,974	46,380	0.158	0.488
0.700	--	--	--	--	--	--
0.800	26	36,269	24,075	50,472	0.079	0.667
0.900	28	39,297	26,199	54,581	0.036	0.801
0.999	42	60,392	40,480	83,345	0.000	0.998



Programs

Methow Steelhead - Safety-Net

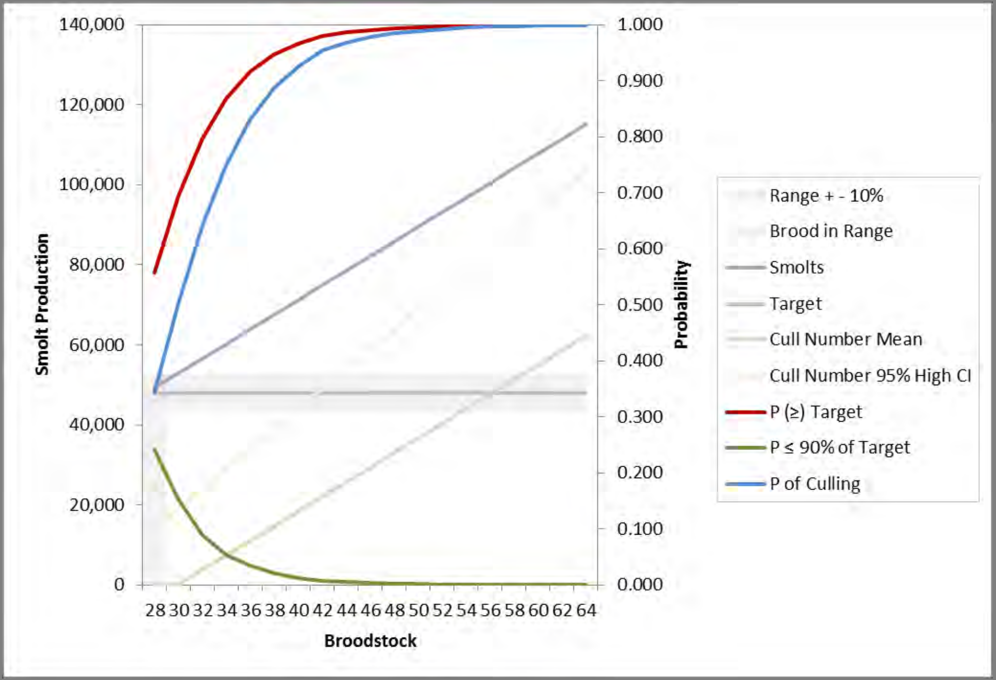
P ≥ Target	Broodstock	Mean Production	Lower 95% CI	Upper 95% CI	P ≤ 90% of Target	P of Culling
0.500	56	102,317	67,387	137,869	0.255	0.332
0.600	58	106,048	69,818	142,772	0.201	0.415
0.700	62	113,485	74,504	152,651	0.123	0.570
0.800	66	120,943	79,344	163,093	0.074	0.698
0.900	72	132,107	86,783	178,456	0.032	0.830
1.000	120	221,452	145,492	298,083	0.000	0.997



Programs

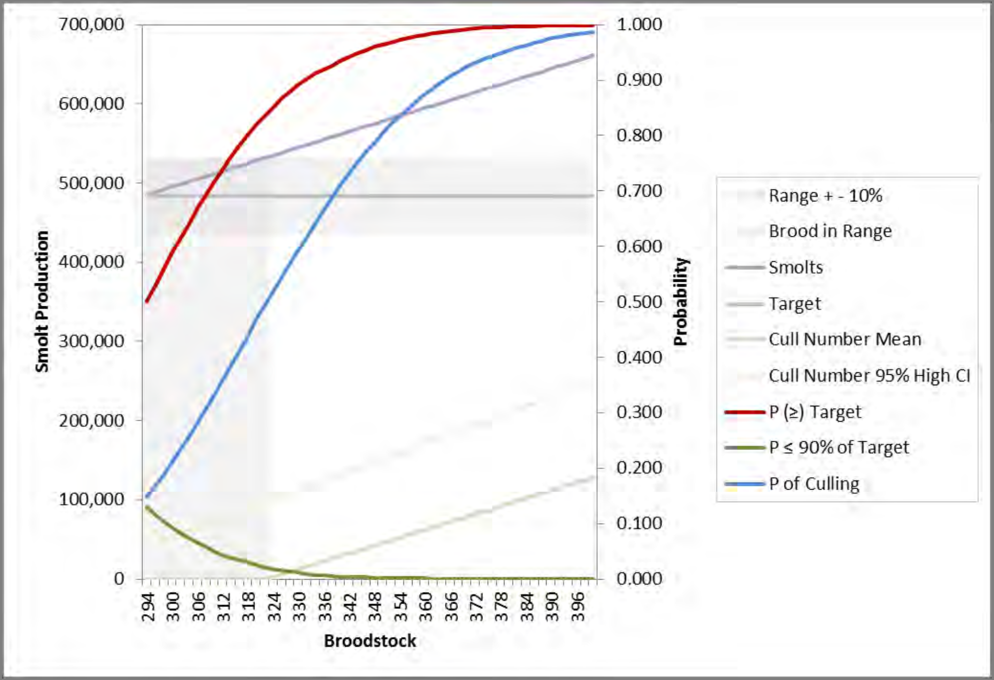
Twisp Steelhead - Conservation

P ≥ Target	Broodstock	Mean Production	Lower 95% CI	Upper 95% CI	P ≤ 90% of Target	P of Culling
0.500	28	49,303	32,120	67,034	0.242	0.344
0.600	30	52,939	34,597	72,065	0.152	0.503
0.700	32	56,590	36,880	77,033	0.089	0.642
0.800	34	60,241	39,248	81,923	0.054	0.750
0.900	36	63,896	41,661	86,831	0.034	0.831
0.999	64	115,062	75,110	156,313	0.000	0.999



Programs
Sub-Yearling Summer Chinook - Harvest

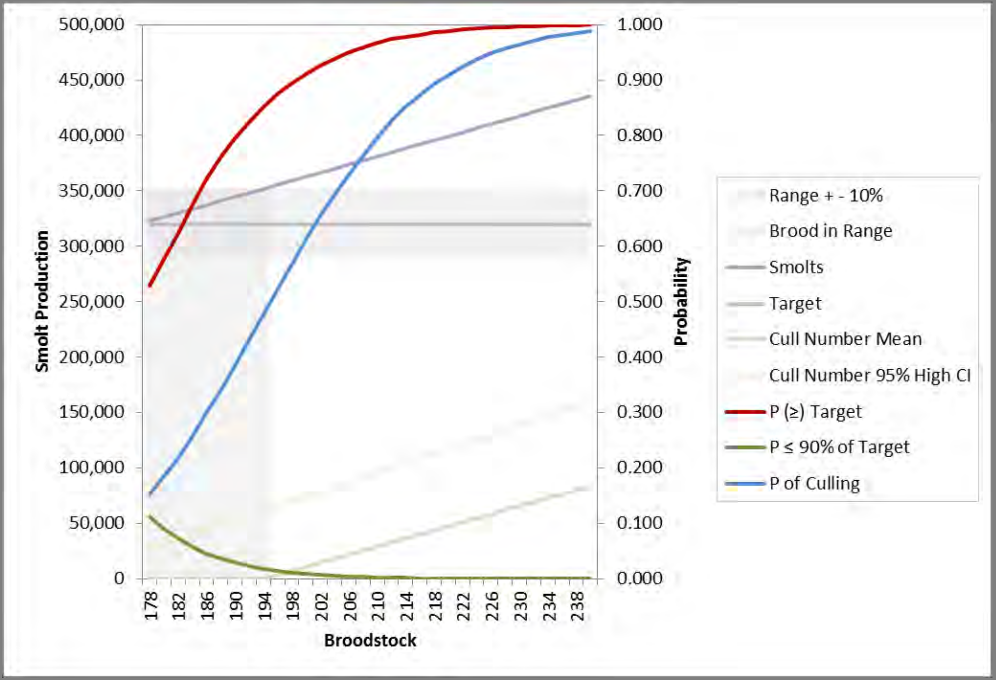
P ≥ Target	Broodstock	Mean Production	Lower 95% CI	Upper 95% CI	P ≤ 90% of Target	P of Culling
0.500	294	485,301	399,943	574,719	0.130	0.148
0.600	302	498,556	410,984	590,586	0.083	0.233
0.700	310	511,814	421,770	606,290	0.051	0.330
0.800	318	525,075	432,534	621,732	0.030	0.439
0.900	332	548,249	452,167	649,026	0.009	0.615
0.999	392	647,642	533,497	767,115	0.000	0.979



Programs

Yearling Summer Chinook - Harvest

P ≥ Target	Broodstock	Mean Production	Lower 95% CI	Upper 95% CI	P ≤ 90% of Target	P of Culling
0.500	178	322,641	267,523	379,331	0.113	0.152
0.600	182	329,939	273,337	388,051	0.072	0.218
0.700	186	337,244	279,479	396,702	0.045	0.299
0.800	192	348,167	288,693	409,735	0.023	0.432
0.900	200	362,752	300,708	426,928	0.009	0.612
0.999	234	424,725	351,939	499,572	0.000	0.978



Conclusions

- Meeting program targets carries considerable uncertainty
- Various objectives may be mutually exclusive
- Broodstock numbers can be specifically tailored to different types of programs using knowledge of uncertainty
- Knowledge of the probability of possible outcomes can allow more informed and effective management of broodstock collection.

Chief Joseph Hatchery
Annual Program Review (APR)

March 5-6, 2013 ***(CCT, State, Fed, PUD and stakeholder meeting)***
March 7-8, 2013 ***(CCT staff and advisor workshops)***

Chief Joseph Hatchery - Central Facility
38 Half Sun Way
Bridgeport, WA 98813

PREFACE:

The Annual Program Review (APR) is an integral component of the Chief Joseph Hatchery Project. The purpose of the APR is threefold: 1) to promote a shared vision for the Okanogan salmon resources and ensure an coordinated "all H" effort in working toward that vision, 2) to ensure that the best available science and most recent information is available to guide annual management decisions, and 3) to share results and accomplishments of the project with the broader community. To this end, the APR will begin with presentations on status and results from all activities supporting the Anadromous Fish Division and the Chief Joseph Hatchery Program (CJHP), followed by panel discussion and feedback from workshop participants. Information brought forward will help shape the action plan for the coming year. The Colville Tribes' Anadromous Fish Division is the host for this workshop, led by the CJHP Science Program.

DAY 1 – Tuesday, March 5: Program Overview and Tour

9:00 - 9:15 Welcome and CCT Policy Review of the CJHP. *Randy Friedlander*

9:15 - 9:45 Introductions, Agenda Review, Work Shop Logistics. *DJW staff*

9:45 - 10:00 APR Workshop Objectives and Structure. *Keith Wolf*

10:00 - 12:00 **P1:** Production Program and Facility Tour. *Pat Phillips, Kirk Truscott*

12:00 - 1:00 *Lunch:* Available for purchase on-site (sandwich and salad buffet)

APR Part 1 – Results of Monitoring and Research

1:00 - 1:15 Agenda Review. *DJW Staff*

1:15 - 1:45 **P2:** CJHP Research, Monitoring and Evaluation Program. *Keith Wolf*

1:45 - 2:30 **P3:** 2012 Field Data/Activities/Analytical Procedures. *Andrea Pearl, Lars Mobrand*

Area 1 - Habitat and Natural Production

2:30 - 3:15 **P4:** Habitat Restoration Projects and Future Plans. *Chris Fisher*

3:15 - 3:30 *Break*

3:30 - 4:15 **P5:** Habitat Monitoring, Status and Trends. *John Arterburn*

Area 2 - Pre-terminal Harvest and Out-of-Subbasin Survival

4:15 - 5:15 **P6:** Adult Management, Tribal and non-Tribal Harvest. *Mike Rayton and Others*
Includes 1) results for 2012, including what CCT harvest did to PNI (how did we move the needle?) 2) run forecast and allocations for 2013 3) anticipated harvest activities for 2013 4) ISIT modeling results to indicate if CCT harvests their allocation then will CJHP achieve its goals (how much do we think we are going to move the needle on PNI)

5:15 - 5:30 Summary of Day 1. *DJW staff*

<u>DAY 2 – Wednesday, March 6: Complete APR Part 1 and Start APR Part 2</u>

8:00 - 8:15 Review Agenda, follow-up from Day 1, Part 1

Area 3 - Other Research and Information

8:15 - 9:00 **P7:** Using eDNA for use in determining spring Chinook presence/absence. *Matt Laramie, USGS et. al.*

9:00- 9:45 **P8:** Tagging, Radio tracking and other fish tagging and interrogation activities. *Ryan Mann, WDFW and Casey Baldwin, CCT*

9:45 - 10:00 *Break*

10:00 - 10:30 **P9:** The 10(J) process for spring Chinook, HGMP and ESA. *Chuck Brushwood*

10:30 - 12:00 **Wrap-up APR Part 1.** The facilitator will invite a panel of reviewers for each of the three topics to address two questions:

- Given the information provided, what are the best estimates for the key assumptions (see Step 1 of the ISIT)?, and
- How could the M&E program be improved in the coming year? The facilitator will summarize the conclusions at the end of the first day.

12:00 - 1:00 *Lunch:* Available for purchase on-site (sandwich and salad buffet)

APR Wrap up- Part 1, Start APR Part 2 – Last Year's Operations Terminal Fisheries, Weir etc.

1:00 - 4:00 Results from 2012 operations. *Lars Mobrand, Kevin Malone, CCT Staff*

Sessions will cover terminal fisheries, operation of weirs and other capture activities, and hatchery operations. A special session will be devoted to run-reconstruction results and status and trend analysis. These sessions will be facilitated by the M&E leader. The objective for the second day is to address two questions: a) How can operations be improved in terms of effectiveness and efficiency in the coming year, and b) were biological targets met last year (and if not, why not?).

ISIT (In Season Implementation Tool)

- Review predicted Biological Targets for 2012
- Review 2012 escapement estimates (standard, CIR)
- Evaluate 2012 biological and management performance
- Review forecast for next year natural and hatchery fish returning
- Review decision rules for 2013

Hatchery and Weir 2013 Planning

- Identify 2013 Action Items related to:
- Weir (review and revise weir operations plan, changes for next year)
- Hatchery broodstock collection, any other details about integration planning
- Data needs

Harvest and Escapement Monitoring 2013 Planning

- 2012 Review
- Changes and plans for 2013
- Review and update weir and escapement management

4:00 - 4:30 **P10:** Program Implementation, Key Internal and External Partnerships. Acknowledgement of federal, state, PUD and other APR/CJHP participants and collaborators. *Kirk Truscott*

4:30 - 5:00 Summary of Day 2. *DJW staff*

DAY 3 – Thursday, March 7: APR Part 3 –Conclusions from Parts 1 & 2; provide updated plan for operating fisheries, weirs and hatchery activities for 2013. *Colville Tribes Staff and Key Advisors*

8:00 - 8:30 Review purpose and agenda for Days 3 and 4. *DJW Staff*

8:30 - 5:00 **WS1:** The CJH program management team (consisting of policy and technical personnel) will meet to review the implications of conclusions from day one on the Decision Rules (see Step 2 of the ISIT). The CJHP's RM&E lead scientist will present conclusions from days one and two, and will present alternative modifications to the Decision Rules. Note that the purpose of the Decision Rules is to assure that the long-term goals for conservation and harvest established in the hatchery Master Plan are met over time. The product of the third day will be an updated plan for operating fisheries, weirs and hatchery activities in the coming year. These activities will be triggered by the NOR run size prediction for the coming season.

8:30 - 11:30 Conclusions from days one and two. Alternatives and modifications to the Decision Rules. *DJW and CCT Staff*

11:30 - 12:30 *Lunch*

12:30 - 3:30 Review the implications of conclusions from day one on the Decision Rules. *DJW and CCT Staff*

3:30 - 5:00 Complete updated plan for operating fisheries, weirs, RM&E and hatchery activities in the coming year. *DJW and CCT Staff*

DAY 4 – Friday, March 8: APR Part 3 Conclusion. Update RM&E operational plan, staff assignments for year-end activities and implementing harvest, hatchery and RM&E plans for 2013. *Colville Tribes Staff and Key Advisors*

8:00 - 8:30 Follow-up from Day 3 and review agenda/purpose for Day 4. *DJW Staff*

8:30 - 12:00 **WS2:** On the fourth day, the M&E operational plan will be reviewed and updated. Staff assignments will be made regarding year end activities (i.e., finalizing annual reports) and for implementing harvest, hatchery and M&E plans for the coming year.

12:00 **Conclude.**

The Chief Joseph Hatchery Program – About Us.

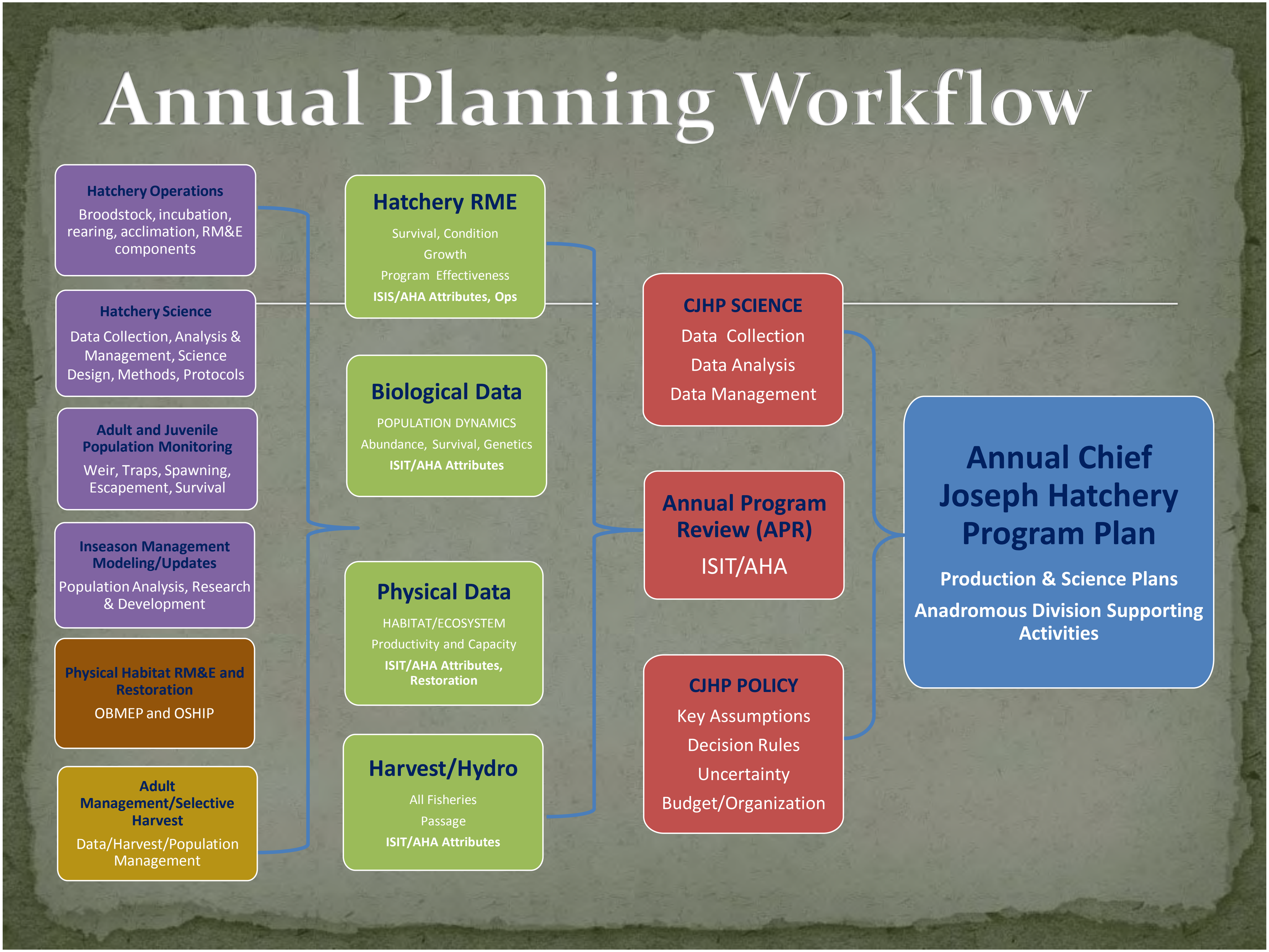
The Colville Tribes began designing the Chief Joseph Hatchery Program (CJHP) in the spring of 2001. The program is aimed at meeting trust obligations to the tribes for ceremony, subsistence, health and cultural purposes. This is the fourth hatchery obligated under the Grand Coulee Dam/Dry Falls project, originating in the 1940s. Because of World War II, the full mitigation responsibilities remained unmet until 2001. The hatchery began production operations in 2013, and the science component has been in place since 2010.

One of the guiding premises that the original planning team adopted was that production of salmon and steelhead at hatchery facilities reflects a considerable regional investment. It was further recognized that facility operation and production activities can have beneficial and or adverse biological and ecological implications extending far into the future. This embodies a new approach to managing and evaluating hatchery programs. Hence, fish culture, hatchery operations and the research, monitoring and evaluation components of the program are guided by rigorous, science-based planning and designs. Fish culture and science operations rely on modern management procedures and state-of-the-art facilities guided by a set of clear principles (See CJHP Principles under "Reports"). Data collection and analyses provide information that results in the use of learned knowledge that is applied in the operation of the hatchery, harvest programs, adult fish management and habitat restoration projects. The Colville Tribes Fish and Wildlife's Anadromous Division, including the CJHP, benefits from the program's impetus on adaptive management.

The Chief Joseph Hatchery is also the first of its kind to be structured under recommendations from the Congressional Hatchery Reform Act, the Northwest Power and Conservation Council's 4- Step Planning and Master Plan process and independent science review. Accordingly, the project has defined objectives; operations, data collection protocols and analytical and reporting processes that span fish culture and research activities. These are being implemented in a manner that restores the characteristics of the historical Okanogan River population of naturally-spawning salmon while meeting related regional and tribal program objectives.

To date, CJHP program efforts have led to improvements in juvenile emigration and baseline survival data sets. Testing of the Okanogan River Adult Fish Weir has advanced design, brood stock and adult management protocols. Other actions are strengthening database development, report programming and Annual Program Review value. Additionally, a new harvest monitoring program was developed and implemented in coordination with the State of Washington, the Anadromous Division of the CCT Fish and Wildlife Department and the Tribes ESA Natural Resources Enforcement Division.

Finally, The Chief Joseph Hatchery Program has completed major infrastructure and program development activities. This includes professional staffing and equipment procurement while completing construction and improving prevailing administrative procedures. The first adult fish returns from the program will begin in 2016.


Annual Planning Workflow
Hatchery Operations
Broodstock, incubation, rearing, acclimation, RM&E components
Hatchery Science
Data Collection, Analysis & Management, Science Design, Methods, Protocols
Adult and Juvenile Population Monitoring
Weir, Traps, Spawning, Escapement, Survival
Inseason Management Modeling/Updates
Population Analysis, Research & Development
Physical Habitat RM&E and Restoration
OBMEP and OSHIP
Adult Management/Selective Harvest
Data/Harvest/Population Management
Hatchery RME
Survival, Condition
Growth
Program Effectiveness
ISIS/AHA Attributes, Ops
Biological Data
POPULATION DYNAMICS
Abundance, Survival, Genetics
ISIT/AHA Attributes
Physical Data
HABITAT/ECOSYSTEM
Productivity and Capacity
ISIT/AHA Attributes, Restoration
Harvest/Hydro
All Fisheries
Passage
ISIT/AHA Attributes
CJHP SCIENCE
Data Collection
Data Analysis
Data Management
Annual Program Review (APR)
ISIT/AHA
CJHP POLICY
Key Assumptions
Decision Rules
Uncertainty
Budget/Organization
Annual Chief Joseph Hatchery Program Plan
Production & Science Plans
Anadromous Division Supporting Activities

Glossary of Terms and Variables

The following is a list of key terms and variables used in the CJHP:

- HOS = the number of hatchery-origin fish spawning naturally.
- NOS = the number of natural origin fish spawning naturally.
- NOB = the number of natural-origin fish used as hatchery broodstock.
- HOB = the number of hatchery origin fish used as hatchery broodstock.
- HORs = hatchery-origin recruits. The number of HORs equals the sum of HOS + HOB + hatchery-origin fish intercepted in fisheries.
- NORs = natural origin recruits. The number of NORs equals the sum of NOB, + NOS + natural-origin fish intercepted in fisheries.
- pHOS = proportion of natural spawners composed of HORs. Equals HOS/(NOS + HOS).
- pNOB = proportion of hatchery broodstock composed of NORs. Equals NOB/(HOB + NOB)
- PNI = proportion of natural influence on a composite hatchery-/natural-origin population. Can also be thought of as the percentage of time the genes of a composite population spend in the natural environment. Equals 1 - pNOB/(pNOB + pHOS).
- SAR = smolt to adult return.

Chief Joseph Hatchery Science Program Overview

Research, Monitoring & Evaluation Programs

Hatchery Coordinating Committee
February 20, 2013

Grant County PUBLIC UTILITY DISTRICT

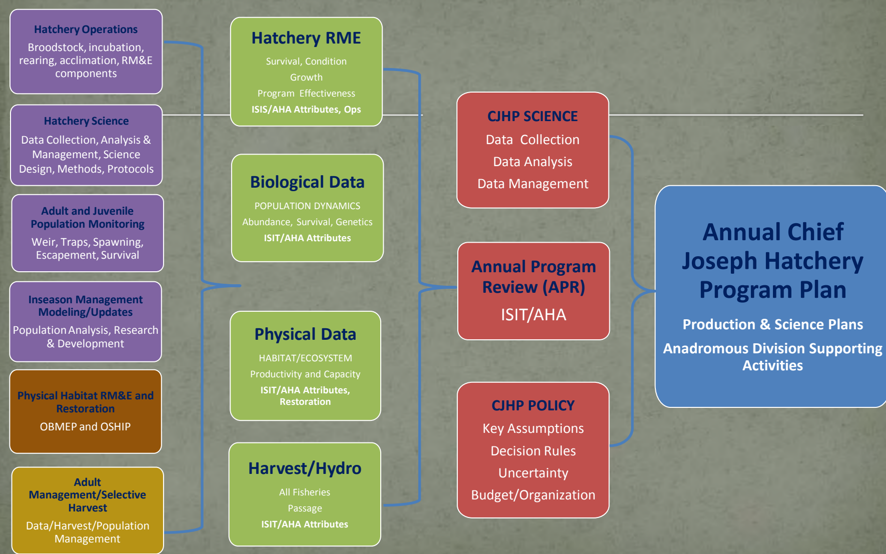
P.U.D. CHELAN COUNTY

DOUGLAS COUNTY PUD

CJHP RM&E Program Activity Overview

Hatchery Monitoring	Spawning and Carcass Survey	Adult Fish Management	Data Management
Okanogan Adult Fish Weir	Tag & Mark Programs	Habitat Status & Trend	**Analysis**
Juvenile Outmigration	Program Logistics	Habitat Restoration	**APR**

Annual Planning Workflow



Glossary of Terms and Variables

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6. NORs = natural origin recruits. The number of NORs equals the sum of NOB, + NOS + natural-origin fish intercepted in fisheries.
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8. pNOB = proportion of hatchery broodstock composed of NORs. Equals NOB/(HOB + NOB)
9. PNI = proportion of natural influence on a composite hatchery-/natural-origin population. Can also be thought of as the percentage of time the genes of a composite population spend in the natural environment. Equals 1 - pNOB/(pNOB + pHOS).
10. SAR = smolt to adult return.

Assumptions

The central, working premises for the Okanogan summer/fall and spring Chinook programs can be captured in four assumptions:

1) Under prevailing habitat and out-of-sub basin survival conditions and current hatchery and pre-terminal harvest regimes, the Okanogan Chinook population can sustain natural spawning escapements greater than 2000 adults.
2) The productivity of the natural population can be increased by reducing the influence of hatchery fish on the spawning grounds as prescribed by the HSRG guidelines for "primary" populations (HSRG 2004).
3) The abundance and composition of the natural spawning escapement and hatchery broodstock can be managed in the terminal areas to meet HSRG guidelines for hatchery influence on "primary" and reintroduced populations.
4) Improved spawner distribution provided by multiple acclimation site releases and improved spawning habitat quality and quantity within the Okanogan River Basin will contribute to increased natural origin abundance and productivity.

Principles

- Manage hatchery broodstock to achieve proper genetic integration with, or segregation from, natural populations;
- Promote local adaptation of natural and hatchery populations;
- Minimize adverse ecological interactions between hatchery- and natural-origin fish;
- Minimize effects of hatchery facilities on the ecosystem;
- Maximize survival of hatchery fish in integrated and segregated programs;
- Develop clear, specific, quantifiable harvest and conservation goals for natural and hatchery populations within an "All H" (Hatcheries, Habitat, Harvest, Hydro) context;

Principles cont.

- Design and operate hatchery programs in a scientifically defensible manner;
- Monitor, evaluate and adaptively manage hatchery programs;
- Institutionalize and apply a common implementation framework;
- Use the framework to set priorities, guide project review, and determine return on investments;
- Provide training for all program staff;
- Host the Chief Joseph Annual Program Review as part of the adaptive management principle, and
- Develop and maintain a state-of-the-art CJHP database and a highly functional web-presence.

Tasks, Objectives & Attributes

Summary – Bonneville Power Administration SOW

1) Manage and Administer Program
2) Transfer/Consolidate Regionally Standardized Data
3) Mark/Tag Animals
4) Population and Annual Run Monitoring and Assessment
5) Life History Characteristics
6) Genetics
7) Socio Economic Effectiveness
8) Data Analysis
9) Annual Program Review (the "APR")
10) Disseminate Raw/Summary data and Results (Annual Report)

Tasks, Objectives & Attributes

- Summary – CJHP Implementation Plan
  - 19 Objectives
  - 72 Tasks
  - 34 Logistics Categories
  - 27 Methods
  - 188 References and Citations
  - Annual Program Review–All Division
  - Annual RM&E Report
  - *See Handout*

CJHP RM&E Program Activity Overview

Hatchery Monitoring	Spawning and Carcass Survey	Adult Fish Management	Data Management
Okanogan Adult Fish Weir	Tag & Mark Programs	Habitat Status & Trend	**Analysis**
Juvenile Outmigration	Program Logistics	Habitat Restoration	**APR**

Central Facility – Bridgeport, WA

Example Attributes Monitored

- Brood Condition
- Mortality – all life stages
- Growth
- Tags and Marks
- Parentage
- Health
- Fecundity
- Returns to Hatchery Ladder
- *Et. cetera*

Okanogan Adult Fish Weir

Objectives and Attributes Monitored

- Adult Management – *objective: PNI, pHOS, harvest*
- Brood Stock Collection – *objective: genetics, race*
- Weir Efficiency
  - Capture
  - Transport - to hatchery
  - Release - of adult NOR's, retention of HORs', etc.
- Weir Effects
  - Delay
  - Mortality
  - 24/7 video observations, 5d/daylight direct observations
  - Passage of non-target species
  - Ecological Site Conditions, etc.
- Permanent Design and Protocols

Capture, tagging, genetics, etc.

Juvenile Sampling Objectives

- Stock Composition
- Species Composition
- Timing (e.g., sockeye for hydro passage programs)
- Abundance Estimates (new “R” based approach)
- Baseline NOR abundance v. future total abundance
- HOR release survival, timing and condition
- Baseline Genetics v. future genetic profile’s
- Survival Estimates
- Tagging 25k NOR CK.

Redds and Deads

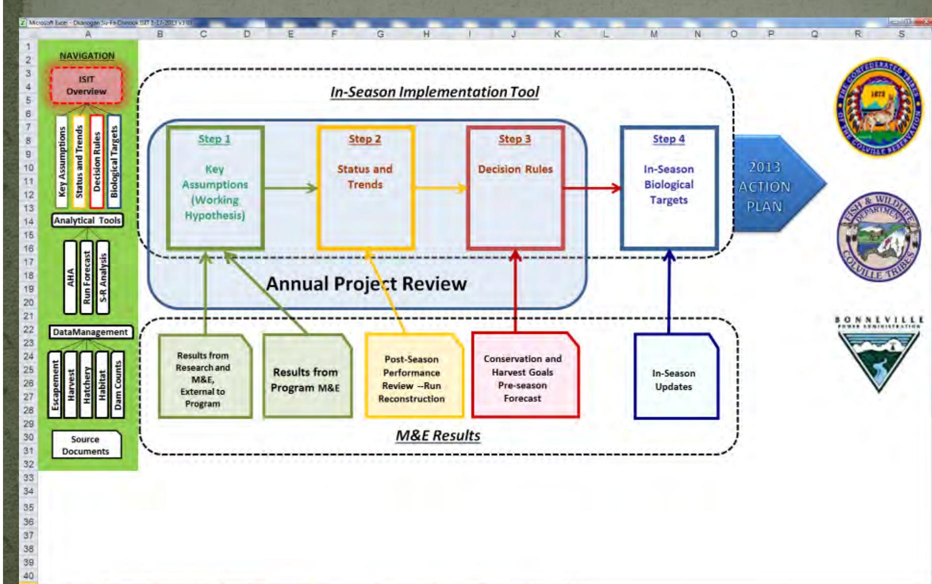
Adult Sampling Objectives

- pHOS
- pNOS
- PNI
- SAR
- Total Abundance
- Escapement
- Age-at-Return
- Freshwater rearing time
- Distribution

- *See "Glossary of Terms" in briefing books for definitions*

Field Offices, Acclimation Sites etc.

Analysis



Data Collection & Management

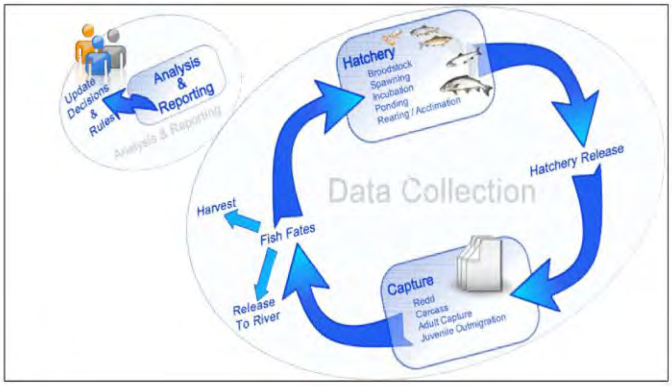


Figure 4-2
CJHP Annual Life Cycle

Data cont.

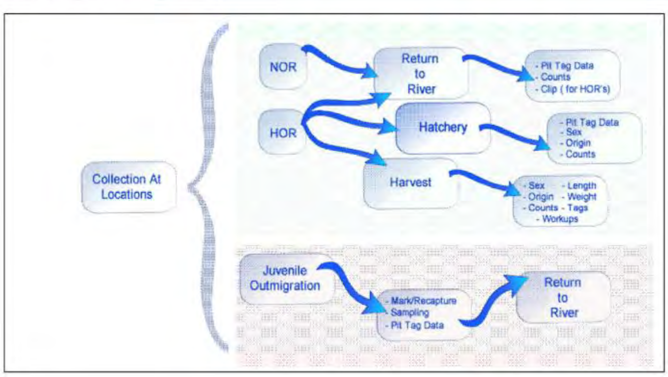
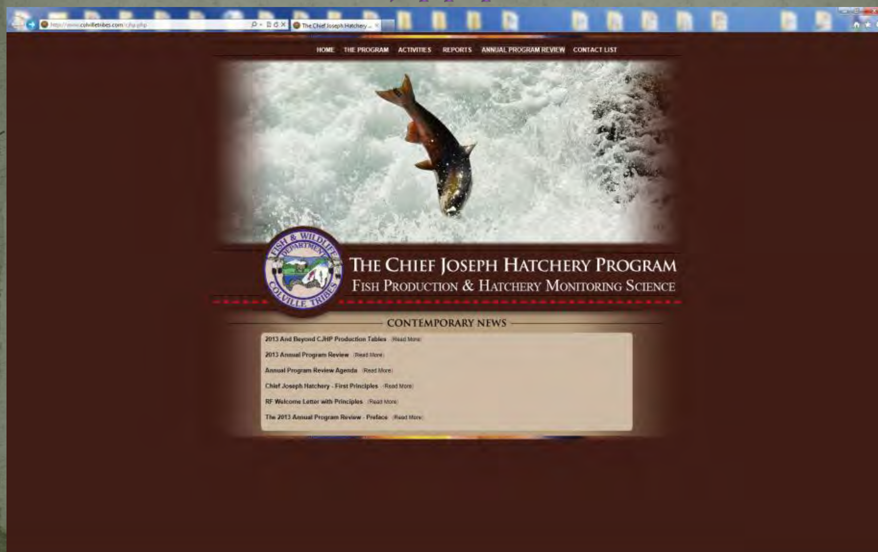


Figure 4-3
Data Collection at Capture, Release, Harvest

Reports, Information, Program Info

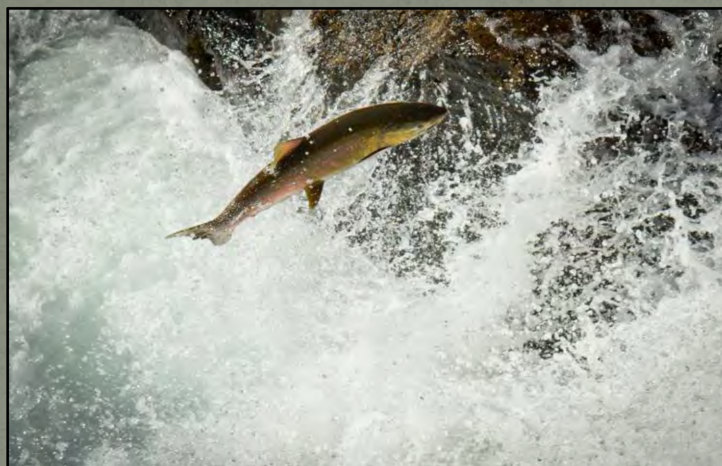
www.colvilletribes.com/cjhp.php



Conclusions

1. *Science and RM&E are integral parts of the CJHP*
2. *The Program is consistent with Hatchery Reform*
3. *The Program is consistent with PUD RM&E Plans*
4. *The Program Principles are well-defined*
5. *The CJHP is an integrated part of the CCT's Anadromous Fish Division*

Fresh Fish – NOR's of Course!



Picture courtesy of Brian Miller, CCT Fish Biologist

ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	April 18, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the March 20, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Douglas PUD headquarters in East Wenatchee, Washington, on Wednesday, March 20, 2013, from 9:30 am to 1:00 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Greg Mackey will provide the Wells Hatchery Modernization Master Plan to the Hatchery Committees for review, when it is available (Item I).
- Chelan PUD, Douglas PUD, Grant PUD, and the Colville Confederated Tribes (CCT) will meet to discuss proportional responsibilities for funding run-composition sampling at Wells Dam for summer Chinook; and Chelan PUD will provide an update on the discussions at the Hatchery Committees April 17, 2013 meeting (Item I).
- Lynn Hatcher will check on the status of internal National Marine Fisheries Service (NMFS) discussions regarding processing of Hatchery and Genetic Management Plans (HGMPs) for non-listed programs currently covered by Permit 1347 (Item II-A).
- Josh Murauskas will distribute a summary of changes to the revised draft Analytical Framework 5-Year Update to the Hatchery Committees no later than March 22, 2013. Following distribution of this list, Hatchery Committees representatives will provide a list of additional objective-level change that should be considered, if any, including suggested revisions, to Kristi Geris for distribution to the Hatchery Committees no later than April 5, 2013 (Item IV-A).
- Alene Underwood will revise and redistribute Chelan PUD's pilot study proposal to trap spring-run Chinook salmon at Rocky Reach Dam in 2013, as recommended; and

Chelan PUD will also brief Bill Gale on the details of the proposal (Item IV-D).

- Hatchery Committees representatives will submit edits and comments on the draft 2013 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols to Mike Tonseth no later than April 8, 2013 (Item VI-A).

STATEMENT OF AGREEMENT DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at this meeting.

AGREEMENTS

- Hatchery Committees representatives present agreed to use the steelhead broodstock collected in the fall of 2012 for the Douglas PUD Methow Safety-Net program broodstock, and to not collect additional broodstock in the Methow basin in the spring of 2013 for this program, unless an unexpected need for additional broodstock is identified by hatchery personnel (Item II-A).
- Hatchery Committees representatives present agreed to Chelan PUD's 2013 Wenatchee River Basin Steelhead Release Strategy (Item V-B).

REVIEW ITEMS

- The draft residual steelhead manuscript *Ecologic and demographic costs of releasing non-migratory juvenile hatchery steelhead in the Methow River, Washington* was distributed to the Hatchery Committees on February 19, 2013, for a 60-day review with comments due to Charlie Snow no later than April 22, 2013.
- The draft 2013 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols were distributed to the Hatchery Committees on March 15, 2013, for review with comments due to Mike Tonseth no later than April 8, 2013.
- The revised draft Analytical Framework 5-Year Update was distributed to the Hatchery Committees on March 19, 2013, for final review. Approval of the draft plan will be requested at the Hatchery Committees April 17, 2013 meeting.

FINALIZED REPORTS

- No reports have been finalized since the last Hatchery Committees meeting.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and reviewed the agenda. The following revisions were made to the agenda:

- Greg Mackey said that Douglas PUD's 2013 program activities update will include: 1) Twisp Weir and Twisp and Chewuch ponds update; 2) Wells Hatchery summer Chinook HGMP update; 3) Methow spring Chinook HGMP and Wells Complex Steelhead HGMP sufficiency letters; 4) Methow spring Chinook broodstock collection analysis; 5) future of spring Chinook broodstock collection for Methow and Okanogan programs; and 6) steelhead broodstock collection for 2013 Methow Safety Net.
- Alene Underwood added a brief discussion on a Carlton Acclimation Facility Capacity Utilization Draft SOA.
- Schiewe said that Craig Busack's agenda item to discuss HGMPs for non-listed programs and bull trout consultations has been postponed; however, Lynn Hatcher said that he would provide an HGMP update in lieu of Busack's agenda item.
- Mike Tonseth added a brief discussion on the draft 2013 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols.
- Kirk Truscott requested clarification regarding the February Monitoring and Evaluation (M&E) Progress Report for the Chelan PUD Hatchery Programs that was distributed to the Hatchery Committees by Tracy Hillman on March 19, 2013.

The revised draft February 20, 2013 meeting minutes were reviewed. Kristi Geris said that comments and revisions received from members of the Committees were incorporated in the revised minutes. She said that Tom Kahler noted an error in Chelan PUD's discussion on "Spring Chinook Brood Collection at the Eastbank Outfall (EBO)." He noted that "spring" should read "summer." The Hatchery Committees members present approved the February 20, 2013 meeting minutes, as revised.

Action items from the last Hatchery Committees meeting on February 20, 2013, and follow-up discussions were as follows:

- *Chelan PUD will draft a study plan to test Methow spring Chinook broodstock collection at the Rocky Reach Trap (Item I).*
  A pilot proposal to test trapping of spring-run Chinook salmon at Rocky Reach Dam in 2013 was distributed to the Hatchery Committees by Geris on March 19, 2013.
- *Bill Gale will provide U.S. Fish and Wildlife Service's (USFWS) Entiat National Fish Hatchery (NFH) and Leavenworth NFH Biological Assessments (BAs) and Biological Opinions (BiOps) to the Hatchery Committees as examples of consultation materials for bull trout (Item II-A).*
  Gale provided the documents and said that they were distributed to the Hatchery Committees on February 21, 2013.
- *Busack and Gale will provide Geris with a list of people who should be invited to the discussion on HGMPs for non-listed programs and the need for bull trout consultations (Item II-A).*
  Busack and Gale provided these lists.
- *Geris will distribute a Doodle Poll for a 1-hour discussion on the status of HGMPs for non-listed programs (Item II-A).*
  A Doodle Poll was distributed, but the discussion was deferred to a future meeting.
- *Josh Murauskas and Chris Moran will provide a proposal for evaluating release strategies for the Wenatchee Steelhead Program, including a consideration of how the release strategy for steelhead would affect the Chiwawa spring Chinook program, no later than one week prior to the Hatchery Committees March 20, 2013 meeting (Item III-A).*
  Murauskas provided this proposal and it was distributed to the Hatchery Committees by Geris on March 15, 2013.
- *Murauskas will distribute to the Hatchery Committees an updated revised draft Analytical Framework 5-Year Update with comments received to date that have been incorporated (Item IV-A).*
  Murauskas provided the revised draft and it was distributed to the Hatchery Committees by Geris on February 27, 2013.
- *Murauskas will distribute a Doodle Poll to the Hatchery Committees to schedule a Hatchery M&E Workgroup meeting to prepare the final revised draft Analytical*

Framework 5-Year Update for Hatchery Committee review (Item IV-A).
Murauskas distributed a Doodle Poll.

- *Greg Mackey will provide the Wells Hatchery Modernization Master Plan to the Hatchery Committees for review, when available (Item V-C).*
  Mackey said that the master plan is still under development, and that it may be available by the end of April 2013. This action item will be carried forward.
- *Chelan PUD, Douglas PUD, Grant PUD, and the CCT will meet to discuss proportional responsibilities for funding run-composition sampling at Wells Dam for summer Chinook; and Chelan PUD will provide an update on the discussions at the Hatchery Committees' March 20, 2013 meeting (Item VI-A).*
  Todd Miller said that WDFW developed a budget for the work and provided this to Peter Graf at Grant PUD. He said that he and Graf are now drafting a statement of work which Miller anticipates should be available for discussion at the Hatchery Committees April 17, 2013 meeting.
- *Keith Wolf will provide Geris with CCT's Chief Joseph Hatchery (CJH) M&E presentation materials for distribution to the Hatchery Committees (Item VI-B).*
  Geris said that Wolf provided the presentation materials and that they were distributed to the Hatchery Committees on February 21, 2013.

II. Douglas PUD

A. 2013 Program Activities Update (Greg Mackey)

<u>Twisp Weir and Twisp and Chewuch Ponds Update</u>

Greg Mackey said that the Twisp Weir was set up on March 11, 2013, and operations started the following day. He said that Twisp and Chewuch ponds were watered up and fish were already being transferred to the ponds on March 11, 2013. He said that Twisp steelhead and spring Chinook will be co-mingled with 5,000 of each species passive integrated transponder (PIT) tagged. He said that Charlie Snow monitors the fish as they exit the pond through the outfall channel. Mackey said that no issues have been observed to date with co-acclimating the Twisp spring Chinook and steelhead in the Twisp Pond.

<u>Wells Hatchery Summer Chinook HGMP Update</u>

Mackey said that Douglas PUD has completed drafting their Wells Hatchery Summer Chinook HGMP. He said that the recent Methow Hatchery Spring Chinook HGMP and the draft 2005 Summer Chinook HGMP that Kirk Truscott drafted were used as templates, with program-specific revisions and updates, as needed. Mackey said that Jayson Wahls, Wells Hatchery Complex Manager, reviewed the HGMP, and that Section 2, which summarizes effects on other populations, was updated with current information. He said that he hopes to get the draft HGMP to the Hatchery Committees for review as soon as possible. Mike Tonseth asked about the status of internal NMFS discussions regarding the processing of HGMPs for non-listed programs currently covered by Permit 1347. Lynn Hatcher said that he will check on this and report back to the Hatchery Committees.

Methow Spring Chinook and Wells Complex Steelhead HGMP Sufficiency Letters

Mackey said that Douglas PUD received Methow Spring Chinook and Wells Complex Steelhead HGMP sufficiency letters, which means that Douglas PUD is now in consultation. Tonseth said that spring Chinook and steelhead sufficiency letters have also been sent to USFWS regarding the Winthrop NFH programs.

Methow FH Spring Chinook Broodstock Collection Analysis

Mackey said that with all of the changes in the Methow spring Chinook Hatchery programs (i.e., survival study adjustments, recalculations, HGMPs, Chelan PUD withdrawal), there has been interest in releasing all 135,000 spring Chinook in the Methow River, and not releasing a portion in the Chewuch River. He said that, based on preliminary analyses, releasing a portion of the Methow Hatchery production in the Chewuch River would likely reduce the returns to Methow Hatchery, and hence the numbers that could be collected as broodstock. He added that this was part of the results when percent hatchery-origin spawners (pHOS) analyses were completed for the Methow basin. Mackey said that he has started analyses to further explore this; however, the analysis is incomplete. He said that so far he has found that the Methow Hatchery program should usually be able to fulfill its broodstock needs with 135,000 Chinook smolts released from the Methow Hatchery. However, he said that excess Methow Hatchery-origin broodstock that would be used in the Winthrop NFH safety-net program are likely to not be available in sufficient numbers, or at all in some years.

Future of Spring Chinook Broodstock Collection for Methow and Okanogan Programs

Mackey said that he and Kirk Truscott have discussed the issue of collecting spring Chinook broodstock for the Methow and Chief Joseph Hatchery spring Chinook programs at Wells Dam. He said that a primary concern is that broodstock collected at Wells Dam cannot be readily sorted into those of Methow- versus Okanogan-origin and that when Chief Joseph Hatchery is at full operation, those fish will greatly outnumber Methow fish. Therefore, trapping at Wells Dam will necessitate handling large numbers of fish to sort through and identify target fish for certain programs. In addition, this means that wild fish will be subjected to this handling along with hatchery-origin fish. Using analytical means to identify wild fish would necessitate holding fish, resulting in migratory delay of non-target fish. Okanogan natural-origin fish would be at risk of being collected as Methow fish because they would be genetically indistinguishable. A fledgling Okanogan population would be at risk if unintentional by-catch for broodstock occurred. He added that a strategy to collect spring Chinook broodstock will need to be developed, especially when CJH begins returning large numbers of fish. Truscott added that neither the Methow nor Okanogan rivers have adult collection capabilities. He said that these issues would need to be addressed soon. Truscott noted that the Methow conservation fish have coded-wire tags (CWTs), so that they can be differentiated. Tonseth said that the first generation safety net fish out of Winthrop also have CWTs. Truscott recommended considering marking strategies for each program in order to differentiate the groups. Truscott asked about the possibility of alternate fin clips, although not typically accepted, and added that it may be useful to conduct a literature review on differential survival. Mackey noted that trapping is known to affect fish passage and it would need to be determined to what degree aggressive trapping would be acceptable. Microchemistry analysis may be a method that could discriminate wild fish, but this would require holding fish, inflicting handling stress and migration delay on non-target fish. Truscott said that CJH is not releasing spring Chinook at CJH this year, and that broodstock collected will be for 2015 releases. Tonseth said that the earliest returns from the Okanogan River will be in 2016—with jacks in 2015. Truscott said that collecting broodstock in-basin for the Methow Program would be complicated; Tonseth noted that improvement to Foghorn Dam was identified in the U. S. Bureau of Reclamation's (Reclamation's) analysis in response to a BiOp reasonable and prudent alternative (RPA) action implementation for steelhead. Keely Murdoch noted that Bill Gale also should be a part of this discussion because of the Winthrop NFH program. Truscott and Mackey agreed. Mackey said that he will continue to run analyses on in-basin trap efficiency and likelihood of achieving broodstock collection to support both programs.

<u>Steelhead Broodstock Collection for 2013 Methow Safety Net</u>

Mackey said that all needed steelhead broodstock for the Methow Safety-Net program were collected in fall 2012 for the 2013 brood year Wells Hatchery Steelhead Programs, and that full egg take has been reached (the fish collected in the fall at Wells Dam and Hatchery spawn prior to when fish remaining in the river move to spawning areas in the spring and become susceptible to broodstock collection once again). Hence, for the 2013 brood year Methow Safety Net Program, he proposed that adult steelhead broodstock already collected and spawned in sufficient numbers to meet egg take requirements be used for the program in lieu of collecting broodstock in the Methow Basin. The return cohort for this brood year does not include returns from the new Twisp stock program, and therefore, returns to the Methow are of the same Wells stock as those already collected. Therefore, there is no advantage to collecting more fish. If additional fish are needed this spring, they would be collected at Wells Dam/Hatchery or the in the Methow basin in spring 2013. Charlie Snow agreed with this proposal and added that any excess fish could go to Ringold Hatchery. Mike Tonseth asked if the Twisp Weir has been considered to fill the safety net program, and Mackey said that 25 percent of the program can be collected from the Twisp Weir and the balance would come from Winthrop NH; and then if needed, additional broodstock could come from Methow Hatchery, or Wells Dam/hatchery. Keely Murdoch said that her only concern is that all broodstock were collected in the fall, which might not be representative of run timing for the entire run. She added, however, that if it is just for one year and only for the safety net program, then this option may not pose a significant issue. Mackey said that essentially, the process is the same as last year. Hatchery Committees representatives present agreed to use the steelhead broodstock collected in the fall of 2012 for the Douglas PUD Methow Safety-Net broodstock, and to not collect additional broodstock in the Methow basin in the spring of 2013 for this program, unless an unexpected need for additional broodstock is identified by hatchery personnel with any excess fish going to Ringold Hatchery.

III. NMFS

A. HGMP Update (Lynn Hatcher)

Lynn Hatcher said that Craig Busack is working on the Mid-Columbia Coho BiOp, and that the Leavenworth NFH spring Chinook and Entiat NFH spring Chinook draft BiOps are still in final review by National Oceanic and Atmospheric Administration (NOAA) General Counsel (GC). Hatcher reminded the Hatchery Committees that the NMFS final review process is taking longer than in the past due to greater scrutiny by the NOAA GC. Mike Tonseth asked if the longer review process is due to more extensive reviews or due to pending lawsuits; and Hatcher replied that both reasons are true. Greg Mackey asked about the status of Methow HGMPs, and Hatcher replied that the *US v OR* Production Advisory Committee (PAC) is still waiting for NMFS and the Yakima Nation (YN) to address several pending issues. Mike Schiewe cautioned that NMFS needs to be mindful that consultations in the Methow have started and deadlines must be met, or agencies will be unable to obtain their permits and will subsequently default on their program requirements.

IV. Douglas PUD, Chelan PUD, and Grant PUD

A. 5-Year M&E Plan Update (Greg Mackey and Josh Murauskas)

Josh Murauskas said that the Hatchery M&E Workgroup met on March 18, 2013. He said that they addressed all comments and edits to the draft Analytical Framework 5-Year Update and a revised draft for final review was distributed to the Hatchery Committees on March 19, 2013. Mike Tonseth said that some components of the plan that consist of tables containing management objectives and targets have yet to be resolved, have been removed from the document, and will instead be added as appendices to the plan when they are fully developed. Murauskas said that, ultimately, the revised plan is similar to the previous plan only with further clarifications and objectives in meeting hatchery goals.

Keely Murdoch noted that the 5-year update of the Hatchery M&E Plan involved two steps: 1) updating the M&E plan to reflect changes in the way the programs are now operated; and

2) considering changes based on the 5-year analyses and reviewing each objective to evaluate if results of the 5-year analyses indicate changes to the plan are warranted. She questioned whether the second part of the review had been completed, and noted that the Hatchery Committees agreed that this step was important for making meaningful revisions to the M&E plan, implementation plan, and/or hatchery program itself. Murdoch asked, for example, how objectives for steelhead reference populations will be addressed. Greg Mackey explained that there are no data available to address steelhead objectives using reference populations, but Tracy Hillman's white paper on using reference streams for M&E analysis has been cited in and appended to the plan. This document described approaches for situations when reference population data are not available. Todd Pearson said that language in the plan was modified, as necessary, to accommodate missing data. Mike Schiewe reminded the Hatchery Committees that the workgroup revising the Hatchery M&E Plan was open to all members and included regular participation by Hatchery Committees members and technical representatives of WDFW and BioAnalysts, which were collectively the biologists most familiar with implementation of the first 5 years of the M&E Program and analyses of the results. He said that based on the progress reports at Hatchery Committees' meetings during the past several months, it was his understanding that the framework was modified based on lessons learned. Murdoch said that she had participated in all but the last meeting of the working group, and that she did not think that the second step had been well-documented. Tonseth added that in terms of program-by-program review, any modifications to any one program would be captured in the appendix, but would not be applied to the entire plan.

Murdoch suggested the need for better documentation of what changes were made, and why they were made. She recalled that, in the past, program objectives were reviewed and rewritten to be achievable, and said that she would like to see the same process implemented with this revision. Murauskas reminded the Hatchery Committees that the intention was to have this plan approved in April 2013 for contracting purposes. Mackey said he believes that a comprehensive review process was completed, and was uncertain that such a formalized record is necessary. He also said that Andrew Murdoch and Tracy Hillman both participated in the review and revision process, and noted that they were among the lead authors of the annual reports and the 5-year summary report.

Schiewe suggested, in consideration of getting the programs in place for 2014, to proceed with the timeline on approving the revised plan, and reconvening again to develop a more detailed record and to evaluate if there are any additional changes needed. Murdoch said she would prefer that the Hatchery Committees review the reports to verify that all updates are incorporated. Kirk Truscott added that it would also be worthwhile to see an executive summary that summarizes what changes were made; and Murauskas said that he will distribute a summary of changes made to the revised draft Analytical Framework 5-Year Update to the Hatchery Committees no later than March 22, 2013. Following distribution of this list, Hatchery Committees representatives will provide a list of additional objective-level changes, if any, which should be considered, including suggested revisions, to Kristi Geris for distribution to the Hatchery Committees no later than April 5, 2013.

V. Chelan PUD

A. M&E Request for Proposal (Josh Murauskas)

Josh Murauskas said that a Wenatchee River Basin Hatchery M&E Request for Proposal (RFP) Timeline (Attachment B) was distributed to the Hatchery Committees by Kristi Geris on March 19, 2013. He said that this timeline is intended to highlight the path forward for the Wenatchee River Basin Hatchery M&E RFP process.

B. 2013 Wenatchee Steelhead Releases (Josh Murauskas)

Josh Murauskas said that Chelan PUD and WDFW discussed ways to improve steelhead releases in the Wenatchee basin, and summarized their discussions and proposed testing in Chelan PUD's 2013 Wenatchee River Basin Steelhead Release Strategy (Attachment C), which was distributed to the Hatchery Committees by Kristi Geris on March 15, 2013. He said that the apparent survival to McNary Dam of forced released fish will be compared with those of volitionally released fish and will be sorted by PIT tags, using both circular tanks and raceways. He acknowledged that the migration rate of hatchery-by-hatchery (H×H) and wild-by-wild (W×W) progeny may be different and could affect results. He said that a key difference with the volitional group in 2013 versus 2012 is that the releases will begin earlier, hopefully improving survival.

Mike Tonseth expressed concern with the release strategy, and in particular with the different parental origins and the potentially different migration patterns based on those origins. He said that recent literature indicates that certain parental crosses have a higher tendency to residualize, and asked whether the 2013 strategy could address this. He also noted that a condition in the hatchery permits specifies that non-migrants can only be released in the lower Wenatchee River. Murauskas acknowledged Tonseth's concerns, and said that hopefully some of these issues can be addressed during review of PIT-tag data. Tonseth said that fish need to be sampled over time to determine dominant origin, and added that he would like this included in this year's work. Murauskas said that Chelan PUD is discussing possible options to obtain additional information, such as installing antennas in the raceways and subsequent in-stream detections.

Regarding the second point (No. 2) in Attachment C, Tonseth asked what the proposed method is for comparing performance of different release strategies. Murauskas explained that if volitional release starts in April, it could bias the forced release; so, a net will be installed to make sure the forced release is representative of the entire population. Tonseth asked if the split would occur before or after the 25,000 fish destined for Blackbird Pond are moved out, and Murauskas replied that Blackbird fish will be taken out prior to installing the net, and that the PIT-tag data will later be tested for random distribution. Murauskas said that fish that do not volitionally exit the rearing raceway will be released in the lower Wenatchee River at Tumwater, as outlined in the Section 10 permit. Lynn Hatcher said that he thought those fish would go to Blackbird Pond, and Tonseth clarified that anything left is treated as a non-migrant. He added that they would not go to Blackbird Pond because there is no co-manager agreement, and the residualism rate is not known. Hatcher asked if the fish that are released below Tumwater would migrate, and Tonseth replied that they may. He added that Charlie Snow authored a white paper about non-migrants' potential to migrate that indicated that migration may simply depend on whether the fish are released in riverine waters or put in landlocked water.

Tonseth noted that according to the February M&E Progress Report for the Chelan PUD Hatchery Programs that was distributed on March 19, 2013, the steelhead population in the proposed strategy is incorrect, and therefore, the sample sizes need to be updated accordingly. Murauskas said that Chris Moran had originally proposed release dates; however, Murauskas stated that some flexibility may help operator in terms of logistics. Tonseth said that the existing data should be reviewed to determine what release time would result in the highest survival, and Murauskas explained that survival in 2012 was so poor, that nothing could be deduced by reviewing these data. Tonseth noted that any proposal should not impact spring Chinook releases in the Chiwawa River. He said that fishery managers are discussing starting spring Chinook volitional releases a day or so earlier than the spill start date and then pushing them out after about one week so that the steelhead volitional release can be initiated.

Kirk Truscott said he thinks that the release dates for circulars and raceways, respectively, need to be the same in order to maintain the same conditions. Murauskas said that forced release cannot be matched with volitional released fish over several weeks. He added that smolt trap data indicate that the maximum steelhead migration peaks in early-May. Keely Murdoch said that she is okay with volitional release not starting the same time, and added that release dates are not what is being compared, but rather, two different strategies are being compared—one is to push the fish out at the usual date, and the other is to let them leave on their own. She said that if the evaluation is when one release strategy works the best, then release dates should be compared.

Tonseth said that he has concerns about dividing the pond and achieving representative sample sizes. He asked if there will be enough PIT tags on each side of the pond, and Murauskas replied that PIT tag data will be reviewed from both groups, when available, to determine if there were representative populations. Truscott asked about the W×W progeny in the ELISA pond, and Alene Underwood said that those fish will not be involved in the release strategy study.

Schiewe summarized that the idea was not to have a perfect experiment, but rather to begin sorting out possible explanations for low survival in 2012 and find a solution to have better survival in future years. Hatchery Committees representatives present agreed to Chelan PUD's 2013 Wenatchee River Basin Steelhead Release Strategy.

C. Spring Chinook HGMPs (Joe Miller)

Joe Miller said that Chelan PUD is preparing a document that requests Endangered Species Act (ESA) coverage for their Methow spring Chinook program. He said that the document focuses on the aspects of the program that have changed from the original HGMP submittal in 2010, as outlined in a handout provided at the meeting and also distributed via email on March 21, 2013 (Attachment D). Miller said that the document will include targets that are reflective of existing HCP targets, and that a variety of facilities will be included that may be available to ensure that ESA coverage exists for multiple contingencies. He added that the basic life-history stages and hatchery locations for Chelan PUD's spring Chinook Hatchery program will also be described. He said that issues that will be addressed include straying, adult management, and percent hatchery origin spawners (pHOS).

Miller said that Chelan PUD is awaiting the results of discussions at the PAC meeting; however, they will need to move forward with this document soon. He said that this document is not a new HGMP, but rather an update.

D. Spring Chinook Pilot at Rocky Reach (Alene Underwood)

Alene Underwood said that a proposal to trap spring-run Chinook salmon at Rocky Reach Dam in 2013, including an overview of the trap design (Attachment E) was distributed to the Hatchery Committees by Kristi Geris on March 19, 2013. She said that the proposal basically looks to target spring Chinook, collect them in the trap, verify their species, and release them; this would happen over a 4-week sampling period from May to June 2013. She said that the trap has been used successfully for bull trout and steelhead with virtually no passage delays, and added that the trap will be videotaped. She said that if no impacts are observed to non-target fish, then a path forward will be proposed.

Mike Tonseth asked how the facility will be staffed in the future if this proposal does prove feasible. He said that his assumption would be that a person would be needed to monitor the trap for fish that are not PIT-tagged. Joe Miller replied that in terms of the pilot, a protocol and/or additional information will be developed, if requested. He added that there are many broodstock issues coming up, and to the extent that this trap benefits hatchery programs, it makes sense. Mike Schiewe said that in terms of passage, this proposal will likely also go to the HCP Coordinating Committees for approval. Miller added that use of this trap has been approved in the past, and so he does not foresee this being an issue. He added that he believes use of the trap is covered by the current permit; however, he is unsure regarding direct take authority. He said that Chelan PUD is proposing only small numbers and the fish will not be taken out of the water. Tonseth said that identifying and isolating the fish will likely be the challenge and Underwood said that this has been accomplished before. Underwood said that Chelan PUD will be asking for approval of the proposal at the Hatchery Committees' April 17, 2013 meeting. Miller said that a letter will be prepared for NMFS that is similar to the letter that was developed for the Parental Based Tagging (PBT) study. Kirk Truscott requested that a summary be included in the proposal that indicates the reason behind the proposal. Underwood said that she will revise and redistribute Chelan PUD's pilot study proposal to trap spring-run Chinook salmon at Rocky Reach Dam in 2013, as recommended. Chelan PUD will also brief Bill Gale on the details of the proposal.

E. Carlton Acclimation Facility Capacity Utilization SOA (Alene Underwood)

Alene Underwood said that the Carlton Acclimation Facility Capacity Utilization Draft SOA that was distributed to the Hatchery Committees by Kristi Geris on March 19, 2013, is a draft for discussion purposes only. She said that the draft SOA is an agenda item at the Priest Rapids Coordinating Committee (PRCC) Hatchery Subcommittee's (HSC's) March 21, 2013 meeting, and that she just wanted to distribute the draft document to the Hatchery Committees prior to the HSC discussion. Mike Tonseth suggested revising the text to reflect that the proposal applies to 2013 broodstock only. He acknowledged, however, that the long-term plan for Chelan PUD's 60,516 Methow spring Chinook mitigation obligation is still unknown. Underwood said that if the Committee as a whole agrees to the revision, she will update the language.

VI. WDFW

A. Draft 2013 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols (Mike Tonseth)

Mike Tonseth said that the draft 2013 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols (Attachment F) were distributed to the Hatchery Committees by Kristi Geris on March 15, 2013. He said that with the deadline to NOAA being April 15, 2013, Tonseth requested that Hatchery Committees representatives submit edits and comments on the draft 2013 Broodstock Protocols no later than April 8, 2013. Tonseth reviewed notable 2013 protocols, as described in Attachment F, and said that the 2013 protocols were largely based on the 2012 Methow Spring Chinook Broodstock Genetic Results, that were also distributed to the Hatchery Committees on March 15, 2013.

VII. CCT

A. February M&E Progress Report for the Chelan PUD Hatchery Programs (Kirk Truscott)

Kirk Truscott requested clarification on rearing activities for the 2011 Brood Wells Summer Chinook Yearling Program, as described in the February M&E Progress Report for the Chelan PUD Hatchery Programs that was distributed to the Hatchery Committees on March 19, 2013. He said that the progress report indicated that Chelan Falls' yearlings are being reared at Chelan Falls Hatchery, and Mike Tonseth clarified that the yearlings are being reared at the Chelan Falls Acclimation Facility. Truscott also asked about the size difference of fish reared in circulars at the Chelan Falls Acclimation Facility, and Alene Underwood suggested that the transfer size could have been different.

VIII. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees' meetings are on April 17, 2013 (Chelan PUD office); May 15, 2013 (Douglas PUD office); and June 19, 2013 (Chelan PUD office).

List of Attachments

Attachment A	List of Attendees
Attachment B	Wenatchee River Basin Hatchery M&E Request for Proposal Timeline
Attachment C	Chelan PUD's 2013 Wenatchee River Basin Steelhead Release Strategy
Attachment D	Chelan PUD Spring Chinook HGMPs
Attachment E	Proposal to trap spring-run Chinook salmon at Rocky Reach Dam in 2013
Attachment F	Draft 2013 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Josh Murauskas*	Chelan PUD
Alene Underwood*	Chelan PUD
Joe Miller	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Todd Pearsons	Grant PUD
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Lynn Hatcher*	National Marine Fisheries Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Todd Miller†	Washington Department of Fish and Wildlife
Chris Moran†	Washington Department of Fish and Wildlife
Jayson Wahls†	Washington Department of Fish and Wildlife
Charlie Snow†	Washington Department of Fish and Wildlife

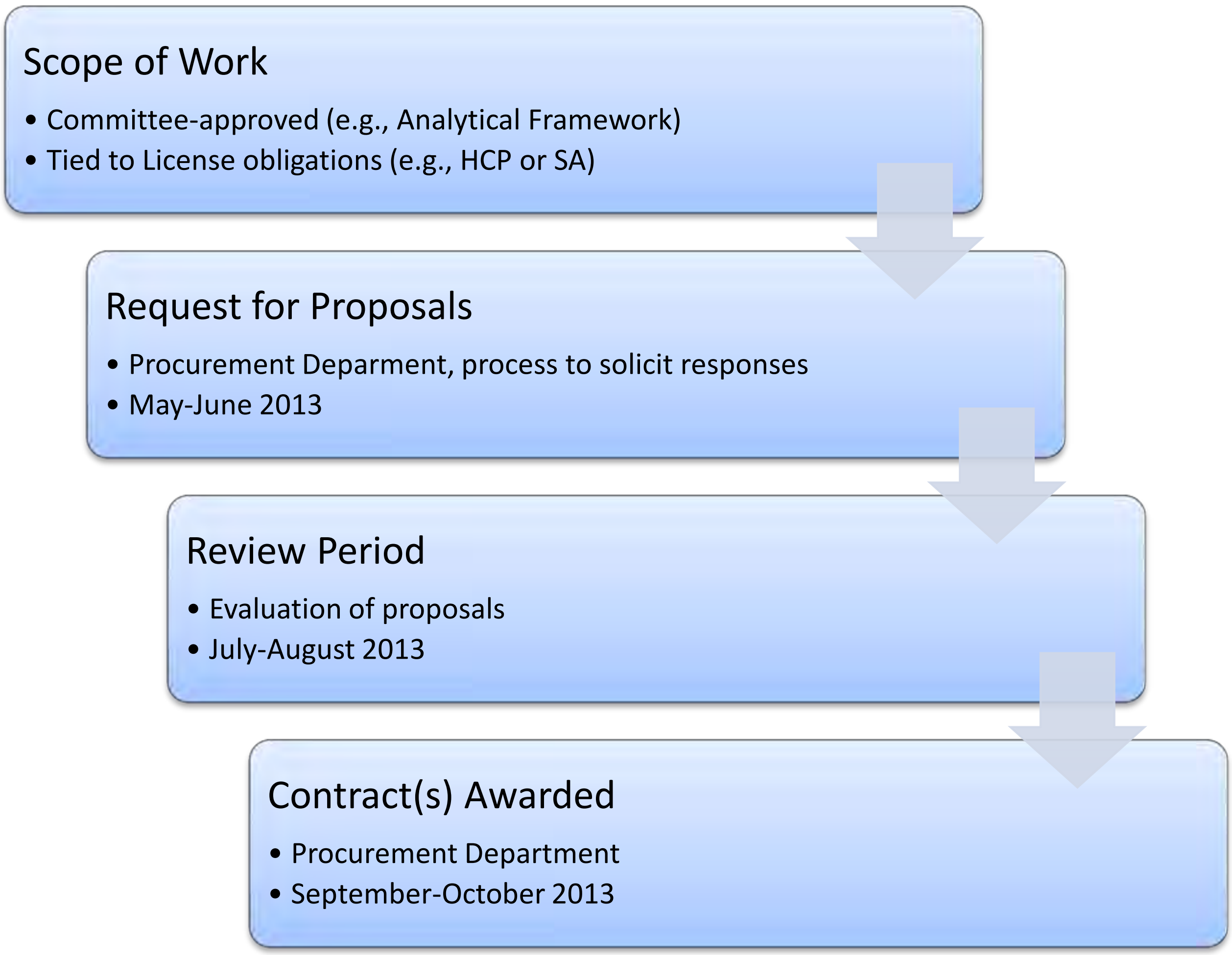
Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

Wenatchee River Basin Hatchery M&E – Request for Proposal Timeline

March 2013 overview for HCP Hatchery Committee



Prepared by J. Murauskas, Chelan PUD

Wenatchee River Basin Steelhead Releases, 2013

Summary

The Chelan PUD Wenatchee River Steelhead Program was relocated to over-winter acclimation at Chiwawa Ponds beginning with release year 2012. In response to varying post-release performance observed in 2012, the HCP Hatchery Committee has requested a closer evaluation of release strategies in 2013. Specifically, a comparison of post-release performance of forced- and volitionally-released steelhead will help inform how each strategy may affect survival and the ability to screen for non-migratory juveniles. Roughly 25,000 passive integrated transponder (PIT) tags were implanted in juvenile steelhead for monitoring and evaluation purposes and will be used to assess post-release performance of the 2013 releases. While logistical constraints limit the ability to conduct fine-scale analyses, the proposed release strategy (Table 1) will provide insight. Specific points are as follows:

1. W×W progeny destined for Nason Creek are in the two circular vessels and the ELISA pond (with no volitional capabilities). Performance of fish reared in the circular vessels will be compared, with one vessel being force-released and the other being volitionally released.
2. Mixed (W×W and H×H) progeny destined for the mainstem Wenatchee River are in the large raceway. Performance of these fish will be compared, with one group being force-released and the remaining fish being volitionally released.
3. The remaining mixed progeny destined for the Chiwawa will be volitionally released with no direct comparison; fish destined for Blackbird Pond will also lack a direct comparison.
4. Fish remaining from the volitional release exercise will be stocked in the mainstem Wenatchee, below Tumwater Dam.
5. Volitional releases will begin in late April, following release of spring Chinook. Forced releases will occur in early May, at the discretion of the Chiwawa Ponds hatchery staff.

Table 1. Steelhead release strategy in the Wenatchee River Basin, 2013.

Vessel	Origin	Number	PITs	Destination	Release strategy	Date range
Circular 1	WxW	12,500	2,500	Nason	Forced	Early May
Circular 2	WxW	12,500	2,500	Nason	Volitional	Late April
ELISA	WxW	50,000	10,000	Nason	Forced	Early May
Nason total		*75,000*	*15,000*			
Raceway	Mix	43,008	2,183	Wenatchee	Forced	Early May
Raceway	Mix	43,008	2,183	Wenatchee	Volitional	Late April
Raceway	Mix	25,000	1,269	Lower Wen.	Non-migrants	Late May
Raceway	Mix	25,000	1,269	Blackbird	N/A	
Wenatchee total		*136,015*	*6,903*			
Raceway	Mix	61,015	3,097	Chiwawa	Volitional	Late April
Chiwawa total		*61,015*	*3,097*			
Grand total		**272,030**	**25,000**			

DRAFT—This document is an update to the HCP hatchery committee for discussion purposes.
Chelan Methow Spring Chinook 3/20/2013.

Chelan Spring Chinook ESA/HGMP Update (3/20/2013 Hatchery Committee)

We are finishing a document that requests ESA coverage for our program. Not sure if it is an addendum, amendment or new HGMP. The document will focus on the aspects of the program that have changed from the original HGMP submittal in 2010.

1. All targets reflect existing HCP targets subject to adaptive management provisions in the HCPs.
    - Number of smolts released = 60,516
    - Smolt-to-adult returns SAR = 0.003
    - Adult Equivalents = 182
    - Number of smolts/adult = 333
    - Hatchery Return Rate = 5.3

2. In terms of facility use, Chelan is describing the maximum range of facilities that may be available to ensure that ESA coverage exists for multiple contingencies (Facilities not owned by Chelan will require additional approvals for use—for instance, WNFH is only approved for one year but may have additional utility if USFWS and the HC approve future use):

Activity	Facility
Broodstock Collection	Wells Dam, Rocky Reach Dam, Winthrop NFH outfalls and other locations approved by HCP Hatchery Committee
Adult Holding	Eastbank Hatchery and Winthrop NFH and other locations approved by HCP Hatchery Committee
Spawning	Eastbank Hatchery and Winthrop NFH and other locations approved by HCP Hatchery Committee
Incubation	Eastbank Hatchery and Winthrop NFH and other locations approved by HCP Hatchery Committee
Early Rearing	Eastbank Hatchery or Winthrop NFH and other locations approved by HCP Hatchery Committee
Overwinter Rearing	Carlton Acclimation Pond or Winthrop NFH and other locations approved by HCP Hatchery Committee
Final Acclimation	Yakama Nation Expanded Acclimation sites: Goat Wall Acclimation Site, Mid Valley Pond, Chewuch River (future YN site) and other locations approved by the HCP Hatchery Committee

3. The basic life-history stages and hatchery locations (parenthetically) for Chelan's spring Chinook Hatchery program are described:

	January	February	March	April	May	June	July	August	September	October	November	December
Year 1					Brood Collection (Wells or RR)			Incubation (Eastbank)				
Year 2	Incubation		Early Rearing (Eastbank)							Overwinter (Carlton)		
Year 3	Overwinter	Acclimation (Goat wall or Mid-Valley)										

DRAFT—This document is an update to the HCP hatchery committee for discussion purposes.
Chelan Methow Spring Chinook 3/20/2013.

4. Chelan will make commitments to address contingencies related to straying: In the event stray rates exceed the HCP targets, Chelan would fund additional in-basin imprinting opportunities including (1) development of new water sources within the basin or (2) early life history acclimation (i.e., incubation and fry) or (3) other measures approved by the HCP hatchery committees.
5. Adult Management and pHOS: Chelan is providing infrastructure (RR trap), FTE funding and marking fish for managers to meet desired PNI goals. Same as Wenatchee HGMP.
6. Next steps: Chelan will send a draft to WDFW as a co-applicant and then off to NMFS (within next 2 weeks).

Proposal to Trap spring-run Chinook salmon at Rocky Reach Dam, 2013

Proposal

Trapping of adult salmon is an important component of hatchery supplementation and adult management in the mid-Columbia River. The Rocky Reach Trap (RRT) has been used historically to capture listed steelhead and bull trout (Alexander et al. 2003; Stevenson et al. 2009) without causing delays to non-target fish. Here, we propose to test the efficacy of the RRT on diverting hatchery-origin spring-run Chinook salmon during the 2013 migration. The trap will be operated during the spring migration, typically observed at in the mid-Columbia River (May/June, Figure 1), using visual selection criteria. The trap operator can target individual fish on the basis of visual identification of external marks observed at the counting window (i.e., ad clipped). No more than five fish will be trapped each week during a four-week sampling period. Fish will be released following trapping (i.e., no handling or delay will occur) and all interactions will be video recorded. Trapping will be active and technicians present at all times.

It is important to note that the Rocky Reach Trap has been successfully used to safely capture other listed species since the HCPs were implemented. The fact that the trap does not cause passage delays for non target fish is a critical benefit of the system. Overall, the consideration of this trapping method for spring Chinook broodstock collection is based on its active selection capability and previous regulatory approvals by NMFS and USFWS.

Overview of Trap Design

Trap facilities at Rocky Reach are integrated with the existing fish-viewing structures within the ladder. Essentially, the fish-viewing guide wall extends upstream to the exit weir, where a pneumatically-activated gate guides fish into a collection area (Figure 2 and 3). On the other side of the pneumatic gate the collection area contains a removable capture vessel. As adult fish enter the viewing area, a technician activates the pneumatic gate, which blocks passage into the forebay and diverts the adult fish into the collection area. Using an underwater camera, the technician observes the adult fish enter the collection area, at which time the gate is closed, trapping the fish. Non-target species are allowed to exit the ladder by simply not activating the pneumatic gate. After an adult fish is contained within the collection area, either an electric or hand-operated winch raises the collection vessel from the collection area up to the work-surface platform. As the vessel emerges from the water, a wooden cover is placed on top of the vessel to reduce stress to the fish and eliminate the possibility of the fish jumping out of the vessel. Captured fish can then be anesthetized and transferred to a processing area. At the RRT, the collection vessel is moved laterally along an I-beam monorail close to the processing facility located under the roadway of the ladder.

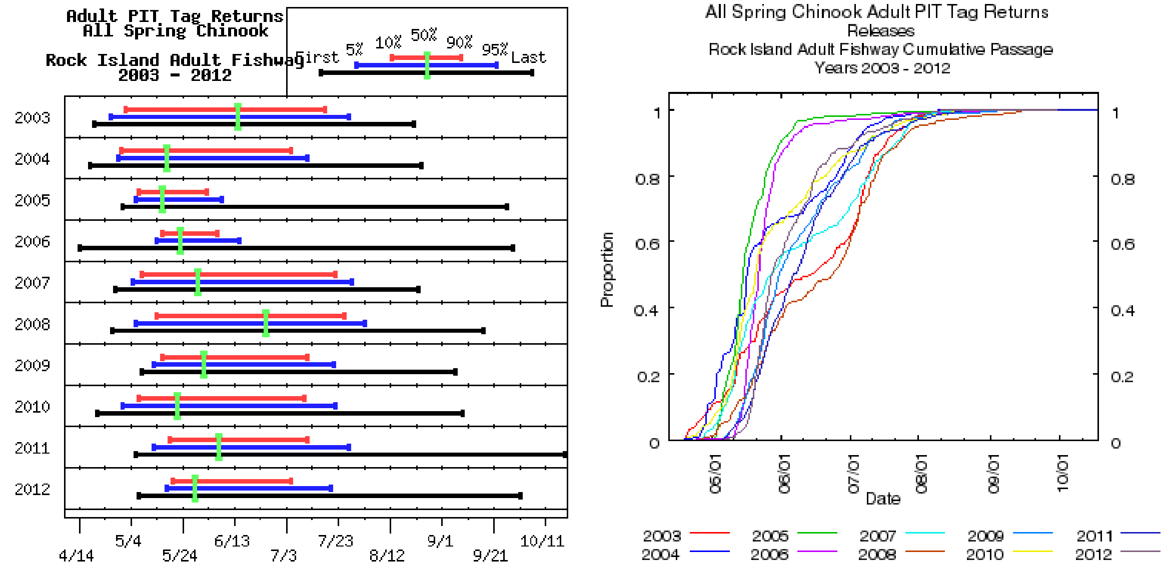


Figure 1. Historical run timing of PIT-tagged wild- and hatcher-origin spring-Run Chinook at Rock Island Dam, 2003-2012 (note that early years may be based on a limited number of adult returns).

Figure 2. Adult trapping facility at Rocky Reach Dam. The pneumatic arm (left and top right) activates a gate that guides fish into a holding vessel (bottom right, shown lifted). Trapped fish are either allowed to exit the holding vessel by opening the gate, or are lifted for processing.

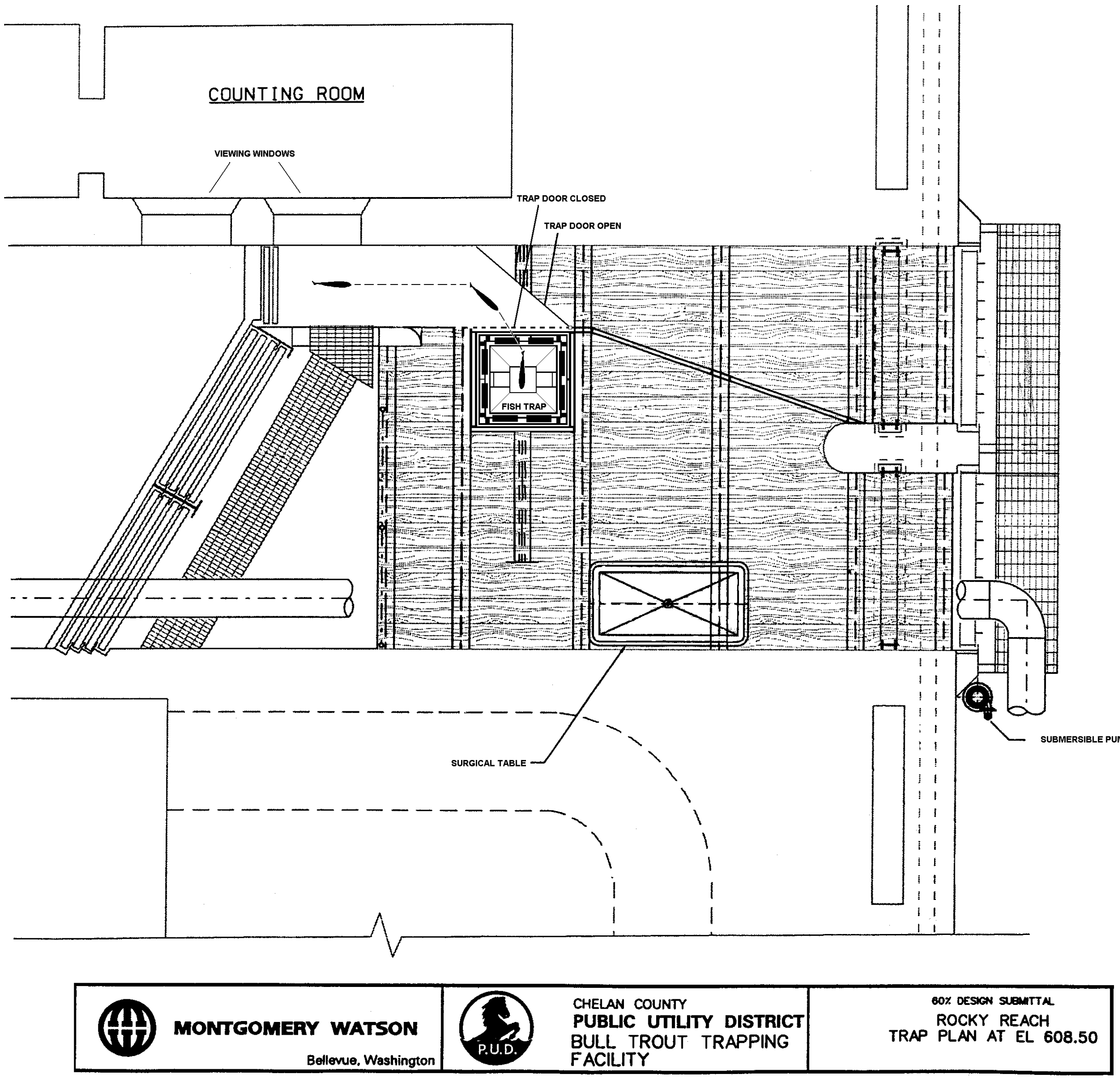


Figure 3. Rocky Reach Trap Layout

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
Wenatchee Research Office
3515 Chelan Hwy 97-A Wenatchee, WA 98801 (509) 664-1227 FAX (509) 662-6606

March 15, 2013

To: NMFS and HCP-HC and PRCC-HSC committee members

From: Mike Tonseth, WDFW

Subject: **DRAFT 2013 UPPER COLUMBIA RIVER SALMON AND STEELHEAD BROODSTOCK OBJECTIVES AND SITE-BASED BROODSTOCK COLLECTION PROTOCOLS**

The attached protocol was developed for hatchery programs rearing spring Chinook salmon, summer Chinook salmon and summer steelhead associated with the mid-Columbia HCPs, spring Chinook salmon and steelhead programs associated with the 2008 Biological Opinion for the Priest Rapids Hydroelectric Project (FERC No. 2114) and fall Chinook consistent with Grant County Public Utility District and Federal mitigation obligations associated with Priest Rapids and John Day dams (ACOE funded), respectively. These programs are funded by Chelan, Douglas, and Grant County Public Utility Districts (PUDs) and are operated by the Washington Department of Fish and Wildlife (WDFW).

This protocol is intended to be a guide for 2013 collection of salmon and steelhead broodstocks in the Methow, Okanogan, Wenatchee, and Columbia River basins. It is consistent with previously defined program objectives such as program operational intent (i.e., conservation and/or harvest augmentation), mitigation production levels (HCPs, Priest Rapids Dam 2008 Biological Opinion), changes to programs as approved by the HCP-HC, and to comply with ESA permit provisions.

Notable in this years protocols are:

- Continuing for 2013, no age-3 males will be incorporated into spring or summer Chinook programs.

- Implementation of the draft Production Management Plan (Appendix B), for all programs where possible, to ensure mitigation production levels are met and that the permitted production ceiling is not exceeded at release.

- Chelan PUD's 2013 Methow spring Chinook Obligation of 60,516 smolts will be met through eyed egg transfers to Eastbank FH from adults collected and spawned at Winthrop national Fish Hatchery.

- Utilization of genetic sampling/assessment to differentiate Twisp River and Methow Basin natural-origin spring Chinook adults collected at Wells Dam, and CWT interrogation during spawning of hatchery spring Chinook collected at the Twisp Weir, Methow FH and Winthrop NFH to differentiate Twisp and Methow Composite hatchery fish for discrete management of Twisp and Methow Composite production components.

- Collection of only hatchery adult steelhead at Wells Dam/hatchery for MFH safety net, Winthrop conservation, Okanogan, and mainstem Columbia programs.

- Implementation of Grant PUD's Nason Creek spring Chinook program beginning with the 2013 brood.

- Targeted collection of natural origin spring Chinook at Tumwater Dam for both the Nason Creek and Chiwawa conservation programs.

- Targeted collection of 100% of the Wenatchee summer Chinook and Wenatchee hatchery origin steelhead broodstock at Dryden Dam to reduce the number of activities that may contribute to delays in fish passage at Tumwater Dam (some adult collections at Tumwater may be necessary if sufficient adults cannot be acquired at Dryden Dam).

- Targeted collection of 100% of the natural origin steelhead broodstock at Tumwater Dam

- Collection of summer Chinook broodstock from the Eastbank Outfall, sufficient to meet a 576K yearling juvenile Chelan Falls program. The Wells volunteer channel will be the fallback location if insufficient females are collected in the outfall.

- Collection of 24-natural origin steelhead at the Twisp Weir in the spring of 2014. Adults will be transferred to Methow Hatchery for spawning and biosecure, isolated incubation through the eyed-egg stage after which they will be moved to Wells FH for the remainder of rearing.

- Collection of surplus hatchery origin steelhead from the Twisp Weir (up to 25% of the required broodstock) to produce the 100K Methow on-station-released smolts (up to 13 adults). The remainder of the broodstock (37) will be WNFH returns collected at WNFH and/or Methow Hatchery and surplus to the WNFH program needs. The collection of adults will occur in spring of 2014.

- With the CCT summer Chinook program coming on-line beginning with the 2013 brood year, only collections of summer Chinook for the Grant PUD's obligation in the Methow (Carlton program) will occur at Wells Dam.

- The collection from the Wells Hatchery volunteer channel of Wells summer Chinook to support the USFWS, Entiat NFH summer Chinook programs (requires agreement of the HCP Hatchery Committee [HC]).

These protocols may be adjusted in-season, based on actual run monitoring at mainstem dams and/or other sampling locations. Additional adaptive management actions as they relate to broodstock objectives may be implemented as determined by the HCP-HC or PRCC-HSC and within the boundaries of applicable permits.

Above Wells Dam

Spring Chinook

Inclusion of natural-origin fish in the broodstock will be a priority, with natural-origin fish specifically being targeted. Collections of natural-origin fish will not exceed 33% of the MetComp and Twisp natural-origin run escapement to maximize natural origin fish on the spawning grounds.

To facilitate BKD management, comply with ESA Section 10 permit take provisions, and to meet programmed production, hatchery-origin spring Chinook will be collected in numbers excess to program production requirements. Based on historical Methow FH spring Chinook ELISA levels above 0.12, the hatchery origin spring Chinook broodstock collection will include hatchery origin spring Chinook in excess to broodstock requirements by approximately 18.2% (based upon the most recent 5-year mean ELISA results for the program). For purposes of BKD management and to comply with maximum production levels and other take provisions specified in ESA Section 10 permit 1196, culling will include the destruction of eggs from hatchery-origin females with ELISA levels greater than 0.12 and/or that number of hatchery origin eggs required to maintain production at 163,249 yearling smolts. Culling of eggs from natural-origin females will not occur unless their ELISA levels are determined by WDFW Fish Health to be a substantial risk to the program. Progeny of natural-origin females, with ELISA levels greater than 0.12, will be differentially tagged for evaluation purposes. Annual monitoring and evaluation of the prevalence and level of BKD and the efficacy of culling in returning hatchery- and natural-origin spring Chinook will continue and will be reported in the annual monitoring and evaluation report for this program.

Recent WDFW genetic assessment of natural-origin Methow spring Chinook (Small et al. 2007) indicated that Twisp natural-origin spring Chinook can be distinguished, via genetic analysis, from non-Twisp spring Chinook with a high degree of certainty. The Wells HCP Hatchery Committee accepted that Twisp-origin fish could be genetically assigned with sufficient confidence that natural origin collections can occur at Wells Dam. Scale samples and non-lethal tissue samples (fin clips) for genetic analysis will be obtained from adipose-present, non-CWT, non-ventral-clipped spring Chinook (suspected natural-origin spring Chinook) collected at Wells Dam, and origins assigned based on that analysis. Natural-origin fish retained for broodstock will be PIT tagged (dorsal sinus) for cross-referencing tissue samples/genetic analyses. Tissue samples will be preserved and sent to WDFW genetics lab in Olympia Washington for genetic/stock analysis. The spring Chinook sampled will be retained at Methow FH and will be sorted as Twisp or Methow Composite (non-Twisp) natural-origin fish prior to spawning. The number of natural-origin Twisp and Methow Composite (non-Twisp) spring Chinook retained will be dependent upon the number of natural-origin adults returning and the collection objective limiting extraction to no greater than 33% of the natural-origin spring Chinook return to the Methow Basin. Natural origin fish not assigning to the Twisp or Methow will be released back into the Columbia River. Based on the broodstock-collection schedule (3-day/week, 16 hours/day), extraction of natural-origin spring Chinook is expected to be approximately 33% or less.

Weekly estimates of the passage of Wells Dam by natural-origin spring Chinook will be provided through stock-assessment and broodstock-collection activities. This information will facilitate in-season adjustments to collection composition so that extraction of natural-origin spring Chinook remains less than 33%. Twisp and Methow Composite hatchery-origin spring Chinook will be captured at the Twisp Weir, and Methow FH outfall. Trapping at the Winthrop NFH will be included if needed because of broodstock shortfalls.

Pre-season run-escapement of Methow-origin spring Chinook above Wells Dam during 2013 is estimated at 1,808 spring Chinook, including 1,589 hatchery and 219 natural origin spring Chinook (Table 1 and Table 2). In-season estimates of natural-origin spring Chinook will be adjusted proportional to the estimated returns to Wells Dam at weekly intervals and may result in adjustments to the broodstock collection targets presented in this document.

The following broodstock collection protocol was developed based on the re-calculated program production levels (163,249 smolts – Chelan PUD spring Chinook production of 60,516 smolts will be met through Winthrop NFH collections and result in transfer of eyed eggs to EB FH per HCP-HC agreements for 2013), BKD management strategies, projected return for BY 2013 Methow Basin spring Chinook at Wells Dam (Table 1 and Table 2), and assumptions listed in Table 3.

The 2013 Methow spring Chinook broodstock collection will target up to 108 adult spring Chinook (24 Twisp, 84 Methow). Based on the pre-season run forecast, Twisp fish are expected to represent 9% of the adipose present, CWT tagged hatchery adults and 10.5% of the natural origin spring Chinook passing above Wells Dam (Tables 1 and 2). Based on this proportional contribution and a collection objective to limit extraction to no greater than 33% of the natural-origin spawning escapement to the Twisp, the 2013 Twisp origin broodstock collection will total 24 fish (7 wild and 17 hatchery origin), representing 100% of the broodstock necessary to meet Twisp program production of 30,000 smolts. Methow Composite fish are expected to represent 42% of the adipose present CWT tagged hatchery adults and 89.5% of the natural origin spring Chinook passing above Wells Dam (Tables 1 and 2). Based on this proportional contribution and a collection objective to limit extraction to no greater than 33% of the natural-origin recruits, the 2013 Methow broodstock collection will total 84 spring Chinook (64 wild and 20 Hatchery). The broodstock collected for the Methow program represents 100% of the broodstock necessary to meet Methow program production of 133,249 smolts. The Twisp River releases will be limited to releasing progeny of broodstock identified as wild Twisp and or known Twisp hatchery origin fish, per ESA Permit 1196. The Methow FH releases will include progeny of broodstock identified as wild non-Twisp origin and known Methow Composite hatchery origin fish. Age-3 males ("jacks") will not be collected for broodstock.

Table 1. Brood year 2008-2010 age class-at-return projection for wild spring Chinook above Wells Dam, 2013.

Brood year	Smolt Estimate		Age-at-return: Twisp Basin				Methow Basin				
	Twisp[1/]	Methow Basin[2/]	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	SAR[3/]
2008	11,932	56,337	7	42	**7**	56	6	192	**67**	265	0.0047
2009	5,124	31,212	7	**14**	3	24	9	**120**	18	147	0.0047
2010	8,927	50,165	**2**	25	15	42	**9**	111	116	236	0.0047
Estimated 2013 Return			**2**	**14**	**7**	**23**	**9**	**120**	**67**	**196**	

[1/]-*Smolt estimate is based on sub-yearling and yearling emigration (Charlie Snow, personal communication).*
[2/]-*Estimated Methow Basin smolt emigration based on Twisp Basin smolt emigration, proportional redd deposition in the Twisp River and Twisp Basin smolt production estimate.*
[3/]- *Mean Chiwawa NOR spring Chinook SAR to the Wenatchee Basin (BY 1998-2003; WDFW unpublished data).*

Table 2. Brood year 2008-2010 age class and origin run escapement projection for UCR spring Chinook at Wells Dam, 2013.

Stock	Projected Escapement – Origin: Hatchery				Wild				Total Methow Basin			
	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total
MetComp	138	468	67	**673**	9	120	67	**196**	147	588	134	**869**
%Total				42%				89%				48%
Twisp	33	98	6	**137**	2	14	7	**23**	35	112	13	**160**
%Total				9%				11%				9%
Winthrop (MetComp)	98	626	55	**779**					98	626	55	**779**
%Total				49%								43%
Total	269	1,192	128	**1,589**	11	134	74	**219**	280	1,326	202	**1,808**

Table 3. Assumptions and calculations to determine the number of broodstock needed for BY 2013 production of 163,249 smolts.

Program Assumptions	Twisp standard	Twisp program	Methow standard	Methow program	Total program
Smolt Release		30,000		133,249	**163,249**
Fertilization-to-release survival	*86.5%*[1]		*84.8%*[1]		
Total egg take target		34,682		157,133	**191,815**
Egg take (production)					
Cull allowance[2/]	*10.9%*	45,455	*18.2%*	163,423	**208,878**
Fecundity[3/]	*3,626H/3,715W*		*3,719H/4,027W*		
Female Target					
Female to male ratio	*1:1*		*1:1*		
Broodstock target					
Pre-spawn survival	*91.8%*		*98.9%*		
Total broodstock collection		**7W 17H**		**64W 20H**	

[1/] *- Median values.*
[2/]*-Hatchery origin MetComp. component only, and is based on the projected natural origin collection and assumption that all Twisp (hatchery and wild) and wild MetComp. fish will be retained for production.*
[3/]*-Based on historical age-4 fecundities and expected 2012 return age structure (Table 1).*

Trapping at Wells Dam will occur at the East and West ladder traps beginning on 01 May, or at such time as the first spring Chinook are observed passing Wells Dam, and continue through 21 June 2013. The trapping schedule will consist of 3-day/week (Monday-Wednesday), up to 16-hours/day. Two of the three trapping days will be concurrent with the stock assessment sampling activities authorized through the 2013 Douglas PUD Hatchery M&E Implementation Plan. Natural origin spring Chinook will be retained from the run, consistent with spring Chinook run timing at Wells Dam (weekly collection quota). Once the weekly quota target is reached, broodstock collection will cease until the beginning of the next week. If a shortfall occurs in the weekly trapping quota, the shortfall will carry forward to the following week. All natural origin spring Chinook collected at Wells Dam for broodstock will be held at the Methow FH.

To meet Methow FH broodstock collection for hatchery origin Methow Composite and Twisp River stocks, adipose-present coded-wire tagged hatchery fish will be collected at Methow FH, Winthrop NFH and the Twisp Weir beginning 01May or at such time as spring Chinook are observed passing Wells Dam and continuing through 23 August 2013. Natural origin spring Chinook will be retained at the Twisp Weir as necessary to bolster the Twisp program production so long as the aggregate collection at Wells Dam and Twisp River weir does not exceed 33% of the estimated Twisp River natural origin spawners to maximize pNOS in the Twisp. All hatchery and natural origin fish collected at Methow FH, Twisp Weir and Winthrop NFH for broodstock will be held at the Methow FH.

Steelhead

Steelhead programs located upstream of Wells Dam and at Wells Hatchery are presented in Table 4.

Table 4. 2014 brood year Steelhead Programs at Wells Hatchery and Upstream of Wells Dam

Program	Hatchery	Owner	Release Location	Release Target	Broodstock Collection Location
Twisp Conservation	Methow Hatchery (incubation); Wells Hatchery (rearing)	Douglas PUD	Twisp Acclimation Pond	48,000	Twisp WxW
Methow Safety-Net	Wells Hatchery	Douglas PUD	Methow Hatchery	100,000	HxH: Twisp Hatchery (25%) + WNFH Hatchery (75%)
Mainstem Columbia Safety-Net	Wells Hatchery	Douglas PUD	Wells Hatchery	160,000	HxH: Methow Hatchery returns (1st option); Wells Stock (2nd option)
WNFH Conservation Program	WNFH	USFWS	WNFH	100,000	Up to 25 collected at Wells Dam/Hatchery; remaining 25 collected by USFWS
Omak Creek	Wells Hatchery	Grant PUD	Omak Creek	Up to 50,000[1]	Omak Creek returns (up to 25 wild or hatchery)
Okanogan	Wells Hatchery	Grant PUD	Okanogan Basin	Up to 100,000[1]	Wells Stock collected at Wells Dam/Hatchery

[1/] The Grant PUD programs will total 100,000, with Omak Creek taking precedence, and the Okanogan program = 100,000 – Omak production.

Steelhead mitigation programs above Wells Dam (including the USFWS steelhead program at Winthrop NFH) utilize adult broodstock collections at Wells Dam, Twisp Weir, Methow Hatchery volunteer trap, and WNFH volunteer trap (Table 5) and incubation/rearing at Wells Fish Hatchery (FH) and incubation at Methow Hatchery (Twisp program). The Wells Steelhead Program has provided eggs for UCR steelhead reared at Ringold FH, not as a mitigation requirement, but rather an opportunity to reduce the prevalence of early spawn hatchery steelhead in the mitigation component above Wells Dam. However, the Methow steelhead program is shifting to locally collected Twisp wild broodstock (Twisp conservation program), and hatchery origin broodstock representative of the Twisp and WNFH conservation programs (Methow safety-net program). Therefore, surplus broodstock will not be collected for the Methow steelhead programs to address the spawn-timing issue of the Wells stock. The Wells Hatchery Columbia River releases will use returns to the Methow Hatchery volunteer trap to the extent possible, and will be augmented with Wells stock as required to fulfill the program.

However, the local collections of broodstock in the Methow Basin will occur in the spring, 2014. To ensure the safety-net programs have broodstock, some broodstock will be collected at Wells Dam in the autumn, 2013, and held at Wells Hatchery. These autumn-collected Wells stock fish will be considered surplus to the spring-collected Methow and Okanogan broodstock, and eggs from these surplus broodstock may be transferred to Ringold Hatchery. In addition, Wells Hatchery may be used for adult management and steelhead removed for adult management may be retained for the Ringold program (Table 5).

Table 5. Broodstock collection locations, number, and origin by program.

Program	**Wells Dam or Hatchery**		**Twisp Weir**		**WNFH**		**Methow Hatchery**		**Omak Creek**	
	H	W	H	W	H	W	H	W	H	W
Twisp Conservation			0	24						
Methow Safety-Net			Up to 52	0	Up to 52 (backup)	0				
Mainstem Columbia Safety-Net	82 (backup)	0					82	0		
WNFH Conservation Program						26[1]				
Omak Creek									Up to 25[2]	
Okanogan	Up to 42	0								
Ringold[3]										
Total	124	0	52	24	52	26	82	0	25	

1/- Wild origin fish for WNFH program will be collected through USFWS hook and line angling efforts in the Methow in the spring of 2014.
2/- Wild origin preferred, but hatchery origin broodstock will also be collected to meet target.
3/- Broodstock derived from adult management at Wells Hatchery and surplus brood collected as backup for Methow and Okanogan programs.

The following broodstock collection protocol was developed based on mitigation program production objectives (Table 6), program assumptions (Table 7), and the probability that sufficient adult steelhead will return in 2013/2014 to meet production objectives absent a preseason forecast at the present time.

Trapping at Wells Dam will selectively retain up to 124 hatchery origin steelhead (East and West ladder collection). Ringold FH production will be based on the availability and comprised of surplus eggs/fish resultant from managing any production overruns in DC and GC PUD production. No adults for the Ringold program will be specifically targeted at Wells. In the spring of 2014, 24 wild steelhead will be targeted at the Twisp Weir and transferred to the Methow Hatchery for spawning and incubation to the eyed-egg stage after which they will be moved to Wells Hatchery for the balance of rearing. In addition, up to 50 surplus hatchery-origin steelhead (to meet the 100K Methow Safety-Net release) will be targeted at the Twisp Weir and/or Methow Hatchery and moved to Wells Hatchery for spawning. Surplus WNFH hatchery returns will be used to augment the Twisp/Methow hatchery-origin collection if needed. Should there be inadequate surplus steelhead from these two sources, steelhead captured at the Methow Hatchery volunteer trap will be used to fulfill the program. Wells stock held at the Wells Hatchery will be used as a final option. Approximately, 16 (up to 25) adult steelhead will be targeted in Omak Creek for a 20K (up to 50K) endemic program operated by the CCT and funded by GCPUD as part of their 100K UCR steelhead mitigation obligation. Overall collection for the programs will be 385 fish (a combination of program specific and back-up adults) and limited to no more than 33% of the entire run or 33% of the natural origin return (NOR composition in the broodstock, is estimated at 17%). Hatchery and natural origin collections will be consistent with run-timing of hatchery and natural origin steelhead at Wells Dam. Ladder trapping at Wells Dam will begin on 01 August and terminate by 31 October, three days per week, up to 16 hours per day, if required to meet broodstock objectives. Trapping will be concurrent with summer Chinook broodstocking efforts through 15 September on the west ladder. If insufficient steelhead adults are encountered on the west ladder, the east ladder trap may be considered. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and Wells dams. Broodstock collection adjustments may be made based on in-season monitoring and evaluation. If collection of adults from the east ladder trap is necessary, access will be coordinated with staff at Wells Dam due to the rotor rewind project.

Table 6. Adult steelhead collection objectives for programs supported through 2013 return year adult steelhead broodstock collected at Wells Dam, Twisp Weir, WNFH, and Omak Creek (CCT endemic program).

Program	**# Smolts**	**# Green eggs**	**% Wild**	**# Wild**	**# Hatchery**	**Total Adults**
DCPUD[1/]	160,000	226,629			82	82
DCPUD[2/]	100,000	141,643			52	52
DCPUD Twisp	48,000	67,989	100%	24		24
GCPUD[3/]	80,000	113,315			42	42
GCPUD Omak	20,000	40,000	100%	16		16[4/]
USFWS	50,000	70,821			26	26
Sub-total	**458,000**	**660,397**	17%	**40**	**202**	**242**
Ringold[5/]	180,000	285,714			103	103
Sub-total	**180,000**	**285,714**			**103**	**103**
Grand Total[6/]	**638,000**	**946,111**	**12%**	**40**	**305**	**345**

1/- Mainstem Columbia releases at Wells Dam. Target HxH parental adults as the hatchery component.
2/- Methow hatchery release of HxH fish produced from either adults returning from the Winthrop conservation program, adults trapped at MFH, and/or surplus hatchery adults from the Twisp weir.
3/- Okanogan Basin releases as part of GCPUD's 100K summer steelhead obligation. Broodstock need is dependent on the Omak collection to achieve 100,000 smolts total.
4/- Broodstock targeted is 16 total (8 male/8 female) of mixed origin composition based upon what is trapped. Collection could range up to 25 broodstock (50,000 smolt program maximum.).
5/- Eggs/juveniles will be provided to the Ringold program consistent with management of program surpluses up to 180,000 smolts. Adults for the Ringold program will not be specifically targeted at Wells Dam/Hatchery in 2013.
6/- Based on steelhead production consistent with Mid-Columbia HCP's, GCPUD BiOp and Section 10 permit 1395.

Table 7. Program assumptions used to determine the number of adults required to meet steelhead production objectives for programs above Wells Dam.

	Standard	
Program assumptions	**Hatchery**	**Wild**
Pre-spawn survival	95.4%	97.6%
Female : Male ratio	1.0:1.0	1.0:1.0
Fecundity	5,822	5,800
Fertilization-to-yearling release	70.6%	70.6%

Summer/fall Chinook

The summer/fall Chinook mitigation program in the Methow River utilizes adult broodstock collections at Wells Dam and incubation/rearing at Eastbank Fish Hatchery. The total production level target is 200,000 summer/fall Chinook smolts for acclimation atCarlton Pond.

The TAC 2012 Columbia River UCR summer Chinook return projection to the Columbia River (Appendix A) and BY 2008, 2009 and 2010 spawn escapement to tributaries above Wells Dam indicate sufficient summer Chinook will return past Wells Dam to achieve full broodstock collection for supplementation programs above Wells Dam. The following broodstock collection protocol was developed based on initial run expectations of summer Chinook to the Columbia River, program objectives and program assumptions (Table 8).

For 2013, WDFW will retain up to 102 natural-origin summer/fall Chinook at Wells Dam east and/or west ladders, including 51females for the Methow summer Chinook program. Collection will be proportional to return timing between 01 July and 15 September. Trapping may occur up to 3-days/week, 16 hours/day. Age-3 males ("jacks") will not be collected for broodstock.

Additionally, in 2013 brood stock collection for Okanogan based summer Chinook programs will fall under the responsibility of the Colville Tribes as part of their overall summer Chinook program. Broodstock collection will be prioritized through purse seine operations, ladder returns to the Chief Joe Hatchery and the Okanogan weir. Should use of Wells Dams be needed to meet any shortfalls in broodstock, the CCT will notify the HCP-HC and coordinate with Douglas PUD and WDFW to facilitate additional effort.

To better assure achieving the appropriate females for program production, the collection will utilize ultrasonography to determine the sex of each fish retained for broodstock.
If the probability of achieving the broodstock goal is reduced based on passage at the west ladder or actual natural-origin escapement levels, broodstock collections may be expanded to the east ladder trap and/or origin composition will be adjusted to meet the broodstock collection objective. If collection of adults from the east ladder trap is necessary, access will be coordinated with staff at Wells Dam due to the rotor rewind project.

Table 8. Assumptions and calculations to determine the number of broodstock needed for 2013 brood summer/fall Chinook production goals in the Methow River basin.

Program Assumptions	Metrics	Carlton Pond
Smolt release		**200,000**
Fertilization-to-release survival	85.9%	
Eggtake target		**232,829**
Fecundity	4,982	
Female target		**48**
Female:male ratio	1:1	
Broodstock target		**96**
Pre-spawn survival	95.5%	
Total collection target		**102**

Columbia River Mainstem below Wells Dam

<u>Summer/fall Chinook</u>

Summer/fall Chinook mitigation programs that release juveniles directly into the Columbia River between Wells and Rocky Reach dams have traditionally been supported through adult broodstock collections at the Wells Hatchery volunteer channel. Beginning in 2013, the broodstock requirement for the Chelan Falls summer Chinook program will be prioritized through broodstock collection of marked summer Chinook in the Eastbank Outfall (EBO) with the Wells volunteer channel as a back-up collection location should insufficient females be acquired at the EBO. The total production level supported by this collection is 320,000 yearling and 484,000 sub-yearling Chinook (Wells Hatchery) and up to 576,000 yearlings for the Chelan Falls program. Upon agreement in the HCP-HC, the 2013, summer Chinook broodstock collections at Wells FH may also include up to 266 adults for the USFWS Entiat program pending agreements between USFWS and DCPUD. If approved by the HCP Hatchery Committee, Adults for the Entiat program will be transferred to Entiat NFH by either WDFW or USFWS staff (arrangements between USFWS and DCPUD will have been made prior to implementation).

Adults returning from the Wells and Chelan Falls programs are to support harvest opportunities and are not intended to increase natural production and have been termed segregated harvest programs. These programs have contributed to harvest opportunities; however, adults from these programs have been documented contributing to adult spawning escapement in tributaries upstream and downstream from their release locations. Because of CCT concerns about sufficient natural origin fish reaching spawning grounds and to ensure sufficient NOR's being available to meet the CCT summer Chinook program, incorporation of natural origin fish for the Wells program or programs with broodstock originating from the Wells volunteer channel, will be limited to fish collected in the Wells volunteer channel. The following broodstock collection protocol was developed based on mitigation objectives and program assumptions (Table 9).

WDFW will target 810 run-at-large summer Chinook from the volunteer ladder trap at Wells

Fish Hatchery outfall for the Wells sub-yearling and yearling programs and the USFWS Entiat summer Chinook program. Due to fish health concerns associated with the volunteer collection site (warming Columbia River water during late August), the volunteer collection will begin 11 July and terminate by 31 August. Age-3 males ("jacks") will not be collected for broodstock.

For 2013, broodstock collection for the Chelan Falls summer Chinook program will be prioritized at the Eastbank Outfall using in-channel seining/netting beginning July 1 (or earlier if summer Chinook are detected in the outfall) through September 15. While preliminary evaluations of feasibility late in 2012 did demonstrate the ability to collect summer Chinook, the catch was comprised primarily of males. Given concerns about acquiring sufficient females to meet production objectives, if the number of females have not been reached by August 15, the broodstock collection will default to the Wells Volunteer channel to make up the difference. The 2013 broodstock target for the Chelan Falls program is 318 adults. Age-3 males will not be incorporated into the broodstock. Confirmation of gender will be made at the time of collection using established ultrsonography techniques.

Table 9. Assumptions and calculations to determine the number of broodstock needed for summer/fall Chinook production goals for programs relying on adult collection at Wells Dam or Wells Hatchery in 2013.

Program Assumptions	**Standard**		**Wells FH**		**Chelan Falls FH**[1/]	**USFWS**[2/]	
	Sub-yearling	**Yearling**	**Sub-yearling**	**Yearling**	**Yearling**	**Adults**	**Total**
Smolt release			**484,000**	**320,000**	**576,000**		**NA**
Green egg-to-release survival	76.1%[4/]	83.6%					NA
Eggtake target			**636,005**	**382,775**	**688,995**		**2,561,784**
Fecundity	4,487	4,487					
Female target			**142**	**86**	**154**		**588**
Female:Male ratio	1:1	1:1					
Broodstock target			**284**	**242**[3/]	**308**		**1,246**
Pre-spawn survival	96.8%	96.8%					
Total collection target			**294**	**250**	**318**	**266**	**1,287**

[1/]-The Well volunteer trap will only be a fallback broodstock source should efforts to acquire broodstock in the Eastbank outfall not provide sufficient females to meet production objectives.
[2/]-Adults for USFWS summer Chinook program in the Entiat River Basin.
[3/]- Includes 70 adults collected for the Lake Chelan triploid Chinook program.

Wenatchee River Basin

Spring Chinook

In 2013 the Eastbank Fish Hatchery (FH) is expecting to rear spring Chinook salmon for the Chiwawa River and Nason Creek acclimation facilities located on the Chiwawa River and Nason

Creek (2013 represents the first brood year production for the new Nason Creek program). The program production level target for the Chiwawa program in 2013 is 144,026 smolts, requiring a total broodstock collection of 74 natural origin spring Chinook (Table 10).

The spring Chinook production obligation for Grant PUD in the Wenatchee Basin is 223,670 smolts. Grant PUD's production was originally scripted to be met through a combination of 74,556 smolts in the White River and 149,114 smolts at Nason Creek. Consistent with agreements in the PRCC-PC SOA 2013-01, the White River production will be met through progeny produced at Nason Creek through 2026. Because two brood years remain in the White River captive brood program, the PRCC SOA identifies a credit of 75,000 smolts from the captive brood program toward meeting the over 223K production obligation. Additionally, if the 2013 Nason program is unable to meet the balance of the production, any additional production from the 2013 captive brood program will be credited to Grant PUD.

2013 represents the proof of concept year in determining the effectiveness of utilizing Tumwater Dam and genetic assignment methodologies to target broodstock for the Nason Creek spring Chinook program and by default for the Chiwawa spring Chinook program as well. While the Chiwawa program could be met through adult collections solely at the Chiwawa without the use of Tumwater Dam, the Chiwawa NOR component makes up the preponderance of the NOR return in the Wenatchee Basin (~61% of the total return and ~72% of the Chiwawa/Nason aggregate based upon a 10-year geometric mean). As a direct result of targeting NOR's for Nason Creek, generally, more than sufficient numbers of Chiwawa fish will be handled (and retained at Eastbank FH pending genetic assignments) to meet the Chiwawa program needs. To limit excessive handling of fish (being transported to EB, sampled, transported back to the river, and subsequently intercepted at the Chiwawa Weir and transported back to EB FH or upriver of the weir as per current protocol) which could contribute to handling mortality and to limit delaying fish as a result of the handling and operation of the weir, the JFP prefer to have collections for both programs occur at Tumwater Dam. If use of Tumwater Dam demonstrates a risk to the Wenatchee Basin population which is unacceptable to co-managers and permitting authorities as result of broodstock collection, alternate and other existing brood collection locations/methods will be considered.

Table 10. Assumptions and calculations to determine the number of broodstock needed for a combined Nason/Chiwawa spring Chinook production goal of 367,696 smolts. For 2013, the Nason Creek production will be met through a combination of smolts produced through one of two remaining captive brood years and the Nason Creek conservation program.

Program Assumptions	Standard	Chiwawa	Nason Creek[1/]		Wenatchee Basin Total
		Conservation	**Conservation**	**Safety net**	
Smolt Release		**144,026**	**125,000**	**98,670**	**367,696**
Fertilization-to-release survival	*85.0%*				
Total egg take target		169,442	147,059	116,082	**432,583**
Egg take (production)					
Cull allowance	*13.1%*			17,499	**450,082**
Fecundity	*4,684 W* *4,145 H*				
Female Target		36	31	32	**99**
Female to male ratio	*1:1*				
Broodstock target		72W	62W	64H	**198**
Pre-spawn survival	*97.7%W/97.7H*				
Total broodstock collection		**74W**	**64W**	**66H**	**204 (138W;66H)**

[1/-] *Because Nason Creek is a new program beginning with the 2013 brood, hatchery performance values from the Chiwawa program were used as a surrogate to estimate the adult requirements for Nason Creek.*

Inclusion of natural origin fish into the broodstock will be a priority, with natural origin fish specifically being targeted. Consistent with ESA Section 10 Permit 1196, natural origin fish collections will not exceed 33 percent of the return.

Pre-season estimates project a total of 2,732 (521 natural origin (19%) and 2,211 hatchery origin (81%) spring Chinook back to the Wenatchee Basin. Approximately 2,514 spring Chinook are destined for the Chiwawa River, of which 303 (12.1%) and 2,211 fish (87.9%) are expected to be natural and hatchery origin spring Chinook, respectively and approximately 110 natural origin spring Chinook are expected back to Nason Creek (Tables 11 and 12). These protocols, target anywhere between 110 and 175 spring Chinook to be trapped at Tumwater Dam and transported to Eastbank FH for broodstock purposes. In-season assessment of the magnitude and origin composition of the spring Chinook return above Tumwater Dam will be used to provide in-season adjustments to hatchery/wild composition and total broodstock collection, consistent with ESA Section 10 Permit 1196.

Table 11. BY 2008-2010 age class return projection for wild spring Chinook above Tumwater Dam during 2013.

Brood year	Nason Cr. Basin[1/]				Chiwawa Basin[1/]				Wenatchee Basin above Tumwater Dam[1/]				
	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	SAR[2/]
2008	3	175	**31**	209	18	283	**128**	429	35	688	**156**	878	0.0047
2009	2	**76**	18	96	12	**156**	74	242	27	**312**	82	421	0.0047
2010	**3**	122	21	146	**19**	261	110	390	**53**	574	125	751	0.0047
Estimated Return	3	76	31	**110**	19	156	128	**303**	53	312	156	**521**	

1/-Based upon average age-at-return (return year 2007-2011), for natural origin spring Chinook above Tumwater Dam (WDFW unpublished data).
2/-Mean Chiwawa spring Chinook SAR to the Wenatchee Basin (BY 1998-2003; WDFW unpublished data).

Table 12. BY 2008-2010 age class return projection for Chiwawa hatchery spring Chinook above Tumwater Dam during 2013.

Brood Year	**Smolt Estimate**	**Adult Returns**				
	Chiwawa[1/]	Age-3[2/]	Age-4[2/]	Age-5[2/]	Total	SAR
2008	609,789	1,229	2,839	**139**	3,476	0.0057[3/]
2009	438,651	411	**1,827**	88	2,325	0.0053[4/]
2010	346,248	**245**	1265	83	1,593	0.0046[5/]
Estimated 2013 Return		**245**	**1,827**	**139**	**2,211**	

1/-Chiwawa smolt release (Hillman et. al. 2013).
2/-Based on average age-at-return for hatchery origin spring Chinook above Tumwater Dam, 2006-2010 (WDFW, unpublished data) and total estimated BY return.
3/-Mean Chiwawa hatchery spring Chinook SAR to the Wenatchee Basin (BY 1998-2003).
4/-Mean Chiwawa hatchery spring Chinook SAR to the Wenatchee Basin (BY 2000-2004).
5/-Mean Chiwawa hatchery spring Chinook SAR to the Wenatchee Basin (BY 2001-2005).

Broodstock collection at Tumwater Dam will begin 01 June and terminate no later than 15 August Spring Chinook trapping at Tumwater Dam if operated independent of the Spring Chinook Reproduction Success Study, will follow a three day per week and up to 16 hours per day and will be consistent with weekly broodstock collection quotas that approximate the historical run timing and a maximum 33 percent retention of the projected natural-origin escapement. If the weekly quota is attained prior to the end of the trapping period, broodstock trapping will cease. If the weekly quota is not attained within the trapping period, the shortfall will carry forward to the next week.

Age-3 males ("jacks") will not be collected for broodstock.

Based upon these forecasts and assumptions, the following options for Wenatchee Basin spring Chinook were developed for discussion/decision by the HCP-HC and PRCC-HSC:

Alternative 1

Approximately 140 natural origin spring Chinook adults will be collected at Tumwater Dam (about 25% of the overall NOR return) through duration of the return and transferred to Eastbank FH for holding until a genetic assignments can be made to spawning aggregates (specifically Nason and Chiwawa). This should result in approximately 119 probable Nason/Chiwawa origin adults. Using an 86% probability assignment rate derived through a recent SNP's evaluation of Wenatchee spring Chinook spawning aggregates, an estimated 29 Nason and 90 Chiwawa NOR's would be identified (Table 13). The 29 Nason and 74 of the Chiwawa spring Chinook would be retained. All remaining adults either in excess of program needs or individuals not assigning to the two spawning aggregates, would be released at locations, yet to be determined above Tumwater Dam (this is to provide some offset to the delay in migration to the spawning grounds experienced by holding adults at Eastbank FH while the genetic evaluations are being conducted).

Under this alternative full production will be achieved for the Chiwawa spring Chinook conservation program (144,026 smolts; Table 13).

The Nason Creek program will achieve an estimated smolt production of 55,740 conservation program smolts (45% of the conservation program and 37% of the 2013 production target for Nason Creek). This will result in an additional 92,930 smolts (167,930) from the 2013 White River captive brood program being credited toward Grant PUD's Wenatchee Spring Chinook production obligation. The 2013 WR captive brood program is expected to produce approximately 259,297 smolts (Table 16).

Alternative 2

Approximately 138 natural origin spring Chinook adults (the total number of adults needed to meet both the Chiwawa and Nason conservation programs not adjusted for adults not assigning to either or any spawning aggregate) will be collected at Tumwater Dam (about 21% of the overall NOR return) through duration of the return and transferred to Eastbank FH for holding until a genetic assignments can be made to spawning aggregates (specifically Nason and Chiwawa). This should result in approximately 115 probable Nason/Chiwawa origin adults. Using an 86% probability assignment rate derived through a recent SNP's evaluation of Wenatchee spring Chinook spawning aggregates, an estimated 29 Nason and 71 Chiwawa NOR's would be identified (Table 13). All 29 Nason and 71 Chiwawa spring Chinook would be retained. All adults not assigning to the two spawning aggregates, would be released at locations, yet to be determined above Tumwater Dam (this is to provide some offset to the delay in migration to the spawning grounds experienced by holding adults at Eastbank FH while the genetic evaluations are being conducted).

Under this alternative approximately 94% of the Chiwawa spring Chinook conservation program (135,368 smolts; Table 13) would be met The balance of the Chiwawa program would achieved by producing 8,658 safety net smolts at Chiwawa (this will require approximately 6 hatchery origin adults).

The Nason Creek program will achieve an estimated smolt production of 43,795 conservation program smolts (35% of the conservation program and 29% of the 2013 production target for Nason Creek). This will result in an additional 140,502 smolts (179,875 total) from the 2013 White River captive brood program being credited toward Grant PUD's Wenatchee Spring Chinook production obligation. The 2013 WR captive brood program is expected to produce approximately 259,297 smolts (Table 16).

Alternative 3

Approximately 172 natural origin spring Chinook adults will be collected at Tumwater Dam (about 33% of the overall NOR return) through duration of the return and transferred to Eastbank FH for holding until a genetic assignments can be made to spawning aggregates (specifically Nason and Chiwawa). This should result in approximately 147 probable Nason/Chiwawa origin adults. Using an 86% probability assignment rate derived through a recent SNP's evaluation of Wenatchee spring Chinook spawning aggregates, an estimated 36 Nason and 111 Chiwawa NOR's would be identified (Table 13). The 36 Nason and 74 of the Chiwawa spring Chinook would be retained. All remaining adults either in excess of program needs or individuals not assigning to the two spawning aggregates, would be released at locations, yet to be determined above Tumwater Dam (this is to provide some offset to the delay in migration to the spawning grounds experienced by holding adults at Eastbank FH while the genetic evaluations are being conducted).

Under this alternative full production will be achieved for the Chiwawa spring Chinook conservation program (144,026 smolts; Table 13) would be met.

The Nason Creek program will achieve an estimated smolt production of 71,665 conservation program smolts (57% of the conservation program and 48% of the 2013 production target for Nason Creek). This will result in an additional 77,005 smolts (152,005 total) from the 2013 White River captive brood program being credited toward Grant PUD's Wenatchee Spring Chinook production obligation. The 2013 WR captive brood program is expected to produce approximately 259,297 smolts (Table 16).

Alternative 4

Alternative 4 is not significantly different than Alternative 3 other than the impacts consider extraction of no more than 33% of the Nason Creek NOR's to Tumwater (versus Alternative 3 where the brood collection targets 33% over the combined NOR return to Tumwater Dam (Table 13). Production levels do not change. The total number of adults retained at Eastbank increases by two fish and would represent about 34% of the NOR return.

Table 13. Options for broodstock collection of spring Chinook for Nason and Chiwawa programs in 2013.

Alternative	NOR's Retained	# Probable Nason/Chiwawa[1/]	Chiwawa			Nason		
			Broodstock[2/]	%[3/]	Smolts	Broodstock[2/]	%[3/]	Smolts
1	140	119	74	0.244	144,026	29	0.264	55,740
2	138	115	71	0.191	135,368	29	0.209	43,795
3	172	147	74	0.244	144,026	36	0.327	71,665
4	175	149	74	0.244	144,026	36	0.327	71,665

[1/-] *The number of adults retained which are of probable Nason or Chiwawa origin. The difference between the number of probable and the number of NOR's retained are fish of probable White, Little Wenatchee, and Upper Wenatchee river spawning aggregates. These fish will be returned to river at some location(s) above Tumwater Dam.*

[2/-] *The number of broodstock are those individuals which assign to either Nason or Chiwawa. The difference between the total of broodstock and the number of probable Nason/Chiwawa are fish which did not assign at the C.I. agreed to by the parties (using SNP's methodology) and/or adults in excess of one or both programs. These fish will be returned to river at some location(s) above Tumwater Dam.*

[3/-] *This is the proportion of broodstock retained for spawning to the estimated total return of the respective spawning aggregates to Tumwater Dam.*

<u>Steelhead</u>

The steelhead mitigation program in the Wenatchee Basin use broodstock collected at Dryden and Tumwater dams located on the Wenatchee River. Per ESA section 10 Permit 1395 provisions, broodstock collection will target adults necessary to meet a 50% natural origin – conservation oriented program and a 50% hatchery origin – safety net program, not to exceed 33% of the natural origin steelhead return to the Wenatchee Basin. Based on these limitations and the assumptions listed below (Table 14), the following broodstock collection protocol was developed.

WDFW will retain a total of 130 mixed origin steelhead for broodstock for a smolt release objective of 247,300 smolts (Table 14). The 66 hatchery origin adults will be targeted at Dryden Dam and if necessary Tumwater dam. The 64 natural origin adults will be targeted for collection at Tumwater Dam. Collection will be proportional to return timing between 01 July and 12 November. Collection may also occur between 13 November and 3 December at both traps, concurrent with the Yakama Nation coho broodstock collection activities. Hatchery x wild and hatchery x hatchery parental cross and unknown hatchery parental cross adults will be excluded from the broodstock collection. Hatchery steelhead parental origins will be determined through evaluation of VIE tags, adipose/cwt presence/absence, and PIT tag interrogation during collection. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and at Dryden Dam. In-season Broodstock collection adjustments may be made based on this monitoring and evaluation. To better assure achieving the appropriate females equivalents for program production, the collection will implement the draft Production Management Plan, including ultrasonography to determine the sex of each fish retained for broodstock.

In the event steelhead collections fall substantially behind schedule, WDFW may initiate/coordinated adult steelhead collection in the mainstem Wenatchee River by hook and line. In addition to trapping and hook and line collection efforts, Tumwater and Dryden dams may be operated between February and early April the subsequent spring to supplement broodstock numbers if the fall trapping effort provides fewer than the required number of adults.

Table 14. Assumptions and calculations to determine the number and origin of 2014 brood Wenatchee summer steelhead broodstock needed for Wenatchee Basin program release of 247,300 smolts.

Program Assumptions	Standard	Conservation	Safety Net	Full Program
Smolt Release		**123,650**	**123,650**	**247,300**
Fertilization-to-release survival	*70.2%*			
Egg take target		176,140	176,140	**352,280**
Fecundity	*5,930 H* *5,787 W*			
Female Target		**31**	**30**	**32 H** **31 W**
Female to male ratio	*1:1*			
Broodstock target		**62**	**60**	**122**
Pre-spawn survival	*90.7%H/97.1%W*	64	66	
Total broodstock collection				**130**

<u>*Summer/fall Chinook*</u>

Summer/fall Chinook mitigation programs in the Wenatchee River Basin utilize adult broodstock collections at Dryden and Tumwater dams, incubation/rearing at Eastbank Fish Hatchery (FH) and acclimation/release from the Dryden Acclimation Pond. The total production level target for BY 2013 is 500,001 smolts (181,816 GCPUD mitigation and 318,185 CCPUD mitigation).

The TAC 2013 Columbia River UCR summer Chinook return projection to the Columbia River (Appendix A) and BY 2008, 2009 and 2010 spawn escapement to the Wenatchee River indicate sufficient summer Chinook will return to the Wenatchee River to achieve full broodstock collection for the Wenatchee River summer Chinook supplementation program. Review of recent summer/fall Chinook run-timing past Dryden and Tumwater dam indicates that previous broodstock collection activities have omitted the early returning summer/fall Chinook, primarily due to limitations imposed by ESA Section 10 Permit 1347 to minimize impacts to listed spring Chinook. In an effort to incorporate broodstock that better represent the summer/fall Chinook run timing in the Wenatchee Basin, the broodstock collection will front-load the collection to account for the disproportionate collection timing. Approximately 43% of the summer/fall Chinook destined for the upper Basin (above Tumwater Dam) occurs prior to the end of the first week of July; therefore, the collection will provide 43% of the objective by the end of the first week of July. Weekly collection after the first week of July will be consistent with run timing of summer/fall Chinook during the remainder of the trapping period. With concurrence from NMFS, summer Chinook collections at Dryden Dam may begin up to one week earlier.

Collections will be limited to a 33% extraction of the estimated natural-origin escapement to the Wenatchee Basin. Based on these limitations and the assumptions listed below (Table 15), the following broodstock collection protocol was developed.

WDFW will retain up to 256 natural-origin, summer Chinook at Dryden and/or Tumwater dams, including 128 females. To better assure achieving the appropriate females for program production, the collection will implement the draft Production Management Plan, including ultrasonography to determine the sex of each fish retained for broodstock. Trapping at Dryden Dam may begin 01 July and terminate no later than 15 September and operate up to 7-days/week, 24-hours/day. Trapping at Tumwater Dam if needed may begin 15 July and terminate no later than 15 September and operate up to 48 hours per week.

Table 15. Assumptions and calculations to determine the number of 2013 brood Wenatchee summer Chinook salmon broodstock needed for Wenatchee Basin program release of 500,001 smolts.

Program Assumptions	Standard	Grant PUD	Chelan PUD	Total Wenatchee Program
Smolt Release		**181,816**	**318,185**	**500,001**
Fertilization-to-release survival	*77.7%*			
Egg take target		**233,997**	**409,505**	**643,502**
Fecundity	*5,085*			
Female Target		**46**	**80**	**126**
Female to male ratio	*1:1*			
Broodstock target		**92**	**160**	**252**
Pre-spawn survival	*98.3%*			
Total broodstock collection		**94**	**162**	**256**

White River Spring Chinook Captive Brood

Smolt production associated with the White River Captive Broodstock Program (75,000 smolts) is linked to implementation of the smolt production objective associated with the Nason Creek adult supplementation program and consistent with the PRCC-PC SOA 2013-01. Spawning, incubation, rearing acclimation and release will be consistent with provisions of (expired) ESA Permit 1592.

Table 16. Estimated smolt production for BY13 and BY14 White River captive brood program at Little White Salmon National Fish Hatchery based upon 5% adult female mortality per month to spawning.

Spawn Year	Release Year	Females Spawned			Egg take	Smolts	Adjusted egg take	Adjusted smolts[1/]
		Age 4	Age 5	Total				
2013	2015	346	92	439	526,225	384,144	355,202[2/-]	259,297
2014	2016	0	187	187	224,556	163,926	78,594[3/-]	57,374

[1/-] Adjusted smolt release numbers are based upon reduced eye-up rates for eggs fertilized with cryo-preserved sperm.
[2/-] Adjusted for 50% of females crossed with cryo-preserved sperm with a mean eye-up rate of 35%.
[3/-] Adjusted for 100% of females crossed with cryo-preserved sperm with a mean eye-up rate of 35%.

Priest Rapids Fall Chinook

Collection of fall Chinook broodstock at Priest Rapids Hatchery will generally begin in early September and continue through mid November. Juvenile release objectives specific to Grant PUD (5,325,543 sub-yearlings + 1,000,000 fry), Federal (1,700,000 sub-yearlings + 3,500,000 eggs – collection of broodstock for the federal programs are conditional upon having contracts in place with the ACOE), mitigation commitments. Biological assumptions are detailed in Table 17. Smolt release objectives for Ringold Springs occur as green eggs collected at Priest Rapids FH and incubated at Bonneville prior to eyed-egg transfers to Ringold Springs. After the new Priest Rapids FH rebuild there will no longer be incubation capacity for programs above GCPUD mitigation obligations.

For 2013, some portion of the broodstock will may be collected at the OLAFT and/or through hook-and-line angling efforts in the Hanford Reach to increase the proportion of natural origin adults in the broodstock to meet integration of the hatcher program. Close coordination between broodstock collections at the volunteer channel, the OLAFT and through hook-and-line efforts in the Hanford Reach will need to occur so over collection is minimized. Presumed NOR's collected and spawned from either hook-and-line caught broodstock or OLAFT collections will be prioritized for PRH programs (i.e. OLAFT and Hanford Reach fish will be held in a separate raceways from volunteer collected fish and spawned first each week).

Based upon the biological assumptions in Table 15, an estimated 3,264 females will need to be spawned to meet the 12,350,575 eggs required to meet the current three up-river bright (URB) programs which rely on adults collected at the Priest Rapids Hatchery volunteer channel trap, hook-and-line efforts on the Hanford Reach, and/or the Priest Rapids Dam off ladder trap (OLAFT).

To increase the probability of incorporating a higher percentage of NOR's from the volunteer channel, only adipose present, non-CWT males and females will be retained.

Implementation Assumptions

1) Broodstock may be collected at any or all of the following locations/means: the PRD off ladder trap (OLAFT – specific use to be determined), hook-and-line angling in the Hanford Reach, and the Priest Rapids Hatchery volunteer channel trap.

2) Assumptions used to determine egg/adult needs is based upon current program performance metrics.

3) Broodstock retained from the volunteer channel will exclude age-2 and 3 males (using length at age) to address genetic risks/concerns of younger age-at-maturity males producing offspring which return at a younger age (decreased age-at-maturity).

4) Only adipose present, non-CWT males and females will be retained for broodstock from volunteer channel collected broodstock unless a shortage is expected.

5) Only adipose present, non-wired fish encountered through hook-and-line angling and at the OLAFT will be retained for broodstock.

6) All gametes of fish spawned from hook-and-line broodstocking efforts and/or OLAFT collections will be incorporated into the URB programs.

Table 17. Assumptions and calculations to determine the number of fall Chinook salmon broodstock needed for a non-actively integrated Priest Rapids program release of 7,025,543 sub-yearling fall Chinook, 1,000,000 fry and 3,500,000 eggs for Ringold, in 2013.

Program Assumptions	Standard	Program objective
Juvenile Production Level		
Grant PUD Mitigation-PUD Funded		**5,325,543 smolts** **1,000,000 fry**
John Day Mitigation-Federally Funded		**1,700,000 smolts**
John Day Mitigation [1]-Ringold Springs-ACOE funding.		**3,500,000 eggs**
Total Program Objectives		**11,525,543 eggs/fry/smolts**
Fertilization-to-release survival	*87%*	
Egg take target		**12,724,762**
Fecundity	*4,300*	
Female Target		**2,959**
Female to male ratio	*2:1*	
Pre-spawn survival	*88%*	
Broodstock target		
Females		**3,363**
Males		**1,681**
Total broodstock collection		**5,044**
Estimated NOR's needed		**1,530**[2/-]
Estimated HOR's needed		**3,514**

[1/-] As of brood year 2009, Priest Rapids Hatchery is taking 3,500,000 eggs for release at Ringold-Meseberg Hatchery funded by the ACOE – incubation of this program occurs at Bonneville.
[2/-]Estimated NOR's assumes a minimum of 306 wild males using them in the 2:1 F:M ratio and no more than 1,224 wild females. If the number of wild males is increased (the number of NOR females would decrease) or agreements are reached in the PRCC-HSC to use males beyond a 2:1 approach, then the total number of NOR's required to meet a pNOB=0.4 would be less (the pNOB target applies only to the sub-yearling smolt and Ringold program. The fry program would consist of HxH crosses).

Appendix A

Columbia River Mouth Fish Returns Actual and Forecasts[a/]			
	2012 Forecast	**2012 Return**	**2013 Forecast**
Spring Chinook Upriver Total	**314,200**	**203,100**	**141,400**
Upper Columbia (total)	32,600	24,400	14,300
Upper Columbia (wild	2,800	4,800	1,600
Snake River Spring/Summer (total)	168,000	109,700	58,200
Snake River (wild	39,000	33,400	18,900
Summer Chinook	**91,200**	**58,300**	**73,500**
Sockeye	**462,000**	**521,000**	**180,500**
Wenatchee	28,800	59,800	44,600
Okanogan	431,300	460,600	135,500
Snake River	1,900	500	1,250

a/ Numbers may not sum due to rounding

Appendix B

DRAFT

Hatchery Production Management Plan

The following management plan is intended to provide life-stage-appropriate management options for Upper Columbia River (UCR) PUD salmon and steelhead mitigation programs. Consistent, significant over-production or under-production risks the PUD's not meeting the production objectives required by FERC and overages in excess of 110% of program release goals violates the terms and conditions set forth for the implementation of programs under ESA and poses potentially significant ecological risks to natural origin salmon communities.
Under RCW 77.95.210 (Appendix A) as established by House Bill 1286, the Washington Department of Fish and Wildlife has limited latitude in disposing of salmon and steelhead eggs/fry/fish. While this RCW speaks more specifically to the sale of fish and/or eggs WDFW takes a broader application of this statute to include any surplus fish and/or eggs irrespective of being sold or transferred.
We propose implementing specific measures during the different life-history stages to both improve the accuracy of production levels and make adjustments if over-production occurs. These measures include (1) Improved Fecundity Estimates, (2) Adult Collection Adjustments, (3) Within-Hatchery Program Adjustments, and (4) Culling.

Improved Fecundity Estimates

A) Develop broodstock collection protocols based upon the most recent 5-year mean in-hatchery performance values for female to spawn, fecundity, Green egg to eye, and green egg to release.

B) Use portable ultrasound units to confirm gender of broodstock collected (broodstock collection protocols assume a 1:1 male-to-female ratio). Ultrsonography, when used by properly trained staff will ensure the 1:1 assumption is met (or that the female equivalents needed to meet production objective are collected). Spawning matrices can be developed such that if broodstock for any given program are male limited sufficient gametes are available to spawn with the females.

Adult Collection Adjustments

C) Make in-season adjustments to adult collections based upon a fecundity-at-length regression model for each population/program and origin composition needs (hatchery/wild). This method is intended to make in-season allowances for the age structure of the return (i.e. age-5 fish are larger and therefore more fecund than age-4 fish), but will also make allowances for age-4 fish that experienced more growth through better ocean conditions compared to an age-5 fish that reared in poorer ocean conditions.

Within-Hatchery Program Adjustments

D) At the eyed egg inventory (first trued inventory), after adjustments have been made for culling to meet BKD management objectives, the over production will be managed in one or more of the following actions as approved by the HCP-HC:

- Voluntary cooperative salmon culture programs under the supervision of the department under chapter 77.100 RCW;
- Regional fisheries enhancement group salmon culture programs under the supervision of the department under this chapter;
- Salmon culture programs requested by lead entities and approved by the salmon funding recovery board under chapter 77.85 RCW;
- Hatcheries of federally approved tribes in Washington to whom eggs are moved, not sold, under the interlocal cooperation act, chapter 39.34 RCW; and
- Governmental hatcheries in Washington, Oregon, and Idaho; or
- Culling for diseases such as BKD and IHN, consistent with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State; or
- Distribution to approved organizations/projects for research.

E) At tagging (second inventory correction) fish will be tagged up to 110% of production level at that life stage. If the balance of the population combined with the tagged population amounts to more than 110% of the total release number allowed by Section 10 permits then the excess will be distributed in one or more of the following actions as approved by the HCP-HC:

- Voluntary cooperative salmon culture programs under the supervision of the department under chapter 77.100 RCW;
- Regional fisheries enhancement group salmon culture programs under the supervision of the department under this chapter;
- Salmon culture programs requested by lead entities and approved by the salmon funding recovery board under chapter 77.85 RCW;
- Hatcheries of federally approved tribes in Washington to whom eggs are moved, not sold, under the interlocal cooperation act, chapter 39.34 RCW; and

- Transfer to another resource manager program such as CCT, YN, or USFWS program;
- Governmental hatcheries in Washington, Oregon, and Idaho;
- Placement of fish into a resident fishery (lake) zone, provided disease risks are within acceptable guidelines; or
- Culling for diseases such as BKD and IHN, consistent with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State; or
- Distribution to approved organizations/projects for research.

F) In the event that a production overage occurs after the above actions have been implemented or considered, and deemed non viable for fish health reasons in accordance with agency aquaculture disease control regulations (i.e. either a pathogen is detected in a population that may pose jeopardy to the remaining population or other programs if retained or could introduce a pathogen to a watershed where it had not previously been detected) then culling of those fish may be considered.

All, provisions, distributions, or transfers shall be consistent with the department's egg transfer and aquaculture disease control regulations as now existing or hereafter amended. Prior to department determination that eggs of a salmon stock are surplus and available for sale, the department shall assess the productivity of each watershed that is suitable for receiving eggs.

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	May 16, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris and Emily Pizzichemi		
Re:	Final Minutes of the April 17, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Chelan PUD headquarters in Wenatchee, Washington, on Wednesday, April 17, 2013, from 9:30 am to 2:30 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Greg Mackey will provide the Wells Hatchery Modernization Master Plan to the Hatchery Committees for review, when available (Item I).
- Chelan PUD, Douglas PUD, Grant PUD, and the Colville Confederated Tribes (CCT) will discuss proportional responsibilities for funding run-composition sampling at Wells Dam for summer Chinook; and an update will be provided on the discussions at the Hatchery Committees May 15, 2013, meeting (Item I).
- National Marine Fisheries Service (NMFS) will have a standing agenda item to provide a Hatchery and Genetic Management Plan (HGMP) update at future Hatchery Committees meetings (Item I).
- Mackey will provide the final Revised Analytical Framework 5-Year Update to Kristi Geris for distribution to the Hatchery Committees (Item II-A).
- Douglas PUD and Chelan PUD will provide their final Statements of Agreement (SOAs) approving the Revised Analytical Framework 5-Year Update to Geris for distribution to the Hatchery Committees (Item II-A).
- Representatives of the Hatchery Committees will submit recommendations for peer reviewers to participate along with Hatchery Committees members in the review of

responses to the Chelan PUD Hatchery Monitoring and Evaluation (M&E) Request for Proposals (RFPs; Item II-A).

- Alene Underwood will provide the final SOA for the Carlton Acclimation Facility Capacity Utilization to Geris for distribution to the Hatchery Committees (Item III-A).
- Underwood will provide the revised Spring Chinook Pilot Study at Rocky Reach to Geris for distribution to the Hatchery Committees no later than April 19, 2013; email approval of the pilot study will be requested from Hatchery Committees representatives no later than April 26, 2013 (Item III-A).
- Lynn Hatcher will provide NMFS direction on what type of additional documentation is needed from the PUDs to obtain new permits (i.e., a full HGMP versus an updated program description) by Friday, April 26, 2013, including a timeline of when documents are needed, to Geris for distribution to the Hatchery Committees (Item IV-A).
- Hatchery Committees representatives will review Mackey's white paper on *Methods for Estimating Likelihoods of Outcomes in Broodstock-Collection* prior to the Hatchery Committees May 15, 2013, meeting, when the Committees will discuss its use in developing future broodstock protocols (Item IV-D).

STATEMENT OF AGREEMENT DECISION SUMMARY

- The Douglas PUD SOA approving the revised Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update was approved by Hatchery Committees representatives (Item II-A).
- The Chelan PUD SOA approving the Revised Analytical Framework 5-Year Update was approved by Hatchery Committees representatives (Item II-A).
- The SOA for the Carlton Acclimation Facility Capacity Utilization was approved by Hatchery Committees representatives present (Item III-A).

AGREEMENTS

- Hatchery Committees representatives present approved the Revised Analytical Framework 5-Year Update (Item II-A).

- Hatchery Committees representatives present agreed that, in the event that Carson ancestry is detected in natural-origin fish collected for broodstock at Methow hatcheries, those fish will be retained and used for broodstock (Item V-A).

REVIEW ITEMS

- The draft residual steelhead manuscript *Ecologic and demographic costs of releasing non-migratory juvenile hatchery steelhead in the Methow River, Washington* was distributed to the Hatchery Committees on February 19, 2013, for a 60-day review with comments due to Charlie Snow no later than April 22, 2013.
- Kristi Geris sent an email to the Hatchery Committees on April 1, 2013, notifying them that the draft 2012 Annual Chelan PUD Hatchery M&E Report is available for download from the FTP site and is out for a 30-day review period, with comments due to Tracy Hillman by April 30, 2013.

FINALIZED REPORTS

- No reports have been finalized since the last Hatchery Committees meeting.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and reviewed the agenda. The following revisions were made to the agenda:

- Mike Tonseth added an update on Chelan Falls summer Chinook.
- Greg Mackey added an update on Wells subyearling release numbers.

The revised draft March 20, 2013 meeting minutes were reviewed. Two outstanding comments were discussed.

- Regarding Chelan PUD's discussion on 2013 Wenatchee Steelhead Releases, Tonseth clarified that hatchery permits specify that non-migrants—not migrants—must be released in the lower Wenatchee River.
- Regarding the discussion of the February M&E Progress Report for the Chelan PUD Hatchery Programs, Kirk Truscott clarified details of his question about the size of fish reared at the Chelan Falls Acclimation Facility.

Kristi Geris said that all other comments and revisions received on the draft meeting minutes were incorporated. The Hatchery Committees members present approved the March 20, 2013 meeting minutes, as revised.

Action items from the last Hatchery Committees meeting on March 20, 2013, and follow-up discussions were as follows:

- *Mackey will provide the Wells Hatchery Modernization Master Plan to the Hatchery Committees for review, when it is available (Item I).*
  Mackey said that Douglas PUD anticipates that the draft Master Plan will be complete by April 30, 2013, as which time he will provide it to the Hatchery Committees for review. Mackey reminded Committees members that the new Federal Energy Regulatory Commission (FERC) license requires agency reviews on many documents (such as this one), and because of uncertainty about FERC deadlines, will likely require expedited review. Mackey noted that the Master Plan, excluding the appendices, includes bio-programming and other conceptual information, but will not include detailed engineering or design specifications. Keely Murdoch asked if an additional review will be held for the engineering specifications, and Mackey replied that Douglas PUD had not yet planned for one. He said, however, that the HCP Coordinating Committees and NMFS will review plans related to fish passage. Murdoch noted that for the Priest Rapids Hatchery rebuild, Grant PUD held meetings where the engineers explained the designs to those interested. She said that these meetings included discussions that resulted in design changes, and added that it may be beneficial to do something similar for the Wells Hatchery modernization. Bill Gale said that changes included significant improvements in how fish are handled, general hatchery operations, and worker safety. Mackey said that Douglas PUD had been considering inviting the HDR Engineering, Inc. (HDR) team to present details of the modernization at a future meeting. He also said that Jayson Wahls of the Washington Department of Fish and Wildlife (WDFW) has been involved in the entire process, and many design issues have been addressed on the ground level. Murdoch agreed that Wahls' involvement was good, but added that it still may be beneficial to obtain additional input from other sources. Tonseth added that the Hatchery Committees are responsible for making sure modifications do not compromise the programs. He also added that meeting with the engineers may help

expedite moving the plans forward, opposed to scheduling additional review periods. Mackey said that Douglas PUD will discuss options for review of the engineering aspects of the modernization.

- *Chelan PUD, Douglas PUD, Grant PUD, and the CCT will meet to discuss proportional responsibilities for funding run-composition sampling at Wells Dam for summer Chinook; and Chelan PUD will provide an update on the discussions at the Hatchery Committees April 17, 2013 meeting (Item I).*
  Alene Underwood said that Chelan PUD and Grant PUD staff had discussed the need for additional information before reaching any agreement. Peter Graf said that Grant PUD is now coordinating with Todd Miller at WDFW, and that discussions are underway. An update on progress will be provided at the Hatchery Committees May 15, 2013 meeting.
- *Hatcher will check on the status of internal NMFS discussions regarding processing of HGMPs for non-listed programs currently covered by Permit 1347 (Item II-A).*
  Hatcher said that Craig Busack has received additional materials from the PUDs and that he is now in the process of determining if information received to date is sufficient to request a time extension on the current Permit 1347. Hatcher added that Busack said to contact him directly with any questions. Schiewe reminded the Hatchery Committees that NMFS needs a U.S. Fish and Wildlife Service (USFWS) consultation for bull trout and any other USFWS-listed species from the PUDs in order for NMFS to issue new permits. Gale recommended contacting Karl Halupka (USFWS), and added that Halupka will do his best to complete consultations in a timely manner. Hatcher said that NMFS, WDFW, and USFWS plan to hold a meeting on April 19, 2013 to discuss Section 7 permitting. Schiewe suggested that NMFS have a standing agenda item to provide a HGMP update at future Hatchery Committees meetings. Hatcher said that he would ask Busack about requesting a set time for the update.
- *Josh Murauskas will distribute a summary of changes to the revised draft Analytical Framework 5-Year Update to the Hatchery Committees no later than March 22, 2013. Following distribution of this list, Hatchery Committees representatives will provide a list of additional objective-level change that should be considered, if any, including suggested revisions, to Geris for distribution to the Hatchery Committees no later than April 5, 2013 (Item IV-A).*

Murauskas provided a summary of changes to the revised draft Analytical Framework 5-Year Update as distributed to the Hatchery Committees by Geris on March 22, 2013.

- *Underwood will revise and redistribute Chelan PUD's pilot study proposal to trap spring-run Chinook salmon at Rocky Reach Dam in 2013, as recommended; and Chelan PUD will also brief Gale on the details of the proposal (Item IV-D).*
  Underwood provided Chelan PUD's revised pilot study proposal as distributed to the Hatchery Committees by Geris on April 16, 2013.
- *Hatchery Committees representatives will submit edits and comments on the draft 2013 Upper Columbia River Salmon and Steelhead Broodstock Objectives and Site-Based Broodstock Collection Protocols to Tonseth no later than April 8, 2013 (Item VI-A).*
  Tonseth said that he will discuss pending comments during his agenda item today.

II. Chelan PUD, Douglas PUD, Grant PUD

A. *DECISION: Revised Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update (Alene Underwood and Greg Mackey)*

Greg Mackey said that the 5-year update of the M&E plan titled "Monitoring and Evaluation for PUD Hatchery Programs: 2013 Update" was distributed to the Hatchery Committees by Kristi Geris on March 19, 2013, for final review. Keely Murdoch provided comments on the revised draft update on April 11, 2013. Kirk Truscott also provided verbal comments on the draft update. Mackey said that, with Murdoch's and Truscott's comments addressed, a final draft was distributed to the Hatchery Committees by Geris on April 16, 2013. Mackey reviewed the changes with the Hatchery Committees and additional edits and clarifications were made to the document as recommended by Hatchery Committees representatives. Hatchery Committees representatives present approved the Monitoring and Evaluation for PUD Hatchery Programs: 2013 Update, and Mackey said that he will provide the final document to Geris for distribution to the Hatchery Committees.

Truscott asked if the Monitoring and Evaluation for PUD Hatchery Programs: 2013 Update will be the basis for RFPs to implement the program, and Alene Underwood replied that it will and that the document will also be appended to the RFPs. Underwood said that Chelan PUD plans to put out their Hatchery M&E RFPs for implementation in 2014 no later than mid-May 2013. She said that RFPs will be out for 2 months, and then proposals received will be reviewed by an expert panel. Joe Miller said that the expert panel is not yet in place yet, and that Chelan PUD plans to seek input from all Hatchery Committees representatives on the composition of the panel. Mike Tonseth noted that with the Monitoring and Evaluation for PUD Hatchery Programs: 2013 Update appended to the RFPs, alternative methods to achieve M&E objectives could potentially be proposed by parties. He asked if and when the Hatchery Committees will have a chance to review proposals submitted in response to the RFPs, and in particular any alternative methods? Mike Schiewe said that the review panel would include Hatchery Committees members that did not have a conflict of interest, as defined in the Hatchery Committees' Conflict of Interest Policy. He said that as outlined in the Policy, members with a conflict will not vote on or be asked to approve or disapprove proposals, but may, at the discretion of the Hatchery Committees participate in discussions on the proposals. Schiewe indicated that members without a conflict will participate on the review panel, and that all members will be asked to recommend external reviewers to assist in the review of proposals. Murdoch asked about the Hatchery Committees' review and approval of the annual Implementation Plans, which in the past has been completed prior to annual contracting. Underwood noted that the contractor(s) will have already been selected by the time the first Implementation Plan is reviewed. Murdoch said that there could be issues approving the Implementation Plan if the Hatchery Committees find that a contractor is unable to meet components of the Implementation Plan. She asked if any significant changes are anticipated with implementation, and Miller replied that he is not expecting anything. Murdoch asked about Douglas PUD's RFP process, and Mackey replied that Douglas PUD must periodically issue RFPs for contracts, but will not be on the same timeline as Chelan PUD's RFP process. Bill Gale asked about the Grant PUD process, and Peter Graf said that Grant PUD will go out with an RFP with Chelan PUD.

Schiewe reiterated that the Hatchery Committees members without a conflict of interest will be part of the expert review panel. All Hatchery Committees representatives will have the opportunity to recommend outside reviewers. Lynn Hatcher asked about limitations to who can be recommended for the panel in terms of cost, and then asked who funds the review. Underwood said that Chelan PUD and Grant PUD would take care of costs for individual reviewers. Murdoch asked how far removed a person would need to be from the conflicted party, and Schiewe replied that the Hatchery Committees Conflict of Interest Policy includes as a conflicted party someone who works for the same agency. Underwood added that this decision is also partly up to the discretion of the person in question—do they feel that they are conflicted? Gale noted that there are also several good, potential reviewers who are retired. The Hatchery Committees agreed to submit recommendations for peer reviewers to participate along with Hatchery Committees members in the review of responses to the Hatchery M&E RFPs.

Returning to the just-approved Hatchery M&E program document, Mackey said that Douglas PUD is also requesting approval of a SOA approving the Monitoring and Evaluation for PUD Hatchery Programs: 2013 Update. Douglas PUD's draft SOA was distributed to the Hatchery Committees by Geris on April 16, 2013. Mackey reviewed the SOA, and Hatchery Committees representatives provided comments and suggested revisions, including the addition of a conditional statement regarding the completion and approval of pending appendices. Underwood said that Chelan PUD is also planning to request approval of a SOA, and that they intend to use the same format and language as Douglas PUD.

The Hatchery Committees representatives present approved the Douglas PUD SOA as revised, and approved a Chelan PUD SOA contingent on the use of the same language as the revised Douglas PUD SOA. *(Note: Douglas PUD's final SOA [Attachment B], and Chelan PUD's final SOA [Attachment C] were distributed to the Hatchery Committees by Geris on April 19, 2013, and April 22, 2013, respectively.)*

III. Chelan PUD

A. DECISION: Carlton Acclimation Facility Capacity Utilization SOA (Alene Underwood)

Alene Underwood said that the revised draft SOA for the Carlton Acclimation Facility Capacity Utilization was distributed to the Hatchery Committees by Kristi Geris on April 16, 2013. Underwood reminded the Hatchery Committees that the intent of this SOA is to merely recognize the existence of sufficient capacity at the Carlton Acclimation Facility to accommodate both Chelan PUD's 60,516 spring Chinook and Grant PUD's 200,000 summer Chinook programs, but does not obligate the Hatchery Committees to support Carlton as a permanent location for overwinter rearing Chelan PUD's spring Chinook obligation. Joe Miller added that the way the SOA was previously written seemed to imply approval of the Carlton Acclimation Facility as a permanent location for Chelan PUD.

Bill Gale questioned whether a SOA is really needed if the only intent is to recognize capacity at the Carlton Acclimation Facility, and Mike Schiewe said that the SOA supports Chelan PUD's relationship with Grant PUD at the facility. Gale also suggested indicating that the SOA only applies to brood year (BY) 2013, and Mike Tonseth recalled that agreement was already reached by the Hatchery Committees that Chelan PUD would use the Carlton Acclimation Facility for BY 2013, as documented in the Hatchery Committees December 12, 2012 meeting minutes. Miller added that specifying BY in the SOA will require a new SOA each year, which Chelan PUD would like to avoid. Gale said that Chelan PUD's spring Chinook program will need to be re-addressed in 2014 regardless, and Miller agreed in terms of the use of the facility, not capacity. Miller suggested adding a statement to the SOA reflecting that the use of the Carlton Acclimation Facility as a long-term location for overwinter rearing will be determined in the future by the Hatchery Committees. Schiewe also suggested adding a statement reflecting that the Hatchery Committees have previously agreed to use the Carlton Acclimation Facility for BY 2013. Gale asked if the Hatchery Committees should expect an additional SOA on how these fish will be marked and evaluated, and Tonseth replied that Chelan PUD has already plans to tag 25 percent with passive integrated transponder (PIT) tags.

Tonseth noted that the SOA acknowledges that the facility is capable of accommodating the programs; however, it does not state the actual capacity of the Carlton Acclimation Facility. Underwood said that the capacity of the facility has already been stated in previous documentation, and Gale suggested simply referencing that documentation.

Underwood incorporated all suggested revisions and the revised SOA for the Carlton Acclimation Facility Capacity Utilization was approved by Hatchery Committees representatives present. The final SOA for the Carlton Acclimation Facility Capacity Utilization (Attachment D) was distributed by Geris to the Hatchery Committees on April 18, 2013.

B. DECISION: Spring Chinook Pilot at Rocky Reach (Alene Underwood)

Alene Underwood said that a revised Chelan PUD pilot study proposal to trap spring-run Chinook salmon at Rocky Reach Dam in 2013 was distributed to the Hatchery Committees by Kristi Geris on April 16, 2013. She said that, as requested at the Hatchery Committees March 20, 2013 meeting, an introductory paragraph was added providing a brief background on the purpose of the pilot study. Following distribution of the latest version of the draft pilot study she said that an additional paragraph about next steps was also added based on comments received from Bill Gale. Mike Tonseth requested that a refined description of trap operations also be included. Mike Schiewe noted that the HCP Coordinating Committees will also need to review this pilot study with regards to potential effects on fish passage. Kirk Truscott asked what data Chelan PUD will be collecting regarding trap efficiency, and Joe Miller replied that the pilot study proposes to simply document ease of operation and any potential problems that need to be addressed. Gale asked that if only ad-clipped fish are targeted, why not collect the fish to obtain additional data? Tonseth replied that collecting and handling the fish might require direct take coverage at Rocky Reach Dam. Underwood added that this pilot only aims to look at operation of the trap. Truscott asked about the efficiency of the trap when the ladder is full of fish. Miller responded that is one of the issues that the pilot study will address. Schiewe said that the Hatchery Committees need to come to agreement on exploring this trap as a collection location for broodstock, and the HCP Coordinating Committees will review the pilot from a fish passage issue perspective. Miller said that Chelan PUD will revise the draft pilot and redistribute it to the Hatchery Committees for email approval. Gale requested that the revisions clearly state the information gaps and how they will be addressed. Tonseth suggested outlining the questions that this year's evaluations are set to address, and also outlining the questions that still need to be addressed, and by whom (i.e., the Hatchery Committees and/or HCP Coordinating Committees). Schiewe reminded the Hatchery Committees that agreement needs to be reached soon because the spring run has already started.

Underwood said that she will provide the revised Spring Chinook Pilot at Rocky Reach to Geris for distribution to the Hatchery Committees no later than April 19, 2013, and email approval of the pilot study will be requested from Hatchery Committees representatives no later than April 26, 2013.

C. Dryden Update (Alene Underwood)

Alene Underwood updated the Hatchery Committees on progress on Chelan PUD's plan for Dryden total maximum daily load (TMDL) compliance (Attachment E) that was originally distributed to the Hatchery Committees on July 18, 2012. The plan was redistributed to the Hatchery Committees by Kristi Geris on April 10, 2013. Regarding Action #1, Underwood said that Chelan PUD is currently conducting phosphorus sampling while fish are on station at the Dryden facility. She said that last year it took about one month to get results back. Regarding Action #2, Underwood said that the low phosphorous feed trial was not ready in time for the 2013 acclimation period; and added that Chelan PUD is still waiting for certain information to come together to move forward. She said that, as for 2014, it is uncertain whether the feed trial will be performed in conjunction with the size evaluation that is already planned. Regarding Action #3, Underwood said that samples are still being collected at Chelan Falls, and that she plans to touch base with the Leavenworth National Fish Hatchery to verify that the circular tanks are still on track to be completed by the end of 2013. Regarding Action #4, Underwood said that she has met with Northwest Fisheries Science Center scientists, Chris Moran, and Eastbank Fish Hatchery staff, and that evaluating 2012 brood is underway. Regarding Action #5, Underwood said that this year the fish on station will be the last of the 864,000 program, and that next year Chelan PUD will evaluate phosphorus discharges from the reduced program.

Also, in March 2013, Underwood said that there was an outbreak of fungus in the summer Chinook at the Dryden facility. She said that losses amounted to approximately 300 to 500 per day. Mike Tonseth said that the fungus was a secondary infection, and added that Bob Rogers has been looking into these losses and is finding deep tissue bruising in the fish. He also added that the bruising appears to be from a lateral hit, and that Rogers plans to evaluate the transportation vessels. Tonseth noted that while each year fungus is observed at the Dryden facility, these issues are not present at the Carlton facility which uses the same equipment. Tonseth said that this increases interest in evaluating the water quality at Dryden. Bill Gale also suggested that something may exist at the Dryden facility that causes additional stress in combination with the injury. Gale asked if the Dryden facility fish are always reared in the same raceways, and Tonseth replied that they are not. Mike Schiewe asked about temperatures of receiving versus rearing water at Dryden and Carlton, and Tonseth replied that they are relatively the similar. He added that fish transfers are only allowed when the water is equal to or less than a 10 degree difference.

IV. Douglas PUD

A. Wells Subyearling Release Numbers Update (Greg Mackey)

Greg Mackey said that higher than typical hatchery survival at Wells Hatchery resulted in surplus subyearling summer Chinook for release in 2013. WDFW has inquired about what to do with the excess fish and identified a need at Prosser Fish Hatchery. Mackey said there are about 600,000 subyearling Chinook on station, of which about 500,000 will be tagged and released to fulfill the 484,000 subyearling Chinook mitigation component under the Wels HCP; the remaining 100,000 will be transferred to Prosser Fish Hatchery, which recently experienced a significant loss of summer Chinook due to a pump failure.

B. Wells Hatchery Master Plan (Greg Mackey)

Greg Mackey discussed this agenda item during the review of action items from the last Hatchery Committees meeting on March 20, 2013.

C. HGMP for Wells Summer Chinook (Greg Mackey)

Greg Mackey said that Rob Jones at NMFS indicated that Douglas PUD needs to provide a full HGMP for the Wells summer Chinook program. However, there has also been discussion of needing to submit only a program description. As a result, Mackey said that Douglas PUDdevelop an updated HGMP, which can serve both purposes. He said that Mike Tonseth has already reviewed the document and provided comments. The draft Wells Summer Chinook HGMP, along with a one-page Wells Summer Chinook HGMP summary, and a draft SOA approving the HGMP, were distributed to the Hatchery Committees by Kristi Geris on April 16, 2013. Mackey said that the updated HGMP is largely the same as the 2005 draft HGMP with the exception of incorporating at least10 percent natural fish in the broodstock. Mackey said that effects on other species and populations were also updated with excerpts from the recent 5-Year M&E report. He added that it was modeled after the 2005 draft that Kirk Truscott developed, and also follows the current draft Methow Hatchery Spring Chinook HGMP.

Mackey said that he is still unsure of when NMFS will need the program description and/or HGMP, and depending on that deadline, Douglas PUD may request an expedited Hatchery Committees review. Mike Tonseth noted that the timeline really depends on whether NMFS needs an actual HGMP or just a program description. He added that if NMFS only requests a program description, then it would seem that NMFS has already determined that only the program description will suffice to get permitted. Lynn Hatcher said that he will provide NMFS direction on what type of additional documentation is needed from the PUDs to obtain new permits (i.e., a full HGMP versus an updated program description), including a timeline of when documents are needed, to Geris for distribution to the Hatchery Committees by Friday, April 26, 2013. Joe Miller indicated that Chelan PUD is not planning to submit any new HGMPs pending further direction from NMFS.

D. Methods for Estimating Likelihoods of Outcomes in Broodstock-Collection (Greg Mackey)

Greg Mackey briefly reviewed and summarized his exploratory work on broodstock estimation and managing risk and expectations in broodstock collection that he presented at the Hatchery Committees February 20, 2013 meeting. He said that he has now incorporated parameters from the draft 2013 Broodstock Protocols into his analyses (Attachment F) to facilitate discussions on applying these methods to brood collection in 2013, or future years. *(Note: the presentation [Attachment F] was distributed to the Hatchery Committees by Kristi Geris on April 18, 2013.)* Mackey added that a white paper on the broodstock collection estimation approach was also distributed to the Hatchery Committees by Geris on April 9, 2013; however, a small revision was made to the paper and a revised draft will be distributed to the Hatchery Committees following the meeting.

Mackey briefly reviewed the broodstock collection formula, as discussed at the Hatchery Committees February 20, 2013 meeting. He then reviewed the Methow spring Chinook program with the draft 2013 Broodstock Protocols paremeters used in the model (highlighted in tan in Attachment F). Mackey reminded the Hatchery Committees that these are not concrete values and are not intended to advocate anything, but rather are meant to inform decisionmaking. Bill Gale said that this formula seems to have real potential to ground truth the current methods of estimating broodstock needs. Mike Tonseth added that there are a few other things to consider when estimating broodstock requirements, depending on whether the program was for listed- and non-listed species, and the potential constraints of a 33 percent extraction rate for natural origin recruits (NORs). He said that, for example, the draft 2013 Broodstock Protocols estimated the need for 88 total Methow spring Chinook, including 20 hatchery- and 68 natural-origin adults to meet program goals. He said that additional natural-origin fish cannot be added because it would exceed the 33 percent extraction rate. As for listed programs, Tonseth said that NMFS may prefer to be under the production goal, rather than over (i.e., surplus). He said that all of these types of considerations need to be evaluated before modifying the protocols. Tonseth said that he has no objections to incorporating the use of Mackey's modeling approach, but exactly how it is used needs to be considered. Keely Murdoch said that she supports the use of Mackey's method if it helps to meet program goals. Tonseth suggested that it might be useful to test the formula this year on a pilot basis to guide collection of broodstock for the Wells subyearling Chinook program. Gale commented that the difficulty has not been with coming up with the numbers, *per se*, but rather collection logistics such as where and when to collect. Mike Schiewe noted that, if the draft 2013 Broodstock Protocols are modified, that WDFW needs to make sure the Hatchery Committees are included in the discussion and that better attention to version control is needed to avoid the same tracking issues experienced with the 2012 Broodstock Protocols. Mackey said that this information is meant more for use as a managerial tool—not necessarily to dictate the process. It can be used by mangers to assess tradeoffs in risk of collecting too few or too many fish for broodstock. He said that the white paper on the broodstock collection estimation approach explains how this method works and how to use it. Hatchery Committees representatives said that they will review Mackey's white paper on *Methods for Estimating Likelihoods of Outcomes in Broodstock-Collection* prior to the Hatchery Committees May 15, 2013 meeting, when the Hatchery Committees will discuss its use in developing future broodstock protocols.

V. WDFW

A. 2013 Broodstock Collection Protocols (Mike Tonseth)

Mike Tonseth recalled the Hatchery Committees' decision to release 27 natural-origin Carson lineage adult spring Chinook, collected as broodstock for the Methow Hatchery program, into the Methow River in 2012; this was discussed at the Hatchery Committees June 20, 2012 meeting. He added that the Yakama Nation (YN) decided to abstain from the decision, and Keely Murdoch explained that the abstention was because the YN had not anticipated the need for a decision, nor had they had the opportunity to fully assess the potential outcomes. Tonseth said that the draft 2013 Broodstock Protocols was once again unclear on Carson ancestry, and that he would like to avoid a similar situation as in 2012. Tonseth said that because numbers of returning NORs are expected to be limited in 2013, Hatchery fish will need to be incorporated to meet program obligations. He said that from this perspective, he sees the question as: what is better to retain for broodstock—natural-origin fish with some degree of Carson lineage or hatchery origin fish which may possess a lower degree of Carson lineage? Hatchery Committees representatives present agreed that, in the event that Carson ancestry is detected in natural origin fish collected for broodstock, those fish will be retained and used for broodstock. Tonseth said that this decision will be reflected in the 2013 Broodstock Protocols.

B. Chelan Falls Summer Chinook Update (Mike Tonseth)

Mike Tonseth said that Bob Rogers recently contacted him about an emerging fish health issue with summer Chinook at Chelan Falls Hatchery. Tonseth said that Rogers initially thought it was a bacterial gill disease (BGD) related to gas bubble trauma (GBT). He said that fish were dying in Circulars 1 and 2, with the fish Circular 2 dying more rapidly. He added that the dissolved oxygen (DO) was quite low in Circulars 3 and 4, and fish in those tanks were taken off feed. Tonseth said that even after feed was halted, DO remained depressed. He said that a decision was made to release Circular 2 due to the disease issue; and because of the low DO in Circulars 3 and 4 and increasing disease in Circular 1, all tanks were ultimately released a few days earlier than planned. Tonseth said that Rogers is developing a pathology report, and once available, will be distributed to the Hatchery Committees for discussion. Alene Underwood added that the water seemed turbid, but there is no indication why. Tonseth noted that the fish health issues were first observed around the same time that Chelan Falls Powerhouse had issues. Underwood said that the facility had recently experienced generator issues and it was not realized that the pump was down for an extended amount of time. She also added that Chelan PUD is now discussing a supplemental oxygen system to avoid a similar situation in the future. Tonseth said that 2013 summer Chinook practices are being compared to those executed in 2012 to identify any differences. He said that low DO was only experienced in Circulars 3 and 4, and added that in addition to BGD, erythrocytic inclusion body syndrome (EIBS), or anemia in fish, was also observed. Tonseth recalled that EIBS had previously been detected in fish at the Eastbank Annex; however, it had no significant impacts on the fish. He added that although fish at the Eastbank Annex had EIBS, fish at the Eastbank Hatchery did not. Underwood said that even with the loss, program goals were still met.

VI. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees' meetings are on May 15, 2013 (Douglas PUD office), June 19, 2013 (Chelan PUD office), and July 17, 2013 (Douglas PUD office).

List of Attachments

Attachment A	List of Attendees
Attachment B	Douglas PUD's final SOA approving the Monitoring and Evaluation for PUD Hatchery Programs: 2013 Update
Attachment C	Chelan PUD's final SOA approving the Revised Analytical Framework 5-Year Update
Attachment D	Final SOA for the Carlton Acclimation Facility Capacity Utilization
Attachment E	Chelan PUD's Plan for Dryden TMDL Compliance
Attachment F	Methods for Estimating Likely Programmatic Outcomes for Broodstock Collection Targets Presentation

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Joe Miller	Chelan PUD
Greg Mackey*	Douglas PUD
Peter Graf	Grant PUD
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Lynn Hatcher*	National Marine Fisheries Service
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

Wells HCP Hatchery Committees
Statement of Agreement

Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013

Statement

The Wells HCP Hatchery Committees approves the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013. Any future appendices for the plan will require HCP Hatchery Committee approval.

Background

The Wells HCP, Section 8.5, requires the HCP Hatchery Committee to develop a five-year monitoring and evaluation plan that is updated every five years. This document, Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013, is the first five-year update of the hatchery monitoring and evaluation plan.

Rock Island and Rocky Reach HCP Hatchery Committees
Statement of Agreement

Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013

Statement

The Rock Island and Rocky Reach HCP Hatchery Committees approves the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013. Any future appendices for the plan will require HCP Hatchery Committee approval.

Background

The Rock Island and Rocky Reach HCPs, Section(s) 8.5, require the HCP Hatchery Committee to develop a five-year monitoring and evaluation plan that is updated every five years. This document, Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013, is the first five-year update of the hatchery monitoring and evaluation plan.

Rock Island and Rocky Reach HCP Hatchery Committees

Statement of Agreement

Carlton Acclimation Facility Capacity Utilization

April 17, 2013

Statement

The Rock Island and Rocky Reach HCP Hatchery Committees agree that the capacity exists (per Grant PUD's Basis of Design, 2012) for Chelan PUD's Methow spring Chinook mitigation obligation (60,516 smolts) to be overwinter reared in the new Carlton Acclimation Facility, to be constructed by Grant PUD in 2013. Fish management for both Chelan PUD's 60,516 spring Chinook and Grant PUD's 200,000 summer Chinook will be targeted to accommodate the following criteria:

Program	Release number	Size at release	Length at release	Density index	Flow index	Flow demand/tank	# 30-ft. tanks
Grant PUD	200,000	15 fpp	5.7"	0.10 lb/cf/in	1.0 lb/cf/in.	388 gpm	6
Chelan PUD	60,516	15 fpp	6.0"	0.087 lb./cf/in	0.6 lb./gpm/in	560 gpm	2

This agreement approves the existence of sufficient capacity at Carlton but does not obligate the HCP Hatchery Committees to support Carlton as a permanent location for overwinter rearing Chelan's spring Chinook obligation. The use of Carlton as a long term location for overwinter rearing will be determined in the future by the Committees. The Committees have previously agreed to using Carlton for the 2013 brood.

Background

As part of the recalculated hatchery compensation levels approved by the Committees on December 14, 2011, Chelan PUD has a mitigation obligation to produce 60,516 Methow spring Chinook. In February 2013, Chelan PUD and Grant PUD executed a lease agreement which allowed Grant PUD to construct a new overwinter acclimation facility on Chelan PUD property. Within this lease, Grant PUD agreed to provide Chelan PUD with capacity to overwinter acclimate 60,516 Methow spring Chinook within the new facility.

Submitted by Chelan PUD for July 18, 2012, HCP HC Meeting

Chelan PUD- Dryden TMDL Compliance

At the June HCP HC meeting, Chelan PUD committed to provide the HC with a description of activities required to ensure that we can meet hatchery production levels and TMDL compliance.

The following actions will be used to ensure that summer Chinook production and infrastructure complies with the Wenatchee River TMDL for phosphorus.

Action	Purpose	Timeline	Decision
1. Measure baseline phosphorus levels in Wenatchee River and at Dryden facility (Chelan PUD) before, during, and after fish on station	Use WQ data to establish baseline phosphorous levels and estimate variability. Then, determine the (1) quantity of phosphorous and (2) the flow "Q" that can be discharged	2013 & 2014 acclimation periods	If background concentration levels exceed wasteload allocation, resize Q to appropriate level or consider other treatment options.
2. Conduct low phosphorous feed trial at Dryden (Grant PUD & Chelan PUD)	Use regular and low phosphorous feeds during acclimation to measure WQ response in effluent and to determine efficacy of future use	2013 acclimation period	If low phosphorous feed reduces effluent phosphorous concentration and meets fish health parameters (evaluated separately at FWS lab), then consider use for TMDL compliance
3. Benchmark Chelan Falls and Leavenworth circulars (Chelan PUD & USFWS).	Determine efficacy of circular tanks and radial flow separators for phosphorous removal by looking at effluent WQ	2013 & 2014 (Chelan Falls is currently operational, Leavenworth would be considered if infrastructure is built)	If circular tanks and waste removal effectively remove phosphorous, consider future application for Dryden. Consider reuse if Q is reduced significantly.
4. Evaluate size of smolts released- use physiological data and PIT tag data to empirically test different smolt sizes (NOAA - Beckman and Larsen & Chelan PUD)	Optimize smolt release size to decrease precocity, increase SARs, and reduce phosphorous input (i.e., less food)	Begins in 2012 and would focus on 2014 & 2015 release years	If a smaller smolt can improve return performance, consider application of smaller size for Dryden production group
5. Evaluate the	Examine reduction in	2014 acclimation period	Program changes are

Submitted by Chelan PUD for July 18, 2012, HCP HC Meeting

Action	Purpose	Timeline	Decision
number of fish released and effects on phosphorous levels (Chelan PUD)	phosphorous discharge associated with 500k smolt production (reduced from 864k)		likely to reduce phosphorous levels (supports decision in Action 1). This is not a proposal for further reductions.
6. Evaluate Actions 1-5 and select best option(s) for Dryden to meet TMDL standard		2015 summer	

Attachment F

Broodstock Collection in 2013: Model Results

Greg Mackey
Douglas PUD
HCP Hatchery Committee
April 2013

Broodstock Calculation

Basic Broodstock Calculation

Number of Females Collected X Pre-Spawn Survival X BKD Culling Survival X Fecundity X Egg to Release Survival = Smolts

Assume 1:1 Sex Ratio → + Number of Males Collected = Total Broodstock

Broodstock Calculation

Data Sources

Used 2013 Broodstock Protocol Mean Values

Number of Females Collected	X	Pre-Spawn Survival	X	BKD Culling Survival	X	Fecundity	X	Egg to Release Survival	=	Smolts
Variance Sources		2011 M&E: Recent 5-Years		2011 M&E: Recent 5-Years		2011 M&E: Recent 10-Years		2011 M&E: Recent 5-Years		

Size Matters

Program				Females			
90%	100%	110%	Fecundity	90%	100%	110%	Range
27,000	30,000	33,000	5,000	6	6	7	1
270,000	300,000	330,000	5,000	54	60	66	12

Methow Spring Chinook Program

134,126	Broodstock							
P ≥ Target	Total	Hatchery	Wild	Mean Production	Lower 95% CI	Upper 95% CI	P < 90% of Target	P > 110% of Target
0.400	84	20	64	132,116	115,883	148,661	0.086	0.034
0.450								
0.500								
0.550	86	20	66	135,465	118,805	152,446	0.043	0.083
0.600								
0.650								
0.700	88	20	68	138,808	121,729	156,190	0.019	0.162
0.750								
0.800	90	20	70	142,161	124,686	159,943	0.008	0.270
0.850	92	20	72	145,511	127,614	163,752	0.003	0.407
0.900	94	22	72	148,098	129,915	166,785	0.001	0.518
0.950	96	22	74	151,451	132,888	170,515	0.000	0.658
1.000	108	24	84	170,803	149,922	192,296	0.000	0.985

Twisp Spring Chinook Program

30,000	Broodstock							
P ≥ Target	Total	Hatchery	Wild	Mean Production	Lower 95% CI	Upper 95% CI	P < 90% of Target	P > 110% of Target
0.400	20	14	6	29,842	21,756	39,279	0.274	0.230
0.450								
0.500								
0.550								
0.600								
0.650	22	16	6	32,640	23,805	42,914	0.117	0.449
0.700								
0.750								
0.800								
0.850	24	18	6	35,544	25,854	46,590	0.043	0.667
0.900	26	18	8	38,690	28,373	50,410	0.011	0.843
0.950	28	20	8	41,663	30,540	54,200	0.003	0.929
1.000	36	26	10	53,126	38,789	69,474	0.000	0.998

Twisp Steelhead Program

48,000	Broodstock							
P ≥ Target	Total	Hatchery	Wild	Mean Production	Lower 95% CI	Upper 95% CI	P < 90% of Target	P > 110% of Target
0.400								
0.450	24	0	24	47,964	31,700	64,929	0.291	0.281
0.500								
0.550								
0.600								
0.650	26	0	26	51,804	34,327	70,092	0.173	0.452
0.700								
0.750	28	0	28	55,688	37,001	75,296	0.099	0.613
0.800								
0.850	30	0	30	59,568	39,567	80,415	0.056	0.737
0.900	32	0	32	63,475	42,112	85,653	0.031	0.830
0.950	34	0	34	67,385	44,751	90,809	0.018	0.894
1.000	54	0	54	106,877	71,227	144,059	0.000	0.999

Methow Safety Net Steelhead Program

100,000	Broodstock							
P ≥ Target	Total	Hatchery	Wild	Mean Production	Lower 95% CI	Upper 95% CI	P < 90% of Target	P > 110% of Target
0.400								
0.450	50	50	0	97,856	65,366	130,213	0.319	0.231
0.500	52	52	0	101,757	67,953	135,499	0.247	0.313
0.550								
0.600	54	54	0	105,666	70,586	140,545	0.191	0.403
0.650	56	56	0	109,580	73,040	145,867	0.146	0.497
0.700								
0.750	58	58	0	113,503	75,695	151,201	0.114	0.573
0.800	60	60	0	117,442	78,134	156,425	0.085	0.647
0.850	62	62	0	121,363	80,772	161,527	0.065	0.710
0.900	66	66	0	129,222	86,207	171,676	0.035	0.811
0.950	72	72	0	140,956	93,792	187,409	0.016	0.903
1.000	110	110	0	215,360	143,932	285,909	0.000	0.999

Columbia Safety Net Steelhead Program

160,000	Broodstock							
P ≥ Target	Total	Hatchery	Wild	Mean Production	Lower 95% CI	Upper 95% CI	P < 90% of Target	P > 110% of Target
0.400								
0.450	80	80	0	157,293	105,351	210,105	0.315	0.239
0.500	82	82	0	161,226	108,123	215,291	0.270	0.295
0.550	84	84	0	165,178	110,766	220,541	0.230	0.351
0.600	86	86	0	169,124	113,325	225,907	0.194	0.405
0.650	88	88	0	173,063	116,024	230,892	0.164	0.459
0.700	90	90	0	176,988	118,613	236,320	0.137	0.509
0.750	94	94	0	184,852	123,931	246,752	0.096	0.607
0.800	96	96	0	188,797	126,532	252,116	0.080	0.651
0.850	100	100	0	196,646	131,396	262,742	0.054	0.727
0.900	104	104	0	204,498	136,641	273,466	0.039	0.789
0.950	112	112	0	220,241	147,341	294,347	0.019	0.881
1.000	184	184	0	361,824	242,174	483,102	0.000	0.999

Attachment F

Wells Yearling Summer Chinook Program

	Broodstock							
P ≥ Target	Total	Hatchery	Wild	Mean Production	Lower 95% CI	Upper 95% CI	P < 90% of Target	P > 110% of Target
0.400								
0.450	174	156	18	317,141	267,361	370,040	0.130	0.093
0.500	176	158	18	320,783	270,348	374,158	0.105	0.122
0.550	178	160	18	324,426	273,432	378,576	0.083	0.151
0.600	180	162	18	328,062	276,524	382,968	0.066	0.184
0.650	182	162	20	331,695	279,703	386,710	0.050	0.223
0.700	186	166	20	338,961	285,837	395,423	0.030	0.311
0.750	188	168	20	342,598	288,651	399,822	0.023	0.361
0.800	190	170	20	346,228	291,736	404,104	0.018	0.409
0.850	194	174	20	353,486	297,901	412,748	0.011	0.505
0.900	198	178	20	360,764	304,101	421,065	0.006	0.603
0.950	204	182	22	371,551	313,390	433,532	0.002	0.731
1.000	236	212	24	429,470	362,381	500,821	0.000	0.987

Attachment F

Wells SubYearling Summer Chinook Program

484,000	Broodstock							
P ≥ Target	Total	Hatchery	Wild	Mean Production	Lower 95% CI	Upper 95% CI	P < 90% of Target	P > 110% of Target
0.400	288	258	30	476,646	397,146	560,488	0.161	0.092
0.450	290	260	30	479,960	399,903	564,105	0.142	0.107
0.500	294	264	30	486,569	405,554	572,182	0.110	0.138
0.550	298	268	30	493,190	410,895	580,069	0.084	0.179
0.600	300	270	30	496,500	413,675	583,963	0.074	0.200
0.650	304	272	32	502,985	418,802	591,362	0.056	0.247
0.700	308	276	32	509,597	424,311	599,167	0.042	0.300
0.750	312	280	32	516,206	430,048	607,069	0.032	0.354
0.800	316	284	32	522,824	435,426	615,037	0.025	0.409
0.850	322	288	34	532,648	443,716	626,928	0.015	0.493
0.900	330	296	34	545,870	454,567	642,480	0.009	0.602
0.950	340	306	34	562,430	468,602	661,238	0.003	0.727
1.000	394	354	40	651,666	542,729	765,884	0.000	0.985

ANCHOR QEA
720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	June 20, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris and Emily Pizzichemi		
Re:	Final Minutes of the May 15, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Douglas PUD headquarters in East Wenatchee, Washington, on Wednesday, May 15, 2013, from 9:30 am to 1:30 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Mike Tonseth will consult with Ken Warheit (Washington Department of Fish and Wildlife [WDFW] geneticist) and then provide the Wenatchee spring Chinook trapping/sampling protocols, including the genetic inclusion/exclusion criteria, to Emily Pizzichemi and Kristi Geris for distribution to the Hatchery Committees (Item II-A).
- Lynn Hatcher will send a status update on Wenatchee spring Chinook permitting to Emily Pizzichemi and Kristi Geris for distribution to the Hatchery Committees no later than May 31, 2013 (Item II-A).
- Emily Pizzichemi and Kristi Geris will arrange a conference line and distribute details to the Hatchery Committees for a conference call to review the status of Wenatchee spring Chinook permitting, scheduled for June 3, 2013, at 10:00 am (Item II-A).
- Hatchery Committees representatives will provide the names of recommended statisticians, salmon ecologists, and hatchery biologists to serve on a technical peer review panel to rank responses to the Chelan PUD Hatchery Monitoring and Evaluation (M&E) Requests for Proposal (RFPs) to Mike Schiewe (with a copy to Kristi Geris) no later than June 3, 2013 (Item III-A).
- Greg Mackey will revise the Wells Hatchery Summer Chinook Program Hatchery

and Genetic Management Plan (HGMP) and Statement of Agreement (SOA) accordingly, as requested by the Hatchery Committees, and Emily Pizzichemi will distribute the revised documents to the Hatchery Committees no later than May 17, 2013 (Item IV-A).
*(*Note: the revised documents were received from Mackey and distributed to the Hatchery Committees by Pizzichemi on May 16, 2013; and the revised HGMP and SOA were approved by email vote on May 22, 2013, with the Yakama Nation [YN], the Colville Confederated Tribes [CCT], the U.S. Fish and Wildlife Service [USFWS], WDFW, and Douglas PUD approving, and the National Marine Fisheries Service [NMFS] abstaining.)*

- Hatchery Committees representatives will send their approval or requested changes to the Wells Summer Chinook HGMP to Mike Schiewe (with copies to Emily Pizzichemi, Kristi Geris, and Greg Mackey) no later than May 22, 2013 (Item IV-A).
- Mackey will provide a list of critical sections in the Wells Hatchery Modernization Master Plan to help guide review to Emily Pizzichemi for distribution to the Hatchery Committees (Item IV-B). *(*Note: the list was received from Mackey and distributed to the Hatchery Committees by Pizzichemi on May 20, 2013.)*
- The Hatchery Committees June 19, 2013 meeting will be held at 9:00 am in the Chelan PUD Auditorium (Item VI-A).

STATEMENT OF AGREEMENT DECISION SUMMARY

- Douglas PUD's revised Wells Summer Chinook HGMP and SOA were approved by email vote on May 22, 2013, with the YN, CCT, USFWS, WDFW, and Douglas PUD approving, and NMFS abstaining.

AGREEMENTS

- There were no agreements discussed at today's meeting.

REVIEW ITEMS

- Emily Pizzichemi sent an email to the Hatchery Committees on May 14, 2013, notifying them that the Wells Hatchery Master Plan is available for download from the ftp site and is out for a 60-day review period, with comments due to Greg Mackey no later than July 13, 2013.

FINALIZED REPORTS

- There are no reports that have been recently finalized.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and asked for any additions or other changes to the agenda. Bill Gale added a brief status update on permitting at the Leavenworth and Tumwater National Fish Hatcheries (NFHs).

The revised draft April 17, 2013 meeting minutes were reviewed. Four outstanding comments were discussed.

- Under the Agreements section, USFWS requested to clarify that natural-origin fish with Carson ancestry collected "at Methow Hatcheries" will be retained and used for broodstock.
- Regarding the Conflict of Interest Policy in the context of the M&E RFPs for PUD Hatchery Programs, Douglas PUD requested that Mike Schiewe's statement be revised so as to not limit the definition of a conflict of interest to professional relationships.
- Regarding the discussion of the revised M&E Plan, Douglas PUD requested to clarify that the Chelan PUD SOA was approved contingent on the use of the same language as the revised Douglas PUD SOA.
- Regarding the Chelan Falls Summer Chinook Update, Mike Tonseth clarified that the emerging fish health issue with summer Chinook at Chelan Falls Hatchery was bacterial gill disease (BGD).

Emily Pizzichemi said that all other comments and revisions received on the draft meeting minutes were incorporated. The Hatchery Committees members present approved the April 17, 2013 meeting minutes as revised.

Action items from the last Hatchery Committees meeting on April 17, 2013, and follow-up discussions were as follows:

- *Greg Mackey will provide the Wells Hatchery Modernization Master Plan to the Hatchery Committees for review, when available (Item I).*
  Emily Pizzichemi notified the Hatchery Committees that the Wells Hatchery Modernization Master Plan was available for download from the ftp site for a 60-day review beginning on May 14, 2013, with comments due no later than July 13, 2013.
- *Chelan PUD, Douglas PUD, Grant PUD, and the CCT will discuss proportional responsibilities for funding run-composition sampling at Wells Dam for summer Chinook; and an update will be provided on the discussions at the Hatchery Committees meeting on May 15, 2013 (Item I).*
  Peter Graf said that Grant PUD is waiting to hear back from WDFW before making a final decision on how to proceed. Alene Underwood proposed removing this item from the list of Action Items as the responsible parties are working on it. The Hatchery Committees representatives present agreed to remove this item from the Action Items with the stipulation that any problems regarding funding run-composition sampling at Wells Dam for summer Chinook are reported to the Hatchery Committees.
- *NMFS will have a standing agenda item to provide a HGMP update at future Hatchery Committees meetings (Item I).*
  Craig Busack provided the first of these standing monthly updates at this meeting.
- *Greg Mackey will provide the final revised M&E Plan for PUD Hatchery Programs: 2013 to Kristi Geris for distribution to the Hatchery Committees (Item II-A).*
  Kristi Geris distributed the final revised *M&E Plan for PUD Hatchery Programs: 2013* to the Hatchery Committees in an email dated April 19, 2013.
- *Douglas PUD and Chelan PUD will provide their final SOAs approving the Revised Analytical Framework 5-Year Update to Kristi Geris for distribution to the Hatchery Committees (Item II-A).*
  Kristi Geris distributed the Final Douglas PUD and Chelan PUD SOAs to the Hatchery Committees in emails dated April 19, 2013, and April 22, 2013, respectively.
- *Representatives of the Hatchery Committees will submit recommendations for peer reviewers to participate along with Hatchery Committees members in the review of responses to the Chelan PUD Hatchery M&E RFPs (Item II-A).*
  Hatchery Committees representatives will provide recommendations for peer reviewers to Mike Schiewe no later than June 3, 2013.

- *Alene Underwood will provide the final SOA for the Carlton Acclimation Facility Capacity Utilization to Kristi Geris for distribution to the Hatchery Committees (Item III-A).*
  Kristi Geris distributed the final SOA for the Carlton Acclimation Facility Capacity Utilization in an email dated April 18, 2013.
- *Alene Underwood will provide the revised Spring Chinook Pilot Study at Rocky Reach to Kristi Geris for distribution to the Hatchery Committees no later than April 19, 2013; email approval of the pilot study will be requested from Hatchery Committees representatives no later than April 26, 2013 (Item III-A).*
  Kristi Geris distributed the updated Rocky Reach Spring Chinook Pilot Study to the Hatchery Committees in an email dated April 22, 2013. Approvals or abstentions were received from all Committees representatives via email.
- *Lynn Hatcher will provide NMFS direction on what type of additional documentation is needed from the PUDs to obtain new permits for the existing Permit 1347 that will expire on October 22, 2013 (i.e., a full HGMP versus an updated program description) by Friday, April 26, 2013, including a timeline of when documents are needed, to Kristi Geris for distribution to the Hatchery Committees (Item IV-A).*
  Lynn Hatcher said that he and Craig Busack are working on this item and will get back to the Hatchery Committees representatives with more information.
- *Hatchery Committees representatives will review Greg Mackey's white paper on Methods for Estimating Likelihoods of Outcomes in Broodstock-Collection prior to the Hatchery Committees May 15, 2013 meeting, when the Committees will discuss its use in developing future broodstock protocols (Item IV-D).*
  Greg Mackey said that although this paper should be discussed because of its potential influence on future broodstock collection protocols, he recommended revisiting the topic at a later date.

II. NMFS

A. Monthly HGMP Update

Craig Busack said that the Entiat Biological Opinion (BiOp) was completed and signed on April 18, 2013. He said NMFS is currently working on consultations for the Mid-Columbia coho program, which requires two BiOps—one for construction of facilities and one for operations. Busack hopes to have the draft BiOp completed by June 2013. Busack said that

Amilee Wilson (NMFS) expects to complete the joint BiOp for the Chiwawa, Nason, and White River spring Chinook programs by June 14, 2013. Wilson has alerted Busack that completion of the National Environmental Policy Act (NEPA) Environmental Assessment (EA) for the Nason Creek and White River programs may cause a delay. Busack said that the Chiwawa spring Chinook program is currently covered by the existing Permit 1196; however, broodstock collection at Tumwater Dam (TWD) for the Nason program will require new permits. Busack added that the new permits will not be available until the NEPA packages are complete. Busack said that the Leavenworth NFH spring Chinook BiOp was delayed because it is being revised to fit a new BiOp template. NMFS is focusing on approval of the Wenatchee spring Chinook BiOp before finalizing the Leavenworth NFH spring Chinook BiOp.

Busack reiterated that the probable completion date for the Chiwawa spring Chinook BiOp is June 14, 2013. Joe Miller asked what ramifications this new deadline will have on the broodstock collection schedule, and Mike Tonseth replied that the biggest issue with the delayed timeline is getting staff prepared on short notice. Alene Underwood said that even though the rivers are running high right now, it is possible that the spring Chinook run will reach Chiwawa soon. Underwood said that the existing permit can be used to collect spring Chinook at the Chiwawa weir if the fish start to run before June 14, 2013, when the new permit is issued for collection at TWD. Bill Gale said that, from the USFWS perspective, collecting at TWD would be preferable, but Kirk Truscott said that sampling and collecting at TWD will require new permits. Tonseth said that with the expected permit completion date of June 14, 2013, broodstock collection can begin as early as June 17, 2013, but it will be a rush to deploy staff.

Underwood asked about the broodstock genetic testing turnaround time for spring Chinook collected at TWD, and Tonseth said that he received more information from Ken Warheit (WDFW geneticist) to discuss at the Priest Rapids Coordinating Committee Habitat Subcommittee (PRCC HSC) meeting on May 16, 2013. Underwood requested that the topic also be discussed today for the benefit of the Hatchery Committees. Tonseth said that genetic testing is expected to take about 4 business days, or less if there is a rush. He said this timeline fits the original proposal time of a 2-week holding period for individual fish, and that hatchery staff will be expected to maintain this schedule. Underwood requested a written protocol to discuss with hatchery staff. Tonseth replied that he is setting up a meeting for the week of May 20, 2013, to discuss the holding plan protocol, and Underwood asked to be included in the discussion. Miller expressed concern about the lack of genetic criteria for inclusion/exclusion in broodstock for each of the Wenatchee spring Chinook programs. Tonseth replied that Warheit is currently travelling and unavailable, but that he will compile more details early next week, including a scope of work and a budget for the genetic testing component. He added that he will eventually arrange a conference call to review everything with the Hatchery Committees.

Hatcher asked Tonseth about starting sampling on June 17, 2013, particularly with the NEPA process not expected to be completed until June 14, 2013. Hatcher suggested that the public review period could delay the sampling start date even more. Busack stressed that June 14, 2013, is a tentative deadline and that he will have to verify when the public comment period opens and closes. Schiewe said that Underwood's idea of setting up a contingency plan is relevant and that WDFW and Chelan PUD may have to collect spring Chinook at the Chiwawa weir under the existing permit authority. Tonseth said that there is a difference of opinion on how sampling at Chiwawa weir may affect bull trout. Gale said that, as far as USFWS is concerned, operating the Chiwawa Weir and TWD collection facilities simultaneously is not recommended because of potential impacts on bull trout and he cannot guarantee USFWS support of dual operation. Busack asked about USWFS's permit coverage and Gale said that the state currently has Section 6 coverage for blanket fish actions. Truscott added that the state's Section 6 coverage explicitly mentions Chiwawa. Tonseth cited conversations he previously had with Karl Halupka and said that they currently have coverage under Section 6 provided WDFW is the operator. He said that if they move forward with collecting broodstock at the Chiwawa weir, WDFW will approve the sampling. Gale said that he supports broodstock collection at TWD under a new permit and not running Chiwawa.

Keely Murdoch asked when staff will begin work on the reproductive success study and suggested loading the computer (at TWD) with passive integrated transponder (PIT)-tag files for definitive identifications, and Tonseth agreed. She said that if fish are getting handled at TWD regardless, then it makes sense to collect those that can be positively identified as natural origin Chiwawa adults at TWD to avoid double-handling and recollection at the

Chiwawa Weir. Josh Murauskas supported Murdoch's idea, and said that there are many PIT-tags from Chiwawa on wild fish—last year there were over 74. Tonseth agreed that PIT-tags can certainly be used for identification if they are linked to the weir computer system. Tonseth said that he hopes to have a clear indication by the end of May 2013 as to whether or not June 14, 2013, is a feasible deadline. Schiewe requested that NMFS provide a permit update no later than May 31, 2013, and Emily Pizzichemi will set up a conference call for June 3, 2013, to discuss the update from Busack with the Hatchery Committees representatives.

Busack gave an update on the permit 1347 programs, which include the non-listed summer and fall Chinook programs. He said that NMFS intends to issue a 10-year extension on the permits, which will expedite the consultation process. The process will still require issuing a BiOp; however, he said that the same EA can be used. Busack said that this has already been completed for the Wenatchee summer Chinook program and that he believes that he has all of the appropriate information for the other programs. Gale asked if they are required to have a separate consultation for bull trout, and Busack proposed that he and Gale discuss the issue outside of the meeting. For the Okanogan programs, Busack said that he needs an HGMP on steelhead from the CCT as soon as possible.

Busack said that BiOps also must be written for the section 10(j) programs (i.e., experimental populations). In order to expedite the NEPA process, he said that he plans to use the Chief Joseph Dam Environmental Impact Statement (EIS) and the Bonneville Power Administration permit to cover the substitution of MetComp fish for Carson fish. Gale asked how many BiOps have to be written, and Busack said that separate BiOps are needed for the hatchery action (holding fish) and release of fish. Busack said that the hatchery BiOp needs to be completed as soon as possible so that the CCT can legally possess the fish. Truscott said he is concerned that if the release permit fails after he has already acted on the transfer authorization, he will be stuck holding fish. He added that if the CCT accepts the fish before they have the section 10(j) permit, they would be releasing *endangered* spring Chinook instead of *threatened* spring Chinook. Hatcher said that, considering this fact, they would need permits by April 2014 because, once the fish are released, they are technically covered under section 10(j). He added that the EA and BiOp on the release action are already underway, and so the entire process should be complete by fall 2013. Gale asked if the two different permitting processes (hatchery holding and release effects) are dependent or if they can be exclusively finalized, and Busack said that they can be separately filed. Gale asked about public comment and Busack said that he has not yet set a date, but would like to put out all of the Methow and Okanogan HGMPs at the same time.

Busack said that there has been considerable discussion within NMFS recently about whether the currently contemplated permits for the Methow basin are *U.S. v. Oregon* compliant. He said that they are currently finalizing the details in the proposals for spring Chinook and steelhead; and will be asking the Hatchery Committees for comments and/or formal approvals. He highlighted the new items in the General Management Framework for Methow Spring Chinook and Steelhead (Attachment B), which was distributed to the Hatchery Committees by Pizzichemi on May 14, 2013. Specifically for spring Chinook, Busack said that the framework includes a requirement for a relative reproductive success study to determine if hatchery-origin fish spawning in the vicinity of hatchery outfalls are contributing to natural production, and if the estimated percentages of hatchery origin spawners (pHOS) have been adjusted to reflect this. He said that this is not intended to be a large study, but rather just a few years of monitoring. For steelhead, Busack said that the previous pHOS values may have been optimistic, and so he has proposed a 2-stage standard—a pHOS of 0.5 over the entire basin (October 2013 to October 2020); and a pHOS of 0.50 calculated over the entire basin, with 0.25 in half of the "production area" (October 2020 to October 2023). Murdoch offered several comments on the draft Management Framework document. Regarding spring Chinook, she considered the hatchery outfall area "artificial," a place where wild fish and hatchery fish interaction is minimal, and she thinks that this area should be discounted from the pHOS calculation. She claimed that in this area, the hatchery fish are not contributing to natural origin recruit (NOR) fish productivity. Busack said that natural production by hatchery fish, whether or not they mix with the wild fish when reproducing, is the issue, because such production ultimately introduces hatchery genetics into the natural population. Murdoch agreed that data should be collected, but she maintained that it should not be used to adjust pHOS value. Greg Mackey suggested that a few years of data under the forthcoming management regime with reduced fish numbers, adult management activities, and potentially adjusted release locations, might help decide if there should be further studies conducted in the area. Gale agreed with Busack that the fish in that area should be considered and suggested that the BiOp be amended to allow for revisions within the first 5 years of data collection. Regarding steelhead, Murdoch said that she is concerned that the Phase II pHOS goal of 0.5 may be too restrictive given the current state of the run. She asked, for example, what happens if they hit pHOS = 0.6 but are still seeing positive trends in the population, will they have to move fish down to the Columbia? Murdoch also suggested adding adaptive management language to the draft Framework. Busack said that he anticipated using a 3-year geomean for pHOS and not assessing pHOS on a one-year basis. Gale suggested revising the Management Framework so that the initial targets for pHOS are moving toward a Phase II goal. Regarding Methow steelhead (i.e., Attachment B, page 3, Overall point 3), Mackey reminded the Hatchery Committees representatives that the previously agreed-upon total steelhead release was 250,000 individuals, which is what the HGMPs reflect, but this new draft Management Framework has 350,000 as the upper limit. Schiewe suggested that if the upper limit (i.e., 350,000) was a change from what had previously been agreed to in approval of the HGMP, then it should be brought back to the Hatchery Committees for discussion regardless of *U.S. v. Oregon*. Gale noted that the Wells HGMP states that the upper basin limit for steelhead release is 150,000. Tonseth pointed out that once the fish move from the upper Methow to the lower Methow, they can be moved to the Columbia River if necessary. Mackey recommended that the limit should be 250,000, regardless of where they come from—not 250,000 from the upper basin and 350,000 overall (as written in the draft Management Framework). Busack said that he thought the Hatchery Committees previously agreed that 250,000 should come from the upper basin. Gale said that if the draft Management Framework is left as it is currently written, once permits are obtained, *U.S. v. Oregon* will need to approve increasing the count from the upper basin from 150,000 to 250,000.

Busack said that because agreement cannot be reached on the new spring Chinook monitoring measure, NMFS may change the pHOS standard from a flat value to a sliding scale to allow for adaptive management. NMFS may also change the total steelhead release number back to 250,000 individuals. Busack said that he will amend and discuss the revised document at the next Joint Fisheries Parties (JFP) conference call. Schiewe reminded Busack that Hatchery Committees approval is independent of *U.S. v. Oregon* approval. Schiewe suggested that Busack include the PUDs in these discussions.

Busack said that NMFS recently received Chelan PUD's permit application detailing their portion of the Methow spring Chinook program. Chelan PUD proposed releasing spring Chinook at two acclimation sites in the Methow, and Busack asked the Hatchery Committees members for their input. Miller said that there is no new information in the plan—just a scope of activities, as discussed previously with the Committees.

III. Chelan PUD

A. Suggestions for M&E RFP Technical Review Panel (Alene Underwood)

Alene Underwood asked Hatchery Committees representatives to recommend people for the M&E RFP Review Panel. Mike Schiewe requested that all suggestions be sent to him (with a copy to Kristi Geris) via email no later than June 3, 2013. He suggested identifying potential reviewers by areas of expertise, and added that potential reviewers should include statisticians, salmon biologists, hatchery biologists, and any other fields of study that the Hatchery Committees deem applicable. Bill Gale said that he has already approached two people—Barry Berejikian of NMFS and Brian Cates, USFWS retired. Gale said that he would like to provide more information about compensation, and Underwood replied that Chelan PUD will fund all expenses related to the project, including travel. Lynn Hatcher recommended Larry Lestelle as a good salmon ecology expert. Underwood said that she anticipates that Chelan PUD will select a minimum of three reviewers, and the final number will depend on qualifications, availability, the number of proposal submissions, and the number of interested reviewers. Murauskas suggested that Chelan PUD compile a list of reviewers, assess their availability, and then come back to the Hatchery Committees for final review. Gale asked if Anchor QEA would facilitate the discussion and review process, and Underwood replied that Chelan PUD and Grant PUD will facilitate the process, but the reviewers will be independent. Murauskas described Chelan PUD's recent experience with a review panel for a sturgeon study, recalling that it consisted of three reviewers working independently; however, one also facilitated the group. Underwood added that for that particular review process, Chelan PUD also conducted an internal review and ranking process. The internal reviews and the expert panel reviews were both considered when making a final contract decision. She said that this RFP will follow a similar protocol. Murauskas recommended Dr. John Skalski for his statistical knowledge, and Dr. John Clark, the chief scientist for Alaska Department of Fish and Game (ADFG), for his salmon biology expertise. Murauskas said that Clark is a good choice because he is close enough to the

Columbia River to understand the issues, but far enough removed to provide a unique view. Keely Murdoch said that the YN hoped that no one would be removed from consideration based on their perceived views or opinions. Schiewe reminded the Hatchery Committees that non-conflicted members of the Hatchery Committees may sit on the panel, and clarified that a conflicted party includes individuals from agencies that are bidding on the project and responding to the RFP.

Underwood said that the RFP closes July 9, 2013, and that she would like the panel to begin the ranking process immediately upon closing. The Hatchery Committees agreed to discuss how to choose reviewers at the Hatchery Committees' June 19, 2013 meeting, once Chelan PUD has had a chance to compile the names and contact information of potential experts. Murdoch asked if the panel is only judging the scientific merit of the proposals or if they are making any final decisions about the study. Underwood confirmed that the panel is solely judging the scientific merit of the proposals in the context of the study, and that their rankings will only be used to inform Chelan PUD's final decision. Underwood also stated that Chelan PUD will be considering the cost effectiveness of each proposal, not necessarily the lowest cost, but the quality of work available for the proposed price.

Mike Tonseth said that he had questions about the RFP itself. He pointed out that sockeye were not mentioned at all, and Murdoch added that sockeye should be addressed because there is an M&E obligation to consider the species. Murauskas said the issue of whether or not the District will continue to fund the upper Wenatchee trap or other activities pertaining to sockeye monitoring has not been resolved, which is why sockeye was not included in the RFP. Tonseth asked if an addendum to the RFP will go out once all of the questions and issues have been resolved, and Underwood replied that Chelan PUD will internally discuss the sockeye question and apprise the Hatchery Committees once a decision is made. Underwood clarified that even though something is not contained within the RFP, that fact does not mean that the RFP does not cover it, and that it is precedent for outstanding issues such as this to be dealt with internally and then clarified to potential proposers in an addendum.

Tonseth asked, regarding spring Chinook in the Wenatchee River, whether the respective PUDs planned to fund hatchery programs independent of their dams. Murauskas replied that there is a geographical dilemma—Grant PUD has responsibilities for Nason Creek and White River, whereas Chelan PUD has responsibility for the Chiwawa; therefore, Chelan PUD and Grant PUD will each assume responsibility for their own portion of the bill. Tonseth said that the language is misleading because it only mentions those three locations, when, in reality, assessing stray rates requires monitoring additional tributaries and reaches. Underwood stressed that the RFP is intended as a guide and that if a potential bidder does not already know that stray sampling also may occur outside of the Chiwawa (or other tributary), then they probably are not qualified to pursue the work. Tonseth asked why the other Mid-Columbia dams are not mentioned, and Murauskas replied that the Methow will be covered by Grant PUD and Douglas PUD in a separate RFP. The in-hatchery monitoring component for Chelan Falls will be addresses at a later date. Tonseth said that there is concern within WDFW about this RFP having too many last-minute changes and addenda. Underwood reminded the group to send all questions or concerns related to clarifications of the RFP to Jackie Krueger.

B. Rocky Reach Trap Pilot Update (Alene Underwood)

Alene Underwood said that Chelan PUD started operating the Rocky Reach trap during the week of May 13, 2013. She said that visibility was low due to high turbidity, and added that Chelan PUD is hopeful that the turbidity will abate in the near future. Tonseth asked if Chelan PUD is tracking days where high turbidity impedes visibility. He added that if turbidity compromises the ability to collect data, then the program might not be a viable undertaking. Underwood said that Chelan PUD keeps a daily log of water quality and that if the problem persists, they will consider different sampling options before shutting the program down completely. Underwood invited Hatchery Committees members to view the trap with the Coordinating Committees at the Coordinating Committees meeting on May 21, 2013, or at another convenient time.

IV. Douglas PUD

A. DECISION: Wells Summer Chinook HGMP/Program description (Greg Mackey)

Greg Mackey reminded the Hatchery Committees that the Wells Hatchery Summer Chinook HGMP and associated draft SOA were distributed to the Hatchery Committees for review by Kristi Geris on April 16, 2013. Mike Schiewe asked if the new program differs from the current program, and Mackey replied that Douglas PUD will be releasing the same number of fish, but the HGMP incorporates the Hatchery Committee approved (Sept. 19, 2012) change in timing for release of subyearlings (revised from mid-June to mid-May), because this change has been shown to improve survival. Mackey said that the only other change is that up to 10 percent of the broodstock will be composed of NORs. Kirk Truscott said that, conceptually, this is a status quo program with the exception of the 10 percent NORs expectation. Tonseth said that the aim was to take as many NORs that enter the volunteer trap, with 10 percent as a goal but not a requirement. Mackey also added that the HGMP language should allow flexibility for years in which it is not possible to reach the 10 percent goal. Kirk Truscott suggested including a statement such as, "in any year that there will be a proposal to collect NORs at Wells, it will be addressed in the Broodstock Collection Agreement." Tonseth agreed that the percentage will be a sliding scale based on the number of fish captured and that they will provide a proposal to the Hatchery Committees for NOR collection. Bill Gale said that a segregated harvest program like this one, by definition, does not typically include targeting NORs for broodstock. He expressed concern that the proposal was creating a hybrid of a segregated program and an integrated program. Gale said that he approves the "up to 10 percent" language, but is uncomfortable defining the numbers in terms of the volunteer channel. Tonseth clarified that using the volunteer trap for sampling is not targeting NORs, but natural-origin fish use the volunteer channel and can be incorporated into the broodstock. Lynn Hatcher agreed with Gale and was concerned that the language suggested that Douglas PUD would be targeting NORs at the dam. Mackey proposed that the language be amended to reflect that broodstock will be composed primarily of hatchery-origin adults, with up to 10 percent of natural-origin. If 10 percent natural-origin fish is expected to be exceeded in any given year, WDFW will present the supporting data and proposal to the Hatchery Committees for inclusion in the Annual Broodstock Collection Protocol. Tonseth added that 10 percent from the volunteer channel should be considered a baseline, but anything above 10 percent NORs—whether from the volunteer channel or from anywhere else—should be justified in the Broodstock Protocol.

Truscott recommended that the monitoring and evaluation indicator target values contained in the document be more specific because, as it is currently written, the values are merely defined as an unknown target value. Mackey said that the Hatchery Committee will be creating new target values for the new Hatchery M&E Plan, and that the M&E Plan will be updated with those values. He said that Douglas PUD will add a footnote to the document saying that the target values are pending approval of the Hatchery Committees (The HGMP references the M&E Plan, so updates to the Plan are automatically linked to HGMP). Truscott proposed that he and Tonseth have an outside discussion about how these new sampling protocols will affect the CCT because there will be fish from CCT-ceded land.

Keely Murdoch requested additional time for review prior to approving the HGMP. Mackey said that he will revise the SOA and the HGMP, making the discussed changes, and he will provide the revised documents to Emily Pizzichemi for distribution to the Hatchery Committees no later than May 17, 2013. *(*Note: the revised documents were received from Mackey and distributed to the Hatchery Committees by Pizzichemi on May 16, 2013).* Hatchery Committees representatives will send their approval or requested changes to the Wells Summer Chinook HGMP to Schiewe (with copies to Pizzichemi, Geris, and Mackey) no later than May 22, 2013. *(*Note: the revised HGMP and SOA were approved by email vote on May 22, 2013, with the YN, CCT, USFWS, WDFW, and Douglas PUD approving, and NMFS abstaining.)*

B. Discussion: Wells Hatchery Modernization Master Plan (Greg Mackey)

Greg Mackey reminded the Hatchery Committees that Emily Pizzichemi sent an email to the Hatchery Committees on May 14, 2013, notifying them that the Wells Hatchery Modernization Master Plan is available for download from the ftp site and is available for 60-day review, with comments due to him no later than July 13, 2013. Mackey noted that the new Wells Hatchery design uses gravity feed to convey water and transfer fish as they transition through different life stages—a process which is more energy efficient for the facility and more beneficial for the fish. He provided a brief explanation of the bio-programming section, which contains calculations for estimating growth and size and required rearing volumes and flows. Mackey said that Douglas PUD plans to host a workshop for the Hatchery Committees and invite HDR Engineering, Inc. (HDR), the firm that designed the facility update, to field questions about the upgrades. Schiewe suggested holding the workshop in early July 2013, because June 2013 is typically a very busy month for the Committees.

Bill Gale asked if there were specific sections of the Master Plan that could be identified to make review by the Committee more efficient. Gale added that having a list of critical areas for review will help focus and guide the review process on such a large document. Tonseth recommended a close review of the fish health section to ensure that details are consistent with previous Hatchery Committees discussions. Mackey said that he will provide a list of critical sections in the Wells Hatchery Modernization Master Plan to help guide review to Emily Pizzichemi for distribution to the Hatchery Committees. *(*Note: the list was received from Mackey and distributed to the Hatchery Committees by Pizzichemi on May 20, 2013).*

Gale asked if Hatchery Committees approval of the Master Plan is needed. Mackey said he was not sure at this point, and that the Federal Energy Regulatory Commission (FERC) may require agency approval, which would be in the form of a SOA from the Hatchery Committees. Gale suggested that the Hatchery Committees' approval could be as simple as noting it in the meeting minutes. Schiewe asked Mackey when FERC needs the Hatchery Committees' approval because that will influence when the Hatchery Committees workshop with HDR is held, as it may influence their decision. Mackey said at this time there is no established date.

V. USFWS

A. National Fish Hatchery Update (Bill Gale)

Bill Gale said that USFWS is behind schedule installing the water-reuse circular tanks at Leavenworth NFH due to construction problems. He said installation has been delayed by a leaky pipe, which remains unresolved. Gale said that some renovations are still moving forward; however, he estimated they are about a year behind schedule.

Gale said that WDFW approached USFWS about taking adult spring Chinook from TWD if the appropriate permitting is obtained. He said that Leavenworth NFH has agreed to house the adults for a 3-day AQUI-S® withdrawal period and that the two agencies are currently discussing logistics of the arrangement.

VI. HCP Administration

A. Next Meetings

Mike Schiewe said that Andy Chinn from the PRCC HSC contacted him about potentially sharing the Hatchery Committees meeting date and location on June 19, 2013. Schiewe said that, if these plans are amenable, he proposed beginning at 9:00 am to accommodate the PRCC HSC meeting in the afternoon. The Hatchery Committees meeting on June 19, 2013 will be held at 9:00 am in the Chelan PUD Auditorium.

The next scheduled Hatchery Committees' meetings are on June 19, 2013 (Chelan PUD Auditorium); July 17, 2013 (Douglas PUD office); and August 21, 2013 (Chelan PUD).

List of Attachments

Attachment A	List of Attendees
Attachment B	General Management Framework for Methow Spring Chinook and Steelhead

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Emily Pizzichemi	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Joe Miller	Chelan PUD
Josh Murauskas*	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Peter Graf	Grant PUD
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Lynn Hatcher*	National Marine Fisheries Service
Craig Busack*†	National Marine Fisheries Service
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

General Management Framework for Methow Spring Chinook and Steelhead

May 13, 2013

Introduction:

This document presents bare-bones overviews of Methow spring Chinook and steelhead management during the proposed 10-year permit period from Fall 2013 to Fall 2023. The purpose of the documents is to achieve agreement on US v. Oregon compliance by augmenting existing HGMPs, addendum documents, and sufficiency letters in a way that both addresses all the concerns that were presented by YN to PAC at its April meeting, and reflects further development of management ideas in response to YN proposals and additional discussion. Our plan is that once these overview frameworks are finalized, their elements will be summarized in addenda that will be added to the permit application package, eliminating the need for edits to existing documents.

Our goal is to be able to report at the PAC meeting on May 22 that the concerns about US v. Oregon compliance have been addressed. At that point NMFS can move forward on the consultations and wind them up before the permits expire.

Methow Spring Chinook

Overall:

1. Program details other than those described here are as described in the HGMPs and addendum documents, and/or will be developed by the managers/operators in a management implementation plan.
2. Adult management will be used to manage overall basin pHOS, by the following sliding scale:

Natural-Origin Escapement	Management Response
<300	500 total spawners
301-500	pHOS ≤ 0.4
501-900	pHOS ≤ 0.3
901-1500	pHOS ≤ 0.2
1501-2000	pHOS ≤ 0.1
>2000	pHOS = 0

3. Reproductive success of hatchery-origin fish spawning in hatchery outfall reaches and in reach "m6 "will be evaluated relative to fish spawning in other areas in a limited-duration study. If fish spawning in these areas are found to be less fit than fish spawning in other areas, this will be reflected in pHOS estimates.

Winthrop Program- Safety-net program

1. 400k fish total- released on-station; if available, additional 200k will be transferred to Okanogan

"Methow" (PUD) Program-Conservation program

1. 224k fish total- released on-station, at Twisp acclimation site, and at other acclimation sites in basin (must include Chewuch) as appropriate as sites and supplementation plans are developed by the managers/operators
2. Currently only 163k fish are included in HGMPs. Remaining 61k will be covered by pending HGMP addendum from Chelan PUD.

Methow Steelhead

Overall:

1. Program details other than those described here are as described in the HGMPs and addendum documents, and/or will be developed by the managers/operators in a management implementation plan.
2. Permit will encompass two phases:
    a. Phase I (10/2013-10/2020) pHOS will be managed to a maximum of 0.5, calculated over entire basin.
    b. Phase II (10/2020-10/2023) pHOS will be managed to a maximum of 0.5 calculated over entire basin and to maximum of 0.25 in half the occupied spawning habitat (details to be determined by the managers/operators).
3. Total steelhead releases into upper basin not to exceed 250K and total Methow releases not to exceed 350K

Wells Program:

1. Twisp pHOS managed at pHOS required by RRS study, for duration of study, then as appropriate to assist in achieving overall pHOS objectives
2. Lower Methow component coordinated with growth of WNFH program; as production increases occur in WNFH program, corresponding number of Wells fish will be moved to lower basin or to Columbia release component

WNFH Program:

1. Managed to accommodate ongoing rearing-strategy study through its completion (release of BY 2014 completes study)
2. Will grow during permit period from 100k to as high as 200k as feasible consistent with pNOB=0.5
3. Will incorporate off-station acclimation as appropriate, as sites and supplementation plans are developed by the managers/operators

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	July 26, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the June 19, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Chelan PUD headquarters in Wenatchee, Washington, on Wednesday, June 19, 2013, from 9:00 am to 11:30 am. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Mike Tonseth will consult with Ken Warheit (Washington Department of Fish and Wildlife [WDFW] geneticist) and then provide the Wenatchee spring Chinook trapping/sampling protocols, including the genetic inclusion/exclusion criteria, to Kristi Geris for distribution to the Hatchery Committees (action item carried forward from Hatchery Committees meeting on May 15, 2013).
- The National Marine Fisheries Service (NMFS) will provide a letter of concurrence for transport back to the river of Wenatchee spring Chinook adults collected for the Nason Creek and Chiwawa River programs that do not assign to either Nason Creek or Chiwawa River (Item II-A). *(Note: NMFS provided approval for transport back to the river of Wenatchee spring Chinook adults not assigning to either Nason Creek or Chiwawa River via email on June 19, 2013.)*
- Lynn Hatcher will distribute an update on the status of Wenatchee spring Chinook permitting to the Hatchery Committees prior to June 27, 2013 (Item II-A).
- Kristi Geris will arrange a conference line to review the status of Wenatchee spring Chinook permitting and potential paths forward, scheduled for June 27, 2013, at 10:00 am (Item II-A).
- Greg Mackey will arrange and distribute a date for the Wells Hatchery Master Plan Workshop, planned to discuss engineering aspects of the modernization with HDR

Engineering, Inc. (HDR) (Item IV-B).

- Greg Mackey will develop an agenda for the next Hatchery Monitoring and Evaluation (M&E) Workgroup meeting, to be attached to the doodle poll distributed to arrange the meeting (Item IV-C).

STATEMENT OF AGREEMENT DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at today's meeting.

AGREEMENTS

- Hatchery Committees representative approved the Chelan PUD Methow Spring Chinook Hatchery and Genetic Management Plan (HGMP) Addendum via email on June 3, 2013.
- Hatchery Committees representatives present agreed to a shortened 14-day review period for Chelan PUD's full Methow Spring Chinook HGMP (Item II-A).
- Grant PUD concurred with WDFW's request to begin Wenatchee spring Chinook broodstock collection for the Nason Creek and Chiwawa River programs of up to 136 natural origin spring Chinook adults at Tumwater Dam, contingent on Chelan PUD's concurrence, and NMFS' approval for transport back to the river of adults not assigning to either Nason Creek or Chiwawa River (Item II-A).
- Hatchery Committees members present agreed with WDFW's request to begin Wenatchee spring Chinook broodstock collection for the Nason Creek and Chiwawa River programs of up to 136 natural origin spring Chinook adults at Tumwater Dam, contingent on NMFS' approval for transport back to the river of adults not assigning to either Nason Creek or Chiwawa River (Item II-A).
- NMFS approved via email on June 19, 2013, transport back to the river of Wenatchee spring Chinook adults collected for the Nason Creek and Chiwawa River programs not assigning to either Nason Creek or Chiwawa River (Item II-A).
- Hatchery Committees representatives present approved the Columbia River Inter-Tribal Fish Commission's (CRITFC's) request to collect tissue samples from broodstock for parentage-based tagging (PBT) of Columbia River hatchery programs. The Colville Confederated Tribes (CCT), although they approved the request, declined to participate in 2013 (Item III-A).

- Hatchery Committees representatives present approved Grant PUD's request for Douglas PUD to produce 100,000 steelhead for release in the Okanogan at Wells Hatchery, and 134,126 Methow River spring Chinook at the Methow Fish Hatchery (FH), for Grant PUD's respective programs (Item IV-A).

REVIEW ITEMS

- Emily Pizzichemi sent an email to the Hatchery Committees on May 14, 2013, notifying them that the Wells Hatchery Master Plan is available for download from the ftp site and is out for a 60-day review period, with comments due to Greg Mackey no later than July 13, 2013.

FINALIZED REPORTS

- The 2012 Annual Chelan PUD Hatchery M&E Report was finalized and posted to the ftp site on June 3, 2013.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Mike Tonseth added a discussion of NMFS' HGMP update on spring Chinook permitting for the Nason Creek and Chiwawa River programs.
- Greg Mackey added a Grant PUD fish production request.
- Alene Underwood added an update on Chelan PUD's Methow Spring Chinook HGMP.
- Kirk Truscott added an update on Chief Joseph Wenatchee spring Chinook brood collection at Leavenworth National Fish Hatchery (NFH).

The revised draft May 15, 2013 meeting minutes were reviewed. Three outstanding comments were discussed regarding NMFS' HGMP update:

- It was clarified that NMFS is focusing on approval of the Wenatchee spring Chinook biological opinion (BiOp)—not steelhead BiOp—before finalizing the Leavenworth NFH spring Chinook BiOp.

- A statement made by Keely Murdoch was clarified to indicate that she considered hatchery outfall areas to be a place where wild fish and hatchery fish interaction is minimal—not that they do not interact at all.
- A statement made by Craig Busack was clarified to indicate that, "*natural production by hatchery fish, whether or not they mix with the wild fish when reproducing, is the issue, because such production ultimately introduces hatchery genetics into the natural population"*—not that, "*NMFS believes that any and all genetic mixing, no matter how unlikely, should be considered*."

Bill Gale also requested the following edits:

- Regarding U.S. Fish and Wildlife Service (USFWS) additions to the agenda, Gale clarified that he added a brief status update on Leavenworth NFH activities—not on permitting at Leavenworth NFH and Tumwater Dam.
- Regarding USFWS' Leavenworth NFH update, Gale clarified that Leavenworth NFH has agreed to hold the adults for a 3-day AQUI-S® withdrawal period—not 30-day MS-222 withdrawal period.

Kristi Geris said that all other comments and revisions received on the draft meeting minutes were incorporated. The Hatchery Committees members present approved the May 15, 2013 meeting minutes as revised.

Action items from the last Hatchery Committees meeting on May 15, 2013, and follow-up discussions were as follows:

- *Mike Tonseth will consult with Ken Warheit (WDFW geneticist) and then provide the Wenatchee spring Chinook trapping/sampling protocols, including the genetic inclusion/exclusion criteria, to Emily Pizzichemi and Kristi Geris for distribution to the Hatchery Committees (Item II-A).*
  Tonseth said that he contacted Warheit and obtained the needed information; however, he has not yet amended the protocols. Tonseth requested that this action item be carried forward.
- *Lynn Hatcher will send a status update on Wenatchee spring Chinook permitting to Emily Pizzichemi and Kristi Geris for distribution to the Hatchery Committees no later than May 31, 2013 (Item II-A).*

Amilee Wilson provided a National Environmental Policy Act/Endangered Species Act (NEPA/ESA) Wenatchee hatchery program consultation update on May 31, 2013, and Geris distributed the update to the Hatchery Committees the same day.

- *Emily Pizzichemi and Kristi Geris will arrange a conference line and distribute details to the Hatchery Committees for a conference call to review the status of Wenatchee spring Chinook permitting, scheduled for June 3, 2013, at 10:00 am (Item II-A).*
  Geris arranged a conference line; however, the Hatchery Committees agreed that the conference call was not needed following receipt of Amilee Wilson's NEPA/ESA Wenatchee hatchery program consultations update.
- *Hatchery Committees representatives will provide the names of recommended statisticians, salmon ecologists, and hatchery biologists to serve on a technical peer review panel to rank responses to the Chelan PUD Hatchery M&E Requests for Proposal (RFPs) to Mike Schiewe (with a copy to Kristi Geris) no later than June 3, 2013 (Item III-A).*
  Recommendations for potential peer reviewers were received from Hatchery Committees representatives.
- *Greg Mackey will revise the Wells Hatchery Summer Chinook Program HGMP and SOA accordingly, as requested by the Hatchery Committees, and Emily Pizzichemi will distribute the revised documents to the Hatchery Committees no later than May 17, 2013 (Item IV-A).*
  Mackey provided the revised documents on May 16, 2013, and Pizzichemi distributed them to the Hatchery Committees the same day.
- *Hatchery Committees representatives will send their approval or requested changes to the Wells Summer Chinook HGMP to Mike Schiewe (with copies to Emily Pizzichemi, Kristi Geris, and Greg Mackey) no later than May 22, 2013 (Item IV-A).*
  The revised HGMP and SOA were approved by email vote on May 22, 2013, with the Yakama Nation (YN), CCT, USFWS, WDFW, and Douglas PUD approving, and NMFS abstaining.
- *Greg Mackey will provide a list of critical sections in the Wells Hatchery Modernization Master Plan to help guide review to Emily Pizzichemi for distribution to the Hatchery Committees (Item IV-B).*
  Mackey provided the list on May 20, 2013, and Pizzichemi distributed it to the Hatchery Committees the same day.

- *The Hatchery Committees June 19, 2013 meeting will be held at 9:00 am in the Chelan PUD Auditorium (Item VI-A).*

  Noted.

II. NMFS

A. HGMP Update (Lynn Hatcher)

Okanogan Programs

Lynn Hatcher said that NMFS is continuing to work on the transfer of spring Chinook from Winthrop NFH to the CCT, and designation of this population as an ESA Section 10(j) experimental population. The Environmental Assessment (EA) will be available for a 60-day public review in July or August 2013, and then public meetings are planned for September or October 2013 to discuss the status of the EA. Hatcher said that BiOps are also planned to be completed no later than October 2013, which is a deadline that would allow the fall 2013 transfer of fish from Winthrop NFH to the acclimation ponds in the Okanogan and subsequent release in the spring of 2014 to initiate the experimental population. He said that in order to obtain permits, both the NEPA process and BiOps need to be complete; and the Section 10(j) designation finalized. Hatcher said that he expects no setbacks from the public meetings and that fish should be ready to transport come this fall. Kirk Truscott asked if the Section 10(j) permit could be issued before the NEPA. Mike Tonseth noted that WDFW was instructed that the BiOp and Section 10 permits may be issued prior to the EA; however, they are not effective until the EA is complete. Hatcher said that fish are not covered under Section 10(j) until they are released. Lastly, Hatcher said that NMFS is waiting for an Okanogan steelhead HGMP from the CCT.

Methow Programs

Hatcher said that agreement seems to have been reached among *U.S. v. Oregon* parties regarding Methow steelhead and spring Chinook. He said that the existing EA was determined sufficient, but a supplemental EA is still needed for the Chelan PUD spring Chinook program; Hatcher added that this supplemental EA is planned to be complete by October 2013. Bill Gale asked what discussions NMFS, Douglas PUD, or Grant PUD have had with Karl Halupka (USFWS) on program interactions with bull trout, and Hatcher replied that NMFS has been in constant communication with Halupka. Greg Mackey said that when Douglas PUD completed relicensing for Wells Dam, a full bull trout consultation with USFWS was completed, which Douglas PUD supplied to NMFS. He added that Grant PUD programs at Douglas PUD facilities are also covered under Douglas PUD's consultation, so long as they are tied to Douglas PUD's facilities and operations. Hatcher said that the addendums for the approved Methow FH and Winthrop NFH HGMPs do not deviate significantly from what was already approved by the Hatchery Committees, and do not require an additional review by the Committees. He also said that the Methow Basin spring Chinook BiOp will include Chelan PUD's 61,000 Methow spring Chinook obligation. However, Alene Underwood said that she had heard otherwise from Craig Busack. Underwood also said that although NMFS had already stated that an addendum would be acceptable for the Chelan PUD Methow spring Chinook program, as described in an email distributed to the Hatchery Committees by Busack on June 3, 2013, NMFS is now requesting a full HGMP. Hatcher explained that NMFS approved the Winthrop NFH spring Chinook HGMP and Methow FH spring Chinook HGMP, and their supplements, but had not yet approved (or received) Chelan PUD's Carlton Rearing Pond spring Chinook HGMP. He said that Chelan PUD's HGMP for the Carlton Rearing Pond is necessary before NMFS can complete the Methow Basin spring Chinook BiOp. She asked the Hatchery Committees if they would approve a shortened review period for the full Chelan PUD Methow Spring Chinook HGMP in consideration of the timeline. Hatchery Committees representatives present agreed to a shortened 14-day review period of Chelan PUD's Methow Spring Chinook HGMP, and Underwood said that she hopes to get a draft out for review within the next 3 weeks.

<u>Wenatchee Programs</u>

Hatcher said that the existing NEPA documentation was determined sufficient for Wenatchee steelhead, but the Wenatchee steelhead BiOp will be on hold until after the spring Chinook BiOp is complete. He said that NMFS is currently working to complete the joint BiOp for the Chiwawa River, Nason Creek, and White River spring Chinook programs, along with the EA for Nason Creek. He said that once those are complete, NMFS will then focus on completing the Leavenworth spring Chinook BiOp. Hatcher said that signature pages will be needed from the PUDs and the State of Washington before permits are effective. Hatcher said that public comment on the Nason Creek spring Chinook EA ended on June 14, 2013, and the EA was sent to Washington D.C. for final review and signature. He also noted that about 30 pages of supporting information were added to the draft BiOp;

however, the analyses themselves were not changed. Underwood added that the BiOp format also changed, and additions were made to the sections on genetics, discussion of strays, and effects analysis. Tonseth asked that NMFS highlight the revisions to expedite a quicker final review.

Collection of Spring Chinook for Nason Creek and Chiwawa River Programs

Tonseth said that he recently distributed a revised spring Chinook adult return update that projected that approximately 40 percent of the run will pass Tumwater Dam by June 22, 2013. He said that, currently, the run is about 20 to 25 percent wild in composition; and that broodstock collection for the Nason Creek and Chiwawa River programs needs to begin as soon as possible. In light of this new information, as described in an email distributed to the Hatchery Committees by Kristi Geris on June 18, 2013, WDFW requested concurrence from NMFS to begin broodstock collection of up to 136 natural origin spring Chinook adults at Tumwater Dam, under and consistent with the current amended Section 10 Permit 1196. NMFS concurred that WDFW's request was consistent with the current amended Section 10 Permit 1196 (NMFS 2004) which states that, "*Of the combined total number of naturally produced spring Chinook salmon adults and jacks that return to the Chiwawa River and Nason Creek each year, WDFW may retain no more than 400 or one-third, whichever is less, for broodstock to meet the smolt production levels of the program. The ESA-listed adult Chinook salmon retained for broodstock may be transferred to transport vehicles and transported to holding/spawning facilities.*"

Tonseth said that once new permits are obtained, collection will default to the original broodstock collection plan of 172 adults as described in the 2013 Broodstock Collection Protocols. Underwood said that although NMFS concurred with the collection and transport of broodstock, Chelan PUD's concern is that the current permit does not cover transport back to the river of adults not assigning to either Nason Creek or Chiwawa River or fish in excess of Program needs. Tonseth noted that releasing unassigned fish back to the river is an activity that already has precedence; and said that WDFW is ready to assume liability for hauling unassigned fish back to the river. Underwood said that Chelan PUD appreciates the offer, but as co-signatories on the permit, Chelan PUD must also assume liability and potential take. Underwood requested that NMFS provide written confirmation that transport back to the river of adults not assigning to either Nason Creek or Chiwawa River is covered under the current Section 10 Permit 1196. Underwood noted that Grant PUD also needs to approve the proposed path forward, and Shannon Lowry said that Grant PUD concurs with WDFW's request to begin Wenatchee spring Chinook broodstock collection for the Nason Creek and Chiwawa River programs of up to 136 natural origin spring Chinook adults at Tumwater Dam, contingent on Chelan PUD's concurrence, and NMFS' approval for transport back to the river of adults not assigning to either Nason Creek or Chiwawa River. Hatchery Committees members present also agreed with WDFW's request to begin Wenatchee spring Chinook broodstock collection for the Nason Creek and Chiwawa River programs, contingent on NMFS' approval for transport back to the river of adults not assigning to either Nason Creek or Chiwawa River. Hatcher said that NMFS will provide a letter of concurrence for transport back to the river of Wenatchee spring Chinook adults collected for the Nason Creek and Chiwawa River programs not assigning to either Nason Creek or Chiwawa River. *(Note: NMFS provided approval for transport back to the river of Wenatchee spring Chinook adults not assigning to either Nason Creek or Chiwawa River via email on June 19, 2013.)*

Gale asked if agreement is reached for spring Chinook brood collection for the Nason Creek and Chiwawa River programs, will the revision also be considered approved in the 2013 Broodstock Protocols. Tonseth replied that the protocols will still need to be revised; then reviewed and approved by the Hatchery Committees; and then sent to NMFS for final approval. With regards to a spring Chinook timeline, Hatcher will distribute an update on the status of Wenatchee spring Chinook permitting to the Hatchery Committees prior to June 27, 2013, and Geris will arrange a conference line to review the status of Wenatchee spring Chinook permitting and potential paths forward, scheduled for June 27, 2013, at 10:00 am.

III. WDFW

A. DECISION: CRITFC Request to Conduct Genetic Sampling for PBT of Columbia River Hatchery Programs (Mike Tonseth and Tom Scribner)

Mike Tonseth said that CRITFC's 2013 request to conduct genetic sampling of broodstock for PBT of Columbia River hatchery programs is consistent with the 2012 request that was presented at the Hatchery Committees meeting on March 28, 2012; he added that, like last year, the request is a 1-year agreement. CRITFC's proposal to conduct a second year of genetic sampling (samples to be archived for possible future use) for PBT of Columbia River hatchery programs (Attachment B) and general tissue sampling protocol for PBT were distributed to the Hatchery Committees by Kristi Geris on June 11, 2013. Tom Scribner also provided additional background information that Geris distributed to the Hatchery Committees on June 12, 2013, including: a PBT geographic range graphic; a media release from the Canadian Journal of Fisheries and Aquatic Sciences (CJFAS) on technology used to genetically tag fish in the Snake River Basin titled, "It's all in the genes — including the tracking device"; and a 2012 paper that was published in CJFAS titled, "Validation of Parentage-Based Tagging for hatchery steelhead in the Snake River basin" by Steele et al.

Tonseth said that some agencies, including WDFW, still have some concerns about the project, such as long-term funding for genetic analyses, access to the database, and who maintains the database. However, he expected these issues will be resolved and WDFW supports collection of the sample for another year. He said that, as was the case last year, Maureen Hess, CRITFC, will provide the supplies needed to conduct sampling. Scribner said that genetic sampling for PBT is expanding rapidly. He acknowledged that there are some associated costs but he said that he sees no downside, conceptually, to participating.

Bill Gale said that USFWS has concerns similar to those of WDFW; however, they are supportive of the intent, and have agreed to collect samples at Leavenworth NFH and Winthrop NFH. He said that USFWS is not planning to sample summer Chinook at Entiat NFH, and added that it was his understanding that CRITFC was not focusing on non-listed species at this time. Tonseth clarified that CRITFC was initially only interested in listed species; however, based on those samples, they have decided to also include non-listed species. He said that, in 2012, samples of non-listed species were obtained from Priest Rapids Fish Hatchery, and added that Hess indicated very clearly that CRITFC will supply staff to collect samples, if needed. Charlie Snow said that, in 2012, summer Chinook at Wells Dam were also sampled. He said that Hess was on site for one day of sampling. Alene Underwood said that Chelan PUD is supportive of the proposal, and Tonseth said that samples were collected last year for Chelan PUD programs. Kirk Truscott said that the CCT supports the proposed sampling; however, the CCT will not participate in 2013. He said that the CCT would like to establish and refine Chief Joseph FH's broodstock protocols before considering additional procedures. The Hatchery Committees representatives present approved

CRITFC's request to conduct genetic sampling for PBT of Columbia River hatchery programs.

IV. Douglas PUD

A. Grant PUD Fish Production Request (Greg Mackey)

Greg Mackey said that each year, Grant PUD submits a request to Douglas PUD to produce fish for Grant PUD programs. He said that Hatchery Committees representatives have routinely approved the request as long as it does not impact Douglas PUD's HCP production. Mackey said that this year, Grant PUD is requesting that Douglas PUD produce 100,000 steelhead for release in the Okanogan at Wells Hatchery, and 134,126 Methow River spring Chinook at the Methow FH. Mackey said that both requests can be comfortably accomplished without placing Douglas PUD programs at risk. Hatchery Committees representatives present approved Grant PUD's request.

B. Wells Hatchery Master Plan Workshop (Greg Mackey)

Greg Mackey recalled that the Hatchery Committees had requested that Douglas PUD arrange a Wells Hatchery Master Plan Workshop to discuss design aspects of the modernization with HDR. He said that Douglas PUD still plans to hold a workshop; however, dates have not yet been solidified. He added that tentative dates are in early July or early August 2013, and that, ideally, Douglas PUD would like to hold the workshop early enough in the design process such that comments and revisions can be addressed and incorporated into the plans without setting back the schedule. Mackey said that the workshop would probably not be scheduled on a Hatchery Committees meeting date, and that the venue would likely be the Douglas PUD office—not Wells Hatchery. He said that comments on the Wells Hatchery Master Plan are due on July 13, 2013, and Bill Gale suggested holding the workshop prior to the comment deadline. Mackey said that he will arrange and distribute a date for the Wells Hatchery Master Plan Workshop. Gale asked if the comment deadline can be delayed in the event that the workshop cannot be scheduled before the July 13, 2013 comment deadline, and Mackey replied that the comment period will remain the same, and that any comments from the workshop will still be considered.

C. Hatchery M&E Plan Assessment Targets (Greg Mackey)

Greg Mackey said that two doodle polls have been distributed trying to reconvene a Hatchery M&E Workgroup. He said there are two issues that remain to be discussed: 1) layout of information in the appendices; and 2) content to be included in the appendices. Mike Tonseth noted that some content may remain blank for some time. Mike Schiewe also noted that if there are some appendices that are not common to all three HCPs and the Grant PUD Settlement Agreement, it would make sense to address those issues in separate meetings, so as to use everyone's time more effectively. Mackey said that he will develop an agenda for the next Hatchery M&E Workgroup meeting. The agenda will be attached to a doodle poll that will be distributed to arrange the meeting.

V. Chelan PUD

A. Hatchery M&E RFP Technical Review Panel (Alene Underwood)

Alene Underwood said that recommendations for potential peer reviewers were received from Hatchery Committees representatives. She said that Chelan PUD plans to contact the recommended reviewers to see who is available and interested in participating on the panel. Underwood said that Chelan PUD also held a mandatory pre-proposal conference for interested proposers, which she reported had a good turnout. Underwood said that once a list of available reviewers is compiled, the list will be shared with the Hatchery Committees. She said that proposals are due on July 9, 2013, and she estimated that the technical review panel would begin reviews by July 15, 2013. She added that Chelan PUD and Grant PUD are still discussing how to facilitate the process.

B. Chelan PUD Methow Spring Chinook HGMP (Alene Underwood)

Alene Underwood said that this agenda item was adequately discussed during NMFS' HGMP update.

VI. CCT

A. Chief Joseph Wenatchee Spring Chinook Brood Collection at Leavenworth NFH (Kirk Truscott)

Kirk Truscott said that USFWS, WDFW, and the CCT had been examining passive integrated transponder (PIT) tag data coming into Leavenworth NFH, and, due to low return projections, the CCT had recently decided to close the CCT spring Chinook fishery on the Icicle River.

He also noted that the YN had delayed expanding their fishery in Icicle Creek. Truscott said that to date, 132 adult females, 62 adult males, and 40 jacks have been obtained for CJH broodstock; and over the weekend, there was a pulse of water and a good number of additional Chinook have come in to Leavenworth NFH. Current projections are that a full broodstock for CJH is likely; therefore, the CCT is planning to reinitiate the CCT spring Chinook fishery on the Icicle River.

VII. HCP Administration

A. Chelan PUD Change in Hatchery Committee Representation

Mike Schiewe announced that Keith Truscott provided notification of a change in Chelan PUD HCP Hatchery Committee representation on June 14, 2013, designating Alene Underwood as the new Chelan PUD HCP Hatchery Committee lead representative.

B. Next Meetings

The next scheduled Hatchery Committees' meetings are on July 17, 2013 (Douglas PUD office); August 21, 2013 (Chelan PUD); and September 18, 2013 (Douglas PUD).

List of Attachments

Attachment A	List of Attendees
Attachment B	CRITFC's proposal to conduct a second year of genetic sampling for PBT of Columbia River hatchery programs

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Todd Pearsons	Grant PUD
Andy Chinn	Grant PUD
Shannon Lowry	Grant PUD
Peter Graf	Grant PUD
Tom Scribner*†	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Lynn Hatcher*	National Marine Fisheries Service
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Charlie Snow†	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

Proposal to collect tissue samples from Chinook salmon and steelhead broodstock annually at facilities under the oversight of the HCP Hatchery Committee and PRCC Hatchery Sub Committee

Submitted to:
HCP Hatchery Committee and PRCC Hatchery Sub Committee

Requesting agency:
Columbia River Inter-Tribal Fish Commission
3059-F National Fish Hatchery Rd.
Hagerman, Idaho 83332

Contact information:
Maureen Hess, CRITFC, hesm@critfc.org, 208-837-9096 x1117
Shawn Narum, CRITFC, nars@critfc.org, 208-837-9096 x1120

Objective

In order to expand parentage based tagging (PBT) throughout the Columbia River basin for Chinook salmon and steelhead, we are requesting that tissue samples be collected from all broodstock as fish are spawned in hatcheries above Bonneville Dam starting in 2012 and continuing for the foreseeable future. We are specifically requesting that Chinook salmon and steelhead hatchery programs collect tissue samples from 100% of broodstock, and tissues be sent to the appropriate operating agency's genetics lab for storage until the anticipated funding is in place to genotype samples.

CRITFC can provide sampling supplies in the form of Whatman sheets for spawn year 2013. At a minimum, we ask that a tissue sample be collected upon spawning from every individual fish used as broodstock, and the corresponding spawn date and gender be recorded for each individual. Optional information would include spawn cross records (i.e., which fish were mated together), length, or any other associated data recorded by hatchery staff.

PBT data is intended to be shared within a centralized database. IDFG recently received funding through Pacific Coast Salmon Recovery Fund to coordinate the development of a broad database to house genetic data for multi-agency use.

Background

Several committees and science review groups have recommended that large-scale evaluations of PBT technology be performed (PFMC 2008; PSC 2008; ISAB/ISRP 2009). Thus far, PBT has been effectively applied to Chinook salmon and steelhead populations in California (Anderson & Garza 2006; Anderson 2010) and throughout the Snake River basin (Steele et al. 2012; Steele et al. *in press*) for accomplishing a variety of objectives including identification of hatchery parents of harvested fish, strays, returning adults, and outmigrating juveniles.

PBT technology greatly reduces the problem of small sample sizes encountered with CWTs, and thus would provide the statistical power needed to improve escapement estimates and identification of stock contributions to fisheries. By genotyping 100% of parental broodstock, 100% of all offspring are genetically tagged. Implementation of PBT involves annual sampling of hatchery broodstock to create a parental genotype baseline. Offspring produced by these parents must then be sampled (e.g. non-lethal fin clips) either as adults or juveniles, and then genotyped to be assigned back to their parents – thus identifying their age and hatchery of origin. This new PBT approach will provide many opportunities to address additional questions related to fisheries management and strongly complements the existing CWT program in the Columbia Basin.

Literature cited

Anderson EC, Garza JC. 2006. The power of single-nucleotide polymorphisms for large-scale parentage inference. Genetics 172: 2567–2582.

Anderson EC. 2010. Computational algorithms and user-friendly software for parentage-based tagging of Pacificc salmonids. Report submitted to the Pacific Salmon Commission. http://swfsc.noaa.gov/publications/CR/2010/2010Anderson.pdf

Hankin DG, Fitzgibbons J, Chen T. 2009. Unnatural random mating policies select for younger age at maturity in hatchery Chinook salmon (*Oncorhynchus tshawytscha*) populations. *Canadian Journal of Fisheries and Aquatic Sciences*, **66**, 1505–1521.

Steele CA, Campbell MR, Ackerman M, McCane J, Hess MA, Campbell N, Narum SR. 2012. Parentage Based Tagging of Snake River hatchery steelhead and Chinook salmon. Bonneville Power Administration. Annual Progress Report, Project number 2010-031-00. https://collaboration.idfg.idaho.gov/FisheriesTechnicalReports/Res12-09Steele2011%20Parentage%20Based%20Tagging%20Snake%20River%20Hatchery%20Steelhead%20and%20Chinook.pdf

Steele CA, Anderson EC, Ackerman MW, Hess MA, Campbell N, Narum SR, Campbell M. 2013. A validation of Parentage-Based Tagging using hatchery steelhead in the Snake River basin. *Canadian Journal of Fisheries and Aquatic Sciences*, in press.

ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	August 21, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the July 17, 2013 HCP Hatchery Committees Conference Call		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held by conference call, on Wednesday, July 17, 2013, from 9:00 am to 11:00 am. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Mike Tonseth will consult with Ken Warheit (Washington Department of Fish and Wildlife [WDFW] geneticist) and provide the Wenatchee spring Chinook trapping and sampling protocols, including the criteria for genetic inclusion or exclusion, to Kristi Geris for distribution to the Hatchery Committees (action item carried forward from the Hatchery Committees meeting on June 19, 2013) (Item I).
- Chelan PUD will provide a schedule and timeline outlining their Hatchery Monitoring and Evaluation (M&E) Request for Proposal (RFP) and 2014 Hatchery M&E Implementation Plan processes, to Kristi Geris for distribution to the Hatchery Committees (Item II-A).
- Chelan PUD will provide an update regarding when their draft Spring Chinook Hatchery and Genetic Management Plan (HGMP) will be available for review, to Kristi Geris for distribution to the Hatchery Committees (Item II-B).
- Mike Tonseth will provide a summary of the genetic assignments of the spring Chinook broodstock that were collected at Tumwater Dam (TWD), to Kristi Geris for distribution to the Hatchery Committees (Item II-C).
- Keely Murdoch will update the Hatchery Committees on potential co-acclimation of Chelan PUD's spring Chinook Methow production and the Yakama Nation's (YN's) coho salmon production at the Chewuch Pond (Item III-A).

- **The Hatchery Committees' meeting on August 21, 2013 will be held at Douglas PUD**, with the Wells Hatchery Master Plan Workshop in the afternoon (Item IV-A).

STATEMENT OF AGREEMENT DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at today's meeting.

AGREEMENTS

- Hatchery Committees representatives present agreed to Chelan PUD's proposed schedule to provide their draft 2014 Hatchery M&E Implementation Plan for Hatchery Committees review as early as September 2013, and no later than October 2013 (Item II-A).
- Hatchery Committees representatives present agreed to the YN's request to continue planning for co-acclimation of Chelan PUD's Methow spring Chinook production with the YN coho salmon production at the Chewuch Pond in 2015 (Item III-A).

REVIEW ITEMS

- There are no items that are currently out for review.

FINALIZED REPORTS

- Kristi Geris sent an email to the Hatchery Committees on August 2, 2013, notifying them that the Wells Hatchery Master Plan was finalized following a 60-day review period, which ended on July 13, 2013. As noted in the email, no comments were received from Hatchery Committees members on the draft plan.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and asked for any additions or other changes to the agenda. Schiewe requested that Chelan PUD provide an update on spring Chinook broodstock collection at TWD. No other additions or changes were requested.

Action items from the last Hatchery Committees meeting on June 19, 2013, and follow-up discussions were as follows:

- *Mike Tonseth will consult with Ken Warheit (WDFW geneticist) and provide the*

Wenatchee spring Chinook trapping and sampling protocols, including the criteria for genetic inclusion or exclusion, to Kristi Geris for distribution to the Hatchery Committees (action item carried forward from Hatchery Committees meeting on May 15, 2013).

Tonseth requested that this action item be carried forward.

- *The National Marine Fisheries Service (NMFS) will provide a letter of concurrence for transport back to the river of Wenatchee spring Chinook adults collected for the Nason Creek and Chiwawa River programs that do not assign to either Nason Creek or Chiwawa River (Item II-A).*

  NMFS provided approval for transport back to the river of Wenatchee spring Chinook adults not assigning to either Nason Creek or Chiwawa River via email on June 19, 2013.
- *Lynn Hatcher will distribute an update on the status of Wenatchee spring Chinook permitting to the Hatchery Committees prior to June 27, 2013 (Item II-A).*

  Craig Busack provided an update on the status of Wenatchee spring Chinook permitting that Kristi Geris distributed to the Hatchery Committees on June 26, 2013.
- *Kristi Geris will arrange a conference line to review the status of Wenatchee spring Chinook permitting and potential paths forward, scheduled for June 27, 2013, at 10:00 am (Item II-A).*

  Kristi Geris arranged a conference line; however, the Hatchery Committees agreed that the conference call was not needed following receipt of Craig Busack's update on the status of Wenatchee spring Chinook permitting.
- *Greg Mackey will arrange and distribute a date for the Wells Hatchery Master Plan Workshop, planned to discuss engineering aspects of the modernization with HDR Engineering, Inc. (HDR) (Item IV-B).*

  Greg Mackey scheduled the Wells Hatchery Master Plan Workshop on the afternoon of August 21, 2013, as Kristi Geris informed the Hatchery Committees on July 8, 2013.
- *Greg Mackey will develop an agenda for the next Hatchery M&E Workgroup meeting, to be attached to the doodle poll distributed to arrange the meeting (Item IV-C).*

  Greg Mackey developed an agenda for the next Hatchery M&E Workgroup meeting that was attached to the doodle poll distributed to arrange the meeting, as the Hatchery Committees were notified by Kristi Geris on July 5, 2013.

The Hatchery Committees reviewed the revised draft June 19, 2013 meeting minutes. Kristi Geris said that a second draft of the revised minutes was distributed to the Hatchery Committees today, prior to the call. She said that the second draft incorporated additional edits, which are tracked in redline in the meeting minutes; these edits are as follows:

- Regarding the NMFS' HGMP update, Bill Gale clarified that the October 2013 deadline for submitting Biological Opinions (BiOps) would allow the fall 2013 transfer of fish from Winthrop National Fish Hatchery (NFH) to the acclimation ponds in the Okanogan and subsequent release in the spring of 2014 to initiate the experimental population.
- Regarding WDFW's decision item about Columbia River Inter-Tribal Fish Commission's (CRITFC's) request, it was clarified that, in 2012, samples of non-listed species were obtained from Priest Rapids Fish Hatchery (FH)—not from Spring Creek NFH.
- Regarding the Colville Confederated Tribe's (CCT's) discussion on Chief Joseph Wenatchee spring Chinook brood collection at Leavenworth NFH, Truscott clarified the sequence of events and reasoning surrounding the decision to close—and the subsequent decision to reinitiate—the CCT spring Chinook fishery on the Icicle River.

Geris said that all other comments and revisions received from members of the Committees were incorporated in the revised minutes. The Hatchery Committees members present approved the June 19, 2013 meeting minutes as revised. Keely Murdoch confirmed Tom Scribner's approval of the revised minutes, and Lynn Hatcher provided NMFS approval of the revised minutes via email on July 26, 2013. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Chelan PUD

A. Hatchery M&E RFP Update and 2014 Hatchery M&E Implementation Plan Schedule (Alene Underwood)

Alene Underwood said that the Chelan PUD Hatchery M&E RFP closed on July 8, 2013. She said that three proposals were received, which are currently being reviewed for completeness. She said that Grant PUD and Chelan PUD have a call scheduled for July 30, 2013, to discuss which proposals qualify as "complete," and also to determine a path forward for interviews. Once it is determined which proposals are complete, those proposals will be provided for review to those Hatchery Committees members who do not have a conflict of interest.

Mike Tonseth asked what assurances the Hatchery Committees would have, as a whole, that what is being proposed meets program needs—specifically as related to aspects of proposals that may be different from past Hatchery M&E Implementation Plans. Underwood replied that it is up to the proposer to demonstrate how objectives will be met. Where different methods are proposed, the proposer will be required to show congruence with past data collection, with no data gaps. She said that if alternative methods are proposed, they will be included in the draft 2014 Hatchery M&E Implementation Plan that will be available for review by the entire Hatchery Committees. Tonseth recalled that, last year, the Hatchery Committees agreed that the draft Hatchery M&E Implementation Plans were to be available for review no later than July 1. *(*Note: this agreement was made at the Hatchery Committees' meeting on December 12, 2012.)* Underwood acknowledged that although the draft Implementation Plan was originally scheduled for review in July, the RFP review process has affected the schedule; and she proposed that the draft Implementation Plan instead be submitted to the Hatchery Committees for review in September or October 2013. Tonseth said that, in order to remain consistent with that agreement, as long as the draft Implementation Plan is a precursor to contracting, there should be no issues with submitting the draft plan at a later date. Underwood clarified that developing the draft Implementation Plan and contracting will be completed on parallel paths because contracting cannot happen without knowing the scope of work. Keely Murdoch said that her main concern in reviewing the Implementation Plan before contracting is to make sure the plan is consistent with the M&E Plan. Underwood said that Chelan PUD is also committed to meeting the objectives outlined in the M&E Plan. She added that even if contracts are in place in general terms, they can be adjusted as needed to meet M&E objectives. Hatchery Committees representatives present agreed to Chelan PUD's proposed schedule of providing their draft 2014 Hatchery M&E Implementation Plan for Hatchery Committees review as early as September 2013, and no later than October 2013.

Underwood said that if interviews with the proposers were judged necessary, they will likely be conducted around the first part of August 2013. She noted that the interviews are separate from the RFP review panel, and both are likely to occur in parallel. She said that about 10 scientists had been recommended by Hatchery Committees representatives for the RFP review panel, and that those recommended will be contacted regarding their availability. She said she expects that 3 to 5, out of the 10 total, may be available; however, she also has no plans to exclude recommended reviewers if they are available. She said that she will have a better idea of what the RFP review panel will look like following Chelan PUD and Grant PUD's coordination call on July 30, 2013. Underwood also said that she will provide a schedule and timeline outlining Chelan PUD's Hatchery M&E RFP and 2014 Hatchery M&E Implementation Plan processes, to Kristi Geris for distribution to the Hatchery Committees.

Tonseth asked if Hatchery Committees representatives with a conflict of interest would still be allowed to review the proposals, but just not comment or participate in the decision-making. Underwood said that she was uncertain about the benefits of including such a step. Schiewe said that it would be highly unusual for a conflicted person to review the proposal at all; and added that there is a certain level of confidentiality with these proposals. Tonseth asked which Hatchery Committees members were not conflicted, and Underwood replied that they include U.S. Fish and Wildlife Service (USFWS), the CCT, and NMFS. Kirk Truscott suggested that, although conflicted parties are not participating in the selection of a contractor, the Hatchery Committees and the RFP review panel may still benefit from a conflicted party's review of the proposals. Schiewe said that if a non-conflicted party decides to seek input from conflicted parties outside of the Hatchery Committees venue, then that is up to them. However, he said that the Conflict of Interest Policy clearly establishes a protocol for review that puts conflicted parties at arm's length in the review process; he added that this is a traditional thing to do.

B. Methow Spring Chinook HGMP Update (Alene Underwood)

Alene Underwood said that, as discussed at the Hatchery Committee's meeting on June 19, 2013, Chelan PUD has been asked to submit a full Methow Spring Chinook HGMP. She said that Chelan PUD planned to have a draft ready for Hatchery Committees review by July 22, 2013; however, the draft may not be ready until July 26, 2013. Underwood said that she will provide an update regarding when the draft HGMP will be available for review, to Kristi Geris for distribution to the Hatchery Committees.

C. Spring Chinook Broodstock Collection at Tumwater Dam (Alene Underwood)

Alene Underwood said that after the Hatchery Committees meeting on June 19, 2013, WDFW commenced collection of spring Chinook broodstock at TWD; and as of July 12, 2013, Grant PUD, Chelan PUD, and WDFW have obtained Section 10 permits for Wenatchee spring Chinook. Mike Tonseth said that 172 adult spring Chinook were collected at TWD as described in the 2013 Broodstock Collection Protocols, and that genetic assignments for a full Chiwawa River spring Chinook program were obtained; however, they were not obtained for Nason Creek. He added that the majority of fish trapped at TWD assigned to the Chiwawa River, followed by White River, Leavenworth, and then Nason Creek. Bill Gale asked how many adults assigned to Leavenworth, and Tonseth replied that about 10 assigned as having originated at Leavenworth NFH; however, only four or five assigned given the broodstock criteria. Tonseth said that assignments will be confirmed once scale analyses are available, and he added that he will provide a summary of the genetic assignments of the spring Chinook broodstock that were collected at TWD, to Kristi Geris for distribution to the Hatchery Committees. Tonseth said that the 55 of 172 adults that did not assign were returned to the Wenatchee River at Swiftwater. He said that fish were sorted in the morning, then trucked to the release location, and released in the afternoon. He said that there were two releases, which were both water-to-water transfers. Tonseth said that he was present for the first transfer, which went well. Fish were released in deep pools so they could become oriented and gain their bearings; and after a short while, they swam into deeper water. He added that, currently, water temperature at the release location is slightly warmer than that at Eastbank.

Underwood said that spring Chinook collection at TWD is now complete, and that high numbers of sockeye are now passing TWD. She said that, as of July 12, 2013, TWD switched to a 3-day trapping schedule, and that weekly monitoring for potential delays associated with trapping has been ongoing. She said that no delays in excess of the criteria previously agreed to by the Hatchery Committees have been observed.

III. Yakama Nation

A. Potential Acclimation Locations for Chelan PUD Methow Spring Chinook (specifically as it relates to the Chewuch River) (Keely Murdoch)

Keely Murdoch said that an agreement is being explored between the YN and Douglas PUD for use of the Chewuch Pond for the YN's coho salmon production and acclimation, and she added that there has been discussion about possibly co-acclimating Chelan PUD's spring Chinook Methow production at the site as well. Mike Tonseth said that the proposal was worth considering; however, he said, additional discussion of long-term adult management would be required. He asked what is known about past acclimation at that location, and he noted that when Douglas PUD's program operated out of the Methow Hatchery, about 40 percent of returning adults did not return to the Chewuch. Murdoch agreed that additional discussion of adult management was appropriate; she also noted that she was uncertain about what effect acclimation at the Chewuch Ponds would have on percent hatchery-origin spawners (pHOS) in the Chewuch. She noted that the Chewuch Pond is also a secure facility, which is advantageous when dealing with listed fish. With regards to previous data, Murdoch said that it was her understanding that closer to 50 percent of Douglas PUD's program did not return to the Chewuch while operating out of the Methow Hatchery. She speculated that this may have been because the fish were homing to the Methow Hatchery. Murdoch said, however, that since Chelan PUD's spring Chinook will be overwintered at Carlton, they may exhibit a higher fidelity to home back to the Chewuch, as opposed to the Methow. She added that depending on how they are marked, options for removal could include Wells Dam.

Tonseth suggested that, in order to evaluate this option, the Hatchery Committees should consider what the expectations are for the program in terms of overwintering at Carlton and spring acclimating in the Chewuch. Bill Gale said that he is more interested in how Chelan PUD is going to collect broodstock than in how they are going to release them. He also said that he is not opposed to the idea, and added that he agrees with Tonseth that NMFS will want to see data that demonstrate that fish will return to the Chewuch. Kirk Truscott noted that he is unaware of options other than what the YN is suggesting; and asked if coho and spring Chinook have been co-acclimated before. Murdoch replied that coho and spring Chinook have been co-acclimated in the back-channel at Winthrop, and she added that fish at Chewuch Pond could either be commingled or be separated by a net. Truscott asked what the capacity is at Chewuch Pond, and Tom Kahler replied that he believes the design capacity is 223,000 fish. Tonseth noted that spring Chinook have lower bacterial kidney disease (BKD) rearing density requirements than coho; and Alene Underwood said that, as described in their Methow Spring Chinook HGMP Addendum, Chelan PUD is not anticipating density issues with regards to their Methow spring Chinook obligation. Tonseth said that it is not Chelan PUD's program that will cause the density issue, but combining the YN's 180,000 coho is what will increase the density. He asked how many coho the YN planned to acclimate in the Chewuch Pond, and Murdoch replied that those figures depend on what other acclimation options are agreed upon in the Methow and Chewuch. She added that the YN is cognizant of keeping densities low with commingled acclimation—they do not intend to acclimate an unhealthy number of fish in one location.

Truscott asked if there are fish health concerns with commingling coho and spring Chinook, and Gale replied that he did not recall any concerns with commingling them in the back-channel at Winthrop. Gale added that there is a correlation between a fish's condition when transferred and subsequent fish health problems. He said that in the past, minor fish health issues arose when fish arrived and the stress of transfer triggered secondary fish health issues. Tonseth said that he has observed behavioral issues among commingled steelhead and spring Chinook, such as fin nipping, and asked if anything of that nature was observed at Winthrop. Gale replied that he had not observed that at Winthrop.

Murdoch noted that the commingled acclimation would be short-term, and she said that, at this point, the YN just wanted to share the concept with the Hatchery Committees to make sure there were no red flags before the YN continues investigating this option. Hatchery Committees representatives present agreed to the YN's request to continue planning for co-acclimation of Chelan PUD's Methow spring Chinook production with the YN coho salmon production at the Chewuch Pond in 2015. Murdoch said that she will update the Hatchery Committees as plans solidify.

IV. HCP Administration

A. Next Meetings

Mike Schiewe reminded the Hatchery Committees that the next meeting on August 21, 2013, will be held at Douglas PUD, with the Wells Hatchery Master Plan Workshop to follow in the afternoon. Alene Underwood added that Chelan PUD and Grant PUD have been discussing inviting Dr. Kim Hyatt of Fisheries and Oceans, Canada (DFO), to provide an update on the Sockeye Reintroduction Program on the morning following the meeting (August 22, 2013). Tom Kahler said that Douglas PUD would be fine with that arrangement, but that they would want Hyatt to also include information on the implementation of the Douglas PUD-funded Fish Water Management Tool (FWMT). Underwood said that she would finalize the arrangements with Grant PUD.

The next scheduled Hatchery Committees' meetings are on August 21, 2013 (Douglas PUD); September 18, 2013 (Douglas PUD); and October 16, 2013 (Chelan PUD).

List of Attachments

Attachment A List of Attendees

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Tom Kahler*	Douglas PUD
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Charlie Snow	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

ANCHOR QEA
720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	October 21, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the August 21, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Douglas PUD headquarters in East Wenatchee, Washington, on Wednesday, August 21, 2013, from 9:30 am to 12:00 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Mike Tonseth will consult with Ken Warheit (Washington Department of Fish and Wildlife [WDFW] geneticist) and provide the Wenatchee spring Chinook trapping and sampling protocols, including the criteria for genetic inclusion or exclusion, to Kristi Geris for distribution to the Hatchery Committees, by no later than the end of 2013 (action item carried forward from the Hatchery Committees meeting on June 19, 2013) (Item I).
- Mike Tonseth will provide a summary of the genetic assignments of the spring Chinook broodstock that were collected at Tumwater Dam (TWD), to Kristi Geris for distribution to the Hatchery Committees (action item carried forward from the Hatchery Committees conference call on July 17, 2013) (Item I).
- Keely Murdoch will provide a draft Implementation Plan for co-acclimation of Chelan PUD's spring Chinook Methow production and the Yakama Nation's (YN's) coho salmon production at the Chewuch Pond, to Kristi Geris for distribution to the Hatchery Committees prior to the September 18, 2013 meeting (Item I).
- Greg Mackey will contact the National Marine Fisheries Service (NMFS) regarding consultations as they relate to coverage under Permit 1347, and will let Mike Schiewe know whether there is a need for him to also contact NMFS on behalf of the Hatchery Committees (Item II-A).
- Greg Mackey will provide draft tables for inclusion in the Hatchery Monitoring and

Evaluation (M&E) Plan Appendices, to Kristi Geris for distribution to the Hatchery Committees (Item III-A).

- Keely Murdoch will contact WDFW fish health staff to confirm their support of the proposed approach for live spawning Twisp River steelhead broodstock at Methow Hatchery; and based on those discussions, she will determine a path forward to be discussed at the Hatchery Committees meeting on September 18, 2013 (Item V-A).
- **The Hatchery Committees' meeting on September 18, 2013 will be held at Douglas PUD (Item VIII-A).**

STATEMENT OF AGREEMENT DECISION SUMMARY

- No Statements of Agreement (SOAs) were approved at today's meeting.

AGREEMENTS

- Hatchery Committees representatives present agreed that Greg Mackey would develop draft tables for inclusion in the Hatchery M&E Plan Appendices, for Hatchery Committee review (Item III-A).

REVIEW ITEMS

- There are no items that are currently out for review.

FINALIZED REPORTS

- There are no reports that have been recently finalized.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Greg Mackey added two brief updates: 1) Draft Douglas PUD 2012 Hatchery M&E Report; and 2) Twisp River Reproductive Success Genetic Analysis.
- Kirk Truscott added an update on Chief Joseph Hatchery (CJH) brood collection.
- Bill Gale added a brief update on U.S. Fish and Wildlife Service (USFWS) staffing.

The Hatchery Committees reviewed the revised draft July 17, 2013 conference call minutes. Kristi Geris said there were two outstanding comments remaining to be discussed, as follows:

- Regarding review of the revised draft June 19, 2013 meeting minutes, Kirk Truscott confirmed that the Colville Confederated Tribes (CCT) discussed Chief Joseph Wenatchee spring Chinook brood collection at Leavenworth National Fish Hatchery (NFH) as it affected the CCT spring Chinook fishery on the Icicle River. Mike Tonseth noted that a recreational fishery was also affected; however, this issue was not specifically discussed at the June 19, 2013 meeting.
- Regarding the YN's discussion on potential acclimation locations for Chelan PUD Methow spring Chinook, Mike Tonseth clarified that spring Chinook have lower *bacterial kidney disease (BKD)* rearing density requirements than coho.

Geris said that all other comments and revisions received from members of the Committees were incorporated in the revised minutes. The Hatchery Committees members present approved the July 17, 2013 meeting minutes as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

Action items from the last Hatchery Committees meeting on July 17, 2013, and follow-up discussions were as follows:

- *Mike Tonseth will consult with Ken Warheit (WDFW geneticist) and provide the Wenatchee spring Chinook trapping and sampling protocols, including the criteria for genetic inclusion or exclusion, to Kristi Geris for distribution to the Hatchery Committees (action item carried forward from the Hatchery Committees meeting on June 19, 2013) (Item I).*
  Tonseth said that he has the needed information, but still needs to amend the protocols. He said that he hopes to have this complete as early as the end of October, and no later than the end of 2013. Tonseth requested that this action item be carried forward.
- *Chelan PUD will provide a schedule and timeline outlining their Hatchery M&E Request for Proposal (RFP) and 2014 Hatchery M&E Implementation Plan processes, to Kristi Geris for distribution to the Hatchery Committees (Item II-A).*
  Chelan PUD will address this today during their Hatchery M&E Update.

- *Chelan PUD will provide an update regarding when their draft Spring Chinook Hatchery and Genetic Management Plan (HGMP) will be available for review, to Kristi Geris for distribution to the Hatchery Committees (Item II-B).*
  Chelan PUD will address this today during their Methow Spring Chinook HGMP Update.
- *Mike Tonseth will provide a summary of the genetic assignments of the spring Chinook broodstock that were collected at Tumwater Dam (TWD), to Kristi Geris for distribution to the Hatchery Committees (Item II-C).*
  Tonseth requested that this action item be carried forward.
- *Keely Murdoch will update the Hatchery Committees on potential co-acclimation of Chelan PUD's Methow spring Chinook production and the Yakama Nation's (YN's) coho salmon production at the Chewuch Pond (Item III-A).*
  Murdoch said that details are still being sorted between the YN and Douglas PUD for use of the Chewuch Pond for co-acclimation of the YN's coho salmon production and Chelan PUD's Methow spring Chinook production. She said that the YN plans to produce a more detailed proposal. Kirk Truscott requested that the YN also provide a draft Implementation Plan and SOA. Mike Tonseth said that a draft Implementation Plan should include more than just the number of spring Chinook that would be placed into Chewuch Pond—that it would also include how many coho, at what size, and what the ultimate flow and rearing density levels would be planned for fish placed in Chewuch Pond. He added that additional details would include timing of transfer (to Chewuch Pond), timing of release, and release strategy (i.e., forced versus volitional). Bill Gale asked how acclimation implementation ties in with consultation. He said that it seems like NMFS will eventually want to know how acclimation ties into spring Chinook objectives, such as escapement goals, etc. Mike Schiewe said that a good start would be for Murdoch to draft an Implementation Plan, highlighting the main features of the program. Greg Mackey said that Douglas PUD would also like a SOA on the use of the Chewuch Pond, in order to document formal approval by the Hatchery Committees. Alene Underwood said that Chelan PUD supports these suggestions. Gale asked if the draft Implementation Plan and SOA would only address the use of the Chewuch Pond, or if they would also include other possible Methow acclimation locations. Murdoch replied that, for Chelan PUD's production, the YN is mainly considering use of the Chewuch Pond; she

added, however, that the YN is also considering other places in the Upper Methow for other programs. Mackey said that Douglas PUD has already provided Tom Scribner with financial information for using Chewuch Pond and Douglas and the YN would need to work out an agreement. Tonseth noted that there are two agreements: a facility sharing agreement, and an agreement for the use of the facility for Chelan PUD production. He requested that there be clear separation of these two agreements. Murdoch said that she will provide a draft Implementation Plan for co-acclimation of Chelan PUD's spring Chinook Methow production and the YN's coho salmon production at the Chewuch Pond, to Kristi Geris for distribution to the Hatchery Committees prior to the September 18, 2013 meeting.

- *The Hatchery Committees' meeting on August 21, 2013 will be held at Douglas PUD, with the Wells Hatchery Master Plan Workshop in the afternoon (Item IV-A).* Noted.

II. NMFS

A. HGMP Update (Lynn Hatcher)

Lynn Hatcher said that NMFS is now primarily focusing on the Mid/Upper-Columbia. He said that Amilee Wilson has been working full time and that everyone has been very responsive to requests, which has all helped move things forward. He said that NMFS would like to have all Upper/Mid-Columbia permitting completed by mid-March 2014.

Okanogan Programs

Hatcher said that NMFS is unable to complete the Biological Opinion (BiOp) and Section 10 permits for USFWS to transfer listed spring Chinook to the CCT by the October 2013 deadline. The new completion date is January 20, 2014. The Endangered Species Act (ESA) Section 10(j) experimental population designation for the CCT's spring Chinook program is still on schedule for completion in March 2014. He added that NMFS and the CCT have been meeting monthly about the Section 10(j) designation and permitting process. Bill Gale said that, as a result, the Winthrop NFH will release 100,000 to 150,000 under-yearling spring Chinook smolts in the Methow this fall to get under capacity; and he added that total release in spring 2014 will be 650,000. Keely Murdoch asked whether, should the Section 10(j) come through in March, the smolts might then not be transferred to the Okanogan, and Mike Tonseth replied that they would not because the capacity problem arises in the fall.

Mike Schiewe asked if the current permit allows pre-smolt release; and Gale replied that it does. Tonseth said that the release is intended to reduce rearing densities and address potential fish health concerns. Gale said that similar situations (excess production) have happened in the past, and that unless someone has space for 100,000 to 150,000 smolts in the Methow, releasing them is the only option. Hatcher said that with regards to the Okanogan steelhead HGMP, NMFS expects to receive a draft from the CCT by September 5, 2013. He said the revised Environmental Assessment (EA) is complete, and that Craig Busack plans to complete the BiOp and the Section 10 permits by January 20, 2014 (same date as for spring Chinook).

Methow Programs

Hatcher said that negotiations among *U.S. v. Oregon* parties are now complete regarding Methow steelhead and spring Chinook. He said that the existing EA was determined sufficient for the current programs, but that a supplemental EA will have to be completed for the Chelan PUD spring Chinook program. He said that the goal is to have one consultation for all Methow Basin steelhead and spring Chinook hatchery programs; however, if Chelan PUD's HGMP is not completed in time, there will have to be two consultations. The BiOp and Section 10 permit for Chelan PUD's spring Chinook program would be separated out, and not completed until an agreement is reached between Chelan PUD and NMFS. *(Note: Greg Mackey later indicated that steelhead and spring Chinook will be handled as separate BiOps and permits.)* Hatcher added that he was concerned that a Section 10 permit will not be approved if Chelan PUD proposes brood collection at Rocky Reach Trap (RRT). Alene Underwood said that she spoke with Busack, and as it stands now, Chelan PUD is including RRT as a potential collection location. She said that Chelan PUD is proposing that brood collection at RRT may also tie into Chiwawa spring Chinook stray management required under the new Section 10 permit. Hatcher said that NMFS is hoping to complete permitting for Methow steelhead and spring Chinook by January 20, 2014, including the Chelan PUD program. Greg Mackey noted that the current Methow steelhead Section 10 Permit 1395 expires October 2, 2013; and Hatcher replied that NMFS will not be able to complete the new permits by then. Tonseth said that USFWS is also covered under Permit 1395. Hatcher said that NMFS would like to publish in a Federal Register Notice (FRN) the Wells and Winthrop Steelhead HGMPs, and the Winthrop and Methow Spring Chinook HGMPs, all at the same time. Mackey said that this is a problem because the Wells Hatchery steelhead programs will not have ESA permit coverage for three months. Gale suggested that if formal consultation is already underway, the program is still covered under the existing permit so long as there are no changes in program activities. Mackey said that Douglas PUD would be requesting a letter from NMFS, acknowledging this lack of coverage between October 2, 2013 and January 20, 2014. As for summer and fall Chinook programs (i.e., Permit 1347), Hatcher said that it is unlikely that the extension of Permit 1347 will be completed by October 23, 2013. Underwood said that Chelan PUD would need a letter from NMFS indicating coverage for Chelan PUD programs from October 23, 2013 to when the extension of Permit 1347 is completed. Hatcher said that NMFS would not likely issue any letters in the interim because the extension of Permit 1347 would be close to being issued.

Wenatchee Programs

Hatcher said that the existing National Environmental Policy Act (NEPA) documentation was determined sufficient for Wenatchee steelhead. Hatcher said that Section 10 permits are being distributed, and that applicant comments are due on September 13, 2013. The draft BiOp has not yet been distributed. Wenatchee steelhead Section 10 permits should be completed before Permit 1395 expires on October 2, 2013. Hatcher said that the Leavenworth spring Chinook BiOp will be sent to the National Oceanic and Atmospheric Administration (NOAA) General Counsel for review by August 26, 2013, and that a new permit will be issued in September 2013. Hatcher also said that Wilson and Karl Halupka (USFWS) have been meeting regularly and are in close coordination on bull trout coverage. Tonseth said that Section 7 consultations for bull trout are on the same completion schedule for Wenatchee programs.

Kirk Truscott said that he thinks a paper trail documenting continued coverage for any of the steelhead programs currently covered under the existing Permit 1395 is still necessary if a new permit is not already in place. Gale asked that everyone operating under that permit receive a copy of the letter if it is drafted. Mackey said that he will contact NMFS regarding consultations as they relate to coverage under Permits 1395 and 1347, and will let Schiewe know whether it would helpful for him to contact NMFS on behalf of the Hatchery Committees.

III. Douglas PUD

A. Hatchery M&E Appendices – Meeting of the PUDs (Greg Mackey)

Greg Mackey said that a Hatchery M&E Workgroup meeting was scheduled on July 31, 2013, at Chelan PUD, as described in an email distributed to the Hatchery Committees by Kristi Geris on July 30, 2013. However, due to last-minute scheduling conflicts for key attendees, the meeting was cancelled. Mackey said that the original plan was to prioritize tasks to finalize the M&E Plan reference (appendix) tables and divvy remaining tasks at the workgroup meeting. Mike Schiewe suggested that, in order to move the process forward, Mackey distribute draft tables and request input. Mackey noted that he had already developed table schema for review and populated some tables with example data, which were distributed to the Hatchery Committee for the previously cancelled meeting. Hatchery Committees representatives present agreed that Mackey would further develop draft tables for inclusion in the Hatchery M&E Plan Appendices; and Mackey said that he will provide draft tables to Geris for distribution to the Hatchery Committees for review. Kirk Truscott suggested developing a schedule for review of the tables prior to convening another Hatchery M&E Workgroup meeting. Alene Underwood suggested reviewing the tables via email, and then setting up a more formal meeting during the first week of November 2013. Todd Pearsons agreed with this suggested approach, and said that Grant PUD is willing to help, as needed. Schiewe said that the need for an in-person Hatchery M&E Workgroup meeting can be gauged once the draft tables are distributed and reviewed, and added that these discussions could also be addressed during a regular Hatchery Committees meeting.

B. Draft Douglas PUD 2012 Hatchery M&E Report (Greg Mackey)

Greg Mackey said that the draft Douglas PUD 2012 Hatchery M&E Report is currently under review by WDFW, and that Douglas PUD hopes to have the draft report ready for a 60-day Hatchery Committees review by the next Hatchery Committees meeting on September 18, 2013.

C. Twisp River Reproductive Success Genetic Sample Runs (Greg Mackey)

Greg Mackey said that a preliminary report of the Twisp River Reproductive Success Sampling is expected by Douglas PUD by the end of August, and that the report should be available to the Hatchery Committees shortly thereafter. Mackey said that this report is an annual update documenting that genetic samples were collected, run, and basic genetic statistics were run on the data, and not for formal review.

IV. Chelan PUD

A. Hatchery M&E Update (Alene Underwood)

Alene Underwood said that after internal review, one of three proposals submitted in response to the Chelan PUD Hatchery M&E RFP was determined to be complete with all components. Therefore, she said that at this point, Chelan PUD is not planning to engage a technical review panel, as previously discussed. She said that follow-up questions were distributed to the complete proposer, with responses due by September 13, 2013; and tentative follow-up discussions are planned with the proposer on September 17, 2013. Bill Gale asked if Chelan PUD has any contracting requirements that would require going out for another RFP to solicit more than one complete proposal; and Underwood replied that they do not. Keely Murdoch asked if Chelan PUD expects the same timeline for a draft Implementation Plan as discussed during the Hatchery Committees' conference call on July 17, 2013; and Underwood replied that Chelan PUD still plans to provide their draft 2014 Hatchery M&E Implementation Plan for Hatchery Committees review no later than October 2013.

B. Methow Spring Chinook HGMP Update (Alene Underwood)

Alene Underwood said that Chelan PUD's draft Methow Spring Chinook HGMP will hopefully go to WDFW for review this week, and then it will be ready for Hatchery Committees' review. She thanked the Committees for their patience, and said that she plans to contact Craig Busack to update him on the progress of the draft document. Mike Tonseth said that he expects WDFW review of the draft HGMP will take about two days. Underwood said that the Chelan PUD draft Methow Spring Chinook HGMP contains largely the same background information as the Douglas PUD HGMP, with no unique or new information. She also said that everything in the addendum, which was already reviewed by the Hatchery Committees, was included in the full HGMP.

Bill Gale asked, regarding the 2013 broodstock collected at Winthrop, if the progeny were on schedule to go to Eastbank, and also if those releases were still scheduled to go to the Chewuch Acclimation Pond. Underwood replied that juveniles will be overwintered at

Carlton in 2014, and would go to Chewuch in 2015. Gale asked if those fish will be marked differently, given that they are from Winthrop hatchery-origin broodstock. Tonseth replied that he believes that in accordance with the current *U.S. v. Oregon* agreement, fish will be marked adipose fin (ad)-present, with coded wire tag (CWT); and added that the CWT would be unique for those fish. Tonseth also noted that a broader discussion of marking schemes for the Upper Columbia hatchery programs needs to occur no later than March 2014. Gale asked if these fish should instead be marked more in line with the safety net program; and Underwood replied that this would be a Hatchery Committees decision. Kirk Truscott said that the balance of the Chelan PUD Methow program for release in 2015 will not include many progeny of natural origin fish; hence he sees no reason that Chelan PUD's 61,000 spring Chinook should be marked ad-present. Keely Murdoch said that in terms of developing new marking strategies, focus should be on a long-term strategy—not just a single year. Lynn Hatcher said that he believes that Busack is also thinking along those same lines. Gale said that if all goes as planned, Winthrop will also be releasing ad-clipped plus CWT fish that same year; and asked if marking schemes for these stocks should match. Truscott said that one of the main reasons to ad-clip fish is for adult management; and Gale added that ad-clipping fish also helps with brood collection identification. Tonseth said that, in the context of adult management, in run escapements where very few of the conservation program fish are needed to meet escapement and proportionate natural influence (PNI) objectives, if Wells Dam is the only location to adequately achieve hatchery-origin recruit (HOR) extraction, nearly 100% of the wild fish would need to be handled to remove nearly 100% of the non-ad-clipped hatchery steelhead (unless there was an alternate fin-clip available); Murdoch did not think that would necessarily be the case. Mike Schiewe said that long-term marking is something that has been discussed before, and suggested that the Hatchery Committees may want to address this issue soon.

C. Okanagan Nations Alliance Sockeye Hatchery Construction Update (Alene Underwood)

Alene Underwood announced that the Okanagan Nations Alliance (ONA) broke ground in late July on the new Kl cp'elk' stim Fish Hatchery in Penticton, British Columbia (BC). She said that the site was filled and graded, and that the foundation for two new buildings is already underway. She said that the facility is scheduled to be available to receive sockeye in fall 2014.

V. Yakama Nation

A. Live Spawning Twisp River Steelhead Broodstock (Keely Murdoch)

Keely Murdoch recalled discussing live-spawning Twisp River steelhead broodstock at the Hatchery Committees' meeting on January 16, 2013. She said that the YN Steelhead Kelt Reconditioning Program has now been up and running at Winthrop NFH for the past two years, where the YN has been working with USFWS to live-spawn natural-origin steelhead (females). Murdoch said that the YN has been working with USFWS to determine if Twisp steelhead could be spawned and early-reared at Winthrop NFH for a kelt program, but use of space at Winthrop NFH is contingent on NMFS issuing the Section 10(j) for the Okanogan spring Chinook program. There will not be enough groundwater or space available until the Okanogan spring Chinook program can be moved off site, which, she added, may mean pushing the schedule back another year. Bill Gale agreed and added that in order for Winthrop NFH to have the space available for the YN program, the hatchery will need to move the Okanogan-bound fish as eyed eggs, and CJH would need to be fully online and with a Section 10(j) in order to transition the eyed eggs to CJH.

Murdoch summarized that in the past, the YN discussed with Douglas PUD incorporating an isoincubation-early rearing facility into their plans for the Wells Hatchery Modernization; however, this option was too expensive. She said that more recently the YN has been working with USFWS and WDFW fish health staff to develop fish health criteria for the program. She provided a quick overview of a plan for spawning, holding, and fish health testing that Joy Evered (USFWS) and Bob Rogers (WDFW) had developed (the "Kelt Plan"). She said that a key element of the plan for Hatchery Committees' consideration and approval is that if Infectious Pancreatic Necrosis Virus (IPNV) is detected among any adults or progeny, all fish would be need to be destroyed to avoid virus spreading. Murdoch said that she had thought this situation could be avoided by keeping fish in separate troughs, as described in the Kelt Plan. She said, however, that IPNV apparently spreads both vertically and horizontally; so if detected, the entire stock would need to be destroyed (parents and offspring). Murdoch said the YN thinks that this program can be a great opportunity. She said that IPNV was detected with regularity about 20 years ago in the stock above Wells Dam, but then has not been detected since. She said that if IPNV does start to show up again, the YN would discontinue live-spawning of Twisp broodstock. However, as long as IPNV is not detected, the YN would proceed.

Greg Mackey said that Murdoch presented the same information to Douglas PUD a few weeks ago, and that Douglas PUD thought there was potential to carry this program forward at the Methow Hatchery—instead of at Winthrop. Mackey said that Douglas PUD staff met with WDFW fish health staff (Bob Rogers) and hatchery staff at the Methow Hatchery to discuss the possibility of operating the program there. He said that they discussed pooling progeny by spawn week, as found in the Kelt Plan, whereas originally WDFW fish health had required keeping each female's progeny in separate tanks. However, Bob Rogers said that the progeny should indeed be reared separately for each female parent. Mackey said that Murdoch was correct about IPNV: all fish would need to be destroyed if IPNV is detected. However, for other diseases, such infectious hematopoietic necrosis virus (IHNV), only the families that were found to be infected would be destroyed, reducing the overall numbers of fish and families that would need to be destroyed. This is the critical advantage of keeping families separate. He said that Douglas PUD asked WDFW to write a letter stating that the level of risk imposed by the kelt program was acceptable to provide Douglas PUD and the Hatchery Committee assurance that, from a fish health perspective, the program did not create unacceptable levels of risk; and he said that his impression was that WDFW may not be willing to provide such a letter. Mackey said that considering Methow Hatchery itself, the current equipment and setup may not be ideal, but it still could work; and he added that the current infrastructure would need to be considered in more detail. Mackey said that the bigger question may be about the Hatchery Committees' comfort level with the fish health concern.

Murdoch said that she appreciates everyone's consideration on this issue, and she added that the YN plans to complete budgeting exercises in October 2013 and would like to have some idea about a path forward by then.

Tonseth said that the Hatchery Committees need to consider effective population size and what possible crosses will look like. Charlie Snow said that individually sampling females, but pooling males, also results in killing a lot of fish. Therefore, Snow recommended individually sampling males, too. He added that, in general, only a few females are spawned each week. Kirk Truscott said that if progeny were pooled by spawn week, one-third of the females could be spawned in a few takes, which could knock off one-third of the program if disease was detected. Tonseth said that at the time that IPNV was last detected, there was brood being collected at Priest Rapids; which Tonseth suggested could have been the cause. He added that with 39 individual families, individual isolation based on parental crosses cannot reasonably be done with three-by-three (3x3) crosses. Gale asked how spring spawning would affect the ability to obtain one-year smolts, and asked if emergence will be delayed. Murdoch said that the original fish health screening plan was to collect two samples: one at swim up and one at 30 days after swim up. She said that it takes an additional 30 days to obtain results, so there is a total of 60 days to transfer after swim-up. She said that, now, there are only 30 days to transfer. She also said that the main concern was developing a more sensitive virus testing protocol that WDFW could support to allow only a single screening. Gale asked if a June transfer matches up with growth at Wells Hatchery. Mackey replied that the temperature profile is in the low 50s at that time of year; and added that he is uncertain if it is different from the Methow. Tonseth said that if there is little temperature difference between Methow, Winthrop, and Wells, then the effect on growth is not likely biologically significant (i.e., size at release of fry transferred to Wells Dam 30 days post-swim up is not likely significantly different than eyed eggs transferred to Wells Dam). Gale noted that Wells fish are spawned earlier; and Tom Kahler said that if Twisp River fish are a bit smaller, they may better match natural fish.

Mackey said that Bob Rogers sees this program as something that would operate for a short period of time, perhaps four years at the most. If the program were to operate longer a dedicated facility should be constructed to house the program. Murdoch said that at this point, the YN is mainly interested in how the kelts will perform. She said that she is not entirely certain what long-term funding looks like; and added that the current funding ends in 2017. She said that she is hoping for continued funding, but that will likely depend on the success of the program. She said that in the interest of moving forward, she will contact WDFW fish health staff to confirm their support of the proposed approach for live spawning Twisp River steelhead broodstock at Methow Hatchery; and based on those discussions, she will determine a path forward to be discussed at the Hatchery Committees meeting on September 18, 2013.

VI. CCT

A. Chief Joseph Hatchery Brood Collection (Kirk Truscott)

Kirk Truscott said that spring Chinook broodstock was successfully transferred from Leavenworth NFH to CJH. He said that the July report is not yet complete, but that fish were on station in June, and he reported no mortalities. He said that 35 pairs were spawned on August 19, 2013, and that eggs are now on station. He said that for summer Chinook, protocols have been met every week, and that collection will continue through next week. He said that the CCT is anticipating meeting full brood for natural and hatchery stocks—about 420 adults (i.e., 60 percent of 700,000). Truscott said that the CCT has not yet operated the weir for brood collection and that all brood collected to date has been by purse seine. Truscott noted that they have collected and successfully released many natural origin fish. Bill Gale recommended keeping open channels of communication with Travis Collier and Steve Croci, in case Leavenworth NFH has extra fish that could potentially be transferred to CJH.

Truscott said that a down side to brood collection is that there was a recent theft of 42 brood fish from CJH—mostly summer natural origin recruits (NORs). He said that based on evidence at the site, it seems that almost all of the fish came out of one pond. He said the up side is that the CCT made up the shortfall with brood collected on August 20, 2013. Mike Tonseth asked what CJH has for security, and Truscott replied that there are a few night-shift staff and real-time security cameras (no recordings). He explained that the ponds are fenced on three sides, and that the fourth side is a steep hill that is unfenced. The loss of broodstock occurred when individuals climbed the hill and came into the compound, snagged the fish and passed them under the gate of the perimeter fence and into a vehicle that was parked at the entrance to the compound. *(Note: The vehicle access to the broodstock compound has now been secured with a locked gate near Chief Joseph Dam [approximately one-half mile from the broodstock compound].)*

Regarding the Okanogan weir, Truscott said that staff completed installing the weir this morning. He said he is unsure whether or not fish have arrived; and added that water temperatures are currently reduced in the Okanogan. He said that pilot broodstock collection will begin immediately—collecting five fish per week—with processing and handling occurring at CJH. He said that six video cameras will be operational this year and that survival will be evaluated for brood collected at the weir versus the purse seine. He added that he believes most sockeye have already passed.

VII. USFWS

A. USFWS Staff Update (Bill Gale)

Bill Gale announced that Al Jensen will be retiring on September 30, 2013. He said he thinks that position will stay vacant, and he added that Travis Collier is now the main Leavenworth NFH contact.

VIII. HCP Administration

A. Next Meetings

Bill Gale said that there will not be USFWS representation at the Hatchery Committees' meeting on September 18, 2013. Mike Schiewe said that if any decision items are planned, USFWS will be contacted in advance, as necessary.

The next scheduled Hatchery Committees' meetings are on September 18, 2013 (Douglas PUD); October 16, 2013 (Chelan PUD); and November 20, 2013 (Douglas PUD).

List of Attachments

Attachment A List of Attendees

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Todd Pearsons	Grant PUD
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Lynn Hatcher*	National Marine Fisheries Service
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Charlie Snow†	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	September 17, 2013
From:	Kristi Geris		
Cc:	Mike Schiewe, HCP Hatchery Committees' Chair		
Re:	Final Summary of the August 21, 2013 Wells Hatchery Modernization Workshop		

This memorandum provides a summary of the Wells Hatchery Modernization Workshop that was held at Douglas PUD headquarters in East Wenatchee, Washington, on Wednesday, August 21, 2013, from 1:00 pm to 3:30 pm. Attendees are listed in Attachment A to this memorandum.

I. Wells Hatchery Modernization Workshop

A. Wells Hatchery Modernization Workshop (Greg Mackey)

Greg Mackey welcomed the attendees and introduced Ken Ferjancic, Jason Hill, and Ed Donahue from HDR Engineering, Inc. (HDR). Mackey presented background information on the Wells Hatchery Modernization (Attachment B), which Kristi Geris distributed to the Hatchery Committees on August 23, 2013. He noted that the modernization of Wells Hatchery was not required by the Federal Energy Regulatory Commission (FERC), but rather was a voluntary action by Douglas PUD to update the facility that was constructed in the mid-1960s. Mackey said that there are three major components of the rebuild, including: 1) a new incubation and early rearing building; 2) new circular tanks for the steelhead programs; and 3) a new adult trapping and broodstock holding facility. Lastly, Mackey reviewed the steelhead, summer Chinook, and non-Habitat Conservation Plan (HCP) program numbers that will be supported by the Wells Hatchery facility.

Ferjancic led HDR's presentation on the Wells Hatchery Modernization (Attachment C), which Geris distributed to the Hatchery Committees on August 23, 2013. He noted that some of the information that is included in his presentation is also included in the appendix of the Wells Fish Hatchery Modernization Master Plan, which was posted to the HCP ftp site by Emily Pizzichemi on May 14, 2013. Ferjancic reviewed metrics that were considered during the development of design criteria for the modernization, including Wells Hatchery program production numbers (as Mackey also noted), density indices (DIs), adult holding criteria, and water temperature profiles. Bill Gale asked why the DIs were not the same for all programs, and Shane Bickford explained that DIs for conservation programs were one-third compared to standard DIs. Ferjancic was asked if the water temperature data were for one year only, and responded that the water temperature profile data represent means for several years. He also noted the lag between peak well and peak river temperatures, and he added that the goal is to gradually reduce temperatures to the lowest temperature to try to mimic natural temperatures of receiving waters. The idea is to have the fish experience a low temperature prior to and coinciding with acclimation so they can experience naturally increasing water temperatures in the acclimation pond, resulting in a more natural and reliable smolting process. Ferjancic also reviewed planned Wells Hatchery inflow requirements, and noted that the inflow requirements are being used to develop the new and improved well field.

A Wells Hatchery site plan depicting general flow of water through the facility was discussed. Ferjancic identified a number of the physical components of the modernization, including removal of the spawning channel located along the western border of the site; a new hatchery building and 12-circular tank area, also located near the west end of the site; a new contingency area capable of housing eight additional circular tanks, located just east of the new 12-tank area; a new garage shop area just north of the new hatchery building; and a new adult trapping and broodstock holding facility located at the northeast corner of the site. Mackey noted that the modernization also is being planned so that the hatchery could remain fully operational throughout the duration of construction. He said that the approach is to install the new pipes, electrical, etc., in a utility corridor while the facility remains in operation, and then when everything is ready, engage the new systems. Ferjancic also noted that biosecurity has been a driving element in the design process, and that HDR will continue to incorporate biosecurity concepts into the design.

A site plan of the new hatchery building was discussed. Ferjancic said that the new building will house eight separate incubation rooms that are sized differently based on size requirements for the respective programs. He noted an area that has been set aside that will be plumbed in to allow natal water to be brought into the facility in the event that imprinting on natal water at the incubation (eyed-egg through alevin) stage is implemented. Bickford added that the area would just be a room that is plumbed in, and tanks can be brought in as needed. Ferjancic also noted that the area would need to be equipped with treatment infrastructure in order to store, treat, and recirculate water, if early imprinting is undertaken. Ferjancic added that the building will include space for offices and feed storage.

A diagram of the circular tank rearing area was discussed. Bickford noted that the enclosed rearing area will allow the fish to experience natural light. Ferjancic said that the area will be enclosed to provide predation control. Gale asked how the tanks will be stocked, and Ed Donahue replied that the tanks will be stocked from outside of the fence via a water-to-water transfer. Mike Tonseth noted that it would be similar to the setup at Chief Joseph Hatchery (CJH). Bickford said that the fish would be transferred from the start tanks to the circulars via water-to-water gravity feed. This is efficient and more fish friendly than using a fish pump or other transfer methods. Subsequent transfer to a fish distribution system, or dirt ponds, would also be water-to-water via gravity feed. He also stressed that the circular ponds will use a flow-through water system and will not be recirculated, and he noted that to achieve the water movement in the circular tanks to allow them to be self-cleaning and to provide the fish with a variety of water velocities in the tanks requires substantially higher flows than would be used in conventional raceways. Therefore, the fish will receive high flow indices and be reared at lower densities in the circular tanks. Gale questioned whether the proposed 3-foot clearance between tanks would be sufficient space for staff. Ferjancic responded that the exact spacing had not yet been addressed, but will be addressed to provide proper clearances for staff and operational needs. Tonseth asked how a tank would be removed if one located in the middle of the room was structurally compromised and need to be replaced. Ferjancic said that a "garage door-like" structure would need to be installed in order to remove a potentially compromised tank. He noted that support columns, as depicted on slide 11 of Attachment B, will need to be located between the tanks to allow room to remove the tanks. Ferjancic also noted that specific tank dimensions are included on slide 13 of Attachment B.

Ferjancic presented example bioprogramming results for Twisp River steelhead to illustrate how space and capacity requirements were developed (for each program) to be used in the design process. He said that typically in January of each year, river water and well water would be blended to achieve the desired water temperatures. He also noted that in March, when Twisp fingerlings are transferred to the acclimation site, they have already experienced a seasonal low temperature and temperatures at the acclimation site are on the upswing. Ferjancic said that in circulars, a minimum water velocity is needed for sweeping; and Gale asked if the same flow will be running into the circulars all year. Gale also asked if there is concern that flow will be too high at early life stages, and also if there is reason to increase flow when fish get larger. Ferjancic replied that flows can be regulated for early life stages he did not think it would be necessary to increase flow above that indicated in the bioprogram when the fish are larger. Kirk Truscott noted that fish can decide where they want to be in the circulars to regulate the flows they experience (i.e., outside in greater flow, or inside with less flow).

Lastly, Ferjancic presented a series of rearing unit allocations for each month of the year. Mackey said that one reason for this exercise is to identify any scheduling issues, such as where and when extra space or conflicts for space occur. Tonseth asked if and how fish location and rearing vessels affect tagging, and Ferjancic replied that those details have not yet been choreographed. Donahue said that fish can be gravity released from any of the circular tanks to a fish handling/distribution center where marking can occur. Tonseth said that his concern is to be able to mark and tag the conservation steelhead programs when all circulars will be in use. Truscott said that butterfly screens can be used with circulars to open space for tagging efforts, and Tonseth replied that he was not suggesting there would not be capacity; however, he thought the issue deserved early consideration.

Gale asked if Bob Rogers has been involved in modernization discussions, and Bickford replied that he had. Gale also asked if the proposed contingency area is already needed, and Bickford replied that it is not. Gale noted that in the rearing unit allocations that were just reviewed, all of the contingency tanks were filled for each month, and Bickford and Ferjancic clarified that those allocations were hypothetical (i.e., if needed). The allocation scenario showed how the facility would be allocated if the contingency space was in use.

Truscott asked if there is ever a month where there is a pinch-point for water, and Donahue replied that there should not be. Bickford said that the bioprogram indicated that peak consumption is about 13,000 gallons per minute (gpm), and the well field will be developed to deliver 18,000 gpm. Gale asked about the effluent from the dual drain tanks, and Donahue replied that a microstrainer will be installed to the clarifier, and then the water will go to overflow. Bickford added that the system will be single-pass water, and that the idea is to try to minimize future use of chemicals. He also added that the circulars help minimize effluent treatment and discharge concerns.

Tonseth asked about the timeline for the renovation. Bickford said that, originally, the plan was to put the project to bid in spring 2014; however, Douglas PUD needs to notify FERC of the proposed project and determine their level of desired involvement. He said that, in the meantime, Douglas PUD is moving forward with the well field redevelopment. He added that the goal is to get to 18,000 gpm as soon as possible so that the well is available prior to disruptions at the hatchery during construction. Lynn Hatcher asked if there was anything that the Hatchery Committees could do to help move the modernization process forward. Bickford suggested that perhaps a Statement of Agreement (SOA), indicating the Committee support and approval of the proposed renovations, would help. He added that it may put FERC at ease if they know that the plans have also been reviewed and approved by the Hatchery Committee. Tonseth asked when the renovations can be expected to be complete if everything goes as planned, and Donahue replied that the project would take 2 years to complete.

Mike Schiewe asked about adult collection and processing, and Bickford replied that Douglas PUD has been working with Bryan Nordlund (NMFS) regarding trap design and fish handling. Bickford said that because the volunteer channel and trap is considered a passage structure, the Wells HCP requires that the Coordinating Committees approve the structure. Tonseth suggested using direct current (DC) for anesthesia in order to keep the fish in water the entire time. Mackey said that Douglas PUD is looking into DC electro narcosis units (i.e., low voltage DC), and hopes to be able to have a system that can anesthetize multiple fish at once. Gale suggested that, for sacrificing fish, a carbon dioxide (CO_2) system is much less expensive than an electro anesthesia (EA) system. Tonseth said that the problem with a CO_2 system is the human safety concerns. Gale said that tricaine methane sulfonate (MS 222) is also an option, in lieu of an EA system. He also suggested that if an electro narcosis system is used that the design also allows other anesthetic options to be used, such as MS 222. Hatcher said that National Marine Fisheries Service (NMFS) engineers have historically supported the use of electro narcosis using DC-based units. Tonseth said that Washington Department of Fish and Wildlife (WDFW) put together a position paper on using DC-based units for electro narcosis; and added that WDFW has data for Chinook and steelhead. He also noted that with DC, there can be human contact with the water. Mackey said that Douglas PUD is still discussing all options.

Keely Murdoch asked about the future use of the east ladder trapping facility, and Bickford replied that the facility is rarely needed anymore. He added that the facility was originally built for the Carlton Chelan PUD program, which is no longer in place. Tonseth said that the facility has also been used for steelhead programs; however, this use also does not occur as much anymore because programs have shifted broodstock collection locations. Tonseth said that the only reason to use the east ladder now would be for adult management, or if a third party wanted to conduct sampling. He added that if the east ladder were to be used in any capacity, it would need improvements. Bickford said that the area is not ideal because of federal security requirements and the uncertainty in getting fish back across the dam during emergency or construction activities, and that the only reason that he could see needing to use it would be if there was a requirement to sample 100 percent of the spring Chinook run.

Gale asked about the feed storage room, and Bickford said that Douglas PUD has been discussing potentially purchasing feed in bulk, as opposed to in individual bags. He said that purchasing bulk feed and using automated feeders would reduce labor, and he added that the feed would be stored in a high-density plastic hopper. Use of bulk feed would reduce the need to handle bags of feed multiple times. Gale asked if using automated feeders would cause concern that fish are not being directly monitored while feeding, and Bickford replied that Douglas PUD has discussed this issue as it relates to the ability to observe fish behavior. Tonseth added that size disparity could also quickly become an issue without close observation. Ferjancic suggested that staff be trained to continue fish behavior observations, despite the fact that they no longer need to physically feed the fish. Todd Pearsons mentioned automated underwater feeding systems that have been implemented to improve feeding, and Gale noted that there are no data to support the claim that underwater feeding systems benefit fish. The group discussed several studies that tested naturalistic rearing treatments and that the studies generally did not find biologically significant differences in the enhanced verses standard rearing approaches. Ferjancic said that he recently came across a paper out of Norway published in the Proceedings of the Royal Society B titled, "Environmental enrichment promotes neural plasticity and cognitive ability in fish" by Gro Vea Salvanes, Moberg, et al. (2013). He said that the paper had some interesting thoughts on environmental enrichment and that he will email it to Geris for distribution. *(Note: Ferjancic provided the paper to Geris, which was distributed to the Hatchery Committees on August 23, 2013.)*

Gale noted the importance that enough space is planned for marking trailers to access needed areas, and that there will be easy access to power in those areas. Ferjancic said that these details are not laid out at the master planning level; however, he said that HDR will be sure to incorporate these details in future planning. Gale asked if the Hatchery Committees will be involved in that planning, and Bickford replied that the Committees can be involved if they want. Bickford said that when planning reaches 30 percent design, it will be a good time for another Hatchery Committee review.

Truscott asked, regarding the circulars, if there is a restriction on how many groups can be simultaneously removed at the terminus of the fish conveyance system. He further explained that releasing volitional migrants is desired and that the distribution system should be able to collect separate programs. Donahue replied that sorting details have not yet been worked out. Bickford said that a couple of options have been discussed for efficient fish transfers and releases.

Bickford said that the dirt ponds will be covered with netting to minimize predation, and he added that the biggest problems are small ducks and herons. He said that, last year, about 20,000 fish were lost to predation. Gale asked if the transmission tower in dirt pond 2 will cause problems installing the bird netting. HDR and Bickford responded that the netting can be installed to account for the effects of the tower.

Bickford said that Douglas PUD plans to submit the Part 12 notice to FERC in the fall of 2013. Schiewe suggested that Douglas PUD keep in touch about the letter to FERC, so that the Hatchery Committees can stay involved and possibly help move things forward. Tonseth asked if HDR needs to wait for FERC's response, and Bickford replied that HDR can keep moving forward. Ferjancic said that 30 percent design will likely be reached by the end of the year. Bickford reminded everyone that the Wells Hatchery Master Plan was finalized following a 60-day review period, which ended on July 13, 2013, as described in an email distributed to the Hatchery Committees by Geris on August 2, 2013. As noted in the email, no comments were received from Hatchery Committees members on the draft plan.

List of Attachments

Attachment A	List of Attendees
Attachment B	Wells Hatchery Modernization (Douglas PUD)
Attachment C	Wells Fish Hatchery Modernization (HDR Engineering, Inc.)

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Shane Bickford	Douglas PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Kenneth Ferjancic	HDR Engineering, Inc.
Ed Donahue	HDR Engineering, Inc.
Jason Hill	HDR Engineering, Inc.
Todd Pearsons	Grant PUD
Lynn Hatcher*	National Marine Fisheries Service
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

Attachment B

Wells Hatchery

MODERNIZATION

HCP Hatchery Committee
Wells Modernization Workshop
Douglas PUD

August 21, 2013

Greg Mackey

Attachment B

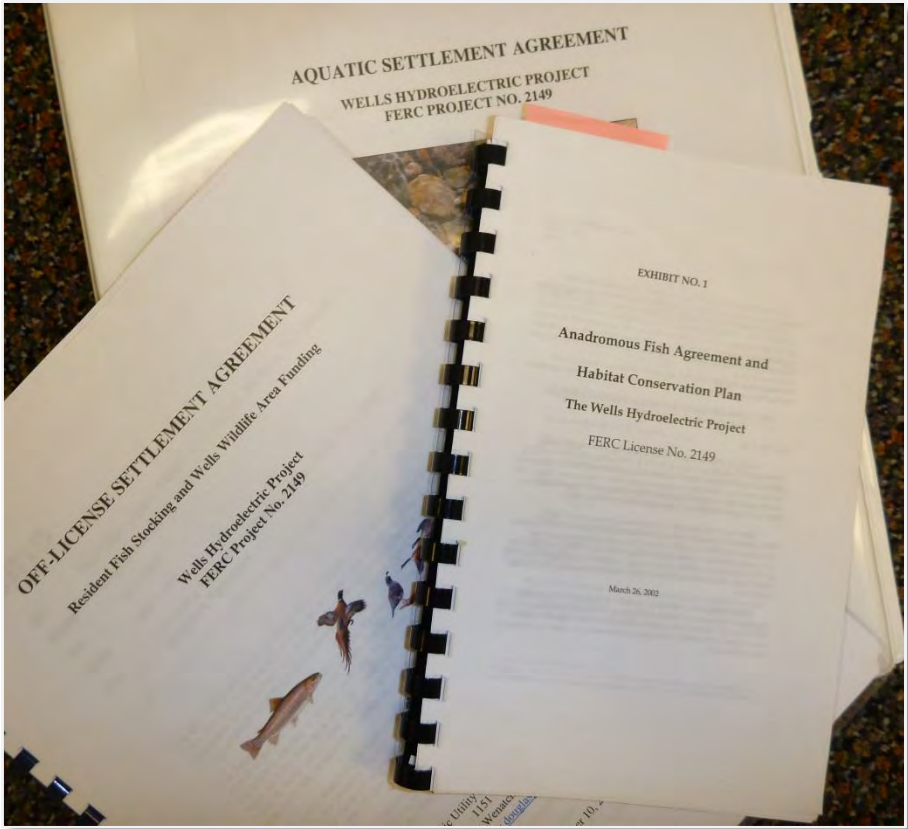
Background

- Constructed in 1967 as a 6,100’ spawning channel
- Upgraded to complete hatchery
- Produces about 156,000 pounds of steelhead, salmon and trout

Attachment B

Background

- Voluntary Action by DPUD
- Not a FERC Requirement
- DPUD seeks to ensure reliable production of quality fish into the future



Programs - Steelhead

Species	Program	Type	Number	
Steelhead	Twisp NNI	Conservation	8,000	48,000 total
Steelhead	Twisp Inundation	Conservation	40,000	
Steelhead	Methow Safety-Net Inundation	Conservation/ Harvest	100,000	
Steelhead	Columbia Safety-Net Inundation	Conservation/ Harvest	160,000	
Steelhead	Omak Conservation	Conservation	20,000	Grant PUD
Steelhead	Okanogan	Conservation/ Harvest	80,000	

Attachment B

Programs – Summer Chinook

Species	Program	Type	Number
Summer Chinook	Yearling Inundation	Harvest	320,000
Summer Chinook	Sub-Yearling Inundation	Harvest	484,000

Attachment B

Programs – Non-HCP

Species	Program	Life Stage	Number	Agreement
Rainbow	Jumbo Rainbow	Catchable	2,000	Off-License
Rainbow	Catchable Rainbow	Catchable	32,000	Off-License
Rainbow	Fingerling Rainbow	Fingerling	60,000	Off-License
Cutthroat	Lahontan Cutthroat	Eyed Eggs	160,000	Off-License
Cutthroat	Lahontan Cutthroat	Fry	75,000	Off-License
Summer Chinook	Lake Chelan Triploid	Eyed Eggs	100,000	Off-License
Kokanee	Palmer Lake Kokanee	Eyed Eggs	300,000	Off-License
White Sturgeon	Wells	Juvenile	5,000	Aquatic Settlement

Attachment C

WELLS FISH HATCHERY MODERNIZATION

AUGUST 21,2013

PRODUCTION PROGRAM

Wells Hatchery Programs as of 2013: updated on January 11, 2013

Species	Program	Life Stage	Number	Pounds	Size	Broodstock	Spawning/Incubation	Rearing	Acclimation	Release	Biosecurity Group	Owner	Rearing Vessel	Notes
Steelhead														
Steelhead: Twisp River	Twisp NNI: Conservation	Yearling	8,000	8,000	6 fpp	26 Twisp WxW	Methow Hatchery (Spawn in ~April)	Wells Hatchery	Twisp Pond	Twisp River	A	Douglas PUD	New Circulars	Broodstock held, spawned, incubated to eyed egg at Methow Hatchery, then moved to Wells Hatchery for grow out.
	Twisp Inundation: Conservation		40,000											
The two Twisp steelhead programs act as one program totaling 48,000 smolts, comprised of the two mitigation obligations listed above. Otherwise, the fish are identical and function as one program.														
Steelhead: Methow River	Methow Safety-Net: Conservation/ Harvest	Yearling	100,000	50,000	6 fpp	52 total: Twisp HxH (up to 25% of the broodstock), WNFH HxW, Methow Safety-Net HxH	Wells Hatchery	Wells Hatchery	Methow Hatchery	Methow River	B	Douglas PUD	Dirt Pond #4	Brood collected in the Methow Basin from up to 3 locations, in order of priority: Twisp HxH (up to 25% of broodstock), WNFH HxW, Methow Safety-Net HxH. Brood will be held temporarily at Methow Hatchery, and trucked to Wells for long-term holding prior to spawning. May be reduced to 60,000 smolts.
Steelhead: Columbia River	Mainstem Columbia Safety-Net: Conservation/ Harvest	Yearling	200,000		6 fpp	104 total: Methow Safety-Net HxH, HxH Wells Stock	Wells Hatchery	Wells Hatchery	Wells Hatchery	Columbia River direct from Wells Hatchery	B	Douglas PUD	Dirt Pond #3	Brood collected at Methow Hatchery, Wells Hatchery volunteer channel, Wells Dam fishway traps. Current production is 160,000, but could increase to 200,000.
Steelhead: Omak (Okanogan)	Omak: Conservation	Yearling	0 to 50,000	0 to 8,333	6 fpp	Omak Creek WxW, HxW	Wells Hatchery	Wells Hatchery	Omak Creek	Omak Creek (Okanogan)	C	Grant PUD	New Circulars	Grant/CCT programs. The max combined program is 100,000 (110,000 with 10% overage allowance). Goal is to maximize Omak and Salmon Creek programs at the expense of the Okanogan program, but still achieve 100,000 total. Programs can vary in size year to year according to broodstock availability. Brood collected in spring, except Wells Stock backup would need to be collected the previous autumn. These would be surplused as eggs or fry (see Ringold program) or released if Okanogan brood were collected in spring.
Steelhead: Okanogan	Okanogan: Conservation	Yearling	0 to 100,000	0 to 16,667		Wells Stock (HxH) collected in the Okanogan (spring collection) or Wells Stock (HxH) collected at Wells Dam (autumn collection)	Wells Hatchery	Wells Hatchery	TBD	Okanogan Basin (TBD)	D	Grant PUD	New Circulars	

PRODUCTION PROGRAM

Species	Program	Life Stage	Number	Pounds	Size	Broodstock	Spawning/Incubation	Rearing	Acclimation	Release	Biosecurity Group	Owner	Rearing Vessel	Notes
Steelhead	Ringold: Harvest	Surplus Eggs or Fry	Up to 120,000	NA	NA	Wells Stock, number is variable	Wells Hatchery	Ringold	Ringold	Columbia River	B	WDFW	Green Deep Troughs	Ringold Hatchery can absorb surplus steelhead eggs or fry due to over-collection of broodstock when trying to fill programs that rely on Wells Dam autumn collections for backup to spring collections at local collection sites.
Summer Chinook														
Summer Chinook	Inundation Yearlings: Harvest	Yearling	320,000	32,000	10 fpp	206 Wells Stock	Wells Hatchery	Wells Hatchery	Wells Hatchery	Columbia River direct from Wells Hatchery: April 15	E	Douglas PUD	Dirt Pond #2	Incubation water chilled to 42 F. No coagulated yolk problem. Adults arrive July/August; spawn in October.
Summer Chinook	Inundation Subyearlings: Harvest	Subyearling	484,000	9,680	50 fpp	320 Wells Stock	Wells Hatchery	Wells Hatchery	Wells Hatchery	Columbia River direct from Wells Hatchery: May 15	E	Douglas PUD	Dirt Pond #1	Incubation water not chilled- have coagulated yolk problem. Adults arrive July/August; spawn in October.
Off-License Settlement (OLS) Fish: 20,000 Pounds of Rainbow Trout Equivalents														
Rainbow	Jumbo Rainbow	Catchable	2,000	2,000	1	None	Wells Hatchery (spawned off-station, incubation only)	Wells Hatchery	None	Region 2 lowland lakes	F	WDFW	New Circulars	Catchable trout for Region 2 lowland lakes and kids fishing derbies.
Rainbow	Catchable Rainbow	Catchable	32,000	14,545	2.2	None	Wells Hatchery (spawned off-station, incubation only)	Wells Hatchery	None	Region 2 lowland lakes	F	WDFW	Pond 16	Catchable trout for Region 2 lowland lakes and kids fishing derbies.
Rainbow	Fingerling Rainbow	Fingerling	60,000	2,000	30	None	Wells Hatchery (spawned off-station, incubation only)	Wells Hatchery	None	Conconully Lake and Reservoir	F	WDFW	Bureau Raceways or circulars	Fry plants to Conconully Lake and Reservoir.
Cutthroat	Lahontan Cutthroat	Eyed Eggs	160,000	160	1,000	None	Wells Hatchery (spawned off-station, incubation only)	Wells Hatchery	None	Transferred to other programs	G	WDFW	No rearing – eyed eggs only	Brood from Lake Lenore. Eyed eggs are for Omak Hatchery, IDFG, ODFW
Cutthroat	Lahontan Cutthroat	Fry	75,000	100	750	None	Wells Hatchery (spawned off-station, incubation only)	Wells Hatchery	None	Transfer to Columbia Basin Hatchery	G	WDFW	Shallow Troughs	Fry are transferred to Columbia Basin Hatchery in August.
Summer Chinook	Lake Chelan Triploid	Eyed Eggs	100,000	500	200	Wells Summer Chinook	Wells Hatchery	Chelan Falls Hatchery	Chelan Falls Hatchery	Lake Chelan	H	WDFW	No rearing – eyed eggs only	Eggs are taken as part of the Wells summer Chinook program and treated to turn into triploids.
Kokanee	Palmer Lake Kokanee	Eyed Eggs	300,000	300	1,000	None	Wells Hatchery to eyed egg. Omak Hatchery for remainder of incubation	Omak Hatchery	None	Palmer Lake	I	WDFW	No rearing – eyed eggs only	These fish require a high level of biosecurity.

PRODUCTION PROGRAM

Species	Program	Life Stage	Number	Pounds	Size	Broodstock	Spawning/Incubation	Rearing	Acclimation	Release	Biosecurity Group	Owner	Rearing Vessel	Notes
Sturgeon														
Sturgeon	DCPUD Sturgeon: Conservation	Juveniles	5,000 (Build to 6,500)	NA	>230 mm up to ~300 mm	None	Wells Hatchery	Wells Hatchery	Wells Hatchery	Columbia River	J	Douglas PUD	New Indoor Combis	New program. Facility designed and construction to be finished in 2013.
Broodstock Collection for Non-Wells Hatchery Programs														
Summer Chinook	USFWS Entiat	Adult	248	NA	NA	Wells Stock	Entiat NFH	Entiat NFH	Entiat NFH	Entiat River	G	USFWS	Salmon Adult Pond	Interim broodstock collection program for Entiat NFH. Will last a number of years.
Summer Chinook	Chelan PUD	Adult	373	NA	NA	Wells Stock	Eastbank	Eastbank	Eastbank	Various	G	Chelan PUD	Salmon Adult Pond	Trap and truck operation
Surplus and Adult Management Activities (Occur in the Wells Hatchery Volunteer Channel and Trap)														
Steelhead	All Programs	Adult	1,000	NA	NA	NA	NA	NA	NA	NA	NA	Douglas PUD, USFWS, Grant PUD/CCT	NA	Remove excess hatchery-origin adults for management purposes
Summer Chinook	All Programs	Adult	700-800	NA	NA	NA	NA	NA	NA	NA	NA	Douglas PUD, USFWS, CCT	NA	Remove excess hatchery-origin adults for surplus or management purposes
Spring Chinook	All Programs	Adult	??	NA	NA	NA	NA	NA	NA	NA	NA	Douglas PUD, USFWS, CCT	NA	Not currently implemented. Remove excess hatchery-origin adults for management purposes
Programs Likely To Be Discontinued – Do Not Include in Design Until Further Notice														
Steelhead	WNFH	Eyed Eggs	60,000	NA	NA	~ 32 Wells Stock	Wells Hatchery	Winthrop NFH	Winthrop NFH	Methow River	B	USFWS	Steelhead Adult Pond	Interim broodstock collection program for Winthrop NFH. Will last a number of years.
Summer Chinook	Yakama Nation	Green Eggs	345,000	NA	NA	167 Wells Stock	Wells Hatchery	Marion Drain	?	?	F	Yakama Nation	NA	YN helps spawn fish.
Coho	Yakama Nation	Smolts	125,000	NA	NA	NA	Various	Various	Wells Hatchery	Columbia River	M	Yakama Nation	Pond 15	Spring acclimation only. Current program, but unclear if this program will continue. Uses Pond 15.

DENSITY INDICES
(FROM LIST OF SPECIFICATIONS AND ASSUMPTIONS)

Maximum density index for early rearing troughs, raceways, and circulars:

Chinook (0)	0.125	lb/cf/in	WDFW Fish Health July 31, 2012. R. Rogers pers. comm.
Steelhead Twisp & Contingency Program	0.20	lb/cf/in	WDFW Fish Health July 31, 2012. R. Rogers pers. comm.
Steelhead-Omak & Okanogan	0.20	lb/cf/in	Client meeting 9/6/12
Steelhead-Methow & Columbia R.	0.30	lb/cf/in	WDFW Fish Health Manual. 2010 Edition.
Chinook (+1)	0.125	lb/cf/in	WDFW Fish Health July 31, 2012. R. Rogers pers. comm.
Rainbow & Cutthroat	0.50	lb/cf/in	WDFW Fish Health Manual. 2010 Edition.

Density index for large ponds:

all species	0.05	lb/cf/in

ADULT HOLDING
(FROM LIST OF SPECIFICATIONS AND ASSUMPTIONS)

	Area Req.		
Steelhead & Contingency Program	2.5	cubic feet/adult	Rogers, R. WDFW Fish Health 2006
Chinook	10	cubic feet/adult	Rogers, R. WDFW Fish Health 2006

	Inflow Req.		
Steelhead & Contingency Program	2.0	gpm/adult	Rogers, R. WDFW Fish Health 2006
Chinook	1.0	gpm/adult	Rogers, R. WDFW Fish Health 2006

WATER TEMPERATURE PROFILE

Code	Month	Well °F	FI @ 1000 MSL	River °F	FI @ 1000 MSL
1	Dec-14	55	1.45	46	2.09
2	Jan-14	54	1.50	39	2.61
3	Feb-14	53	1.55	35	2.61
4	Mar-14	51	1.67	37	2.61
5	Apr-14	51	1.67	41	2.52
6	May-14	50	1.74	48	1.91
7	Jun-14	48	1.91	56	1.40
8	Jul-14	51	1.67	61	1.21
9	Aug-14	52	1.61	64	1.12
10	Sep-14	54	1.50	65	1.12
11	Oct-14	58	1.32	62	1.18
12	Nov-14	57	1.36	55	1.45

Temperature profile based on 5/1/12 WDFW-DCPUD data.
Temperatures rounded to the nearest whole number.

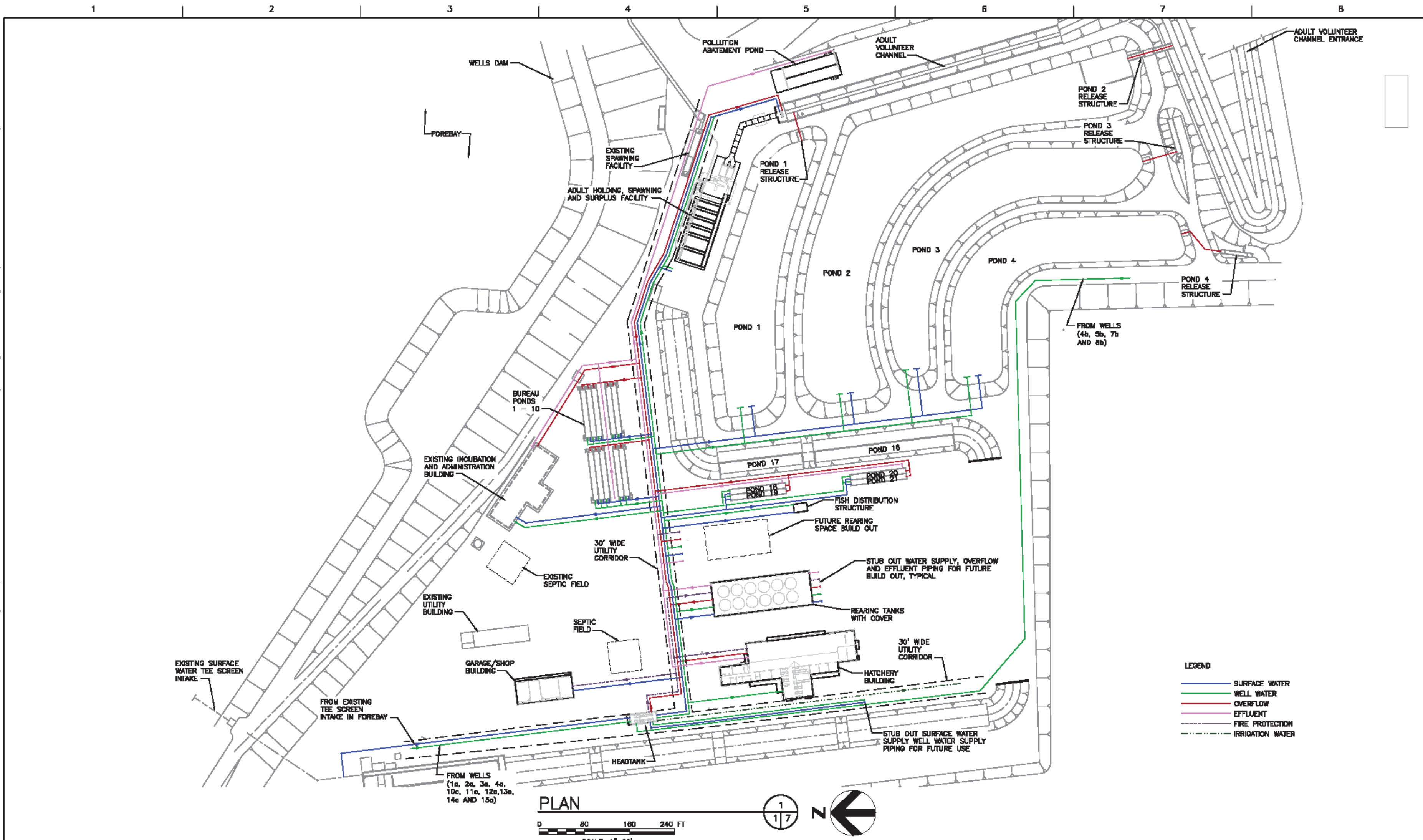
Flow rates calculated using Piper 1982.
Flow index (Fi) maintains minimum of five p.p.m. effluent D.O.

PLANNED WELLS HATCHERY INFLOW REQUIREMENTS

Subtotal by Water Source				Facility Total		Month
Well (gpm)	Well (cfs)	Surface (gpm)	Surface (cfs)	gpm	cfs	
12,390	27.59	363	0.81	12,753	28.40	December
6,567	14.63	6,152	13.70	12,719	28.33	January
6,677	14.87	6,251	13.92	12,928	28.79	February
7,133	15.89	5,793	12.90	12,926	28.79	March
6,833	15.22	4,899	10.91	11,732	26.13	April
6,778	15.10	2,527	5.63	9,305	20.72	May
3,176	7.07	334	0.74	3,510	7.82	June
3,550	7.91	334	0.74	3,884	8.65	July
4,361	9.71	434	0.97	4,795	10.68	August
5,597	12.47	434	0.97	6,031	13.43	September
8,106	18.05	434	0.97	8,540	19.02	October
10,999	22.49	363	0.81	10,462	23.30	November

Attachment C

SITE PLAN



BAR LENGTH ON ORIGINAL DRAWING EQUALS ONE INCH. ADJUST SCALE ACCORDINGLY

HDR Fisheries DESIGN CENTER

ISSUE	DATE	DESCRIPTION

PROJECT MANAGER	
DESIGNED BY	
DRAWN BY	
CHECKED BY	
PROJECT NUMBER	000000000178576

Public Utility District No. 1 of Douglas County

WELLS HATCHERY
MASTER PLAN

GENERAL FLOW DIAGRAM

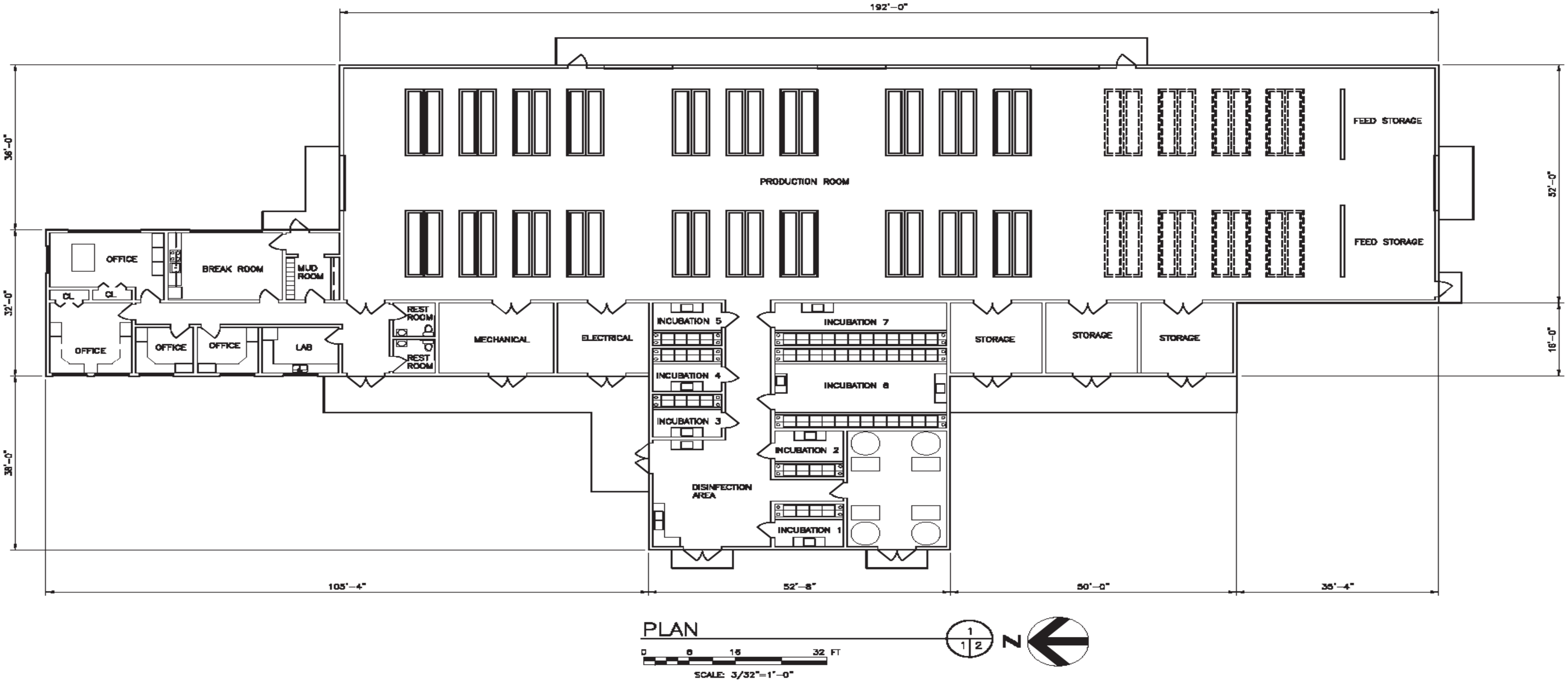
DATE	Sep 21, 2012	FILE	DCWH007.DWG
SCALE	AS NOTED		

DWG: C:\pwworking\sea\d0895213\dcwh007.dwg USER: ablake XREFS: 00G-BD00-01 DATE: Apr 19, 2013 12:19pm

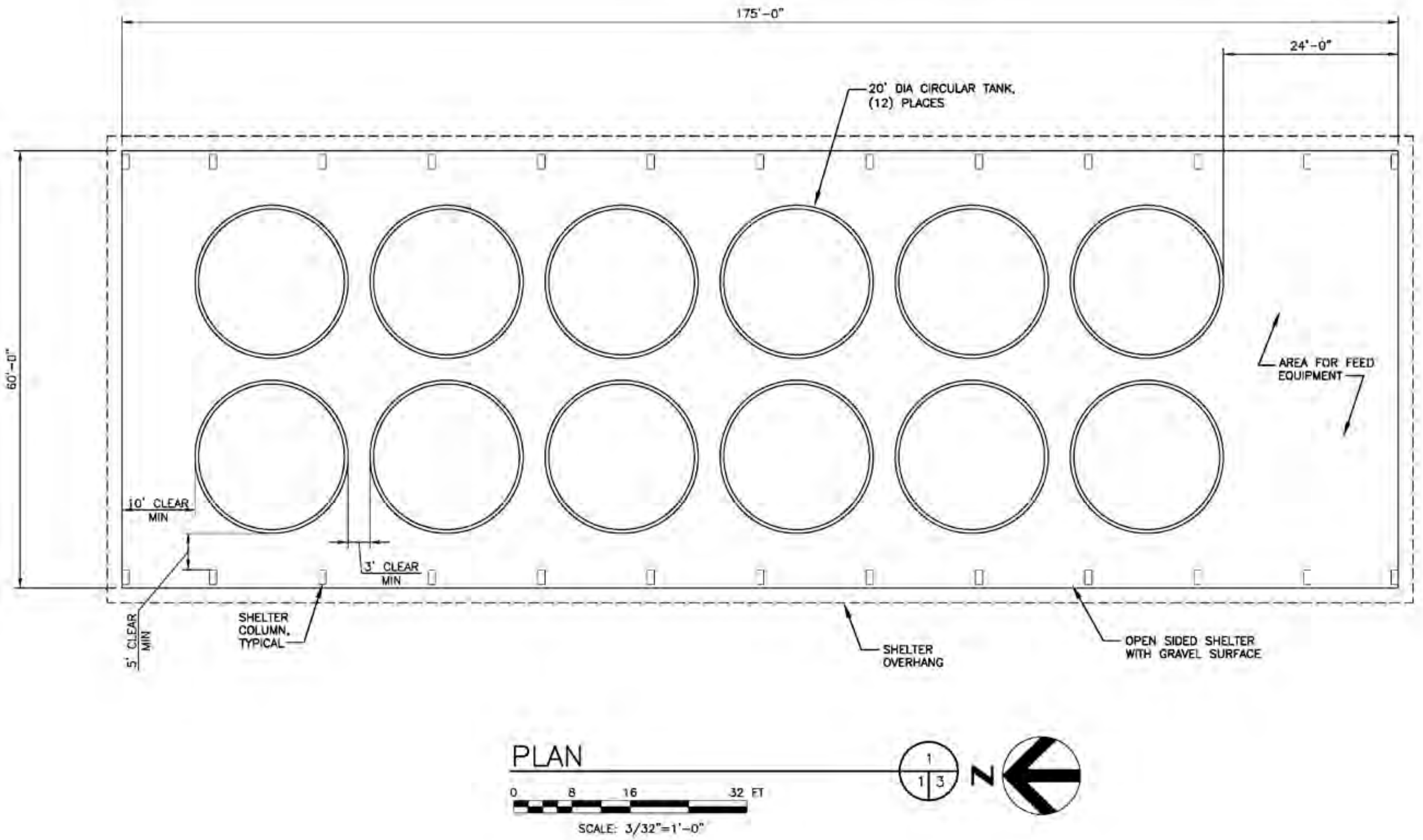
Attachment C

HATCHERY BUILDING

INCUBATION ROOM KEY	
ROOM NUMBER	SPECIES
1	TWISP STEELHEAD
2	OMAK STEELHEAD
3	OKANAGON STEELHEAD
4	CONTINGENCY PROGRAM
5	METHOW STEELHEAD
6	SUB/YEARLY CHINOOK
7	COLUMBIA STEELHEAD



CIRCULAR TANK REARING



BIOPROGRAMMING RESULTS

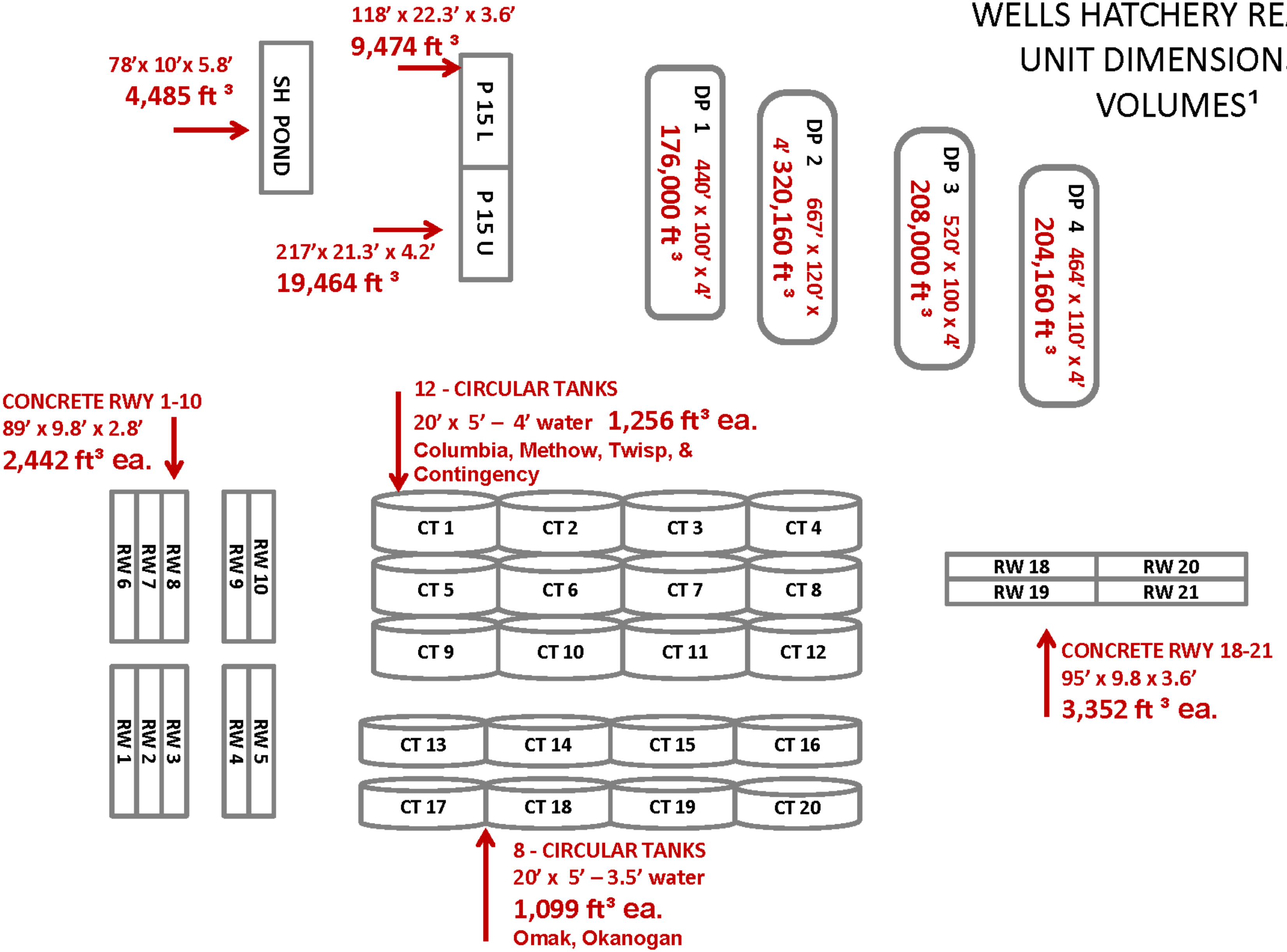
STEELHEAD - Twisp

Month Code	Date	Event	Inflow Temp. (F)	Degree Days for Period	Growth Rate Factor	Growth Assumed Length (inches)	Fish per Pound	Density Index (lb/cf/in)	Assumed 100% saturation in, minimum 5ppm out: Flow Index (lb/gpm/in)	Flow (gpm)	Probable Water Source	Circular Tank Rearing Provisions: Adjusted Sweeping Veolcity =2 t.o./hr.(gpm)	Projected # of tanks in use
7	Jun-30	First Feeding	48.0	0	100%	0.9	3,759	0.20	1.91	9	Twisp Ground	313	1
8	Jul-31		51.0	465	100%	1.6	737	0.20	1.67	29	Ground	313	1
9	Aug-31		52.0	496	100%	2.3	243	0.20	1.61	62	Ground	313	1
10	Sep-30		54.0	540	100%	3.1	102	0.20	1.50	117	Ground	313	1
11	Oct-31		58.0	682	140%	4.4	34	0.20	1.32	273	Ground	626	2
12	Nov-30		57.0	630	140%	5.7	16	0.20	1.36	431	Ground	626	2
1	Dec-31		55.0	589	140%	6.9	9	0.20	1.45	581	Ground	939	3
2	Jan-31	Blend inflow[1]	46.0	310	100%	7.3	8	0.20	2.09	451	River / Well	1252	4
3	Feb-28	Blend inflow[1]	38.0	56	100%	7.4	7.3	0.20	2.61	361	River / Well	1252	4
4	Mar-31	To Twsp R. Acc.	40.0	124	100%	7.6	6.8	0.20	2.61	370	Twisp		
5	Apr-30		40.0	120	100%	7.7	6.3	0.20	2.61	379	Twisp		
6	May-14	Release	40.0	56	100%	7.8	6	0.20	2.61	383	Twisp		

1. Inflow blended to reduce temperature, simulate natural seasonal gradients, & prepare fish for remote acclimation site transfer.

Attachment C

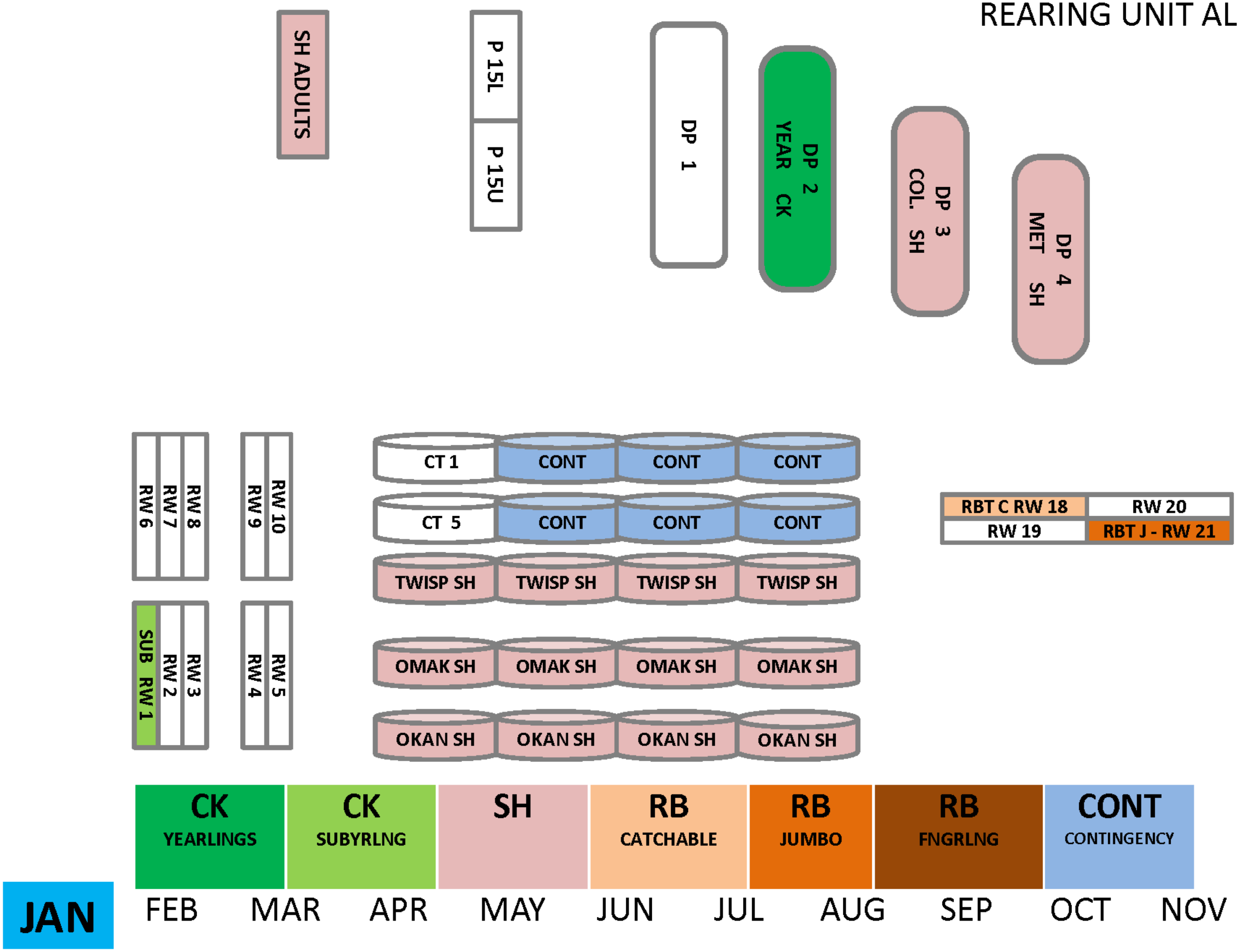
VERSION 10 ALT #1 WELLS HATCHERY REARING UNIT DIMENSIONS & VOLUMES[1]



[1] Existing vessel dimensions sourced by *Wells Pond Volumes* data sheet. WDFW 2012.

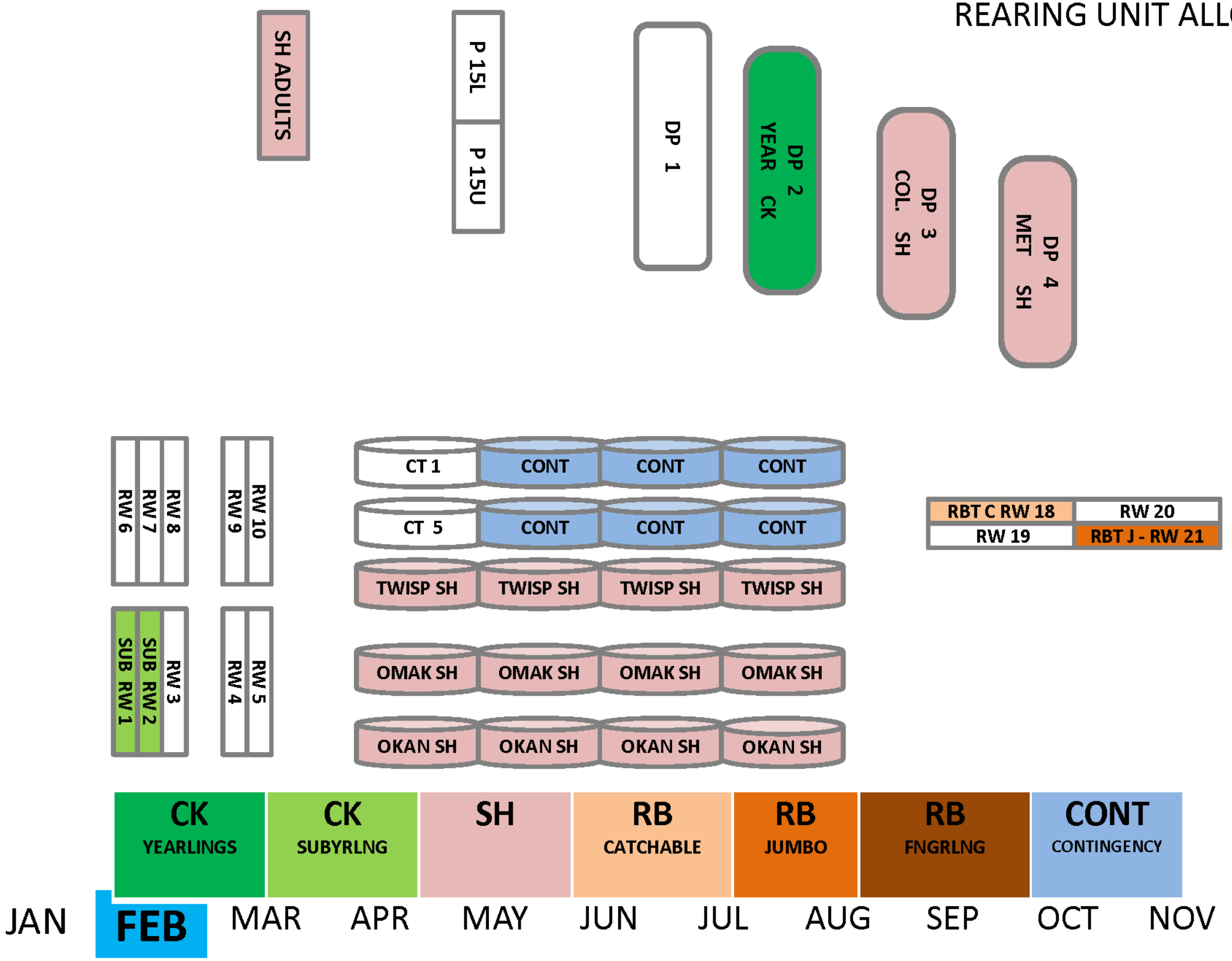
Attachment C

VERSION 10 ALT #1
JANUARY WELLS HATCHERY
REARING UNIT ALLOCATION



Attachment C

VERSION 10 ALT #1
FEBRUARY WELLS HATCHERY
REARING UNIT ALLOCATION



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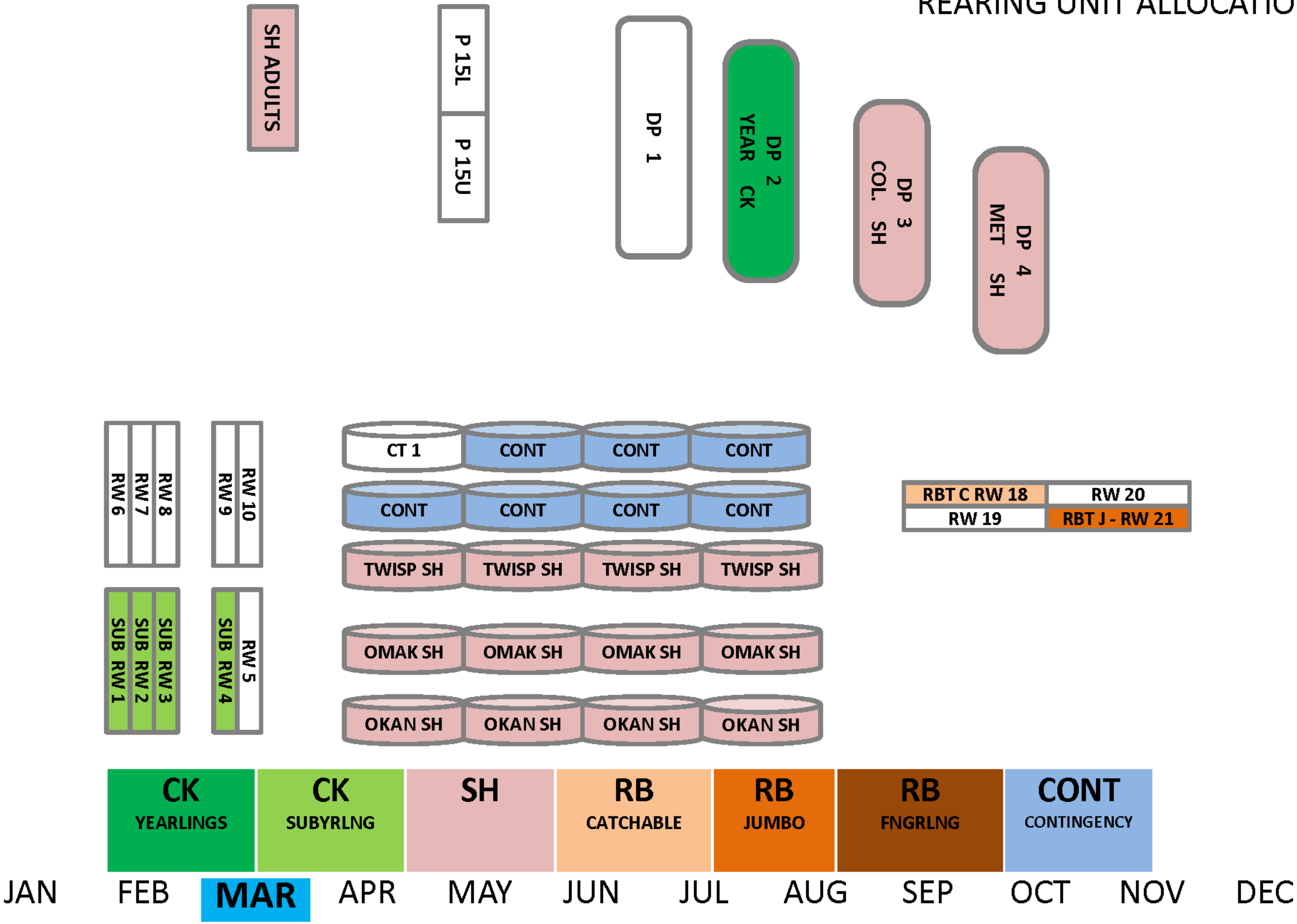
VERSION 10 ALT #1
MARCH WELLS HATCHERY
REARING UNIT ALLOCATION



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EARLY APRIL WELLS HATCHERY
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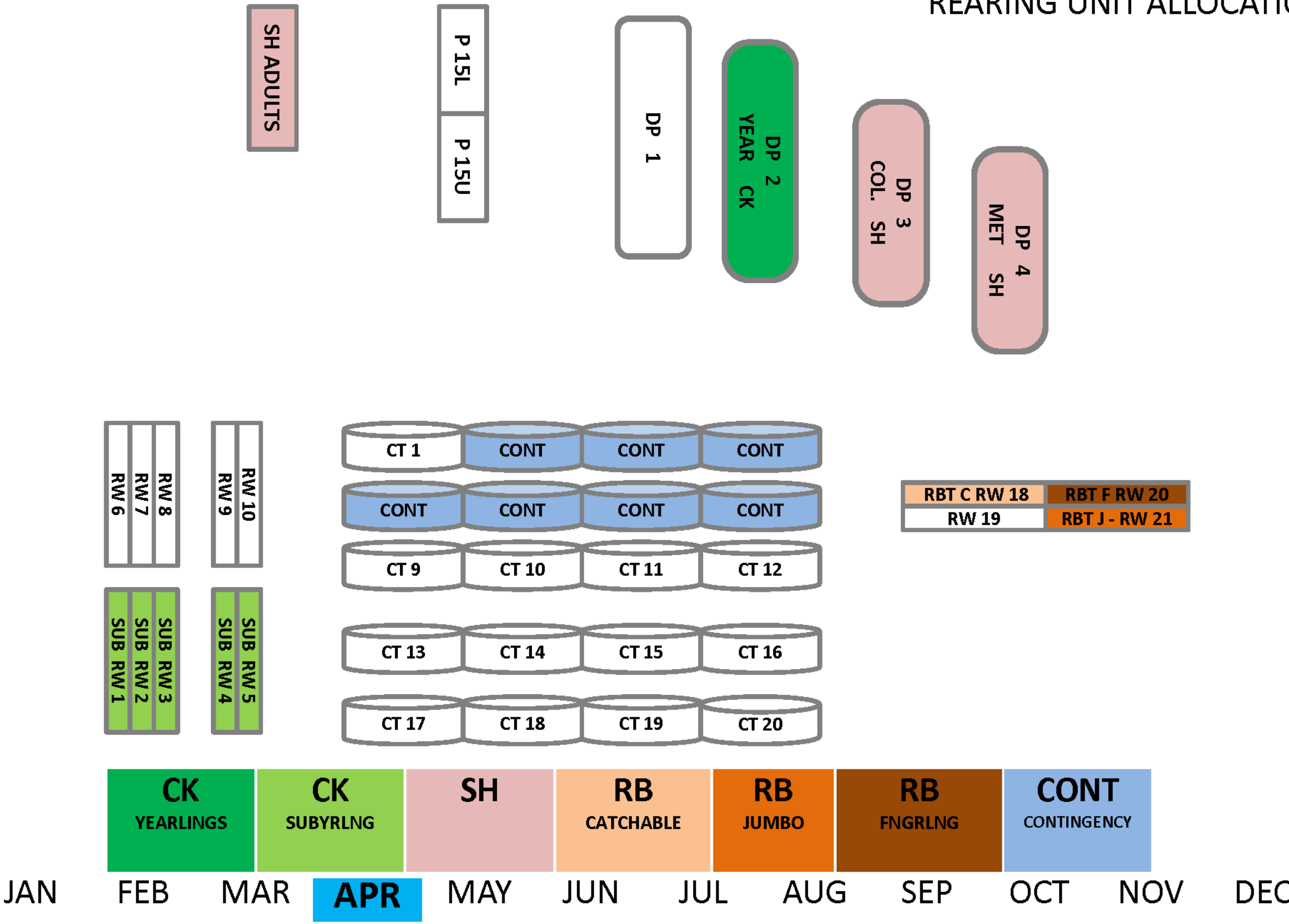

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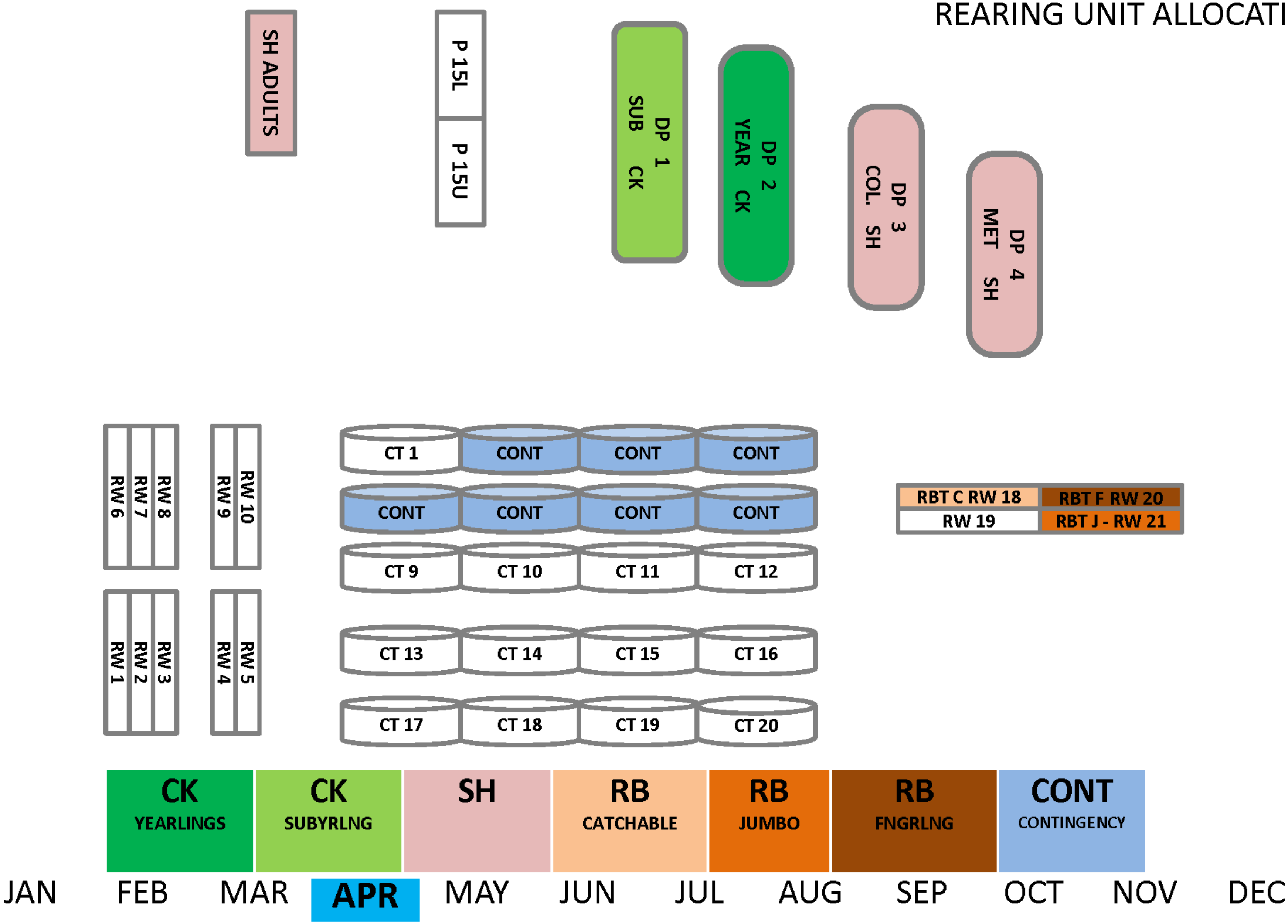

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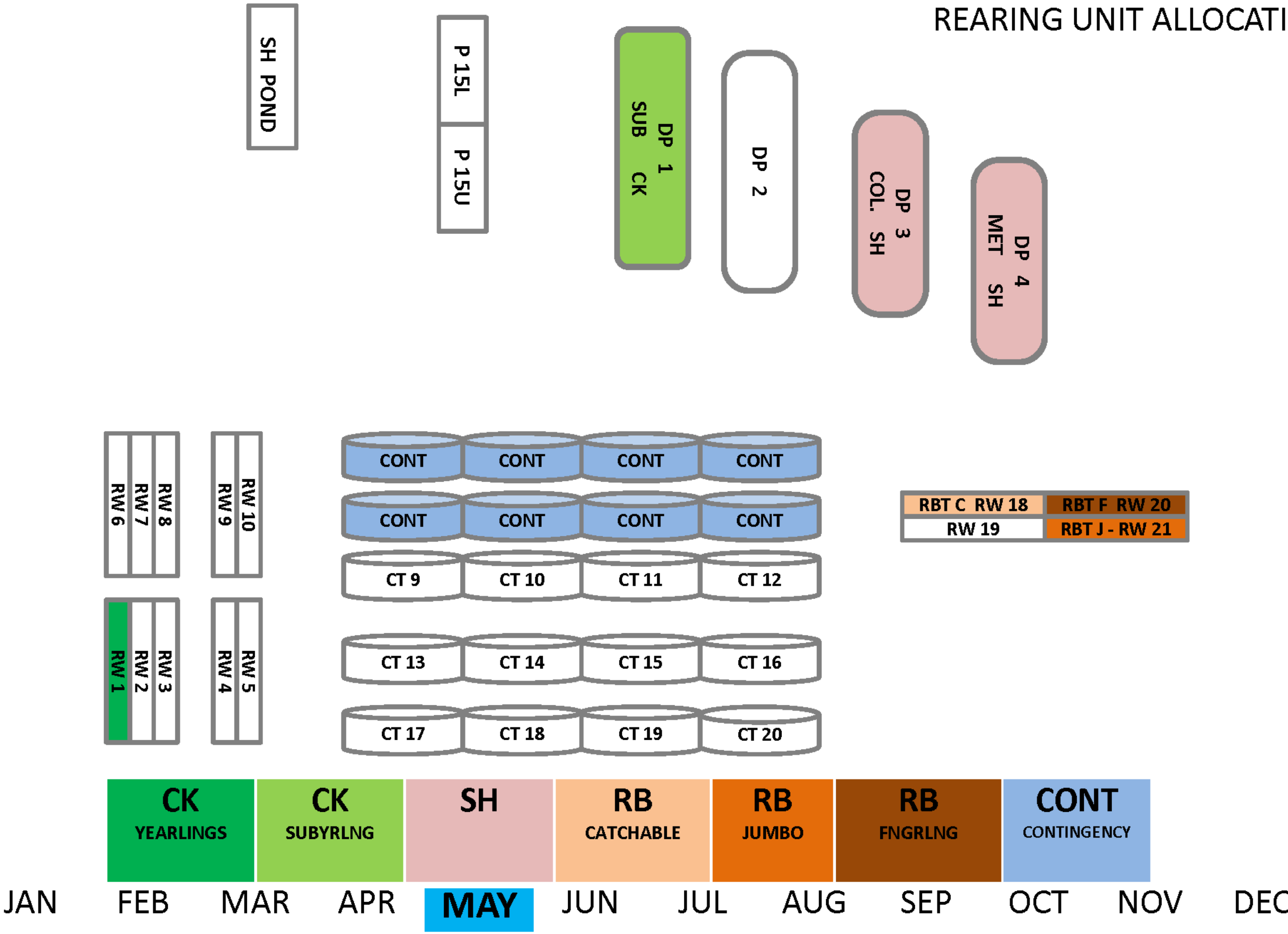

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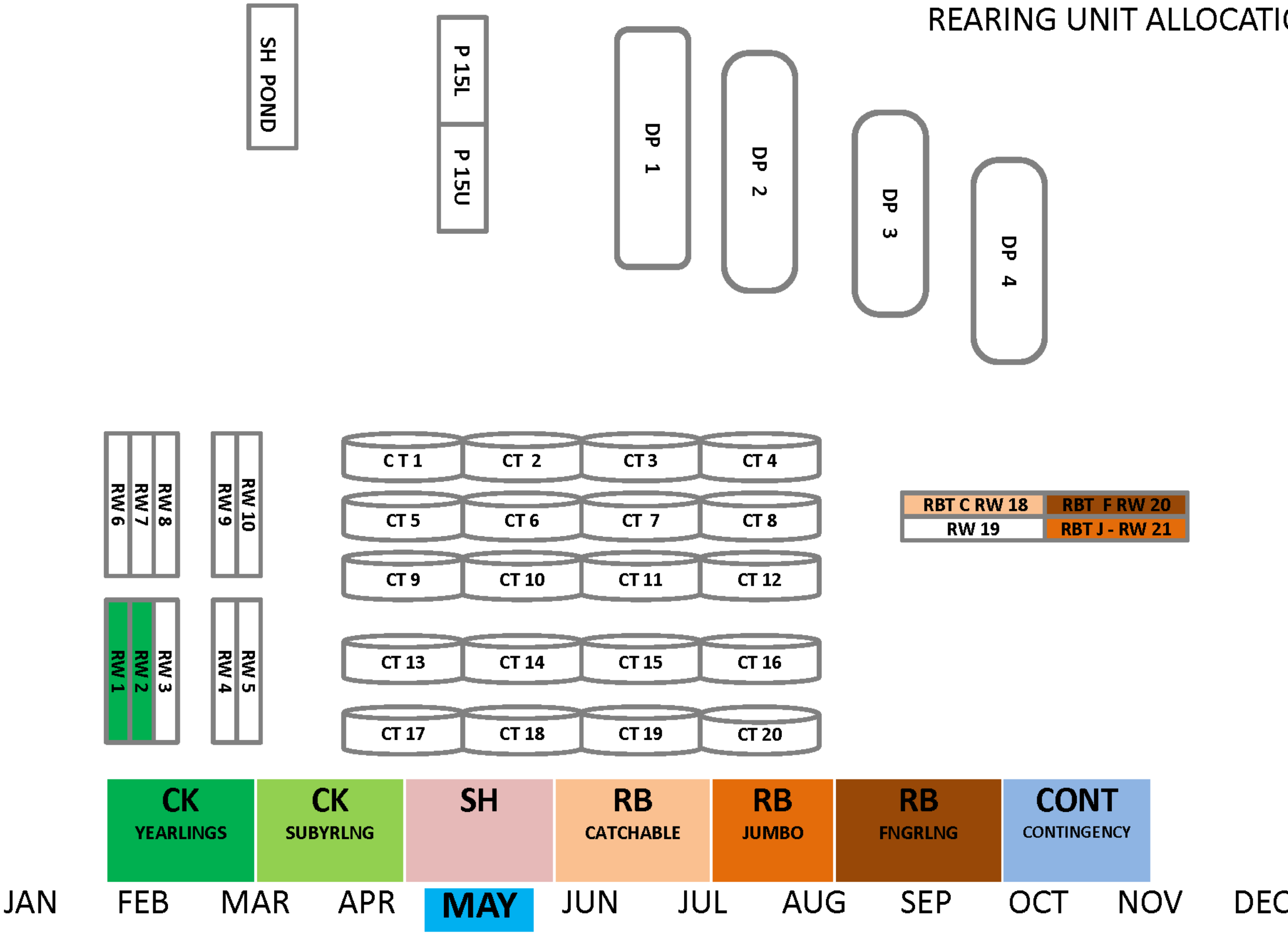

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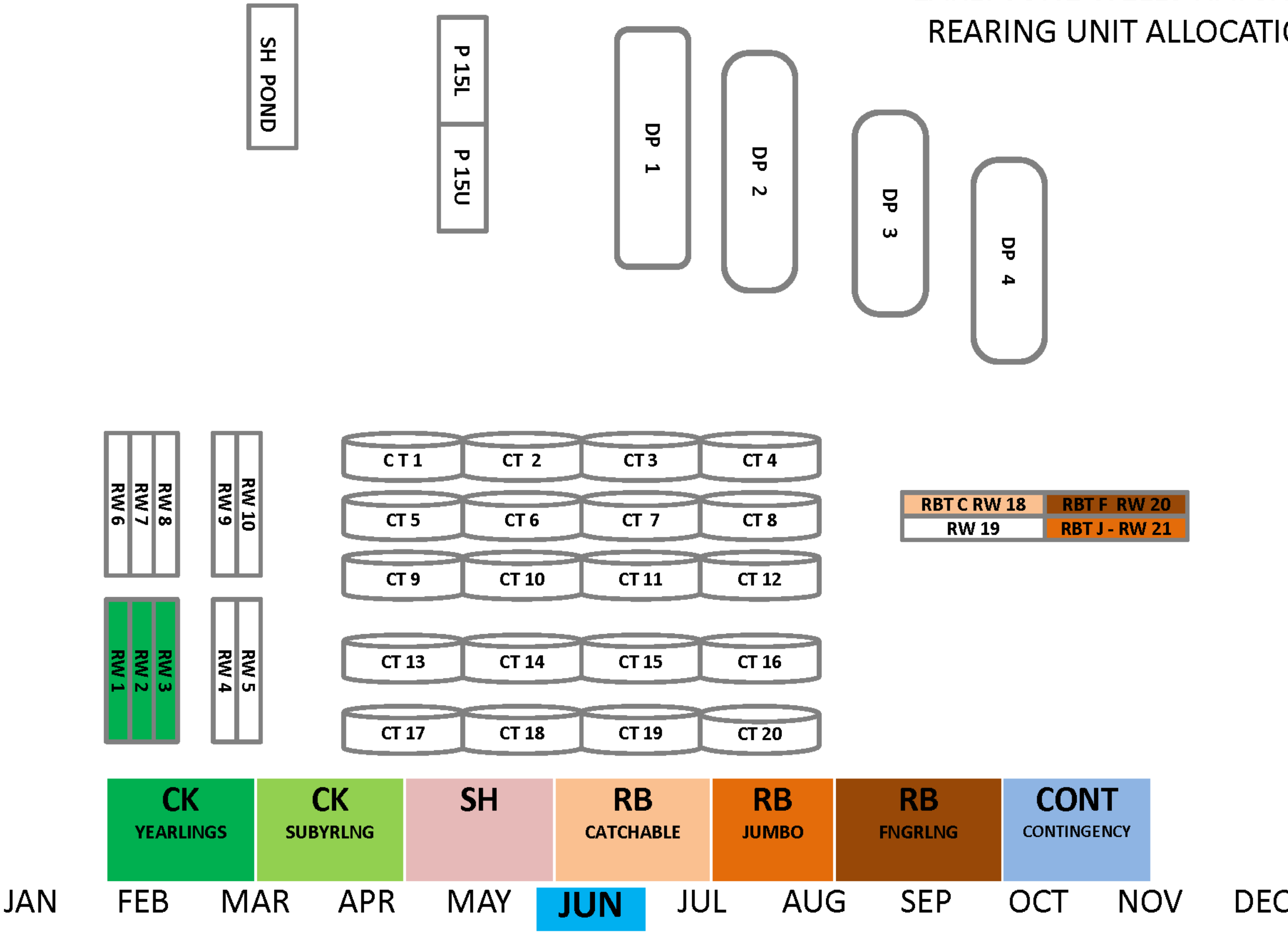

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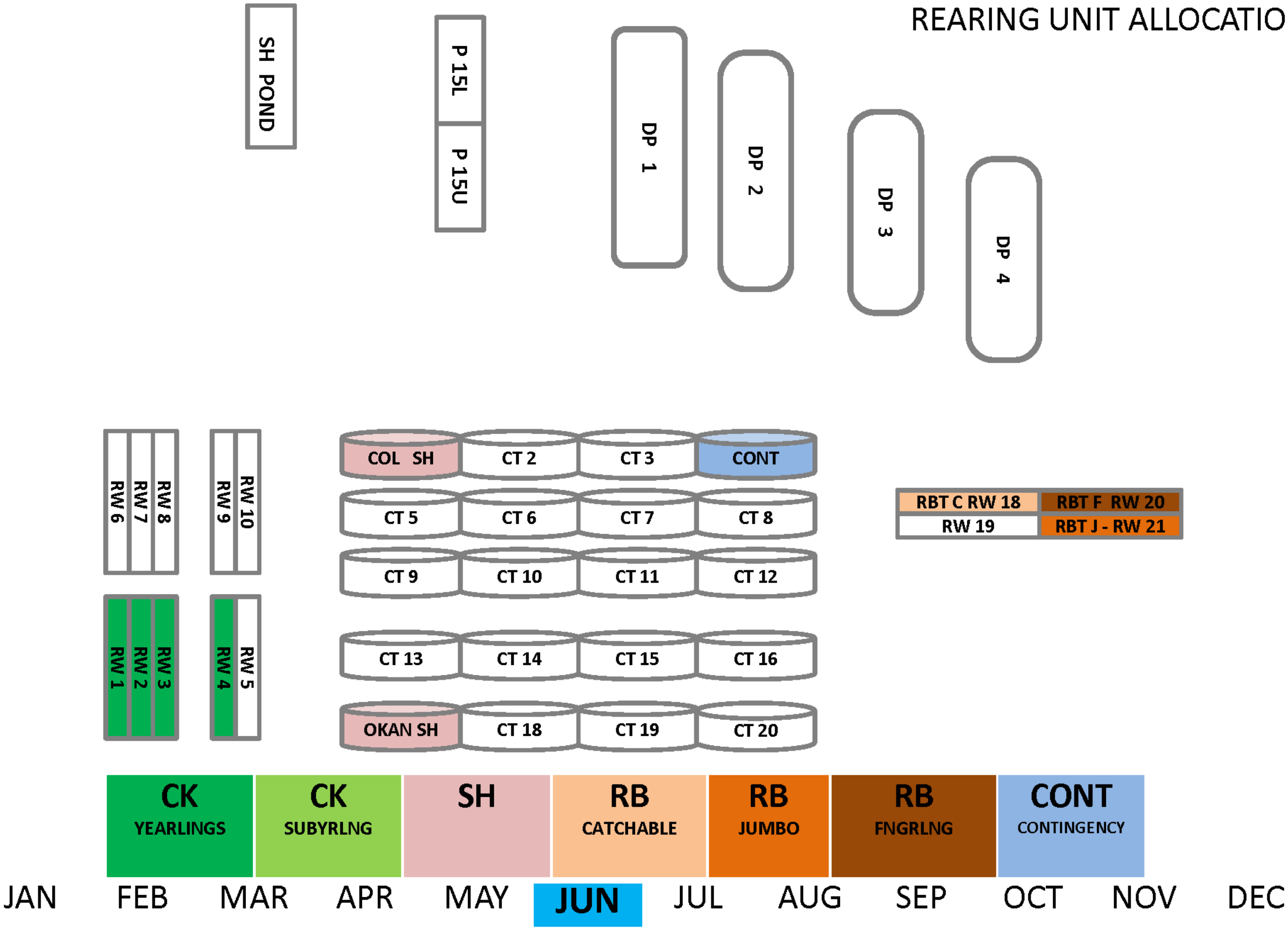

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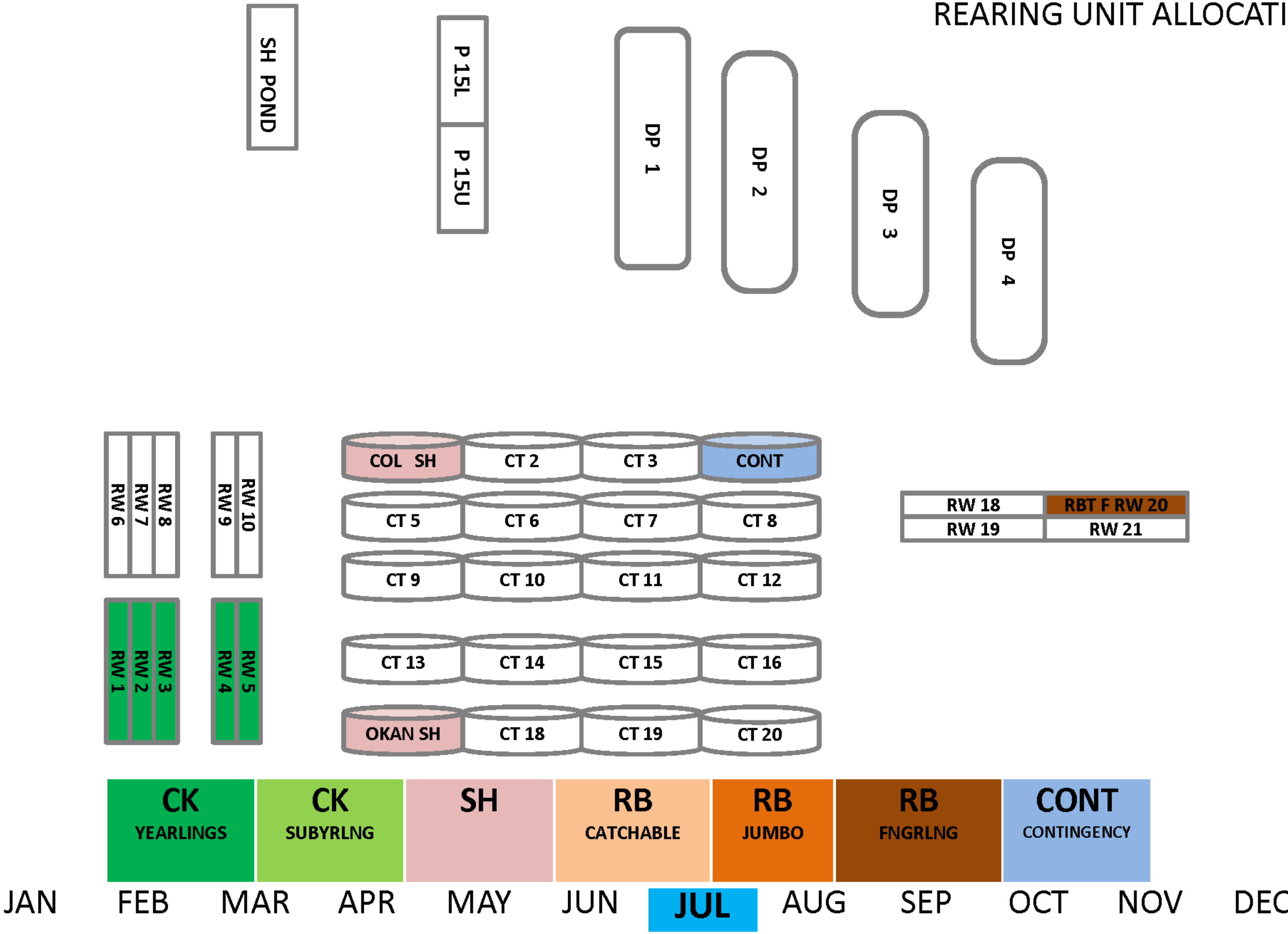
EARLY JULY WELLS HATCHERY REARING UNIT ALLOCATION



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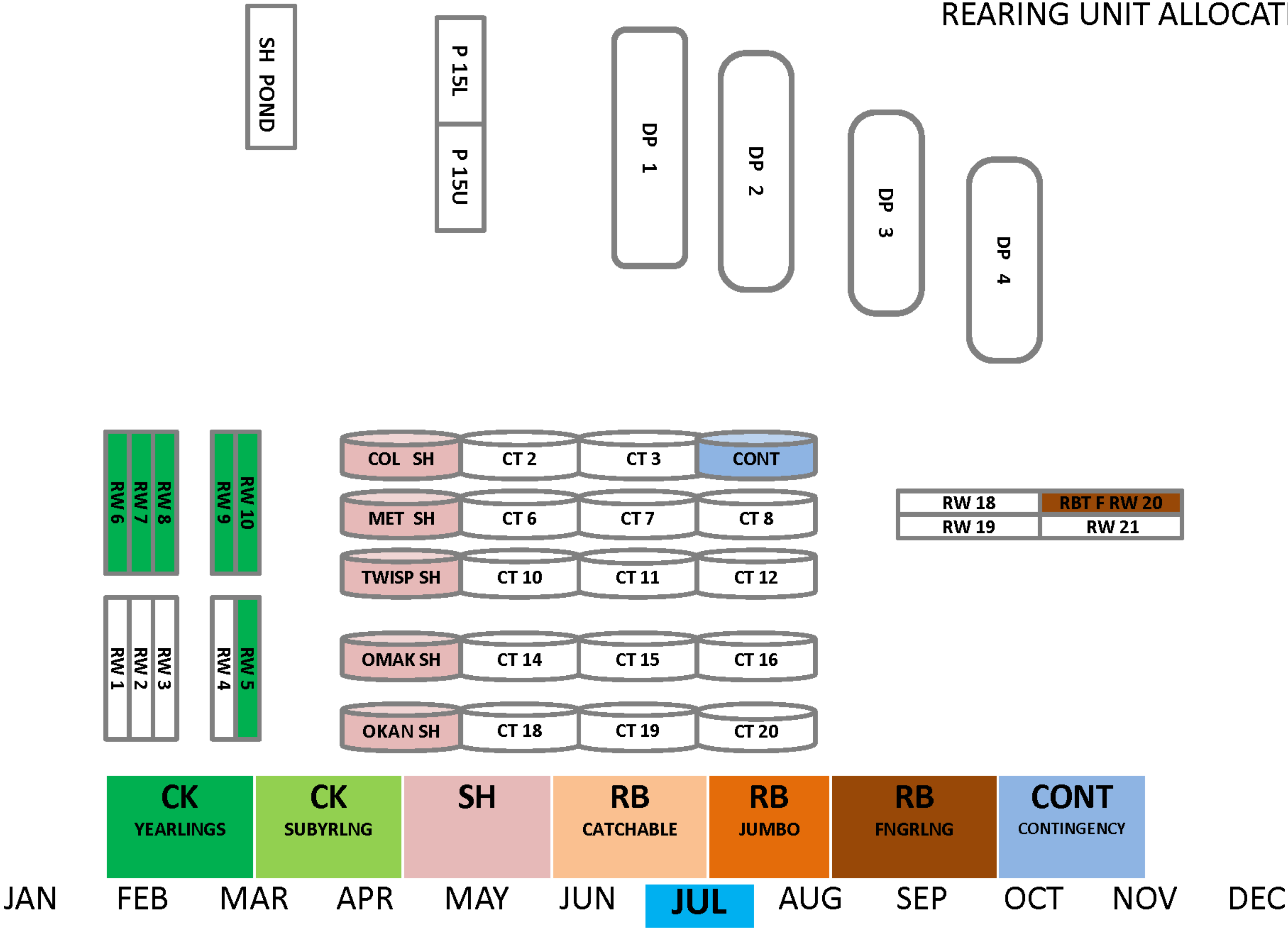

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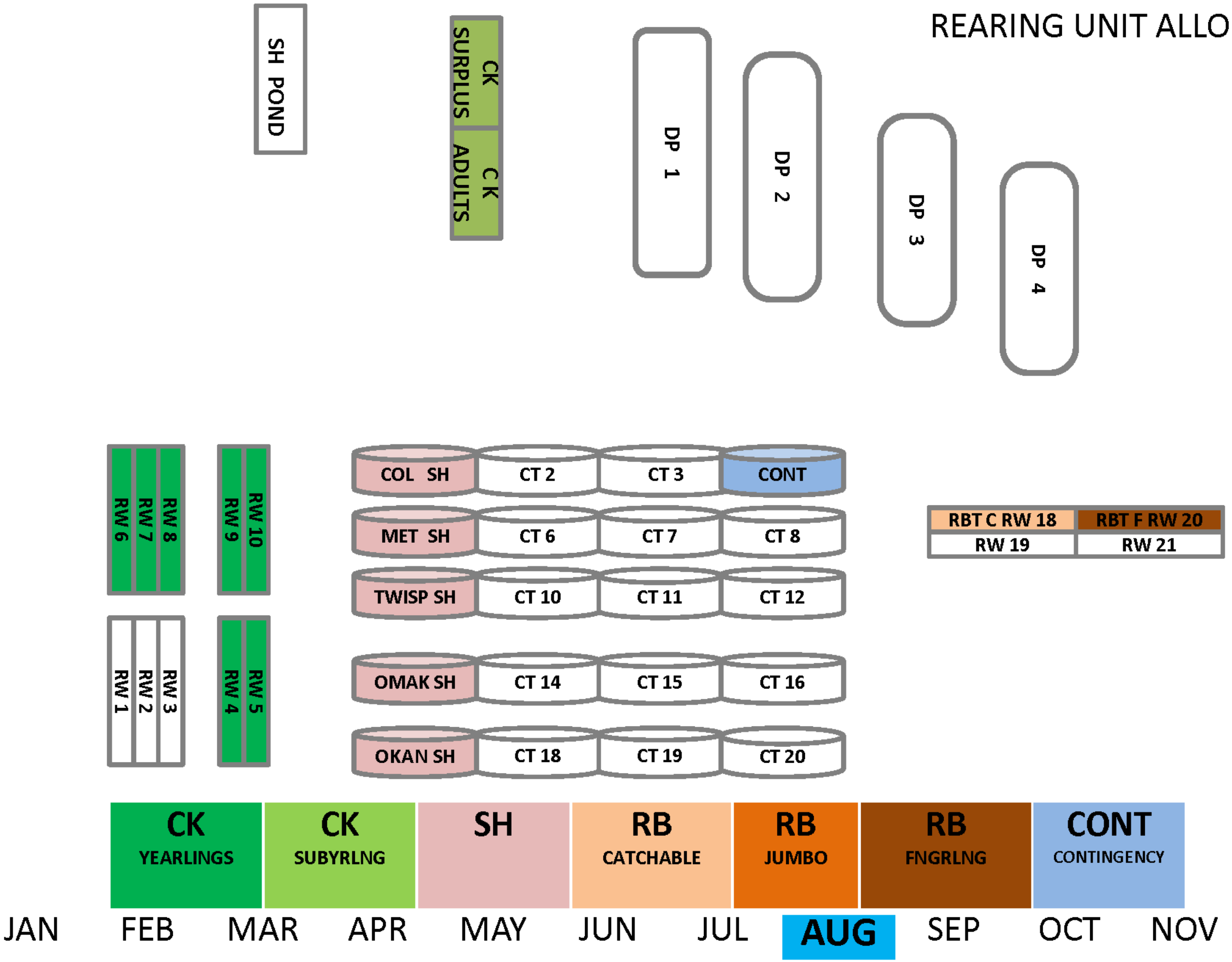

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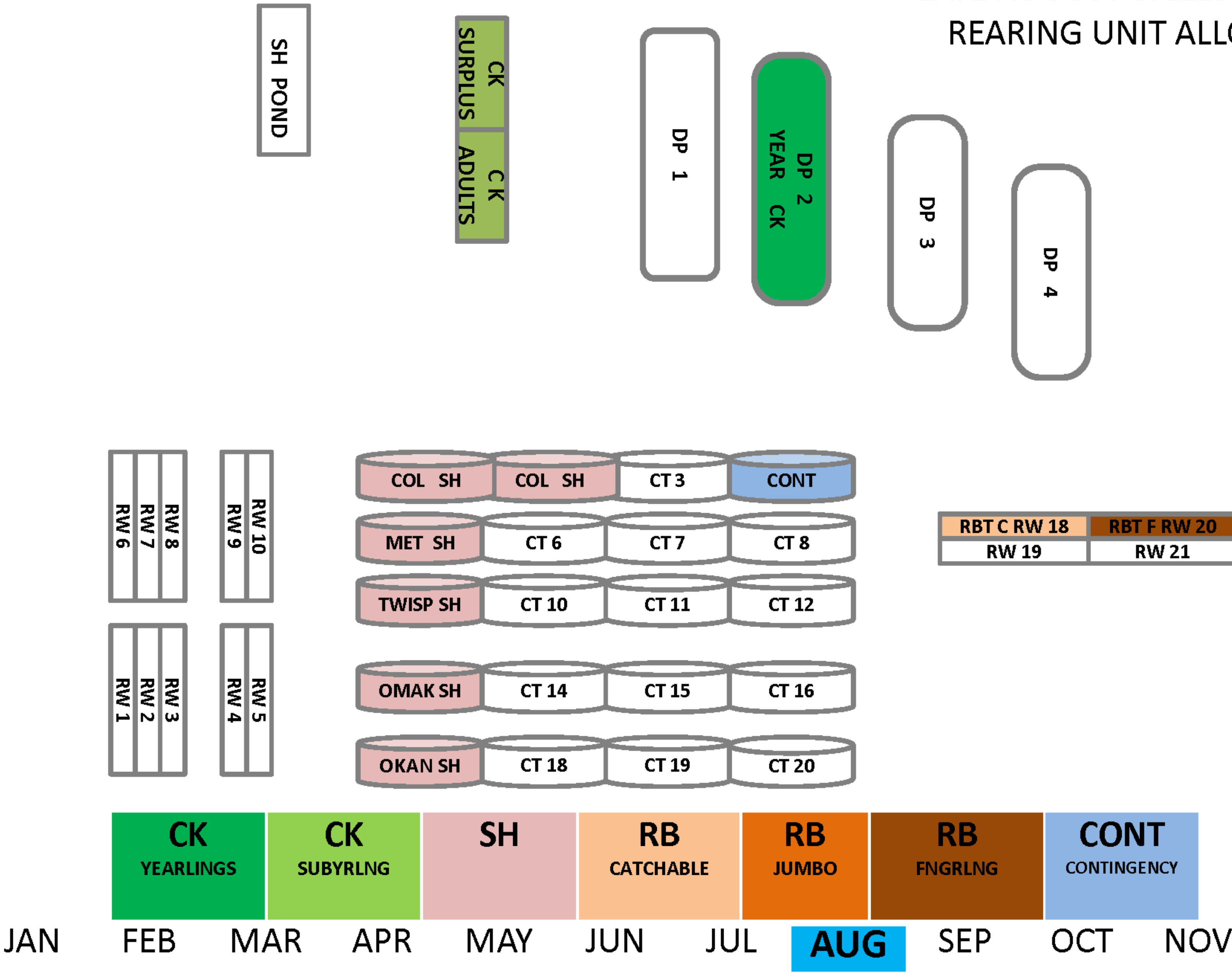

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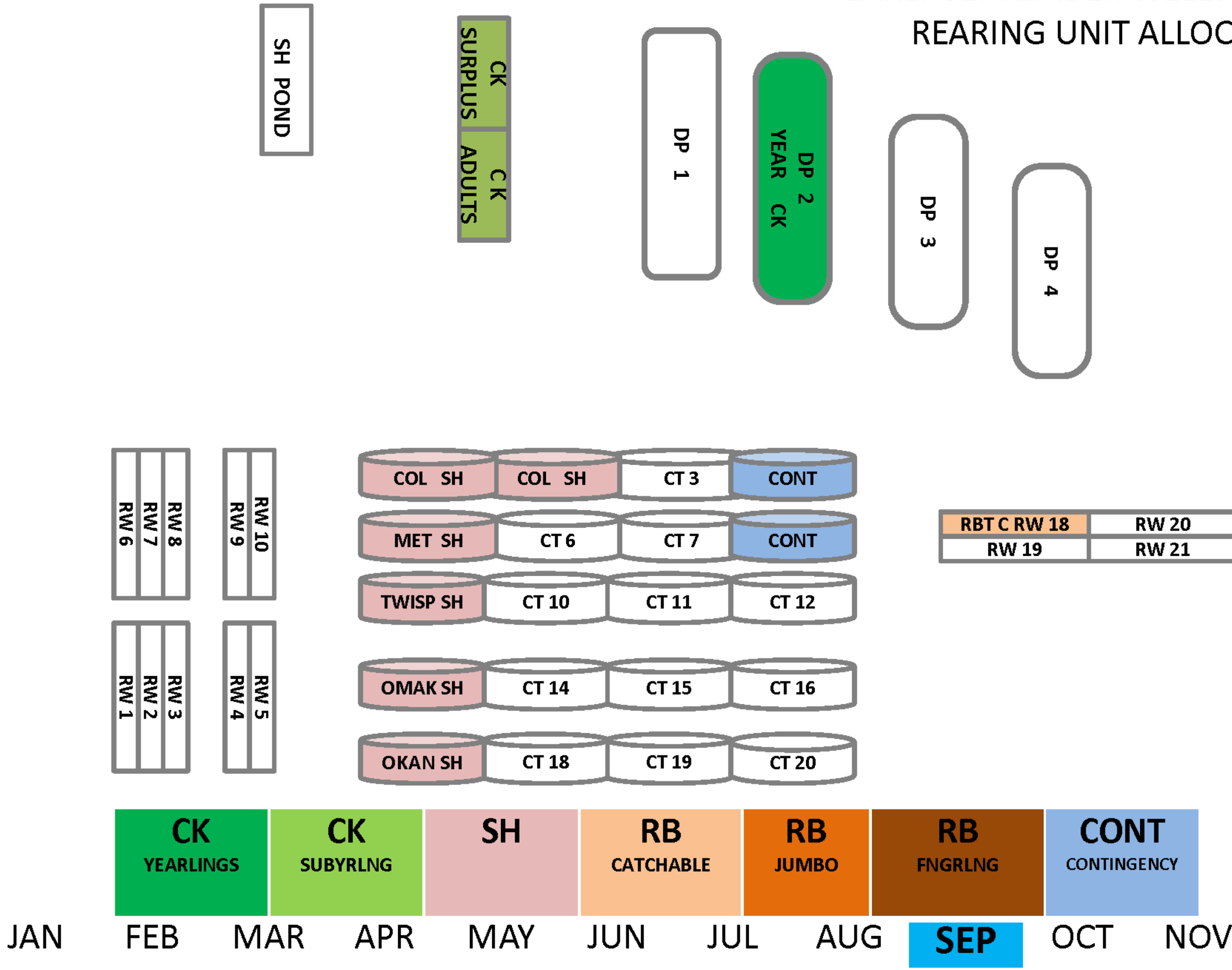

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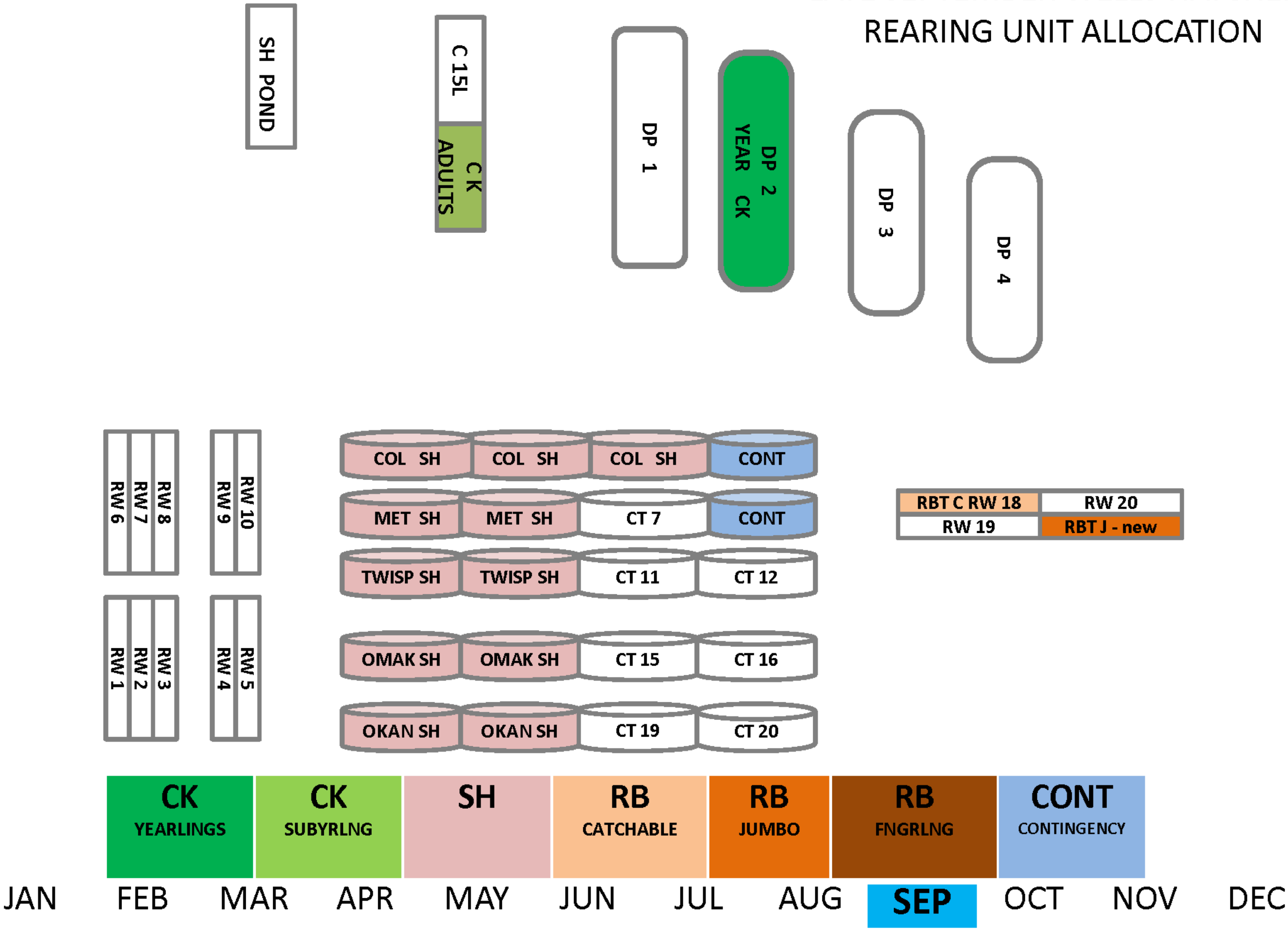

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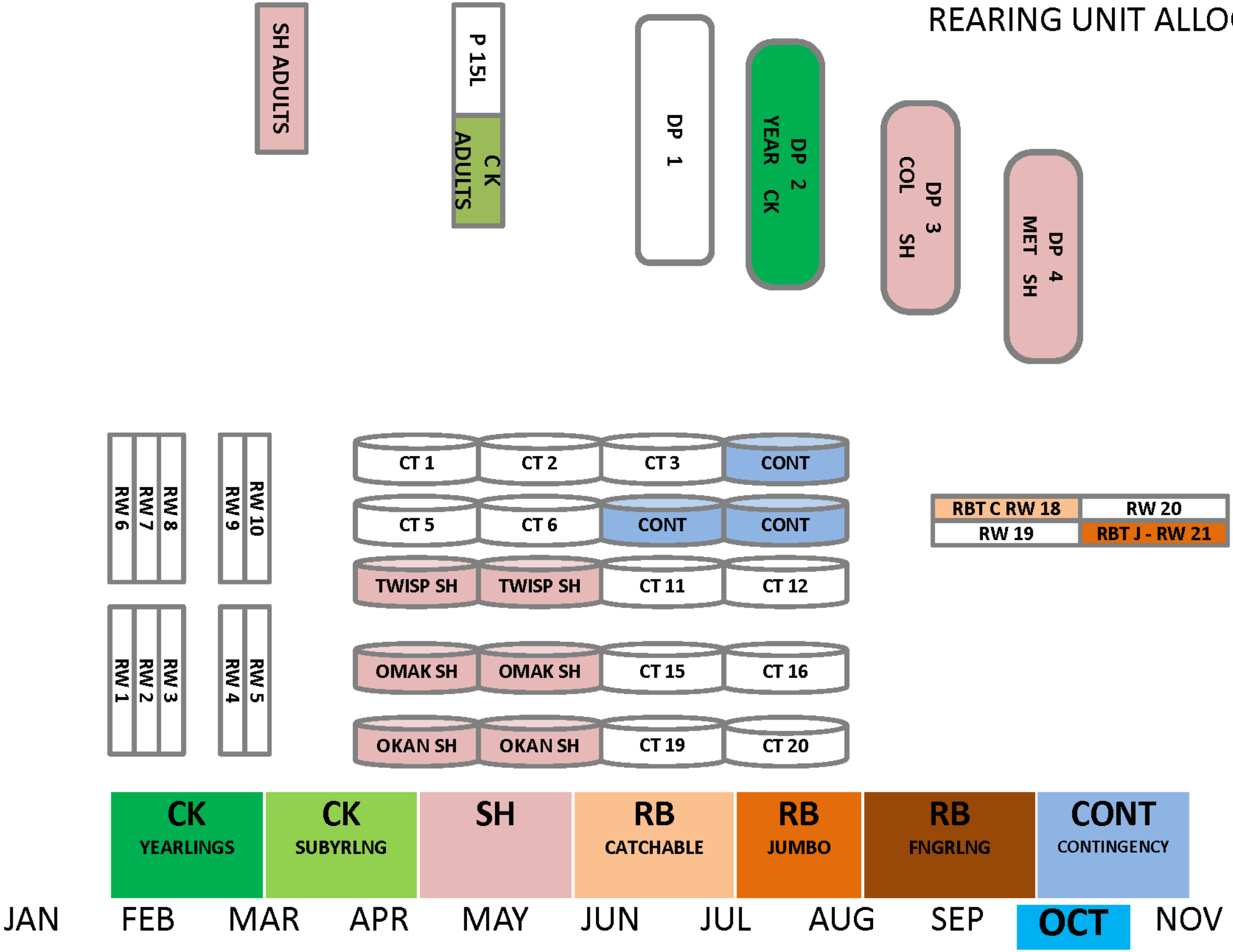

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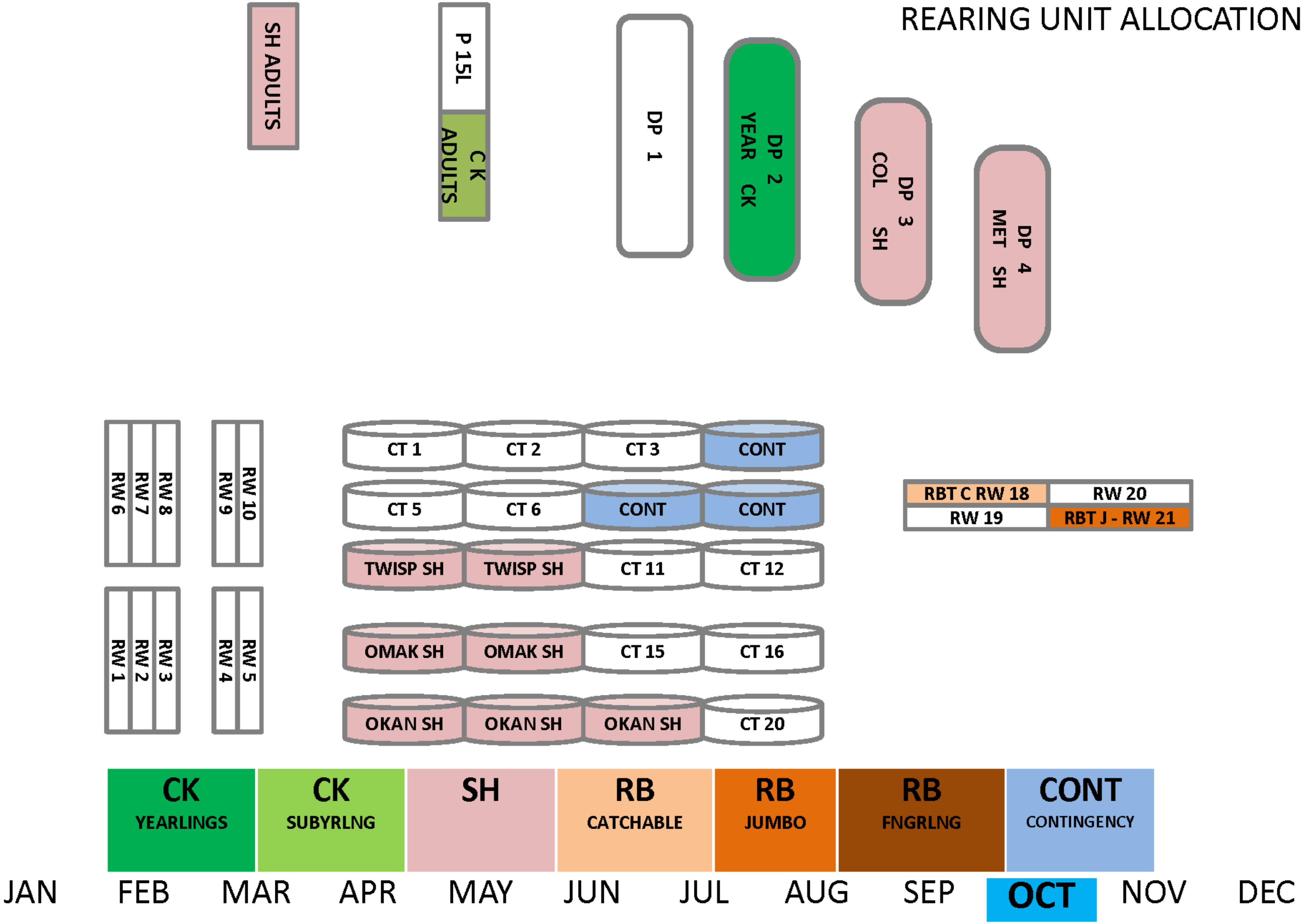

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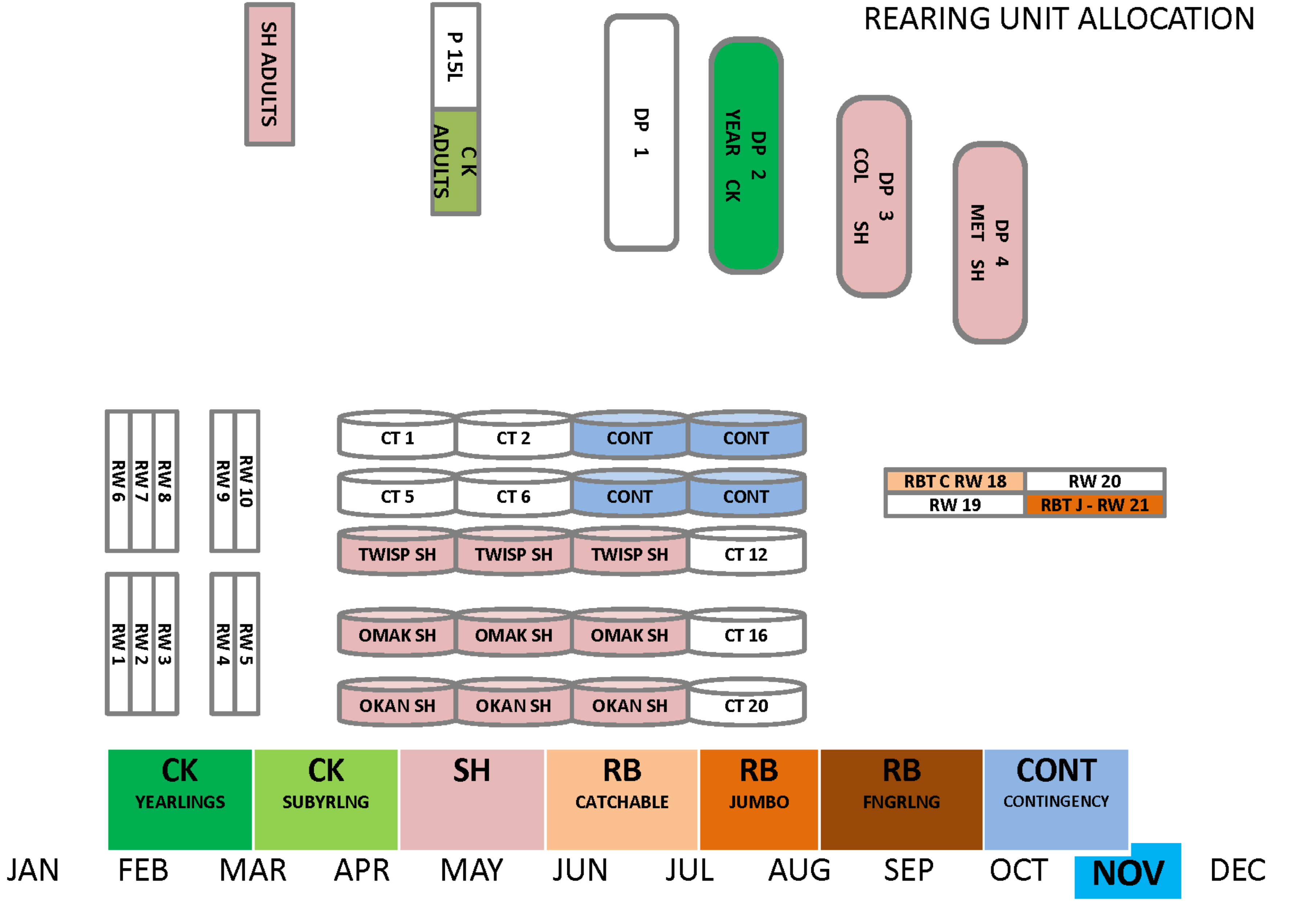

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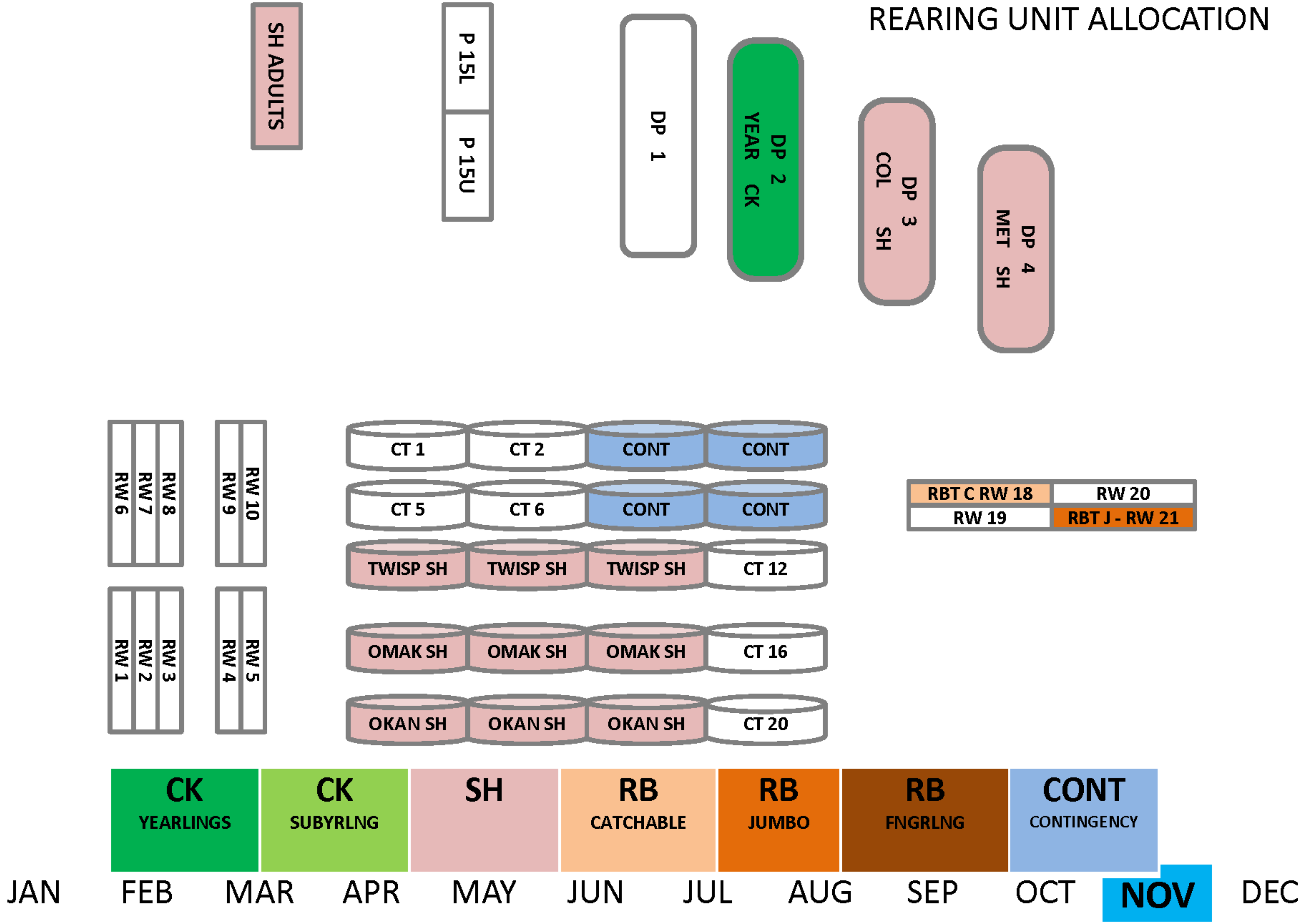

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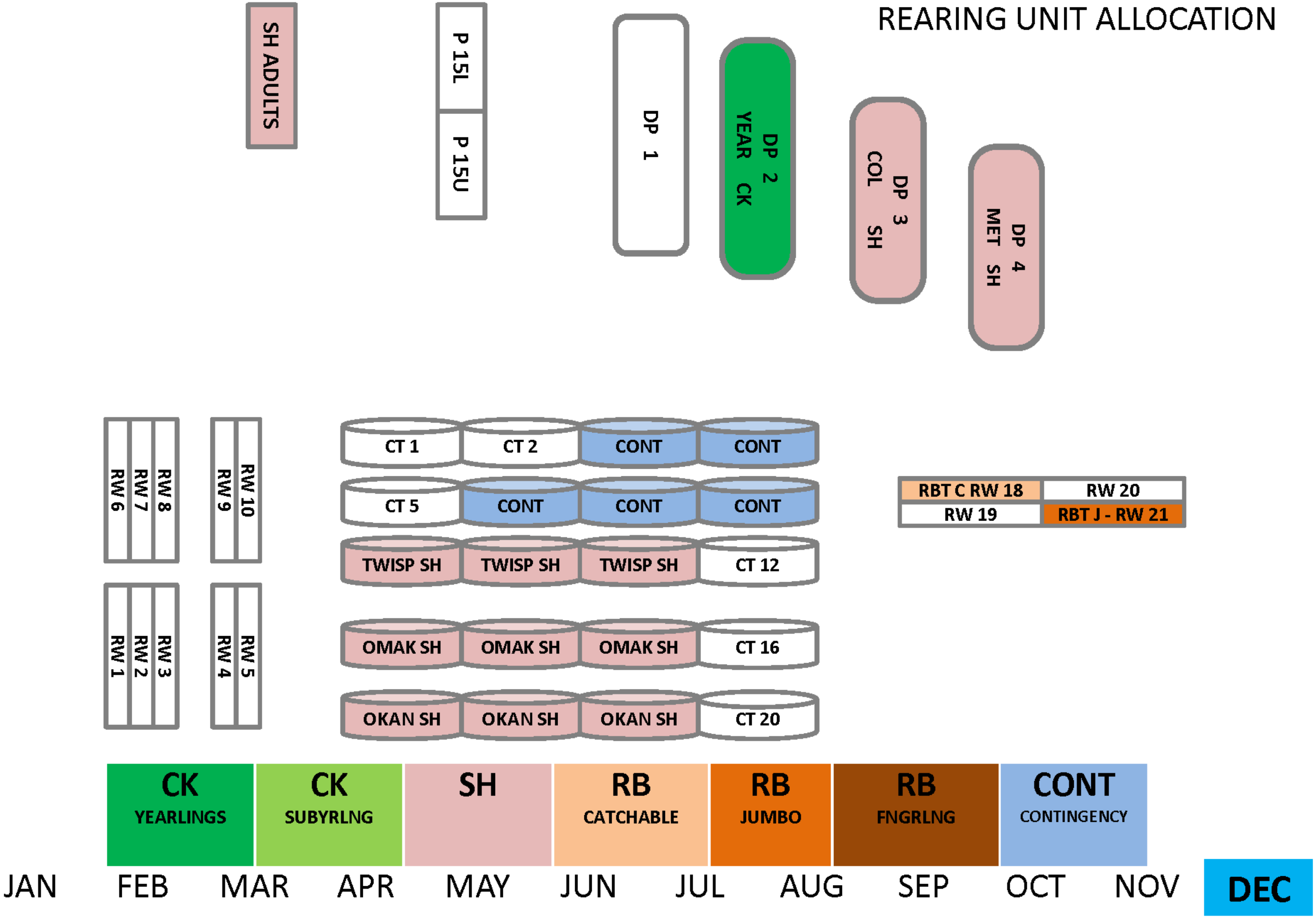

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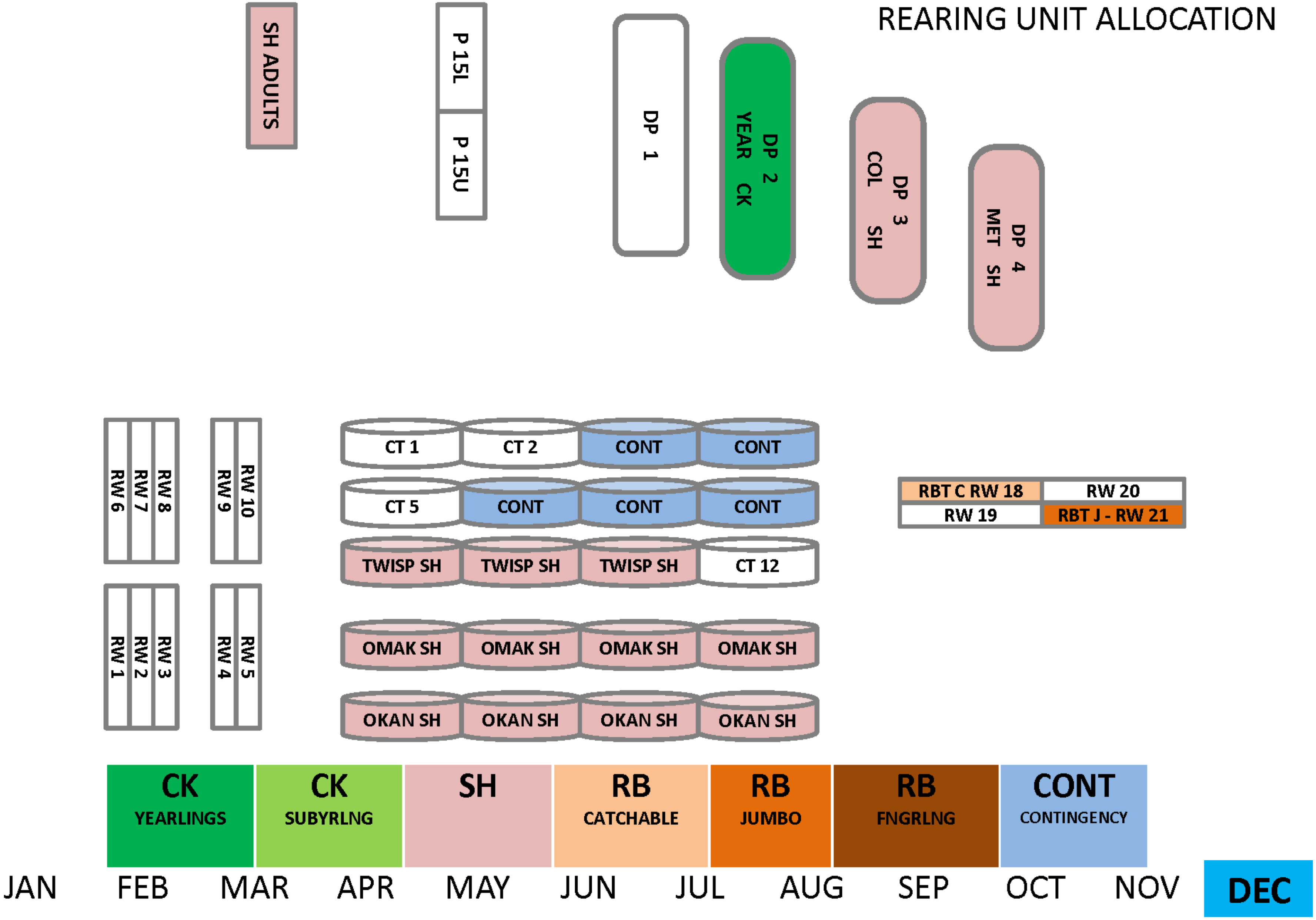


Source: USGS
Source: NASA, NGA, USGS
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esri

DISCUSSION

ANCHOR QEA
720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	October 21, 2013
From:	Kristi Geris		
Cc:	Mike Schiewe, HCP Hatchery Committees' Chair		
Re:	Final Summary of the Okanagan Nations Alliance Sockeye Program Update from the August 22, 2013, Priest Rapids Coordinating Committee Hatchery Subcommittee Meeting		

This memorandum provides a summary of the Okanagan Nations Alliance (ONA) Sockeye Program Update from the Priest Rapids Coordinating Committee Hatchery Subcommittee (PRCC HSC) meeting that was held at Chelan PUD headquarters in Wenatchee, Washington, on Thursday, August 22, 2013. This update was held from 9:00 am to 11:00 am. Attendees are listed in Attachment A to this memorandum.

I. ONA Sockeye Program Update

A. Okanagan Sockeye Re-Introduction to Skaha Lake: Progress Eight Years into a 12-Year Adaptive Management Experiment (Rich Bussanich)

Rich Bussanich presented Okanagan Sockeye Re-Introduction to Skaha Lake: Progress Eight Years into a 12-Year Adaptive Management Experiment (Attachment B), which was distributed to the Hatchery Committees by Kristi Geris on August 23, 2013. Bussanich said that in 2004, the 12-year experiment to reintroduce sockeye into Skaha Lake was started. He said that the experiment is intended to address both scientific and management goals related to the conservation, protection, and restoration of Okanagan River sockeye stocks.

Bussanich first provided a brief overview on the background of the ONA, including membership, geographical location, and their mission. He then reviewed the historical range of Okanagan sockeye and also key ecosystem-level questions that were considered during the design phase of the project. He said that in 1997, the concept was outlined for reintroducing sockeye into Okanagan Lake; after 7 years of planning, in 2004, the first sockeye salmon were released in Penticton Channel. He highlighted key fish passage events in 2009 and

2010, and discussed that in 2012 there was the largest recorded harvest of sockeye salmon in Osoyoos Lake.

Bussanich provided a brief overview on project design, implementation, and monitoring. He also reviewed key results and paths forward. He noted that, based on results from broodyears (BYs) 2004 to 2010, fry abundance and smolt abundance per hectare for both Osoyoos (natural) and Skaha (hatchery) stocks were literally off the charts—ranging from hundreds of thousands to millions for both populations. He also noted that mysid shrimp were found to be key drivers in the lake food web, and a possible hatchery effect on sockeye fry has been observed. Bussanich said that, as part of the project's adaptive management strategy, based on results thus far, a decision was made for a fallow year in BY 2013, followed by a truck and transport for BY 2014 adults.

Lastly, Bussanich announced that the Kl cp'elk' stim Fish Hatchery in Penticton, British Columbia, is expected to be fully operational for BY 2014. *(Note: Attachment B incorrectly reports this date as BY 2015.)*

Casey Baldwin asked about the potential causes of hatchery effects on sockeye fry. Bussanich suggested that causes may include confinement, operational limitations causing deformities (i.e., pinheading), or selective grading. He added that run-time differences were also beginning to be observed. He said that in terms of juveniles, several measurable population characteristics and ratios could be factors. Dr. Kim Hyatt said initial observations were that hatchery-origin fish introduced into Skaha were surviving from fry at a lower rate than those introduced into Osoyoos. Hyatt said that this could mean one of two things: hatchery effect or lake effect. He said that in order to investigate this further, the methods would need to be reversed and then those results evaluated. Hyatt said that this is of interest because results would identify the presence of domestication effects that could affect the wild stocks.

Steve Hemstrom asked about nutrient-loading and its effects on the system. Hyatt replied that nutrient contribution can be estimated, and added that Osoyoos already has high productivity without carcass contributions. He said that some nutrient issues have been identified in Osoyoos; however, none have been associated with a reduction in the smolt growth rate in the lake. Hyatt noted that Osoyoos can support 10,000 smolts per hectare, and that Skaha is 30% less productive, which translates to 30% less sockeye. Hyatt said that the in-lake productive capacity work is some of the more detailed and firmer knowledge of what is known, to date.

B. Water Management Tool Update (Dr. Kim Hyatt)

Dr. Kim Hyatt presented Okanagan Fish-and-Water Management Tools (FWMT) Project Contributions to Stock Rebuilding of Okanagan Sockeye Salmon (Attachment C), which was distributed to the Hatchery Committees by Kristi Geris on August 23, 2013. Hyatt first provided background information on the Columbia River sockeye population, including sockeye return aggregate (1970 to 2011) data, and information on factors that have contributed to the rebuilding of the Okanagan sockeye salmon run since implementation of the FWMT Project. He reviewed information on the Okanagan Lake/River (OLR) System, including geography, water management control points, and hydrology; and also described factors that drive water management decisions in the OLR System and issues that affect water management decisions. Hyatt said that an audit on the Okanagan Basin Agreement indicated that fishery flows prior to 1997 were often noncompliant; he noted that reduced compliance was often the result of competing rules and objectives.

Hyatt described the development of the FWMT, starting with the development of a program to model flow versus water needs during key sockeye salmon life stages. He explained that available spawning habitat was modeled as a function of flow, and that the quantity of habitat and the survival of sockeye eggs and alevins in that habitat could be controlled by flow. He noted the egg scour threshold and the desiccation threshold as two key habitat components to consider. Hyatt presented the results of an evaluation of risks, by life stage, to the Osoyoos Lake sockeye population as a result of a temperature-oxygen "squeeze," a density-independent rearing limitation in Osoyoos Lake. He said that during a temperature-oxygen "squeeze," the volume of useable water in Osoyoos Lake can drop to zero and prolonged periods of reduced rearing habitat will result in a loss of population for the current brood year fry/parr.

Hyatt said that early on, it was identified that additional models could be built that supplement current models. Therefore, the FWMT was built as a coupled set of biophysical models of key relationships among climate, water, fish, and property, based on real-time, prospective, and retrospective data. He reviewed the architecture of the FWMT system, including an overview of the step-wise process for FWMT system users to create fish-and-water management "scenario(s)." He explained that FWMT simulations provide multiple objective hazard assessment (MOHA) reports that evaluate different areas in the OLR System, managing for indicators for fish and human needs, such as flood protection and drought mitigation. Hyatt shared a few example MOHA reports that depicted predicted versus actual flows to demonstrate the precision of the FWMT. He also reviewed examples of how FWMT predictions have been used by water managers to manage water storage and release strategies to minimize density-independent mortality of sockeye and kokanee.

Lastly, Hyatt reviewed Okanagan FWMT results, a weight of evidence summary, and conclusions to date. He noted that increasing escapement is correlated with increased spawning habitat. He also said, however, that the system is potentially vulnerable to density-independent losses that are beyond the control of the FWMT and noted the damaging effects of the 2010 Testalinden Creek landslide that, among other things, dumped significant loads of sediment and pesticide into the OLR System.

Steve Hemstrom asked if pre-historic data have been estimated. Hyatt replied that they have not; however, he added that a colleague has investigated some paleolithic data for different species. Hyatt said that he would be interested in conducting a paleolithic study in Osoyoos, Skaha, and the Okanagan lakes, to reconstruct what their history may have been; however, he speculated that the Province of British Columbia (Province) would not be supportive of such studies. Hyatt said that a paleolithic study could provide further information on the Osoyoos Lake temperature-oxygen "squeeze" problem, and that paleolithic fossils and isotopes would also contain an abundance of information. Hyatt said that, in addition to the many potential studies that could be conducted in this system, there is still a need for continual management of the current stocks—especially with the changing climate. He suggested that Daniel Selbie would likely be the best-suited candidate for continuing coordination and maintaining connections in rebuilding Okanagan sockeye salmon populations.

Lynn Hatcher asked if there is any interest in applying these studies to Vaseux Lake. Hyatt replied that sockeye would not do well in Vaseux Lake due to poor water quality and a high abundance of predatory fish. He added that, like in the Okanagan, the Province would likely not support these studies in Vaseux Lake either.

Hatcher asked about the views of agricultural businesses and power industries regarding this type of water management, and Hyatt replied that no power industries are involved—only agriculture. He said that agricultural businesses are supportive so long as there are no costs to the businesses and they receive their water. He said that there have been very few cases where all needs have not been met.

Kirk Truscott asked about differences in productivity between Osoyoos versus Skaha, and Hyatt replied that productivity does not always correspond to the top of the food chain, but rather, sometimes refers to the bottom. He said that the food web differs in the two locations and that although mysids are found in both, they occur in higher densities in Skaha.

List of Attachments

Attachment A	List of Attendees
Attachment B	Okanagan Sockeye Re-Introduction to Skaha Lake: Progress Eight Years into a 12-Year Adaptive Management Experiment
Attachment C	Okanagan Fish-and-Water Management Tools Project Contributions to Stock Rebuilding of Okanagan Sockeye Salmon Presentation

Attachment A
List of Attendees

Name	Organization
Elizabeth McManus	Ross Strategic
Ken Ghalambor	Ross Strategic
Dr. Kim Hyatt	Fisheries and Oceans Canada
Rich Bussanich	Okanagan Nation Alliance
Howie Wright	Okanagan Nation Alliance
Todd Pearsons†	Grant PUD
Shannon Lowry†	Grant PUD
Eric Lauver	Grant PUD
Peter Graf	Grant PUD
David Duvall	Grant PUD
Lynn Hatcher*†	National Marine Fisheries Service
Keely Murdoch*†	Yakama Nation
Kirk Truscott*†	Colville Confederated Tribes
Casey Baldwin	Colville Confederated Tribes
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Steve Hemstrom	Chelan PUD
Keith Truscott	Chelan PUD
Jeff Osborn	Chelan PUD
Becky Gallaher	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Rick Klinge	Douglas PUD (retired)

Notes:

* Denotes Hatchery Committees member or alternate

† Denotes PRCC Hatchery Subcommittee member or alternate

Attachment B

Okanagan Sockeye Re-Introduction to Skaha Lake: Progress 8 Years into a 12-yr Adaptive Management Experiment

syilx Okanagan Nation Alliance

Presented by: Howie Wright & Richard Bussanich

Presented to Public Utility Districts (Grant County, Chelan)

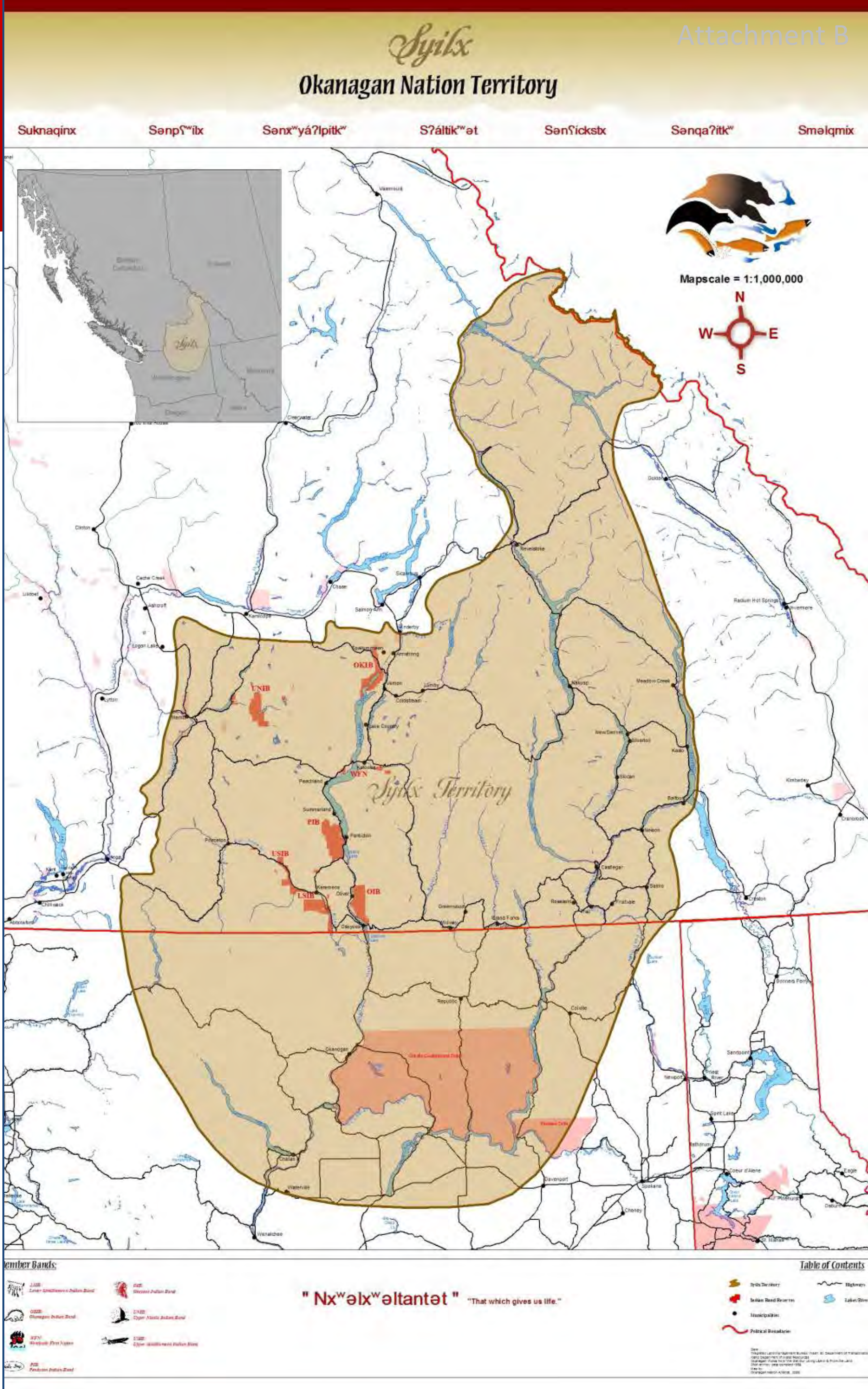
22 August, 2013

Okanagan Nation Alliance

Seven member band communities:

1. Osoyoos Indian Band
2. Penticton Indian Band
3. Westbank First Nation
4. Okanagan Indian Band
5. Upper Nicola Band
6. Lower Similkameen Band
7. Upper Similkameen Band

And the Colville Confederated Tribes (USA)



Mission:

To stabilize and rebuild the declining wild Okanagan sockeye population, to return sockeye to their former habitat and migration range, and to revitalize the Okanagan Nation salmon fishery.

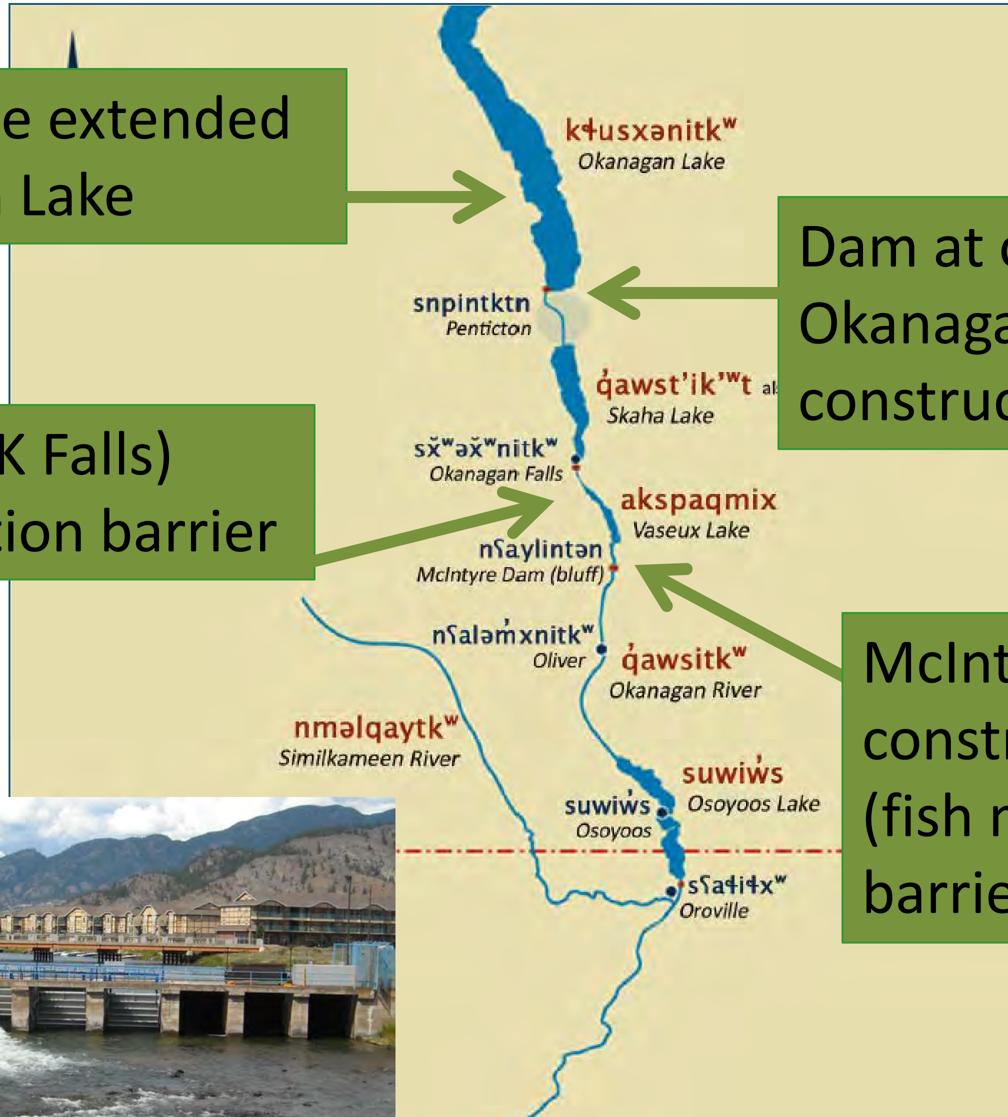
Historical Range of Okanagan Sockeye

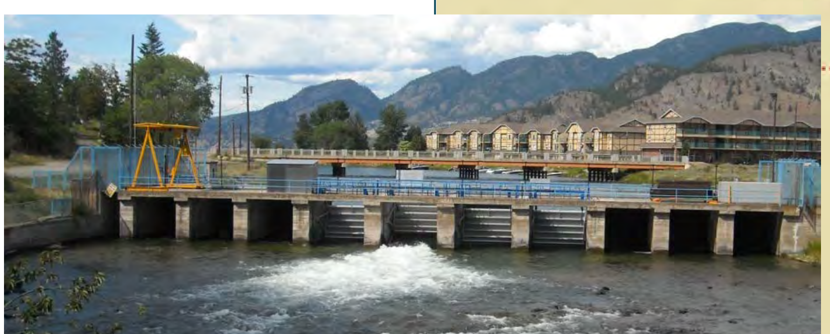
Historical range extended into Okanagan Lake

Dam at outlet of Okanagan Lake constructed in 1914

Skaha Dam (OK Falls) current migration barrier

McIntyre Dam constructed in 1921 (fish migration barrier until 2009)





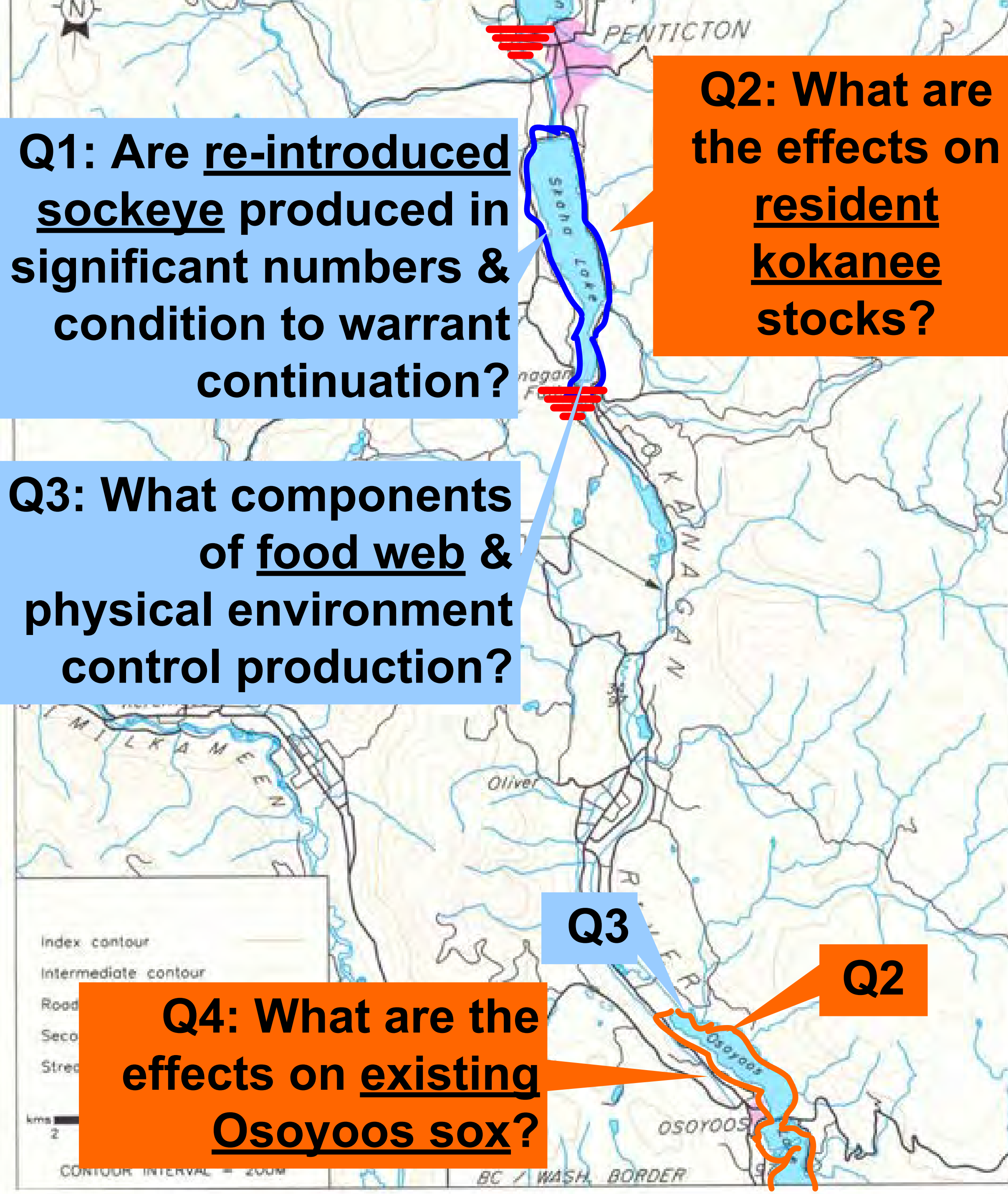
Design: Big Questions

Q1: Are **re-introduced sockeye** produced in significant numbers & condition to warrant continuation?

Q2: What are the effects on **resident kokanee** stocks?

Q3: What components of **food web** & physical environment control production?

Q4: What are the effects on **existing Osoyoos sox**?



Our Journey

Project History

(1997)	Concept outlined to reintroduce sockeye into Okanagan Lake
(1998)	ONA and Canadian agencies agreed to investigate feasibility study
(2000)	Terms of reference adopted between Canadian tripartite *www.obtwg.ca*
(2000 – 2003)	Pre-feasibility risk assessments (disease, life cycle model, habitat, invasive)
(2003)	Test adult sockeye collection, egg fertilization and incubation methods
(2004)	First sockeye salmon release (June) at Penticton Channel.
(2004 –today)	Implementation, annual peer review, outreach, communications
(2009)	Fish passage at McIntyre Dam
(2010)	Sockeye and Chinook volitionally pass upstream of Skaha Dam (hi flows)
(2012)	Agencies agree (not if, but how many into Skaha)
(2012)	Largest recorded harvest in Osoyoos Lake (60,000)

Design

The Skaha Sockeye Reintroduction Program is a 12-year (2004 – 2015) adaptive management experiment designed to assess the feasibility of reintroducing sockeye salmon into their historic range, which includes Okanagan Lake.

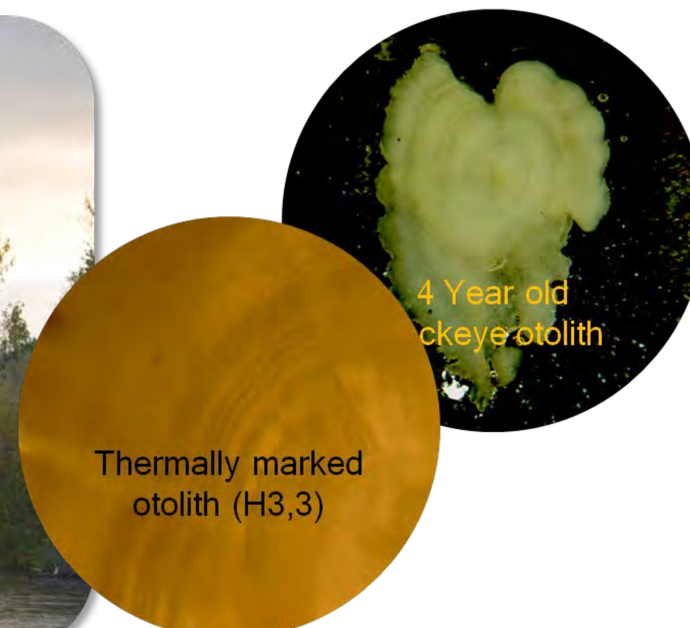
Key **research questions** include:

1. Can reintroduced sockeye be produced in significant numbers and in ‘good’ condition to continue the program?
2. What is the effect on resident kokanee in Skaha Lake?
3. What are the key ‘drivers’ that control sockeye and kokanee production?
4. What are the effects of a hatchery population on the existing Okanagan sockeye population?

Implement

Tested experimental treatments:

- Marked sockeye fry released into Skaha Lake (2004 – present)
- Remove fish passage barriers at McIntyre Dam (2009 – present)
- Transport adults into Skaha Lake (2005 pilot; 2011, 2012 voluntary due to high flows)



Monitor

- Juvenile and adult Sockeye and Kokanee
- Water quality
- Phytoplankton, Zooplankton,
- Mysid shrimp
- Bioenergetics = > Productivity

SOME SURVIVAL UNCERTAINTIES

Freshwater: Summer – Fall

- Low flow
- Cold water refuge
- Degraded habitat
- Poaching

Freshwater: Winter - Spring

- Low/High flows
- Predation
- Entrainment
- Degraded habitat
- Non-native species

Ocean (1 – 3 years)

- Columbia Flows
- Coastal upwelling (temp. and prey)
- Harvest
- Predation



Learning Outcomes (by 2004-2010)

Sockeye Population Measurable Characteristics	Osoyoos (Natural)	Skaha (Hatchery)
Number of adult spawners per year	13,500 to 209,000	500 to 20,000*
Egg-to-fry survival	2 - 7%	8 - 35%
Fry-to-smolt survival	39 - 82%	10 - 44%
Smolt-to-adult survival	1 - 11%	2 - 20%
Smolt size	6 - 9 grams (65 - 100 mm)	13 - 19 grams (100 - 120 mm)
Adult size (mm)	375 - 585 mm	425 - 605 mm
Fry abundance (early summer)	1,000,000 - 10,000,000	300,000 - 1,600,000
Smolt abundance (spring)	800,000 - 7,000,000	100,000 - 200,000
Peak smolt migration	Late April - early May	Late April - early May
Peak adult migration	Mid-October	Mid-October

RESULTS

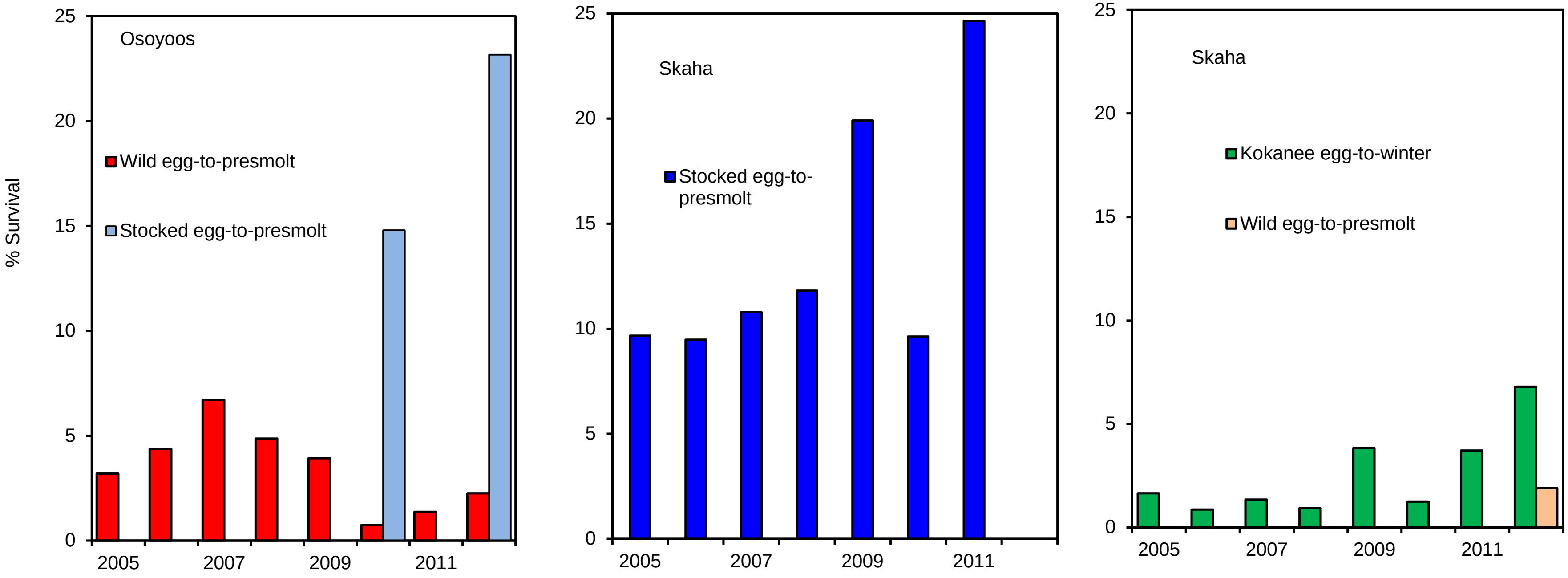
- At tested treatment levels (176-807 fry/ha), sockeye outplanting **does not influence growth and survival of the resident kokanee** population in Skaha Lake
- Lake **food web driven by Mysid shrimp**, which consume 2-3x as much zooplankton as all fish combined
- **Possible hatchery effect on sockeye fr**y - hatchery origin fry are larger but do not survive as well as wild origin fry
- Skaha hatchery **smolt-to-adult survival is equal or better** than the natural sockeye population
- **No disease outbreaks** recorded in hatchery stock
- High proportion of hatchery origin adult sockeye spawners observed upstream (>40%) vs. downstream (<10%) McIntyre Dam
- ***Spawning habitat is the limiting factor for sockeye production*** in Skaha Lake, therefore recommend habitat enhancement and restoration

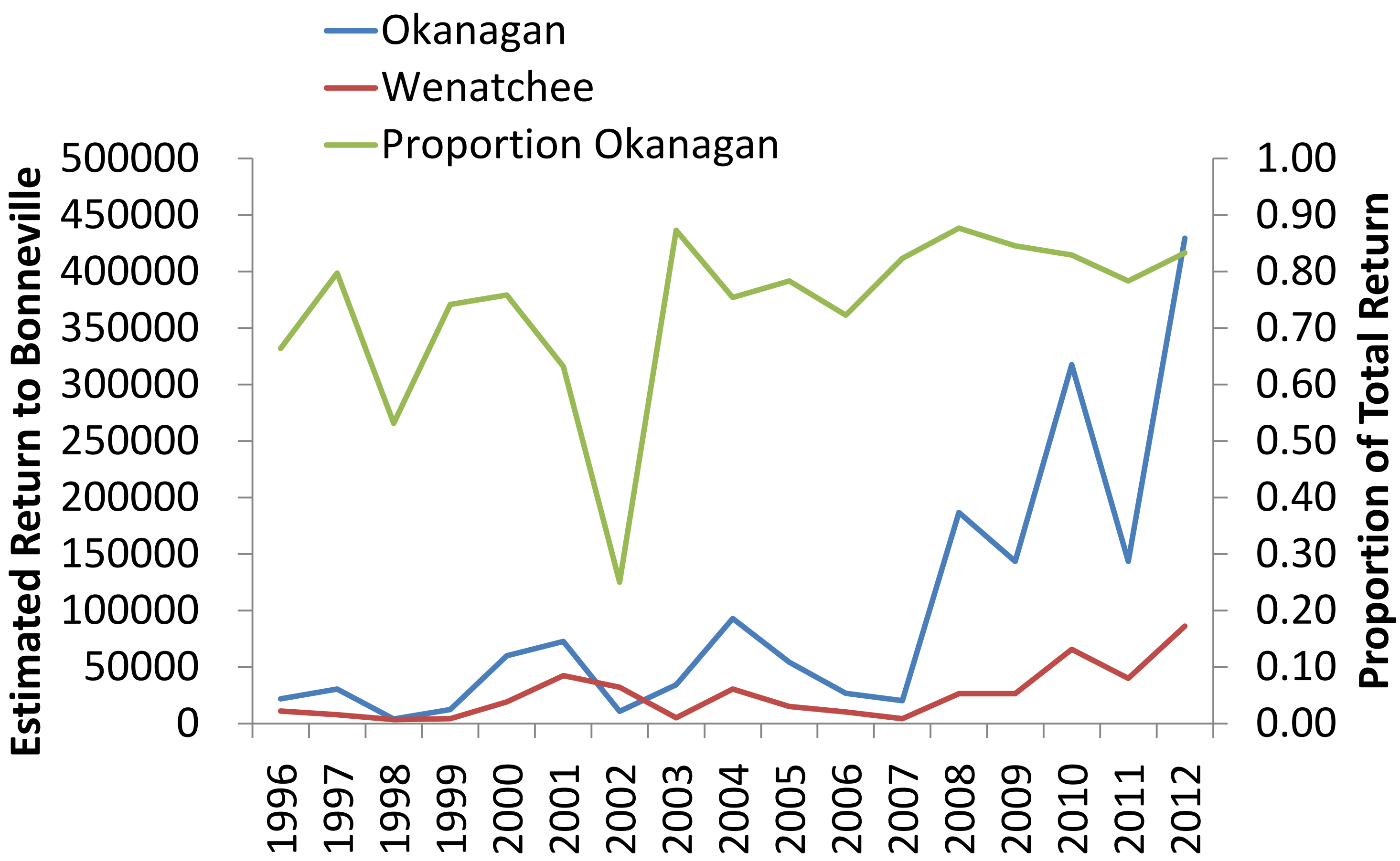
Adjust & Renew

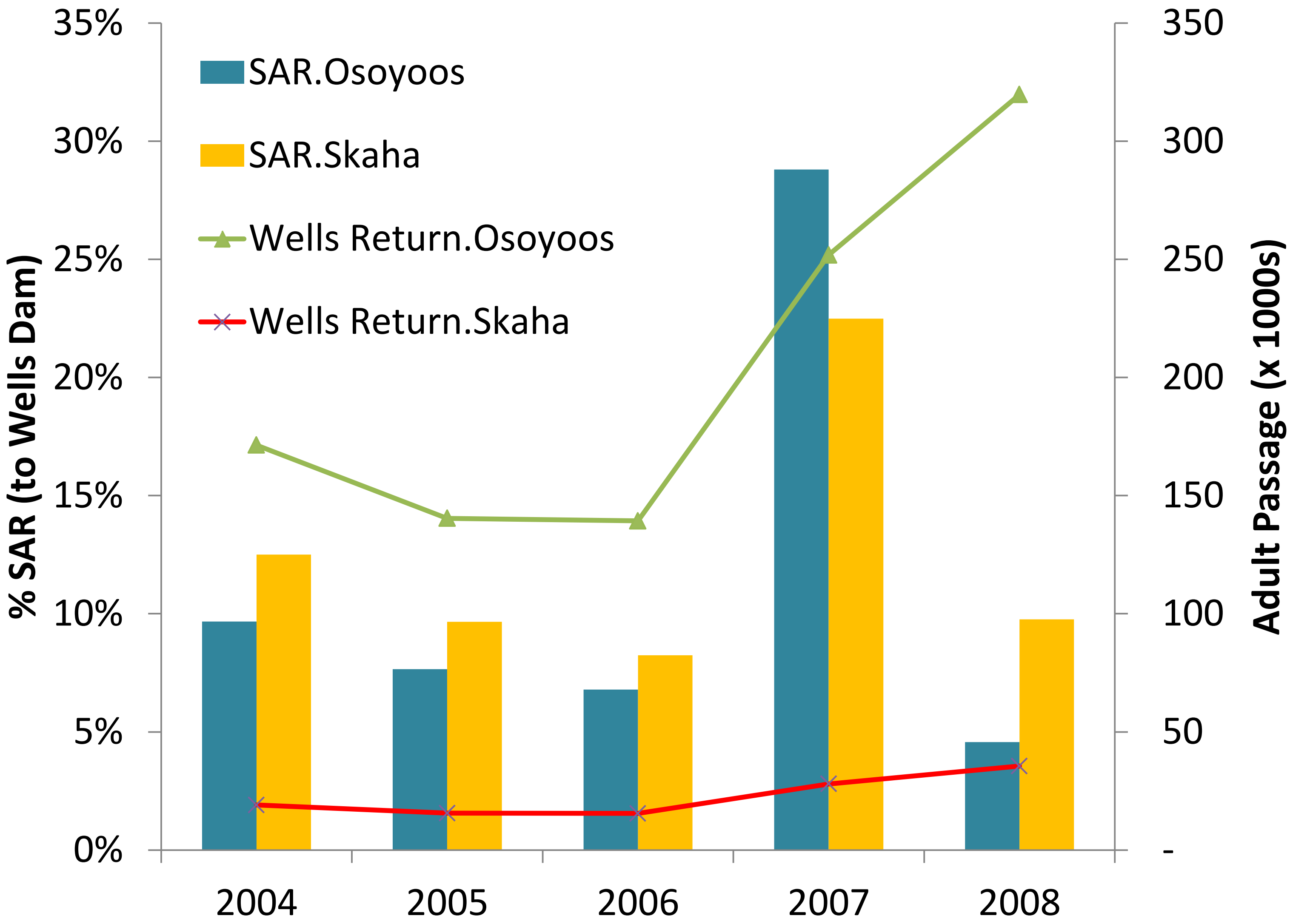
Attachment B

Key **Adaptive Management Directions** include:

1. Modify Skaha Dam to regulate fish passage (known #'s) (2015)
2. No Broodstock Collection in BY 2013
3. Plan Truck & Transport for adults BY 2014 ***
4. Penticton Channel Enhancement (& ORRI Phase 2)
5. Penticton hatchery fully operational BY 2015
6. Evaluate paired-lake fry release (reverse common garden experiment Osoyoos:Skaha)
7. Eight year synthesis summarizes performance metrics
   a. draft Nov 2013, peer review-workshop in April 2014
   b. Update biological reference points (E.g.. Adult escapement for Osoyoos (MSY = 60,000) and Skaha populations (MSY = 6,000)
8. Out-basin monitoring (PIT juveniles pilot trials (25-35% aggregate survival) & genetic interactions (sockeye-kokanee, 2 years)


% Survival
Osoyoos
Wild egg-to-presmolt
Stocked egg-to-presmolt
Skaha
Stocked egg-to-presmolt
Skaha
Kokanee egg-to-winter
Wild egg-to-presmolt
0
5
10
15
20
25
2005
2007
2009
2011


Okanagan
Wenatchee
Proportion Okanagan
Estimated Return to Bonneville
500000
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
Proportion of Total Return
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


35%
30%
25%
20%
15%
10%
5%
0%
% SAR (to Wells Dam)
SAR.Osoyoos
SAR.Skaha
Wells Return.Osoyoos
Wells Return.Skaha
350
300
250
200
150
100
50
-
Adult Passage (x 1000s)
2004
2005
2006
2007
2008

kt c'palk stim' Hatchery Construction Update

- **Hatchery Design Finalized**
  April/May 2013
- **Ground-breaking ceremony**
  May 2013
- **Project bid out**
  May / June 2013
- **Contract Change Order**
  July 2013
- **Land Lease/well permits signed, Contractor hired**
  July 2013

kt c'palk stim' Hatchery Construction Update

- **Construction start**
  week of July 29, 2013
- **Site excavation/prep completed**
  week of August 12, 2013
- **Footings and in-stream work starting**
  week of August 19
- **Construction timeline**
  52 Weeks

Lim Limp't (Thank You)

Okanagan Nation Alliance

Okanagan Fish-and-Water Management Tools (Ok-FWMT) Project Contributions to Stock Rebuilding of Okanagan Sockeye Salmon

HCP Briefing, Wenatchee, April 18, 2012.

Douglas County Public Utility District

Fisheries and Oceans Canada / Pêches et Océans Canada

Department of Fisheries and Oceans Canada

British Columbia

BC Ministry of Water Land and Air Protection

Okanagan Nation Alliance

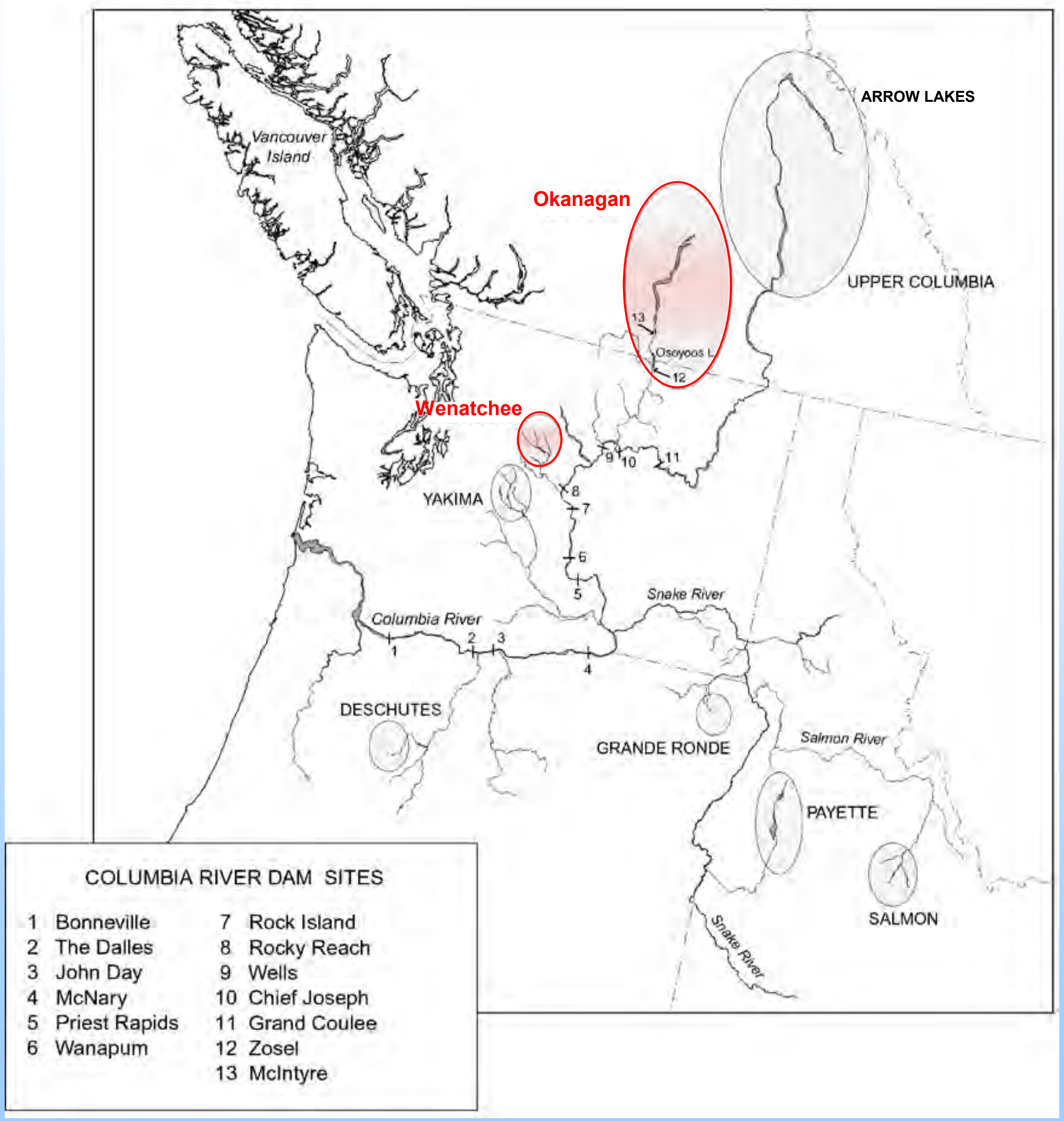
Kim Hyatt and Margot Stockwell

Fisheries and Oceans Canada

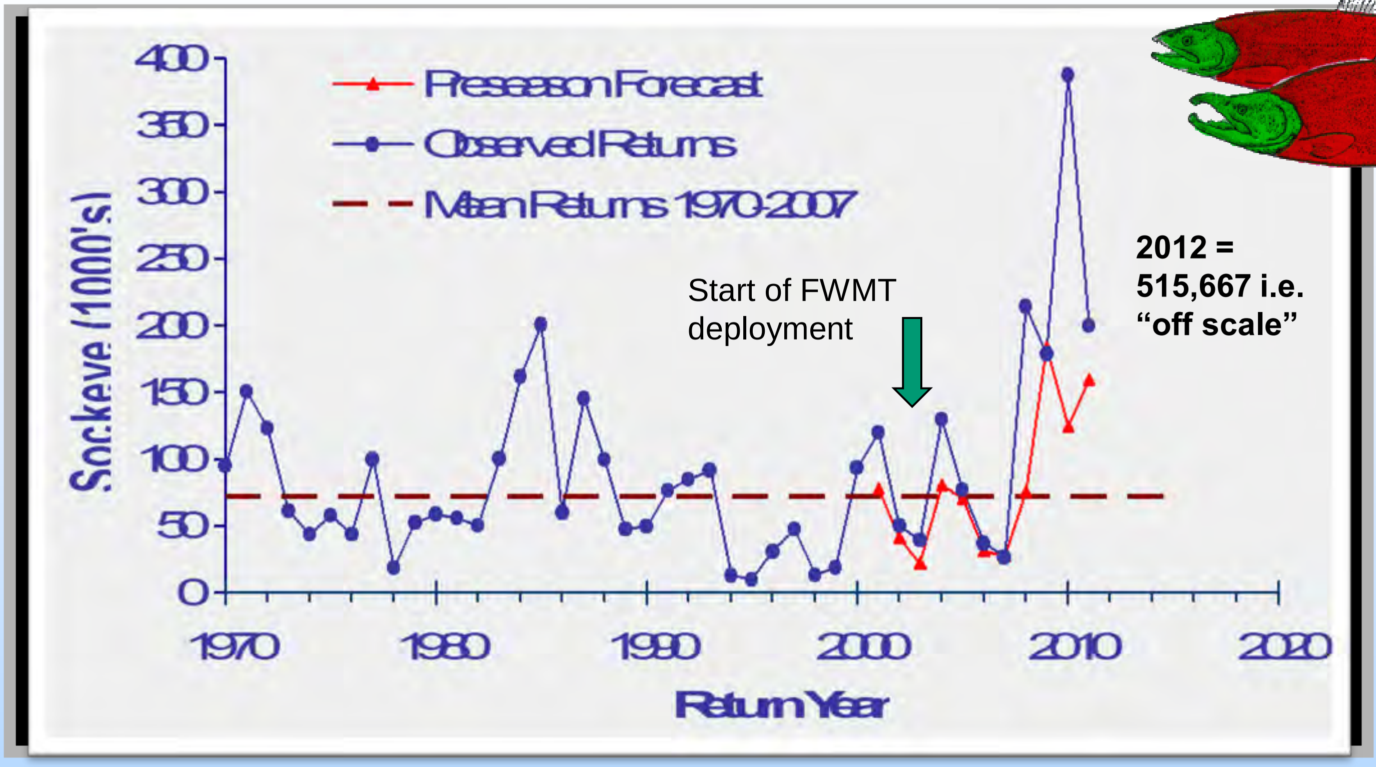
Columbia River Sockeye Salmon Populations

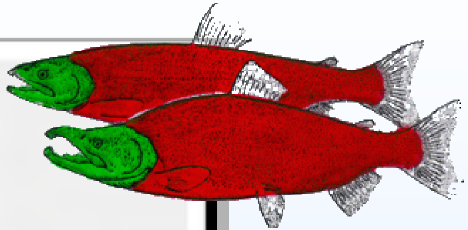
Columbia River sub-basins historically accessible to sockeye

Columbia River sub-basins with present day viable sockeye populations



Columbia R. Adult Sockeye Returns 1970 - 2011





Percent Okanagan Sockeye in Columbia River Returns

	1970 - 2003	**2004 - 2011**
Mean:	54%	81%
Range:	15-85%	63-90%

Factors or Events Contributing to Rebuilding of Okanagan Sockeye Salmon Since Inception of FWMT Deployment in 2003-04

- [x] Revised escapement objectives to utilize full carrying capacity of freshwater spawning and rearing environments,
- [X] Development /deployment of FWMT decision support system to facilitate "fish friendly" flows to reduce losses of eggs & fry to density independent mortality events,
- [X] FWMT mitigation of rearing habitat reductions for juvenile sockeye due to oxygen-temperature "squeeze" conditions in Osoyoos L.
- [x] Supplemental production of hatchery-origin sockeye from Skaha L.
- [ ] Improvements in juvenile fish-passage in the Columbia River,
- [x] Recent survival-favourable conditions for southern sockeye stocks in coastal marine waters.

OLR-System Management Begins in the Okanagan Lake Headwaters of the Okanagan River

Drainage area = 6,090 sq km
Surface area = 341 sq km
Average outflow = 14.7 m3/s

Okanagan R: Natural = 8.4 km
Channelized= 16.2 km
Average outflow = 14.7 m3/s

Okanagan Lake Dam at Penticton is the major control point in the system

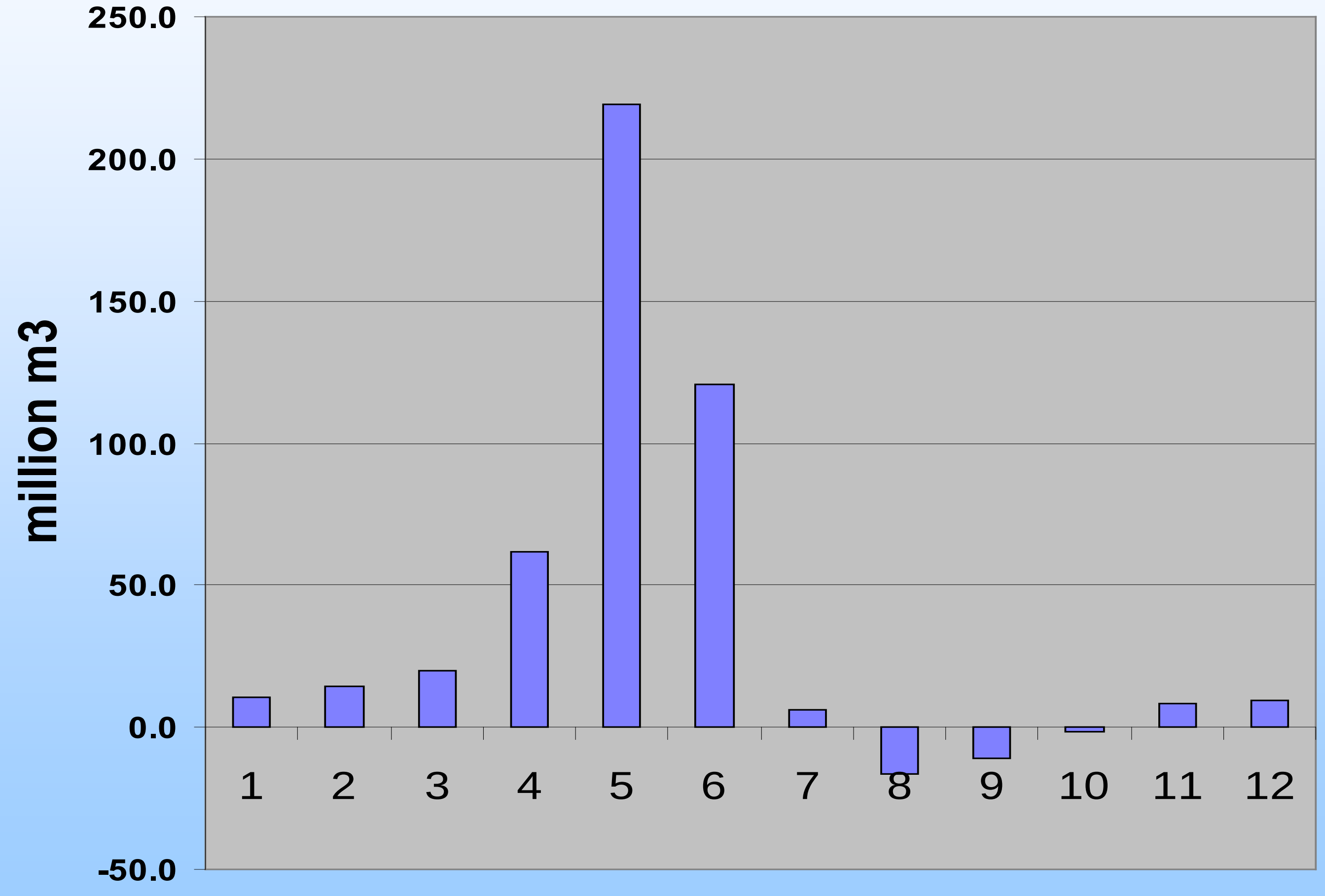
Okanagan Lake Dam (Penticton)

OKANAGAN LAKE HYDROLOGY


Mission Creek
June 1, 1997

- Annual inflow hydrograph dominated by snowmelt runoff
- Large range of annual inflows:
  - 78 million to 1.4 billion m^3
  - 0.23 m to 4.12 m stage change

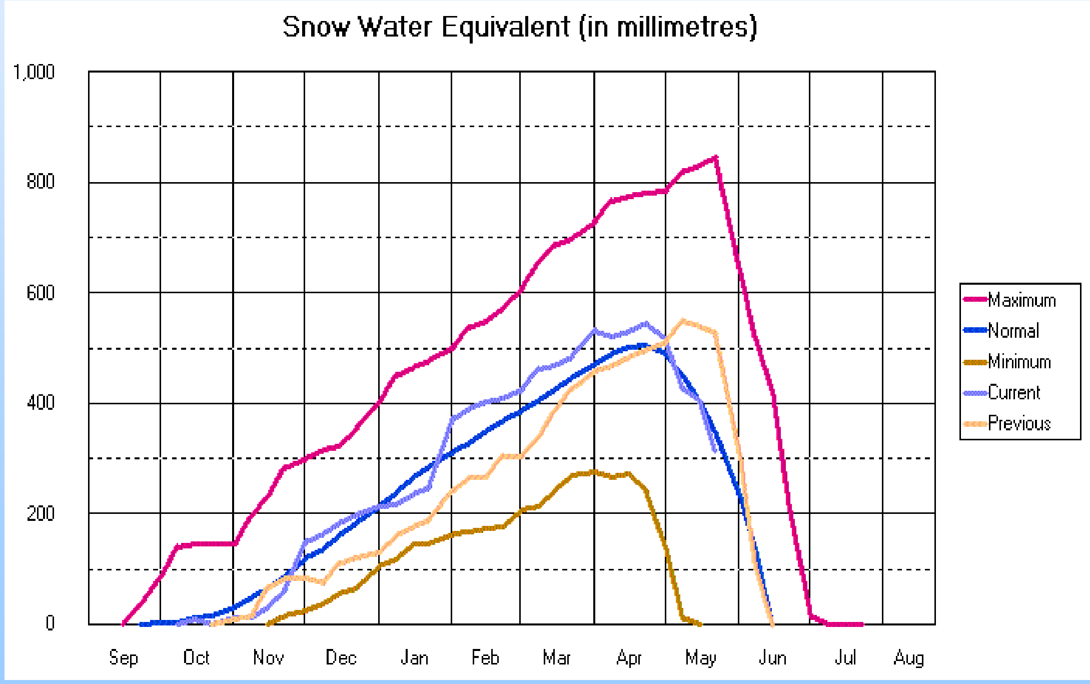
Mean Monthly Inflows to Okanagan L.
(85 % of inflow from Apr-Jun)



Inflow Forecasts and Discharge Observations Drive Management Decisions

Inflow forecasts are based on seasonal precipitation, snow packs & tributary inflow data.

2003-04 Mission Ck. Snow Pillow @2F05P



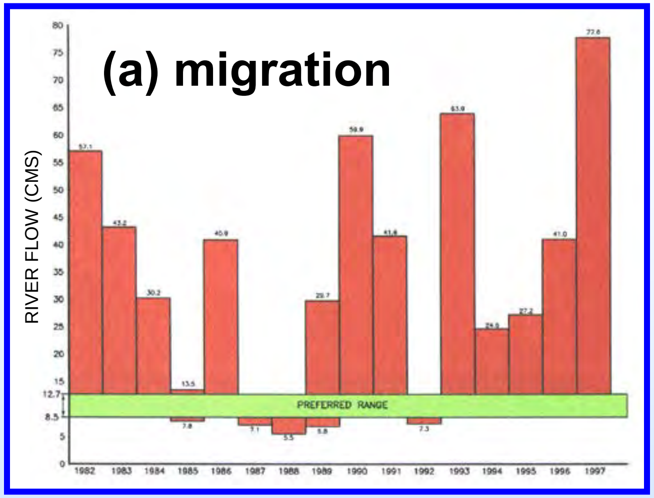
OLRS OPERATIONS

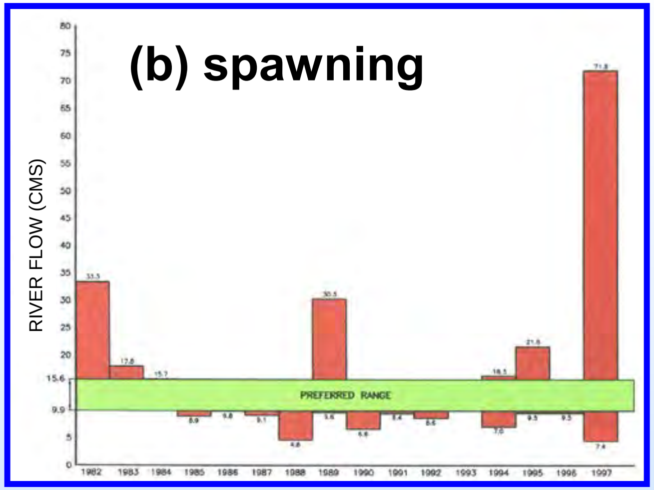
- OBA rules specify seasonal lake levels and flows.
- Operating plans/decisions reflect inflow forecasts.
- Decisions address competing objectives to satisfy: flood control, fisheries values, water storage/extraction, navigation, tourism, international agreements, etc.

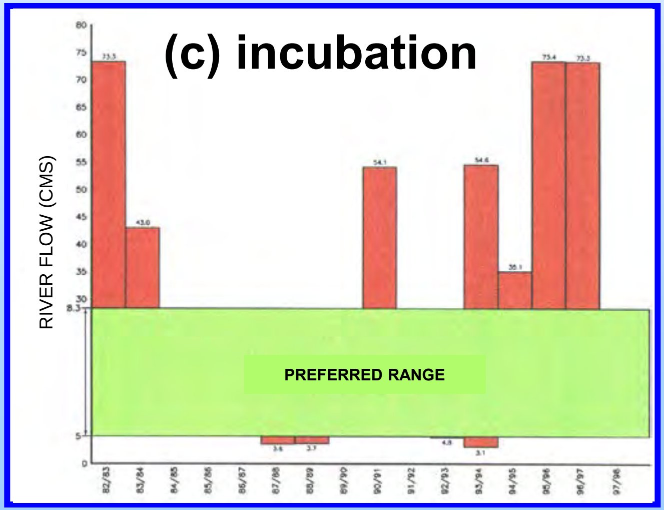
OPERATOR CHALLENGES

- Forecast uncertainty re: freshet inflow volumes and capacity to match lake spill or storage to spring inflows (“bathtub” analogy).
- Effects of environmental variability (water levels, flow, temp.) on risk assessments given competing economic, social & environmental demands of multiple “parties” & authorities.
- **OLRS decisions re: water storage or release based on rules of thumb, past experience & incomplete information.**

Compliance with OBA Fishery Flows was low prior to 1997.







OBA preferred flow range

Observed flow range

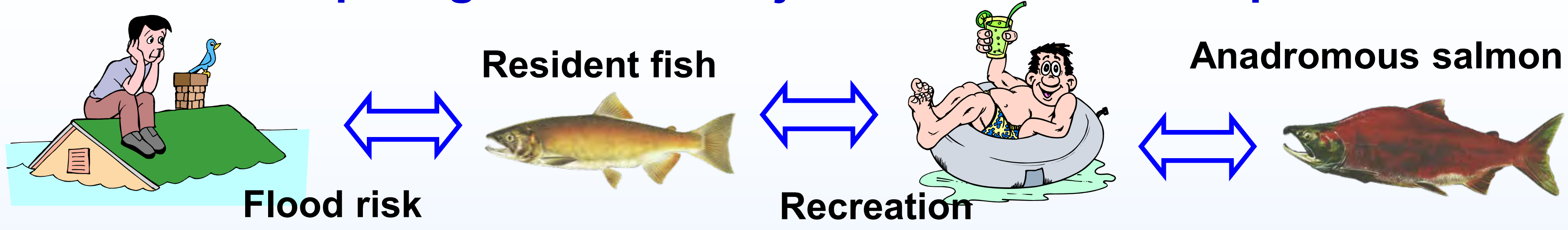
From 1982-1997 river discharge exceeded OBA fishery flows in:

(a) 13 of 16 yrs for adult migration

(b) 7 of 16 yrs for spawning and

(c) 7 of 16 yrs for egg incubation & fry migration

Competing "Rules"& Objectives Reduce Compliance



Rule 1: Don't fill Okanagan Lake above 342.56 meters (i.e. 10 cm rise above 342.56 incurs $5-$10 million in "property" losses !)

Rule 2: Try to avoid drafting to lake levels below 341.50 meters. (i.e. problems with docks, water intakes & vessel navigation become severe).

Rule 3: Minimize draw-down of Okanagan L. between the time of kokanee spawning and 100% fry emergence (i.e. minimize dewatering kokanee eggs & fry but don't risk violatin of "rules" 1 or 6,7,8, & 9)

Rule 4: Minimize the number of buildings flooded at Penticton

Rule 5: Provide summer flows for recreation if possible

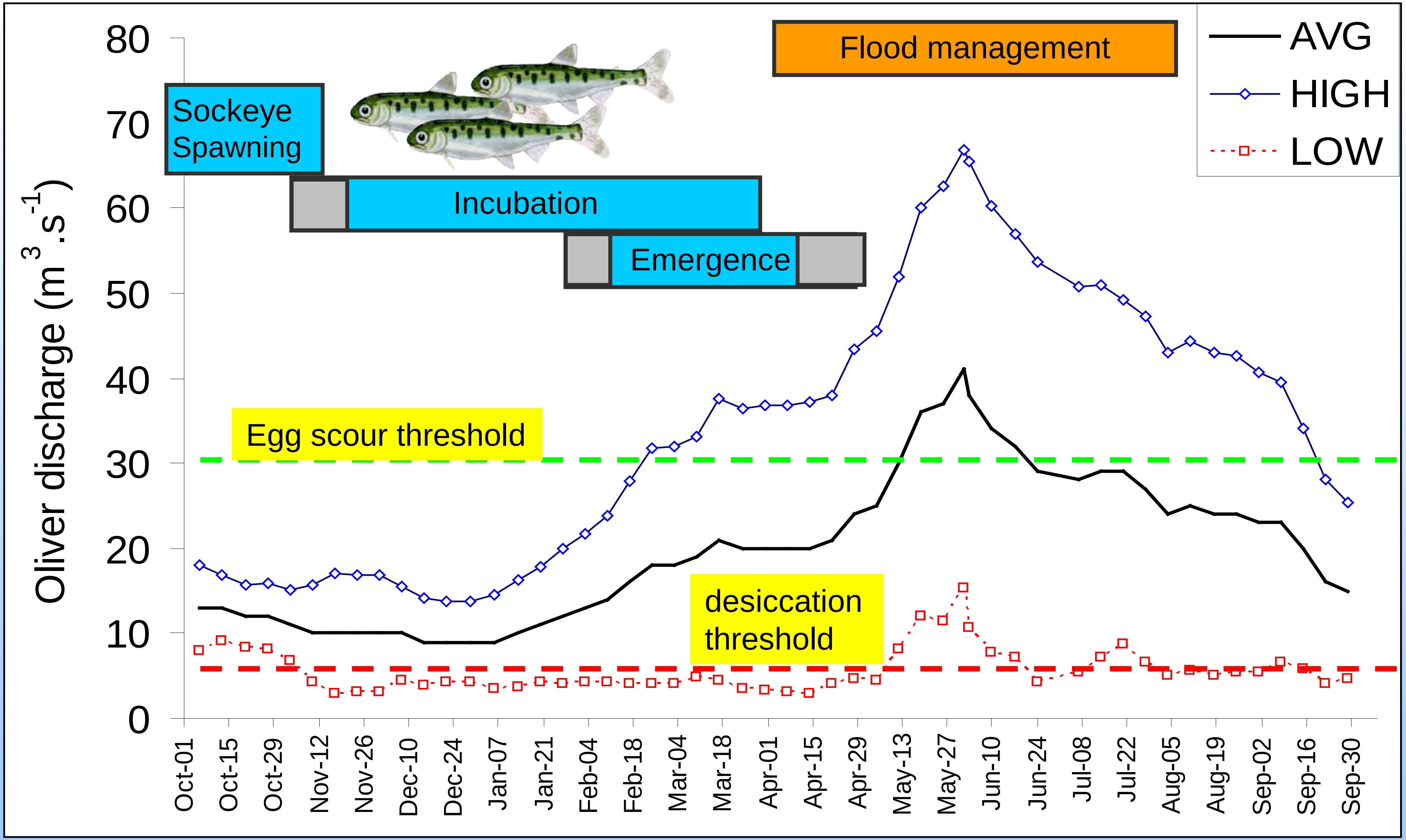
Rule 6: Sox. Migration – maintain flows (@ Oliver) between 8.5 & 12.7 cms during Aug 1 to Sept 15 to allow "easy" passage of VDS.

Rule 7: Sox. Spawning – maintain flows between 9.9- 15.6 cms during Sept 16- Oct 31 to maximize "good" spawning habitat.

Rule 8: Sox Incubation- flows at 5.0- 28.3 cms during Nov 1- Feb 15 i.e. egg incubation flows greater than or equal to 50 % of spawning flows & must not exceed 28.3 cms to avoid redd desiccation & scouring.

Rule 9: Sox. Fry emergence-migration- flows during Feb16- Apr 30 at 5.0- 28.3 cms.

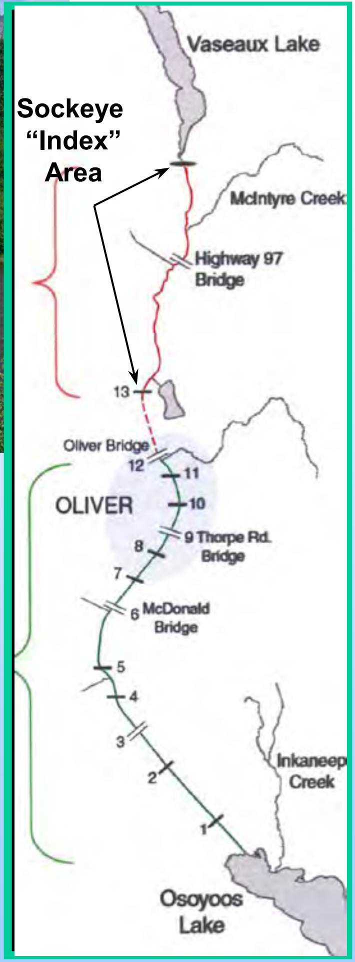
Event timing & natural variations determine whether fish-and-water managers satisfy OBA rules & competing objectives



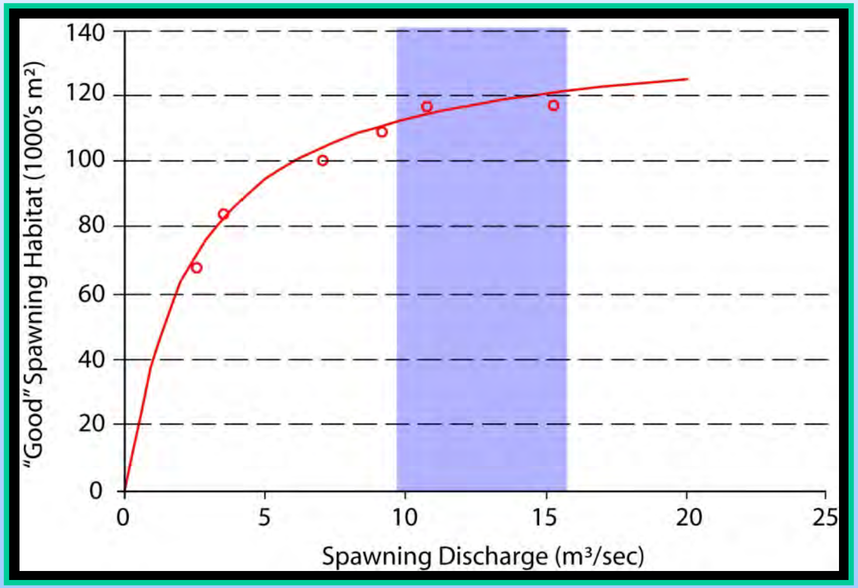
Available Spawning Habitat is Controlled by Flow

Paul Rankin photo

Okanagan Nation Alliance photo



Recommended flows for Okanagan sockeye spawning are: **9.9 m³/sec to 15.6 m³/sec**

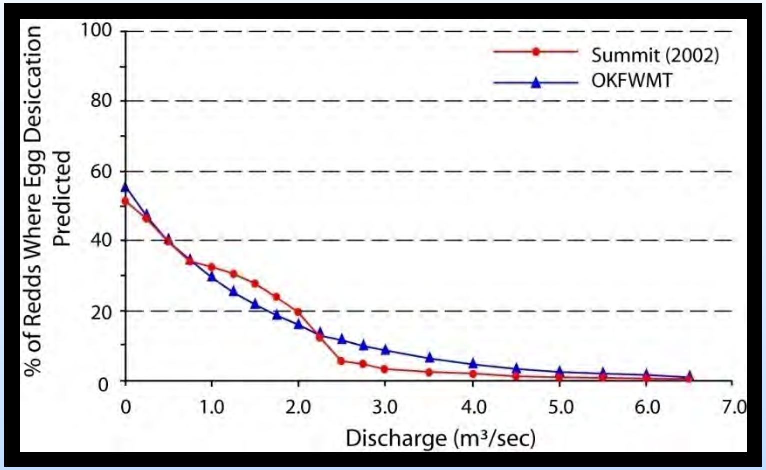


Data Sources: Anon. 1983; Hyatt et al. 2005

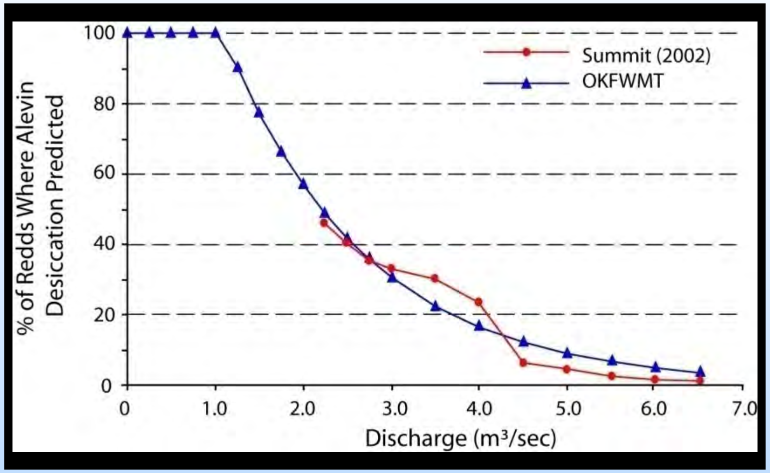
Discharge and Okanagan Sockeye Incubation

Dewatering/desiccation or flood-and-scour processes control incubation and emergence success of sockeye eggs and alevins.

(a) % Eggs Dewatered

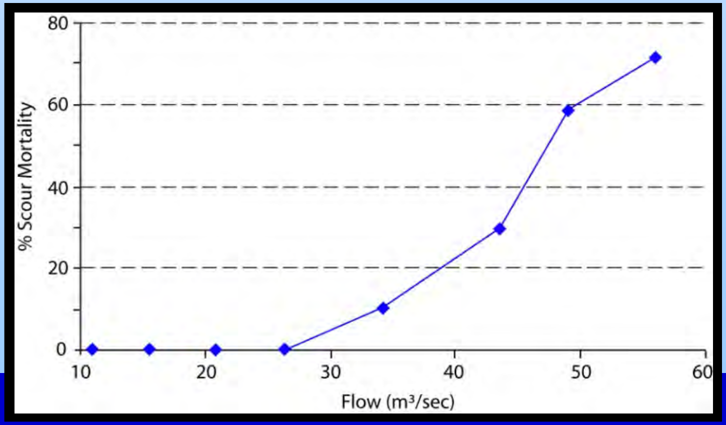


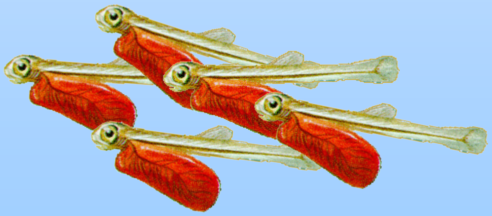
(b) % Alevins Stranded



(c) % Eggs / Alevins Scoured

photo: www.nbis.org

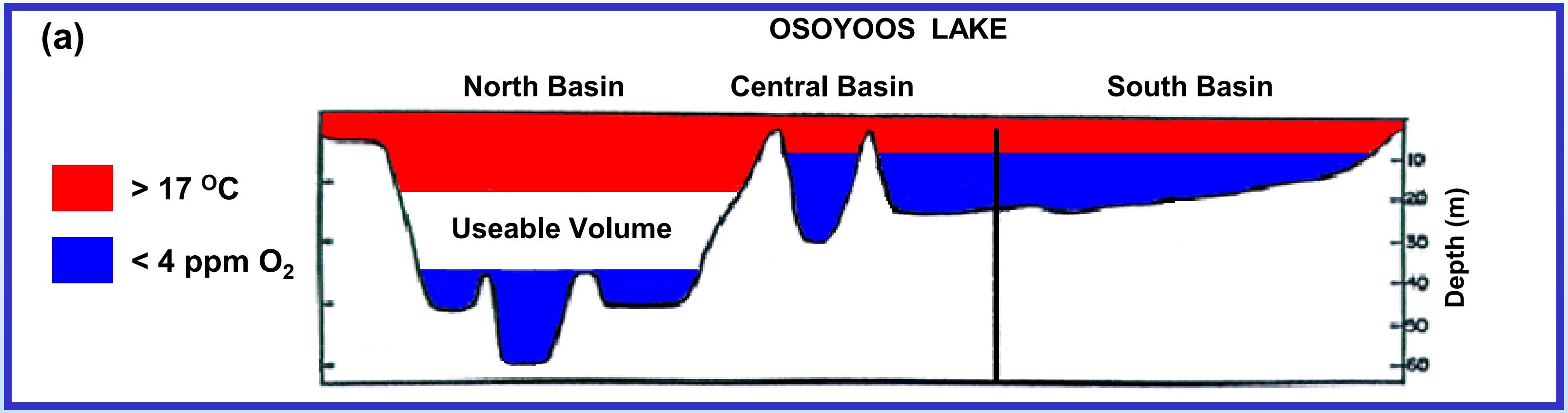




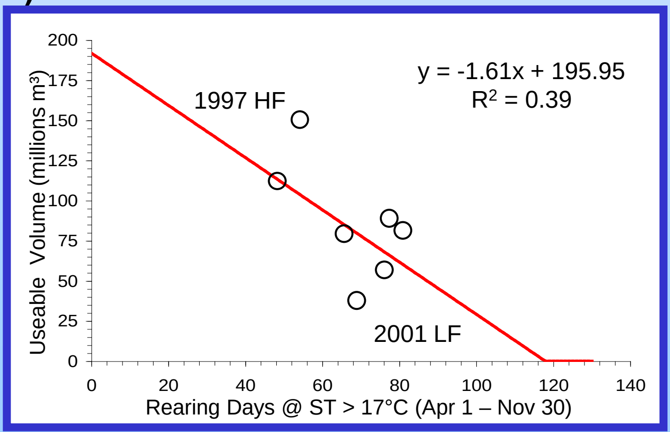
Data Source: Hyatt et al 2005

Temperature-Oxygen "Squeeze" and Density-Independent Rearing Limitations in Osoyoos L.

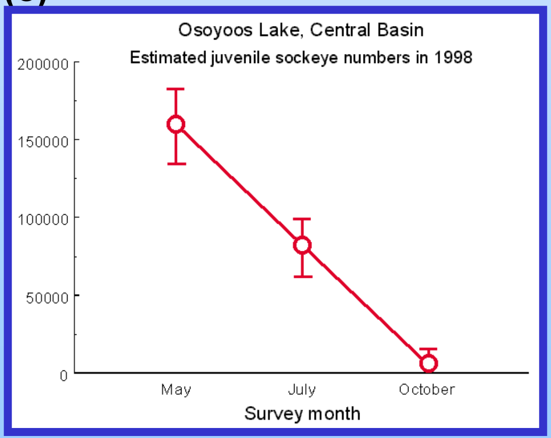
Hyatt et al (in prep) have established that seasonal temperature and oxygen extremes may operate together to restrict the useable rearing volume of Osoyoos Lake which can induce density-independent mortality processes.



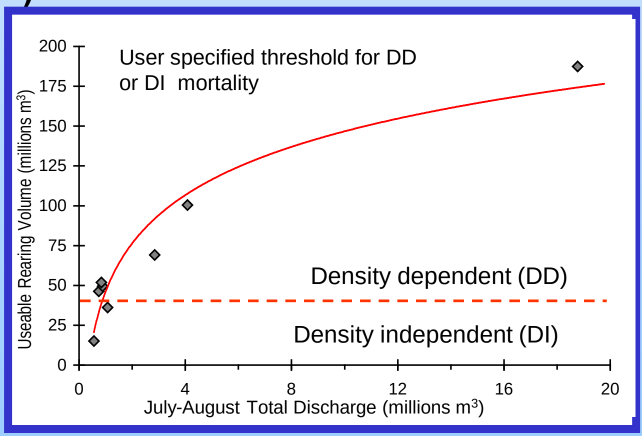
(b)



(c)

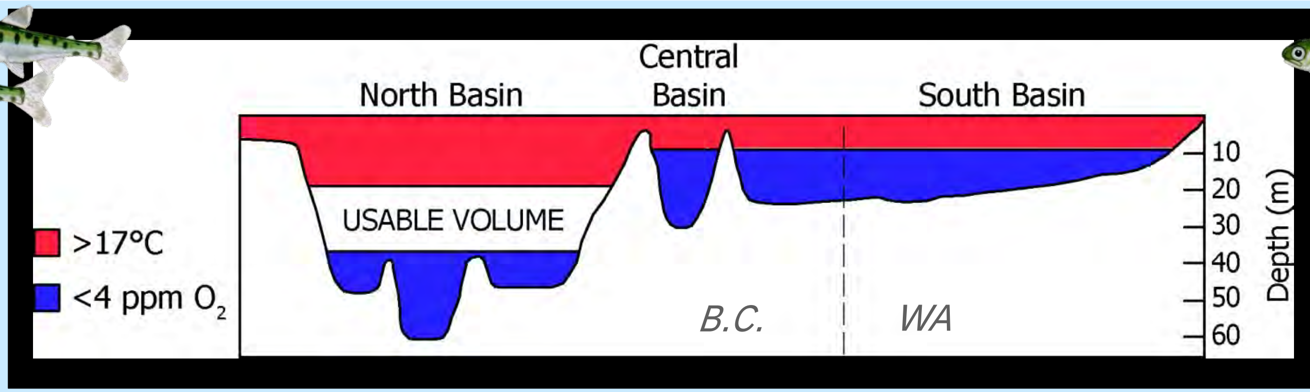


(d)

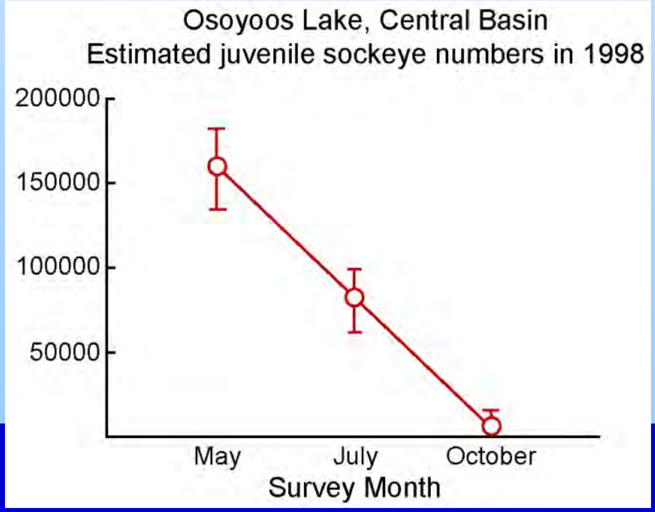


Rearing habitat limits due to temperature-oxygen "squeeze" in Osoyoos L. are partially controlled by summer discharge

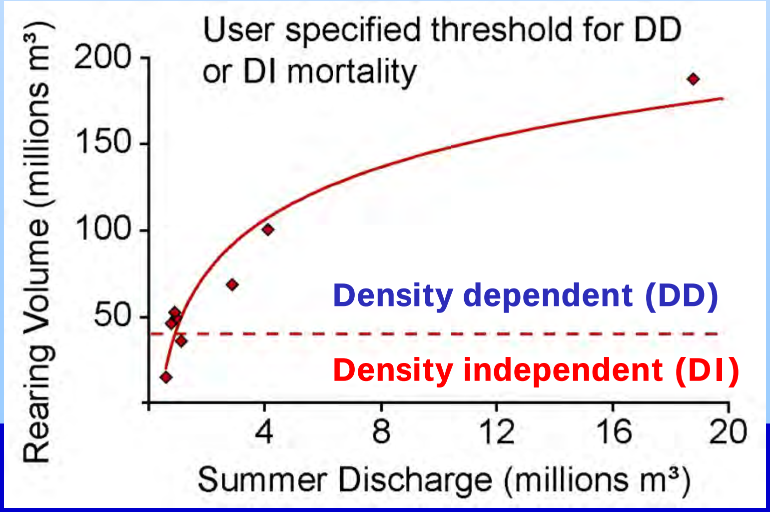
Seasonal temperature and oxygen extremes operate together to restrict the useable rearing volume of Osoyoos Lake.



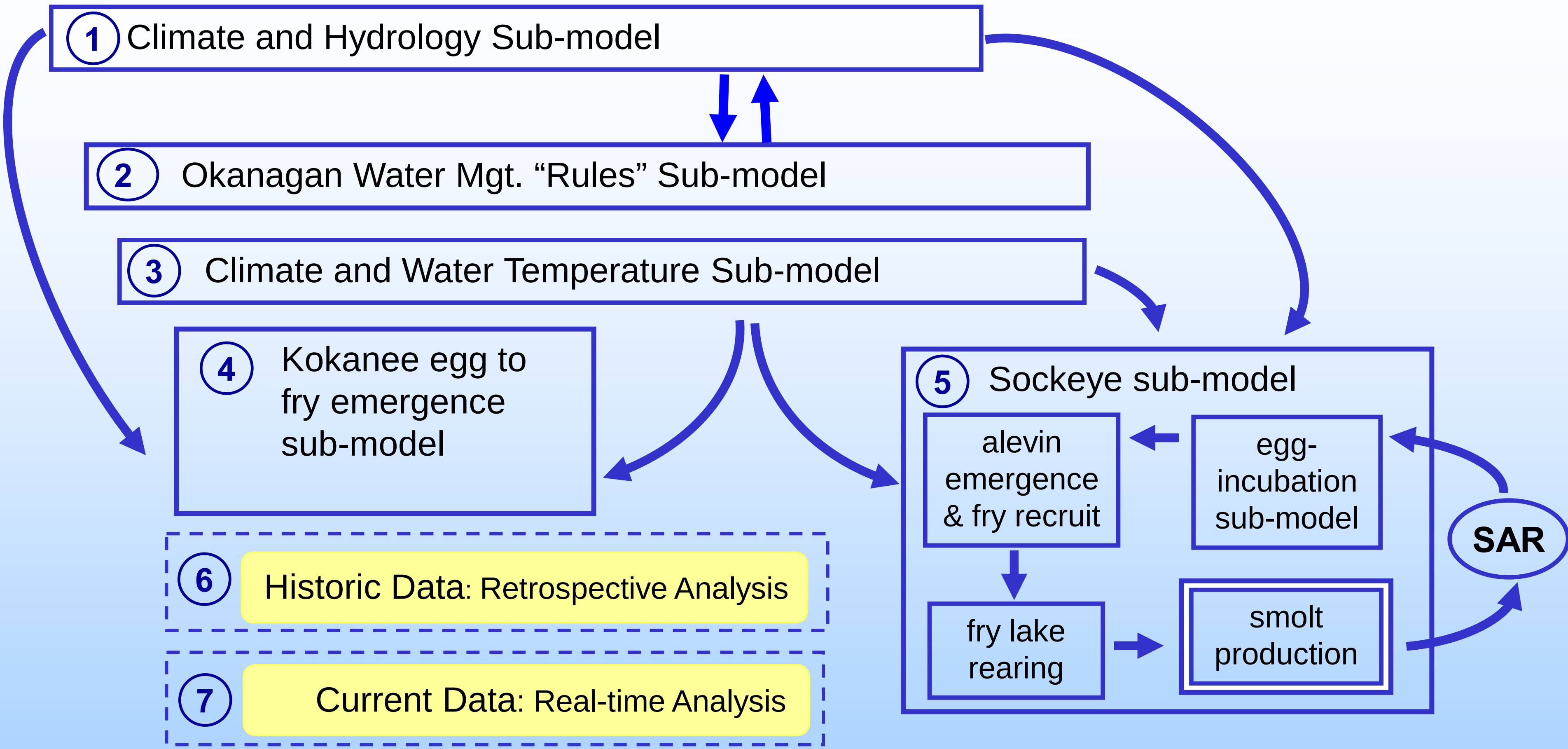
"Squeeze" induced losses of juvenile



Discharge, habitat & mortality



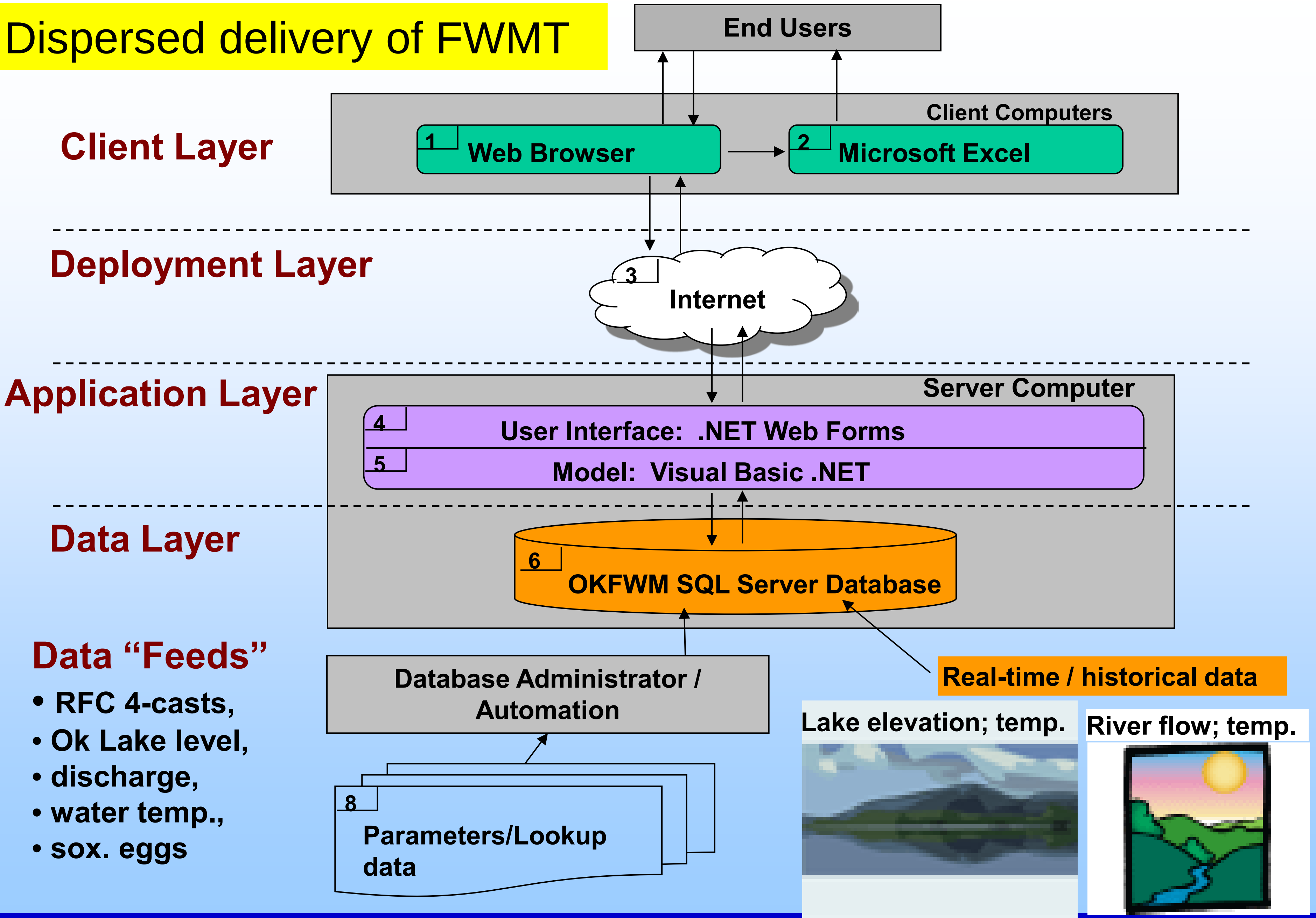
FWMT Decision Support System



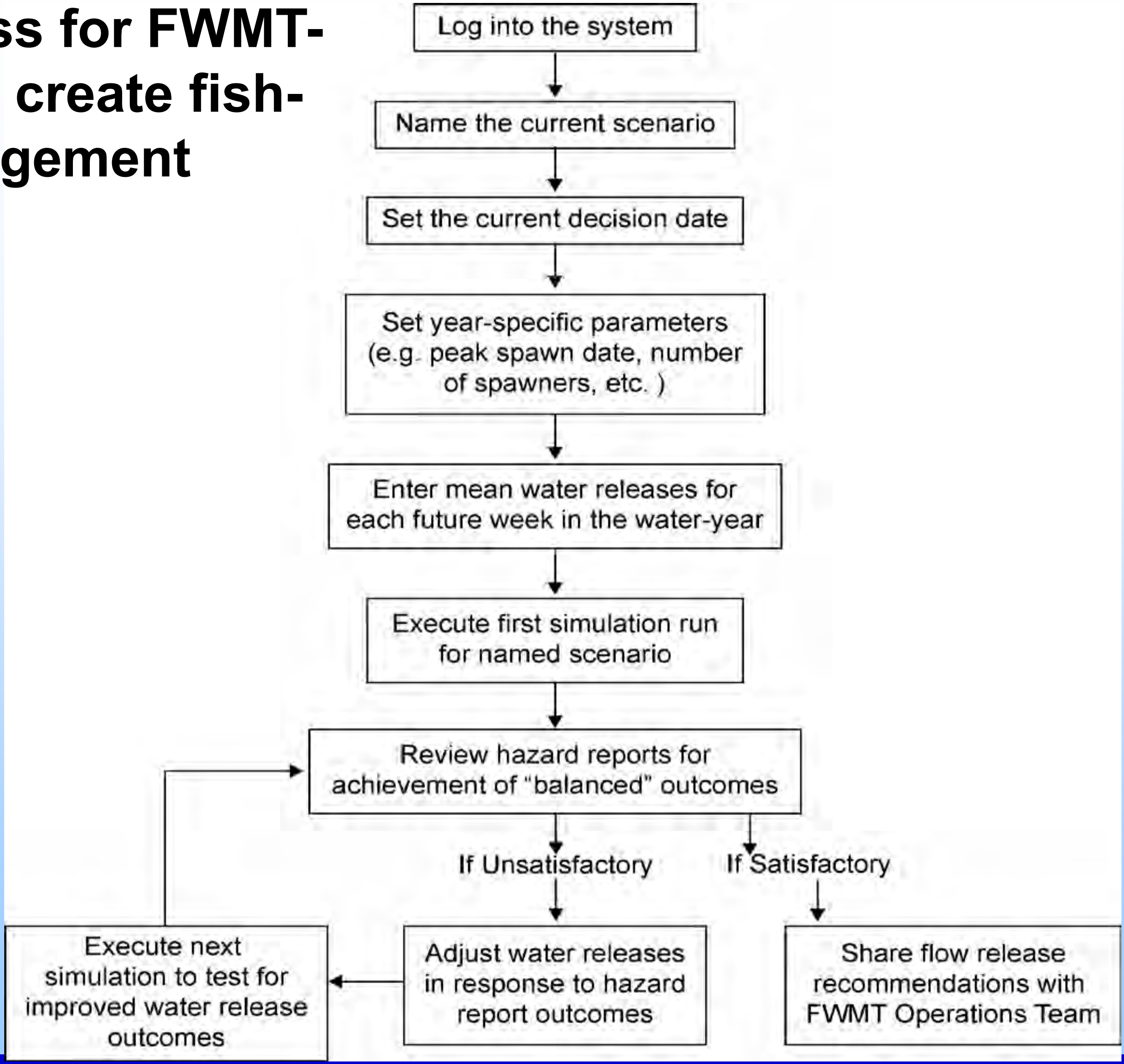
The FWMT System is a coupled set of biophysical models of key relationships (among climate, water, fish & property) used to predict the consequences of water mgt. decisions for fish & other water users.

FWMT may be used to explore water management decision impacts in an operational mode employing real-time data, a prospective-mode going forward or in a retrospective-mode looking back on historic water supply, climate & fish years.

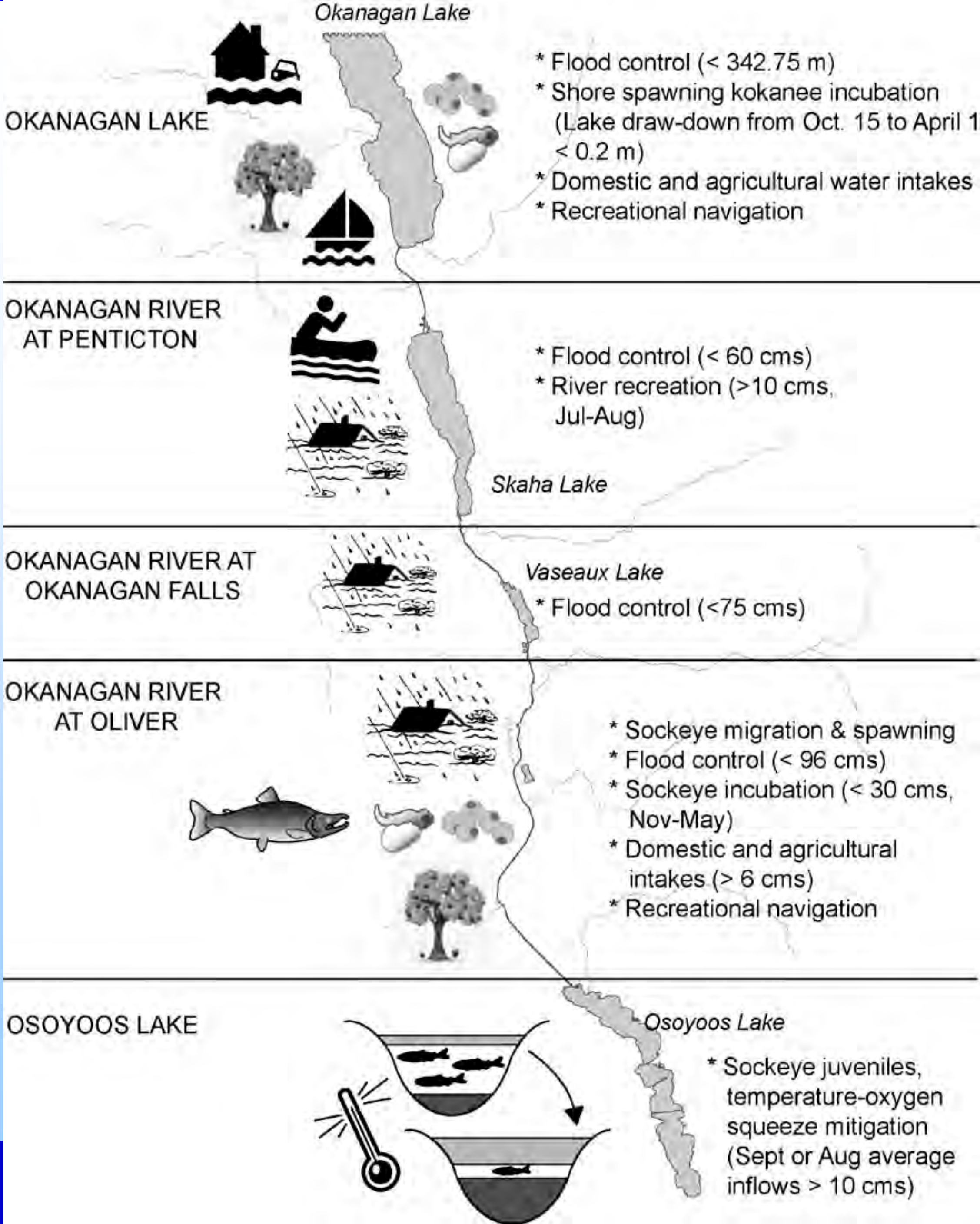
Dispersed delivery of FWMT

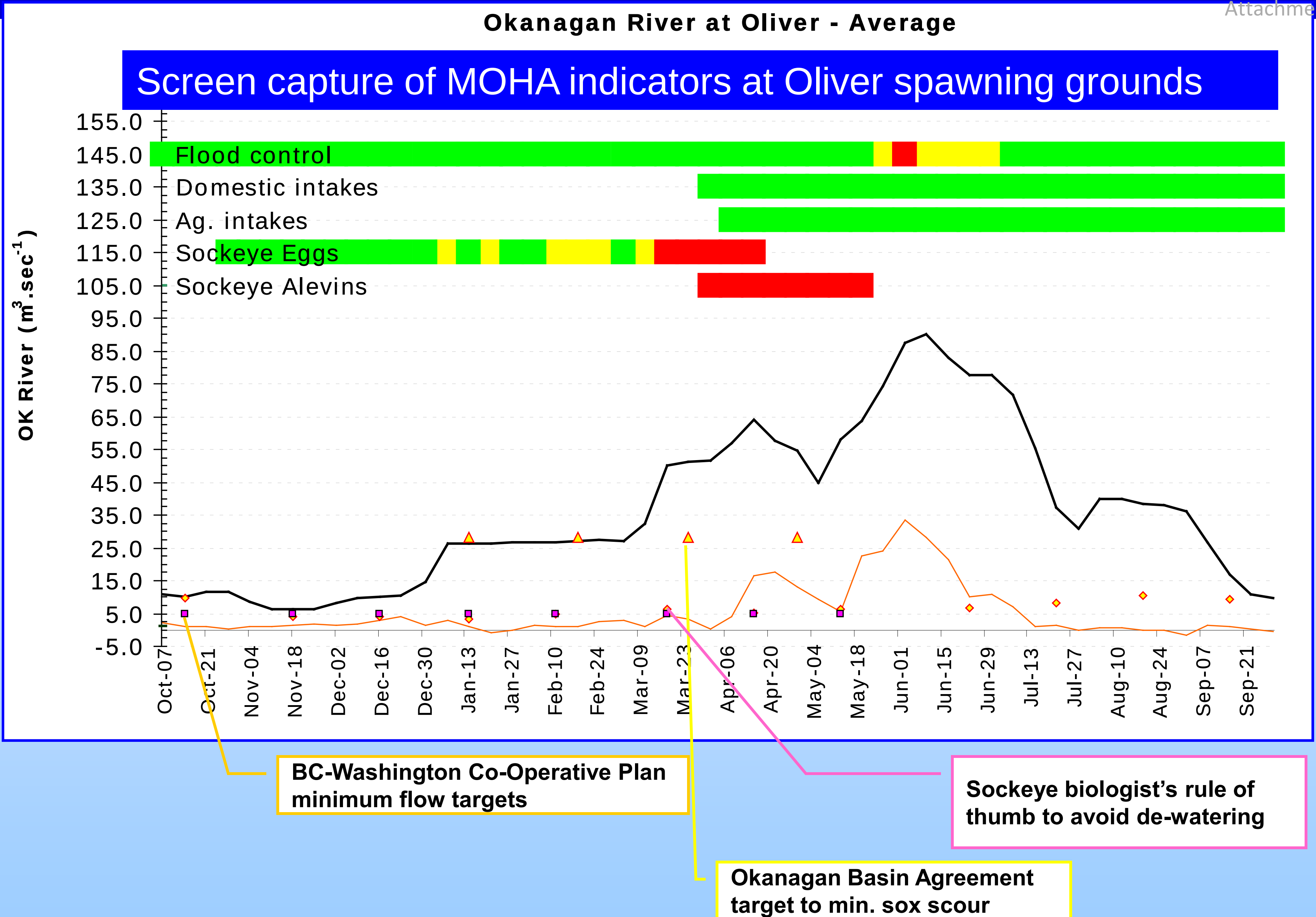


Stepwise process for FWMT-system users to create fish-and-water management "scenario(s)".



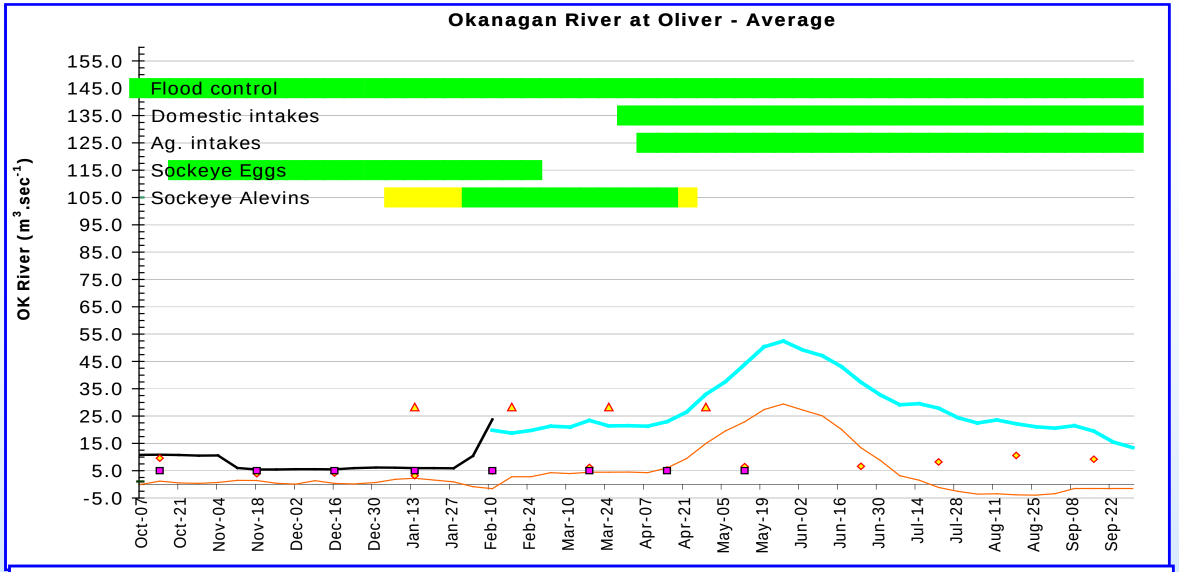
FWMT simulations provide multiple objective hazard assessment (MOHA) reports on human-system and natural-system maintenance needs in each of 5 geographic segments of the Okanagan Lake and River System



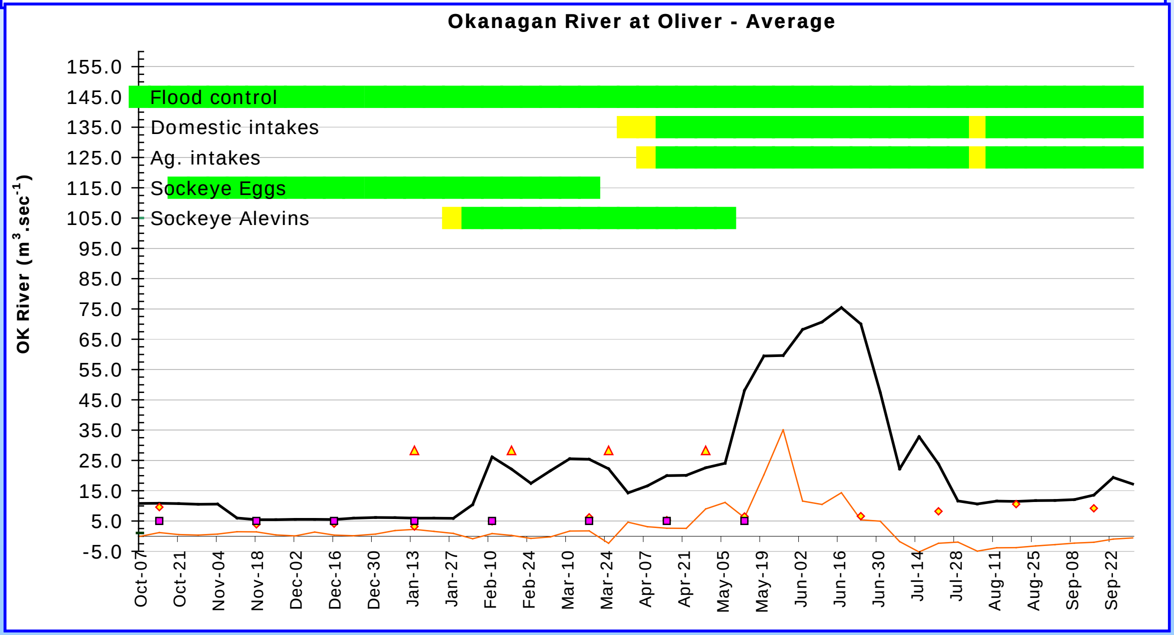

Okanagan River at Oliver - Average
Screen capture of MOHA indicators at Oliver spawning grounds
155.0
145.0
135.0
125.0
115.0
105.0
95.0
85.0
75.0
65.0
55.0
45.0
35.0
25.0
15.0
5.0
-5.0
Flood control
Domestic intakes
Ag. intakes
Sockeye Eggs
Sockeye Alevins
OK River (m3.sec-1)
Oct-07
Oct-21
Nov-04
Nov-18
Dec-02
Dec-16
Dec-30
Jan-13
Jan-27
Feb-10
Feb-24
Mar-09
Mar-23
Apr-06
Apr-20
May-04
May-18
Jun-01
Jun-15
Jun-29
Jul-13
Jul-27
Aug-10
Aug-24
Sep-07
Sep-21
BC-Washington Co-Operative Plan minimum flow targets
Sockeye biologist's rule of thumb to avoid de-watering
Okanagan Basin Agreement target to min. sox scour

Managing with FWMT to avoid flood risk and redd scour in 2005-2006

(A) Actual and predicted flows at Oliver (sockeye spawning grounds) 9-Feb-06

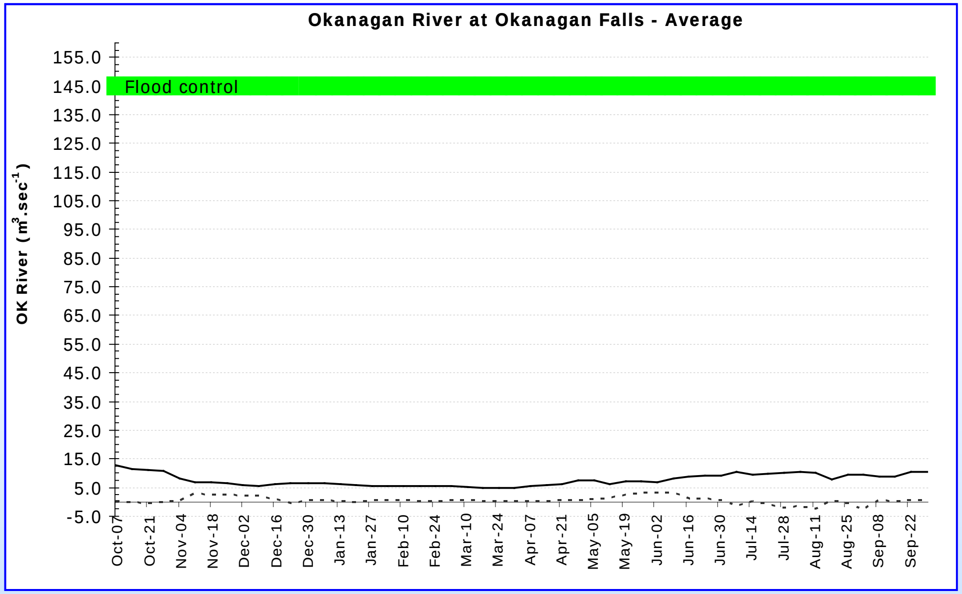


(B) Final outcome at Oliver (sockeye spawning grounds) 30-Sep-06

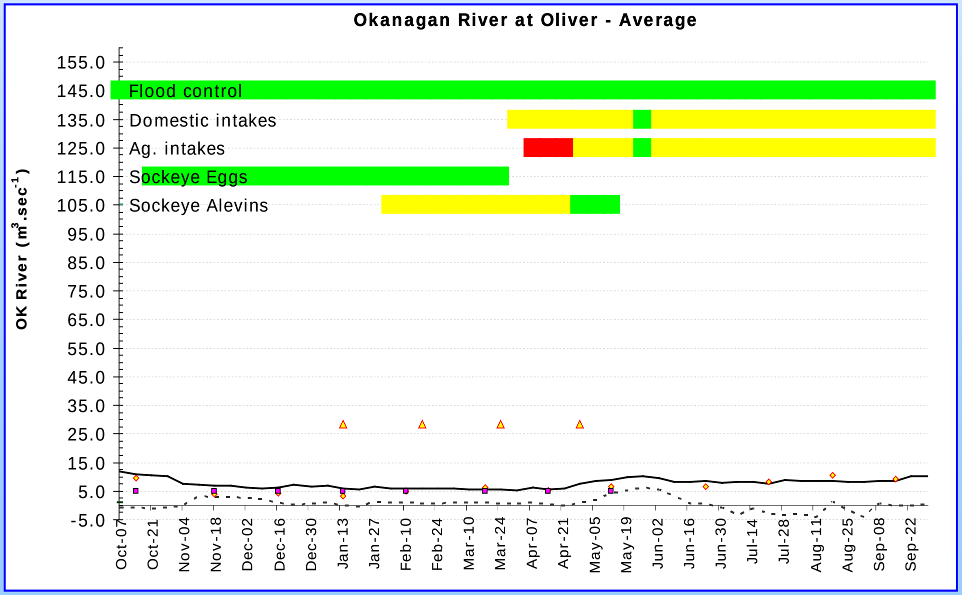


Managing with FWMT to avoid drought induced losses of fry in 2008-09

C. Okanagan River at Ok Falls

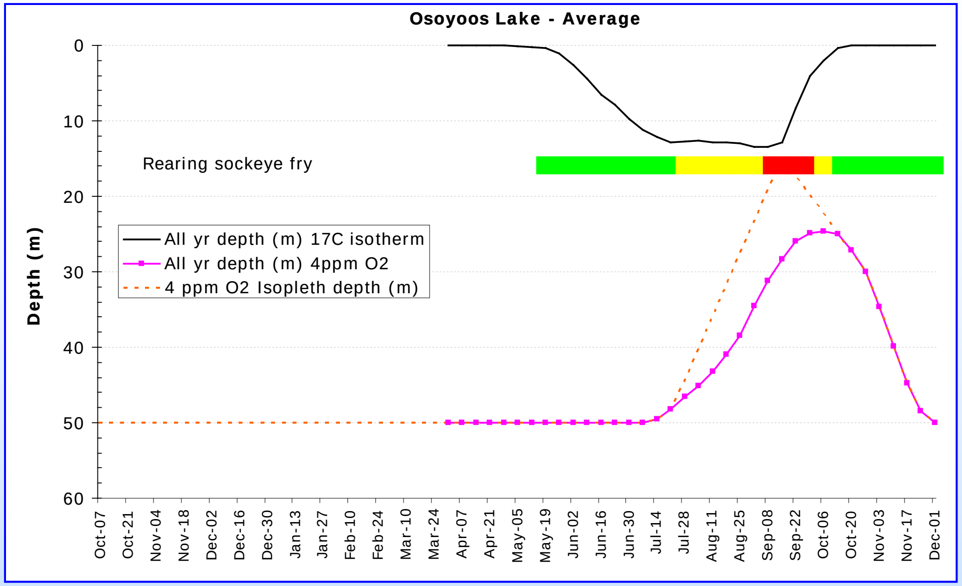


D. Okanagan River at Oliver

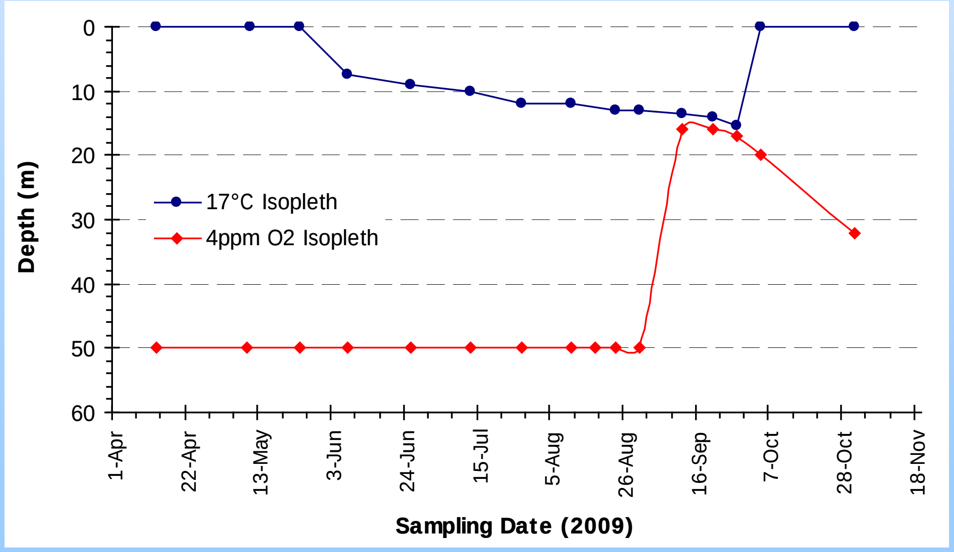


FWMT prediction vs observed "squeeze" in Osoyoos L. 2008 - 2009

Predicted "Squeeze"



Observed "Squeeze"

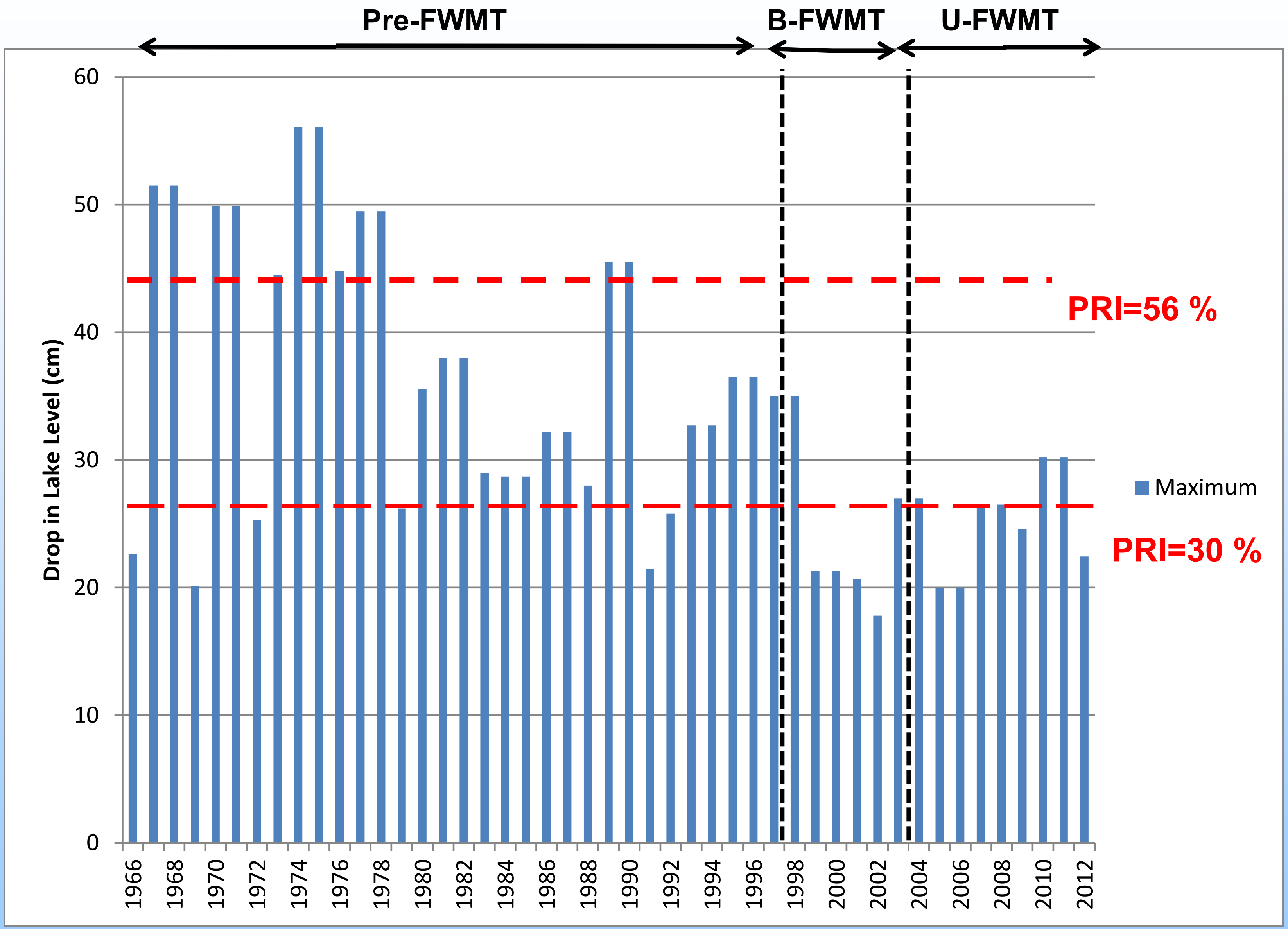


FWMT identifies "fish-friendly" options in 2008-09 drought

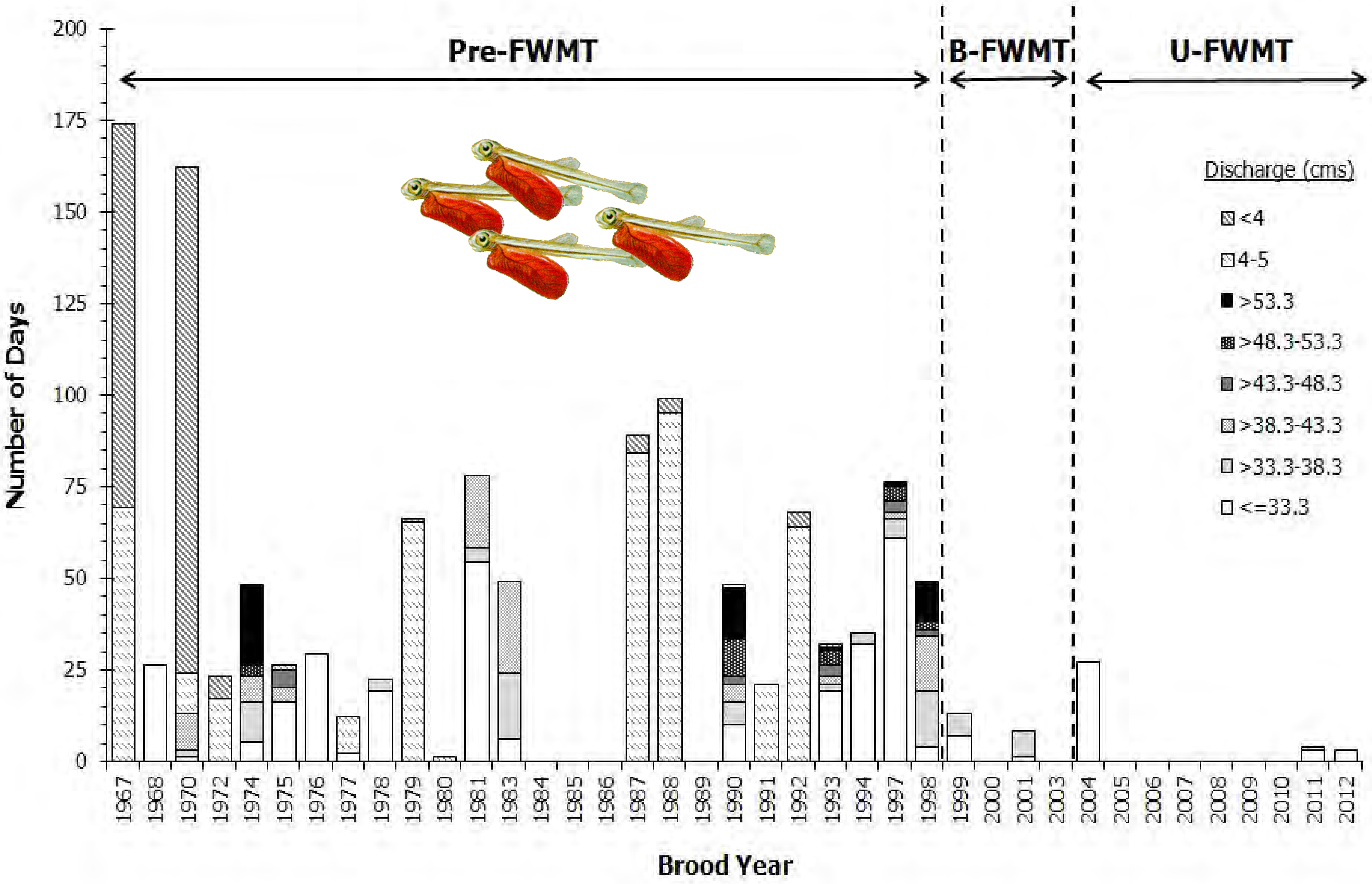
Table 1. A summary by location & issue of consequences associated with adoption of three alternate flow scenarios (FWMT-569, 561,568) during Aug-Sept, 2009.

	FWMT-569	FWMT-561	FWMT-568
Location/Issue [1]	Current (10.7 cms)	OBA max (12.7 cms)	Mitigate squeeze (18.3 cms)
Ok Lk levels predicted (Sept 30, 2009) [2]	341.76	341.72	341.69
Domestic intakes [3]			
Agricultural intakes [3]			
Navigation boats [4]			
Navigation docks [4]			
Kokanee spawn/survival [5]			
Ok Lk levels expected by Oct 14, 2009 [5]	341.72	341.66	341.64
Okanagan River			
Recreation at Penticton [6]			
Domestic intakes-Oliver [7]			
Agricultural intakes-Oliver [8]			
Osoyoos Lake			
Juvenile sockeye rearing [9]			
Adult sockeye holding [9]			
Ok Lk levels expected by April 1, 2010 [10]	341.48	341.42	341.40

FWMT impact on compliance with "kokanee-friendly" levels at Ok-lake



FWMT impact on compliance with “sockeye-friendly” flows at Oliver

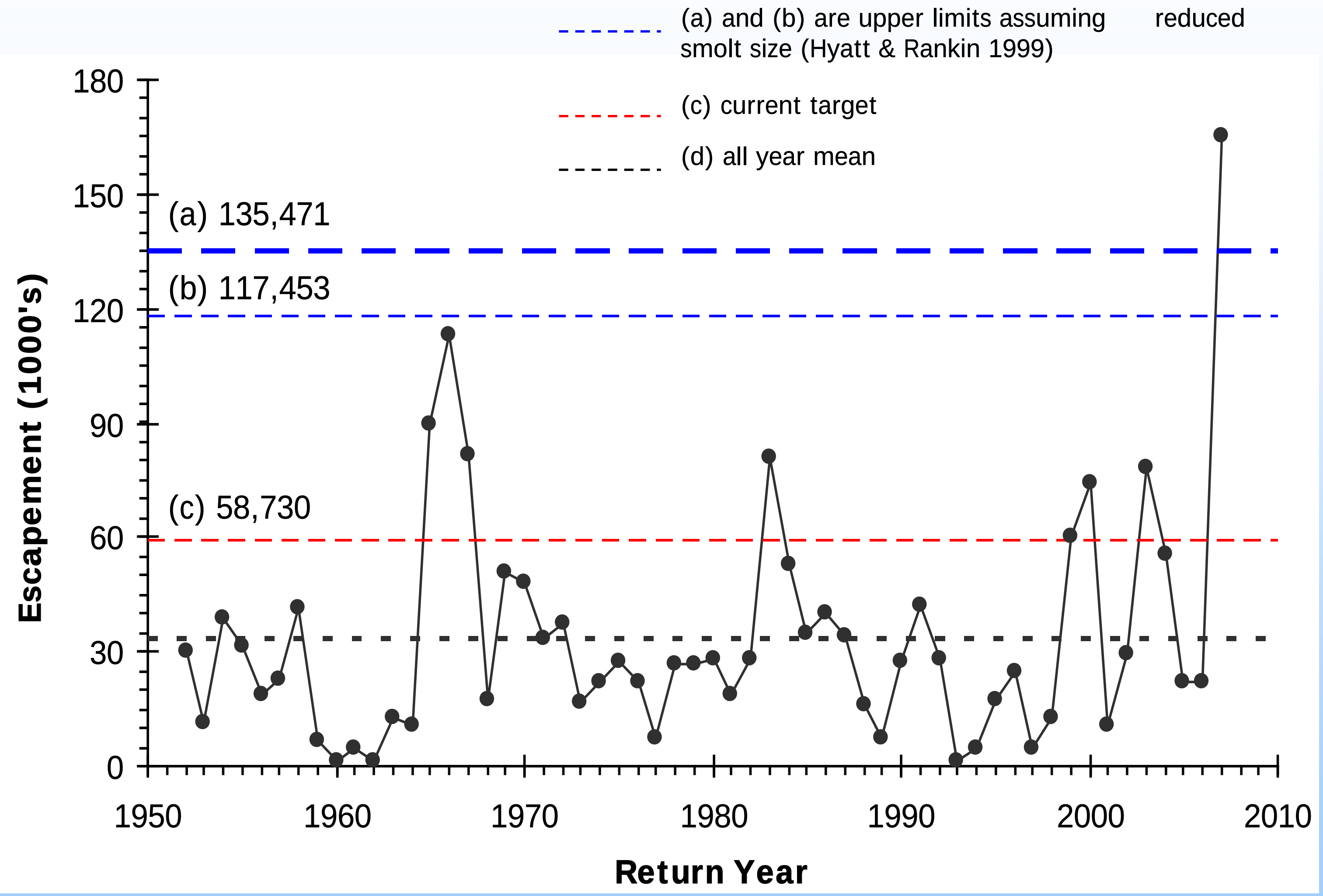


Ok-FWMT Results to Date

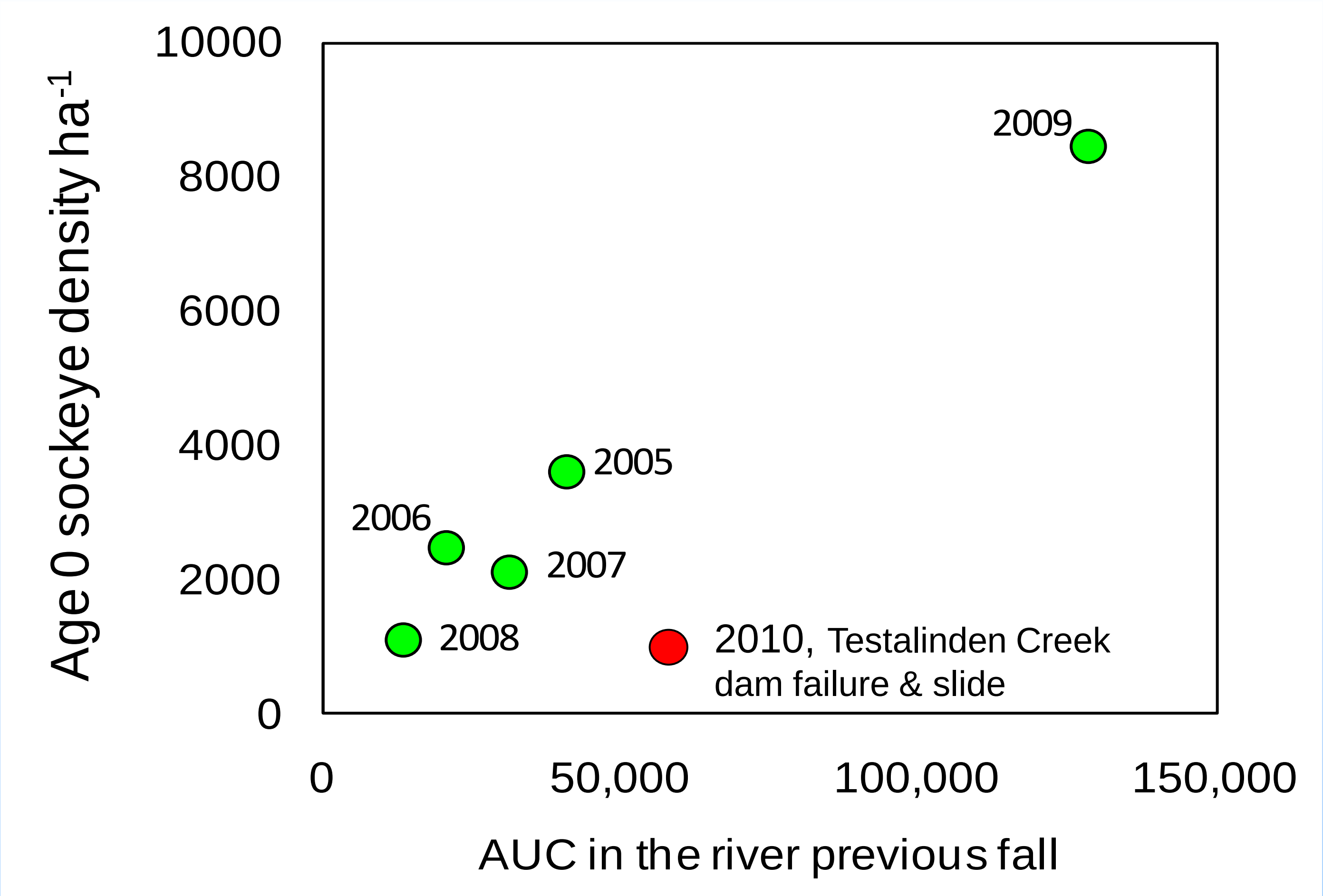
- balances consideration of multiple objectives (*i.e.* social, economic, cultural, ecological)
- recognizes inflow forecast uncertainties,
- uses “rich” information sources refreshed in real-time (*i.e.* annual to daily imports of biophysical data),
- facilitates effective input from limited pool of expertise,
- provides record of annual strategy & outcomes to assess performance against multiple objectives.
- since deployment in fall of 2005 we have avoided (a) major drought and desiccation or flood and scour losses of fry production in-river and (b) most temp-O2 induced losses of lake-rearing fry (i.e. reduced density-independent losses of fry & smolt production).

Influence of FWMT plus other factors on sockeye recovery ?

Escapement Revisions, Hyatt & Rankin 1996

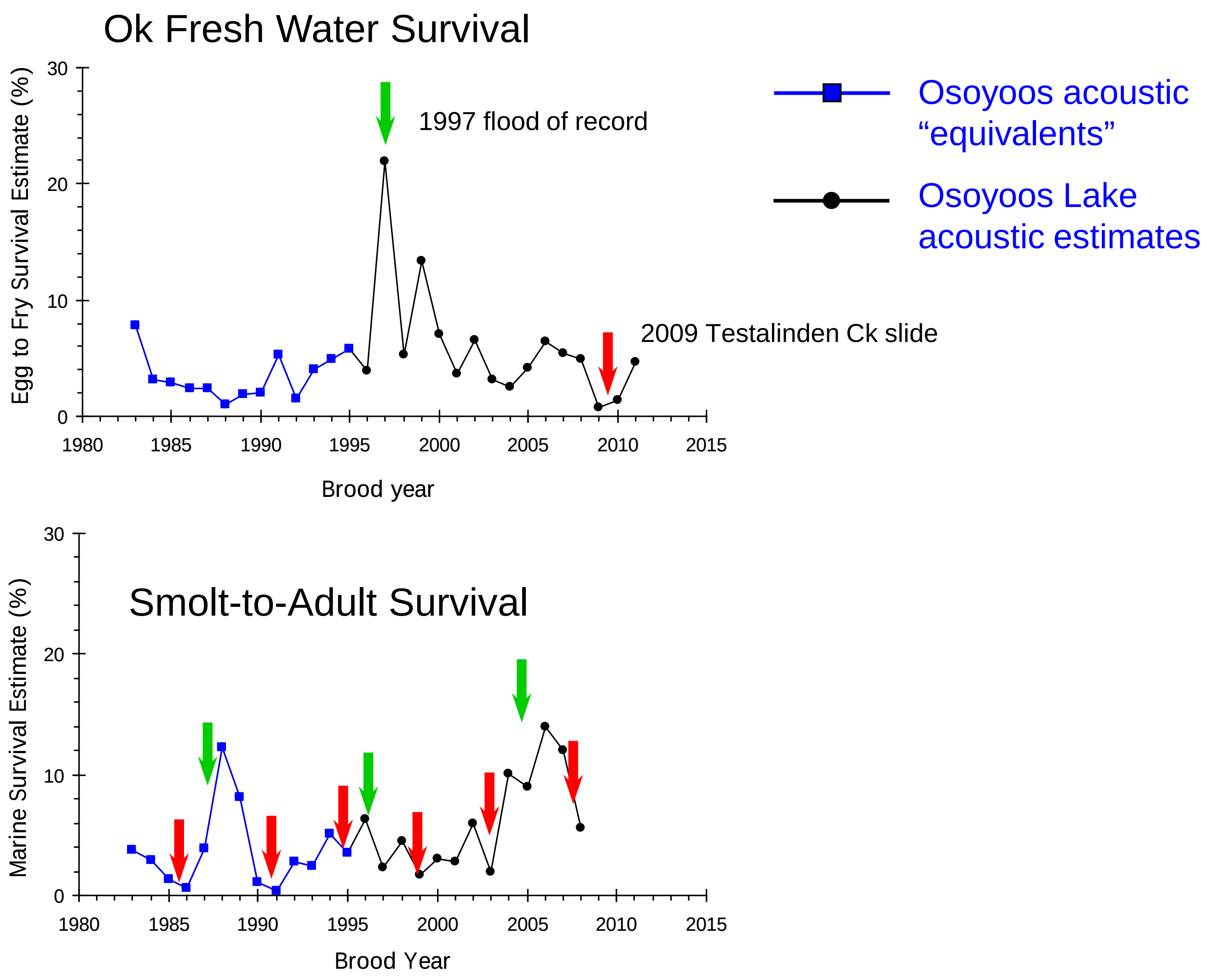


Where do all the sockeye come from ?



Post FWMT deployment, more adult spawners clearly lead to more smolt production as per Hyatt & Rankin (1996) analysis of carrying capacity of river and lake habitats. However, density independent losses of eggs/fry do still occur e.g. spring 2010.

Survival of Ok-sockeye during pre-FWMT and FWMT intervals



Weight of Evidence Summary

- No net impact (NNI) objective for Wells dam was to increase smolt production by 7% above historic baseline.

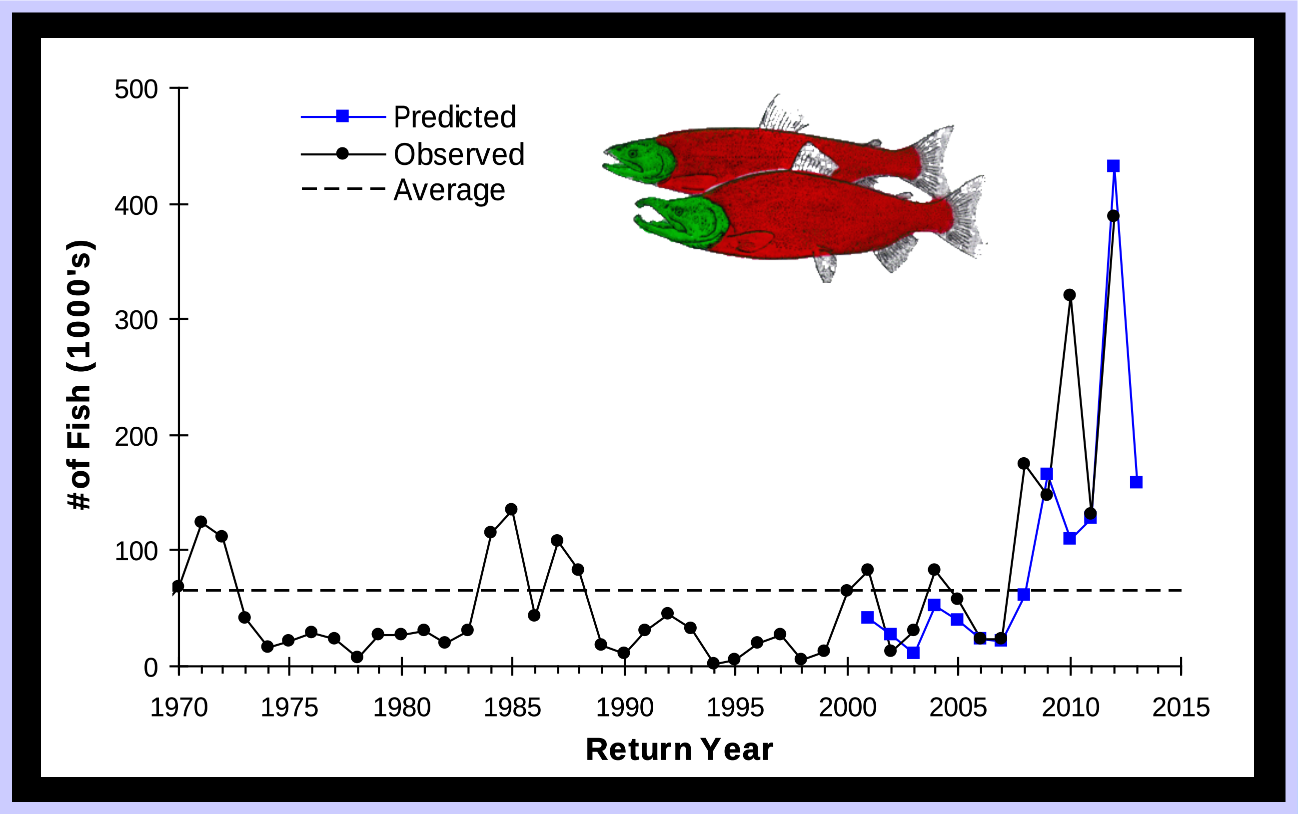
- Retrospective analysis we conducted early on in FWMT deployment suggested a theoretical benefit for FWMT use ranging from a 12.3% (median value) to 55% (mean value) increase in smolt production would be possible.

- The observed average increase in smolt production during the "use-FWMT" decade has been 137%.

- Hatchery origin smolts from the Skaha reintroduction project account for 10% of this increase i.e. 90% of the increased smolt production is attrubatble to wild production.

- Adult production during the pre-FWMT control interval (1967-1998) was 47, 463 by contrast with 234,650 adult returns during the FWMT interval.

Okanagan Sockeye Forecasts and Actual Returns



Conclusions

- FWMT deployment has stabilized smolt production per spawner by reducing density-independent losses from flood-and-scour or drought-and-desiccation events.
- Higher escapements more fully utilize inherent habitat capacity for spawning, egg incubation and rearing fry with resultant increases in annual smolt production
- Average annual output of smolts from Osoyoos L. increased 5-10 fold in 1998-2010 relative to the 1970-1997 interval.
- Record returns of Columbia R. sockeye principally reflect wild Okanagan sockeye increases in escapement, fry (*from the Okanagan R.*), smolt production (*from Osyoos L.*) and favourable smolt-to-adult survival (*in the Columbia R and Pacific Ocean*).

Questions ?

Fisheries and Oceans Canada Pêches et Océans Canada

Canada

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	November 20, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the October 7, 2013 HCP Hatchery Committees Conference Call		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held by conference call on Monday, October 7, 2013, from 9:30 am to 10:15 am. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Greg Mackey will provide Bob Rogers with Douglas PUD's suggested edits to the revised draft Twisp River Steelhead Live Spawning Plan memorandum (*Incubation and early rearing of juvenile Twisp summer steelhead at Methow Hatchery from incomplete viral sampled adult female summer steelhead*).
- Bob Rogers will remove references about Winthrop National Fish Hatchery (NFH) from the background section of the revised draft Twisp River Steelhead Live Spawning Plan memorandum, and will instead convey that Methow Hatchery can accommodate the program.
- Jayson Wahls and Greg Mackey will provide the Yakama Nation (YN) with a budget of expected costs associated with the YN's use of the Methow facility for their Steelhead Kelt Reconditioning Program.
- Bob Rogers will have Washington Department of Fish and Wildlife (WDFW) Fish Health staff contact Keely Murdoch regarding the type of sonicator that is needed for processing samples for virus testing of live-spawned Twisp River steelhead at the Methow Hatchery.
- Keely Murdoch and Bob Rogers will contact Lynn Hatcher, once Hatcher becomes available after the government shutdown, to bring him up to speed on the details of the proposed actions for live-spawning Twisp River steelhead at the Methow Hatchery for the YN's Steelhead Kelt Reconditioning Program.

- Bob Rogers will revise the draft Twisp River Steelhead Live Spawning Plan memorandum, as discussed at the October 7, 2013 conference call, and will provide the updated revised memo to Mike Schiewe and Kristi Geris for distribution to the Hatchery Committees.

I. Welcome, Agenda Review

Mike Schiewe welcomed the Hatchery Committees, and said that the purpose of today's conference call is to discuss the YN's proposal for live-spawning Twisp River steelhead at Methow Hatchery. This agenda item was originally planned for the Hatchery Committees meeting on September 18, 2013, before it was canceled due to limited availability for participation; and due to the time-sensitive nature of the topic, the YN requested that the topic be discussed as soon as possible.

II. Yakama Nation

A. Live-Spawning Twisp River Steelhead Update (Keely Murdoch)

Keely Murdoch thanked everyone for joining the call. She explained that this topic is time-sensitive because, if the proposed actions for live-spawning Twisp River steelhead are approved by the Hatchery Committees, costs associated to the program need to be included in a budget that needs to be submitted to the Bonneville Power Administration (BPA) this month. Murdoch recalled that the Hatchery Committees have been discussing the YN Steelhead Kelt Reconditioning Program over the course of several meetings now. She said that a draft Twisp River Steelhead Live Spawning Plan Statement of Agreement (SOA) was distributed to the Hatchery Committees by Kristi Geris on September 12, 2013, and that a revised draft Twisp River Steelhead Live Spawning Plan memorandum (*Incubation and early rearing of juvenile Twisp summer steelhead at Methow Hatchery from incomplete viral sampled adult female summer steelhead*; Attachment B) was distributed to the Hatchery Committees by Geris prior to the conference call on October 7, 2013. Murdoch said that she hoped to reach agreement on the SOA so that program costs can be included in their BPA budget.

Bob Rogers suggested that Hatchery Committees members review the revised draft memorandum (Attachment B), and then he can address any comments or questions. He said that a revision was made to Planned Action #8 after the revised draft was originally distributed; the revision removed U.S. Fish and Wildlife (USFWS) personnel from involvement in the sampling. He said Planned Action #8 now states that Matt Abrahamse and WDFW will handle all sampling.

Greg Mackey said that Douglas PUD is supportive of the seemingly comprehensive, well-thought out biosecurity plan. He suggested, however, in the interest of informing Douglas PUD and the HCP Hatchery Committee to enable them to make a decision based on WDFW Fish Health Staff's opinion of risk, inclusion of a statement addressing the level of risk this new program would pose to the ongoing spring Chinook and steelhead programs. He said that Hatchery Committees approval will largely be based on whether this action—which is not a part of the HCPs—is worth the risk to the HCP programs. Rogers agreed to include a statement as requested; and added that the level of risk will be minimal so long as the planned actions to minimize risk, as outlined in the revised draft memorandum (Attachment B), are met. *(Note: Douglas PUD subsequently requested in writing [email to Rodgers] following the phone conference that WDFW provide the statement of their fish health risk assessment of the kelt program in a separate letter.)*

Mackey asked that Planned Action #16 in the revised draft memorandum (Attachment B) be clarified to include the different categories of disease. For example, if Infectious Pancreatic Necrosis Virus (IPNV) is detected, it should be clear what needs to be destroyed to avoid virus spreading. Rogers clarified that during spawning, any pairings displaying evidence of pathogens will be destroyed.

Mackey also suggested for Planned Action #15 in the revised draft memorandum (Attachment B), that the text specify an approximate number of days after swim up that the fish can be released from Wells Hatchery. Rogers said that fish health screening samples are collected at swim up, and then at 30 days after swim up. He said it takes another 28 to 30 days to obtain the results of the second sample; so, fish should be ready to transfer about 60 days after swim up. Mackey said that in addition to edits just discussed, Douglas PUD has other minor edits to the revised draft memo that he will provide to Rogers.

Mike Tonseth said that, as long as WDFW Fish Health staff is satisfied that spring Chinook and steelhead are not at risk, he is supportive of what is proposed.

Bill Gale agreed with Tonseth, and added, however, that the background section of the revised draft memorandum (Attachment B) should be revised to indicate that the reason why Winthrop NFH could not accommodate the program was due to Section 10(j) fish being on station, and the inability to make additional commitments of space. Mike Schiewe suggested removing all references about Winthrop NFH as they do not seem to contribute to the document. Rogers said that he will remove the references, and will instead convey that Methow Hatchery can accommodate the program.

Gale speculated that homing to the Methow may improve if early rearing progeny on Methow River water continues. Mackey said that he believes that homing to the Twisp River could decrease because fish would also home to the Methow Hatchery, having potentially imprinted to the hatchery as alevins, but noted that any difference may be difficult to detect given the challenge steelhead pose in assessing straying. Murdoch asked if early rearing will be on river or well water, and Rogers replied that eggs and alevins will be on groundwater. Tonseth noted that as long as the fish are passive integrated transponder- (PIT-) tagged, homing can be monitored. Murdoch added that if any issues arise, methods will be re-evaluated. Schiewe suggested adding a planned action to PIT-tag fish prior to release. Mackey said that Douglas PUD is currently PIT-tagging 5,000 Twisp River fish for monitoring in the acclimation pond. He said that low detection rates make it difficult to accurately estimate levels of straying; and added that additional fish would likely need to be tagged in order to tease out a stray signal. *(Note: There are not sufficient pre-treatment data available to identify an effect on homing and straying that could be related to the kelt program implementation at Methow Hatchery.)*

Kirk Truscott said that, like WDFW and USFWS, the Colville Confederated Tribes (CCT) are also supportive of the proposed plan, so long as WDFW Fish Health staff determine the proposed actions pose acceptably low risk to HCP production. He also noted that the fate of reconditioned adults whose progeny come back positive does not seem to be addressed in the planned actions. Tonseth said that if the juvenile is positive, the adults will be destroyed as well. Mackey said that "all fish linked to that sample" as stated in Planned Action #16 seems to address this issue. Murdoch asked if vertical transmission from a male is common where the result would be euthanizing a reconditioned kelt, and Rogers replied that likelihood is extremely low. Murdoch added that transmission from males can be tracked because all males will be lethally sampled at Methow Hatchery for a full disease workup.

Mackey asked Rodgers if a dedicated steelhead kelt facility will be needed if this program continues in the long-term, and Rogers replied that he could not speak to that. Murdoch said that funding for this program lasts until 2017, and that future funding will be dependent on the success in the next few years. Jayson Wahls said that this year, additional infrastructure such as screens, curtains, and additional tanks, will be needed for bio-security. He added that other things like salaries and benefits will need to be incorporated into a budget. Mackey said that Douglas PUD also needs to develop an agreement with the YN. Murdoch said that Rogers was very clear on what was needed from the YN from the fish health aspect, and that she was unaware that anything beyond his requests were needed; she asked that WDFW and Douglas PUD provide the YN with those requests as soon as possible. Wahls and Mackey agreed to provide the YN with a budget of expected costs associated with the YN's use of the Methow facility for their Steelhead Kelt Reconditioning Program. Rogers also said that he will have WDFW Fish Health staff contact Murdoch regarding the type of sonicator that is needed for processing samples for virus testing of live-spawned Twisp River steelhead at the Methow Hatchery.

Schiewe said that because this program could affect listed species, the National Marine Fisheries Service (NMFS) also needs to be in on the decision. Murdoch and Rogers agreed to contact Lynn Hatcher, once Hatcher becomes available after the federal government shutdown, to bring him up to speed. Schiewe added that WDFW Fish Health's statement characterizing the level of risk also needs to be included in the SOA. Murdoch said that the SOA will reference Roger's revised draft memorandum (Attachment B), which will include the statement about risk. Schiewe said that the SOA will be considered for final approval at the next Hatchery Committees meeting on October 16, 2013, assuming that a full complement of members will be back from the government shutdown. Rogers said that he will revise the draft Twisp River Steelhead Live Spawning Plan memo, as discussed, and will provide the updated revised memo to Schiewe and Geris for distribution to the Hatchery Committees.

III. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees' meetings are on October 16, 2013 (Chelan PUD), November 20, 2013 (Douglas PUD), and December 18, 2013 (Chelan PUD).

List of Attachments

Attachment A	List of Attendees
Attachment B	Memorandum *Incubation and early rearing of juvenile Twisp summer steelhead at Methow Hatchery from incomplete viral sampled adult female summer steelhead*

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Keely Murdoch*	Yakama Nation
Matt Abrahamse	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Bob Rogers	Washington Department of Fish and Wildlife
Jayson Wahls	Washington Department of Fish and Wildlife
Charlie Snow	Washington Department of Fish and Wildlife
Guy Wiest	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

August 07, 2013: Methow Hatchery meeting with Shane Bickford, Greg Mackey, Guy Wiest, Dave Dinsmore, Jason Wahls, and Bob Rogers

Incubation and early rearing of juvenile Twisp summer steelhead at Methow Hatchery from incomplete viral sampled adult female summer steelhead

Background: Earlier discussions identified the USFWS Winthrop Hatchery as a site to hold adult female Twisp summer steelhead for Kelt reconditioning as well as associated short term juvenile rearing. Since then, rearing requirements at Winthrop reportedly have increased with a subsequent incubation/rearing capacity decrease. Conversely, the WDFW Methow Hatchery program has decreased, and the site will have spatial and temporal capabilities (with modifications) to short-term rear the progeny of the live-spawned adults from April-June.

Discussion: Identify actions to minimize the pathogen risk to endangered Spring Chinook at Methow Hatchery by rearing progeny of incomplete viral sampled live-spawned adult female Twisp summer steelhead. Identify pathogen sampling needs at Methow hatchery. Identify modifications at Methow hatchery to accommodate juvenile rearing, annually, with the potential for the short-term rearing to span 4 years.

Planned actions to minimize risk to WDFW Methow Hatchery programs:

1) Adult Twisp stock summer steelhead (13 pairs) will be collected from the Twisp weir and held/spawned at WDFW Methow hatchery (April-May, 2014)

2) Live spawned adult females will be transferred to the USFWS Winthrop Hatchery Kelt site.

3) Ovarian fluid for virology will be collected from each female and individually numbered

4) Ovarian fluid supernatant will be inoculated to CHSE-214 and EPC cells at WDFW Olympia fish health lab

5) Ovarian fluid pellets will be sonicated and inoculated to CHSE-214 and EPC cells at WDFW Olympia fish health lab. **NOTE: REQUIRES PURCHASE OF SONICATOR AND BATH**

6) Kidney/spleen samples for virology will be collected from each male and numbered individually. These samples will be inoculated to CHSE-214 cells at WDFW Olympia lab

7) All mortalities at Methow Hatchery will sampled for virology and submitted to WDFW Olympia lab

8) All post-spawn mortality of female Twisp kelts at USFWS Winthrop Hatchery will be sampled by USFWS fish health personnel for virology if possible. If USFWS personnel are not able to sample mortality, WDFW personnel will be notified and will collect the samples

9) Individual egg incubation/hatching/rearing tanks/tools will be used. Rearing containers (circular tanks) will be separated by curtains (yet to be built/installed). Access to incubation room/rearing tanks will be restricted by physical barriers and signs

10) Additional disinfection pads (virkon) will be added at access points

11) All tools will be disinfected with 1:100 dilution of Virkon Aquatic for a minimum 10 minute contact time

12) Healthy and moribund/mortality fish will be examined periodically and sampled as necessary

13) 150 un-fed fry will be sampled at swim-up for virology. Moribund fish will be sampled at any time as determined needed. Samples will be representative of the total spawn, i.e., equal numbers of fry from each female

14) 150 fed fry will be sampled at approx 30days after start of feed for virology. Moribund fish will be sampled at any time as determined needed. Samples will be representative of the total spawn, i.e., equal numbers of fry from each female

15) Juveniles will be transferred to Wells Hatchery for rearing and release only after viral assay results are completed and no evidence of virus is found

16) In the event that any regulated viral pathogen is detected in any juvenile sample, all parties agree in advance that all fish linked to that sample will immediately be euthanized. Subsequent to that, increased monitoring for clinical evidence and/or increased mortality of remaining fish will be implemented with samples taken as appropriate

17) Hatchery staff will work from known "clean" areas of the facility to areas of "unknown" fish health status. Hatchery staff will set up a "keep-out" perimeter for all non-hatchery personnel.

Robert W Rogers

WDFW Fish Health, Region 2

PO Box 856

421 W 4th Ave

Omak, WA 98841

ph/FAX 509-826-7338

cell 509-429-8208

Robert.Rogers@dfw.wa.gov

Modified September 25, 2013 (Consult with John Kerwin)

ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	November 20, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the October 16, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Chelan PUD headquarters in Wenatchee, Washington, on Wednesday, October 16, 2013, from 9:30 am to 1:00 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Kristi Geris will follow up with Lynn Hatcher, once he becomes available after the government shutdown, regarding his approval of the Hatchery Committees August 21, 2013 meeting minutes, prior to finalizing and distributing them to the Committees (Item I). *(Note: Hatcher approved the Hatchery Committees August 21, 2013 meeting minutes via email on October 18, 2013, and the final meeting minutes were distributed to the Hatchery Committees by Geris on October 21, 2013.)*
- Greg Mackey will follow up with Tom Kahler by October 18, 2013, regarding Douglas PUD's approval of the Okanagan Nations Alliance (ONA) Sockeye Program Update memorandum, prior to Kristi Geris finalizing and distributing the memorandum to the Committees (Item I). *(Note: Kahler provided minor grammatical edits to and his approval of the ONA Sockeye Program Update memorandum via email on October 18, 2013, as distributed to the Hatchery Committees by Geris on October 21, 2013.)*
- Greg Mackey will provide Douglas PUD's revised edits to the Twisp River Steelhead Live Spawning Plan Statement of Agreement (SOA) to the Yakama Nation (YN; Item II-A).
- The YN will provide a revised Twisp River Steelhead Live Spawning Plan SOA to Kristi Geris for distribution to the Hatchery Committees by October 21, 2013, that includes: 1) Douglas PUD's suggested revisions; 2) the revised Washington Department of Fish and Wildlife (WDFW) Fish Health risk analysis memorandum

and the revised Twisp River Steelhead Live Spawning Plan; and 3) a statement indicating that the YN will keep the Hatchery Committees updated on progress and results of their Steelhead Kelt Reconditioning Program (Item II-A). *(Note: Keely Murdoch provided the final revised SOA to Geris on October 22, 2013, which Geris distributed to the Hatchery Committees, along with the revised WDFW Fish Health risk analysis memorandum and the revised Twisp River Steelhead Live Spawning Plan, on that same day.)*

- The YN will prepare a Chewuch Acclimation Plan SOA, and will provide the SOA to Kristi Geris for distribution to the Hatchery Committees. The YN will be requesting approval of the SOA at the Hatchery Committees' meeting on November 20, 2013 (Item II-B).
- Keely Murdoch will provide Kirk Truscott with data on adipose-fin-wire (ad-wire) retention (Item II-B).
- The YN will develop a document summarizing their plans for expanding acclimation areas in the upper Methow, and will provide the document to Kristi Geris for distribution to the Hatchery Committees (Item II-B).
- Keely Murdoch will provide the YN's non-target taxa of concern (NTTOC) model runs to Greg Mackey (Item III-A).
- Greg Mackey will develop a document that summarizes the NTTOC model runs, and will distribute the document in early 2014 (Item III-A).
- The Hatchery Committees representatives will provide comments on the Hatchery Monitoring and Evaluation (M&E) Plan Tables to Greg Mackey no later than November 11, 2013, for discussion at the Hatchery Committees' meeting on November 20, 2013 (Item III-B).
- Chelan PUD and Grant PUD will incorporate their respective data into the Hatchery M&E Plan Tables, and will provide the updated tables to Greg Mackey no later than November 11, 2013, for discussion at the Hatchery Committees' meeting on November 20, 2013 (Item III-B).
- **Kristi Geris distributed a meeting invite for a conference call on November 6, 2013, from 10:00 am to 12:00 pm, to discuss Chelan PUD's draft 2014 M&E Implementation Plan (Item IV-B).**
- Chelan PUD will provide a revised Methow Spring Chinook Hatchery and Genetic Management Plan (HGMP) for review to Kristi Geris for distribution to the Hatchery

Committees no later than October 25, 2013 (Item IV-D).

STATEMENT OF AGREEMENT DECISION SUMMARY

- No SOAs were approved at today's meeting.

AGREEMENTS

- The Hatchery Committees representatives present agreed to consider approval of the Twisp River Steelhead Live Spawning Plan SOA by email (Item II-A).
- The Hatchery Committees representatives present agreed to a Chelan PUD request for 3,500 summer Chinook salmon eggs (from those destined for final acclimation and release at the Chelan Falls Acclimation Facility) for use in an egg-fry survival study in the Chelan River Tailrace and habitat channel (Item IV-A).
- The Hatchery Committees representatives present agreed to Chelan PUD's request for a shortened review period for their draft 2014 Hatchery M&E Implementation Plan, in order to assist Chelan PUD in meeting their contracting deadlines (Item IV-B).

REVIEW ITEMS

- Mike Schiewe sent an email to the Hatchery Committees on September 13, 2013, notifying them that the draft Douglas PUD 2012 M&E Plan Report is available for review for a 60-day period, with comments due to Greg Mackey no later than November 14, 2013 (Item III-D).

FINALIZED REPORTS

- The final Twisp Steelhead Relative Reproductive Success 2012 Genotyping Report was distributed to the Hatchery Committees by Kristi Geris on September 9, 2013 (Item III-E).

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Greg Mackey added: 1) a Chief Joseph Summer Chinook Program update; and 2) an introduction to the Wells and Methow Hatcheries M&E Implementation Strategy for 2014.
- Alene Underwood added: 1) an introduction to the SOA for estimating carrying capacity using juvenile data; 2) a Methow Spring Chinook HGMP update; and 3) a Chelan PUD staff update.

The Hatchery Committees reviewed the revised draft August 21, 2013 meeting minutes. Kristi Geris said that a third revised draft was distributed to the Hatchery Committees on September 17, 2013. She said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that a redline strikeout version was also distributed along with the third revised draft that tracked comments addressed from the first and second revised drafts. She said that there was one outstanding comment remaining to be discussed regarding the Colville Confederated Tribes' (CCT's) Hatchery Brood Collection agenda item. Kirk Truscott clarified via email on October 21, 2013, that the fourth side of the broodstock compound at Chief Joseph Hatchery is a steep hill that is unfenced. He said that the loss of broodstock occurred when individuals climbed the hill and came into the compound, took the fish, and passed them under the gate of the perimeter fence and into a vehicle that was parked at the entrance to the compound. He also noted that vehicle access to the broodstock compound has now been secured with a locked gate near Chief Joseph Dam (approximately 0.5 mile from the broodstock compound). Keely Murdoch also clarified a statement that she made during the YN's live-spawning Twisp River Steelhead broodstock agenda item. She clarified that at the time of the discussion, the plan was to discontinue live-spawning of Twisp broodstock if Infectious Pancreatic Necrosis Virus (IPNV) was detected; and not discontinue the Kelt Reconditioning Program. The Hatchery Committees members present conditionally approved the August 21, 2013 meeting minutes, pending Lynn Hatcher's approval. Geris will follow up with Hatcher, once he becomes available after the government shutdown, regarding his approval of the minutes, prior to finalizing and distributing them to the Committees. *(Note: Hatcher approved the Hatchery Committees August 21, 2013 meeting minutes via email on October 18, 2013, and the final meeting minutes were distributed to the Hatchery Committees by Geris on October 21, 2013.)*

A memorandum providing a summary of the Wells Hatchery Modernization Workshop that was held at Douglas PUD headquarters in East Wenatchee, Washington, on Wednesday, August 21, 2013, from 1:00 pm to 3:30 pm, was distributed to the Hatchery Committees on September 3, 2013. All comments and revisions received from members of the Committees were incorporated in the revised memo, and the final Wells Hatchery Modernization Workshop memo was approved via email by the Wells Hatchery Committee on September 17, 2013, as distributed to the Committees by Geris that same day.

Geris said that a memorandum providing a summary of the ONA Sockeye Program Update from the Priest Rapids Coordinating Committee Hatchery Subcommittee (PRCC HSC) meeting that was held at Chelan PUD headquarters in Wenatchee, Washington, on Thursday, August 22, 2013, from 9:00 am to 11:00 am, was distributed to the Hatchery Committees on September 3, 2013. She said that no comments or revisions were received from members of the Committees. The Hatchery Committees members present conditionally approved the ONA Sockeye Program Update memorandum, pending Douglas PUD's approval. Greg Mackey said that he will follow up with Tom Kahler regarding Douglas PUD's approval of the memorandum, prior to Geris finalizing and distributing the memorandum to the Committees. *(Note: Kahler provided minor grammatical edits and his approval the ONA Sockeye Program Update memorandum via email on October 18, 2013, as distributed to the Hatchery Committees by Geris on October 21, 2013.)*

II. Yakama Nation

A. DECISION: Twisp River Steelhead Live Spawning Plan SOA (Keely Murdoch)

Keely Murdoch said that a revised draft Twisp River Steelhead Live Spawning Plan SOA was distributed to the Hatchery Committees by Kristi Geris on October 15, 2013; and added that edits received from the CCT and WDFW were incorporated into the revised draft. She said that all action items pertaining to the SOA have been completed, including revising the SOA to indicate that the YN will cover additional costs that were identified in the budgets provided by WDFW and Douglas PUD. She said that a WDFW Fish Health risk analysis memorandum and a revised draft Twisp River Steelhead Live Spawning Plan were also distributed to the Hatchery Committees by Geris on October 15, 2013. She noted that the revised draft plan included a reduced number for sampling (i.e., combined total). Mike Tonseth also noted a typo in the WDFW Fish Health risk analysis memorandum. A revised memorandum and the revised Twisp River Steelhead Live Spawning Plan (Attachment B) were distributed to the Hatchery Committees by Geris on October 22, 2013.

Bill Gale asked if the YN has received feedback on the SOA or plan from the National Marine Fisheries Service (NMFS), and Murdoch replied that they have not. She said, however, that spawning of Twisp fish is included in permits that have been approved by NMFS; and she added that kelt reconditioning is a Reasonable and Prudent Alternative (RPA) in the Federal Columbia River Power System (FCRPS) Biological Opinion. She said that the Twisp Program (i.e., adult holding and live-spawning, at Methow Hatchery) was accounted for in the HGMP. Mike Schiewe noted that because there are listed species involved, NMFS should be consulted prior to approval of the SOA.

Greg Mackey said that prior to approving the SOA, Douglas PUD will need time for internal review of the revised SOA and the WDFW Fish Health risk analysis memorandum; and also Douglas PUD and the YN need to have a discussion about the budget. Tom Scribner said that he had received Douglas PUD's budget, and that there are a few pending details to be worked out with WDFW, but all costs will be covered. Murdoch added that those details are largely about timeline. She said, for example, that the YN will purchase items that are needed now, such as a sonicator; however, items that are not needed now will be purchased after the YN's new Bonneville Power Administration (BPA) budget begins and subcontracting is in place (i.e., likely around late-March or early-April 2014). Mackey said that those details are what Douglas PUD and the YN need to discuss. He added that Douglas PUD has edits to the SOA and that, once updated per today's discussions, he will provide those edits to the YN. Murdoch asked what the timeline is for Douglas PUD's internal process, and Mackey replied that it depends on schedules and availability, but that it would likely be just a few days.

Gale suggested that the YN include language in the SOA or plan that states that they will keep the Hatchery Committees updated on the progress and success of the Steelhead Kelt Reconditioning Program. Kirk Truscott also suggested that aside from results of the Program, the reports should also address any effects on the ongoing HCP programs. Tonseth added that it also seems important to highlight fish health problems, if any, affecting overall hatchery production. Mackey suggested incorporating an update in the monthly Hatchery M&E report that Charlie Snow provides, and Murdoch replied that Matt Abrahamse of the

YN develops a similar report; she suggested that the same fish health update can be included in both publications.

The YN agreed to provide a final revised Twisp River Steelhead Live Spawning Plan SOA to Geris for distribution to the Hatchery Committees by October 21, 2013, that includes: 1) Douglas PUD's suggested revisions; 2) the revised WDFW Fish Health risk analysis memorandum and the revised Twisp River Steelhead Live Spawning Plan; and 3) a statement indicating that the YN will keep the Hatchery Committees updated on progress and results of their Steelhead Kelt Reconditioning Program. *(Note: Murdoch provided the final revised SOA [Attachment C] to Geris on October 22, 2013, which Geris distributed to the Hatchery Committees, along with the revised WDFW Fish Health risk analysis memorandum and the revised Twisp River Steelhead Live Spawning Plan, on that same day.)* In consideration of time constraints, the Hatchery Committees representatives present agreed to consider approval of the Twisp River Steelhead Live Spawning Plan SOA by email consent.

B. Expanded Acclimation in the Methow (Keely Murdoch)

Chewuch Acclimation Plan

Keely Murdoch said that a draft Chewuch Acclimation Plan (Attachment B) was distributed to the Hatchery Committees by Kristi Geris on October 10, 2013, per the Hatchery Committees' request. She noted that the plan is limited to acclimation only, and that the other program components will be included in Chelan PUD's Spring Chinook HGMP. She said that a SOA was not developed because she was unsure if one was needed; and she asked if approval of the acclimation plan would be included under the approval of Chelan PUD's HGMP. Greg Mackey said that Douglas PUD would not require a SOA regarding how Chelan PUD's program is managed because it is not Douglas PUD's program. Mike Tonseth recalled discussing at the Hatchery Committees' meeting on August 21, 2013, the need for two SOAs: 1) a facility sharing agreement between the YN and Douglas PUD; and 2) an agreement for the use of the facility for Chelan PUD production. Tonseth said, however, that if the YN's program is included as a long-term program in the Chelan PUD Spring Chinook HGMP, any SOA for that HGMP would probably suffice. Alene Underwood reminded the Hatchery Committees that in 2014, Chelan PUD's 60,516 spring Chinook obligation will be overwinter reared in Grant PUD's new Carlton Acclimation Facility. Murdoch suggested that, for now, the Hatchery Committees review and comment on the draft Chewuch Acclimation Plan, and then a SOA can be developed, if needed, for review at the Hatchery Committees' meeting on November 20, 2013. Bill Gale said that, logically, brood collection should be discussed prior to acclimation. He added that he does not want to see Winthrop fish taking the place of spring Chinook from the conservation program at Methow FH, Winthrop is to serve as a safety net program and therefore should not be the first choice for use in an acclimation facility. Tonseth said that this acclimation plan is still a step that needs to be completed; and Murdoch added that National Environmental Policy Act (NEPA) processes are required for all expanded acclimation programs, and so approval is needed by BPA. Gale said that he would be supportive of a SOA, and suggested including a caveat statement that the SOA is contingent on brood collection. Murdoch said that the YN will prepare a Chewuch Acclimation Plan SOA, and will provide the SOA to Geris for distribution to the Hatchery Committees. The YN will be requesting approval of the SOA at the Hatchery Committees meeting on November 20, 2013.

Tom Scribner agreed with Gale's genetic concerns about releasing safety net fish in the Chewuch; and Gale added that he sees no genetic concern for this year. He said, however, that in the long-term, there is concern. Tonseth said the safety net program has many purposes, but the program is intended to be used only when absolutely necessary. He said the program is a stop-gap measure to ensure production targets are met, in the event of unforeseen events. Gale said that if safety net fish are used, in general, his preference would be that they are released from the Methow—not the Chewuch.

<u>Expanding Acclimation Areas in the Upper Methow</u>

Murdoch said that the YN is interested in expanding acclimation areas in the upper Methow. Scribner said that a formal plan is not yet developed, but at this point, the YN is hoping to obtain a "concept commitment" from the Hatchery Committees. He said that, in the interest of enhancing natural production, the YN is interested in moving acclimation and release of all conservation production to locations with the best opportunity to spawn and naturally reproduce. He said these areas include places such as Early Winters Creek, Goat Wall, Heath Ranch, and perhaps others; and he added that there are data that favor moving out of the Methow, and into the upper Methow. He said this would involve permitting and NEPA processes, which would first require agreement, or a commitment, in concept. Schiewe asked if the YN planned to develop a draft plan or concept statement, and Scribner replied that they could. Scribner added that he is interested in gathering feedback from the Hatchery Committees about what is needed to move fish out of Methow Hatchery and into the upper Methow, so that those discussions can take place and issues can be addressed.

Tonseth noted that this concept should also be discussed within the PRCC HSC, and Scribner said that he can present these plans to the HSC as well. Mackey also suggested approaching this concept on a reach-by-reach basis—for example, how many fish should return where—as it relates to spawning abundance thought to be needed in a reach and to percent hatchery origin spawners (pHOS) issues. He said the conservation program also serves as a demographic and genetic buffer, and cautioned that a measured approach should be developed. He said there are data showing spawning distributions, and he asked what those data indicate about available capacity. He said those types of data should indicate how many additional fish should be targeted to return to certain areas. Murdoch noted that some of that information is unknown.

Tonseth added that there are also the added issues of acquiring brood in particular locations. Murdoch asked whether, for hatchery origin fish, it makes sense to trap at Wells. Kirk Truscott said that the CCT will have returning adults from the Section 10(j) releases in the Okanogan that will be adipose-fin-present (ad-present). Murdoch noted that there are marking schemes to distinguish where fish are headed, and asked whether these types of techniques should be employed. Tonseth said that those types of measures are not yet in place, and he added that it takes time to get those measures approved, and that there would be an interim period where origin of fish was indistinguishable. Truscott asked if there are data on ad-wire retention, and Murdoch said that she will provide Truscott with those data.

Tonseth suggested that another option would be passive integrated transponder (PIT-)-tagging a large enough group; however, high costs would be associated with that option. Murdoch said that if the goal is to separate Twisp and Methow hatchery fish, she suggested employing Parental Based Tagging (PBT), and she added that this option may be cheaper than coded wire tags. She also added that the YN is considering PBT for their coho program to track parentage and source programs. Mackey noted that PBT delays fish migration for one week, which is not desirable. Gale agreed that PBT may not be a good choice, and suggested exploring alternatives. He said that it may not be ideal to have all fish in acclimation ponds.

Scriber said that he appreciates the comments, and agreed that it makes biological sense to take a measured approach to expanding acclimation in the upper Methow. Mackey noted that even if fish are released in upper river ponds, there is the possibility that those fish may volunteer back to the Methow Hatchery. He added that if fish are moved upstream, the water may have stronger cues; and Truscott noted that the M&E program should inform those questions. Tonseth said that the Methow has not been operated in a manner to test homing fidelity, and he suggested looking at data from the Chewuch to get a general feel for what may be going on. Gale also suggested looking at data from Winthrop National Fish Hatchery because the same water source is used there as at Methow Hatchery.

Scribner said that the YN will develop a document that analyzes the factors discussed and summarizes their plans for expanding acclimation areas in the upper Methow, and will provide the document to Geris for distribution to the Hatchery Committees. Schiewe asked if this program would go through an Independent Scientific Review Panel (ISRP) review, and Murdoch replied that the program already went through ISRP review in 2008.

III. Douglas PUD

A. NTTOC Update (All)

Mike Schiewe summarized that NTTOC analyses were last discussed about one year ago. He said that at that time, Chelan PUD and the CCT had not run their models; and then he asked if there has been any progress. Greg Mackey said that Douglas PUD, Grant PUD, the U.S. Fish and Wildlife Service (USFWS), Chelan PUD, and the YN have all run their models. He added, however, that he has not yet received the YN's data. Keely Murdoch said that she will provide the YN's NTTOC model runs to Mackey. Bill Gale clarified that models have been run for Winthrop, but not for the Entiat; he added that those will be completed. Mackey also said that last fall, Andrew Murdoch ran Chelan PUD's programs and those data have now been incorporated into the database of model runs. He said that although many model runs have not been completed, there are now hundreds of model runs in the dataset and it is very robust. However, there is still the uncertainty as to why some model runs do not work.

Keely Murdoch and Gale both recalled having the same issue where models would not run if the non-target taxa were larger than the program fish; and Keely Murdoch noted that this was often the case in model runs of coho against steelhead. Gale suggested making the decision to assume the effects are negligible when NTTOC fish are larger than program fish. Mackey said that various people have consulted Craig Busack, but Busack indicated that he did not have the time or the resources to delve into coding issues. Mackey added that Douglas PUD programmers have determined that fixing the program cannot be done easily; and that Andrew Murdoch is in the process of having WDFW programmers look into it, but WDFW has not yet done this. Gale asked if the only issue is what he and Keely Murdoch mentioned. Mackey replied that it is the only major issue; however, that there are also other minor issues.

Mackey recalled that the original intent of the NTTOC modeling was to develop a report summarizing the results. He said the methods are already written in a published paper; and in order to complete this task, he suggested tabulating the results, writing a summary and interpretation of the results, and acknowledging the limitations of the existing model. He added that conclusions can always be revisited if the code ever gets fixed. Keely Murdoch asked about the Delphi review panel, and Mackey said the panel could consist of a more local, accessible group since the problems with the model does not justify a major Delphi panel effort. He added that, now, he is unsure of the value of convening the panel. Keely Murdoch suggested that the Delphi approach, at this point, might be more worthwhile than the model outputs; and she added that the Delphi panelists might address issues or concerns the models cannot address. She said that the Delphi determinations can then be compared to the models. Todd Pearsons suggested that the report might consider the results in terms of high, medium, and low risk. He said that this approach would make evaluating the thousands of comparisons more manageable.

Gale asked if the models indicated any large negative impacts, and Mackey replied that the vast majority of effects were small. Mackey noted that some programs were showing inflated effects due to data entry artifacts. He said he believes that this error was fixed, and that the summary report would include a discussion evaluating the possible source of error.

Mackey volunteered to develop a short report summarizing the modeling results in order to finalize the NTTOC study with the Hatchery Committees. Schiewe agreed that developing a short report is a good first step, and suggested that the report may identify the need for a Delphi review panel. Mike Tonseth also suggested that the Hatchery Committees come to consensus on how to close the loop on the NTTOC SOA. He added that it may be closed as inconclusive, but that is acceptable if that is the outcome. Mackey said that he will develop a document that summarizes the NTTOC model runs, and will distribute the document in early 2014.

B. Hatchery M&E Plan Tables (All)

Greg Mackey said that the draft Hatchery M&E Appendices tables were distributed to the Hatchery Committees by Kristi Geris on September 24, 2013. He noted that the tables are reference tables for the Hatchery M&E Plan, and that the Hatchery Committees agreed at the Hatchery Committees' meeting on August 21, 2013, that Mackey should develop the tables. He noted that the tables primarily include Douglas PUD data, and that Chelan PUD and Grant PUD still need to populate their respective data. He also noted that he has included an appendix with a collection of carrying capacity estimates that have been done by various authors for populations in this region and much of the information was already compiled in the Quantitative Analytical Report (QAR). He stressed that the carrying capacity estimates are not a metric of the M&E Plan; rather, they are meant to be informational reference numbers.

The Hatchery Committees representatives agreed to provide comments on the Hatchery M&E Plan Tables to Mackey no later than November 11, 2013, for discussion at the Hatchery Committees' meeting on November 20, 2013. Chelan PUD and Grant PUD also agreed to incorporate their respective data into the tables, and provide the updated tables to Mackey by the November 11, 2013 comment deadline. The Hatchery Committees also agreed that Grant PUD should be invited to participate in the Hatchery M&E Plan Tables discussions at the Hatchery Committees' meeting on November 20, 2013.

C. Chief Joseph Summer Chinook Program Update (Greg Mackey)

Greg Mackey said that the summer Chinook from Chief Joseph's program that were reared at Wells Hatchery will be transferred to Chief Joseph's acclimation pond at the end of October.

He reminded the Committees that a single year of summer Chinook production was reared at Wells Hatchery to meet Douglas PUD's mitigation in lieu of Chief Joseph production because Chief Joseph's facility was not yet ready to accommodate the program.

D. Draft Douglas PUD 2012 Hatchery M&E Report (Greg Mackey)

Greg Mackey reminded the Hatchery Committees that Mike Schiewe sent an email to the Hatchery Committees on September 13, 2013, notifying them that the draft Douglas PUD 2012 M&E Plan Report is available for review for a 60-day period, with comments due to Mackey no later than November 14, 2013.

E. Twisp Steelhead Relative Reproductive Success 2012 Genotyping Report Update (Greg Mackey)

Greg Mackey said that the final Twisp Steelhead Relative Reproductive Success 2012 Genotyping Report was distributed to the Hatchery Committees by Kristi Geris on September 9, 2013. He noted that WDFW has updated the single nucleotide polymorphic loci (SNPs) panel that was used for analysis in this report. He said that the first four years of the study were run with a preliminary SNP panel, but because certain markers were not conforming or meeting genetic statistical expectations, the panel has been updated, with some markers removed and new ones added, to create the final panel that WDFW plans to use. All the analyses from the previous years in the study were rerun with the new SNP panel, so all data are consistent and up to date. He said that results were reanalyzed, and no differences from past analyses were observed.

Alene Underwood asked when the study ends, and Mackey replied that he believes a final report will be developed in 2021. He added that the last parent cohort will be collected around 2017, and then parental analyses will begin to be run on parents and returning adult offspring, while the study awaits the final offspring to return. He also added that the study was designed to include grandchildren from earlier cohorts.

F. Wells and Methow Hatcheries M&E Implementation Strategy for 2014 (Greg Mackey)

Greg Mackey reviewed the Wells and Methow Hatcheries M&E Implementation Strategy for 2014 (Attachment C), which Kristi Geris distributed to the Hatchery Committees on October 17, 2013. He recalled that the Hatchery Committees had agreed that Chelan PUD and

Douglas PUD would provide their respective draft M&E Implementation Plans to the Hatchery Committees for review no later than July 1 of the year preceding the proposed M&E activities. However, as provided in a letter to the Hatchery Committees on July 1, 2013, due to uncertainty in the M&E requirements pending consultation and issuance of Endangered Species Act (ESA) permits for Methow Spring Chinook, Wells Steelhead, and Wells Summer Chinook, Douglas PUD was unable to provide a plan by that deadline. Mackey said that on September 20, 2013, Douglas PUD received a letter from NMFS indicating that the existing ESA permits would be temporarily extended, with no specific end date. He said that because the new permits will contain terms and conditions that will likely affect the M&E program, Douglas PUD plans to develop a compartmentalized M&E implementation plan that can be contracted as separate work orders for each major activity. Mackey said that he will provide this draft plan to the Hatchery Committees as soon as it is complete.

IV. Chelan PUD

A. Summer Chinook Egg Request (Alene Underwood)

Alene Underwood said that a request for 3,500 summer Chinook salmon eggs for Chelan River egg-fry survival studies (Attachment D) was distributed to the Hatchery Committees by Kristi Geris on October 4, 2013. Underwood said that the request is largely the same as the request that was approved by the Hatchery Committees in 2012, only more eggs are being requested this year (3,000 eggs were requested in 2012), and some of the methodologies are slightly different from those used in previous years.

Mike Tonseth asked if there is an end date to these studies, and Underwood replied that there is not, and she added that the evaluation is tied to the Lake Chelan license. She said the studies are addressing egg survival, which the proposal explains in greater detail. Tonseth requested that for future years, the need for additional eggs is requested earlier. He said his concern is that the request is for almost an equivalent of a full female of eggs and collection has already passed. He added that although this will not be an issue this year, he would like to avoid potential issues (i.e., such as precluding meeting Rocky Reach mitigation) in the future.

Kirk Truscott recalled the dissolved oxygen (DO) issue with rearing juveniles at Chelan Falls in 2012, and Underwood clarified that the DO issue arose at the end of rearing which prompted the early release. She added that earlier in rearing, there was also a disease problem. She said that no strong correlations could be made linking the 2012 outcomes to DO issues.

The Hatchery Committees representatives present agreed to Chelan PUD's request for 3,500 summer Chinook salmon eggs (from those destined for final acclimation and release at the Chelan Falls Acclimation Facility) for use in an egg-fry survival study in the Chelan River Tailrace and habitat channel.

B. Draft Chelan PUD 2014 M&E Implementation Plan (Alene Underwood)

Alene Underwood said that a draft Chelan PUD 2014 M&E Implementation Plan was distributed to the Hatchery Committees by Kristi Geris on October 15, 2013. She noted that the draft plan was distributed by the October deadline as promised at the Hatchery Committees meeting on July 17, 2013. She said that the draft plan includes only Chelan PUD's programs, and explained that because contracting will be completed separately from the other PUDs, it was decided that they will develop separate plans. She said a section was added to the introduction that explains what methods in the plan differ from previous year's methodologies. She also said that the plan is organized differently than in the past. She said it is organized in a similar fashion as the Request for Proposal, which, Underwood said, seems to be more user-friendly. She said the draft plan does not include sockeye, and that Chelan PUD hoped to have a discussion regarding proposed sockeye activities at the November 20, 2013 meeting. She said the plan includes adult monitoring in the Methow although there is an understanding with Grant PUD that this work will be shared.

Mike Tonseth noted that the draft Chelan PUD 2014 M&E Implementation Plan no longer included Table 1 that assigns tasks and responsible parties; and Underwood said that she can re-incorporate Table 1 into a revised draft plan and provide the revised plan to Geris for distribution to the Hatchery Committees. Chelan PUD re-incorporated Table 1 and also added language for the Chelan Falls summer Chinook and Methow spring Chinook aquaculture monitoring component into a revised draft plan (Attachment E), and provided the updated plan to Geris on October 17, 2013, which she distributed to the Hatchery Committees that same day.

Underwood requested a conference call in two weeks to discuss comments on the plan, and added that she hoped to obtain the Hatchery Committees' approval of the plan within 2 to 3 weeks in order to continue with contracting. She said that the plan will serve as the scope of work, and so Chelan PUD plans to attach the approved plan to the contract. Tonseth asked if contracting deadlines are driving this expedited process, and Underwood replied that they are. The Hatchery Committees representatives present agreed to Chelan PUD's request for a shortened review period for their draft 2014 Hatchery M&E Implementation Plan to facilitate meeting contracting deadlines. Geris distributed a meeting invite for a conference call on November 6, 2013, from 10:00 am to 12:00 pm, to discuss Chelan PUD's draft 2014 M&E Implementation Plan.

C. SOA for Estimating Carrying Capacity Using Existing Juvenile Data (Catherine Willard)

Catherine Willard said Chelan PUD and Grant PUD are considering developing a SOA to use juvenile data in future habitat carrying capacity estimates in the Wenatchee Basin and target tributaries, and HCP No-Net-Impact (NNI) recalculations. She said that within the next week, Andrew Murdoch will meet with the Joint Fisheries Parties (JFP) to discuss how these data can be used to estimate carrying capacity. Mike Tonseth further explained that there has been a lot of discussion regarding the use of existing data—a lot of which has evolved around juvenile data. He said that recently Murdoch began developing a conceptual approach for how to use existing juvenile data to manage adult activities, and how to define carrying capacity in tributaries and in the basin as a whole. Tonseth added that, currently, Andrew Murdoch is mainly looking at spring Chinook in the basin. He said that Andrew Murdoch's conceptual approach should be available next week, and that the SOA will describe how these data will be used in the future.

Keely Murdoch expressed concern that commitments are already being sought on what data are used for the next recalculations when they are still so far in the future (10 years). Alene Underwood urged collecting data that have a specific use. She said the SOA is not defining methodologies; rather, it is an attempt to be more proactive in preparing for the next recalculations. Keely Murdoch said that according to an article by Williamson et al. (2010), the two driving factors that lower reproductive success are spawning location and fish size at return, and she added that these two factors are different for hatchery versus wild fish. She also added that estimates vary because of how the hatchery program is operated, in addition to natural conditions. Tonseth agreed with Keely Murdoch's recollection of the Williamson et al. (2010) article, but he added that Andrew Murdoch's analyses produced different results. He also added that Andrew Murdoch's findings are a stark contrast to what has been presented in the past, and he recommended keeping an open mind until Andrew Murdoch's findings can be discussed. Tonseth said that once these discussions have taken place in the JFP, the SOA will be presented to the Hatchery Committees for discussion.

D. Methow Spring Chinook HGMP Update (Alene Underwood)

Alene Underwood said that all comments have been received on their Methow Spring Chinook HGMP, and that a revised HGMP for review will be provided to Kristi Geris for distribution to the Hatchery Committees no later than October 25, 2013.

E. Chelan PUD Staff Update (Alene Underwood)

Alene Underwood announced that Catherine Willard, the new Chelan PUD Senior Fisheries Biologist, is now on board. Willard was formerly with the U.S. Forest Service Entiat Ranger District. Underwood said that she will be transitioning many Hatchery Committees topics to Willard, and Underwood encouraged the Hatchery Committees members to contact Willard at any time.

V. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees' meetings are on November 20, 2013 (Douglas PUD); December 18, 2013 (Chelan PUD); and January 15, 2014 (Douglas PUD).

List of Attachments

Attachment A	List of Attendees
Attachment B	Revised WDFW Fish Health risk analysis memorandum and Revised Twisp River Steelhead Live Spawning Plan
Attachment C	Final Revised Twisp River Steelhead Live Spawning Plan SOA

Attachment D	Draft Chewuch Acclimation Plan
Attachment E	Wells and Methow Hatcheries M&E Implementation Strategy for 2014
Attachment F	Request for 3,500 Summer Chinook Salmon Eggs for Chelan River Egg-Fry Survival Studies
Attachment G	Revised Draft Chelan PUD 2014 M&E Implementation Plan

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Catherine Willard	Chelan PUD
Greg Mackey*	Douglas PUD
Todd Pearsons	Grant PUD
Tom Scribner*††	Yakama Nation
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Charlie Snow†	Washington Department of Fish and Wildlife

Notes:
* Denotes Hatchery Committees member or alternate
† Joined by phone
†† Joined by phone for the Yakama Nation agenda items and the Non-Target Taxa of Concern Update

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
FISH PROGRAM
FISH HEALTH UNIT

October 15, 2013

TO: Mike Tonseth

FROM: John Kerwin JK
Fish Health Unit Leader

SUBJECT: Proposed Methow Hatchery Steelhead Kelt Rehabilitation Program

Twisp River steelhead are one of many steelhead stocks in the middle Columbia River that have experienced low stock abundance and are listed under the Endangered Species Act. This has resulted in considerable interest in the question of steelhead kelt reconditioning programs by numerous governmental and non-governmental organizations. It is generally recognized that a successful kelt reconditioning program presents potential boosts to low stock abundance and gene flow between brood years.

However, the reconditioning adult steelhead also presents some inherent fish health risks because of the inability to adequately sample the adult broodstock for serious fish pathogens using standard sampling protocols. Fish health risks are also present for the offspring of these adults because some fish pathogens, notably Infectious Pancreatic Necrosis Virus (IPNV) (transmitted vertically (from parent to progeny)) and Infectious Hematopoietic Necrosis Virus (IHNV) can both cause epidemic juvenile fish losses.

The Washington Department of Fish and Wildlife's (WDFW) Fish Health Unit, staff from the Methow Hatchery, and representatives from Douglas PUD has created the attached document titled: "Incubation and early rearing of juvenile Twisp summer steelhead at Methow Hatchery from incomplete viral sampled adult female summer steelhead".

Both IPNV and IHNV are of the greatest concern because of their ability to be transmitted vertically (from parent to progeny) and the lack of any therapeutant treatment programs if juvenile salmonids become infected. IPNV can be detected inside the ova and is not accessible to any known methods of egg disinfection while IHNV is associated with the surface of the ova and the ova can be successfully surface disinfected if the correct procedures are followed. In the Columbia River Basin in Washington State, IPNV has been isolated from summer steelhead stocks at three hatchery facilities (Wells, Yakima, and Leavenworth hatcheries). For WDFW operated hatcheries in the Upper Columbia River Basin, IPNV has been isolated from adult summer steelhead at the Wells Hatchery in 1988, 1989, 1991, 1993, 1996, and 1997.

Essentially the attached document is a risk assessment and a suite of planned actions designed to minimize risks to the progeny from the unsampled kelts and other salmonids reared at the Methow Hatchery.

WDFW has for over thirty years based fish health protection on avoidance based protocols. Because standard fish pathogen detection protocols that are avoidance based cannot be utilized with steelhead kelt reconditioning programs, the attached strategy should be implemented to reduce the risk of a viral based epidemic at any hatchery facility where a kelt reconditioning program is initiated.

The attached document also includes the following assumptions:

- HSRG recommendations, if any, will be followed;
- A juvenile testing program designed with a minimum sample size for each lot of fish with two sample periods for each specific lot that provides 95% confidence that infected specimens will be sampled, assuming a minimum prevalence of infection equal to or greater than 5% will be approved. For this program, a lot is defined as progeny of a single days spawning. In addition, the males utilized for fertilization will be considered part of the lot.
- All involved natural resource agencies and affected parties will agree to, in advance, the euthanasia of juvenile steelhead that exhibit clinical symptoms of regulated pathogens; confirmed by plaque assay and/or Polymerase Chain Reaction (PCR).

It is our opinion that by following the recommendations made above in this memo and in the attached document that risks associated with the kelt reconditioning program to other salmonid species being reared at the Methow Hatchery will be minimal.

Attachment

Incubation and early rearing of juvenile Twisp summer steelhead at Methow Hatchery from incomplete viral sampled adult female summer steelhead

Shane Bickford, Greg Mackey, Guy Wiest, Dave Dinsmore, Jason Wahls, and Bob Rogers

October 11, 2013

Background: Earlier discussions identified the USFWS Winthrop Hatchery (WNFH) as a site to hold adult female Twisp summer steelhead for Kelt reconditioning as well as associated short term juvenile rearing. However, WNFH cannot provide early juvenile rearing in support of the kelt program at this time. Conversely, the Methow Hatchery has spatial and temporal capabilities (with modifications as described below) to short-term rear the progeny of the live-spawned adults from April-June.

Discussion: Identify actions to minimize the pathogen risk to endangered Spring Chinook at Methow Hatchery by rearing progeny of incomplete viral sampled live-spawned adult female Twisp summer steelhead. Identify pathogen sampling needs at Methow hatchery. Identify modifications at Methow hatchery to accommodate juvenile rearing, annually, with the potential for the short-term rearing to occur for up to 4 brood years (2014-2017).

Planned actions to minimize risk to WDFW Methow Hatchery programs:

1) Adult Twisp stock summer steelhead (13 pairs) will be collected from the Twisp weir March-May and held/spawned at Methow Hatchery (April-May)

2) Live spawned adult females will be double tagged with both a PIT tag and VI tag prior to being transferred to the USFWS Winthrop Hatchery Kelt site.

3) Ovarian fluid for virology will be collected from each female and individually numbered

4) Ovarian fluid supernatant will be inoculated to CHSE-214 and EPC cells at WDFW Olympia fish health lab

5) Ovarian fluid pellets will be sonicated and inoculated to CHSE-214 and EPC cells at WDFW Olympia fish health lab.

6) Kidney/spleen samples for virology will be collected from each male and numbered individually. These samples will be inoculated to CHSE-214 cells at WDFW Olympia lab

7) All mortalities at Methow Hatchery will be sampled for virology and submitted to WDFW Olympia Fish Health lab.

8) All post-spawn mortality of female Twisp kelts at USFWS Winthrop Hatchery will be sampled by YN personnel for virology and samples submitted to the WDFW Olympia Fish Health lab. Sampling protocols will be developed and provided to samplers. WDFW personnel will be notified.

9) The progeny from each female (family) will be incubated and reared in biosecure isolation from other steelhead families and all spring Chinook. Each family will have separate egg incubation/hatching/rearing tanks/tools. Rearing containers (circular tanks) will be separated by curtains. Access to incubation room/rearing tanks will be restricted by physical barriers and signs.

10) Additional disinfection pads (Virkon Aquatic) will be added at all access points.

11) All tools will be disinfected with 1:100 dilution of Virkon Aquatic, or other suitable disinfectant, for a minimum 10 minute contact time.

12) Healthy and moribund/mortality fish will be examined periodically and sampled as necessary.

13) 60 un-fed fry (targeting any moribund or fresh dead fish) will be sampled at swim-up for virology. Moribund fish will be sampled at any time as determined needed. Samples will be representative of the total spawn, i.e., equal numbers of fry from each female.

14) 60 fed fry (targeting any moribund or fresh dead fish) will be sampled at approximately 30 days after start of feed for virology. Moribund fish will be sampled at any time as determined needed. Samples will be representative of the total spawn, i.e., equal numbers of fry from each female.

15) Juveniles will be transferred to Wells Hatchery for rearing and release only after viral assay results are completed approximately 60 days after swim-up and no evidence of virus is found.

16) In the event that any regulated viral pathogen is detected in any juvenile sample, all parties agree in advance that all fish linked to that sample will immediately be euthanized. Linked fish include parents, siblings, and other fish that shared a common environment where disease transmission may have occurred. Subsequent to that, increased monitoring for clinical evidence and/or increased mortality of remaining fish will be implemented with samples taken as appropriate.

17) Hatchery staff will work from known "clean" areas of the facility to areas of "unknown" fish health status. Hatchery staff will set up a "keep-out" perimeter for all non-hatchery personnel.

Robert W Rogers
WDFW Fish Health, Region 2
PO Box 856
421 W 4th Ave
Omak, WA 98841
ph/FAX 509-826-7338
cell 509-429-8208
Robert.Rogers@dfw.wa.gov

Modified September 25, 2013 (Consult with John Kerwin).
Modified October 11, 2013 by John Kerwin (WDFW) and agreed to by Bob Rogers on October 11, 2013.
Further modified by John Kerwin on October 14, 2013 and agreed to by Bob Rogers on October 14, 2013.

Wells HCP Hatchery Committee

Statement of Agreement

Twisp River Steelhead Live Spawing Plan

October 22, 2013

Statement

The Wells HCP Hatchery Committee agrees to live-spawn Twisp River NOR female steelhead broodstock, supported by a letter from WDFW Fish Health director dated October 15, 2013 indicating that the proposed live spawning program will not pose undue risk to the ESA listed spring Chinook and steelhead programs taking place at the Methow Hatchery, provided that the additional costs incurred as a result of live spawning would be paid for by the YN's Upper Columbia Kelt Reconditioning Project and provided that WDFW agrees to fully implement all of the necessary facility improvements at Methow Hatchery following guidelines provided by Bob Rogers (WDFW Fish Health Specialist; Attachment 1).

Live-spawned females will be reconditioned in YN's Upper Columbia Kelt Reconditioning Facilty located at Winthrop NFH. YN personnel will be responsible for transferring the live spawned kelts to the reconditioning facility. Twisp River steelhead will be spawned, incubated, and early reared until fish health testing is completed at the Methow Fish Hatchery. Once progeny have been cleared through the fish health screening, steelhead fry testing negative for regulated viruses will be transferred to Wells FH for rearing. Any juveniles or adults associated with any sample testing positive for regulated viruses will be euthanized immediately. YN staff will provide annual reports and updates from the Upper Columbia Kelt Reconditioning Project the HCP HC.

Background

The YN operates a kelt reconditioning facility in the Methow basin. Beginning in 2012, YN began working closely with the USFWS to recondition live-spawned steelhead from Winthrop National Fish Hatchery, so that NOR broodstock have the opportunity to spawn in the wild, maximizing their contribution to increasing abundance. YN is also working closely with CRITFC to learn and build upon reconditioning efforts throughout the Columbia Basin. As part of these efforts Dworshak NFH has also begun live spawning steelhead so that NOR broodstock may be reconditioned.

YN is requesting that NOR females from DCPUD's Twisp River steelhead supplementation program be live-spawned and reconditioned (in YN's facility) to help increase the abundance of NOR spawners and and work towards recovery goals in the Methow Basin.

YN has been working closely with WDFW and USFWS fish health staff to develop a plan which meets fish health needs to proceed with live spawning as described in the attachment. YN's kelt reconditioning program will provide any necessary equipment or staff time to support virology testing and segregation during rearing as required for live spawning. Similarly YN staff is trained in live-spawning and can assist with live-spawning operations.

Chewuch Acclimation Plan

9 October 2013

1.0 Background

1.1 YN's Expanded Acclimation Project

YN's Expanded Acclimation Project (Project) is based on the premise that acclimating salmon and steelhead in a manner that mimics natural systems can increase the effectiveness of integrated (conservation) hatchery programs and can be used to improve the Viable Salmonid Population (VSP) status of ESA listed spring Chinook and steelhead.

The Columbia River Basin Fish Accords (MOA) recognize that hatchery actions can provide important benefits to ESA listed species and to the Tribes, supporting treaty fishing rights. This Project seeks to improve the efficacy of current supplementation programs by providing additional short-term acclimation sites with the purpose of improving the spawning distribution of adult returns and/or homing fidelity, which may contribute to improved productivity and survival.

The concept of acclimating salmon smolts in 'natural' ponds has been thoroughly tested over the last decade as part of YN's coho restoration project in the Wenatchee and Methow Rivers. The coho restoration project has demonstrated both high survival rates (juvenile and adults) as well as adult returns with SARs comparable or higher than established supplementation programs in the Upper Columbia (YN 2010). More recently YN has demonstrated that the technique of short term acclimation and co-mingling species is a viable method of acclimating smolts (Kamphaus 2011). However adult return data (SARs, etc.) from the comingled releases are still being collected and are not yet available.

Beginning in 2014, as a result of the HCP No-Net-Impact (NNI) recalculation, smolt release numbers from most conservation hatchery programs in the Methow and Wenatchee basins will be significantly reduced. Because of this reduction, we believe it is crucially important that each program be operated in a manner which maximizes efficacy of the supplementation effort.

1.2 Chewuch Acclimation Pond

The Chewuch Acclimation Pond (Chewuch AP) is owned by Douglas County PUD and has been operated by the Washington Department of Fish and Wildlife (WDFW) since 1994 (Brood Year 1992). In 2014, recalculated hatchery mitigation objectives for DCPUD, CCPUD and GCPUD will take effect. Recalculated values have significantly reduced the number of spring Chinook reared for conservation purposes and as a result, 2014 will mark the first year that no spring Chinook will be released from the Chewuch AP.

YN believes that continued releases in the Chewuch are an important part of salmon recovery in the Methow Basin. YN is seeking to lease the facility from DCPUD for the acclimation of coho salmon (Coho Reintroduction Project) and spring Chinook (Expanded Acclimation Project). This lease would begin in 2015.

2.0 Chewuch Acclimation Plan

YN proposes to acclimate approximately 60,516 spring Chinook in the Chewuch AP beginning in 2015. These fish would represent CCPUD's Methow Spring Chinook production.

2.1 Fish Transportation Procedures

Spring Chinook pre-smolts would be transported in March (by WDFW tanker truck) from the Carlton over-winter site to the Chewuch AP for final acclimation . Current fish-transport procedures include crowding and loading into distribution trucks via a fish pump. Water will be tempered as appropriate. Fish are tempered to within 3°C of the receiving water prior to release into the ponds. Loading densities may range from 0.3 to 0.5 pounds of fish per gallon of water.

2.2 Acclimation Procedures

Density Criteria

The following table represents current density criteria for HCP spring Chinook rearing and acclimation. The HCP Hatchery Committee may adjust criteria as necessary

Table 1. Density criteria for spring Chinook.

Acclimation Criteria	ELISA≤0.119[a]	ELISA≥0.12
Density Index (lbs/cf-in)	0.10	0.06
Flow Index (lbs/gpm-in)	1.00	0.60

[a]The 0.119 threshold was developed jointly by the USFWS and WDFW. Fish with an ELISA>0.19 would be culled.

In 2015, only Chinook would be present in- pond with a density index well below the limits described in Table 1. In 2016, the pond may be shared with coho smolts but density criteria described above would not be exceeded (Table 1).

Co-acclimation with Coho Salmon

Beginning in 2016, it is likely that spring Chinook pre-smolts could be co-acclimated alongside coho salmon pre-smolts in the Chewuch AP. Numbers of coho salmon acclimated would depend on the densities chosen for any given year (Table 1) and would likely be between

66,000 to 151,000 coho pre-smolts. Coho could be co-mingled with, or separated from Chinook with a barrier net depending upon similarities in fish size at transfer.

Fish Condition, Growth, and Health Monitoring

A pre-transfer fish health examination will be conducted by WDFW fish health specialists. Once in the pond, fish will be monitored daily by staff for signs of disease symptoms (lethargic behavior, skin coloration, visible lesions, caudal fungus, etc.) through observation of feeding behavior and monitoring of daily mortality trends. Additionally staff will collect data from a random sample of approximately 100 fish (of each species when applicable) on a weekly basis. Weekly sampling will include a general assessment of fish condition, stage of smoltification, fish length, and fish weight so that growth rates and condition factors maybe be assessed. A fish health specialist will be contacted if any disease symptoms are noted. If required, YN staff under the direction of the fish health specialist will provide treatment for disease.

Release

Spring Chinook would be released as close as possible to the agreed upon size target (15-18 fpp). Targets are subject to change at the discretion of the HCP Hatchery Committees. Spring Chinook will be volitionally released from the acclimation site into the Chewuch River (RKM 12.9) in mid-to-late April. If necessary, any remaining fish will be force released by May 1st.

3.0 Adult Return Rates and Adult Management

Historic adult return rates from the Chewuch Pond can be found in Table 2 below.

Table 2. Brood year, number of smolts released, adult returns, and SAR (%) from the Chewuch Acclimation Pond 1992-2010 (data source: Snow et al. 2012).

Brood Year	Smolt Released	Adult Returns	SAR (%)
1992	40881	39	0.001
1993	284165	116	0.0004
1994	11854	2	0.0002
1996	91,672	37	0.0004
1997	132,759	295	0.0022
2001	261,284	738	0.0028
2002	254,238	699	0.0027
2003	127,614	61	0.0005
2004	204,906	194	0.0009
2005	232,811	308	0.0013
Mean	**164,218**	**289**	**0.0012**

Based on the minimum, mean, and maximum SARs (%) from previous releases, we would expect an average of 73 adults to return to the Chewuch River from a release of 60,516 smolts (Table 3).

Table 3. Anticipated number of returning spring Chinook adults from a release size of 60,516 at the Chewuch Acclimation Pond.

Target Number of Smolts	Anticipated Number of Adults Returned		
	Maximum SAR	Mean SAR	Minimum SAR
Chewuch (60,516)	169 (0.28%)	73 (0.12%)	12 (0.02%)

The historic SARs for hatchery fish (Table 2) along with historic estimates of natural origin spawners in the Chewuch can be used to provide a retrospective analysis of what PNI would have been had 60,516 had been released annually and SARs remained the same. This retrospective analysis provides insight into what PNI values could be in the future (Table 4). Based on this analysis, it is unlikely that adult management will be needed to achieve a PNI of 0.67 in the Chewuch River. Additionally, pHOS in the retrospective analysis averages 0.25 (Table 4). Should future SAR rates exceed historic SARs and adult management becomes advisable in the future, uniquely marked hatchery fish (PIT tag, body tag, etc) could be removed at Rocky Reach Dam Trap , Wells Dam, or another location as determined by the Co-managers.

Table 4. Forecast of adult returns and PNI using a retrospective analysis of SARs and NOR spawning escapement.

Return Year[a]	Chewuch NOR spawning Escapement	Hatchery SAR[b]	Hypothetical Hatchery Return	Hypothetical Proportion of Run		PNI (pNOB = 1)	PNI (pNOB =0.5)	PNI (pNOB = 0.25)
				Hatchery	Natural			
1997	123	0.0004	24	0.16	0.84	0.86	0.75	0.60
2000	83	0.0004	24	0.23	0.77	0.82	0.69	0.53
2001	732	0.0022	133	0.15	0.85	0.87	0.76	0.62
2005	289	0.0028	169	0.37	0.63	0.73	0.57	0.40
2006	378	0.0027	163	0.30	0.70	0.70	0.62	0.45
2007	203	0.0005	30	0.13	0.87	0.89	0.79	0.66
2008	86	0.0009	54	0.39	0.61	0.72	0.56	0.39
2009	271	0.0013	79	0.22	0.78	0.82	0.69	0.53
Mean	**271**		**86**	**0.25**	**0.75**	**0.75**	**0.68**	**0.52**

a. Years not included in this analysis either had no NOR spawners data (1996, 1998) or had no Chewuch hatchery release SAR data (BY 1995, 1998, 1999, 2000).

b. For the purposes of this exercise hatchery SARs were matched with return year NORs based on a 4-year age class return

4.0 Monitoring and Evaluation

With the exception of fish condition and growth sampling conducted in-pond, Chelan PUD will be responsible for all M&E associated with the proposed release of spring Chinook from their mitigation program. M&E objectives and metrics applicable to this release can be found in the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update.

MEMORANDUM

TO: Wells HCP Hatchery Committee

FROM: Greg Mackey

DATE: October 16, 2013

SUBJECT: Wells and Methow Hatcheries M&E Implementation Strategy for 2014

Douglas PUD and Washington Department of Fish and Wildlife prepared an M&E implementation plan for 2014 that was ready for distribution to the HC for review by July 1 2013. Unfortunately, we were unable to distribute this plan for HC review due to uncertainty in the M&E requirements pending consultation and issuance of ESA permits for Methow Spring Chinook, Wells Steelhead, and Wells Summer Chinook (July 1, 2013 letter to the HC). We expected the steelhead BiOp and permitting process to be completed by now (original permit expired Oct 2, 2013), and the spring Chinook consultation with NMFS to be very far along now, as well (current permit expires Jan. 20, 2014). However, on Sept, 20, 2013 NMFS sent a letter to Douglas, Grant, and Chelan PUDs notifying us that the existing ESA permits would be temporarily extended (in order to give NMFS time to perform the consultations and issue permits) with no specific end date. We anticipate receiving new permits in 2014, date unknown, that contain terms and conditions likely to affect the M&E program. Do to the continued uncertainty in M&E requirements for the Douglas PUD-operated programs, and the pending requirements and implementation that are anticipated for Chelan PUD and USFWS programs in the Methow Basin, and in order to allow the M&E program to be able to adapt to as yet unknown requirements in 2014, we plan to construct an M&E implementation plan that allows us to contract the plan as separate work orders for each major activity. We have not yet worked out the details of this approach, but will shortly develop an M&E implementation plan for HC review.

Request for 3,500 summer Chinook salmon eggs for Chelan River egg-fry survival studies

For the past two years, Chelan PUD has requested and received 2,500 summer Chinook salmon eyed-eggs for egg-fry survival studies in the Chelan River tailrace and Habitat Channel. The studies in 2011 and 2012 have been concurrent with studies to determine the relationship between intra-gravel dissolved oxygen in Chinook salmon redds and operation of the Chelan Hydroelectric Project. The intra-gravel dissolved oxygen study in 2011 provided information to develop a regime of minimum powerhouse operation to protect incubating Chinook salmon eggs in the tailrace. That operation regime was tested in 2012 and intra-gravel dissolved oxygen was maintained under that operating regime. That operating regime will be tested again during the 2013-2014 incubation season to confirm that it provides adequate protection of Chinook eggs.

Results from the egg-fry survival tests have been equivocal. These studies followed a protocol successfully used by Battelle in the Columbia River Hanford Reach, with eyed-eggs placed in cylindrical egg tubes (CETs) that are placed by SCUBA divers in simulated redds. This methodology has given good, consistent results in the Chelan River Habitat Channel, but results in the tailrace have been inconsistent. In 2012, none of the eggs in the CETs in the tailrace, not even eggs in the control CETs (placed on clean rock substrate and barely covered with cobble to prevent periphyton from clogging screens), survived to hatch. This information was inconsistent with the good oxygen levels maintained in the Chinook salmon redds and inconsistent with egg survivals in the tailrace CETs in 2011. The 2012-2013 results are particularly puzzling because the powerhouse was operated at full flow through the end of January, with the exception of minimum generation (800 cfs) and a single 2-hour period of no flow during CET installation. Examination of the dead eggs in the CETs showed very little development past the eyed-egg stage had occurred, but egg-fry survival in the Habitat Channel exceeded 90 percent.

The high egg-fry survivals achieved in the Habitat Channel and similar results using CETs in the Hanford Reach indicate that the CET technique works well in areas with strong water velocities. Water velocities in the Chelan tailrace are also strong during full powerhouse generation, but considerably lower at 800 cfs since SCUBA divers were able (barely) to hold position during CET installation. The CETs have a double layer of plastic mesh to prevent fry from escaping the CETs prior to retrieval and enumeration. We suspect that this mesh may present too much resistance to flow for the CET environment to provide adequate water exchange and dissolved oxygen in areas where stream velocities are low.

The 2013-2014 tests will incorporate measures to test whether the CET technique presents an experimental bias in the tailrace environment that prevents its use for estimating egg-fry survival in naturally-spawned redds. The 2013-14 protocol will include sampling of egg survival in natural redds at several intervals following CET installation. Also, we will replicate the CET eyed-egg experiment with some eyed-egg placements using mesh bags or baskets with greater mesh porosity. For this reason we are requesting 3,500 eyed-eggs rather than the 2,500 requested in previous years. As in the past, the request is for summer Chinook eggs from those destined for final acclimation and release at the Chelan Falls Acclimation Facility.

October 4, 2013

Chelan County PUD Hatchery Monitoring and Evaluation Implementation Plan 2014

Prepared by:

Alene Underwood and Catherine Willard

Draft October 2013

CHELAN COUNTY POWER

Contents

1. INTRODUCTION

The Habitat Conservation Plan (HCP) specifies that a monitoring and evaluation plan will be developed for the hatchery program. The approach to monitoring the hatchery programs was guided by the "*Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update"* (Hillman et al. 2013) and the "*Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Programs*" (Murdoch and Peven 2005).

The purpose of this document is to define the tasks associated with the approved scope of work to implement Chelan PUD's (CPUD's) hatchery monitoring and evaluation (M&E) plan for 2014. Monitoring and evaluation activities for Lake Wenatchee sockeye in 2014 have not yet been determined. Chelan PUD will submit an addendum to this implementation Plan by February 2014 to address these activities. The work described in this plan has ESA coverage provided by ESA permits 18121, 1347, and 1395. All activities conducted under this Implementation Plan shall adhere to all terms and conditions as specified in the referenced permits. These permits allow for changes to monitoring or research protocols with the caveat that such modifications are approved by NMFS prior to implementing those changes.

The Implementation Plan includes all four components of the M&E Program including: (1) aquaculture monitoring; (2) juvenile monitoring; (3) adult monitoring; and (4) data, analysis and reporting. Under each component are study design elements that will be used to inform the overarching program components. Figure 1 illustrates the relationship of the components and study design elements used to address each component. Table 1 depicts which study design element is being performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

The methods described in this plan differ from previous methodologies in the following ways:

- Emigrant abundance estimates will use newly derived analytical approaches that reduce bias and increase precision to include estimates of emigration during the winter non-trapping periods.
- The yearling smolt production estimates at the lower Wenatchee smolt trap will be apportioned into summer and spring Chinook. Spring Chinook will be apportioned by major spawning areas (i.e., Chiwawa, Nason, White, Little Wenatchee, Icicle and other).
- Spring Chinook spawner abundance estimates will be adjusted for observer efficiency and include estimates of precision.
- Summer Chinook spawner abundance will be based on census counts and be adjusted for observer efficiency and include estimates of precision.
- Steelhead run and spawning escapement estimates will be based on a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates.

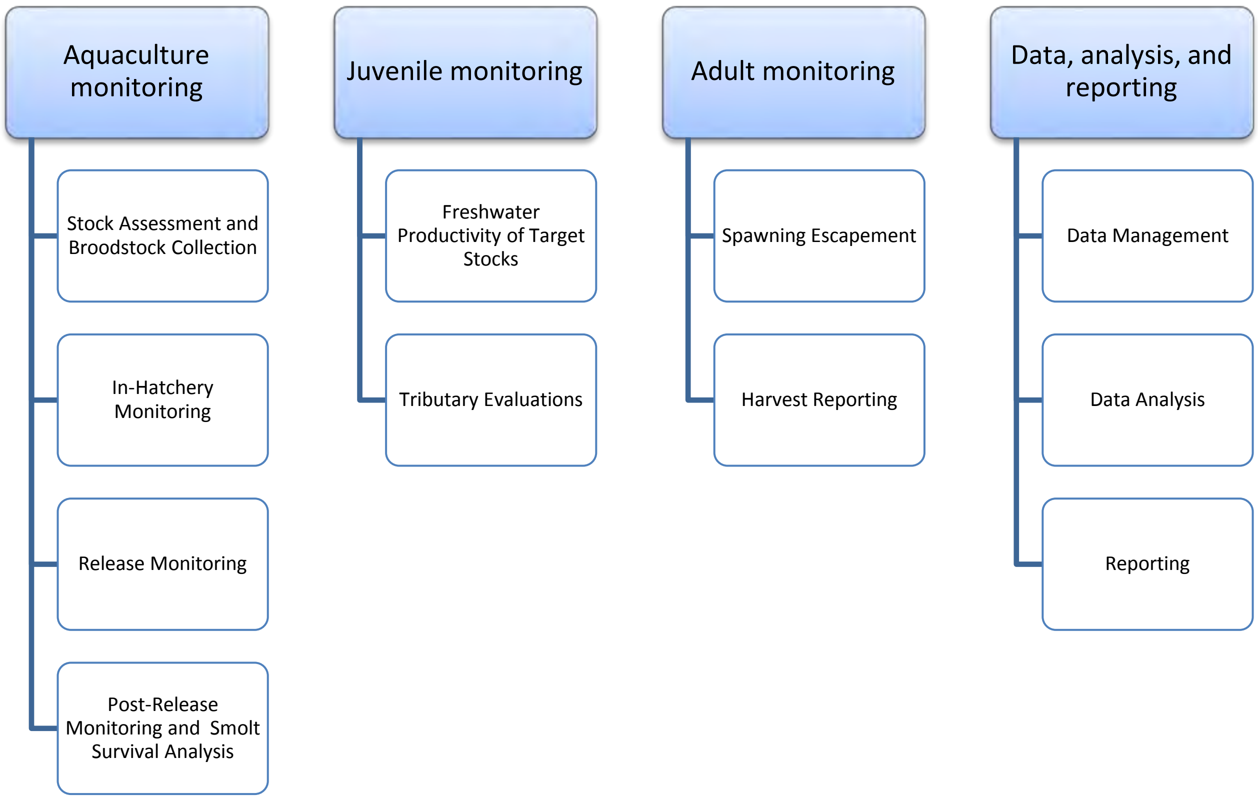


Figure 1. The four components of the hatchery monitoring and evaluation program and the study design elements within each component.

Table 1. Study design elements performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

Monitoring and evaluation component	Objectives	Study Design Elements	Chiwawa spring Chinook	Wenatchee summer Chinook	Chelan summer Chinook[2]	Methow spring Chinook[3]	Wenatchee Steelhead	Wenatchee Sockeye
Aquaculture Monitoring	3,5,6,8,9	Stock assessment and broodstock collection	WDFW	WDFW	WDFW	WDFW	WDFW	NA
		In-hatchery monitoring	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	NA
		Release monitoring	WDFW	WDFW	WDFW	WDFW	WDFW	NA
		Post-release monitoring and smolt survival analysis	WDFW	WDFW	WDFW	WDFW	WDFW	NA
Juvenile monitoring	2	Freshwater productivity of stocks	WDFW	WDFW	NA	NA	WDFW	TBD
		Tributary evaluations	WDFW	WDFW	NA	NA	WDFW	TBD
Adult monitoring	1,2,3,4,5,6, 8,10	Spawning escapement	CPUD	WDFW	CPUD	BioAnlaysts	WDFW	TBD
		Harvest reporting	WDFW	WDFW	WDFW	WDFW	WDFW	TBD
Data, analysis, and reporting	All	Data management	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Data analysis	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Reporting	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD

[1]CPUD crews will PIT tag in-hatchery fish.
[2]Because the Chelan summer Chinook program is primarily an augmentation program, monitoring and evaluation efforts focus on straying, release characteristics, and harvest.
[3]Monitoring and evaluation in 2014 will be shared by Grant and Chelan PUDs.

2. AQUACULTURE MONITORING

The Aquaculture monitoring component is comprised of two basic elements: (1) stock assessment and broodstock collection at adult trapping locations and (2) in-hatchery monitoring including spawning, rearing, and release of juveniles. Data collected during these elements primarily support monitoring questions 5.1.1, 8.1.1, 8.2.1, 8.3.1, 8.3.2, 8.4.1, 9.1.1, 9.2.1, 9.3.1 and 9.4.1, but also contribute data to monitoring questions 3.2.1, 3.2.2, 6.1.1, 6.2.1, and 6.3.1 (Hillman et al. 2013). These monitoring questions support the following objectives:

> ***Objective 3:*** *Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.*
>
> ***Objective 5:*** *Determine if the run timing, spawn timing, and spawning distribution of both the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.*
>
> ***Objective 6:*** *Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.*
>
> ***Objective 8:*** *Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.*
>
> ***Objective 9:*** *Determine if hatchery fish were released at the programmed size and number.*

2.1 Stock Assessment and Broodstock Collection

Broodstock collection for Wenatchee summer steelhead, Wenatchee summer Chinook, Methow summer Chinook, Chelan Falls summer Chinook, and Chiwawa River spring Chinook, hatchery programs will occur consistent with the Broodstock Collection Protocol approved annually by the Hatchery Committee (e.g., Tonseth 2013). Trapping locations and timing will be dictated by the annual broodstock collection protocol and the relevant permits. Data collection during broodstock collection will be consistent with Murdoch and Peven (2005). A representative sample of all fish trapped, collected for broodstock, or released back to the river, will be sampled for origin, age, sex, size, and migration timing. Biological sampling of all fish trapped will include presence of internal (CWT or PIT) and external (VIE) tags or marks, scales, length, and sex (determined by ultrasound). PIT tags will be injected into all target species (Chinook and steelhead), whether collected or released. All non-target species will be enumerated daily. Measures of central tendency and spread will be calculated and reported for each metric.

2.2 In-Hatchery Monitoring

The in-hatchery monitoring component will begin when adult fish are collected and retained for broodstock, and ends when juvenile fish are released. Life stage specific in-hatchery survival and growth rates, disease monitoring, and an estimate of the number of fish released will be collected and analyzed according to Murdoch and Peven (2005). Additional data to be collected includes individual lengths and weights of juveniles during monthly sampling, and the weight of

gonadal mass and body of spawned broodstock. Measures of the central tendency and spread will be calculated and reported for each metric.

Fish Marking

All of Chelan PUD's hatchery fish will be coded-wire tagged (CWT) and externally marked or marked as otherwise agreed to by the HCP-HC. The identification of these hatchery-produced fish is needed for a suite of adult metrics and may be used for adult management and/or fisheries as contemplated by the co-managers.

Using methods described in Keller and Murauskas (2012), hatchery fish will be PIT-tagged (Table 1) at Eastbank Fish Hatchery approximately two to four weeks before the fish are transferred to acclimation ponds (Table 2). Additional PIT-tagging may occur for program specific studies/comparisons as approved by the HSC. The data collected from the PIT-tags will assist in release monitoring, migration timing, juvenile survival, and smolt-to-smolt survival. For all fish marking, quality control check will be performed during and immediately following tagging and prior to release.

Table 1. Wenatchee River basin hatchery program release goals and recommended number of fish PIT tagged.

Program	Release goals	Number of fish PIT tagged[1]	PIT tag rate (%)
Chiwawa River spring Chinook	144,026	5,000	3.5
Wenatchee River steelhead	247,500	15,000	6.0
Wenatchee River summer Chinook	318,816 (CPUD Program) 181,184 (GPUD Program)	20,600[2]	4.1

[1] Additional PIT tagging may take place for Chelan PUD approved studies and/or comparisons.

[2] Includes a component of PIT-tagged fish for the NOAA size target study and a component for Grant PUD's program).

2.3 Release Monitoring

Hatchery fish will be released during smoltification in the spring, typically between 15 April and 1 June. Whenever possible, the exact release dates will coincide with environmental conditions that promote a rapid emigration that minimizes both the potential negative ecological interactions of hatchery fish with naturally produced fish and predation on hatchery fish by avian or other predators. The monitoring data collected for each stock are described below.

Spring Chinook – Chiwawa River

Pre-release sampling data will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring

questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan (Hillman et al. 2013). PIT tag monitoring of spring Chinook released in the Chiwawa River will occur during the release period (April). Juvenile Chinook will pass through two 92-cm diameter PIT-tag antennas connected to Allflex 310 readers and Quantitative Sampling Technologies (QST) QuBE data logger. The release location and type (i.e., volitional, forced, or trucked) are recorded for each observation file created and uploaded to the PTAGIS database maintained by the Pacific States Marine Fisheries Commission after each year of release. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Spring Chinook – Methow
Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Should PIT tagging occur, a monitored release strategy consistent with other Chinook stocks (i.e., Chiwawa Spring Chinook) will be implemented. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Steelhead–Wenatchee River Basin
Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Monitoring of steelhead released in the Wenatchee River basin will occur during loading of fish into transport trucks, unless fish are released directly into the Chiwawa River. Steelhead will pass through a series of PIT-tag antennas, each connected to a data logger, thereby allowing the creation of a PIT-tag observation file for each truckload of steelhead consisting of unique tag records. The release location (stream and rkm), release type (volitional or forced), and hatchery group (HxH or WxW) will be recorded for each tag file created. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. However, because PIT-detection efficiency during loading will not be 100%, the number of fish in each truckload will be estimated using volumetric displacement. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Chinook – Wenatchee River and Chelan Falls
Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions

9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Should PIT tagging occur, a monitored release strategy consistent with other Chinook stocks (i.e., Chiwawa Spring Chinook) will be implemented. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

2.4 Post-Release Monitoring and Survival Analysis

Data will be collected during rearing, acclimation, release, and the emigration period that may prove valuable in explaining variability in adult survival (Murdoch and Peven 2005). Rearing densities have been reported to influence the survival of hatchery fish (Martin and Wertheimer 1989; Banks 1994) and may also be linked to disease prevalence during rearing (Banks 1994; Ogut and Reno 2004). Acclimation of hatchery fish before release has been found to increase survival and reduce stray rates when the duration of the acclimation period is sufficient (Clarke et al. 2010, 2012; Rosenberger et al. 2013). These metrics (i.e., rearing density and acclimation period) will be collected annually to determine their influence on fish survival.

PIT-tagged groups of hatchery fish will be used to estimate survival during their emigration. Variation in survival during the emigration period may also inform observed adult survival rates. Survival during emigration or smolt-to-smolt survival and travel will be estimated using interrogation or release files and the standard Cormack-Jolly-Seber (CJS) estimator. CJS estimates are termed apparent survival estimates because it is unknown whether fish suffered mortality (e.g., size or time of release) or simply failed to emigrate (i.e., residualized or were precocial males). In the latter case, the proportion of PIT-tagged fish detected in the Wenatchee or Columbia rivers after the emigration period is complete may explain variation in smolt-to-smolt survival rates. The post-release performance of PIT-tag groups will be estimated and monitored annually, consistent with methods in Murdoch and Peven (2005).

3. JUVENILE MONITORING

Data collected during these elements primarily support monitoring questions 2.1.1 and 2.2.1. These monitoring questions support the following objective:

> ***Objective 2:*** *Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.*

3.1 Freshwater productivity of Supplemented Stocks

Steelhead, Spring Chinook, and Summer Chinook

The freshwater productivity of supplemented stocks in the Wenatchee Basin will be monitored using smolt traps in the Chiwawa River and the lower Wenatchee River consistent with historical trapping efforts. Additionally, a newly derived analytical method which uses PIT-tag mark-recapture data will be utilized that reduces bias and increases precision by including

estimates of emigration during the winter non-trapping periods. Parr will be PIT tagged in the fall, based on the spatial distribution and abundance estimated during parr snorkel surveys, to generate estimates of migration during the non-trapping periods in Chiwawa River. Using PIT tagged parr detections at the lower PIT array during the non-trapping period, the total number of PIT-tagged parr that emigrated will be estimated, and then expanded by the tag rate. PIT-tag mark-recapture trials conducted during the trapping period in the fall will also be used to estimate detection probabilities of the PIT-tag array at a given discharge level. Abundance and variance will be estimated using the same methods as those used in the smolt trap estimate. The estimated abundance and variance from each method and time period (trapping and non-trapping periods) will be summed to estimate a total production estimate. Under the proposed methodology, unbiased estimates of abundance during the entire migration period will be generated with relatively high precision (PSE < 15%), which is consistent with NOAA Fisheries' recommendations (Crawford and Rumsey 2011). Historical estimates will be revised using the new estimation techniques.

All captured spring Chinook that are trapped at the lower Wenatchee trap will be assigned to stocks using genetic techniques. The results from the genetic stock partitioning will be applied to the overall estimated number of migrating spring Chinook to generate freshwater productivity by stock.

3.2 Tributary Evaluations

Chiwawa River

Snorkel surveys will be utilized to estimate summer parr abundance within the Chiwawa River basin. This approach has been used in the Chiwawa River basin since 1992. In parallel to addressing Objective 2 additional juvenile data can help to assess the habitat carrying capacity in each tributary. This information can add value to the overall M&E plans and help inform management decisions.

Sampling will follow a stratified random sampling design. Landscape classification will be used to stratify streams in the Chiwawa basin that support juvenile Chinook salmon. In the Chiwawa River basin, WDFW found that classification "explained" most of the variability in fish numbers caused by geology, land type, valley bottom type, stream state condition, and habitat type (Hillman 2013). The same classification method was used to identify sections of the Little Wenatchee River (reference area) that corresponded to discrete reaches in the supplemented basins, but that had no release of hatchery Chinook. Consistent with previous efforts, habitat types within each land-class or reach will be identified and quantified annually. At least three units of each habitat type within each reach will be randomly selected for estimating densities of salmon and trout. Thus, overall sampling consists of a stratified-random sampling design, which increases the accuracy and precision of population estimates.

Densities of salmon and trout will be estimated in August and September by direct underwater observation within the randomly-selected habitat units. Underwater methods will follow those described by Thurow (1994), Dolloff et al. (1996), and O'Neal (2007). Habitat surface areas and volumes will be estimated during fish sampling. Numbers of fish counted will be adjusted for detection probabilities using the models published in Hillman et al. (1992). For each habitat type within a state type and reach stratum, the mean density of salmon and trout will be calculated as the ratio of mean numbers to mean area or volume sampled (Cochran 1977). Total numbers of fish will be estimated per habitat type within a state type and reach stratum as the product of mean density of fish in a given habitat type, times total area or volume of that habitat type within the stratum (Cochran 1977). Total numbers of fish within the supplemented basin will be estimated as the sum of all population numbers per habitat type in state type/reach strata. Bootstrapping methods will be utilized to estimate variance and percent errors (based on 95% confidence interval) for total numbers of fish.

4. Adult Monitoring

The Adult monitoring component is comprised of two basic elements: (1) estimating spawning escapement and (2) harvest monitoring. Data collected during these elements primarily support monitoring questions 1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.2.1, 3.2.2, 4.1.1, 5.2.1, 5.3.1, 5.3.2, 6.3.1, but also contribute data to monitoring questions 6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.4.1, 10.1.1, 10.1.2, 10.1.3 and 10.1.4 (Hillman et al. 2013). These monitoring questions support the following objectives:

Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.

Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.

Objective 5: Determine if the run timing, spawn timing, and spawning distribution of both the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.

Objective 6: Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.

Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

Objective 10: Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.

4.1 Spawning Escapement Estimates

Chelan and Methow Summer/Fall Chinook

Chinook spawning ground surveys will be conducted in the Chelan River and Methow subbasin (see Appendix A for survey reaches). Spawning ground surveys will be conducted via foot or raft beginning late September and continuing until spawning has ended (usually mid-November). Frequency of surveys will vary depending on method.

Summer Chinook carcass surveys will be conducted in the Chelan and Methow subbasins beginning in September and ending in November consistent with methods described in Murdoch and Peven (2005). A representative sample (i.e., 20%) of spawners as determined by spawner abundance and distribution (typically 100% of the carcasses encountered in the Chelan and Methow) will be sampled. Biological data will include collection of scale samples for age analysis, length measurements (POH and FKL), gender, egg voidance, and a check for tags or marks. DNA samples (five-hole punches from operculum) will be collected as needed to address different objectives. These data will be used to assess length-at-age, size-at-age, egg voidance, origin (hatchery or naturally produced), stray rates, and genetics. All carcass surveys will be conducted within the historical reaches.

Wenatchee Steelhead

The number of hatchery and naturally produced steelhead returning to the Wenatchee Basin will be estimated using a PIT tag mark recapture model. The estimated spawner abundance for the Wenatchee steelhead population will be a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates. Steelhead redd counts will be conducted weekly in all major spawning areas in the mainstem Wenatchee River (see Appendix A for survey reaches); minor spawning areas in the mainstem Wenatchee River will be surveyed once, based on the spawn timing in adjacent major spawning areas, to estimate redd abundance at peak spawning. The estimated total number of redds in the Wenatchee River mainstem will be expanded by the sex ratio of the population to estimate spawner abundance. Spawner abundance in tributaries of the Wenatchee River will be estimated using a PIT tag mark recapture model.

Chiwawa Spring Chinook

Chiwawa spring Chinook spawning escapement will be estimated based on the total number of redds found in each tributary (Murdoch et al. 2010) using methods described in Murdoch and Peven (2005). Redd and carcass surveys will be conducted simultaneously from the first week of

August through September (see Appendix A for survey reaches). Redd-based estimates assume that each female constructs one redd, which WDFW has found to be appropriate for this population (Murdoch et al. 2009). Redd counts will be expanded and the number of hatchery and naturally produced fish will be estimated using methods in Murdoch et al. (2010). Carcasses encountered during surveys will be sampled according to methods outlined in Murdoch and Peven (2005). In addition, all redds and female carcasses will be geo-referenced using hand-held GPS devices. Carcass recovery bias has been detected in the Chiwawa spring Chinook population (Murdoch et al. 2010) and if not corrected will bias estimates of hatchery and naturally produced fish on the spawning grounds. While it may be appropriate to correct for carcass recovery bias for some monitoring questions (e.g., 2.2), when comparisons to reference populations are made in monitoring questions 1.1.and 1.2, carcass bias will not be corrected because other monitoring programs have not corrected for a similar bias.

Wenatchee Summer Chinook

Wenatchee summer Chinook spawning ground counts will begin the last week in September and continue through the end of spawning in November (see Appendix A for survey reaches). Redd counts will be conducted by foot or raft depending on stream size, flow, and density of spawners within the stream reach. All stream reaches will be surveyed once per week. Redd data will be collected using methods described in Murdoch and Peven (2005). Salmon carcass data collected during spawning ground surveys will be consistent with Murdoch and Peven (2005).

Redd Observer Efficiency and Fish per Redd Value

Estimating redd observer efficiency is a costly and laborious task. Models generated for spring Chinook salmon are not applicable for summer Chinook because of differences in river characteristics of spawning locations. Small unmanned air systems (e.g., four blade helicopter) have been used successfully to document the abundance and distribution of fall Chinook redds in the Snake River (P. Groves, Idaho Power, Pers. comm.). We intend to use this technology to determine the true number of summer Chinook redds in selected reaches of the Wenatchee River. Weekly aerial photos of selected reaches will be digitally overlaid to document existing and newly constructed redds. Weekly ground-based estimates and the true number of redds will be compared in order to determine observer efficiency. Weekly river characteristics (e.g., channel width, water depth, discharge, visibility, and habitat complexity), observer experience, and survey effort will be incorporated into a model to predict observer efficiency in all river reaches. Predicted redd observer efficiency for each river reach will be used to expand ground-based redd counts to estimate the total reach redd count. Aerial photographs and ground-based surveys will also be used to estimate redd life for each river reach. The estimated spawner abundance in the Wenatchee River and an associated level of precision will be calculated using the estimated total redd count

for each reach, mean redd life, and the sex ratio of the population similar to methods described in Millar et al. (2012).

4.2 Harvest Reporting

In years when the expected hatchery adult returns are in excess of the levels needed to meet the hatchery program goals (i.e., broodstock and/or escapement), surplus fish may be available for harvest. Harvesting or removal of surplus hatchery fish may have benefits to the natural populations by reducing potential negative ecological and genetic impacts (e.g., density dependent effects, loss of fitness, and loss of genetic variation). The contribution of hatchery fish to fisheries will be monitored using CWT recoveries on a brood-year basis supporting Objective 10.

To obtain the necessary data to determine if the harvest rates are meeting objectives, a statistically valid creel program will be designed and implemented for all sport and/or conservation fisheries in the Upper Columbia River to estimate harvest of hatchery fish from both Chelan and Grant County PUD funded hatchery programs (Murdoch and Peven 2005). Information collected during creel surveys are an integral component to calculating the HRR (Objective 3), particularly given most CWT recoveries for PUD mitigation programs occur in the Upper Columbia River and its tributaries, with the exception of summer Chinook where most CWT recoveries occur in ocean fisheries. Because of considerable time lags in reporting of CWT's to the Regional Marking Information System (RMIS) database, it requires an ongoing query of recovery data until the number of estimated fish does not change.

5. Data Management , Analysis, and Reporting

5.1 Data Management

A database system has been developed in Microsoft Access that manages all the monitoring data collected for hatchery evaluations. The database will contain and manage all data associated with aquaculture monitoring, juvenile monitoring, and adult monitoring.

All data entered into the database are evaluated for quality control and quality assurance. Quality control checks using analyses such as modified Z-scores, boxplots, and the Generalized Extreme Studentized Deviate Procedure (Iglewicz and Hoaglin 1993) will be conducted for all data entry. In the event outliers are identified, discussion will occur on whether identified outliers are true data points or transcription errors. This process ensures that the data used to test statistical hypotheses are correct and accurate.

5.2 Data Analysis

The analyses proposed are consistent with the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update (Hillman et al. 2013). Each of the objectives will be addressed

using the appropriate statistical tests, as well as graphic analyses that convey relevant information.

5.3 Reporting

An annual M&E report will be generated following the completion of each calendar year and will be available for HCP HC review by June 1 of the following year. Additionally, monthly progress reports will be made available to the HCP HC.

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APPENDIX A

Designated survey reaches for Methow subbasin summer Chinook spawning ground surveys.

River	Reach	Code	RM
Methow	Mouth to Methow Bridge	M1	0.0-14.78
	Methow Bridge to Carlton Bridge	M2	14.78-27.17
	Carlton Bridge to Twisp Bridge	M3	27.17-39.55
	Twisp Bridge to MVID	M4	39.55-44.85
	MVID to Winthrop Bridge	M5	44.85-49.80
	Winthrop Bridge to Hatchery Dam	M6	49.80-51.55

Designated survey reaches for Wenatchee River basin summer Chinook spawning grounds surveys. Asterisks denotes reaches where redd observer efficiency will be assessed.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Bridge	54.20-53.58
	Bridge to Swamp *	53.58-52.66
	Swamp to Chiwawa River	52.66-48.39
W9	Chiwawa River to Schugart Flats	48.39-47.93
	Schugart Flats to Old Plain Bridge	47.93-46.21
	Old Plain Bridge to RR Bridge	46.21-41.91
	RR Bridge to RR Tunnel	41.91-39.28
	RR Tunnel to Swing Pool *	39.28-36.67
	Swing Pool to Tumwater Br	36.67-35.55
W8	Tumwater Br to Swiftwater Campground *	35.55-33.50
	Swiftwater Campground to Unimproved Campground	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Penstock Br	30.91-28.66
	Penstock Br to Icicle Road Br *	28.66-26.43
W6	Icicle Road Br to Icicle Mouth	26.43-25.61
	Icicle Mouth to Boat Takeout *	25.61-24.49
	Boat Takeout to Leavenworth Br	24.49-23.90
W5	Leavenworth Br to Irrigation Flume *	23.90-22.77
	Irrigation Flume to Peshastin Br	22.77-20.00
W4	Peshastin Br to Dryden Dam *	20.00-17.76
W3	Dryden Dam to Williams Canyon	17.76-15.54
	Williams Canyon to Upper Cashmere Br	15.54-10.22
	Upper Cashmere Br to Lower Cashmere Br	10.22-9.49
W2	Lower Cashmere Br to Old Monitor Br *	9.49-7.12
	Old Monitor Br to Sleepy Hollow Br	7.12-3.27
W1	Sleepy Hollow Br to River Bend *	3.27-1.73
	River Bend to Siphon	1.73-1.29
	Siphon to Mouth	1.29-0.45

Designated survey reaches for Wenatchee Basin spring Chinook spawning grounds surveys.

Reach Code	Reach Section	River Mile
Chiwawa River and Tributaries (Rock and Chikamin)		
C7	Buck Cr to Phelps Cr	36.39-33.46
C6	Phelps Cr (Trinity) to Maple Cr Br	33.46-29.64
C5	Maple Cr Br to Atkinson Flats	29.64-26.59
C4	Atkinson Flats to Schaefer Cr	26.59-24.24
C3	Schaefer Cr to Rock Cr Campground	24.24-22.97
R1 - Rock	Mouth to Chiwawa River Road Bridge	0.00-1.05
C2	Rock Cr Campground to Grouse Cr	22.97-12.27
K1 - Chikamin	Mouth to Chiwawa River Road Bridge	0.00-0.68
C1	Grouse Cr to Mouth	12.27-0.00
Nason Creek		
N4	White Pine Creek to Lower R.R. Bridge	16.09-13.68
N3	Lower R.R. Bridge to Hwy 2 Bridge	13.68-9.13
N2	Hwy 2 Bridge to Kahler Cr	9.13-4.46
N1	Kahler Cr to Mouth	4.46-0.00
White River and Tributaries (Panther and Napeaqua)		
H4	Falls to Grasshopper Meadows	21.16-19.78
T1 - Panther	Boulder field to Mouth	0.43-0.00
H3	Grasshopper Meadows to Napeaqua River	19.78-17.59
Q1 - Napeaqua	Take out to Mouth	0.91-0.00
H2	Napeequa River to Sears Cr Bridge	17.59-11.97
H1	Sears Cr Bridge to Mouth	11.97-0.00
Little Wenatchee River		
L3	Rainy Cr to Lost Cr	10.78-6.74
L2	Lost Cr to Old Fish Weir	6.74-2.13
L1	Old Fish Weir to Mouth	2.13-0.00
Upper Wenatchee River		
W10	Lake Wenatchee to Chiwawa River	54.20-48.39
Chiwaukum Creek		
U1	Metal bridge to Mouth	1.0 – 0.0
Icicle River		
I1	Hatchery to Mouth	3.02-0.00
Peshastin Creek and Tributaries (Ingalls Creek)		
D1 - Ingalls	Trailhead to mouth	0.64-0.00
P2	Ingalls Creek to Camas Cr	9.14-5.63
P1	Camas Cr to Mouth	5.63-0.00

Designated survey reaches for Wenatchee River basin steelhead spawning grounds surveys. Asterisks denote index reaches. Spawning escapements in tributaries will be estimates using PIT-tag arrays.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Chiwawa River*	54.20-48.39
W9	Chiwawa River to Tumwater Bridge*	48.39-35.55
W8	Tumwater Br to Swiftwater Campground	35.55-33.50
	Swiftwater Campground to Unimproved Campground*	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Icicle Road Bridge	30.91-26.43
W6	Icicle Road Br to Leavenworth boat ramp*	26.43-24.49
	Boat Takeout to Leavenworth Bridge	24.49-23.90
W5	Leavenworth Bridge to Peshastin Bridge	23.90-20.00
W4	Peshastin Bridge to Dryden Dam	20.00-17.76
W3	Dryden Dam to Lower Cashmere Bridge	17.76-9.49
W2	Lower Cashmere Bridge to Sleepy Hollow Bridge *	9.49-3.27
W1	Sleepy Hollow Bridge to Mouth	3.27-0.45

Tributary	River mile of PIT tag array
Mission Creek	0.54
Peshastin Creek	1.91
Chumstick Creek	0.31
Icicle River	0.26
Chiwaukum Creek	0.24
Chiwawa River	0.58
Nason Creek	0.52
Little Wenatchee River	1.74
White River	1.65

ANCHOR QEA

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	December 19, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the November 6, 2013 HCP Hatchery Committees Conference Call		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held by conference call on Wednesday, November 6, 2013, from 10:00 am to 11:30 am. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- The Hatchery Committees will review the draft Juvenile Carrying Capacity Statement of Agreement (SOA) prior to the Hatchery Committees meeting on November 20, 2013, when Chelan PUD will be requesting approval of the SOA (Item II-A).

The following action items relate to revisions discussed for the draft Chelan PUD 2014 Monitoring and Evaluation (M&E) Implementation Plan (Item II-B): *(Note: references to comments following each action item [e.g., "kdt2" or "GW3"] correlate to comments received from the U.S. Fish and Wildlife Service [USFWS] and the Colville Confederated Tribes [CCT] on Chelan PUD's draft plan, as distributed to the Hatchery Committees by Kristi Geris on October 31, 2013.)*

- Chelan PUD will revise a section to include more explicit details regarding how each objective will be achieved for each species; the revised section will be provided to Kristi Geris for distribution to the Hatchery Committees for further discussion and decisions regarding the organization and level of detail to include throughout the entire document (Yakama Nation [YN] general comment).

- Chelan PUD will revise Section 2.1 Stock Assessment and Broodstock Collection to clarify that stock assessment and broodstock collection are not always concurrent activities (CCT comment [kdt2]).
- Chelan PUD will incorporate language regarding plans to address precocity, residualism, and early maturation where appropriate (CCT comment [kdt3]; USFWS comment [GW3]).
- Chelan PUD will reference specific permit terms and conditions as they relate to hatchery M&E where appropriate (USFWS comment [GW3]).
- The YN will internally discuss marking strategy language (CCT comment [kdt4]).
- Chelan PUD will follow-up with Andrew Murdoch regarding how he estimated winter mortality (USFWS comment [GW4]).
- Chelan PUD will revise the draft Chelan PUD 2014 M&E Implementation Plan, as discussed, and will provide the revised draft to Kristi Geris for distribution to the Hatchery Committees by Friday, November 8, 2013.

STATEMENT OF AGREEMENT DECISION SUMMARY

- No SOAs were approved at this meeting.

AGREEMENTS

- Hatchery Committees representatives present agreed to continue discussions about fish marking at the Hatchery Committees meeting on November 20, 2013, including developing a timeline and outlining what needs to be done in terms of developing a marking strategy (Item II-B).

REVIEW ITEMS

- There are no items that are currently out for review.

FINALIZED REPORTS

- The final 2013 Broodstock Collection Protocols were distributed to the Hatchery Committees by Kristi Geris on November 4, 2013.

I. Welcome, Agenda Review

Mike Schiewe welcomed the Hatchery Committees and said that the purpose of today's conference call, as agreed to at the last Hatchery Committees' meeting on October 16, 2013, is to continue discussions and address comments received on the Chelan PUD 2014 Hatchery M&E Implementation Plan. Schiewe said that a draft Juvenile Carrying Capacity SOA (Attachment B) was also distributed for discussion purposes only. Schiewe said that the Priest Rapids Coordinating Committees Hatchery Sub Committee (PRCC HSC) has also been discussing Hatchery M&E implementation and because of the similarity between certain issues, there was a request to combine the Hatchery Committees' call and the PRCC HSC's call. Schiewe reminded everyone that while it is efficient to work through selected issues together, decisions and agreements will ultimately be made in the respective committees. *(Note: Due to the limited time and in the interest of continuity in Grant PUD's discussion, Grant PUD chose to postpone their participation in discussions until the PRCC HSC call scheduled for later in the day.)*

II. Chelan PUD

A. Draft Juvenile Carrying Capacity Statement of Agreement (Alene Underwood)

Alene Underwood said that a draft Juvenile Carrying Capacity SOA (Attachment B) was distributed to the Hatchery Committees by Kristi Geris on November 5, 2013. She said that she would like to introduce the concepts of the SOA today, and then hold discussions about the SOA until the Hatchery Committees' meeting on November 20, 2013. She added that Grant PUD has also developed a similar SOA (for discussion purposes only).

Bill Gale asked how the SOA links to finalizing the M&E Plan, and added that he was concerned that the SOA was not relevant to the purpose of this call. Underwood said that it is not her intention to have a robust discussion about the SOA during today's call; rather, she felt it was prudent to introduce the SOA as it pertains to a portion of the juvenile component of the M&E Plan. She added that the SOA is intended to clarify how some of the M&E data are used. Underwood noted that Chelan PUD has extended the timeline for approving a new contract; therefore, instead of requesting approval of their 2014 Hatchery M&E Implementation Plan during today's conference call, as discussed at the Hatchery Committees' meeting on October 16, 2013, they now have more time and will be requesting approval of their plan at the Hatchery Committees' meeting on November 20, 2013. Gale asked if the M&E Plan is contingent on the SOA, and Underwood replied that it is not. She noted that in terms of process, the SOA needs to be presented to the Hatchery Committees at least 10 days prior to the next Hatchery Committees meeting in order to request a vote.

Underwood briefly reviewed the draft Juvenile Carrying Capacity SOA (Attachment B). She said the SOA sets guidelines for estimating carrying capacity and outlines its uses as described in the first three bullets in Attachment B. She noted the four conditions that need to be met for estimating carrying capacity, as described in the second set of bullets in Attachment B. Underwood said that Chelan PUD is open to discuss additional or alternate conditions at the Hatchery Committees' meeting on November 20, 2013. She said that, currently, the Hatchery Committees do not have an agreed-upon estimate of carrying capacity, and that carrying capacity is an important metric that can be used to inform important management issues.

Underwood reiterated that Chelan PUD will be requesting approval of the SOA at the Hatchery Committees' meeting on November 20, 2013. Gale suggested including information in the background section of the SOA so that the linkage between the SOA and the M&E Plan is clear. Keely Murdoch agreed, and said that since the M&E Plan has not yet been discussed, it is unclear how the two documents relate.

The Hatchery Committees agreed to review the draft Juvenile Carrying Capacity SOA prior to the Hatchery Committees meeting on November 20, 2013, when Chelan PUD will be requesting approval of the SOA.

B. Chelan PUD 2014 Hatchery M&E Implementation Plan (Alene Underwood)

Alene Underwood displayed a revised draft Chelan PUD 2014 M&E Implementation Plan via WebEx, which included comments received from the USFWS and the CCT (USFWS and CCT comments on the draft M&E Plan were distributed to the Hatchery Committees by Kristi Geris on October 31, 2013). Underwood said that the draft being displayed on WebEx had not yet been distributed because she planned on addressing pending comments and making further revisions based on today's discussions. Discussions were as follows:

Section 1 Introduction

> USFWS comment [GW1]: Will sockeye monitoring be done under a separate contract or as a change order to the existing contract with Washington Department of Fish and Wildlife (WDFW)? How might this affect current contracting deadlines/activities?

Underwood said that she cannot answer these questions at this time. She said the plan is to have a draft addendum for sockeye ready for discussion at the Hatchery Committees meeting on November 20, 2013 (as discussed at the Hatchery Committees meeting on October 16, 2013). Bill Gale asked if sockeye monitoring will be a separate Request for Proposal, and Underwood replied that it would not. She added that at this time, it is unknown who will do the work—first agreement needs to be reached on what the work will be. Mike Tonseth asked if development of the M&E Plan is a requirement of Chelan PUD's Federal Energy Regulatory Commission license, and Underwood replied that it is not.

Section 1 Introduction

> CCT comment [kdt1]: Based on our recent experience during 2013 of unsuccessful genotyping adults to stream of origin, I do not think this is a viable option. Even if it were, genotyping will not provide production estimates for sub-watersheds, as strays spawning in those watersheds (e.g. Chiwawa fish in Nason Creek) will be typed as Chiwawa production when they were actually produced in Nason Creek.

> USFWS comment [GW2]: If this is the main mechanism for determining juvenile abundance by major spawning area it needs further discussion in committee, I am not convinced that the genetic approach will work, nor that it is appropriate.

Underwood said that this topic is tied to the Grant PUD M&E Plan, and recommended deferring this discussion until after Chelan PUD has addressed comments specific to their plan.

YN General Comment

Keely Murdoch said that organizing the plan by components makes sense; however, compared to previous approved M&E implementation plans, the plan seems vague regarding what is being done for each objective for each species. She suggested indicating how each objective will be addressed for each species; for example, in Section 2 Aquaculture Monitoring, there are a list of tasks and a list of objectives. She said, however, there is no indication of how each task will address, or achieve, each objective. She added that as currently written, the reader needs to make assumptions that may, or may not, be correct. Underwood said that Chelan PUD will revise a section to include more explicit details regarding how each objective will be achieved for each species; the revised section will be provided to Geris for distribution to the Hatchery Committees for further discussion and decisions regarding the organization and level of detail to include throughout the entire document.

Section 2.1 Stock Assessment and Broodstock Collection

> CCT comment [kdt2]: This section is titled "Stock Assessment and Broodstock Collection" yet the text does not reference any tasks associated with "Stock Assessment." This section infers, but does not state, that stock assessment and broodstock collection are concurrent activities with concurrent data collection. Please revise to clarify if brood collection and stock assessment are concurrent activities.

Underwood reviewed edits in redline strikeout (RLSO) that were incorporated to address this comment. Murdoch also noted that in the past, stock assessment and brood collection have not always been run concurrently. Underwood said that Chelan PUD will revise the text to clarify that stock assessment and broodstock collection are not always concurrent activities.

Section 2.2 In-Hatchery Monitoring

> CCT comment [kdt3]: Will precocity be evaluated? This could be useful in assessing optimal growth rates/size to reduce precocity and minimize mini-jack and jack rates.

> USFWS comment [GW3]: What about the residualism/early maturation work that has been funded in the past, how are we assessing this?

Underwood said there are components of ongoing studies for Dryden summer Chinook and Chelan Falls summer Chinook that may address these issues; however, she said that Chelan PUD is not supposing these types of activities as M&E objectives. Gale asked if components of the Biological Opinion (BiOp) require hatchery programs to assess when fish are ready to migrate, or what fish do not migrate, etc. Underwood said that some language about monitoring residualism is already included, but additional language can be incorporated where appropriate. Kirk Truscott added that it seems it would be important to correlate growth rates and size at release to precocity and some of the earlier investigations to indicate that growth rate and size have effects on jacking rates. He added that it seems to be a prudent hatchery component to monitor. Underwood said that Chelan PUD has not proposed that level of work for all stocks; and added that this type of work would need to be considered in terms of M&E objectives. Gale said that the National Marine Fisheries Service (NMFS) BiOp for spring Chinook has certain requirements to implement an M&E Plan. He said he thinks it is important to link the BiOp to the M&E Plan to ensure that all requirements are being addressed. Underwood said that permits are already referenced in the M&E Plan and that requirements are also included in the document. She added that the language calls out the importance of each component as it relates to the permit. Gale said, however, that specific terms and conditions of the permit are not called out. He added that the language could be more explicit. Underwood said that she does not consider the M&E Plan the appropriate document for that, and added that there are other documents that track permit compliance. She said, although, that components in the M&E Plan can be called out more clearly that are related to permit compliance. Gale said that he feel like it is the Hatchery Committees' responsibility to provide oversight to the PUDs to make sure they are addressing the terms and conditions within their respective permits. He asked what other documents there are that track permit compliance where the Hatchery Committees have input; Underwood said, for example, the monthly M&E Reports and the annual reports. Gale said that he was looking to provide input on what is planned—not on what has already occurred. Mike Schiewe noted that it is the responsibility of the permitee and NMFS (as the issuer of the permit) to monitor compliance. He then suggested the possible use of a matrix to show the linkage between components of the permit and the M&E Plan. Underwood said that a matrix could be developed; however, based on the language in the permit, she was uncertain of the usefulness. She added that the permit is broad, and includes only a provision to implement an M&E Plan. She said that Chelan PUD will reference specific permit terms and conditions as they relate to hatchery M&E where appropriate.

Section 2.2 In-Hatchery Monitoring > Fish Marking
> CCT comment [kdt4]: As "Fish Marking" is included in this Implementation Plan, a table should be included that details the marking/tagging strategy by production program. Although external marks may not be fully vetted in the Hatchery Committees, a table detailing the current mark/tag strategy would prompt the committee to decide on the mark/tag strategy for 2014.
Underwood said that Chelan PUD's permit requires that fish will be externally marked. She added that while this topic is important to discuss further, she suggested continuing this

discussion at another time, separate from the M&E Plan discussion. Truscott said that his comment was intended to tee up a process to reach concurrence on a marking strategy. He said, however, if this takes too much time and impedes the progress of the M&E Plan, he will withdraw his comment. Tonseth suggested developing a basic foundation to work with based on the current *U.S. v. Oregon* marking agreement. Underwood said this may be possible; however, the permit may not be consistent with the *U.S. v. Oregon* agreement. Schiewe agreed this information should be made available; however, the question is whether this information is needed in the M&E plan. He added that the point that marking has been continually put off is valid; and suggested planning a discussion for the next Hatchery Committees meeting. Hatchery Committees representatives present agreed to continue discussions about fish marking at the Hatchery Committees meeting on November 20, 2013, including developing a timeline and outlining what needs to be done in terms of developing a marking strategy. Truscott suggested addressing his comment by adding to the end of the first sentence of the *Fish Marking* section, "…and will be included as an addendum to this Plan." Underwood incorporated the revision, as requested. Gale endorsed the idea of an addendum, and added that when further discussion takes place, he requested that someone speak specifically to NMFS permit requirements as they relate to marking. He added that if the NMFS permit is advising something contrary, or conflicts, with the *U.S. v. Oregon* agreement, it needs to be highlighted now. Murdoch said that this also seems to be in conflict with the Hatchery and Genetic Management Plans, which indicate that conservation plan fish will be adipose fin (ad-) present and safety net fish will be ad-clipped. Underwood said that the HCP indicates that all fish will be externally marked. She said Chelan PUD's M&E Plan reflects this, and also states, "…or marked as otherwise agreed to by the HCP-HC." Murdoch said that she will internally discuss acceptable marking strategy language.

Section 3.1 In Freshwater productivity of Supplemented Stocks

> CCT comment [kdt5]: How will passive integrated transponder (PIT) tag loss be account for?

> USFWS comment [GW4]: How is mortality during the winter to spring period accounted for to convert winter migrants to smolts?

> USFWS comment [GW5]: How many will be tagged?

> USFWS comment [GW6]: How is tag loss accounted for?

> USFWS comment [GW7]: Will genetics be utilized to validate the differentiation between summer and spring Chinook smolts…
> USFWS comment [GW8]: How many samples are we talking about?
> USFWS comment [GW9]: In the case of spring Chinook salmon (SCS) this is confounded by straying that occurs between the tributaries. I.e., a Chiwawa fish that spawns in Nason would produce progeny that will be typed to Chiwawa though the fish was produced elsewhere…
Underwood said that Andrew Murdoch provided additional information to address these comments, and she reviewed the edits that were incorporated in RLSO. Gale asked how Murdoch estimated winter mortality. Underwood said that she did not know, but that she would follow-up with Murdoch to find out.

Section 4.1 Spawning Escapement Estimates > Chiwawa Spring Chinook
> CCT comment [kdt7]: So, will carcass recovery bias be used to correct carcass recovery data where it is appropriate? Also, will observer efficiency be accounted for in the redd surveys? If so, will they be based on existing efficiency models or new models? It appears if Chelan PUD staff will be conducting the spring Chinook surveys, which is a departure from the past 10 years or so, making a strong case for a newly developed observer efficiency model.
> USFWS comment [GW10]: Who is responsible for reading coded wire tags (CWTs) from SCS carcasses, who reports this data to Regional Mark Information System, what is the timeframe under which this will be done?
Underwood reviewed edits about total number of redds and clarification about who is responsible for data that were incorporated in RLSO. Keely Murdoch noted that the observer efficiency model was based on naïve surveys, and questioned how transferable these data would be. She asked if ground-truthing the model with a new crew might be worthwhile. Tonseth said that the model took into account a broad range of survey experience, from novice to experienced, and regular to seasonal, etc.; and he added, therefore, that the model was designed to account for survey biases. He suggested that it may be worth inviting Andrew Murdoch to present an overview and background about the model to the Hatchery Committees.

Section 4.1 Spawning Escapement Estimates > Wenatchee Summer Chinook

> CCT comment [kdt8]: Based on the Introduction Section, this is a census based methodology and should be reiterated in this section.
Underwood reviewed edits in RLSO that were incorporated to address this comment.

Section 5.1 Data Management
> CCT comment [kdt10]: Who is responsible for data entry, data management and quality assurance/quality check (QA/QC)?
Underwood reviewed edits in RLSO that were incorporated to address this comment.

Underwood said that Chelan PUD plans to revise the draft Chelan PUD 2014 M&E Implementation Plan, as discussed, and will provide the revised draft to Geris for distribution to the Hatchery Committees by Friday, November 8, 2013. She said that Chelan PUD will be requesting approval of the revised draft plan at the Hatchery Committees meeting on November 20, 2013.

III. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees' meetings are on November 20, 2013 (Douglas PUD); December 18, 2013 (Chelan PUD); and January 15, 2014 (Douglas PUD).

List of Attachments

Attachment A	List of Attendees
Attachment B	Draft Juvenile Carrying Capacity SOA
Attachment C	USFWS comments on the revised draft Chelan PUD 2014 M&E Implementation Plan
Attachment D	CCT comments on the revised draft Chelan PUD 2014 M&E Implementation Plan

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Catherine Willard	Chelan PUD
Tom Kahler*	Douglas PUD
Todd Pearsons	Grant PUD
Peter Graf	Grant PUD
Shannon Lowry	Grant PUD
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

Rock Island and Rocky Reach HCP Hatchery Committees

DRAFT Statement of Agreement

For Discussion Only

Use of Juvenile Data for Estimating Carrying Capacity

Approved XXX

Statement

The Rock Island and Rocky Reach Habitat Conservation Plans' (HCP) Hatchery Committees (HC) agree that:

1) An estimate of spring Chinook carrying capacity in the Wenatchee Basin and target tributaries is needed to inform management decisions such as spawning escapement and hatchery production.
2) Spring Chinook juvenile productivity data funded under Chelan PUD's hatchery Monitoring and Evaluation Program will be used to generate an HC approved estimate of carrying capacity provided that the data meet conditions described below.
3) An HC approved estimate of carrying capacity will be used to inform management decisions such as spawning escapement and set the upper limit of mitigation requirements for naturally produced spring Chinook salmon.

Part 2 and 3 of the previous statements will be modified if any of the following occur:

1) The quality of the data collected within the next 5 years have lower precision or accuracy than data collected in previous years using similar methods;

2) The data suggest that survival is density independent or there is insufficient contrast (e.g., variation) in the annual number of spawners;

3) An alternative data set generates a more accurate estimate of carrying capacity (if this occurs, then the HC will use it as the approved estimate of carrying capacity);

4) The estimated carrying capacity of a later life-stage (e.g., smolt or adult) is of sufficient quality (if this occurs, then the HC will use it as the approved estimate of carrying capacity).

Background

Currently, the HC does not have an approved estimate of carrying capacity. Carrying capacity is an important metric that can be used to inform the size of hatchery supplementation programs, spawning escapement, adult management, and other important management issues. The collection of juvenile fish data can help to generate or refine science based estimates of carrying capacity.

Chelan County PUD Hatchery Monitoring and Evaluation Implementation Plan 2014

Prepared by:

Alene Underwood and Catherine Willard

Draft October 2013

Contents

1. INTRODUCTION

The Habitat Conservation Plan (HCP) specifies that a monitoring and evaluation plan will be developed for the hatchery program. The approach to monitoring the hatchery programs was guided by the "*Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update"* (Hillman et al. 2013) and the "*Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Programs*" (Murdoch and Peven 2005).

The purpose of this document is to define the tasks associated with the approved scope of work to implement Chelan PUD's (CPUD's) hatchery monitoring and evaluation (M&E) plan for 2014. Monitoring and evaluation activities for Lake Wenatchee sockeye in 2014 have not yet been determined. Chelan PUD will submit an addendum to this implementation Plan by February 2014 to address these activities. The work described in this plan has ESA coverage provided by ESA permits 18121, 1347, and 1395. All activities conducted under this Implementation Plan shall adhere to all terms and conditions as specified in the referenced permits. These permits allow for changes to monitoring or research protocols with the caveat that such modifications are approved by NMFS prior to implementing those changes.

Comment [GW1]: Will sockeye monitoring be done on a separate contract or as an change order to the existing contract with WDFW? How might this effect current contracting deadlines/activities?

The Implementation Plan includes all four components of the M&E Program including: (1) aquaculture monitoring; (2) juvenile monitoring; (3) adult monitoring; and (4) data, analysis and reporting. Under each component are study design elements that will be used to inform the overarching program components. Figure 1 illustrates the relationship of the components and study design elements used to address each component. Table 1 depicts which study design element is being performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

The methods described in this plan differ from previous methodologies in the following ways:

- Emigrant abundance estimates will use newly derived analytical approaches that reduce bias and increase precision to include estimates of emigration during the winter non-trapping periods.
- The yearling smolt production estimates at the lower Wenatchee smolt trap will be apportioned into summer and spring Chinook. Spring Chinook will be apportioned by major spawning areas (i.e., Chiwawa, Nason, White, Little Wenatchee, Icicle and other).
- Spring Chinook spawner abundance estimates will be adjusted for observer efficiency and include estimates of precision.
- Summer Chinook spawner abundance will be based on census counts and be adjusted for observer efficiency and include estimates of precision.
- Steelhead run and spawning escapement estimates will be based on a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates.

Comment [GW2]: If this is the main mechanism for determining juvenile abundance by major spawning area it needs further discussion in committee, I am not convinced that the genetic approach will work, nor that it is appropriate…..

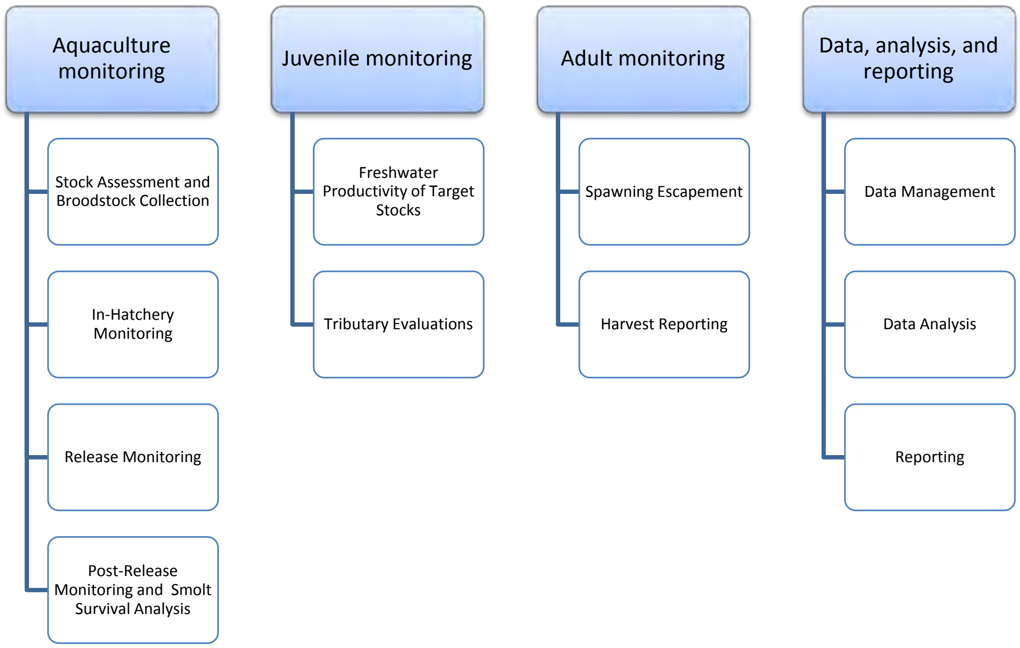

Figure 1. The four components of the hatchery monitoring and evaluation program and the study design elements within each component.

Table 1. **S**tudy design elements performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

Monitoring and evaluation component	Objectives	Study Design Elements	Chiwawa spring Chinook	Wenatchee summer Chinook	Chelan summer Chinook[2]	Methow spring Chinook[3]	Wenatchee Steelhead	Wenatchee Sockeye
Aquaculture Monitoring	3,5,6,8,9	Stock assessment and broodstock collection	WDFW	WDFW	WDFW	WDFW	WDFW	NA
		In-hatchery monitoring	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	NA
		Release monitoring	WDFW	WDFW	WDFW	WDFW	WDFW	NA
		Post-release monitoring and smolt survival analysis	WDFW	WDFW	WDFW	WDFW	WDFW	NA
Juvenile monitoring	2	Freshwater productivity of stocks	WDFW	WDFW	NA	NA	WDFW	TBD
		Tributary evaluations	WDFW	WDFW	NA	NA	WDFW	TBD
Adult monitoring	1,2,3,4,5,6, 8,10	Spawning escapement	CPUD	WDFW	CPUD	BioAnlaysts	WDFW	TBD
		Harvest reporting	WDFW	WDFW	WDFW	WDFW	WDFW	TBD
Data, analysis, and reporting	All	Data management	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Data analysis	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Reporting	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD

[1]CPUD crews will PIT tag in-hatchery fish.
[2]Because the Chelan summer Chinook program is primarily an augmentation program, monitoring and evaluation efforts focus on straying, release characteristics, and harvest.
[3]Monitoring and evaluation in 2014 will be shared by Grant and Chelan PUDs.

2. Aquaculture Monitoring

The Aquaculture monitoring component is comprised of two basic elements: (1) stock assessment and broodstock collection at adult trapping locations and (2) in-hatchery monitoring including spawning, rearing, and release of juveniles. Data collected during these elements primarily support monitoring questions 5.1.1, 8.1.1, 8.2.1, 8.3.1, 8.3.2, 8.4.1, 9.1.1, 9.2.1, 9.3.1 and 9.4.1, but also contribute data to monitoring questions 3.2.1, 3.2.2, 6.1.1, 6.2.1, and 6.3.1 (Hillman et al. 2013). These monitoring questions support the following objectives:

> ***Objective 3:*** *Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.*
> ***Objective 5:*** *Determine if the run timing, spawn timing, and spawning distribution of both the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.*
> ***Objective 6:*** *Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.*
> ***Objective 8:*** *Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.*
> ***Objective 9:*** *Determine if hatchery fish were released at the programmed size and number.*

2.1 Stock Assessment and Broodstock Collection

Broodstock collection for Wenatchee summer steelhead, Wenatchee summer Chinook, Methow summer Chinook, Chelan Falls summer Chinook, and Chiwawa River spring Chinook, hatchery programs will occur consistent with the Broodstock Collection Protocol approved annually by the Hatchery Committee (e.g., Tonseth 2013). Trapping locations and timing will be dictated by the annual broodstock collection protocol and the relevant permits. Data collection during broodstock collection will be consistent with Murdoch and Peven (2005). A representative sample of all fish trapped, collected for broodstock, or released back to the river, will be sampled for origin, age, sex, size, and migration timing. Biological sampling of all fish trapped will include presence of internal (CWT or PIT) and external (VIE) tags or marks, scales, length, and sex (determined by ultrasound). PIT tags will be injected into all target species (Chinook and steelhead), whether collected or released. All non-target species will be enumerated daily. Measures of central tendency and spread will be calculated and reported for each metric.

2.2 In-Hatchery Monitoring

The in-hatchery monitoring component will begin when adult fish are collected and retained for broodstock, and ends when juvenile fish are released. Life stage specific in-hatchery survival and growth rates, disease monitoring, and an estimate of the number of fish released will be collected and analyzed according to Murdoch and Peven (2005). Additional data to be collected includes individual lengths and weights of juveniles during monthly sampling, and the weight of

gonadal mass and body of spawned broodstock. Measures of the central tendency and spread will be calculated and reported for each metric.

Comment [GW3]: What about the residualism/early maturation work that has been funded in the past, how are we assessing this?

Fish Marking

All of Chelan PUD's hatchery fish will be coded-wire tagged (CWT) and externally marked or marked as otherwise agreed to by the HCP-HC. The identification of these hatchery-produced fish is needed for a suite of adult metrics and may be used for adult management and/or fisheries as contemplated by the co-managers.

Using methods described in Keller and Murauskas (2012), hatchery fish will be PIT-tagged (Table 1) at Eastbank Fish Hatchery approximately two to four weeks before the fish are transferred to acclimation ponds (Table 2). Additional PIT-tagging may occur for program specific studies/comparisons as approved by the HSC. The data collected from the PIT-tags will assist in release monitoring, migration timing, juvenile survival, and smolt-to-smolt survival. For all fish marking, quality control check will be performed during and immediately following tagging and prior to release.

Table 1. Wenatchee River basin hatchery program release goals and recommended number of fish PIT tagged.

Program	Release goals	Number of fish PIT tagged[1]	PIT tag rate (%)
Chiwawa River spring Chinook	144,026	5,000	3.5
Wenatchee River steelhead	247,500	15,000	6.0
Wenatchee River summer Chinook	318,816 (CPUD Program) 181,184 (GPUD Program)	20,600[2]	4.1

[1] Additional PIT tagging may take place for Chelan PUD approved studies and/or comparisons.
[2] Includes a component of PIT-tagged fish for the NOAA size target study and a component for Grant PUD's program).

2.3 Release Monitoring

Hatchery fish will be released during smoltification in the spring, typically between 15 April and 1 June. Whenever possible, the exact release dates will coincide with environmental conditions that promote a rapid emigration that minimizes both the potential negative ecological interactions of hatchery fish with naturally produced fish and predation on hatchery fish by avian or other predators. The monitoring data collected for each stock are described below.

Spring Chinook – Chiwawa River

Pre-release sampling data will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring

questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan (Hillman et al. 2013). PIT tag monitoring of spring Chinook released in the Chiwawa River will occur during the release period (April). Juvenile Chinook will pass through two 92-cm diameter PIT-tag antennas connected to Allflex 310 readers and Quantitative Sampling Technologies (QST) QuBE data logger. The release location and type (i.e., volitional, forced, or trucked) are recorded for each observation file created and uploaded to the PTAGIS database maintained by the Pacific States Marine Fisheries Commission after each year of release. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Spring Chinook – Methow

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Should PIT tagging occur, a monitored release strategy consistent with other Chinook stocks (i.e., Chiwawa Spring Chinook) will be implemented. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Steelhead–Wenatchee River Basin

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Monitoring of steelhead released in the Wenatchee River basin will occur during loading of fish into transport trucks, unless fish are released directly into the Chiwawa River. Steelhead will pass through a series of PIT-tag antennas, each connected to a data logger, thereby allowing the creation of a PIT-tag observation file for each truckload of steelhead consisting of unique tag records. The release location (stream and rkm), release type (volitional or forced), and hatchery group (HxH or WxW) will be recorded for each tag file created. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. However, because PIT-detection efficiency during loading will not be 100%, the number of fish in each truckload will be estimated using volumetric displacement. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Chinook – Wenatchee River and Chelan Falls

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions

9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Should PIT tagging occur, a monitored release strategy consistent with other Chinook stocks (i.e., Chiwawa Spring Chinook) will be implemented. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

2.4 Post-Release Monitoring and Survival Analysis

Data will be collected during rearing, acclimation, release, and the emigration period that may prove valuable in explaining variability in adult survival (Murdoch and Peven 2005). Rearing densities have been reported to influence the survival of hatchery fish (Martin and Wertheimer 1989; Banks 1994) and may also be linked to disease prevalence during rearing (Banks 1994; Ogut and Reno 2004). Acclimation of hatchery fish before release has been found to increase survival and reduce stray rates when the duration of the acclimation period is sufficient (Clarke et al. 2010, 2012; Rosenberger et al. 2013). These metrics (i.e., rearing density and acclimation period) will be collected annually to determine their influence on fish survival.

PIT-tagged groups of hatchery fish will be used to estimate survival during their emigration. Variation in survival during the emigration period may also inform observed adult survival rates. Survival during emigration or smolt-to-smolt survival and travel will be estimated using interrogation or release files and the standard Cormack-Jolly-Seber (CJS) estimator. CJS estimates are termed apparent survival estimates because it is unknown whether fish suffered mortality (e.g., size or time of release) or simply failed to emigrate (i.e., residualized or were precocial males). In the latter case, the proportion of PIT-tagged fish detected in the Wenatchee or Columbia rivers after the emigration period is complete may explain variation in smolt-to-smolt survival rates. The post-release performance of PIT-tag groups will be estimated and monitored annually, consistent with methods in Murdoch and Peven (2005).

3. Juvenile Monitoring

Data collected during these elements primarily support monitoring questions 2.1.1 and 2.2.1. These monitoring questions support the following objective:

> ***Objective 2:*** *Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.*

3.1 Freshwater productivity of Supplemented Stocks

Steelhead, Spring Chinook, and Summer Chinook

The freshwater productivity of supplemented stocks in the Wenatchee Basin will be monitored using smolt traps in the Chiwawa River and the lower Wenatchee River consistent with historical trapping efforts. Additionally, a newly derived analytical method which uses PIT-tag mark-recapture data will be utilized that reduces bias and increases precision by including

estimates of emigration during the winter non-trapping periods. Parr will be PIT tagged in the fall, based on the spatial distribution and abundance estimated during parr snorkel surveys, to generate estimates of migration during the non-trapping periods in Chiwawa River. Using PIT tagged parr detections at the lower Chiwawa (?) PIT array during the non-trapping period, the total number of PIT-tagged parr that emigrated will be estimated, and then expanded by the tag rate. PIT-tag mark-recapture trials conducted during the trapping period in the fall will also be used to estimate detection probabilities of the PIT-tag array at a given discharge level. Abundance and variance will be estimated using the same methods as those used in the smolt trap estimate. The estimated abundance and variance from each method and time period (trapping and non-trapping periods) will be summed to estimate a total production estimate. Under the proposed methodology, unbiased estimates of abundance during the entire migration period will be generated with relatively high precision (PSE < 15%), which is consistent with NOAA Fisheries' recommendations (Crawford and Rumsey 2011). Historical estimates will be revised using the new estimation techniques.

Comment [GW4]: How is mortality during the winter to spring period accounted for to convert winter migrants to smolts?

Comment [GW5]: How many will be tagged?

Comment [GW6]: How is tag loss accounted for?

All captured spring Chinook that are trapped at the lower Wenatchee trap will be assigned to stocks using genetic techniques. The results from the genetic stock partitioning will be applied to the overall estimated number of migrating spring Chinook to generate freshwater productivity by stock.

Comment [GW7]: Will genetics be utilized to validate the differentiation between summer and spring Chinook smolts…

Comment [GW8]: How many samples are we talking about?

Comment [GW9]: In the case of SCS this is confounded by straying that occurs between the tribs. i.e. a chiwawa fish that spawns in Nason would produce progeny that will be typed the Chiwawa though the fish was produced elsewhere…..

3.2 Tributary Evaluations

Chiwawa River

Snorkel surveys will be utilized to estimate summer parr abundance within the Chiwawa River basin. This approach has been used in the Chiwawa River basin since 1992. In parallel to addressing Objective 2 additional juvenile data can help to assess the habitat carrying capacity in each tributary. This information can add value to the overall M&E plans and help inform management decisions.

Sampling will follow a stratified random sampling design. Landscape classification will be used to stratify streams in the Chiwawa basin that support juvenile Chinook salmon. In the Chiwawa River basin, WDFW found that classification "explained" most of the variability in fish numbers caused by geology, land type, valley bottom type, stream state condition, and habitat type (Hillman 2013). The same classification method was used to identify sections of the Little Wenatchee River (reference area) that corresponded to discrete reaches in the supplemented basins, but that had no release of hatchery Chinook. Consistent with previous efforts, habitat types within each land-class or reach will be identified and quantified annually. At least three units of each habitat type within each reach will be randomly selected for estimating densities of salmon and trout. Thus, overall sampling consists of a stratified-random sampling design, which increases the accuracy and precision of population estimates.

Densities of salmon and trout will be estimated in August and September by direct underwater observation within the randomly-selected habitat units. Underwater methods will follow those described by Thurow (1994), Dolloff et al. (1996), and O'Neal (2007). Habitat surface areas and volumes will be estimated during fish sampling. Numbers of fish counted will be adjusted for detection probabilities using the models published in Hillman et al. (1992). For each habitat type within a state type and reach stratum, the mean density of salmon and trout will be calculated as the ratio of mean numbers to mean area or volume sampled (Cochran 1977). Total numbers of fish will be estimated per habitat type within a state type and reach stratum as the product of mean density of fish in a given habitat type, times total area or volume of that habitat type within the stratum (Cochran 1977). Total numbers of fish within the supplemented basin will be estimated as the sum of all population numbers per habitat type in state type/reach strata. Bootstrapping methods will be utilized to estimate variance and percent errors (based on 95% confidence interval) for total numbers of fish.

4. Adult Monitoring

The Adult monitoring component is comprised of two basic elements: (1) estimating spawning escapement and (2) harvest monitoring. Data collected during these elements primarily support monitoring questions 1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.2.1, 3.2.2, 4.1.1, 5.2.1, 5.3.1, 5.3.2, 6.3.1, but also contribute data to monitoring questions 6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.4.1, 10.1.1, 10.1.2, 10.1.3 and 10.1.4 (Hillman et al. 2013). These monitoring questions support the following objectives:

Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.

Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.

Objective 5: Determine if the run timing, spawn timing, and spawning distribution of both the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.

Objective 6: Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.

Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

Objective 10: Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.

4.1 Spawning Escapement Estimates

Chelan and Methow Summer/Fall Chinook

Chinook spawning ground surveys will be conducted in the Chelan River and Methow subbasin (see Appendix A for survey reaches). Spawning ground surveys will be conducted via foot or raft beginning late September and continuing until spawning has ended (usually mid-November). Frequency of surveys will vary depending on method.

Summer Chinook carcass surveys will be conducted in the Chelan and Methow subbasins beginning in September and ending in November consistent with methods described in Murdoch and Peven (2005). A representative sample (i.e., 20%) of spawners as determined by spawner abundance and distribution (typically 100% of the carcasses encountered in the Chelan and Methow) will be sampled. Biological data will include collection of scale samples for age analysis, length measurements (POH and FKL), gender, egg voidance, and a check for tags or marks. DNA samples (five-hole punches from operculum) will be collected as needed to address different objectives. These data will be used to assess length-at-age, size-at-age, egg voidance, origin (hatchery or naturally produced), stray rates, and genetics. All carcass surveys will be conducted within the historical reaches.

Wenatchee Steelhead

The number of hatchery and naturally produced steelhead returning to the Wenatchee Basin will be estimated using a PIT tag mark recapture model. The estimated spawner abundance for the Wenatchee steelhead population will be a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates. Steelhead redd counts will be conducted weekly in all major spawning areas in the mainstem Wenatchee River (see Appendix A for survey reaches); minor spawning areas in the mainstem Wenatchee River will be surveyed once, based on the spawn timing in adjacent major spawning areas, to estimate redd abundance at peak spawning. The estimated total number of redds in the Wenatchee River mainstem will be expanded by the sex ratio of the population to estimate spawner abundance. Spawner abundance in tributaries of the Wenatchee River will be estimated using a PIT tag mark recapture model.

Chiwawa Spring Chinook

Chiwawa spring Chinook spawning escapement will be estimated based on the total number of redds found in each tributary (Murdoch et al. 2010) using methods described in Murdoch and Peven (2005). Redd and carcass surveys will be conducted simultaneously from the first week of

August through September (see Appendix A for survey reaches). Redd-based estimates assume that each female constructs one redd, which WDFW has found to be appropriate for this population (Murdoch et al. 2009). Redd counts will be expanded and the number of hatchery and naturally produced fish will be estimated using methods in Murdoch et al. (2010). Carcasses encountered during surveys will be sampled according to methods outlined in Murdoch and Peven (2005). In addition, all redds and female carcasses will be geo-referenced using hand-held GPS devices. Carcass recovery bias has been detected in the Chiwawa spring Chinook population (Murdoch et al. 2010) and if not corrected will bias estimates of hatchery and naturally produced fish on the spawning grounds. While it may be appropriate to correct for carcass recovery bias for some monitoring questions (e.g., 2.2), when comparisons to reference populations are made in monitoring questions 1.1.and 1.2, carcass bias will not be corrected because other monitoring programs have not corrected for a similar bias.

Comment [GW10]: Who is responsible for reading CWTs from SGS carcasses, who reports this data to RMIS, what is the timeframe under which this will be done?

Wenatchee Summer Chinook

Wenatchee summer Chinook spawning ground counts will begin the last week in September and continue through the end of spawning in November (see Appendix A for survey reaches). Redd counts will be conducted by foot or raft depending on stream size, flow, and density of spawners within the stream reach. All stream reaches will be surveyed once per week. Redd data will be collected using methods described in Murdoch and Peven (2005). Salmon carcass data collected during spawning ground surveys will be consistent with Murdoch and Peven (2005).

Redd Observer Efficiency and Fish per Redd Value

Estimating redd observer efficiency is a costly and laborious task. Models generated for spring Chinook salmon are not applicable for summer Chinook because of differences in river characteristics of spawning locations. Small unmanned air systems (e.g., four blade helicopter) have been used successfully to document the abundance and distribution of fall Chinook redds in the Snake River (P. Groves, Idaho Power, Pers. comm.). We intend to use this technology to determine the true number of summer Chinook redds in selected reaches of the Wenatchee River. Weekly aerial photos of selected reaches will be digitally overlaid to document existing and newly constructed redds. Weekly ground-based estimates and the true number of redds will be compared in order to determine observer efficiency. Weekly river characteristics (e.g., channel width, water depth, discharge, visibility, and habitat complexity), observer experience, and survey effort will be incorporated into a model to predict observer efficiency in all river reaches. Predicted redd observer efficiency for each river reach will be used to expand ground-based redd counts to estimate the total reach redd count. Aerial photographs and ground-based surveys will also be used to estimate redd life for each river reach. The estimated spawner abundance in the Wenatchee River and an associated level of precision will be calculated using the estimated total redd count

for each reach, mean redd life, and the sex ratio of the population similar to methods described in Millar et al. (2012).

4.2 Harvest Reporting

In years when the expected hatchery adult returns are in excess of the levels needed to meet the hatchery program goals (i.e., broodstock and/or escapement), surplus fish may be available for harvest. Harvesting or removal of surplus hatchery fish may have benefits to the natural populations by reducing potential negative ecological and genetic impacts (e.g., density dependent effects, loss of fitness, and loss of genetic variation). The contribution of hatchery fish to fisheries will be monitored using CWT recoveries on a brood-year basis supporting Objective 10.

To obtain the necessary data to determine if the harvest rates are meeting objectives, a statistically valid creel program will be designed and implemented for all sport and/or conservation fisheries in the Upper Columbia River to estimate harvest of hatchery fish from both Chelan and Grant County PUD funded hatchery programs (Murdoch and Peven 2005). Information collected during creel surveys are an integral component to calculating the HRR (Objective 3), particularly given most CWT recoveries for PUD mitigation programs occur in the Upper Columbia River and its tributaries, with the exception of summer Chinook where most CWT recoveries occur in ocean fisheries. Because of considerable time lags in reporting of CWT's to the Regional Marking Information System (RMIS) database, it requires an ongoing query of recovery data until the number of estimated fish does not change.

5. Data Management , Analysis, and Reporting

5.1 Data Management

A database system has been developed in Microsoft Access that manages all the monitoring data collected for hatchery evaluations. The database will contain and manage all data associated with aquaculture monitoring, juvenile monitoring, and adult monitoring.

All data entered into the database are evaluated for quality control and quality assurance. Quality control checks using analyses such as modified Z-scores, boxplots, and the Generalized Extreme Studentized Deviate Procedure (Iglewicz and Hoaglin 1993) will be conducted for all data entry. In the event outliers are identified, discussion will occur on whether identified outliers are true data points or transcription errors. This process ensures that the data used to test statistical hypotheses are correct and accurate.

5.2 Data Analysis

The analyses proposed are consistent with the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update (Hillman et al. 2013). Each of the objectives will be addressed

using the appropriate statistical tests, as well as graphic analyses that convey relevant information.

5.3 Reporting

An annual M&E report will be generated following the completion of each calendar year and will be available for HCP HC review by June 1 of the following year. Additionally, monthly progress reports will be made available to the HCP HC.

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APPENDIX A

Designated survey reaches for Methow subbasin summer Chinook spawning ground surveys.

River	Reach	Code	RM
Methow	Mouth to Methow Bridge	M1	0.0-14.78
	Methow Bridge to Carlton Bridge	M2	14.78-27.17
	Carlton Bridge to Twisp Bridge	M3	27.17-39.55
	Twisp Bridge to MVID	M4	39.55-44.85
	MVID to Winthrop Bridge	M5	44.85-49.80
	Winthrop Bridge to Hatchery Dam	M6	49.80-51.55

Designated survey reaches for Wenatchee River basin summer Chinook spawning grounds surveys. Asterisks denotes reaches where redd observer efficiency will be assessed.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Bridge	54.20-53.58
	Bridge to Swamp *	53.58-52.66
	Swamp to Chiwawa River	52.66-48.39
W9	Chiwawa River to Schugart Flats	48.39-47.93
	Schugart Flats to Old Plain Bridge	47.93-46.21
	Old Plain Bridge to RR Bridge	46.21-41.91
	RR Bridge to RR Tunnel	41.91-39.28
	RR Tunnel to Swing Pool *	39.28-36.67
	Swing Pool to Tumwater Br	36.67-35.55
W8	Tumwater Br to Swiftwater Campground *	35.55-33.50
	Swiftwater Campground to Unimproved Campground	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Penstock Br	30.91-28.66
	Penstock Br to Icicle Road Br *	28.66-26.43
W6	Icicle Road Br to Icicle Mouth	26.43-25.61
	Icicle Mouth to Boat Takeout *	25.61-24.49
	Boat Takeout to Leavenworth Br	24.49-23.90
W5	Leavenworth Br to Irrigation Flume *	23.90-22.77
	Irrigation Flume to Peshastin Br	22.77-20.00
W4	Peshastin Br to Dryden Dam *	20.00-17.76
W3	Dryden Dam to Williams Canyon	17.76-15.54
	Williams Canyon to Upper Cashmere Br	15.54-10.22
	Upper Cashmere Br to Lower Cashmere Br	10.22-9.49
W2	Lower Cashmere Br to Old Monitor Br *	9.49-7.12
	Old Monitor Br to Sleepy Hollow Br	7.12-3.27
W1	Sleepy Hollow Br to River Bend *	3.27-1.73
	River Bend to Siphon	1.73-1.29
	Siphon to Mouth	1.29-0.45

Designated survey reaches for Wenatchee Basin spring Chinook spawning grounds surveys.

Reach Code	Reach Section	River Mile
Chiwawa River and Tributaries (Rock and Chikamin)		
C7	Buck Cr to Phelps Cr	36.39-33.46
C6	Phelps Cr (Trinity) to Maple Cr Br	33.46-29.64
C5	Maple Cr Br to Atkinson Flats	29.64-26.59
C4	Atkinson Flats to Schaefer Cr	26.59-24.24
C3	Schaefer Cr to Rock Cr Campground	24.24-22.97
R1 - Rock	Mouth to Chiwawa River Road Bridge	0.00-1.05
C2	Rock Cr Campground to Grouse Cr	22.97-12.27
K1 - Chikamin	Mouth to Chiwawa River Road Bridge	0.00-0.68
C1	Grouse Cr to Mouth	12.27-0.00
Nason Creek		
N4	White Pine Creek to Lower R.R. Bridge	16.09-13.68
N3	Lower R.R. Bridge to Hwy 2 Bridge	13.68-9.13
N2	Hwy 2 Bridge to Kahler Cr	9.13-4.46
N1	Kahler Cr to Mouth	4.46-0.00
White River and Tributaries (Panther and Napeaqua)		
H4	Falls to Grasshopper Meadows	21.16-19.78
T1 - Panther	Boulder field to Mouth	0.43-0.00
H3	Grasshopper Meadows to Napeaqua River	19.78-17.59
Q1 - Napeaqua	Take out to Mouth	0.91-0.00
H2	Napeequa River to Sears Cr Bridge	17.59-11.97
H1	Sears Cr Bridge to Mouth	11.97-0.00
Little Wenatchee River		
L3	Rainy Cr to Lost Cr	10.78-6.74
L2	Lost Cr to Old Fish Weir	6.74-2.13
L1	Old Fish Weir to Mouth	2.13-0.00
Upper Wenatchee River		
W10	Lake Wenatchee to Chiwawa River	54.20-48.39
Chiwaukum Creek		
U1	Metal bridge to Mouth	1.0 – 0.0
Icicle River		
I1	Hatchery to Mouth	3.02-0.00
Peshastin Creek and Tributaries (Ingalls Creek)		
D1 - Ingalls	Trailhead to mouth	0.64-0.00
P2	Ingalls Creek to Camas Cr	9.14-5.63
P1	Camas Cr to Mouth	5.63-0.00

Designated survey reaches for Wenatchee River basin steelhead spawning grounds surveys. Asterisks denote index reaches. Spawning escapements in tributaries will be estimates using PIT-tag arrays.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Chiwawa River*	54.20-48.39
W9	Chiwawa River to Tumwater Bridge*	48.39-35.55
W8	Tumwater Br to Swiftwater Campground	35.55-33.50
	Swiftwater Campground to Unimproved Campground*	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Icicle Road Bridge	30.91-26.43
W6	Icicle Road Br to Leavenworth boat ramp*	26.43-24.49
	Boat Takeout to Leavenworth Bridge	24.49-23.90
W5	Leavenworth Bridge to Peshastin Bridge	23.90-20.00
W4	Peshastin Bridge to Dryden Dam	20.00-17.76
W3	Dryden Dam to Lower Cashmere Bridge	17.76-9.49
W2	Lower Cashmere Bridge to Sleepy Hollow Bridge *	9.49-3.27
W1	Sleepy Hollow Bridge to Mouth	3.27-0.45

Tributary	River mile of PIT tag array
Mission Creek	0.54
Peshastin Creek	1.91
Chumstick Creek	0.31
Icicle River	0.26
Chiwaukum Creek	0.24
Chiwawa River	0.58
Nason Creek	0.52
Little Wenatchee River	1.74
White River	1.65

Attachment D

Chelan County PUD Hatchery Monitoring and Evaluation Implementation Plan 2014

Prepared by:

Alene Underwood and Catherine Willard

Draft October 2013

Contents

1. INTRODUCTION

The Habitat Conservation Plan (HCP) specifies that a monitoring and evaluation plan will be developed for the hatchery program. The approach to monitoring the hatchery programs was guided by the "*Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update"* (Hillman et al. 2013) and the "*Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Programs*" (Murdoch and Peven 2005).

The purpose of this document is to define the tasks associated with the approved scope of work to implement Chelan PUD's (CPUD's) hatchery monitoring and evaluation (M&E) plan for 2014. Monitoring and evaluation activities for Lake Wenatchee sockeye in 2014 have not yet been determined. Chelan PUD will submit an addendum to this implementation Plan by February 2014 to address these activities. The work described in this plan has ESA coverage provided by ESA permits 18121, 1347, and 1395. All activities conducted under this Implementation Plan shall adhere to all terms and conditions as specified in the referenced permits. These permits allow for changes to monitoring or research protocols with the caveat that such modifications are approved by NMFS prior to implementing those changes.

The Implementation Plan includes all four components of the M&E Program including: (1) aquaculture monitoring; (2) juvenile monitoring; (3) adult monitoring; and (4) data, analysis and reporting. Under each component are study design elements that will be used to inform the overarching program components. Figure 1 illustrates the relationship of the components and study design elements used to address each component. Table 1 depicts which study design element is being performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

The methods described in this plan differ from previous methodologies in the following ways:

- Emigrant abundance estimates will use newly derived analytical approaches that reduce bias and increase precision to include estimates of emigration during the winter non-trapping periods.
- The yearling smolt production estimates at the lower Wenatchee smolt trap will be apportioned into summer and spring Chinook. Spring Chinook will be apportioned by major spawning areas (i.e., Chiwawa, Nason, White, Little Wenatchee, Icicle and other).
- Spring Chinook spawner abundance estimates will be adjusted for observer efficiency and include estimates of precision.
- Summer Chinook spawner abundance will be based on census counts and be adjusted for observer efficiency and include estimates of precision.

Comment [kdt1]: Based on our recent experience during 2013 of unsuccessful genotyping adults to stream of origin I don't think this is a viable option. Even if it were, genotyping will not provide production estimates for sub-watersheds, as strays spawning in those watersheds (e.g. Chiwawa fish in Nason Creek) will be typed as Chiwawa production when they were actually produced in Nason Creek.

- Steelhead run and spawning escapement estimates will be based on a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates.

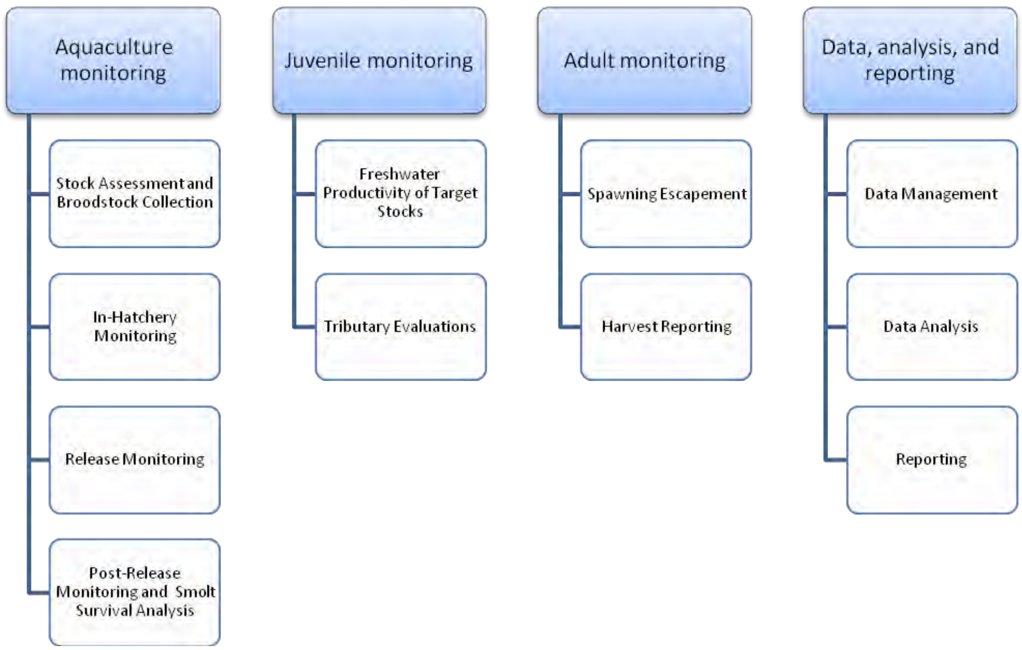

Figure 1. The four components of the hatchery monitoring and evaluation program and the study design elements within each component.

Table 1. **S**tudy design elements performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

Monitoring and evaluation component	**Objectives**	**Study Design Elements**	**Chiwawa spring Chinook**	**Wenatchee summer Chinook**	**Chelan summer Chinook[2]**	**Methow spring Chinook[3]**	**Wenatchee Steelhead**	**Wenatchee Sockeye**
Aquaculture Monitoring	3,5,6,8,9	Stock assessment and broodstock collection	WDFW	WDFW	WDFW	WDFW	WDFW	NA
		In-hatchery monitoring	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	WDFW CPUD[1]	NA
		Release monitoring	WDFW	WDFW	WDFW	WDFW	WDFW	NA
		Post-release monitoring and smolt survival analysis	WDFW	WDFW	WDFW	WDFW	WDFW	NA
Juvenile monitoring	2	Freshwater productivity of stocks	WDFW	WDFW	NA	NA	WDFW	TBD
		Tributary evaluations	WDFW	WDFW	NA	NA	WDFW	TBD
Adult monitoring	1,2,3,4,5,6, 8,10	Spawning escapement	CPUD	WDFW	CPUD	BioAnlaysts	WDFW	TBD
		Harvest reporting	WDFW	WDFW	WDFW	WDFW	WDFW	TBD
Data, analysis, and reporting	All	Data management	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Data analysis	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Reporting	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD

[1]CPUD crews will PIT tag in-hatchery fish.
[2]Because the Chelan summer Chinook program is primarily an augmentation program, monitoring and evaluation efforts focus on straying, release characteristics, and harvest.
[3]Monitoring and evaluation in 2014 will be shared by Grant and Chelan PUDs.

2. AQUACULTURE MONITORING

The Aquaculture monitoring component is comprised of two basic elements: (1) stock assessment and broodstock collection at adult trapping locations and (2) in-hatchery monitoring including spawning, rearing, and release of juveniles. Data collected during these elements primarily support monitoring questions 5.1.1, 8.1.1, 8.2.1, 8.3.1, 8.3.2, 8.4.1, 9.1.1, 9.2.1, 9.3.1 and 9.4.1, but also contribute data to monitoring questions 3.2.1, 3.2.2, 6.1.1, 6.2.1, and 6.3.1 (Hillman et al. 2013). These monitoring questions support the following objectives:

Objective 3: *Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.*

Objective 5: *Determine if the run timing, spawn timing, and spawning distribution of both the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.*

Objective 6: *Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.*

Objective 8: *Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.*

Objective 9: *Determine if hatchery fish were released at the programmed size and number.*

2.1 Stock Assessment and Broodstock Collection

Broodstock collection for Wenatchee summer steelhead, Wenatchee summer Chinook, Methow summer Chinook, Chelan Falls summer Chinook, and Chiwawa River spring Chinook, hatchery programs will occur consistent with the Broodstock Collection Protocol approved annually by the Hatchery Committee (e.g., Tonseth 2013). Trapping locations and timing will be dictated by the annual broodstock collection protocol and the relevant permits. Data collection during broodstock collection will be consistent with Murdoch and Peven (2005). A representative sample of all fish trapped, collected for broodstock, or released back to the river, will be sampled for origin, age, sex, size, and migration timing. Biological sampling of all fish trapped will include presence of internal (CWT or PIT) and external (VIE) tags or marks, scales, length, and sex (determined by ultrasound). PIT tags will be injected into all target species (Chinook and steelhead), whether collected or released. All non-target species will be enumerated daily. Measures of central tendency and spread will be calculated and reported for each metric.

Comment [kdt2]: This section is titled "Stock Assessment and Broodstock Collection" yet the text does not reference any tasks associated with "stock Assessment". This section infers, but does not state that stock assessment and broodstock collection are concurrent activities with concurrent data collection. Please revise to clarify if brood collection and stock assessment are concurrent activities.

2.2 In-Hatchery Monitoring

The in-hatchery monitoring component will begin when adult fish are collected and retained for broodstock, and ends when juvenile fish are released. Life stage specific in-hatchery survival and growth rates, disease monitoring, and an estimate of the number of fish released will be collected and analyzed according to Murdoch and Peven (2005). Additional data to be collected includes individual lengths and weights of juveniles during monthly sampling, and the weight of

Comment [kdt3]: Will precocity be evaluated? This could be useful in assessing optimal growth rates,/size to reduce precocity and minimize mini-jack and jack rates.

gonadal mass and body of spawned broodstock. Measures of the central tendency and spread will be calculated and reported for each metric.

Fish Marking

Comment [kdt4]: As "Fish Marking" is included in this Implementation plan, a table should be included that details the marking/tagging strategy by production program. Although external marks may not be fully vetted in the HC, a table detailing the current mark/tag strategy would prompt the committee to decide on the mark/tag strategy for 2014.

All of Chelan PUD's hatchery fish will be coded-wire tagged (CWT) and externally marked or marked as otherwise agreed to by the HCP-HC. The identification of these hatchery-produced fish is needed for a suite of adult metrics and may be used for adult management and/or fisheries as contemplated by the co-managers.

Using methods described in Keller and Murauskas (2012), hatchery fish will be PIT-tagged (Table 1) at Eastbank Fish Hatchery approximately two to four weeks before the fish are transferred to acclimation ponds (Table 2). Additional PIT-tagging may occur for program specific studies/comparisons as approved by the HSC. The data collected from the PIT-tags will assist in release monitoring, migration timing, juvenile survival, and smolt-to-smolt survival. For all fish marking, quality control check will be performed during and immediately following tagging and prior to release.

Table 1. Wenatchee River basin hatchery program release goals and recommended number of fish PIT tagged.

Program	Release goals	Number of fish PIT tagged[1]	PIT tag rate (%)
Chiwawa River spring Chinook	144,026	5,000	3.5
Wenatchee River steelhead	247,500	15,000	6.0
Wenatchee River summer Chinook	318,816 (CPUD Program) 181,184 (GPUD Program)	20,600[2]	4.1

[1] Additional PIT tagging may take place for Chelan PUD approved studies and/or comparisons.
[2] Includes a component of PIT-tagged fish for the NOAA size target study and a component for Grant PUD's program).

2.3 Release Monitoring

Hatchery fish will be released during smoltification in the spring, typically between 15 April and 1 June. Whenever possible, the exact release dates will coincide with environmental conditions that promote a rapid emigration that minimizes both the potential negative ecological interactions of hatchery fish with naturally produced fish and predation on hatchery fish by avian or other predators. The monitoring data collected for each stock are described below.

Spring Chinook – Chiwawa River

Pre-release sampling data will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring

questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan (Hillman et al. 2013). PIT tag monitoring of spring Chinook released in the Chiwawa River will occur during the release period (April). Juvenile Chinook will pass through two 92-cm diameter PIT-tag antennas connected to Allflex 310 readers and Quantitative Sampling Technologies (QST) QuBE data logger. The release location and type (i.e., volitional, forced, or trucked) are recorded for each observation file created and uploaded to the PTAGIS database maintained by the Pacific States Marine Fisheries Commission after each year of release. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Spring Chinook – Methow

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Should PIT tagging occur, a monitored release strategy consistent with other Chinook stocks (i.e., Chiwawa Spring Chinook) will be implemented. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Steelhead–Wenatchee River Basin

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Monitoring of steelhead released in the Wenatchee River basin will occur during loading of fish into transport trucks, unless fish are released directly into the Chiwawa River. Steelhead will pass through a series of PIT-tag antennas, each connected to a data logger, thereby allowing the creation of a PIT-tag observation file for each truckload of steelhead consisting of unique tag records. The release location (stream and rkm), release type (volitional or forced), and hatchery group (HxH or WxW) will be recorded for each tag file created. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. However, because PIT-detection efficiency during loading will not be 100%, the number of fish in each truckload will be estimated using volumetric displacement. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Chinook – Wenatchee River and Chelan Falls

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions

9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Should PIT tagging occur, a monitored release strategy consistent with other Chinook stocks (i.e., Chiwawa Spring Chinook) will be implemented. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

2.4 Post-Release Monitoring and Survival Analysis

Data will be collected during rearing, acclimation, release, and the emigration period that may prove valuable in explaining variability in adult survival (Murdoch and Peven 2005). Rearing densities have been reported to influence the survival of hatchery fish (Martin and Wertheimer 1989; Banks 1994) and may also be linked to disease prevalence during rearing (Banks 1994; Ogut and Reno 2004). Acclimation of hatchery fish before release has been found to increase survival and reduce stray rates when the duration of the acclimation period is sufficient (Clarke et al. 2010, 2012; Rosenberger et al. 2013). These metrics (i.e., rearing density and acclimation period) will be collected annually to determine their influence on fish survival.

PIT-tagged groups of hatchery fish will be used to estimate survival during their emigration. Variation in survival during the emigration period may also inform observed adult survival rates. Survival during emigration or smolt-to-smolt survival and travel will be estimated using interrogation or release files and the standard Cormack-Jolly-Seber (CJS) estimator. CJS estimates are termed apparent survival estimates because it is unknown whether fish suffered mortality (e.g., size or time of release) or simply failed to emigrate (i.e., residualized or were precocial males). In the latter case, the proportion of PIT-tagged fish detected in the Wenatchee or Columbia rivers after the emigration period is complete may explain variation in smolt-to-smolt survival rates. The post-release performance of PIT-tag groups will be estimated and monitored annually, consistent with methods in Murdoch and Peven (2005).

3. JUVENILE MONITORING

Data collected during these elements primarily support monitoring questions 2.1.1 and 2.2.1. These monitoring questions support the following objective:

> ***Objective 2:*** *Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.*

3.1 Freshwater productivity of Supplemented Stocks

Steelhead, Spring Chinook, and Summer Chinook

The freshwater productivity of supplemented stocks in the Wenatchee Basin will be monitored using smolt traps in the Chiwawa River and the lower Wenatchee River consistent with historical trapping efforts. Additionally, a newly derived analytical method which uses PIT-tag mark-recapture data will be utilized that reduces bias and increases precision by including

estimates of emigration during the winter non-trapping periods. Parr will be PIT tagged in the fall, based on the spatial distribution and abundance estimated during parr snorkel surveys, to generate estimates of migration during the non-trapping periods in Chiwawa River. Using PIT tagged parr detections at the lower PIT array during the non-trapping period, the total number of PIT-tagged parr that emigrated will be estimated, and then expanded by the tag rate. PIT-tag mark-recapture trials conducted during the trapping period in the fall will also be used to estimate detection probabilities of the PIT-tag array at a given discharge level. Abundance and variance will be estimated using the same methods as those used in the smolt trap estimate. The estimated abundance and variance from each method and time period (trapping and non-trapping periods) will be summed to estimate a total production estimate. Under the proposed methodology, unbiased estimates of abundance during the entire migration period will be generated with relatively high precision (PSE < 15%), which is consistent with NOAA Fisheries' recommendations (Crawford and Rumsey 2011). Historical estimates will be revised using the new estimation techniques.

Comment [kdt5]: How will PIT tag loss be account for?

All captured spring Chinook that are trapped at the lower Wenatchee trap will be assigned to stocks using genetic techniques. The results from the genetic stock partitioning will be applied to the overall estimated number of migrating spring Chinook to generate freshwater productivity by stock.

Comment [kdt6]: See comment kdt1

3.2 Tributary Evaluations

Chiwawa River

Snorkel surveys will be utilized to estimate summer parr abundance within the Chiwawa River basin. This approach has been used in the Chiwawa River basin since 1992. In parallel to addressing Objective 2 additional juvenile data can help to assess the habitat carrying capacity in each tributary. This information can add value to the overall M&E plans and help inform management decisions.

Sampling will follow a stratified random sampling design. Landscape classification will be used to stratify streams in the Chiwawa basin that support juvenile Chinook salmon. In the Chiwawa River basin, WDFW found that classification "explained" most of the variability in fish numbers caused by geology, land type, valley bottom type, stream state condition, and habitat type (Hillman 2013). The same classification method was used to identify sections of the Little Wenatchee River (reference area) that corresponded to discrete reaches in the supplemented basins, but that had no release of hatchery Chinook. Consistent with previous efforts, habitat types within each land-class or reach will be identified and quantified annually. At least three units of each habitat type within each reach will be randomly selected for estimating densities of salmon and trout. Thus, overall sampling consists of a stratified-random sampling design, which increases the accuracy and precision of population estimates.

Densities of salmon and trout will be estimated in August and September by direct underwater observation within the randomly-selected habitat units. Underwater methods will follow those described by Thurow (1994), Dolloff et al. (1996), and O'Neal (2007). Habitat surface areas and volumes will be estimated during fish sampling. Numbers of fish counted will be adjusted for detection probabilities using the models published in Hillman et al. (1992). For each habitat type within a state type and reach stratum, the mean density of salmon and trout will be calculated as the ratio of mean numbers to mean area or volume sampled (Cochran 1977). Total numbers of fish will be estimated per habitat type within a state type and reach stratum as the product of mean density of fish in a given habitat type, times total area or volume of that habitat type within the stratum (Cochran 1977). Total numbers of fish within the supplemented basin will be estimated as the sum of all population numbers per habitat type in state type/reach strata. Bootstrapping methods will be utilized to estimate variance and percent errors (based on 95% confidence interval) for total numbers of fish.

4. ADULT MONITORING

The Adult monitoring component is comprised of two basic elements: (1) estimating spawning escapement and (2) harvest monitoring. Data collected during these elements primarily support monitoring questions 1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.2.1, 3.2.2, 4.1.1, 5.2.1, 5.3.1, 5.3.2, 6.3.1, but also contribute data to monitoring questions 6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.4.1, 10.1.1, 10.1.2, 10.1.3 and 10.1.4 (Hillman et al. 2013). These monitoring questions support the following objectives:

Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.

Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.

Objective 5: Determine if the run timing, spawn timing, and spawning distribution of both the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.

Objective 6: Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.

Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

Objective 10: Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.

4.1 Spawning Escapement Estimates

Chelan and Methow Summer/Fall Chinook

Chinook spawning ground surveys will be conducted in the Chelan River and Methow subbasin (see Appendix A for survey reaches). Spawning ground surveys will be conducted via foot or raft beginning late September and continuing until spawning has ended (usually mid-November). Frequency of surveys will vary depending on method.

Summer Chinook carcass surveys will be conducted in the Chelan and Methow subbasins beginning in September and ending in November consistent with methods described in Murdoch and Peven (2005). A representative sample (i.e., 20%) of spawners as determined by spawner abundance and distribution (typically 100% of the carcasses encountered in the Chelan and Methow) will be sampled. Biological data will include collection of scale samples for age analysis, length measurements (POH and FKL), gender, egg voidance, and a check for tags or marks. DNA samples (five-hole punches from operculum) will be collected as needed to address different objectives. These data will be used to assess length-at-age, size-at-age, egg voidance, origin (hatchery or naturally produced), stray rates, and genetics. All carcass surveys will be conducted within the historical reaches.

Wenatchee Steelhead

The number of hatchery and naturally produced steelhead returning to the Wenatchee Basin will be estimated using a PIT tag mark recapture model. The estimated spawner abundance for the Wenatchee steelhead population will be a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates. Steelhead redd counts will be conducted weekly in all major spawning areas in the mainstem Wenatchee River (see Appendix A for survey reaches); minor spawning areas in the mainstem Wenatchee River will be surveyed once, based on the spawn timing in adjacent major spawning areas, to estimate redd abundance at peak spawning. The estimated total number of redds in the Wenatchee River mainstem will be expanded by the sex ratio of the population to estimate spawner abundance. Spawner abundance in tributaries of the Wenatchee River will be estimated using a PIT tag mark recapture model.

Chiwawa Spring Chinook

Chiwawa spring Chinook spawning escapement will be estimated based on the total number of redds found in each tributary (Murdoch et al. 2010) using methods described in Murdoch and Peven (2005). Redd and carcass surveys will be conducted simultaneously from the first week of

August through September (see Appendix A for survey reaches). Redd-based estimates assume that each female constructs one redd, which WDFW has found to be appropriate for this population (Murdoch et al. 2009). Redd counts will be expanded and the number of hatchery and naturally produced fish will be estimated using methods in Murdoch et al. (2010). Carcasses encountered during surveys will be sampled according to methods outlined in Murdoch and Peven (2005). In addition, all redds and female carcasses will be geo-referenced using hand-held GPS devices. Carcass recovery bias has been detected in the Chiwawa spring Chinook population (Murdoch et al. 2010) and if not corrected will bias estimates of hatchery and naturally produced fish on the spawning grounds. While it may be appropriate to correct for carcass recovery bias for some monitoring questions (e.g., 2.2), when comparisons to reference populations are made in monitoring questions 1.1.and 1.2, carcass bias will not be corrected because other monitoring programs have not corrected for a similar bias.

Comment [kdt7]: So, will carcass recovery bias be used to correct carcass recovery data where it is appropriate?

Also, will observer efficiency be accounted for in the redd surveys? If so, will they be based on existing efficiency models or new models? It appears if CPUD staff will be conducting the spring Chinook surveys, which is a departure from the past 10 years or so, making a strong case for a newly developed observer efficiency model.

Wenatchee Summer Chinook

Wenatchee summer Chinook spawning ground counts will begin the last week in September and continue through the end of spawning in November (see Appendix A for survey reaches). Redd counts will be conducted by foot or raft depending on stream size, flow, and density of spawners within the stream reach. All stream reaches will be surveyed once per week. Redd data will be collected using methods described in Murdoch and Peven (2005). Salmon carcass data collected during spawning ground surveys will be consistent with Murdoch and Peven (2005).

Comment [kdt8]: Based on the Introduction Section, this is a census based methodology and should be reiterated in this section.

Redd Observer Efficiency and Fish per Redd Value

Estimating redd observer efficiency is a costly and laborious task. Models generated for spring Chinook salmon are not applicable for summer Chinook because of differences in river characteristics of spawning locations. Small unmanned air systems (e.g., four blade helicopter) have been used successfully to document the abundance and distribution of fall Chinook redds in the Snake River (P. Groves, Idaho Power, Pers. comm.). We intend to use this technology to determine the true number of summer Chinook redds in selected reaches of the Wenatchee River. Weekly aerial photos of selected reaches will be digitally overlaid to document existing and newly constructed redds. Weekly ground-based estimates and the true number of redds will be compared in order to determine observer efficiency. Weekly river characteristics (e.g., channel width, water depth, discharge, visibility, and habitat complexity), observer experience, and survey effort will be incorporated into a model to predict observer efficiency in all river reaches. Predicted redd observer efficiency for each river reach will be used to expand ground-based redd counts to estimate the total reach redd count. Aerial photographs and ground-based surveys will also be used to estimate redd life for each river reach. The estimated spawner abundance in the Wenatchee River and an associated level of precision will be calculated using the estimated total redd count

Comment [kdt9]: Can I fly this contraption?

for each reach, mean redd life, and the sex ratio of the population similar to methods described in Millar et al. (2012).

4.2 Harvest Reporting

In years when the expected hatchery adult returns are in excess of the levels needed to meet the hatchery program goals (i.e., broodstock and/or escapement), surplus fish may be available for harvest. Harvesting or removal of surplus hatchery fish may have benefits to the natural populations by reducing potential negative ecological and genetic impacts (e.g., density dependent effects, loss of fitness, and loss of genetic variation). The contribution of hatchery fish to fisheries will be monitored using CWT recoveries on a brood-year basis supporting Objective 10.

To obtain the necessary data to determine if the harvest rates are meeting objectives, a statistically valid creel program will be designed and implemented for all sport and/or conservation fisheries in the Upper Columbia River to estimate harvest of hatchery fish from both Chelan and Grant County PUD funded hatchery programs (Murdoch and Peven 2005). Information collected during creel surveys are an integral component to calculating the HRR (Objective 3), particularly given most CWT recoveries for PUD mitigation programs occur in the Upper Columbia River and its tributaries, with the exception of summer Chinook where most CWT recoveries occur in ocean fisheries. Because of considerable time lags in reporting of CWT's to the Regional Marking Information System (RMIS) database, it requires an ongoing query of recovery data until the number of estimated fish does not change.

5. Data Management , Analysis, and Reporting

5.1 Data Management

Comment [kdt10]: Who is responsible for data entry, data management and QA/QC?

A database system has been developed in Microsoft Access that manages all the monitoring data collected for hatchery evaluations. The database will contain and manage all data associated with aquaculture monitoring, juvenile monitoring, and adult monitoring.

All data entered into the database are evaluated for quality control and quality assurance. Quality control checks using analyses such as modified Z-scores, boxplots, and the Generalized Extreme Studentized Deviate Procedure (Iglewicz and Hoaglin 1993) will be conducted for all data entry. In the event outliers are identified, discussion will occur on whether identified outliers are true data points or transcription errors. This process ensures that the data used to test statistical hypotheses are correct and accurate.

5.2 Data Analysis

The analyses proposed are consistent with the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update (Hillman et al. 2013). Each of the objectives will be addressed

using the appropriate statistical tests, as well as graphic analyses that convey relevant information.

5.3 Reporting

An annual M&E report will be generated following the completion of each calendar year and will be available for HCP HC review by June 1 of the following year. Additionally, monthly progress reports will be made available to the HCP HC.

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APPENDIX A

Designated survey reaches for Methow subbasin summer Chinook spawning ground surveys.

River	Reach	Code	RM
Methow	Mouth to Methow Bridge	M1	0.0-14.78
	Methow Bridge to Carlton Bridge	M2	14.78-27.17
	Carlton Bridge to Twisp Bridge	M3	27.17-39.55
	Twisp Bridge to MVID	M4	39.55-44.85
	MVID to Winthrop Bridge	M5	44.85-49.80
	Winthrop Bridge to Hatchery Dam	M6	49.80-51.55

Designated survey reaches for Wenatchee River basin summer Chinook spawning grounds surveys. Asterisks denotes reaches where redd observer efficiency will be assessed.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Bridge	54.20-53.58
	Bridge to Swamp *	53.58-52.66
	Swamp to Chiwawa River	52.66-48.39
W9	Chiwawa River to Schugart Flats	48.39-47.93
	Schugart Flats to Old Plain Bridge	47.93-46.21
	Old Plain Bridge to RR Bridge	46.21-41.91
	RR Bridge to RR Tunnel	41.91-39.28
	RR Tunnel to Swing Pool *	39.28-36.67
	Swing Pool to Tumwater Br	36.67-35.55
W8	Tumwater Br to Swiftwater Campground *	35.55-33.50
	Swiftwater Campground to Unimproved Campground	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Penstock Br	30.91-28.66
	Penstock Br to Icicle Road Br *	28.66-26.43

W6	Icicle Road Br to Icicle Mouth	26.43-25.61
	Icicle Mouth to Boat Takeout *	25.61-24.49
	Boat Takeout to Leavenworth Br	24.49-23.90
W5	Leavenworth Br to Irrigation Flume *	23.90-22.77
	Irrigation Flume to Peshastin Br	22.77-20.00
W4	Peshastin Br to Dryden Dam *	20.00-17.76
W3	Dryden Dam to Williams Canyon	17.76-15.54
	Williams Canyon to Upper Cashmere Br	15.54-10.22
	Upper Cashmere Br to Lower Cashmere Br	10.22-9.49
W2	Lower Cashmere Br to Old Monitor Br *	9.49-7.12
	Old Monitor Br to Sleepy Hollow Br	7.12-3.27
W1	Sleepy Hollow Br to River Bend *	3.27-1.73
	River Bend to Siphon	1.73-1.29
	Siphon to Mouth	1.29-0.45

Designated survey reaches for Wenatchee Basin spring Chinook spawning grounds surveys.

Reach Code	Reach Section	River Mile
Chiwawa River and Tributaries (Rock and Chikamin)		
C7	Buck Cr to Phelps Cr	36.39-33.46
C6	Phelps Cr (Trinity) to Maple Cr Br	33.46-29.64
C5	Maple Cr Br to Atkinson Flats	29.64-26.59
C4	Atkinson Flats to Schaefer Cr	26.59-24.24
C3	Schaefer Cr to Rock Cr Campground	24.24-22.97
R1 - Rock	Mouth to Chiwawa River Road Bridge	0.00-1.05
C2	Rock Cr Campground to Grouse Cr	22.97-12.27
K1 - Chikamin	Mouth to Chiwawa River Road Bridge	0.00-0.68
C1	Grouse Cr to Mouth	12.27-0.00
Nason Creek		
N4	White Pine Creek to Lower R.R. Bridge	16.09-13.68
N3	Lower R.R. Bridge to Hwy 2 Bridge	13.68-9.13
N2	Hwy 2 Bridge to Kahler Cr	9.13-4.46
N1	Kahler Cr to Mouth	4.46-0.00
White River and Tributaries (Panther and Napeaqua)		
H4	Falls to Grasshopper Meadows	21.16-19.78
T1 - Panther	Boulder field to Mouth	0.43-0.00
H3	Grasshopper Meadows to Napeaqua River	19.78-17.59
Q1 - Napeaqua	Take out to Mouth	0.91-0.00
H2	Napeequa River to Sears Cr Bridge	17.59-11.97
H1	Sears Cr Bridge to Mouth	11.97-0.00
Little Wenatchee River		
L3	Rainy Cr to Lost Cr	10.78-6.74

L2	Lost Cr to Old Fish Weir	6.74-2.13
L1	Old Fish Weir to Mouth	2.13-0.00
Upper Wenatchee River		
W10	Lake Wenatchee to Chiwawa River	54.20-48.39
Chiwaukum Creek		
U1	Metal bridge to Mouth	1.0 – 0.0
Icicle River		
I1	Hatchery to Mouth	3.02-0.00
Peshastin Creek and Tributaries (Ingalls Creek)		
D1 - Ingalls	Trailhead to mouth	0.64-0.00
P2	Ingalls Creek to Camas Cr	9.14-5.63
P1	Camas Cr to Mouth	5.63-0.00

Designated survey reaches for Wenatchee River basin steelhead spawning grounds surveys. Asterisks denote index reaches. Spawning escapements in tributaries will be estimates using PIT-tag arrays.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Chiwawa River*	54.20-48.39
W9	Chiwawa River to Tumwater Bridge*	48.39-35.55
W8	Tumwater Br to Swiftwater Campground	35.55-33.50
	Swiftwater Campground to Unimproved Campground*	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Icicle Road Bridge	30.91-26.43
W6	Icicle Road Br to Leavenworth boat ramp*	26.43-24.49
	Boat Takeout to Leavenworth Bridge	24.49-23.90
W5	Leavenworth Bridge to Peshastin Bridge	23.90-20.00
W4	Peshastin Bridge to Dryden Dam	20.00-17.76
W3	Dryden Dam to Lower Cashmere Bridge	17.76-9.49
W2	Lower Cashmere Bridge to Sleepy Hollow Bridge *	9.49-3.27
W1	Sleepy Hollow Bridge to Mouth	3.27-0.45

Tributary	River mile of PIT tag array
Mission Creek	0.54
Peshastin Creek	1.91
Chumstick Creek	0.31
Icicle River	0.26
Chiwaukum Creek	0.24
Chiwawa River	0.58
Nason Creek	0.52
Little Wenatchee River	1.74
White River	1.65

ANCHOR QEA
720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	December 19, 2013
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the November 20, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Douglas PUD headquarters in East Wenatchee, Washington, on Wednesday, November 20, 2013, from 9:30 am to 1:00 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Keely Murdoch will provide Kirk Truscott with data on adipose fin coded-wire-tag (CWT) retention (carried forward from the Hatchery Committees' meeting on October 16, 2013; Item I).
- The Yakama Nation (YN) will develop a document summarizing their proposed plans for expanding acclimation areas in the upper Methow, and will provide the document to Kristi Geris for distribution to the Hatchery Committees (carried forward from the Hatchery Committees' meeting on October 16, 2013; Item I).
- Chelan PUD will take the lead on moving forward with development of the Hatchery Monitoring and Evaluation (M&E) Plan Appendices and incorporating information on carrying capacity estimates (Item III-A).
- Chelan PUD will provide redline strikeout (RLSO) and final versions of the final Chelan PUD 2014 Hatchery M&E Implementation Plan to Kristi Geris for distribution to the Hatchery Committees (Item III-B).
- Chelan PUD will provide reports comparing and evaluating sockeye salmon escapement estimates based on spawning ground surveys and passive integrated transponder (PIT)-tag detections of returning adults to Kristi Geris for distribution to the Hatchery Committees (Item III-C).
- Chelan PUD will provide a draft Sockeye Addendum to the final Chelan PUD 2014 Hatchery M&E Implementation Plan to Kristi Geris for distribution to the Hatchery

Committees (Item III-C).

- Chelan PUD will discuss the Rocky Reach Adult Trap Pilot Study Results at the Hatchery Committees' meeting on December 18, 2013 (Item III-E).
- Chelan PUD will provide a revised Methow Spring Chinook Hatchery and Genetic Management Plan (HGMP) for review to Kristi Geris for distribution to the Hatchery Committees (Item III-E).
- Lynn Hatcher will check on permit coverage for new activities conducted at Winthrop National Fish Hatchery (NFH; Item IV-A).
- Hatchery Committees representatives will submit comments on the draft Douglas PUD 2014 Hatchery M&E Implementation Plan to Greg Mackey no later than Friday, December 6, 2013; Douglas PUD will be requesting approval of the draft plan at the Hatchery Committees' meeting on December 18, 2013 (Item V-A).
- Mike Tonseth will provide a letter notifying the National Marine Fisheries Service (NMFS) of the Wells Hatchery adult steelhead loss that occurred on Sunday, November 17, 2013 (Item V-C).

STATEMENT OF AGREEMENT DECISION SUMMARY

- The Twisp River Steelhead Live Spawning Plan Statement of Agreement (SOA) was approved, as revised, by the Wells HCP Hatchery Committee via email on November 4, 2013 (Item I).
- The Chewuch Acclimation Plan SOA was approved, as revised, by the HCP Hatchery Committees representatives present (Item II-A).
- The Hatchery Committees representatives present approved the Chelan PUD 2014 Hatchery M&E Implementation Plan, contingent upon incorporating revisions as discussed during today's meeting (Item III-B).

AGREEMENTS

- The Hatchery Committees representatives present agreed to continue discussions on fish marking schemes after the Joint Fishery Parties (JFP) develop a document summarizing the current status of marking for each program (Item VI-A).

REVIEW ITEMS

- Kristi Geris sent an email to the Hatchery Committees on November 21, 2013, notifying them that the draft Douglas PUD 2014 Hatchery M&E Implementation Plan is available for review, with comments due to Greg Mackey no later than December 6, 2013 (Item V-A).

FINALIZED REPORTS

- The final 2013 Broodstock Collection Protocols were distributed to the Hatchery Committees by Kristi Geris on November 4, 2013.

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Alene Underwood added: 1) a Similkameen Pond production update; and 2) a Spring Chinook HGMP update.
- Greg Mackey added: 1) a Wells steelhead broodstock update; and 2) a Wells modernization update.
- Mike Tonseth added a fish marking discussion update.

The Hatchery Committees reviewed the revised draft October 7, 2013 conference call minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to discuss. Hatchery Committees members present approved the draft October 7, 2013 conference call minutes, as revised. Geris will finalize the conference call minutes and distribute them to the Committees.

The Hatchery Committees reviewed the revised draft October 16, 2013 meeting minutes. Three outstanding comments were discussed, as follows:

- Regarding the Chewuch Acclimation Plan, Bill Gale clarified that he did not support acclimating spring Chinook derived from Winthrop broodstock in Chewuch Pond—Winthrop is to serve as a safety net program and therefore should not be the first choice for use in conservation program.

- Regarding expanding acclimation areas in the Upper Methow, Gale clarified that he suggested looking at data from Winthrop NFH because the same water source is used there as at Methow Hatchery—not Chewuch.
- Regarding the discussion about a carrying capacity SOA, Keely Murdoch clarified a statement that she made that reproductive success estimates vary because of how the hatchery program is operated, *in addition to* natural conditions.

Geris said that all other comments and revisions received from members of the Committees were incorporated in the revised minutes, and the Hatchery Committees members present approved the draft October 16, 2013 meeting minutes, as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

Action items from the last Hatchery Committees meeting on October 16, 2013, and follow-up discussions were as follows: *(Note: italicized item numbers below correspond to agenda items from the October 16, 2013 meeting.)*

- *Kristi Geris will follow up with Lynn Hatcher, once he becomes available after the government shutdown, regarding his approval of the Hatchery Committees August 21, 2013 meeting minutes, prior to finalizing and distributing them to the Committees (Item I).*
  Hatcher approved the Hatchery Committees August 21, 2013 meeting minutes via email on October 18, 2013, and the final meeting minutes were distributed to the Hatchery Committees by Geris on October 21, 2013.
- *Greg Mackey will follow up with Tom Kahler by October 18, 2013, regarding Douglas PUD's approval of the Okanagan Nations Alliance (ONA) Sockeye Program Update memorandum, prior to Kristi Geris finalizing and distributing the memorandum to the Committees (Item I).*
  Kahler provided minor grammatical edits to, and his approval of, the ONA Sockeye Program Update memorandum via email on October 18, 2013, as distributed to the Hatchery Committees by Geris on October 21, 2013.
- *Greg Mackey will provide Douglas PUD's revised edits to the Twisp River Steelhead Live Spawning Plan SOA to the YN (Item II-A).*
  Edits were provided.
- *The YN will provide a revised Twisp River Steelhead Live Spawning Plan SOA to*

Kristi Geris for distribution to the Hatchery Committees by October 21, 2013, that includes: 1) Douglas PUD's suggested revisions; 2) the revised Washington Department of Fish and Wildlife (WDFW) Fish Health risk analysis memorandum and the revised Twisp River Steelhead Live Spawning Plan; and 3) a statement indicating that the YN will keep the Hatchery Committees updated on progress and results of their Steelhead Kelt Reconditioning Program (Item II-A).
Keely Murdoch provided the final revised SOA to Geris on October 22, 2013, which Geris distributed to the Hatchery Committees, along with the revised WDFW Fish Health risk analysis memorandum and the revised Twisp River Steelhead Live Spawning Plan, on that same day. The Twisp River Steelhead Live Spawning Plan SOA was approved, as revised, by the Wells HCP Hatchery Committee via email on November 4, 2013.

- *The YN will prepare a Chewuch Acclimation Plan SOA, and will provide the SOA to Kristi Geris for distribution to the Hatchery Committees. The YN will be requesting approval of the SOA at the Hatchery Committees' meeting on November 20, 2013 (Item II-B).*
  Keely Murdoch provided a draft Chewuch Acclimation Plan SOA to Geris on October 30, 2013, which Geris distributed to the Hatchery Committees on that same day.
- *Keely Murdoch will provide Kirk Truscott with data on adipose-fin-wire (ad-wire) retention (Item II-B).*
  This action item was carried forward.
- *The YN will develop a document summarizing their plans for expanding acclimation areas in the upper Methow, and will provide the document to Kristi Geris for distribution to the Hatchery Committees (Item II-B).*
  This action item was carried forward.
- *Keely Murdoch will provide the YN's non-target taxa of concern (NTTOC) model runs to Greg Mackey (Item III-A).*
  Murdoch provided Mackey with YN's model runs.
- *Greg Mackey will develop a document that summarizes the NTTOC model runs, and will distribute the document in early 2014 (Item III-A).*
  In progress.
- *The Hatchery Committees representatives will provide comments on the Hatchery M&E Plan Tables to Greg Mackey no later than November 11, 2013, for discussion at*

the Hatchery Committees' meeting on November 20, 2013 (Item III-B).
No comments were received; will discuss further during planned agenda item below.

- *Chelan PUD and Grant PUD will incorporate their respective data into the Hatchery M&E Plan Tables, and will provide the updated tables to Greg Mackey no later than November 11, 2013, for discussion at the Hatchery Committees' meeting on November 20, 2013 (Item III-B).*
  Complete.
- *Kristi Geris distributed a meeting invite for a conference call on November 6, 2013, from 10:00 am to 12:00 pm, to discuss Chelan PUD's draft 2014 M&E Implementation Plan (Item IV-B).*
  The conference call was held. Catherine Willard provided the revised draft Chelan PUD 2014 M&E Implementation Plan to Geris on November 14, 2013, which Geris distributed to the Hatchery Committees on that same day.
- *Chelan PUD will provide a revised Methow Spring Chinook HGMP for review to Kristi Geris for distribution to the Hatchery Committees no later than October 25, 2013 (Item IV-D).*
  This action item was carried forward and is discussed further below.

II. Yakama Nation

A. DECISION: Chewuch Acclimation Plan SOA (Keely Murdoch)

Keely Murdoch said that the draft Chewuch Acclimation Plan SOA was distributed to the Hatchery Committees by Kristi Geris on October 30, 2013. Greg Mackey said that Douglas PUD had since incorporated the statement, "…contingent upon the subsequent approval by the Hatchery Committees for the use of the pond for coho and Chelan PUD spring Chinook." He said he wanted the SOA to be clear about the Hatchery Committees approving the use of the pond for coho and Chelan PUD spring Chinook. Bill Gale said he thought the SOA was also supposed to be contingent on the development of broodstock collection and protocols to ensure that Chelan PUD's program is part of the conservation program, and does not use safety net fish. Murdoch said she understood that broodstock collection would be addressed in Chelan PUD's Spring Chinook HGMP; and therefore, did not need to be included in the Chewuch Acclimation Plan SOA. Mike Tonseth agreed there is still the issue of how Chelan PUD will acquire broodstock in future years; however, he said this does not preclude the use of safety net fish. He added that if insufficient fish are obtained for a program, safety net fish have been identified as the fallback—to say that safety net fish will not be used at all is incorrect. Gale agreed, but recommended that the SOA should still be contingent upon developing concurrence on details of the HGMP. He added that the SOA is agreeing on a portion of the HGMP, while agreement has not yet been reached on other components. He said it seems that the agreements are not in sequence. Murdoch acknowledged that the timeline is somewhat disjointed and explained that this is how permitting and contracting came together. The Hatchery Committees also agreed to incorporate the statement, "…contingent upon the YN and Douglas PUD arriving at a lease agreement…," into the draft SOA.

Lynn Hatcher asked if it had been determined whether coho and spring Chinook would be commingled or separated by a net. Murdoch said that coho will not be ready for acclimation until 2016 and so those types of decisions will be discussed based on numbers and size of each species at that time. Murdoch also recalled that two SOAs had previously been discussed—the other regarding the use of Douglas PUD's facility. She noted that the second SOA would memorialize a change in use for the facility following a final lease agreement between Douglas PUD and the YN.

Jayson Wahls asked, regarding Section 2.1 Fish Transportation Procedures of the Chewuch Acclimation Plan, if the YN anticipated that WDFW would be hauling and pumping the fish. He added that currently, WDFW is not equipped for these tasks at Carlton. Alene Underwood said that the lease agreement between Chelan PUD and Grant PUD will detail how the transfers will occur.

The Chewuch Acclimation Plan SOA was approved, as revised, by the HCP Hatchery Committees representatives present. Mackey distributed the edits to the SOA as discussed during the meeting, and the YN provided the final Chewuch Acclimation Pond SOA (Attachment B) to Geris on November 21, 2013, which Geris distributed to the Hatchery Committees that same day.

III. Chelan PUD

A. DECISION: Carrying Capacity SOA (Alene Underwood)

Alene Underwood said that a memorandum from the JFP (Attachment C) regarding their concerns about the draft SOA on the use of juvenile M&E data for estimating carrying capacity was distributed to the Hatchery Committees by Kristi Geris on November 18, 2013. She also reminded the Hatchery Committees that Chelan PUD provided a draft Juvenile Carrying Capacity SOA that was distributed to the Hatchery Committees by Geris on November 5, 2013. She said although it has been made clear that there is no interest in moving forward with the SOA, because the SOA has already been distributed, she requested an official vote for the record. She said she would also like to discuss the JFP concerns regarding the SOA in more detail to be sure she is clear on their reasoning.

Keely Murdoch said that the YN is not opposed to collecting and using juvenile salmonid data to develop a carrying capacity estimate. She said the main issue is the proposed linkage made to mitigation levels, considering that carrying capacity estimates will likely increase in the next years. She added that if the link to mitigation is removed, an SOA would not be needed. Murdoch also added that if the goal is to capture how carrying capacity can help adaptively manage programs, she suggested that the M&E Plan would be the appropriate avenue to address the issue. She said that as currently written, the YN does not support the draft Juvenile Carrying Capacity SOA. Catherine Willard asked if Murdoch could provide examples of how carrying capacity data have been used to adaptively manage in the past. Murdoch said, for example, that carrying capacity data were used when considering adult spawning escapement to establish the split between safety net and conservation fish in the Chiwawa. She said that Tracy Hillman also used carrying capacity estimates during the 5-year analysis to correct for density dependence when comparing Chiwawa to reference streams. She added that while developing the Spring Chinook Management Plan carrying capacity was discussed, including how carrying capacity could be used to estimate escapement goals. She said they discussed that, as more data are obtained, escapement goals should be modified, and that conservation program splits may also be revisited.

Kirk Truscott said that the Colville Confederated Tribes (CCT) does not support the draft Juvenile Carrying Capacity SOA; and added that the CCT's primary concerns are similar to those expressed by the YN. He also added that hatchery mitigation levels based on juvenile production is inconsistent with the HCP that utilizes average adult returns and SARs as the basis for calculating mitigation obligations and agreed that using carrying capacity to help structure hatchery programs is a better use of those data.

Mike Tonseth said that WDFW does not support the draft Juvenile Carrying Capacity SOA and agreed with the YN's and CCT's sentiments regarding the linkage to mitigation. He also noted that the SOA speaks to a single approved estimate for a non-specified program, rather than describing a method for estimating carrying capacity.

Lynn Hatcher said that NMFS does not support the draft Juvenile Carrying Capacity SOA and he agreed with the concerns regarding the link to mitigation. However, he noted that he liked the possibility of the monitoring program that required handling fewer fish. He said the proposed genetics work in the combined Chelan PUD and Grant PUD plan would be covered under the current permit; however, it could not be completed *in lieu* of individual trapping within the tributaries. Underwood clarified that Chelan PUD is not proposing to remove the Chiwawa smolt trap and added that at this point in time, references to genetics have been removed from the draft Chelan PUD 2014 Hatchery M&E Implementation Plan. Tonseth said the proposed genetics work would require a proof of concept period. He added that the Hatchery Committees would probably be supportive of a genetics sampling program running concurrent with the tributary trapping effort; however, as Hatcher indicated, not in lieu of the tributary effort. Murdoch agreed that a feasibility study would be needed. She also cautioned that losing data on parr migrants versus yearling migrants in the tributaries may result in some loss of resolution regarding differential survival and how to adaptively manage based on those data.

Bill Gale said that the U.S. Fish and Wildlife Service (USFWS) does not support the draft Juvenile Carrying Capacity SOA and agreed that the link to mitigation was an issue for everyone. He said another pressing issue is that the SOA does not link to M&E. He added that the methodology in the SOA is integral in M&E; however, he would prefer to first have a robust discussion on M&E, and then discuss how the SOA fits in—not the other way around.

Truscott suggested making carrying capacity a task in the M&E Plan, and Underwood said that estimating carrying capacity is already covered under Objective 2 of the M&E Plan. She said the purpose of the SOA was intended to address the next step—how will these data be best used. Tonseth said that certain program areas can be identified where these data may be applied, such as setting adult escapement levels in tributaries and resizing conservation programs. He added that carrying capacity is a moving target, and Underwood agreed that carrying capacity is dynamic. Tonseth said, however, he is concerned that an SOA does not allow things to be dynamic because it locks those in agreement into a single position; whereas, the M&E Plan allows more flexibility.

Underwood summarized that several ideas have been shared regarding carrying capacity, and now agreement needs to be reached that addresses the collective views. Murdoch suggested developing carrying capacity further in Objective 2 of the M&E Plan. She said for example, that in the Analytical Framework, monitoring questions were identified, and from those questions and hypotheses were developed. She also suggested that carrying capacity could be addressed in a stand-alone document because it relates directly to the hatchery program. Underwood asked if carrying capacity is based around questions, will that limit the flexibility of estimating carrying capacity? Murdoch said that she thinks the questions could be stated to allow flexibility. Underwood said that ultimately, Chelan PUD would like assurance that those data planned to be collected, as outlined in the draft Chelan PUD 2014 Hatchery M&E Implementation Plan, will be used as intended. She also asked how this can be structured to show that progress is being made.

Greg Mackey said that the hypotheses in the M&E Plan are set up in terms of how a hatchery program is performing. He added that estimating carrying capacity is not a hypothesis; rather, it is more like an action. He said he believes that estimating carrying capacity is already embedded in Objective 1 of the M&E Plan and added, however, that he does not believe the M&E Plan is structured to state how data will be used. He suggested inserting a separate objective stating that carrying capacity will be estimated. He said that in the recent recalculation of hatchery production, methods derived from the Biological Assessment and Management Plan (BAMP 1998) were known as the "BAMP approach." He explained the BAMP approach as a "thought experiment," where SARs of hatchery programs were used to back-calculate how many natural-origin smolts must have passed through a given project to produce the number of natural-origin adult returns that were observed. This estimate of natural origin smolts as derived through the BAMP approach must always be below the carrying capacity of juvenile production for a population. Therefore, if all the data are correct, the carrying capacity should be equivalent to the upper limit of an estimate of smolts that are calculated using the BAMP approach. Murdoch questioned whether this was true, and Mackey said that it is mathematically true and that carrying capacity and SARs are hard to estimate—neither are perfect. Gale said all of those caveats are the reasons why he is reluctant to link carrying capacity to mitigation levels.

Gale said that in terms of moving forward for Chelan PUD, he suggested tabling this topic for now, as it does not need to be resolved for 2014, and addressing other M&E actions that need to be addressed. Underwood said that she does not want to lose momentum on this issue and added that Chelan PUD is trying to determine the most efficient data collection methods. She also added that knowing how these data will be used may inform how to better collect these data in the future. She said that with every month that goes by there is less time to adaptively manage these things; in order to realistically meet the July 2014 deadline for the 2015 Implementation Plan, this discussion needs to continue.

Tonseth said the JFP's recommended path forward is to move in the direction of incorporating carrying capacity into the M&E Plan. He added that he understands that Chelan PUD is still interested in establishing an agreement regarding how those data will be used. Underwood said that if incorporating carrying capacity into the M&E Plan does not work, she would like to discuss what other options are available.

Murdoch said she believes that the M&E Plan goes to great lengths to describe how data are used. She added, however, that the part that was missing following the last Comprehensive Report, was going back through the results of the 5-Year Comprehensive Report, and making changes to the hatchery program, as needed. She recalled that the consensus was that since the hatchery programs were substantially reduced in size after recalculation, the reduction alone may address identified problems in the 5-year Analytical Report, such as the reduction of stray rates that might correspond to reductions in mitigation programs. Murdoch recommended that the results of the 5-year reports should be reviewed, as initially intended, and as needed, make adaptive changes to the hatchery programs.

Mike Schiewe said that the general consensus seems to be leaning towards incorporating carry capacity in the context of the M&E Plan. He recalled that the current revision of the M&E Plan was a combination of the former Hatchery M&E Analytical Framework and Conceptual Plan, and suggested starting there. Mackey noted that a compilation of carrying capacity estimates from the literature with analyses specific to these populations is already included in the M&E Plan Appendices, and he said that Hillman's analysis of Upper Columbia spring Chinook is also included in the appendices. Hatcher asked if a few other items were inserted into the appendices including recovery goals and Thomas Cooney's work on intrinsic potential. Mackey said that yes, these were included and he was seeking that type of input so that a collection of knowledge-to-date can be incorporated into the M&E Plan Appendices.

Schiewe recalled the key people who were involved in developing the current iteration of the M&E Plan, including Mackey, Andrew Murdoch, Hillman, Keely Murdoch, Todd Pearsons, and Josh Murauskas; he asked if it makes sense that this same group, to the extent possible, convene to incorporate carrying capacity. He added that at this time, this is a Chelan PUD document and the Grant PUD document on carrying capacity to be presented in their Hatchery Subcommittee meeting needs to be acknowledged as separate. Todd Pearsons suggested combining everything related to carrying capacity into the appendix, so that the body of the M&E Plan does not need to be revised. Schiewe suggested convening a small group including Catherine Willard, Mackey, Keely Murdoch, Hillman, Andrew Murdoch, Matt Cooper, and Pearsons. Gale requested that the entire Hatchery Committees are also included on meeting requests for this small group. Chelan PUD agreed to take the lead on moving forward with development of the Hatchery M&E Plan Appendices and incorporating information on carrying capacity estimates. The Committees agreed that the M&E workgroup would be open to all Committees members, as had been previously done.

B. DECISION: Chelan PUD 2014 Hatchery M&E Implementation Plan (Alene Underwood)
Alene Underwood said that the revised draft Chelan PUD 2014 M&E Implementation Plan was distributed to the Hatchery Committees by Kristi Geris on November 14, 2013. This version addresses comments discussed during the Hatchery Committees' conference call that was held on November 6, 2013. She reminded the Hatchery Committees that page 2 of the

revised plan explains what methods in the plan differ from previous years; and that the plan was also organized differently than in the past. She noted that Catherine Willard and Keely Murdoch worked together on reformatting, as recommended during the Hatchery Committees' conference call on November 6, 2013. Murdoch said that after working with Willard, the new revisions adequately addressed her concerns regarding the new format. Underwood reviewed the other revisions made to the plan and a few additional, minor revisions were requested that were made in the draft. Since the changes discussed during the meeting were not substantial, the Hatchery Committees representatives present approved the Chelan PUD 2014 Hatchery M&E Implementation Plan, contingent upon incorporating revisions as discussed. Chelan PUD provided a RLSO and final version (Attachment D) of the final Chelan PUD 2014 Hatchery M&E Implementation Plan to Geris on November 22, 2013, which Geris distributed to the Hatchery Committees that same day.

C. Sockeye M&E Discussion (Alene Underwood)

Alene Underwood recalled the commitment that Chelan PUD made during recalculation to monitor the natural sockeye population. She said that Viable Salmonid Population (VSP) parameters were used to develop the most appropriate M&E program in moving forward and that based on preliminary feedback, a draft addendum will be developed and distributed. Mike Tonseth asked about the timeline for approval, and Underwood said that the addendum needs approval by February 2014. Tonseth expressed concern that the M&E Implementation Plan is being fragmented. He explained that there are new requirements for inclusion in the annual broodstock protocols, which include all M&E activities, release locations/plans, and site based operational protocols (e.g., Tumwater Dam), and are also due to the Hatchery Committees for review in February 2014. Underwood said that she does not believe there is anything drastic that will affect the protocols.

Catherine Willard reviewed a draft table of Chelan PUD's proposed Lake Wenatchee sockeye salmon M&E activities (Attachment E). Underwood said that Chelan PUD has not yet determined who will complete the work and added that in the past, the proposed work has been completed by WDFW in coordination with other work they were already doing.

Lynn Hatcher asked if PIT-tag detection arrays would be used to monitor adult escapement, and Underwood said that they would not propose anything other than PIT-tags. Bill Gale asked if redd surveys have been conducted that could be used for comparison, and Mike Schiewe recalled that Chelan PUD has developed a report that speaks to this. Underwood said that Chelan PUD will provide reports comparing and evaluating sockeye salmon escapement estimates based on spawning ground surveys and PIT-tag detections of returning adults to Kristi Geris for distribution to the Hatchery Committees. Keely Murdoch recalled that at the time of those surveys, there were questions about detection efficiency and the need for multiple detection arrays. She suggested gaining a better idea of the current array configurations to determine if they need updating in terms of detection efficiency. Kirk Truscott suggested that adult monitoring metrics such as pre-spawn mortality, timing, and success do not need to be collected each year; rather, those are important metrics to monitor every few years. Tonseth also noted that gender composition needs to be collected.

Murdoch recalled that when the decision was made to discontinue the sockeye hatchery program, it was agreed that sufficient M&E would continue to determine if sockeye need to be supplemented. She suggested considering what data are needed to make those types of decisions in a decade. Willard noted that those data that are being proposed to be collected will allow estimation of the same metrics used to determine supplementation levels in the past.

Tonseth said that the big change for 2014 is the change in location of the White River array, and added that the detection efficiency of the new location needs to be ground-truthed with ground surveys. Schiewe asked if the array in the Little Wenatchee River is also changing, and Tonseth replied that it is not. Tom Kahler noted that the Columbia River Inter-Tribal Fish Commission (CRITFC) data on sockeye smolt production are also available; Murdoch said that she is unsure how those data will fit into this effort. She explained that monthly collections of zooplankton and phytoplankton are ongoing (excluding during the winter). She added that those data being collected speak more to food base and densities. She said that also, three times each year, Department of Fisheries and Oceans (DFO) Canada conducts hydroacoustic surveys and trawls to obtain densities and distributions of fry in Lake Wenatchee. She said that DFO is investigating factors that affect productivity, and then they compare these factors to other sockeye lakes. Underwood said that she understood that DFO was planning to obtain estimates of outmigrants from Lake Wenatchee; last year, they indicated that funding may be discontinued. Murdoch said that at this point, efforts are still moving forward. Kahler added that the DFO acoustic and trawl surveys for fry, parr, and pre-smolt abundance estimates are the source of the CRITFC data on smolt production that he mentioned (above). He said that those surveys correspond with the surveys that ONA conducts in Osoyoos Lake (for DFO) and that DFO conducts in sockeye lakes throughout Canada; and thus, those data should provide reliable and acceptable smolt-production estimates. He believes CRITFC has five more years of funding for these surveys and the limnology work.

Underwood said that as a next step, Chelan PUD will provide a draft Sockeye Addendum to the final Chelan PUD 2014 Hatchery M&E Implementation Plan to Geris for distribution to the Hatchery Committees.

D. Similkameen Pond Production Update (Alene Underwood)

Alene Underwood announced that there had been high mortality in Chelan PUD's 166,000 (166k) summer Chinook program being reared at Similkameen Pond. She said that staff culled roughly 8,000 of the 2012 broodstock due to high enzyme-linked immunosorbent assay (ELISA) titers and about 160k were transferred to Similkameen from Eastbank in October 2013; then over the past week and a half, an additional 30k to 35k were lost to unknown causes. Jayson Wahls explained that the fish were bloated, but no diagnosis had been made. Mike Tonseth asked if staff looked at the feed, and Wahls replied that they did. He added that the fish were not eating well. Underwood said that Chelan PUD is now at about 78% of the program. *(Note: Underwood provided an update via email on December 3, 2013, that the program was estimated to be around 117k total, or 43k loss.)* She said she will update the Hatchery Committees as more information becomes available.

E. Methow Spring Chinook HGMP Update (Alene Underwood)

Alene Underwood said that the Methow Spring Chinook HGMP is still under development. She estimated that it will be another month before Chelan PUD will have a draft ready. She said a suite of long-term options are being considered for their 60k Methow spring Chinook program, including potential options with Douglas PUD, or maybe conducting another pilot study at the Rocky Reach Adult Trap for broodstock. Keely Murdoch asked about the results from the Rocky Reach Adult Trap Pilot Study that was conducted in May 2013, and Underwood said that Chelan PUD will discuss the Rocky Reach Adult Trap Pilot Study

Results at the Hatchery Committees' meeting on December 18, 2013. Mike Schiewe recalled the Coordinating Committees' and Hatchery Committees' concerns with the pilot as they related to passage issues and genetic appropriateness, respectively. Bill Gale recalled that at one point a sort-by-code system was discussed and noted that if Chelan PUD is considering moving in that direction, discussions should take place soon to allow adequate time to install infrastructure, if needed. Keely Murdoch noted that a sort-by-code system may be a work-around for turbidity issues; Gale added that the system would also help alleviate USFWS's concerns with handling Entiat fish. Murdoch also suggested coordinating with U.S. Geological Survey (USGS) who is already PIT-tagging fish originating in the Methow. Underwood said that Chelan PUD has multiple options to consider and hopes to have a discussion at the next committee meeting. Underwood said she will provide a revised Methow Spring Chinook HGMP for review to Kristi Geris for distribution to the Hatchery Committees as soon as it is available.

IV. NMFS

A. HGMP Update (Lynn Hatcher)

Lynn Hatcher said that on September 20, 2013, Permits 1196, 1395, and 1497 were extended with an indefinite end date. He said that hatchery consultations are scheduled to be complete by summer 2014. He said that Craig Busack is now working only on spring Chinook programs in the Okanogan and Methow. Amilee Wilson is working on the steelhead programs in those basins.

Hatcher said for Okanogan spring Chinook, the Section 10(j) Environmental Assessment (EA) will be complete by spring 2014; currently, Busack is working on the Biological Opinion (BiOp) for holding and transporting spring Chinook from the Methow to the Okanogan. Hatcher said that the Federal Register Notice (FRN) will be out in December 2013. He said that because Chelan PUD's Methow Spring Chinook HGMP is not completed, it will not be included in the FRN. He said the time schedule for completion of the Methow spring Chinook and steelhead permits is set for June 2014, and added that the Okanagan spring Chinook 10(j) will be completed by April 2014.

Mike Tonseth said, regarding the Section 10(j) EA, he thought since 200k spring Chinook were released this fall, there would be no spring Chinook to release in spring 2014. Hatcher said that NMFS promised the CCT the Section 10j would be complete in spring 2014, regardless, and confirmed, however, that the Section 10j would have no implication for 2014 releases.

Hatcher said that the Wenatchee steelhead draft BiOp and Section 10 permits have been reviewed and should be complete by December 2013. He added that a Fishery Plan still needs to be completed, and Tonseth said that the JFP is still working on it. Hatcher said that Amilee Wilson indicated that the non-listed summer/fall Chinook programs are now the lowest priority for consultation after a recent meeting with the HGMP applicants in the upper Columbia stressed the need to address the steelhead and spring Chinook permits.

Bill Gale asked about Methow steelhead. Gale said that USFWS is concerned about permit coverage for Winthrop NFH steelhead winter and spring activities prior to receiving a new permit. He added that the Service's steelhead program coverage had lapsed and was concerned that the Service would be without coverage until the new permit was issued. Hatcher said that he will check on permit coverage for new activities conducted at Winthrop NFH.

Hatcher said that NMFS is planning to complete USFWS's Leavenworth program by December 31, 2013, and noted that there was an issue with the terms and conditions. He said the coho BiOp was distributed on November 15, 2013, and added that the coho program should be complete by the end of January 2014.

V. Douglas PUD

A. Douglas PUD 2014 Hatchery M&E Implementation Plan (Greg Mackey)

Greg Mackey said that the draft Douglas PUD 2014 Hatchery M&E Implementation Plan should be ready for distribution by the end of the day. *(Note: Mackey provided the draft Douglas PUD 2014 Hatchery M&E Implementation Plan to Kristi Geris on November 21, 2013, which Geris distributed to the Hatchery Committees that same day.)* He said Douglas PUD has been working closely with Grant PUD on the plan; particularly spring Chinook, which is a departure from the past. He added that, previously, the implementation plan was developed by WDFW and Douglas PUD; however, Grant PUD, as a major sharing partner in the Methow Hatchery, was now more involved in developing the M&E plan. Mackey said that this year, he and Charlie Snow developed a technical change for steelhead redd counts. He explained that the objectives related to spawning in the M&E Plan are to compare hatchery- versus natural-origin fish. He said that in the Twisp, the M&E crews can collect good data on hatchery and natural origin spawning distribution of steelhead because the fish are Floy-tagged at the weir and can be visually detected on the spawning grounds. In addition, the Twisp is a smaller river and spawner surveys are more effective because visibility tends to hold up longer as the flows increase in the spring. However, in the large rivers such as the Methow mainstem, there is no way to visually identify the origin (hatchery or natural) of spawners, and poor visibility greatly limits the efficiency of finding redds or fish and also curtails the length of time surveys can be accomplished as the flows increase. He said that Andrew Murdoch provided a report where fish are PIT-tagged at Priest Rapids and instream arrays are used to extrapolate how many steelhead of known-origin are coming up different parts of the rivers. He said that Snow proposed to conduct index redd surveys in the lower river, where fish may hold through the winter and not be fully accounted for by PIT-detection arrays. Snow said that standard methods would be employed, and added that the hope is that USGS arrays in the Methow at Winthrop can be used similarly to how the Chewuch and Twisp arrays are used.

Bill Gale asked if only natural-origin fish would be PIT-tagged at Priest Rapids, and Snow clarified that both hatchery- and wild-origin fish would be PIT-tagged. Gale asked how harvest would be accounted for; Snow said that the report that Murdoch provided, which also used Priest Rapids data, accounted for harvest based on creel census estimates. Kirk Truscott asked if steelhead are still PIT-tagged at Wells Dam for stock assessment; Snow confirmed this and added that 6 to 8% of the steelhead run is typically sampled at Wells Dam. He added that those fish should assist in augmenting escapement data sets, but the model used to estimate spawning escapement using the Priest Rapids tagged fish may not allow incorporation of fish tagged at other locations.

Mackey said that Douglas PUD will be developing a new contract with WDFW, and added that the current contract ends December 31, 2013. He said that Douglas PUD was hoping to obtain preliminary comments soon to facilitate completion of the new contract by the end of the year. Gale asked how long the contract would be, and Mackey said it would be a 1-year contract. Hatchery Committees representatives agreed to submit comments on the draft

Douglas PUD 2014 Hatchery M&E Implementation Plan to Mackey no later than Friday, December 6, 2013, and Douglas PUD will be requesting approval of the draft plan at the Hatchery Committees' meeting on December 18, 2013.

B. Hatchery M&E Appendices Tables (Douglas PUD, Chelan PUD, Grant PUD)

This agenda item was previously discussed under review of action items from the last Hatchery Committees' meeting on October 16, 2013, and also under Chelan PUD's carrying capacity agenda item.

C. Wells Steelhead Broodstock Update (Greg Mackey)

Greg Mackey announced that there was a steelhead broodstock loss at Wells Hatchery on November 17, 2013. He explained that Biomark was on-site PIT-tagging fish, and treated water used to disinfect the tagging equipment was discharged to the parking lot where it ran into a parking lot drain that led into the steelhead holding pond. The drain was thought to be tied into the main drain of the hatchery, but unbeknownst to everyone familiar with the hatchery, this drain had been inadvertently tied into the source water for the steelhead holding pond at some point in the past. Mackey said that 178 of the 200 fish were lost. He said all fish were hatchery-origin, and that the broodstock were for the Columbia Safety-Net and the Okanogan program, and also served as backup collections for the Methow Safety-Net, Twisp and Omak programs, with unneeded backup fish available for the Ringold program. He said Permit 1395 allows trapping of fish from the Wells fishways through November; so to recover the fish, he said Douglas PUD plans to trap as many fish from the Wells fishways and hatchery volunteer channel this fall as possible. Jayson Wahls confirmed that they have already commenced outfall trapping at Wells Hatchery for this purpose, but would not use the Wells ladder traps as they have already winterized them. Mackey cautioned that the Wells programs will be prioritized for broodstock, and that brood would be supplied to Winthrop NFH only once the Wells programs were fulfilled. Bill Gale said he was unsure if steelhead will be volunteering at the Winthrop NFH outfall now, and added that he would be interested in looking at the escapement numbers. He asked Mackey if he thought there will be enough fish to broodstock Douglas PUD's program and Winthrop NFH's program. Mackey said that some surplus steelhead may be trapped at the Twisp weir in spring 2014, and also broodstock may be trapped at the Methow and Winthrop NFH hatchery outfalls in spring 2014. Keely Murdoch asked if it is possible to postpone shutting down Methow Hatchery collection to obtain more fish, and Mike Tonseth said that shutting down the fishery is already being considered as early as next week. Gale said that he will touch base with Winthrop NFH.

Tonseth asked if NMFS has been notified, and explained that the permit requires that NMFS is immediately notified for any fish kill larger than 10%. Tonseth said that he will provide a letter notifying NMFS of the Wells Dam steelhead fish loss that occurred on Sunday, November 17, 2013. *(Update: Douglas PUD had the drain welded shut to prevent further contaminants from entering the steelhead pond.)*

D. NTTOC Report Status (Greg Mackey)

Greg Mackey said that all model data have been received. He said he still needs to incorporate these data into the database, and will develop a report as previously discussed.

E. Wells Modernization Update (Greg Mackey)

Greg Mackey announced that the Wells modernization will be at 30% design by December 2013. He recalled that a workshop was planned for when the modernization reached 30% design, which he confirmed is still the plan, but has yet to be scheduled.

VI. WDFW

A. Fish Marking Discussion Update (Mike Tonseth)

Mike Tonseth said that he is developing a document summarizing the current status of marking for each Upper Columbia hatchery program, including where agreements currently lie within *U.S. v Oregon* and other management plans. He said the JFP agreed to use this document as a starting point for discussion. The Hatchery Committees representatives present agreed to continue discussions on fish marking schemes after the JFP develop a document summarizing the current status of marking for each program.

VII. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees' meetings are on December 18, 2013 (Chelan PUD); January 15, 2014 (Douglas PUD); and February 19, 2014 (Chelan PUD).

List of Attachments

Attachment A	List of Attendees
Attachment B	Final Chewuch Acclimation Plan SOA
Attachment C	JFP Memorandum regarding their concerns about the Chelan draft SOA on the use of juvenile M&E data for estimating carrying capacity
Attachment D	Final Chelan PUD 2014 M&E Implementation Plan
Attachment E	Chelan PUD's proposed Lake Wenatchee sockeye salmon monitoring and evaluation activities

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Catherine Willard	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Todd Pearsons	Grant PUD
Lynn Hatcher*	National Marine Fisheries Service
Keely Murdoch*	Yakama Nation
Kirk Truscott*	Colville Confederated Tribes
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Jayson Wahls	Washington Department of Fish and Wildlife
Chris Moran†	Washington Department of Fish and Wildlife
Charlie Snow†	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

Rock Island and Rocky Reach HCP Hatchery Committee

Statement of Agreement

Chewuch Acclimation Plan

November 20, 2013

Statement

The Rock Island and Rocky Reach HCP Hatchery Committees agree to acclimate Chelan PUD's Methow spring Chinook mitigation obligation (60,516 smolts) in the Chewuch Acclimation Pond as part of YN's Expanded Acclimation Project beginning with the 2015 release (BY2013) contingent upon the YN and Douglas PUD arriving at a lease agreement and subsequent approval by the HC for the use of the pond for coho and Chelan PUD spring Chinook. The smolts would be short-term acclimated between March and May. Starting in 2016 spring Chinook may be co-acclimated with coho salmon pre-smolts. Annual reports and monthly updates will be provided to the HCP HC.

Background

YN's Expanded Acclimation Project is based on the premise that acclimating and releasing salmon and steelhead smolts in select locations can increase the effectiveness of integrated (conservation) programs. YN intends to lease the Chewuch Acclimation Pond from DCPUD for the purpose of acclimating coho and spring Chinook salmon. Continued releases of spring Chinook in the Chewuch are an important part of salmon recovery in the Methow Basin. Additional details can be found in Attachment 1 (Chewuch Acclimation Plan). This SOA is contingent upon approval of an SOA from the Wells HCP HC allowing the use of the facility.

To: Rock Island and Rocky Reach HCP Hatchery Committee (HCP-HC), Priest Rapids Project Salmon and Steelhead Settlement Agreement Hatchery Sub-Committee (PRCC-HSC).

From: Upper Columbia River Joint Fisheries Parties

Re: Efficacy of Draft SOAs concerning the use of juvenile data for estimating carrying capacity.

This memorandum is to convey the results of discussions between the Joint Fisheries Parties (JFP; consisting of representatives from the Yakama Nation, Confederated Tribes of the Colville Reservation, National Marine Fisheries Service, US Fish and Wildlife Service and Washington Department of Fish and Wildlife) during a meeting on Nov 8, 2013. These discussions were in regards to SOAs submitted to the HCP-HC and the PRCC-HSC by Chelan and Grant PUDs, respectively. This summary should be considered the consensus JFP view on this topic.

On November 5, 2013 two draft SOAs, one circulated by email to the members of the PRCC-HSC (email from Elizabeth McManus) and the other to the members of the HCP-HC (email from Alene Underwood forwarded to the committee by Kristi Geris). These SOAs were largely identical and for the purposes of this discussion are considered as a single document circulated within two separate committees. As understood by the JFP, the intent of these SOAs are to 1) provide committee support for the use of juvenile abundance data as a means to estimate juvenile carrying capacity within tributaries of interest (e.g., Nason Creek, White River, Chiwawa River), 2) establish a link between estimates of carrying capacity and subsequent management decisions such as setting an upper limit to mitigation requirements for naturally produced spring Chinook salmon, and 3) institute criteria for the evaluation of the quality and robustness of resulting carrying capacity estimates, with the caveat that failure to meet these requirements/criteria could then be used as a means to limit or modify the use of this data in future decision making processes.

The use of M&E data to better estimate metrics such as carrying capacity has broad support within the JFP. It is recognized that carrying capacity data can be integral to inform effective adaptive management of hatchery programs and provide key scientific support for decisions. The JFP maintains that the most effective way to support this type of data analysis and exploration is by establishing a clear and direct linkage between M&E objectives (as identified in the M&E Plans and Analytical Frameworks) and program management concerns/issues. The JFP assert that the SOAs, as proposed by the PUDs, are not the appropriate avenue to establish this linkage, rather it should be considered and integrated as a standalone M&E Objective or linked to an existing objective. The JFP proposes that the respective committees amend the recently developed and approved (2013) 5-year Monitoring & Evaluation Plan to include a new objective addressing carrying capacity estimates and work toward refining the objective and any associated analytical framework. If carrying capacity and its ability to inform the adaptive management process, is truly important, then we should all be able agree that development of a new objective addressing carrying capacity is the best path forward.

Upper Columbia River Joint Fisheries Parties: Bill Gale, USFWS; Lynn Hatcher, NMFS; Keely Murdoch, Yakama Nation; Mike Tonseth, WDFW; Kirk Truscott, Confederated Tribes of the Colville Reservation

Furthermore the JFP are emphatically opposed to any stated linkage in the SOA between this data analysis activity and the establishment of PUD mitigation requirements. Setting aside any facts indicating that use of the lower Wenatchee trap to develop juvenile production estimates for the supplemented spawning aggregates is wholly inconsistent with the program descriptions provided in the Committee(s) approved HGMPs for the respective programs, there is significant concern that this proposed action is also inconsistent with the effects analysis conducted during the Biological Opinion development process for Section 10 coverage. Additionally, both the HCP and the Settlement Agreement contain language (shown below) which appears to contradict the sole use of a juvenile based estimate for recalculation of mitigation levels and instead references the use of methods that rely on adult based equivalents.

8.4.3 Periodic Adjustment of District Hatchery Levels. Hatchery production levels, except for original inundation mitigation, shall be adjusted in 2013 and every 10 years thereafter as is required to adjust for changes in the average adult returns of Plan Species and for changes in the adult-to-smolt survival rate, and for changes to smolt-to-adult survival rate from the hatchery production facilities, considering methodologies described in the BAMP. The Hatchery Committee will be responsible for determining program adjustments considering the methodology described in BAMP and providing recommended implementation plans to the District. The District will be responsible for funding the implementation plan. From the Anadromous Fish Agreement and Habitat Conservation Plan Rock Island Hydroelectric Project

13.1.2 Adjustments in Production Levels. Grant PUD shall maintain the initial production levels until 2013 unless modified by agreement of the Parties and after consultation with the other members of the PRCC. The initial production levels, except for original inundation mitigation, shall be reviewed in 2013 and every 10 years thereafter to determine if adjustments are appropriate to achieve and maintain NNI. Adjustments will be made if necessary based on changes in average adult returns, adult-to-smolt survival rate and smolt-to-adult survival rates from the hatcheries relative to the survival rates utilized to establish the initial production levels via the BAMP. Adjustments in production levels may also be based upon changes in the estimates of unavoidable Project adult or juvenile mortalities underlying these initial NNI calculations. The Parties will be responsible for recommending adjustments in program levels and strategies considering the methodologies described in the BAMP and recommending modified implementation plans for Grant PUD funding. From the Priest Rapids Project Salmon and Steelhead Agreement.

As stated earlier, while the JFP support development and use of carrying capacity estimates to adaptively manage the hatchery programs, for the above reasons the JFP do not agree that an SOA is the correct avenue. At this time the JFP does not support nor do we desire to further consider the draft SOAs circulated to the Committees.

Upper Columbia River Joint Fisheries Parties: Bill Gale, USFWS; Lynn Hatcher, NMFS; Keely Murdoch, Yakama Nation; Mike Tonseth, WDFW; Kirk Truscott, Confederated Tribes of the Colville Reservation

Attachment D

Chelan County PUD Hatchery Monitoring and Evaluation Implementation Plan 2014

Prepared by:

Alene Underwood and Catherine Willard

November 2013

Contents

1. Introduction

The Habitat Conservation Plan (HCP) specifies that a monitoring and evaluation plan will be developed for the hatchery program. The approach to monitoring the hatchery programs was guided by the "*Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update"* (Hillman et al. 2013) and the "*Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Programs*" (Murdoch and Peven 2005).

The purpose of this document is to define the tasks associated with the approved scope of work to implement Chelan PUD's (CPUD's) hatchery monitoring and evaluation (M&E) plan for 2014. Monitoring and evaluation activities for Lake Wenatchee sockeye in 2014 have not yet been determined. Chelan PUD will submit an addendum to this implementation Plan by February 2014 to address these activities. Additionally, specific activities to address Objective 7 of the M&E Plan have not yet been determined. As these become available, this Plan will be amended.

The work described in this plan has Endangered Species Act (ESA) coverage provided by NFMS Section 10(a)(1)(A) permits 18121 and 1395 and Section 10(a)(1)(B) permit 1347. All activities conducted under this Implementation Plan shall adhere to all terms and conditions as specified in the referenced permits. These permits allow for changes to monitoring or research protocols with the caveat that such modifications are approved by NMFS prior to implementing those changes. Terms and conditions relevant to monitoring and evaluating the hatchery programs have been used to inform the various measurements below and associated scopes of work with entities performing the work. A report summarizing compliance with the terms and conditions set forth under the above-references permits is required for submittal to NMFS; a copy of this completed report will be provided to the HCP HC.

The Implementation Plan includes all four components of the M&E Program including: (1) aquaculture monitoring; (2) juvenile monitoring; (3) adult monitoring; and (4) data, analysis and reporting. Under each component are study design elements that will be used to inform the overarching program components. Figure 1 illustrates the relationship of the components and study design elements used to address each component. Table 1 depicts which study design element is being performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

The methods described in this plan differ from previous methodologies in the following ways:

- Emigrant abundance estimates will use newly derived analytical approaches that reduce bias and increase precision to include estimates of emigration during the winter non-trapping periods.
- Spring Chinook spawner abundance estimates will be adjusted for observer efficiency and include estimates of precision.
- Summer Chinook spawner abundance will be based on census counts and be adjusted for observer efficiency and include estimates of precision.
- Steelhead run and spawning escapement estimates will be based on a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates.

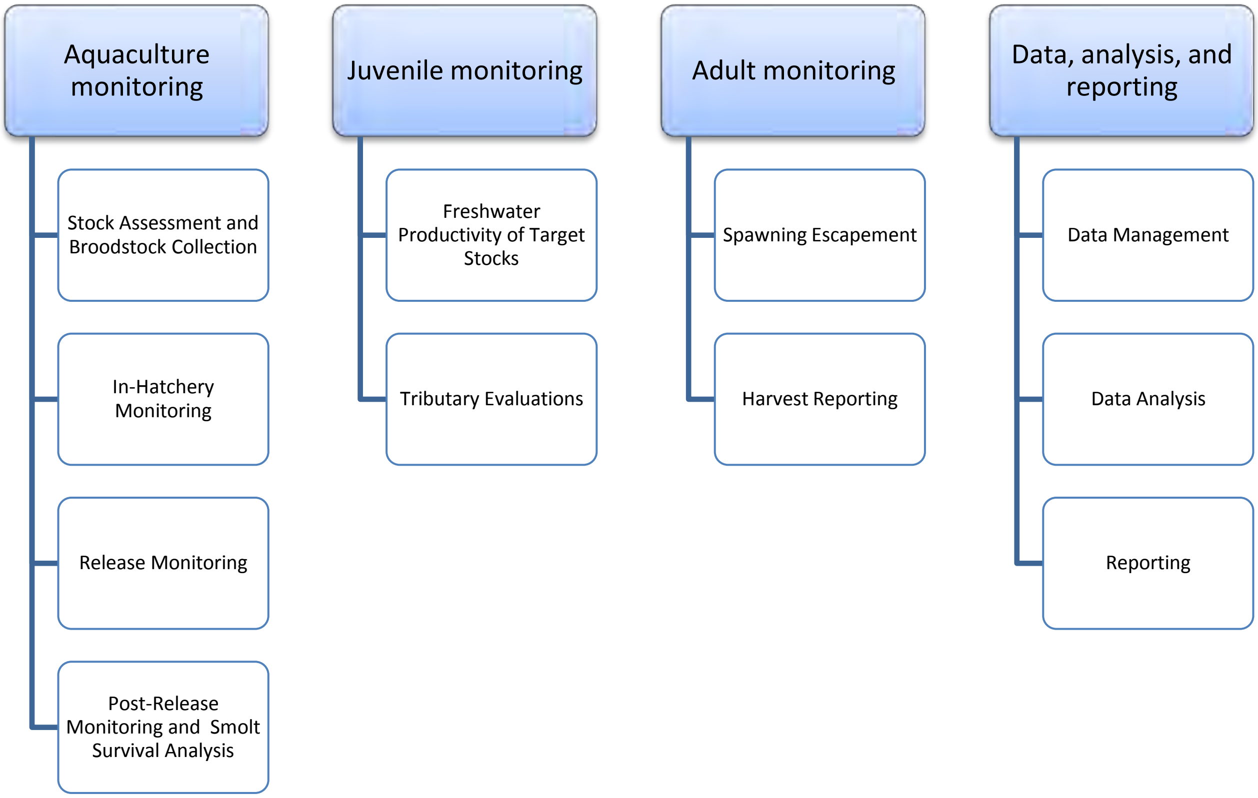

Figure 1. The four components of the hatchery monitoring and evaluation program and the study design elements within each component.

Table 1. Study design elements performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

Monitoring and evaluation component	Objectives[1]	Study Design Elements	Chiwawa spring Chinook	Wenatchee summer Chinook	Chelan Falls summer Chinook[3]	Methow summer Chinook[4]	Wenatchee Steelhead	Wenatchee Sockeye
Aquaculture Monitoring	3,5,8	Stock assessment and broodstock collection	WDFW	WDFW	WDFW	WDFW	WDFW	NA
	5, 8	In-hatchery monitoring	WDFW CPUD[2]	WDFW CPUD[2]	WDFW CPUD[2]	WDFW CPUD[2]	WDFW CPUD[2]	NA
	9	Release monitoring	WDFW	WDFW	WDFW	WDFW	WDFW	NA
	9	Post-release monitoring and smolt survival analysis	WDFW	WDFW	WDFW	WDFW	WDFW	NA
Juvenile monitoring	2	Freshwater productivity of stocks	WDFW	WDFW	NA	NA	WDFW	TBD
		Tributary evaluations	WDFW	WDFW	NA	NA	WDFW	TBD
Adult monitoring	1,2,3,4,5,6, 8,10	Spawning escapement	CPUD	WDFW	BioAnalysts	BioAnalysts	WDFW	TBD
	8	Harvest reporting	WDFW	WDFW	WDFW	WDFW	WDFW	TBD
Data, analysis, and reporting	All	Data management	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Data analysis	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Reporting	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD

[1] Specific activities to address Objective 7 have not yet been identified.
[2]CPUD crews will PIT tag in-hatchery fish.
[3]Because the Chelan summer Chinook program is primarily an augmentation program, monitoring and evaluation efforts focus on straying, release characteristics, and harvest.
[4]Monitoring and evaluation in 2014 will be shared by Grant and Chelan PUDs.

2. Aquaculture Monitoring

The Aquaculture monitoring component is comprised of two basic elements: (1) stock assessment and broodstock collection at adult trapping locations and (2) in-hatchery monitoring including spawning, rearing, and release of juveniles. Data collected during these elements primarily support monitoring questions 5.1.1, 5.2.1, 8.1.1, 8.2.1, 8.3.1, 8.3.2, 8.4.1, 9.1.1, 9.2.1, 9.3.1 and 9.4.1, but also contribute data to monitoring questions 3.2.1, and 3.2.2 (Hillman et al. 2013). Table 2 below provides a summary of the variables to be measured in 2014 under the Aquaculture monitoring component and what objective the measure(s) supports. The text that follows in this section further describes the activities.

Table 2. Monitoring and Evaluation Plan (Hillman et al. 2013) objectives and the associated measured variables for the aquaculture monitoring component.

Objectives	**Measured Variables** *(Applicable Study Component(s))*
Objective 3: Determine if the hatchery adult-to adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	• Number of hatchery and naturally produced fish collected for broodstock (*Broodstock Collection and Stock Assessment*) • Number of broodstock used by brood year (hatchery and naturally produced fish) (*Broodstock Collection and Stock Assessment*)
Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	• Ages of hatchery and naturally produced fish sampled via PIT tags or stock assessment monitoring (*Broodstock Collection and Stock Assessment*) • Time (Julian date) of ripeness of hatchery and natural origin steelhead captured for broodstock (*Broodstock Collection and Stock Assessment*)
Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of the natural populations.	• Size (length), gender, and total/salt age of broodstock (*Broodstock Collection and Stock Assessment*) • Assess age of fish (*Broodstock Collection and Stock Assessment*) • Length, weight, and age (covariate) of hatchery and natural-origin broodstock after eggs have been removed (*Broodstock Collection and Stock Assessment*) • Number and weight of eggs (*Broodstock Collection and Stock Assessment*)
Objective 9: Determine if hatchery fish were released at the programmed size and number.	• Fork length and weights of random samples of hatchery juveniles at release (*Release Monitoring*) • Monthly individual lengths and weights of random samples of hatchery juveniles (*In-Hatchery Monitoring*) • Numbers of smolts released from the hatchery (*Release Monitoring*)

2.1 Broodstock Collection and Stock Assessment

Broodstock collection and stock assessment for Wenatchee summer steelhead, Wenatchee summer Chinook, Methow summer Chinook, Chelan Falls summer Chinook, and Chiwawa River spring Chinook, hatchery programs will, in most instances, occur concurrent to and consistent with the Broodstock Collection Protocol approved annually by the Hatchery Committee (e.g., Tonseth 2013) and relevant permits Data collection during broodstock collection will be consistent with Murdoch and Peven (2005). A representative sample of fish trapped throughout the entire run, either collected for broodstock or released back to the river, will be sampled for origin, age, sex, size, and migration timing. Biological sampling of all fish trapped will include presence of internal (CWT or PIT) and external (VIE) tags or marks, scales, length, and sex (determined by ultrasound). PIT tags will be injected into all target species (Chinook and steelhead), whether collected for broodstock or released back to the river to monitor for potential fallbacks. All non-target species will be enumerated daily. Measures of central tendency and spread will be calculated and reported for each metric.

2.2 In-Hatchery Monitoring

The in-hatchery monitoring component will begin when adult fish are collected and retained for broodstock and ends when juvenile fish are released. Life stage specific in-hatchery survival and growth rates, disease monitoring, and an estimate of the number of fish released will be collected and analyzed according to Murdoch and Peven (2005). Additional data to be collected includes individual lengths and weights of juveniles during monthly sampling, and the weight of gonadal mass and body of spawned broodstock. Measures of the central tendency and spread will be calculated and reported for each metric.

Fish Marking

All of Chelan PUD’s hatchery fish will be coded-wire tagged (CWT) and externally marked or marked as otherwise agreed to by the HCP HC. A comprehensive marking strategy will be developed by the HCP HC and included as an Addendum to this Plan. The identification of these hatchery-produced fish is needed for a suite of adult metrics and may be used for adult management and/or fisheries as contemplated by the co-managers.

Using methods described in Keller and Murauskas (2012), hatchery fish will be PIT-tagged (Table 3) at Eastbank Hatchery approximately two to four weeks before the fish are transferred to acclimation ponds. Additional PIT-tagging may occur for program specific studies/comparisons as approved by the HC. The data collected from the PIT-tags will assist in release monitoring, migration timing, juvenile survival, and smolt-to-smolt survival. For all fish marking, quality control check will be performed during and immediately following tagging and prior to release.

Table 3. Wenatchee River basin hatchery program release goals and recommended number of fish PIT tagged.

Program	Release goals	Number of fish PIT tagged[1]	PIT tag rate (%)
Chiwawa River spring Chinook	144,026	5,000	3.5
Wenatchee River steelhead	247,300	15,000	6.0
Wenatchee River summer Chinook	318,816 (CPUD Program) 181,184 (GPUD Program)	20,600[2]	4.1

[1] Additional PIT tagging may take place for Chelan PUD approved studies and/or comparisons.

[2] Includes a component of PIT-tagged fish for the NOAA size target study and a component for Grant PUD's program.

2.3 Release Monitoring

Hatchery fish will be released during smoltification in the spring, typically between 15 April and 1 June. Whenever possible, the exact release dates will coincide with environmental conditions that promote a rapid emigration that minimizes both the potential negative ecological interactions of hatchery fish with naturally produced fish and predation on hatchery fish by avian or other predators. The default release method will incorporate a volitional approach, as approved by the HCP HC, unless it can be demonstrated other approaches are better. The monitoring data collected for each stock are described below.

Spring Chinook – Chiwawa River

Pre-release sampling data will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan (Hillman et al. 2013). PIT tag monitoring of spring Chinook released in the Chiwawa River will occur during the release period (April). Juvenile Chinook will pass through two 92-cm diameter PIT-tag antennas connected to Allflex 310 readers and Quantitative Sampling Technologies (QST) QuBE data logger. The release location and type (i.e., volitional, forced, or trucked) are recorded for each observation file created and uploaded to the PTAGIS database maintained by the Pacific States Marine Fisheries Commission after each year of release. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Steelhead–Wenatchee River Basin

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions

9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Monitoring of steelhead released in the Wenatchee River basin will occur during loading of fish into transport trucks, unless fish are released directly into the Chiwawa River. Steelhead will pass through a series of PIT-tag antennas, each connected to a data logger, thereby allowing the creation of a PIT-tag observation file for each truckload of steelhead consisting of unique tag records. The release location (stream and rkm), release type (volitional or forced), and hatchery group (HxH or WxW) will be recorded for each tag file created. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. However, because PIT-detection efficiency during loading will not be 100%, the number of fish in each truckload will be estimated using volumetric displacement. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Chinook – Wenatchee River and Chelan Falls
Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Should PIT tagging occur, a monitored release strategy consistent with other Chinook stocks (i.e., Chiwawa Spring Chinook) will be implemented. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

2.4 Post-Release Monitoring and Survival Analysis

Data will be collected during rearing, acclimation, release, and the emigration period that may prove valuable in explaining variability in adult survival (Murdoch and Peven 2005). Rearing densities have been reported to influence the survival of hatchery fish (Martin and Wertheimer 1989; Banks 1994) and may also be linked to disease prevalence during rearing (Banks 1994; Ogut and Reno 2004). Acclimation of hatchery fish before release has been found to increase survival and reduce stray rates when the duration of the acclimation period is sufficient (Clarke et al. 2010, 2012; Rosenberger et al. 2013). These metrics (i.e., rearing density and acclimation period) will be collected annually to determine their influence on fish survival.

PIT-tagged groups of hatchery fish will be used to estimate survival during their emigration. Variation in survival during the emigration period may also inform observed adult survival rates. Survival during emigration or smolt-to-smolt survival and travel will be estimated using interrogation or release files and the standard Cormack-Jolly-Seber (CJS) estimator. CJS estimates are termed apparent survival estimates because it is unknown whether fish suffered mortality (e.g., size or time of release) or simply failed to emigrate (i.e., residualized or were precocial males). In the latter case, the proportion of PIT-tagged fish detected in the Wenatchee or Columbia rivers after the emigration period is complete may explain variation in smolt-to-smolt survival rates. The post-release performance of PIT-tag groups will be estimated and monitored annually, consistent with methods in Murdoch and Peven (2005). Additionally, precocity of hatchery releases will be evaluated by examining the proportion of PIT tag releases detected in adult fish ladders and tributaries within the same year as release.

3. Juvenile Monitoring

Data collected during these elements primarily support monitoring questions 2.1.1 and 2.2.1. and the monitoring objectives described in Table 4 (Hillman et al. 2013). Table 4 below provides a summary of the variables to be measured in 2014 under the Juvenile monitoring component and what objective the measure supports. The text that follows in this section further describes the activities.

Table 4. Monitoring and Evaluation Plan (Hillman et al. 2013) objectives and the associated measured variables for the juvenile monitoring component.

Objective	Measured Variables *(Applicable Study Component(s))*
Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	• Number of juveniles (smolts, parr [where appropriate], and emigrants) (*Freshwater Productivity of Supplemented Stocks*)

3.1 Freshwater productivity of Supplemented Stocks

Steelhead, Spring Chinook, and Summer Chinook

The freshwater productivity of supplemented stocks in the Wenatchee Basin will be monitored using smolt traps in the Chiwawa River and the lower Wenatchee River consistent with historical trapping efforts. Additionally, a newly derived analytical method which uses PIT-tag mark-recapture data will be utilized that reduces bias and increases precision by including estimates of emigration during the winter non-trapping periods. Up to 3,000 parr will be PIT tagged in the Chiwawa River in the fall, based on the spatial distribution and abundance estimated during parr snorkel surveys, to generate estimates of migration during the non-trapping periods. A random sample of a minimum of 10 percent of fish per remote site will be held in a live box for 24 hours to evaluate tag loss and delayed mortality. Using PIT tagged parr detections at the lower Chiwawa PIT array during the non-trapping period, the total number of PIT-tagged parr that emigrated will be estimated, and then expanded by the tag rate. Overwinter mortality of PIT-tagged parr is assumed to be the same as non-PIT-tagged parr. Overwinter survival estimates of Chiwawa River parr will be derived by estimating survival to the lower Wenatchee PIT tag array and analyses with the TribPit Survival software program and/or estimating survival of fall parr and spring smolts to McNary. PIT-tag mark-recapture trials conducted during the trapping period in the fall will also be used to estimate detection probabilities of the PIT-tag array at a given discharge level. Abundance and variance will be estimated using the same methods as those used in the smolt trap estimate. The estimated abundance and variance from each method and time period (trapping and non-trapping periods) will be summed to estimate a total production estimate. Under the proposed methodology, unbiased estimates of abundance during the entire migration period will be generated with relatively high precision (PSE < 15%), which is consistent with NOAA Fisheries' recommendations (Crawford and Rumsey 2011). Historical estimates will be revised using the new estimation techniques.

3.2 Tributary Evaluations

Chiwawa River

Snorkel surveys will be utilized to estimate summer parr abundance within the Chiwawa River basin. This approach has been used in the Chiwawa River basin since 1992. In parallel to addressing Objective 2, additional juvenile data can help to assess the habitat carrying capacity in each tributary. This information can add value to the overall M&E plans and help inform management decisions.

Sampling will follow a stratified random sampling design. Landscape classification will be used to stratify streams in the Chiwawa basin that support juvenile Chinook salmon. In the Chiwawa River basin, WDFW found that classification "explained" most of the variability in fish numbers caused by geology, land type, valley bottom type, stream state condition, and habitat type (Hillman 2013). The same classification method was used to identify sections of the Little Wenatchee River (reference area) that corresponded to discrete reaches in the supplemented basins, but that had no release of hatchery Chinook. Consistent with previous efforts, habitat types within each land-class or reach will be identified and quantified annually. At least three units of each habitat type within each reach will be randomly selected for estimating densities of salmon and trout. Thus, overall sampling consists of a stratified-random sampling design, which increases the accuracy and precision of population estimates.
Densities of salmon and trout will be estimated in August and September by direct underwater observation within the randomly-selected habitat units. Underwater methods will follow those described by Thurow (1994), Dolloff et al. (1996), and O'Neal (2007). Habitat surface areas and volumes will be estimated during fish sampling. Numbers of fish counted will be adjusted for detection probabilities using the models published in Hillman et al. (1992). For each habitat type within a state type and reach stratum, the mean density of salmon and trout will be calculated as the ratio of mean numbers to mean area or volume sampled (Cochran 1977). Total numbers of fish will be estimated per habitat type within a state type and reach stratum as the product of mean density of fish in a given habitat type, times total area or volume of that habitat type within the stratum (Cochran 1977). Total numbers of fish within the supplemented basin will be estimated as the sum of all population numbers per habitat type in state type/reach strata. Bootstrapping methods will be utilized to estimate variance and percent errors (based on 95% confidence interval) for total numbers of fish.

4. Adult Monitoring

The Adult monitoring component is comprised of two basic elements: (1) estimating spawning escapement and (2) harvest monitoring. Data collected during these elements primarily support monitoring questions 1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.2.1, 3.2.2, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 5.3.2, 6.3.1, but also contribute data to monitoring questions 6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.4.1, 10.1.1, 10.1.2, 10.1.3 and 10.1.4. Table 5 below provides a summary of the variables to be measured in 2014 under the Adult monitoring component and what objective the measure(s) supports. The text that follows in this section further describes the activities.

Table 5. Monitoring and Evaluation Plan (Hillman et al. 2013) objectives and the associated measured variables for the adult monitoring component.

Objective	**Measured Variables** *(Applicable Study Component(s))*
Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)* • Number of hatchery and naturally produced fish taken for broodstock (*Broodstock Collection and Stock Assessment*) • Number of hatchery and naturally produced fish taken in harvest (if recruitment is to the Columbia) *(Harvest Reporting)*
Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	• Number of hatchery and naturally produced fish on the spawning grounds (*Spawning Escapement Estimates*) • Number of redds *(Spawning Escapement Estimates)*
Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)* • Number of hatchery and naturally produced fish harvested *(Harvest Reporting)*
Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)*
Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	• Time (Julian date) of hatchery and naturally produced salmon carcasses or marked steelhead detected on spawning grounds within defined reaches *(Spawning Escapement Estimates)* • Time (Julian date) of arrival at mainstem projects and within tributaries (e.g., traps, PIT arrays) with the intent to identify biologically significant differences *(Spawning Escapement Estimates)* • Location (GPS coordinates) of female salmon carcasses observed on spawning grounds *(Spawning Escapement Estimates)*

Objective	**Measured Variables** *(Applicable Study Component(s))*
Objective 6: Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.	• Number of hatchery fish collected for broodstock (*Broodstock Collection and Stock Assessment*) • Number of hatchery fish taken in fishery (*Harvest Reporting*) • Locations of live and dead strays (used to tease out overshoot) *(Spawning Escapement Estimates)* • Number of hatchery carcasses (PIT-tagged and/or CWT) found in non-target and target spawning areas or number of returning spawners counted via PIT-tag detection or at weirs in close temporal proximity to spawning areas (stray data into the Entiat subbasin will be obtained from USFWS Fisheries Resource Office-Leavenworth) *(Spawning Escapement Estimates)*
Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.	• Total and salt (ocean) age and gender of hatchery and naturally produced salmon carcasses collected on spawning grounds *(Spawning Escapement Estimates)* • Whenever possible, age at maturity and sex ratio will be measured at weirs or dams near the spawning stream to avoid the size-related carcass recovery bias on spawning grounds (carcass sampling or ultrasound on live fish) *(Spawning Escapement Estimates)* • Assess age of fish, including harvested fish *(Spawning Escapement Estimates and Harvest Reporting)*
Objective 10: Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.	• Numbers of hatchery fish taken in harvest *(Harvest Reporting)* • Numbers of natural-origin fish taken in harvest *(Harvest Reporting)*

4.1 Spawning Escapement Estimates

Chelan and Methow Summer/Fall Chinook

Chinook spawning ground surveys will be conducted in the Chelan River and Methow subbasin (see Appendix A for survey reaches). Spawning ground surveys will be conducted via foot or raft beginning late September and continuing until spawning has ended (usually mid-November). Frequency of surveys will vary depending on method.

Summer Chinook carcass surveys will be conducted in the Chelan and Methow subbasins beginning in September and ending in November consistent with methods described in Murdoch and Peven (2005). A representative sample (i.e., 20%) of spawners as determined by spawner abundance and distribution (typically 100% of the carcasses encountered in the Chelan and Methow) will be sampled. Biological data will include collection of scale samples for age analysis, length measurements (POH and FKL), gender, egg voidance, and a check for tags or marks. DNA samples (five-hole punches from operculum) will be collected as needed to address different objectives. These data will be used to assess length-at-age, size-at-age, egg voidance, origin (hatchery or naturally produced), stray rates, and genetics. All carcass surveys will be conducted within the historical reaches.

Wenatchee Steelhead
The number of hatchery and naturally produced steelhead returning to the Wenatchee Basin will be estimated using a PIT tag mark recapture model. The estimated spawner abundance for the Wenatchee steelhead population will be a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates. Steelhead redd counts will be conducted weekly in all major spawning areas in the mainstem Wenatchee River (see Appendix A for survey reaches); minor spawning areas in the mainstem Wenatchee River will be surveyed once, based on the spawn timing in adjacent major spawning areas, to estimate redd abundance at peak spawning. The estimated total number of redds in the Wenatchee River mainstem will be expanded by the sex ratio of the population to estimate spawner abundance. Spawner abundance in tributaries of the Wenatchee River will be estimated using a PIT tag mark recapture model.

Chiwawa Spring Chinook
Chiwawa spring Chinook spawning escapement will be estimated based on the total number of redds found in each tributary (Murdoch et al. 2010) using methods described in Murdoch and Peven (2005). Weekly redd and carcass surveys will be conducted simultaneously from the first week of August through September (see Appendix A for survey reaches). Redd-based estimates assume that each female constructs one redd, which WDFW has found to be appropriate for this population (Murdoch et al. 2009). The total number of redds in each reach will be estimated using methods described in Millar et al. (2012) and using the observer efficiency model currently under development by WDFW. Redd counts will be expanded and the number of hatchery and naturally produced fish will be estimated using methods in Murdoch et al. (2010). Carcasses encountered during surveys will be sampled according to methods outlined in Murdoch and Peven (2005). All CWTs (i.e., snout or adipose) from carcasses will be sent to the WDFW lab in Olympia. The CWT lab will extract and read CWTs and submit all required information to RMIS within one year of collection. In addition, all redds and female carcasses will be geo-referenced using hand-held GPS devices. Carcass recovery bias has been detected in the Chiwawa spring Chinook population (Murdoch et al. 2010) and if not corrected will bias estimates of hatchery and naturally produced fish on the spawning grounds. While it may be appropriate to correct for carcass recovery bias for some monitoring questions (e.g., 2.2), when comparisons to reference populations are made in monitoring questions 1.1.and 1.2, carcass

bias will not be corrected because other monitoring programs have not corrected for a similar bias.

Wenatchee Summer Chinook

Wenatchee summer Chinook spawning ground counts will begin the last week in September and continue through the end of spawning in November (see Appendix A for survey reaches). Total census redd counts will be conducted by foot or raft depending on stream size, flow, and density of spawners within the stream reach (see Appendix A for survey reaches). All stream reaches will be surveyed once per week. Redd data will be collected using methods described in Murdoch and Peven (2005). Salmon carcass data collected during spawning ground surveys will be consistent with Murdoch and Peven (2005). All CWTs (i.e., snout or adipose) from carcasses will be sent to the WDFW lab in Olympia. The CWT lab will extract and read CWTs and submit all required information to RMIS within one year of collection.

Redd Observer Efficiency and Fish per Redd Value

Estimating redd observer efficiency is a costly and laborious task. Models generated for spring Chinook salmon are not applicable for summer Chinook because of differences in river characteristics of spawning locations. Small unmanned air systems (e.g., four blade helicopter) have been used successfully to document the abundance and distribution of fall Chinook redds in the Snake River (P. Groves, Idaho Power, Pers. comm.). We intend to use this technology to determine the true number of summer Chinook redds in selected reaches of the Wenatchee River. Weekly aerial photos of selected reaches will be digitally overlaid to document existing and newly constructed redds. Weekly ground-based estimates and the true number of redds will be compared in order to determine observer efficiency. Weekly river characteristics (e.g., channel width, water depth, discharge, visibility, and habitat complexity), observer experience, and survey effort will be incorporated into a model to predict observer efficiency in all river reaches. Predicted redd observer efficiency for each river reach will be used to expand ground-based redd counts to estimate the total reach redd count. Aerial photographs and ground-based surveys will also be used to estimate redd life for each river reach. The estimated spawner abundance in the Wenatchee River and an associated level of precision will be calculated using the estimated total redd count for each reach, mean redd life, and the sex ratio of the population similar to methods described in Millar et al. (2012).

4.2 Harvest Reporting

In years when the expected hatchery adult returns are in excess of the levels needed to meet the hatchery program goals (i.e., broodstock and/or escapement), surplus fish may be available for harvest. Harvesting or removal of surplus hatchery fish may have benefits to the natural populations by reducing potential negative ecological and genetic impacts (e.g., density dependent effects, loss of fitness, and loss of genetic variation). The contribution of hatchery fish to fisheries will be monitored using CWT recoveries on a brood-year basis supporting Objective 10.

To obtain the necessary data to determine if the harvest rates are meeting objectives, a statistically valid creel program will be designed and implemented for all sport and/or conservation fisheries in the Upper Columbia River to estimate harvest of hatchery fish from both Chelan and Grant County PUD funded hatchery programs (Murdoch and Peven 2005). Information collected during creel surveys are an integral component to calculating the HRR (Objective 3), particularly given most CWT recoveries for PUD mitigation programs occur in the Upper Columbia River and its tributaries, with the exception of summer Chinook where most CWT recoveries occur in ocean fisheries. Because of considerable time lags in reporting of CWT's to the Regional Marking Information System (RMIS) database, it requires an ongoing query of recovery data until the number of estimated fish does not change.

5. Data Management , Analysis, and Reporting

5.1 Data Management

A Microsoft Access database maintained by WDFW will contain all the monitoring data collected for hatchery evaluations. The database will contain and manage all data associated with aquaculture monitoring, juvenile monitoring, and adult monitoring.

All data entered into the database are evaluated for quality control and quality assurance by WDFW. Quality control checks using analyses such as modified Z-scores, boxplots, and the Generalized Extreme Studentized Deviate Procedure (Iglewicz and Hoaglin 1993) will be conducted for all data entry. In the event outliers are identified, discussion will occur on whether identified outliers are true data points or transcription errors. This process ensures that the data used to test statistical hypotheses are correct and accurate.

5.2 Data Analysis

The analyses proposed are consistent with the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update (Hillman et al. 2013). Each of the objectives will be addressed using the appropriate statistical tests, as well as graphic analyses that convey relevant information.

5.3 Reporting

An annual M&E report will be generated following the completion of each calendar year and will be available for HCP HC review by June 1 of the following year. Additionally, monthly progress reports will be made available to the HCP HC.

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Appendix A

Designated survey reaches for Methow subbasin summer Chinook spawning ground surveys.

River	Reach	Code	RM
Methow	Mouth to Methow Bridge	M1	0.0-14.78
	Methow Bridge to Carlton Bridge	M2	14.78-27.17
	Carlton Bridge to Twisp Bridge	M3	27.17-39.55
	Twisp Bridge to MVID	M4	39.55-44.85
	MVID to Winthrop Bridge	M5	44.85-49.80
	Winthrop Bridge to Hatchery Dam	M6	49.80-51.55

Designated survey reaches for Wenatchee River basin summer Chinook spawning grounds surveys. Asterisks denotes reaches where redd observer efficiency will be assessed.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Bridge	54.20-53.58
	Bridge to Swamp *	53.58-52.66
	Swamp to Chiwawa River	52.66-48.39
W9	Chiwawa River to Schugart Flats	48.39-47.93
	Schugart Flats to Old Plain Bridge	47.93-46.21
	Old Plain Bridge to RR Bridge	46.21-41.91
	RR Bridge to RR Tunnel	41.91-39.28
	RR Tunnel to Swing Pool *	39.28-36.67
	Swing Pool to Tumwater Br	36.67-35.55
W8	Tumwater Br to Swiftwater Campground *	35.55-33.50
	Swiftwater Campground to Unimproved Campground	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Penstock Br	30.91-28.66
	Penstock Br to Icicle Road Br *	28.66-26.43
W6	Icicle Road Br to Icicle Mouth	26.43-25.61
	Icicle Mouth to Boat Takeout *	25.61-24.49
	Boat Takeout to Leavenworth Br	24.49-23.90
W5	Leavenworth Br to Irrigation Flume *	23.90-22.77
	Irrigation Flume to Peshastin Br	22.77-20.00
W4	Peshastin Br to Dryden Dam *	20.00-17.76
W3	Dryden Dam to Williams Canyon	17.76-15.54
	Williams Canyon to Upper Cashmere Br	15.54-10.22
	Upper Cashmere Br to Lower Cashmere Br	10.22-9.49
W2	Lower Cashmere Br to Old Monitor Br *	9.49-7.12
	Old Monitor Br to Sleepy Hollow Br	7.12-3.27
W1	Sleepy Hollow Br to River Bend *	3.27-1.73
	River Bend to Siphon	1.73-1.29
	Siphon to Mouth	1.29-0.45

Designated survey reaches for Wenatchee Basin spring Chinook spawning grounds surveys.

Reach Code	Reach Section	River Mile
Chiwawa River and Tributaries (Rock and Chikamin)		
C7	Buck Cr to Phelps Cr	36.39-33.46
C6	Phelps Cr (Trinity) to Maple Cr Br	33.46-29.64
C5	Maple Cr Br to Atkinson Flats	29.64-26.59
C4	Atkinson Flats to Schaefer Cr	26.59-24.24
C3	Schaefer Cr to Rock Cr Campground	24.24-22.97
R1 - Rock	Mouth to Chiwawa River Road Bridge	0.00-1.05
C2	Rock Cr Campground to Grouse Cr	22.97-12.27
K1 - Chikamin	Mouth to Chiwawa River Road Bridge	0.00-0.68
C1	Grouse Cr to Mouth	12.27-0.00
Nason Creek		
N4	White Pine Creek to Lower R.R. Bridge	16.09-13.68
N3	Lower R.R. Bridge to Hwy 2 Bridge	13.68-9.13
N2	Hwy 2 Bridge to Kahler Cr	9.13-4.46
N1	Kahler Cr to Mouth	4.46-0.00
White River and Tributaries (Panther and Napeaqua)		
H4	Falls to Grasshopper Meadows	21.16-19.78
T1 - Panther	Boulder field to Mouth	0.43-0.00
H3	Grasshopper Meadows to Napeaqua River	19.78-17.59
Q1 - Napeaqua	Take out to Mouth	0.91-0.00
H2	Napeequa River to Sears Cr Bridge	17.59-11.97
H1	Sears Cr Bridge to Mouth	11.97-0.00
Little Wenatchee River		
L3	Rainy Cr to Lost Cr	10.78-6.74
L2	Lost Cr to Old Fish Weir	6.74-2.13
L1	Old Fish Weir to Mouth	2.13-0.00
Upper Wenatchee River		
W10	Lake Wenatchee to Chiwawa River	54.20-48.39
Chiwaukum Creek		
U1	Metal bridge to Mouth	1.0 – 0.0
Icicle River		
I1	Hatchery to Mouth	3.02-0.00
Peshastin Creek and Tributaries (Ingalls Creek)		
D1 - Ingalls	Trailhead to mouth	0.64-0.00
P2	Ingalls Creek to Camas Cr	9.14-5.63
P1	Camas Cr to Mouth	5.63-0.00

Designated survey reaches for Wenatchee River basin steelhead spawning grounds surveys. Asterisks denote index reaches. Spawning escapements in tributaries will be estimates using PIT-tag arrays.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Chiwawa River*	54.20-48.39
W9	Chiwawa River to Tumwater Bridge*	48.39-35.55
W8	Tumwater Br to Swiftwater Campground	35.55-33.50
	Swiftwater Campground to Unimproved Campground*	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Icicle Road Bridge	30.91-26.43
W6	Icicle Road Br to Leavenworth boat ramp*	26.43-24.49
	Boat Takeout to Leavenworth Bridge	24.49-23.90
W5	Leavenworth Bridge to Peshastin Bridge	23.90-20.00
W4	Peshastin Bridge to Dryden Dam	20.00-17.76
W3	Dryden Dam to Lower Cashmere Bridge	17.76-9.49
W2	Lower Cashmere Bridge to Sleepy Hollow Bridge *	9.49-3.27
W1	Sleepy Hollow Bridge to Mouth	3.27-0.45

Tributary	River mile of PIT tag array
Mission Creek	0.54
Peshastin Creek	1.91
Chumstick Creek	0.31
Icicle River	0.26
Chiwaukum Creek	0.24
Chiwawa River	0.58
Nason Creek	0.52
Little Wenatchee River	1.74
White River	1.65

Chelan PUD's proposed Lake Wenatchee sockeye salmon monitoring and evaluation activities.

Life History Stage	M&E Activity	Related analysis	VSP parameter addressed
Juvenile	Concurrent operation of the lower Wenatchee smolt trap to collect juvenile outmigration data	Generate distribution of outmigration timing and determine average smolt size.	Diversity
Juvenile	PIT tagging smolts at lower Wenatchee smolt trap (up to 5,000 fish annually)	Estimate smolt-to-adult returns	Productivity
Juvenile	Develop spawner-smolt production estimates	Use previously collected data to quantify the relationship between spawner abundance and smolt production	Productivity
Adult	Rock Island and Rocky Reach Dam adult counts	Initial spawner abundance (Okanogan stock separation)	Abundance and spatial structure
Adult	PIT tag subsample of returning adults at Tumwater Dam to support mark-recapture evaluation	Calculate spawner abundance and relative distribution in tributaries	Abundance and spatial structure
Adult	Collect and age scales[1] from returning adults at Tumwater Dam	Estimate age-at-return and relative productivity of contributing spawner cohorts	Productivity and diversity
Adult	Tumwater Dam adult counts	Estimate potential spawner abundance (pre Lake-Wenatchee harvest), potential productivity (recruits/spawner), and run timing distribution	Abundance and diversity
Adult	Operate PIT detection arrays on Little Wenatchee and White River	Calculate spawner abundance (post-Lake Wenatchee harvest and other mortality), actual productivity (recruits/spawner), and entry-to-spawning-habitat timing distribution, and spatial spawner distribution	Abundance, productivity, spatial structure, and diversity

[1] Scales would be collected concurrently from adults that are PIT tagged at Tumwater Dam

720 Olive Way, Suite 1900
Seattle, Washington 98101
Phone 206.287.9130
Fax 206.287.9131
www.anchorqea.com

FINAL MEMORANDUM

To:	Wells, Rocky Reach, and Rock Island HCPs Hatchery Committees	**Date:**	January 16, 2014
From:	Mike Schiewe, Chair		
Cc:	Kristi Geris		
Re:	Final Minutes of the December 18, 2013 HCP Hatchery Committees Meeting		

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans (HCPs) Hatchery Committees' meeting was held at Chelan PUD headquarters in Wenatchee, Washington, on Wednesday, December 18, 2013, from 9:30 am to 12:30 pm. Attendees are listed in Attachment A to these meeting minutes.

ACTION ITEM SUMMARY

- Kristi Geris will review the administrative record to compile a summary of how containment levels were established for Non-Target Taxa of Concern (NTTOC) modeling (Item II-B).
- The Hatchery Evaluation Technical Team (HETT) will review the technical approach identified by HETT to address cutthroat trout NTTOC risk assessment, focusing on the use of spatial overlap as a proxy for risk (Item II-B).
- Greg Mackey, Keely Murdoch, and Todd Pearsons will investigate how fry predation was handled in the NTTOC modeling (Item II-B).
- Douglas PUD Information Systems (IS) Staff will provide a presentation on the Douglas PUD Extranet Site at the Hatchery Committees' meeting on January 15, 2014 (Item II-E).
- Public comments on the Okanogan and Methow Spring Chinook Hatchery and Genetic Management Plans (HGMPs) are due on January 9, 2014 by 5:00 pm. The Federal Register Notice (FRN) and HGMPs for review can be accessed here: http://www.westcoast.fisheries.noaa.gov/hatcheries/hgmp/Okanogan_and_Methow_salmon_hatchery_applications.html (Item III-A).
- Chelan PUD will provide a formal Rocky Reach Trap Pilot Study report for consideration at the Hatchery Committees' meeting on January 15, 2014 (Item IV-B).
- Hatchery Committees representatives will submit edits and comments on the draft

Chelan PUD Spring Chinook HGMP to Alene Underwood by January 10, 2014, for discussion at the Hatchery Committees' meeting on January 15, 2014 (Item IV-C).

- Chelan PUD will provide the draft Chelan PUD 2014 HCP Rocky Reach and Rock Island Action Plan to Kristi Geris for distribution to the Hatchery Committees (Item IV-F).
- Mike Tonseth will provide a brief written request from Washington Department of Fish and Wildlife (WDFW) and the National Marine Fisheries Service (NMFS) for a change in the scope of work for the Bonneville Power Administration (BPA)-funded Wenatchee Spring Chinook Reproductive Success Study, to Kristi Geris for distribution to the Hatchery Committees (Item V-A).

STATEMENT OF AGREEMENT DECISION SUMMARY

- The Hatchery Committees representatives present approved the Douglas PUD 2014 Hatchery Monitoring and Evaluation (M&E) Implementation Plan, as revised (Item II-A).
- The Hatchery Committees representatives present approved the sacrifice of 375 Chelan PUD Chiwawa spring Chinook juveniles for Grant PUD's White River Size Target Study (Item IV-D).

AGREEMENTS

- The Hatchery Committees representatives present agreed, in principle, to the Colville Confederated Tribes' (CCT's) Wells Steelhead Broodstock Replacement proposal, pending further discussion at the Hatchery Committees' meeting on January 15, 2014 (Item II-C).

REVIEW ITEMS

- Kristi Geris sent an email to the Hatchery Committees on December 18, 2013, notifying them that the draft Douglas PUD 2014 HCP Wells Action Plan is available for review. Douglas PUD will be requesting approval of the draft plan at the Hatchery Committees' meeting on January 15, 2014 (Item II-D).
- The draft Sockeye Addendum to the final Chelan PUD 2014 Hatchery M&E Implementation Plan that was distributed to the Hatchery Committees by Kristi Geris

on December 11, 2013, is out for review. Chelan PUD will be requesting approval of the draft addendum at the Hatchery Committees' meeting on January 15, 2014 (Item IV-A).

- Kristi Geris sent an email to the Hatchery Committees on December 18, 2013, notifying them that the draft Chelan PUD Spring Chinook HGMP is available for review, with comments due to Alene Underwood by January 10, 2014, for discussion at the Hatchery Committees' meeting on January 15, 2014 (Item IV-C).

FINALIZED REPORTS

- The revised draft Chelan PUD 2014 Hatchery M&E Implementation Plan that was approved by the Hatchery Committees on November 20, 2013, was finalized and distributed to the Hatchery Committees by Kristi Geris on November 22, 2013.
- The draft Douglas PUD 2012 M&E Plan Report was approved by the Hatchery Committees on November 14, 2013, following a 60-day review period, and was finalized and distributed to the Hatchery Committees by Kristi Geris on December 13, 2013.
- The revised draft Douglas PUD 2014 Hatchery M&E Implementation Plan, as approved at the Hatchery Committees' December 18, 2013 meeting, was finalized and distributed to the Hatchery Committees by Kristi Geris on December 19, 2013 (Item II-A).

I. Welcome, Agenda Review, Meeting Minutes, and Action Items

Mike Schiewe welcomed the Hatchery Committees and asked for any additions or other changes to the agenda. The following revisions were requested:

- Douglas PUD added: 1) the CCT's Wells Steelhead Broodstock Replacement Memorandum to the Douglas PUD Steelhead Broodstock at Wells Hatchery Update; 2) an update on the draft Douglas PUD 2014 HCP Wells Action Plan; and 3) a discussion on the Douglas PUD Extranet site.
- Chelan PUD added: 1) a request regarding Grant PUD's White River Size Target Study; 2) a Similkameen Update; and 3) an update on the draft Chelan PUD 2014 HCP Rocky Reach and Rock Island Action Plan.

- WDFW added a request regarding the BPA-funded Wenatchee Spring Chinook Reproductive Success Study.

The Hatchery Committees reviewed the revised draft November 6, 2013 conference call minutes. Kristi Geris said that all comments and revisions received from members of the Committees were incorporated in the revised minutes, and that there were no outstanding edits or questions to discuss. Kirk Truscott provided the CCT's approval of the revised minutes via email on December 17, 2013. The Hatchery Committees members present approved the draft November 6, 2013 conference call minutes, as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

The Hatchery Committees reviewed the revised draft November 20, 2013 meeting minutes. Kristi Geris said that a third revised draft was distributed to the Hatchery Committees on December 17, 2013. She said the third revised draft included additional edits, tracked in redline strikeout, which addressed all pending comments in the first and second drafts; there are no outstanding comments to be discussed. Kirk Truscott provided the CCT's approval of the revised minutes via email on December 17, 2013. The Hatchery Committees members present approved the draft November 20, 2013 meeting minutes, as revised. Geris will finalize the meeting minutes and distribute them to the Committees.

II. Douglas PUD

A. DECISION: Douglas PUD 2014 Hatchery M&E Implementation Plan (Greg Mackey)

Greg Mackey said that a revised draft Douglas PUD 2014 Hatchery M&E Implementation Plan (Attachment B) was distributed to the Hatchery Committees by Mackey and Kristi Geris on December 17, 2013. He said the revised draft included comments from the CCT, which were also distributed to the Hatchery Committees on December 10, 2013. He said he discussed the CCT's comments with Charlie Snow, and that comments from Snow are also included in the revised draft. Mackey reviewed the edits in the revised draft plan, as follows:

<u>Module 1: In-Hatchery Metrics – Steelhead</u> (page 5)
Mackey explained that historically, the CCT have not sampled Omak broodstock at Wells Hatchery during spawning; therefore, that sentence was omitted.

Module 2: Steelhead Adult Stock Assessment (page 7)

Mackey explained that in the Douglas PUD 2013 Hatchery M&E Implementation Plan, the proportion of hatchery origin spawners (pHOS) was calculated for conservation programs; however, for safety net programs, pHOS metrics were not as relevant. He added that because pHOS was already being documented for the conservation program, it was not needed for safety net programs. He said that pHOS and proportionate natural influence metrics will be estimated for the Twisp; however, the data necessary to estimate pHOS in the mainstem Methow and Chewuch will be collected and reported. Mackey said that Snow indicated that field activities are largely the same as in previous years.

Module 4: Steelhead Spawning Distribution and Timing (page 8)

Mackey explained that run-timing, spawn-timing, and spawning distribution need to be determined for steelhead. He said that passive integrated transponder (PIT)-tag arrays are located in key locations to help address these metrics. He added that steelhead spawner surveys (except in the Twisp where fish can be Floy-tagged and survey conditions are favorable) cannot address the objectives in the M&E plan because hatchery and wild fish cannot be differentiated, and steelhead surveys are typically curtailed due to high water and poor visibility. He said that Andrew Murdoch and Snow would still like to conduct index reach redd surveys in both the lower and upper Methow. He said in the lower Methow, there is the possibility that fish will overwinter, so Murdoch and Snow would like to survey redds and use stock assessments to parse out what was observed. Mackey said that Snow would also like to conduct index surveys in the upper Methow to augment the PIT-tag detection data. He said that it is important to begin shifting towards PIT-tag detections for estimating steelhead spawner distribution and timing rather than continuing to implement spawner surveys that do not provide reliable estimates. The PIT-tag detection method will continue to be supplemented with index reach counts in the mainstem Methow until a more accurate PIT-tag detection arrays can be installed in the lower Methow Basin.

Module 5: Estimation of Steelhead Stray Rates (page 9)

Mackey explained that he had suggested using March as a cutoff for strays; however, after discussion, it was decided that this would be addressed during analysis and did not pertain to implementation, and so it was omitted.

Module 6: Steelhead Juvenile Population Assessment (page 9)

Mackey explained that continued use of screw traps was planned for 2014, but in addition, the use of PIT-tagging juveniles in-stream coupled with juvenile population estimates and survival models was planned to provide population estimates at the parr and smolt stages, as well as survival estimates to key life history stages. He said it was decided to set up the Twisp with a sampling scheme involving General Random Tessellation Sampling and also PIT-tagging (i.e., "Approach 2"). Keely Murdoch asked if "Approach 2" is a pilot study for implementation in 2014 in addition to rotary smolt trapping, and Mackey said that is correct. He added that this pilot will offer a comparison, but importantly, will also help gauge how feasible this approach will be in terms of what level of effort is required for catching and PIT-tagging fish. He said fish are PIT-tagged in a stream while conducting a population estimate and their survival tracked through the system, which will provide data for population estimates at later life stages (smolts) and survival to key life stages. Murdoch suggested that it may be important to compare methods. Mackey responded that it is not necessarily informative to expect a correlation between two methods if one method provides poor estimates. Smolt trapping experiences many missed days which cannot be corrected statistically and the lower river trap, in particular, has very low efficiency which makes extrapolating population estimates prone to error. Mackey added that a key for evaluating juvenile fish performance in the Methow is the Rocky Reach Juvenile Bypass (RRJB) detector. He said that the survival studies conducted for the Wells Project provide excellent estimates of survival that can be used to adjust the survival and population estimates obtained at the RRJB detector to determine how many fish are emigrating from the Methow. Mike Schiewe asked how many detection systems are installed upstream from Rocky Reach. Mackey said that systems are installed in the lower Methow near Pateros, lower Twisp, lower Chewuch, mainstem Methow near Winthrop, at the base of the Lost River, and in a number of the tributaries. Bill Gale noted the difficulty with poor detection efficiency for juveniles at certain times of the year; Tom Kahler said the same issue exists with screw traps. Kahler also noted that instream arrays during the summer have much higher detection efficiency. Mackey added that Douglas PUD would also look into upgrading key arrays to improve performance of this approach if it is adopted; Kahler noted the vast improvements that have been developed for arrays. Mackey said that to satisfy Truscott's comments to this section, "in the Twisp River" was added to "Approach 2."

Module 11: Spring Chinook Spawners Surveys (page 16)
Mackey said that to address Truscott's comment, Table 4 was copied from the Douglas PUD 2013 Hatchery M&E Implementation Plan and inserted in this section.

Module 12: Estimation of Spring Chinook Stray Rates (page 16)
Gale requested clarification regarding how soon coded-wire-tag (CWT) data will be uploaded to the Regional Mark Information System (RMIS) database. Mike Tonseth said that WDFW Olympia staff handles uploading data to RMIS, which typically is completed within 12 months; however, Snow receives those CWT data earlier and he recommended that Gale coordinate with Snow if he was in need of those data sooner. Mackey added that Douglas PUD receives a draft report from Snow by July 1, and so Mackey estimated that Snow has those data by about June. Gale asked if a deadline could be added, for example, "data will be available within 12 months." Tonseth explained that there is no guarantee of the timing when the WDFW lab will process tags and when those data are subsequently uploaded to RMIS. Furthermore, uploading data to RMIS by a certain date is not part of the M&E obligations under the HCP. He said the timing of CWT extraction and uploading to RMIS is a built-in cost of tagging that Douglas PUD and WDFW have no control over. Gale said he was fine with leaving the text as is.

Module 13: Juvenile Spring Chinook Population Assessment (page 17)
Mackey said this comment was the same as the previous comment regarding "Approach 2."

Schiewe said that he spoke with Truscott on December 17, 2013, and Truscott indicated that unless there were major revisions made to the plan during today's meeting, the CCT approves the revised draft Douglas PUD 2014 Hatchery M&E Implementation Plan. The Hatchery Committees representatives present also approved the Douglas PUD 2014 Hatchery M&E Implementation Plan, as revised; the final plan was distributed to the Hatchery Committees by Geris on December 19, 2013.

B. NTTOC Update and Discussion (Greg Mackey)
Greg Mackey said that development of the summary report is underway, and that all model data are now uploaded in a database and can be extracted. He said, in summary, the analyses started with 50 hatchery programs and 25 NTTOC populations, which resulted in 526

possible interactions. He said that 416 of 526 interactions were suitable for Predation, Competition, and Disease (PCD) Risk1 modeling, and that 110 of 526 interactions involved lamprey and cutthroat, which could not be modeled. He said that 80 of 416 interactions were Chief Joseph Hatchery program interactions that were not modeled, which resulted in 336 interactions that were modeled. He said that 202 of 336 interactions were run to completion (about two-thirds), and that 134 would not run to completion. He said he was uncertain about the cause for why each of the 134 did not run to completion, although he noted that modeling runs crashed and some modeling runs ran too slowly to complete.

Mackey recalled that the original plan was to use a panel to address lamprey and cutthroat trout. He said if the Hatchery Committees still wish to finish lamprey and cutthroat, a few panelists need to be identified to review those interactions. Todd Pearsons recalled that cutthroat were going to be assessed based on distributional overlap with the hatchery programs, and the assumption would be that the risk of that population would be under containment level given the small spatial overlap (i.e., low risk). Bill Gale said he thought only ecological impacts were being evaluated—not program impacts as a whole, such as trapping operations. Mike Schiewe indicated he thought the objective was to determine the effects of hatchery fish on NTTOC, but suggested that the language of the objective should be reviewed to confirm. Gale suggested that if the focus included the program then a panel should be convened to evaluate lamprey because there may be facility impacts.

Schiewe suggested revisiting the objectives and reviewing the compiled, summarized data prior to making further decisions. Keely Murdoch said that it seems if a panel is convened for lamprey, one may need to be convened for all interactions. Schiewe suggested revisiting Objective 10, and also the Statement of Agreement dating back to using the modeling approach.

Murdoch recalled cases where there were issues with fry predation where it should have been excluded, for example, with releases in Nason Creek preying on Wenatchee Sockeye fry. She said she tried eliminating that age class and the models would not run, so the plan was to go back through these data following the modeling because there was no way to address this issue while running the models. Pearsons added that he recalled that the plan was to run the models and then subtract fry predation losses from the total. Mackey suggested that once these data are summarized more, a few people should convene and discuss a suitable work-around to address this issue.

Mackey noted that the containment objective for Chiwawa and Nason spring Chinook was 10%, and all other listed populations were lower at 5%. He asked if anyone remembered the reasoning behind this, or if it was an oversight. Pearsons said it would make sense that all listed species had the same containment objective. Schiewe said any differences would have been decided early in the process. Kristi Geris said she will review the administrative record to compile a summary of how containment levels were established for NTTOC modeling. The HETT agreed to investigate the extent of spatial overlap for cutthroat trout in the NTTOC modeling. Mackey, Murdoch, and Pearsons agreed to investigate how fry predation was handled in the earlier NTTOC modeling.

C. Steelhead Broodstock at Wells Hatchery Update (Jayson Wahls)

Jayson Wahls said that since the last Hatchery Committees meeting, 16 marked steelhead have been obtained from Ringold Hatchery, including 9 males and 7 females, which will be used for the 160,000 Columbia Safety-Net Program. Mike Tonseth added that between all of the different methods being employed to replace the broodstock, and combined with the CCT's proposal, he is fairly certain brood will be replaced for all programs. Tonseth said that the CCT will be collecting both natural-origin (NO) broodstock and if supported by the Committees, hatchery-origin (HO) broodstock for the Omak program, and hopes to collect HO broodstock for the Okanogan program (see below); Greg Mackey added that Kirk Truscott informed him that the CCT has a permit to install a weir at Wild Horse Springs. Bill Gale asked what the total broodstock need is, and Wahls replied that 200 fish are needed. Wahls added that this amount would cover the 50,000 needed for Winthrop National Fish Hatchery (NFH), and he also added that 5 pairs are needed for the Omak program and 20 pairs are needed for the Okanogan program. Mike Schiewe asked how the efforts to collect fish at Wells and in the Methow tie in with the CCT's proposal, and Tonseth replied that it dovetails into making sure production requirements can be met. He added that if the CCT already has a permit to install a temporary weir in the Omak or Okanagan, there are no additional impacts. *(Note: Tom Kahler later noted that the CCT has a permanent weir in Omak Creek.)* Gale asked if the mainstem Columbia River is closed between Rocky Reach Dam and Wells Dam, and Tonseth replied that it is. He added that it may open back up for angling in March 2014. Gale asked if the fisheries located above Wells Dam are open, and Tonseth replied that they are; however, efforts are low and catch is very low. Schiewe noted that one provision in the CCT's proposal is to replace one-for-one, and he asked if this was agreeable to the Committees. Tonseth replied that he believes it is reasonable, and added that the HO fish are returns from Okanogan Basin releases. Mackey noted that this means holding and rearing 80,000 fish separately, and added that assurances would need to be made that there is adequate space to accommodate this arrangement. Wahls said that he believes there should be no issues with space.

Wells Steelhead Broodstock Replacement (the CCT's proposal)

The CCT provided a Wells Steelhead Broodstock Replacement Memorandum (Attachment C) that was distributed to the Hatchery Committees by Kristi Geris on December 17, 2013. Tonseth explained the CCT's proposal as including operating the weir in Omak Creek, in addition to another proposed weir in Wild Horse Springs that the CCT is already permitted for. He said this presents options to obtain HO steelhead in the Okanogan. Mackey added that Douglas PUD would continue to collect Wells stock; however, fish would also be collected in the Methow in the spring. He said that fish obtained in the spring would normally replace fall-caught fish, with the excess fish going toward Ringold production. Wahls asked if the CCT's excess fish could be used at Ringold, and Tonseth said that the CCT will likely prefer to keep those fish in the Okanogan. Tonseth later clarified that regardless if the excess fish were adults collected or juveniles produced, he believes that the CCT would prefer to prioritize HO adults collected in the Okanogan and their subsequent progeny be used for the Okanogan based releases. He added that any excess HO adults collected at Wells or in the Methow not needed to meet the Okanogan production could be used for Ringold as well as any excess juveniles produced from HO adults collected in the Okanogan. Schiewe asked if the Hatchery Committees would be willing to approve the CCT's proposal, or approve in principle pending additional discussion at the Hatchery Committees meeting on January 15, 2014. Mackey said that Douglas PUD would like to know additional details regarding Wells Hatchery, in terms of the CCT's proposal and asked to wait until January 2014 for a final approval vote. The Hatchery Committees representatives present agreed, in principle, to the CCT's Wells Steelhead Broodstock Replacement proposal, pending further discussion at the Hatchery Committees' meeting on January 15, 2014.

D. Douglas PUD 2014 HCP Wells Action Plan (Tom Kahler)

Kristi Geris sent an email to the Hatchery Committees following the meeting on December 18, 2013, notifying them that the draft Douglas PUD 2014 HCP Wells Action Plan is available for review. Mike Schiewe reminded the Hatchery Committees that the action plan summarizes a list of activities planned for the coming year, which is distributed to the HCP Hatchery Committees, Coordinating Committees, and Tributary Committees for approval each year. Tom Kahler asked the Hatchery Committees to review the draft action plan and to note anything that may be missing. He said that Douglas PUD will be requesting approval of the draft plan at the Hatchery Committees' meeting on January 15, 2014.

E. Douglas PUD Extranet Site (Tom Kahler)

Tom Kahler said that HCP-related documents are currently housed on an ftp site hosted by Anchor QEA. He said that Douglas PUD's new license agreement now requires Douglas PUD to maintain their own system that also houses HCP documents, which must be made available to the HCP Committees. He said that developing a new system has been discussed over the past year or so, and Douglas PUD has settled on a SharePoint option. He explained that the system is an extranet site with secure access. He said that documents are searchable and easy to work with, and that the site has customizable views. He noted that the Aquatic SWG has also adopted an extranet site that is now live and has been working out fairly well. He said that the Coordinating Committees are also discussing moving document archiving to an extranet site; however, there are pending issues regarding whether all HCP documents or only Douglas PUD HCP documents will be housed on the site. He added that Steve Hemstrom, the HCP Coordinating Committees Technical Representative for Chelan PUD, is assisting with coordination between Douglas PUD and Chelan PUD management to resolve pending issues. Kahler said that Douglas PUD IS Staff will provide a presentation on the Douglas PUD Extranet Site at the Hatchery Committees' meeting on January 15, 2014.

III. NMFS

A. HGMP Update (Lynn Hatcher)

Okanogan spring Chinook and Methow spring Chinook

Lynn Hatcher said that the Section 10(j) public process is complete. The Section 10(j) FRN was released on October 24, 2013, and closed on December 10, 2013. He said that eight comments were received, including six positive comments. He said the Finding of No Significant Impact is scheduled to be released in March 2014.

He said the Okanogan and Methow spring Chinook HGMPs FRN was released on December 10, 2013, with comments due by January 9, 2014. The completion date is set for June 2014. Bill Gale requested that the hyperlink to access the FRN be distributed, and Kristi Geris included the requested information in the meeting actions items and minutes, as follows: public comments on the Okanogan and Methow Spring Chinook HGMPs are due on January 9, 2014 by 5:00 pm. The FRN and HGMPs for review can be accessed here: http://www.westcoast.fisheries.noaa.gov/hatcheries/hgmp/Okanogan_and_Methow_salmon_hatchery_applications.html.

Okanogan Steelhead

Hatcher said that NMFS and the CCT met on December 9, 2013, to discuss the steelhead timeline. He said the FRN will be posted on February 1, 2014, and permits are scheduled for summer 2014. He said that Amilee Wilson is working on this portion.

Wenatchee

Hatcher said that NMFS is still waiting for Joint Fisheries Parties approval of a fisheries harvest plan. He said permitting will be completed after the first of the year.

Leavenworth

Hatcher said that USFWS and NMFS are working on this, and plan to meet in January 2014 to discuss terms and conditions.

Mike Tonseth noted that the deadline to submit all project descriptions to Wilson for permit extensions is December 31, 2013. Keely Murdoch asked if NMFS needs a program description for the coho program as well. Tonseth replied that this requirement is specific to outstanding PUD programs. Murdoch added that the Yakama Nation (YN) received the Mid-Columbia Coho Draft Biological Opinion from Craig Busack, and said that the YN is working on the comments now. Hatcher said that the coho completion date is expected to be the end of January 2013.

IV. Chelan PUD

A. Sockeye Implementation Plan Discussion (Catherine Willard)

Catherine Willard said that a draft Sockeye Addendum to the final Chelan PUD 2014 Hatchery M&E Implementation Plan (Attachment D) was distributed to the Hatchery Committees by Kristi Geris on December 11, 2013, along with a summary of HCP Hatchery Committees meeting minutes regarding the use of mark-recapture methodology to estimate Wenatchee sockeye escapement (Attachment E), and also the study *Use of PIT Technology to Estimate Adult Sockeye Salmon Escapement in the Upper Wenatchee River Basin, 2009-2010* by Murauskas et al. (2011; Attachment F). Willard also handed out a summary of sockeye salmon escapement estimates based on spawning ground surveys and PIT-tag detections of returning adults in 2009 to 2012 (Attachment G), which Geris distributed to the Hatchery Committees following the meeting on December 19, 2013.

Willard reviewed the draft Sockeye Addendum (Attachment D). She noted that the draft addendum is divided into a juvenile and adult component. She then reviewed the summary of sockeye salmon escapement estimates based on spawning ground surveys and PIT-tag detections of returning adults in 2009 to 2012 (Attachment F), noting Tables 1 and 2 which outline results of the area-under-the-curve method versus the mark-recapture method.

The Hatchery Committees requested additional time to review the draft addendum prior to making a decision. Alene Underwood agreed and said that Chelan PUD will be requesting approval of the draft addendum at the Hatchery Committees' meeting on January 15, 2014.

B. 2013 Rocky Reach Trap Results (Alene Underwood)

Alene Underwood handed out a summary of Rocky Reach ladder trapping of adipose fin (ad)-clipped spring Chinook from mid-May through mid-June 2013 (Attachment H); which Kristi Geris also distributed electronically to the Hatchery Committees following the meeting on December 18, 2013. Underwood summarized that the objective of the pilot was to capture five fish per week over a 4-week sampling period during the months of May and June. She reviewed the totals as outlined at the bottom of Attachment H. She said that turbidity posed problems throughout the study, and noted one particular trapping event on May 17, 2013, where operators were unable to see that a fish had been trapped due to turbid waters. She said that trapping protocols were changed after this event to ensure that no fish remained in the hopper after the door was operated. She said that most fish observed were ad-present fish, as expected. She said that recommendations to improve future trapping efforts are being discussed, including: 1) replacing the solid trap door with a grated or perforated trap door that would not displace the water column as much when operated; 2) adding underwater lighting; 3) installing additional cameras to obtain footage from different angles; 4) painting the trap floor white to provide greater contrast to see when a fish is present; and 5) installing an electrical control pendent to give the two operators the opportunity to operate the door depending on visibility. Underwood explained that the trap is currently set up where the trap operator communicates via radio to another staff member who has a direct view of the trap.

Mike Tonseth asked if only ad-clipped fish were trapped, and Underwood replied, yes, that the goal was to evaluate the efficacy of trapping a target fish. Tonseth asked about the width of the trap structure, and said that he is thinking in terms of what is at Tumwater Dam. He added that some widths can reduce the effects of turbidity, and asked if that can be modified at Rocky Reach. Underwood said the board has been modified in the past, and staff found that fish appeared to behave differently due to the changes; therefore, she said Chelan PUD would not likely modify the width again. Mike Schiewe reminded the Hatchery Committees that the HCP Coordinating Committees will also be evaluating this very closely if it moves forward.

Bill Gale asked if any more thought has been put into a sort-by-code system. Underwood said that Chelan PUD investigated that option and obtained cost estimates that, she added, were not exorbitant. She said that if the Hatchery Committees want to move forward with the Rocky Reach trap, Chelan PUD would like to conduct a second pilot year with the proposed improvements prior to installing a sort-by-code system. Gale noted that the strength of a sort-by-code system is that fish of known origin can be targeted, while the proposed improvements cannot. Keely Murdoch added that with a sort-by-code system, not only could HOs be collected for programs, but there would also be an opportunity to target NOs in the tributaries, which, she said, seems to make sense if fish will be acclimated in the Chewuch. She also added that as a result of being able to target NOs, there may be an opportunity to combine efforts with the U.S. Geological Survey (USGS) and their rotary trapping and PIT-tagging efforts in the Chewuch to increase the number of PIT-tagged NO juveniles, which would increase the likelihood of meeting the adult requirements for Chelan PUD's Methow spring Chinook conservation program obligation. Underwood agreed with Murdoch, and said that Chelan PUD has discussed the same thing. She added that they are looking at what would be needed to make a sort-by-code system work.

Tonseth asked, in terms of assessment, if Chelan PUD is looking at historical numbers in the Methow and Chewuch, and then monitoring PIT-tags passing Rocky Reach; Underwood replied that they have. She added that only 38 fish are needed; at this point, Chelan PUD is still exploring all options. She said that Chelan PUD is also planning to conduct a bull trout study in 2018, and the recommended trap improvements will benefit that study. She said the improvements are already planned to be installed during the 2013/2014 winter maintenance outage.

Underwood said that Chelan PUD plans to present a pilot proposal at the Hatchery Committees' meeting on January 15, 2014. Murdoch asked if broodstock can be collected while also conducting the pilot study. Underwood said Chelan PUD can do so if that is what the Hatchery Committees want; however, in terms of a sort-by-code, at this point, she said that Chelan PUD cannot commit. Tonseth asked about installing a downstream array and Tom Kahler noted that Chelan PUD already has adult antennas located downstream, and suggested monitoring those. He added that installing additional downstream antennas is no easy task, and noted in particular interference from noise. Underwood said that installing additional antennas would require the ladders to be dewatered. Gale noted, however, that all equipment would need to be running in order to accurately test the noise levels; Schiewe said that Biomark has temporary test equipment to evaluate noise. Tonseth said that it seems as though interference may be an issue for any sort-by-code system; Underwood said that depending on the type of antenna, there are some defenses against noise.

Greg Mackey noted that Twisp emigrants are caught and PIT-tagged at the Methow screw trap, which means that returning adults identified by PIT-tags and taken for broodstock could inadvertently incorporate Twisp stock fish. Murdoch said that it would be beneficial to touch base with all entities operating area fish traps to make sure different efforts are not confounding other studies. Underwood said that Chelan PUD will provide a formal Rocky

Reach Trap Pilot Study for consideration at the Hatchery Committees' meeting on January 15, 2014.

C. Methow Spring Chinook Program (Alene Underwood)

Alene Underwood said that the draft Chelan PUD Methow Spring Chinook HGMP is complete. Kristi Geris distributed the draft HGMP to the Hatchery Committees following the meeting on December 18, 2013. Bill Gale asked if the draft HGMP identifies alternative approaches to meet program goals, and Underwood replied that it does. She added that she is confident with where the program is headed in 2014 as it relates to brood year 2013. She said Chelan PUD has an agreement with Grant PUD to overwinter at Carlton, and final acclimation is proposed in the Chewuch. She said she would like to discuss options for broodstock collection, and added that Chelan PUD is interested in more tributary-based options, such as tangle netting or hook-and-line. She said that only 38 fish need to be obtained to meet the program goals. She said she discussed options with Kirk Truscott, and he indicated that he would be willing to discuss other options as well. Gale said he expects that the U.S. Fish and Wildlife Service (USFWS) will want to understand bull trout impacts, and recommended that Chelan PUD is prepared to describe how impacts will be minimized. Underwood said that Chelan PUD will be prepared, and that language on potential bull trout impacts was borrowed from the USFWS-issued letter approving tangle netting in Nason Creek in 2013. Mike Tonseth said that in terms of Chelan PUD meeting their broodstock obligation in 2014, he recommended considering the tangle netting option. Underwood agreed and asked, however, if that option would be feasible in the Chewuch. Gale said he believes it would be following the Nason Creek model. Tonseth also suggested developing a contingency plan, anticipating that the June deadline for a new Section 10 permit may not be met. He added that the agreement with USFWS for Nason Creek was for 1 year only. He said the new Nason Creek permit does not exclude tangle netting; however, it may be considered on a case-by-case scenario. He said that he agreed tangle netting may not be the best option, but with limited options, it is not a bad plan. Underwood said that Chelan PUD would like to have planning complete by March 2014. Gale noted that Tom Scribner had some issues with tangle netting near spawning grounds, and Underwood said that she would contact him. Tonseth said that Amilee Wilson and other key people are meeting in January 2014, and suggested that Chelan PUD have a plan drafted prior to their meeting. Lynn Hatcher suggested talking to Wilson first, and Underwood said she told Craig Busack that she would contact him. Gale said that another consideration with tangle netting is that transportation to Eastbank Hatchery is farther, and he asked what the difference is between Nason to Eastbank versus Chewuch to Eastbank. Underwood said a couple of hours, and Gale noted that consideration needs to be taken regarding that additional stress. Underwood said that another option would be to take the fish to Winthrop NFH. Gale asked about the stress associated with change in water temperature, and Tonseth replied that Eastbank would be cooler. Keely Murdoch noted that there was discomfort about tangle netting in Nason Creek, and that it was understood that the arrangement was temporary—not part of a permanent program. She said she will discuss this further with Scribner, but she suspects there may be issues with making this a permanent part of the program.

Mike Schiewe asked about the timeline for feedback on the draft HGMP. Underwood said the HGMP is largely the same as what has been reviewed in the past: 1) the HGMP is closely based on the Methow Hatchery HGMP that was distributed to the Hatchery Committees by Douglas PUD in 2010 and reviewed and approved by the Wells Hatchery Committee; and 2) the Addendum developed by Chelan PUD that was approved by the Hatchery Committees in June 2013. She said the proposed tributary broodstock collection is the only new piece that was not in the Addendum, and added that the final acclimation piece was discussed in the Addendum. *(Note: to clarify, the Chelan PUD Methow Spring Chinook HGMP and review process are separate from the Douglas PUD Methow Hatchery HGMP and review process.)*

Hatchery Committees representatives present agreed to submit edits and comments on the draft Chelan PUD Spring Chinook HGMP to Alene Underwood by January 10, 2014, for discussion at the Hatchery Committees' meeting on January 15, 2014.

D. Grant PUD's White River Size Target Study (Alene Underwood)

Alene Underwood said that Grant PUD has been discussing with the Priest Rapids Coordinating Committee Hatchery Subcommittee a change in their White River Size Target Study involving the sacrifice of a sample of Chelan PUD Chiwawa spring Chinook juveniles. She said that Grant PUD is proposing for Chelan PUD to raise fish to 18 fish per pound as usual, and then sacrifice the same amount from both programs, which would equal 375 Chiwawa spring Chinook juveniles. Todd Pearsons said that the CCT inquired about the possibility of placing two different fish sizes on the same fish growth timeline. Underwood said that Hatchery Staff indicated that they believe they can mirror the growth regimes, as requested. The Hatchery Committees representatives present approved the sacrifice of 375 Chelan PUD Chiwawa spring Chinook juveniles for Grant PUD's White River Size Target Study.

E. Similkameen Update (Jayson Wahls)

Jayson Wahls reported a total loss of 44,000 Chelan PUD summer Chinook from the Similkameen Program. He said that about 115,000 to 116,000 remain. He said that 8,800 eyed eggs were culled at Eastbank Hatchery due to medium-to-high enzyme-linked immunosorbent assay (ELISA) titers levels, and added that, ultimately, losses have slowed at Similkameen.

F. Chelan PUD 2014 HCP Rocky Reach and Rock Island Action Plan (Alene Underwood)

Alene Underwood said that Chelan PUD will provide the draft Chelan PUD 2014 HCP Rocky Reach and Rock Island Action Plan to Kristi Geris for distribution to the Hatchery Committees prior to the January meeting.

V. WDFW

A. Wenatchee Spring Chinook Reproductive Success Study (Mike Tonseth)

Mike Tonseth said that both WDFW and NMFS are requesting an extension from BPA on the BPA-funded Wenatchee Spring Chinook Reproductive Success Study. He clarified that the request is not for additional money; rather, it is a request to change the scope of work. He explained that in the original scope of work, the last year of adult sampling at Tumwater Dam (for HO and NO adults) was completed in 2013, and genetic sampling of NOs would take place from 2014 to 2018. He said the request is for an extension to include genetic sampling of HOs, as well as NOs passed upstream of Tumwater Dam. He added that samples would be taken from HORs that are already being trapped, so the request would not require additional handling; it would just take data collection further out. Additionally, with the change in scope, the last brood year included in the study would only be monitored through the smolt stage in 2020. Tonseth said that he will provide a written summary of the request from WDFW and NMFS for a change in the scope of work for the BPA-funded Wenatchee Spring Chinook Reproductive Success Study, to Kristi Geris for distribution to the Hatchery

Committees. Tonseth said that WDFW will be requesting approval of the request at the Hatchery Committees' meeting on January 15, 2014.

VI. HCP Administration

A. Next Meetings

The next scheduled Hatchery Committees' meetings are on January 15, 2014 (Douglas PUD); February 19, 2014 (Chelan PUD); and March 19, 2014 (Douglas PUD).

List of Attachments

Attachment A	List of Attendees
Attachment B	Revised Draft Douglas PUD 2014 Hatchery M&E Implementation Plan
Attachment C	The CCT's Wells Steelhead Broodstock Replacement Memorandum
Attachment D	Draft Sockeye Addendum to the final Chelan PUD 2014 Hatchery M&E Implementation Plan
Attachment E	Summary of HCP Hatchery Committees meeting minutes regarding the use of mark-recapture methodology to estimate Wenatchee sockeye escapement
Attachment F	Use of PIT Technology to Estimate Adult Sockeye Salmon Escapement in the Upper Wenatchee River Basin, 2009-2010 (Murauskas et al. 2011)
Attachment G	Summary of sockeye salmon escapement estimates based on spawning ground surveys and PIT-tag detections of returning adults in 2009-2012
Attachment H	Summary of Rocky Reach ladder trapping of ad-clipped spring Chinook mid-May through mid-June 2013

Attachment A
List of Attendees

Name	Organization
Mike Schiewe	Anchor QEA, LLC
Kristi Geris	Anchor QEA, LLC
Alene Underwood*	Chelan PUD
Catherine Willard	Chelan PUD
Greg Mackey*	Douglas PUD
Tom Kahler*	Douglas PUD
Todd Pearsons	Grant PUD
Lynn Hatcher*	National Marine Fisheries Service
Keely Murdoch*†	Yakama Nation
Bill Gale*	U.S. Fish and Wildlife Service
Mike Tonseth*	Washington Department of Fish and Wildlife
Jayson Wahls	Washington Department of Fish and Wildlife
Chris Moran†	Washington Department of Fish and Wildlife

Notes:

* Denotes Hatchery Committees member or alternate

† Joined by phone

IMPLEMENTATION OF COMPREHENSIVE MONITORING AND EVALUATION OF WELLS HATCHERY AND METHOW HATCHERY PROGRAMS IN 2014

Greg Mackey

Douglas County PUD

Todd Pearsons

Grant County PUD

Charlie Snow

Andrew Murdoch

Methow Research Team

Hatchery/Wild Interactions Unit, Science Division

Washington Department of Fish and Wildlife

20268 Hwy 20, Suite 7

Twisp, WA 98856

November 2013

Introduction

The contractor for the M&E Implementation Plan will conduct the field work, data collection, and data management. Reporting will be a collaborative effort between the contractor, Douglas PUD, and Grant PUD.

The Douglas County PUD and Grant County PUD Monitoring and Evaluation Plans (M&E Plan; Wells HCP Hatchery Committee 2007) described eight objectives specific to the hatchery programs funded by Douglas County PUD and Grant County PUD, and two regional objectives that were related to artificial propagation in general. These objectives were designed to address key questions regarding the use of supplementation as mitigation for unavoidable mortality associated with the operation of the Wells Hydroelectric Project (Douglas PUD) and the Priest Rapids Hydroelectric Project (Grant PUD). In 2013, these M&E Plans were reviewed and updated (HCP HC and PRCC Hatchery Sub-Committee) to reflect shifting management paradigms and to incorporate data collection and analysis from the first five years of hatchery program monitoring (Murdoch et al. 2012) conducted under the original M&E Plans. The updated M&E Plan (hereafter referred to as the M&E Plan) contains ten objectives specific to hatchery programs funded by PUDs and two regional objectives, all of which have specific metrics that will be measured and compared against target values or reference conditions as established in the M&E Plan.

The primary focus of this proposal is the first ten objectives outlined in the M&E Plan, but two additional regional objectives are addressed here. Both disease (Objective 11) and non-target taxa (Objective 12) assessment are regional objectives that require participation from state and federal agencies and tribes. A study design for Objective 11 has not yet been established and this objective is not currently being addressed by the regional group. Objective 12 is currently being addressed by the Hatchery and Evaluation Technical Team (HETT), a sub-committee under the HCP Hatchery Committee and is not addressed in this plan.

Successful implementation of the M&E Plan requires relationships between the PUDs, M&E contractor, and other entities conducting similar field work in the Upper Columbia River Basin. Certain objectives require the collection of data from both target populations and non-target populations, such as reference populations. This proposal does not include field activities conducted by other entities to collect data for reference non-target populations required to implement the M&E Plan.

Addressing all the objectives within the M&E Plan requires multiple years of data collection. This is year one under the 2013 update of the M&E Plan and year nine of the plan under the HCP. Objectives 5, 7, 8, and 10 are designed to be addressed after one year or five years (Table 1), and may require only periodic monitoring. Statistical analyses will be conducted consistent with the M&E Plan, revisions thereof, or the 5-year M&E report (Murdoch et al. 2012) as applicable. The Implementation Plan is presented in a format where species, programs, and the associated M&E Objectives are presented in separate sections that are subdivided into modules to clearly define actions under the M&E Plan and allow flexibility in administering budgets.

Table 1. A potential long-term implementation schedule of objectives outlined in the Douglas County PUD M&E Plan. The M&E plan, its objectives, and implementation may be changed by the HCP HC in future years. Monitoring and evaluation of hatchery programs in years prior to the years 6-9 period have been completed and are included here for reference only. The work conducted within this proposal would be implementation year nine. HETT = Hatchery Evaluation Technical Team.

Objective	Year of implementation									
	1-4	5	6-9	10	11-14	15	16-19	20	21-24	25
1	X	X	X	X	X	X	X	X	X	X
2	X	X	X	X	X	X	X	X	X	X
3	X	X	X	X	X	X	X	X	X	X
4	X	X	X	X	X	X	X	X	X	X
5	X	X		X		X		X		X
6	X	X	X	X	X	X	X	X	X	X
7	X				X				X	
8	X				X				X	
9	X	X	X	X	X	X	X	X	X	X
10	X	X		X		X		X		X
11	Experimental design not established									
12	HETT is currently conducting this assessment									

This proposal encompasses one year of work to implement the updated Monitoring and Evaluation Plan for PUD Hatchery Programs operated at the Wells Hatchery and Methow Hatchery, as described in the work plan, below.

2014 M&E Work Plan by Species, Programs, and Activities

Summer Steelhead

Module 1: In-Hatchery Metrics – Steelhead

Required to meet:

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

Objective 9: Determine if hatchery fish were released at the programmed size and number.

Biological data for origin, sex, age, size, fecundity, and survival of broodstock will be recorded for all steelhead hatchery programs: Twisp Conservation, Methow Safety-Net, Columbia Safety-Net, Okanogan Safety-Net, Omak Creek Conservation. Number of fish, stage-specific survivals, size, coefficient of variation, condition factor, and fish health issues will be recorded. An annual review of size, number and supporting statistics of fish from each program will be compared to those values defined in the M&E Plan Appendix 6, or adjusted values agreed to by the Wells HCP Hatchery Committee. If release targets were achieved within acceptable levels (i.e., +/-10% of HCP defined values) then the programs will be considered within acceptable parameters for the program. If release targets are not achieved then causation will be determined and recommendations made based upon the results of the evaluation.

Fecundity of spawned females is assessed by hatchery personnel when fertilized eggs are at the eyed stage, and data are provided to evaluation staff. To assess overall egg mass, we will collect total egg weight samples just after removal from spawned females, and will record the weight of female fish after egg removal.

Comment [GM1]: The Omak program will be sampled under the M&E program.

Comment [kdt2]: Currently CCT samples Omak Creek Broodstock at collection for origin, sex, age and size, but not at Wells Hatchery during spawning. These data at spawning are important to provide specifics on adults comprising the broodstock spawned. Because CCT's SOW with GPUD for the Omak program does not include sampling during spawning, these data collections need to be conducted by hatchery and WDFW M&E staff participating in the spawning events at Wells Hatchery. Any additional expenses associated with sampling Omak Creek broodstock at spawning should be addressed in the contract between DPUD and GPUD for the contracted work associated with GPUD's steelhead production at Wells Hatchery.

Comment [CS3]: Originally, DCPUD had language in this document indicating that WDFW M&E folks would sample the Omak Broodstock at spawning as Kirk suggests. Since we have never done that before, and it is time consuming to sample a very-low number of fish during a very busy period, I had suggested to Greg M. that he change the language to indicate that CCT would do the sampling as usual. I am not aware of the SOW wrangling between CCT and GCPUD or why we should have to sample their fish for them since they have an incomplete SOW relative to their program needs. However, we can do the sampling if they need—or more likely—train the hatchery staff to do it--not a big deal, just inconvenient.

Deleted: , except that the CCT will sample the Omak broodstock at the collection site and during spawning.

Comment [kdt4]: See comment kdt1

Module 2: Steelhead Adult Stock Assessment

Required to meet:

Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.

Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.

Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.

Objective 7: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.

Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

The Twisp Weir will be operated for steelhead adult stock assessment between March 1, 2014 (approximate as environmental conditions allow) and June 30, 2014. Activities implemented at the Twisp Weir will include sampling all adult steelhead captured (origin, length, sex, genetic tissue sample, record any marks or tags, Floy tag fish to be released according to color scheme [Table 2]); PIT tagging and releasing adult steelhead (females PIT tagged in abdomen, males in pelvic girdle); retain natural origin Twisp returns for broodstock; handle any non-target species captured according to operational protocols and permit conditions; and, perform adult management of hatchery origin returns to achieve a 1:1 hatchery:natural origin ratio of spawner upstream of the Twisp Weir. Fish sacrificed for adult management may be sampled for fecundity to augment the sample size for hatchery-origin fish. Rainbow trout and cutthroat trout captured at the Twisp Weir will also be sampled and tagged similarly to steelhead.

Table 2. Floy Tag Colors for Adult Twisp Steelhead Released Upstream of the Twisp Weir in 2014

Sex	Origin	Tag Color
Female	Natural	Blue
Female	Hatchery	Red
Male	Natural	Pink
Male	Hatchery	Chartreuse

Floy tag colors will be alternated every other year between hatchery and wild fish to control for any potential color effects on reproductive success.

Wells Dam fish counts will provide data on escapement upstream of Wells Dam. Stock assessment will be used to estimate the composition of the escapement. Wells Dam stock assessment will be performed concurrent with broodstock collection activities at Wells Dam and Wells Hatchery from July 2014 – November 2014. Activities will include sampling all adult steelhead captured (origin, length, sex, genetic tissue sample, record any marks or tags, PIT tag fish to be released [females and males PIT tagged in the pelvic girdle]), retain hatchery-origin returns for Columbia Safety-Net, Methow Safety-Net, and Okanogan broodstock, handle any non-target species captured according to operational protocols and permit conditions.

HRR will be estimated and values that fall below the expected values or the corresponding estimate of NRR (Appendix 2 of the M&E Plan) will be evaluated to determine whether in-hatchery or out-of-hatchery factors contributed to the reduced survival. SAR will be estimated for each program and for the natural origin Twisp population.

The proportion of hatchery origin spawners (pHOS) and PNI will be estimated for the Twisp steelhead program and population. Data for pHOS and PNI (for broodstock within Douglas PUD program facilities) will be collect for other parts of the basin. Numbers and proportions of hatchery origin returns removed for adult management for the Twisp, Methow and Columbia programs will be estimated and reported consistent with terms and conditions (Appendix 3 of the M&E Plan) in the pending Wells Complex Summer Steelhead HGMP ESA permit.

Comment [kdt5]: pHOS and PNI for DPUD safety-net programs also need to be determined and reported. Please provide explanation on how this will be accomplished within the DPUD implementation plan.

Comment [GM6]: For conservation programs, pHOS and PNI are metrics that will be estimated and reported. For Safety-Net programs an estimate of the number of fish removed and by subtraction, the safety-net spawning escapement is appropriate. By definition, a safety-net program is an emergency backup program to a conservation program. A safety-net program can contribute to pHOS, although in theory it should do so only when needed. Therefore, its contribution to pHOS is secondary and the metric of concern to managers is primarily for number of potential spawners removed.

We do not yet know what the new permits will require for reporting, and this task would be updated to meet those requirement if necessary.

Comment [CS7]: We will be conducting steelhead redd counts for the upper Methow and lower Methow subbasins using expanded-index area methodology as usual. Chewuch River escapement will be estimated by expanding PIT tag hits on the USGS array. These data, coupled with run composition and harvest estimates we are also collecting (or Fish Management is) should allow pHOS and PNI to be estimated for each major tributary (Met, Twisp, Chewuch).

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Module 3: Report Steelhead Contribution to Harvest

Required to meet:

Objective 10: Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.

In years when the expected returns of hatchery adults exceed the level required to meet program goals of Wells Complex steelhead programs, surplus fish may be available for harvest. The contribution to harvest will be reported for programs that are consistent with harvest.

Conservation fishery data derived from creel census (funded and conducted by WDFW) are reported to NMFS annually, and harvest data reported outside the scope of this plan (PTAGIS, etc.) will be summarized.

Module 4: Steelhead Spawning Distribution and Timing

Required to meet:

Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.

Spawner surveys will be conducted at least weekly in the Twisp River using standard spawning ground survey methodology and data analysis as described in Snow et al. (2012). Locations of redds will be recorded using GPS; fish location and origin (identified by Floy tags) will also be recorded. Data collected will provide the number of redds, and timing and spatial distribution of spawning by fish origin. Any carcasses encountered will be sampled for sex, origin, age, egg retention, PIT tag, and other relevant biological data. Spawn timing comparisons of hatchery and natural origin steelhead will be conducted using data from Twisp River reaches T4-T10. Surveyors will periodically scan completed redds for PIT tags to confirm female origin, or to identify female origin for redds where no visual observations of spawners occurred. The capture efficiency of the Twisp Weir will be estimated by observing the number of fish observed that are not Floy tagged compared to the total escapement estimate.

Additionally, temporary in-stream PIT tag antenna arrays will be placed in selected tributaries in the Twisp drainage to assist with evaluation of spawning spatial distribution and timing. In conjunction with returning steelhead adults tagged as juveniles and adult steelhead tagging at the Twisp Weir and Wells and Priest Rapids dams, these arrays are expected to provide a reliable, cost-effective means of corroborating current survey methodologies with observed steelhead use, and detect spawning (if any) in locations where spawning is presumed to not occur, or where surveys are difficult to conduct. Permanent PIT tag arrays located in the Chewuch River, Lost River, and in the Methow River near Winthrop, Washington will be used to estimate overall steelhead spawner abundance, origin of spawners, and pHOS, for the Chewuch River, Lost River, and the upper Methow River. Index redd surveys will be used in the upper and lower Methow reaches in conjunction with PIT tag detection and stock assessment to estimate the number of spawners in the upper and lower Methow.

Comment [kdt8]: Considering the location of the PIT tag arrays described above, the resolution of hatchery and natural origin steelhead spawner distribution and spawn timing will be low (e.g. upper Methow spawner distribution will have only one point of detection, so how can distribution within the habitats in the Methow River above Winthrop be assessed?) Same issue for Chewuch, Lost and Methow River below Winthrop.

Comment [GM9]: Index redd surveys in the lower Methow make sense because fish detected at Pateros but not detected upstream could still be in the lower Methow, could have been removed by angling, or could be removed through natural mortality. Therefore, index spawner surveys make sense to attempt to account for the remaining fish that may still be alive or that have died by one means or another. The more upstream reaches (Twisp, Chewuch, Upper Methow, Lost) have fish that move up in late winter and March-June. These fish can be documented via PIT tag detection. However, we will conduct index spawner surveys in the upper Methow to augment the PIT tag detection data.

Comment [CS10]: As stated above, we will be conducting steelhead spawning ground surveys using the standard expanded-index area methodology as we have typically used in the past. These surveys will be conducted in the Upper Methow and lower Methow subbasins. Spawn timing and distribution will therefore be available for the Methow and Twisp. Chewuch will have only returns of 2-salt hatchery fish, and we will estimate pHOS in the river through the PIT array. This river seldom allows accurate estimation of overall distribution because of high turbidity. We can still conduct weekly red counts in the index area for spawn timing if necessary, but we have never been able to estimate spawn timing by origin except with the floy tags in the Twisp.

Module 5: Estimation of Steelhead Stray Rates

Required to meet:

Objective 6: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.

Stray rates of Twisp conservation, Methow Safety-Net, and Columbia Safety-Net steelhead will be estimated by PIT tag detections at in-stream PIT tag detection stations in the Methow Basin and in watersheds outside the Methow Basin (via PTAGIS), and positive identification of recovered or captured steelhead at traps (Twisp Weir, Methow Hatchery, Omak Weir), during spawner surveys, or through creel census. In addition, pre-spawn steelhead movements will be reported.

Collecting stray rate information for steelhead poses a challenge because carcasses are not available for examination. Adult PIT tag monitoring provides the most accurate assessment of stray rates, both within and among populations.

Module 6: Steelhead Juvenile Population Assessment

Required to meet:

Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.

The population abundance of emigrating juvenile steelhead will be estimated in the rivers supplemented by Douglas PUD's steelhead hatchery programs. Sampling locations and methods may utilize a combination of the following methods: screw traps, mark-recapture population estimates, electrofishing removal population estimates, snorkel surveys, and PIT tag based survival modeling. Two approaches will be used in 2014.

Approach 1: Rotary screw smolt traps in the Twisp River and the Methow River. Trapping locations and methods will remain as described in Snow et al. 2012. Biological data (species, length, origin, scale samples, genetic samples) will be collected from fish collected each day. Scale samples will be taken from random samples of steelhead juveniles to estimate the age structure of the emigrants. The Twisp trap will be fished from early March through late November, and the Methow Trap will be fished from late February through late November, as conditions allow at both trapping locations. Steelhead greater than 65 mm will be PIT tagged. Trap efficiency trials will be conducted at various flows as the number of available fish for trials allows. Population estimates will be calculated by expanding the number of fish caught on a daily basis by the estimated trap efficiency on that day as estimated using a flow-efficiency model.

Approach 2: Juvenile in-stream PIT tag population estimate coupled with survival model in the Twisp River. Steelhead will be captured by electrofishing at sites chosen using General Random Tessellation Sampling (GRTS) or other random sample method. The standing crop of juveniles will be estimated by either multiple-pass removal estimates or mark-recapture estimates coupled with single-pass electrofishing extrapolated to the amount of habitat in the stream. Captured fish will be PIT tagged. Survival of the fish will be estimated through emigration using a multi-state survival model (J. Skalski and R. Buchanan, personal communication). The number of emigrants will be estimated using this PIT tag based survival model.

Comment [kdt11]: This approach will likely provide a under estimate of stray rates. For example, Twisp conservation fish may be detected at the Winthrop array prior to the March-June period and would not be included in the stray calculation. Another example is the Columbia safety-net fish detected at the lower Methow array prior to March would not be included in the stray rate calculation if they were not detected at other arrays upstream from the lower Methow array during the March-June period or detected in the fishery during the March-June period.

Potentially, stray rates should be calculated as the total estimated number of strays passing the lowest most array defining a "stray area" for that specific production component, minus harvest, minus estimated over-winter mortality, minus fall-back to defined spawning area for that specific production component (e.g. total estimated Columbia safety-net Pit tags passing the lower Methow array and lower Okanogan PIT tag array, minus harvest estimate of Columbia safety-net PIT tagged fish, minus estimate of over-winter mortality, minus Columbia safety-net PIT tags falling back over the lower Methow and Okanogan PIT tag arrays and not subsequently detected at these two arrays after the fall-back detection.

Comment [GM12]: Moving to a PIT based steelhead spawner survey methodology can provide data that we never had before. Standard redd surveys tell us nothing about steelhead straying. There is no perfect way to estimate steelhead strays because we simply cannot readily document where fish spawn. Steelhead are known to move a l ... [1]

Comment [CS13]: This is a methodology-related comment not really relevant to budgeting purposes. I think Greg was assuming that this is the way we would estimate stray rates in the tributaries using PIT arrays, which is generally true because few fish enter the tribs to spawn before mid-March a ... [2]

Deleted: . Steelhead detection, capture or recovery data shall be limited to March-June to be considered a stray for analytical purposes.

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Comment [CS14]: My understanding is that we will be conducting remote PIT tagging the Twisp and Methow Rivers for both spring Chinook and steelhead parr. I think Greg has this in here because they (Greg and Rebecca) believe that a different approach to tagging (using GRTS or somethin ... [3]

Comment [GM15]: This will be conducted in the Twisp as a pilot effort. Expanding this effort could be possible with partnerships. This would not occur until late summer/early fall so we would use the time to further develop this method.

Comment [kdt16]: Will this approach be conducted in the Twisp, Methow, Chewuch and Lost rivers? If not, what watersheds (sub-basins) within the Methow River Basin will it be conducted?

Module 7: Steelhead Population Genetic Monitoring

Required to meet:

Objective 7: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.

Hypotheses related to genetic diversity, population structure, and effective population size were addressed in the 2008-2010 work plans and will not be addressed in 2014. However, to provide the ability to conduct future analysis, we will collect and archive tissue samples (opercle-punch or fin clip) from all steelhead broodstock, and from natural origin steelhead collected on the spawning grounds and at the Twisp River Weir. Samples will have associated data recorded (fish origin, age, date, location, sex, and biological characteristics).

Table 3. Cross Reference of Steelhead M&E Implementation Modules and M&E Objectives

Objective		Modules	Data
1	Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.	2, 4	• Adult returns • Sex and Origin of Adults • Number of Spawners
2	Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	2,4,6	• Adult Returns • Sex and Origin of Adults • Number of Spawners • Juvenile Population Estimates
3	Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	1,2,4	• Broodstock Data • Adult returns • Sex and Origin of Adults • Number of Spawners
4	Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.	2,4	• Adult returns • Sex and Origin of Adults • Number of Spawners
5	Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	2, 4	• Run timing • Spawn timing • Spatial Distribution of Spawning • Adult returns • Sex and Origin of Adults • Number of Spawners
6	Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.	4,5	• Sex and Origin of Adults • Number of Spawners • Spatial Distribution of Spawning
7	Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.	1,2,4,7	• Sample Broodstock • Sample Adult Returns • Sample Spawners • Sample Juveniles • Various Population Genetic Analyses
8	Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.	1,2	• In-Hatchery Metrics • Adult Phenotype Metrics
9	Determine if hatchery fish were released at the programmed size and number.	1	• In-Hatchery Metrics
10	Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.	3	• Various Harvest Data (PITAGIS, RMIS, Agency Reports, etc.)

Spring Chinook

Module 8: Spring Chinook In-Hatchery Metrics

Required to meet:

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

Objective 9: Determine if hatchery fish were released at the programmed size and number.

Biological data for origin, sex, age, size, fecundity, and survival of broodstock will be recorded for the Twisp Conservation, Chewuch Conservation, and Methow Conservation hatchery programs. Number of fish, stage-specific survivals, size, coefficient of variation, condition factor, and fish health issues will be recorded. An annual review of size, number and supporting statistics of fish from each program will be compared to those values defined in the M&E Plan Appendix 6, or adjusted values agreed to by the Wells HCP Hatchery Committee. If release targets were achieved within acceptable levels (i.e., +/-10% of HCP defined values) then the programs will be considered within acceptable parameters for the program. If release targets are not achieved then causation will be determined and recommendations made based upon the results of the evaluation.

Module 9: Spring Chinook Adult Stock Assessment

Required to meet:

Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.

Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.

Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.

Objective 7: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.

Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

The Twisp Weir and Methow Hatchery volunteer trap(s) will be operated for spring Chinook broodstock collection between July 1, 2014 and August 30, 2014 (Twisp Weir is operated under the auspices of steelhead collection and sampling through June 30, but spring Chinook will be collected opportunistically prior to July 1). Wells Dam fish ladders will be operated between about 1 May and 30 June for spring Chinook broodstock collection and overall population stock assessment. Activities will include sampling all adult spring Chinook captured (origin, length, sex, genetic tissue sample, apply PIT tag in the pelvic girdle of released fish, record any marks or tags, retain natural origin Twisp returns for broodstock, handle any non-target species captured according to operational protocols and permit conditions).

Carcass recoveries and coded wire tag data will be the primary means of stock assessment (see the spawner survey section for more information). Samples and data for run composition, age, origin, size, spawn timing, egg retention, and population genetic analyses will be collected.

HRR will be estimated and values that fall below the expected values or the corresponding estimate of NRR (Appendix 2 of the M&E Plan) will be evaluated to determine whether in-hatchery or out-of-hatchery factors contributed to the reduced survival. SAR will be estimated for each program and for the natural origin Twisp and Methow populations.

The pHOS and PNI will be estimated for the Twisp and Methow programs and populations. Numbers and proportions of hatchery origin returns removed for adult management for the Twisp and Methow programs will be estimated and reported consistent with terms and conditions (Appendix 3 of the M&E Plan) in the pending Methow Hatchery Spring Chinook ESA permit.

<u>Module 10: Spring Chinook Contribution to Harvest</u>

Required to meet:

Objective 10: Determine if appropriate harvest rates have been applied to conservation, ~~safety-net, and segregated harvest~~ programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.

In years when the expected returns of hatchery adults exceed the level required to meet program goals for the Methow hatchery spring Chinook programs, surplus fish may be available for harvest. The contribution to harvest will be reported based on numbers of fish released for programs that are consistent with harvest. Conservation fishery data derived from creel census will be reported to NMFS annually, and harvest data reported outside the scope of this plan (PITagIS, RMIS, etc.) will be summarized.

Module 11: Spring Chinook Spawner Surveys

Required to meet:

Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.

Spawner surveys will be conducted at least weekly in all spawning reaches of the rivers supplemented by the Methow Hatchery (Table 4) using standard spawning ground survey methodology and data analysis as described in Snow et al. (2012). Locations of redds will be recorded using GPS. Data collected will provide the number of redds, and timing and spatial distribution of spawning by origin. Any carcasses encountered will be sampled for location of recovery, sex, origin, age, egg retention, CWT, PIT tag, and other relevant biological data.

Comment [CS17]: Not sure this is really necessary. Could we just say that we intend to survey all spawning areas, as per our usual method...?

Comment [kdt18]: Include table showing spawner survey reaches.

Table 4. Spring Chinook Spawner Survey Reaches and Methods

Population	Spawning ground methodology	Spawner composition	Age composition
Methow	Total ground	Carcasses	Wells Dam
Chewuch	Total ground	Carcasses	Wells Dam
Twisp	Total ground	Carcasses	Wells Dam

Module 12: Estimation of Spring Chinook Stray Rates

Required to meet:

Objective 6: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.

Stray rates of Twisp, Chewuch, and Methow conservation programs will be estimated by CWT recoveries within and outside of the Methow Basin. The Regional Mark Information System (RMIS) database will provide all necessary CWT information needed to estimate stray rates for each brood year for within- and outside-basin stray rates based on spawning escapement estimates.

Brood year stray rates for Chinook will require multiple-year CWT recoveries (i.e., all age classes) from broodstock and carcass recoveries on the spawning grounds to account for all cohort age classes. The estimated number of strays for the entire brood year will be calculated by dividing the number of strays by the total number of hatchery fish that returned. Stray rates within, and between independent populations will be calculated in a similar manner as brood year stray rates, except on an annual basis and based on the estimated spawning escapement.

Module 13: Juvenile Spring Chinook Population Assessment

Required to meet:

Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.

The population abundance of emigrating juvenile spring Chinook will be estimated in the rivers supplemented by Douglas PUD's spring Chinook hatchery programs. Sampling locations and methods may utilize a combination of the following methods: screw traps, mark-recapture population estimates, electrofishing removal population estimates, snorkel surveys, and PIT tag based survival modeling. Two approaches will be used in 2014.

Approach 1: Rotary screw smolt traps in the Twisp River and the Methow River. Trapping locations and methods will remain as described in Snow et al. 2012. Biological data (species, length, origin, scale samples, genetic samples) will be collected from fish collected each day. Scale samples will be taken from random samples of spring Chinook juveniles to estimate the age structure of the emigrants. The Twisp trap will be fished from early March through late November, and the Methow Trap will be fished from late February through late November, as conditions allow at both trapping locations. Spring Chinook greater than 65 mm will be PIT tagged. Trap efficiency trials will be conducted at various flows as the number of available fish for trials allows. Population estimates will be calculated by expanding the number of fish caught on a daily basis by the estimated trap efficiency on that day as estimated using a flow-efficiency model.

Approach 2: Juvenile in-stream PIT tag population estimate coupled with survival model in the Twisp River. Spring Chinook will be captured by electrofishing at sites chose using General Random Tessellation Sampling (GRTS) or other random sample method. The standing crop of juveniles will be estimated by either multiple-pass removal estimates or mark-recapture estimates coupled with single-pass electrofishing extrapolated to the amount of habitat in the stream. Captured fish will be PIT tagged. Survival of the fish will be estimated through emigration using a multi-state survival model (J. Skalski and R. Buchanan, personal communication). The number of emigrants will be estimated using this PIT tag based survival model.

Comment [kdt19]: See comment kdt6

Comment [GM20]: This is covered above.

Comment [CS21]: See CS response CS10

Module 14: Spring Chinook Population Genetic Monitoring

Required to meet:

Objective 7: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.

Hypotheses related to genetic diversity, population structure, and effective population size were addressed in the 2008-2010 work plans and will not be addressed in 2014. However, to provide the ability to conduct future analysis, we will collect and archive tissue samples (opercle-punch or fin clip) from all spring Chinook broodstock, and from natural origin spring Chinook collected on spawning grounds and at the Twisp River Weir. Samples will have associated data recorded (fish origin, age, date, location, sex, and biological characteristics).

Table 5. Cross Reference of Spring Chinook M&E Implementation Modules and M&E Objectives

Deleted: 4

Objective		Modules	Data
1	Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.	9, 11	• Adult returns • Sex and Origin of Adults • Number of Spawners
2	Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	9,11,13	• Adult Returns • Sex and Origin of Adults • Number of Spawners • Juvenile Population Estimates
3	Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	8,9,11	• Broodstock Data • Adult returns • Sex and Origin of Adults • Number of Spawners
4	Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.	9,11	• Adult returns • Sex and Origin of Adults • Number of Spawners
5	Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	9, 11	• Run timing • Spawn timing • Spatial Distribution of Spawning • Adult returns • Sex and Origin of Adults • Number of Spawners
6	Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.	11,12	• Sex and Origin of Adults • Number of Spawners • Spatial Distribution of Spawning
7	Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.	8,9,11,14	• Sample Broodstock • Sample Adult Returns • Sample Spawners • Sample Juveniles • Various Population Genetic Analyses
8	Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.	8,9	• In-Hatchery Metrics • Adult Phenotype Metrics
9	Determine if hatchery fish were released at the programmed size and number.	8	• In-Hatchery Metrics
10	Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.	10	• Various Harvest Data (PITAGIS, RMIS, Agency Reports, etc.)

Summer Chinook

Module 15: Summer Chinook In-Hatchery Metrics

Required to meet:

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than ~~the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and~~ the target hatchery survival rate.

Objective 9: Determine if hatchery fish were released at the programmed size and number.

Biological data for origin, sex, age, size, fecundity, and survival of broodstock will be recorded for the Wells yearling and subyearling hatchery programs. Number of fish, stage-specific survivals, size, coefficient of variation, condition factor, and fish health issues will be recorded. An annual review of size, number and supporting statistics of fish from each program will be compared to those values defined in Appendix 6, or adjusted values agreed to by the Wells HCP Hatchery Committee. If release targets were achieved within acceptable levels (i.e., +/-10% of HCP defined values) then the programs will be considered within acceptable parameters for the program. If release targets are not achieved then causation will be determined and recommendations made based upon the results of the evaluation.

Module 16: Summer Chinook Adult Stock Assessment

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

Stock assessment will be performed on broodstock collected at Wells Hatchery. Activities will include sampling all adult summer Chinook broodstock for origin, length, sex, genetic tissue sample, record any marks or tags, handle any non-target species captured according to operational protocols and permit conditions.

Coded wire tag data will be the primary means of stock assessment. Samples and data for run composition, age, origin, size, spawn timing, egg retention, and population genetic analyses will be collected.

HRR will be estimated and values that fall below the expected value (Appendix 2 of the M&E Plan) will be evaluated to determine whether in-hatchery or out-of-hatchery factors contributed to the reduced survival. SAR will be estimated for each program.

Module 17: Summer Chinook Contribution to Harvest

Required to meet:

Objective 10: Determine if appropriate harvest rates have been applied to ~~conservation, safety-net, and~~ segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.

In years when the expected returns of hatchery adults exceed the level required to meet program goals, surplus fish may be available for harvest. The contribution to harvest will be reported based on numbers of fish released for programs that are consistent with harvest and harvest data funded, collected, and reported outside the scope of this plan (PITAGIS, RMIS, etc.).

Module 18: Estimation of Summer Chinook Stray Rates

Required to meet:

Objective 6: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.

Stray rates of Wells yearling and subyearling summer Chinook will be estimated through CWT recoveries reported in RMIS. The RMIS database will provide all necessary CWT information to estimate stray rates for each brood year for within- and outside-basin stray rates based on spawning escapement estimates.

Brood year stray rates for Chinook will require multiple-year CWT recoveries (i.e., all age classes) from broodstock and carcass recoveries on the spawning grounds to account for all cohort age classes. The estimated number of strays for the entire brood year will be calculated by dividing the number of strays by the total number of hatchery fish that returned. Stray rates in independent populations will be calculated in a similar manner as brood year stray rates, except on an annual, run-year basis and based on the estimated spawning escapement.

Module 19: Summer Chinook Population Genetic Monitoring

Required to meet:

Objective 7: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.

Hypotheses related to genetic diversity, population structure, and effective population size were addressed in the 2008-2010 work plans and will not be addressed in 2014. However, to provide the ability to conduct future analysis, we will collect and archive tissue samples (opercle-punch or fin clip) from all summer Chinook broodstock. Samples will have associated data recorded (fish origin, age, date, location, sex, and biological characteristics).

Table 6. Cross Reference of Summer Chinook M&E Implementation Modules and M&E Objectives

Deleted: 5

Objective		Modules	Data
1	Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.	NA	• NA
2	Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	NA	• NA
3	Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	15,16	• Broodstock Data • Adult returns • Sex and Origin of Adults
4	Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.	NA	• NA
5	Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	NA	• NA
6	Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.	18	• Sex and Origin of Adults • Number of Spawners • Spatial Distribution of Spawning
7	Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.	19	• Sample Broodstock • Sample Adult Returns • Sample Spawners • Sample Juveniles • Various Population Genetic Analyses
8	Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.	NA	• NA
9	Determine if hatchery fish were released at the programmed size and number.	15	• In-Hatchery Metrics
10	Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.	17	• Various Harvest Data (PITAGIS, RMIS, Agency Reports, etc.)

DELIVERABLES

Annual Reports: A draft annual report will be provided to the Hatchery Committee by 1 July, 2015. A final report will be provided to the HCP HC within 30 days of receiving comments on the draft report. The annual report will summarize all field activities conducted during the contract period. The report will be in a scientific format, organized so that Douglas PUD and other HCP Hatchery Committee members can clearly and concisely evaluate M&E Plan results. Data tables and figures will be cumulative such that all comparable data from previous years is included and that the most recent report supersedes all previous reports. Monitoring indicators and the data used in calculations will be presented for each hypothesis evaluated.

Monthly Reports: Monthly reports will be provided to keep Douglas PUD, Grant PUD, as well as HCP and PRCC HSC Committee members and co-managers informed on all hatchery and evaluation related activities. Unless otherwise requested by Douglas PUD, the role of monthly reports will remain the same. Upon request, additional information can be included in the monthly reports.

Databases: The contractor will enter and audit all data collected under this M&E Plan into existing databases that contain the historical data as well as the current-year data. These databases, once updated with 2014 data, will be delivered to Douglas PUD by 1 July, 2015. The databases will include all of the data collected during implementation of this plan. Historic data that are not contained in contemporary databases will be provided in an acceptable format. Genetic data will be provided to the extent it is available in raw genotypes, metadata, or statistical results.

Recommendations: Recommendations to modify the M&E Plan or reporting will be provided as warranted on an annual basis or within the five-year summary reports. Changes to protocols or methodologies may be necessary to ensure the data required in the M&E Plan are collected. Suggested changes to the M&E Plans' implementation or hypotheses will be included in the five-year summary report. Recommendations will be consistent with the hatchery program goals and will be included in a separate section of the summary report.

Presentations: The contractor will develop and may be asked to present the results of the M&E Plan at the request of Douglas PUD, Grant PUD, or the HCP HC or PRHSC. Presentations will include the results of analyses for the M&E programs and interpretation of these results. Similar presentations of annual results from field activities can be requested and provided if warranted.

COORDINATION

Douglas PUD's M&E contractor will be required to closely coordinate and collaborate with hatchery staff at the Wells and Methow hatcheries. Hatchery staff conduct many of the in-hatchery routine sampling and data collected by hatchery staff must be provided to evaluation staff to ensure the data are included the M&E Plan reports. However, special meetings with the hatchery staff are typically conducted prior to significant events (i.e., broodstock collection, spawning, release of juveniles) to ensure proper methodologies are used and critical data are collected. Evaluation staff will be present at all significant events to collect data needed for evaluation purposes.

Coordination between evaluation staff, hatchery staff, and the ESA Permit compliance officer is required to ensure that conditions of ESA Section 10 permits are not violated. All ESA reporting related to the hatchery programs is the responsibility of the ESA compliance officer.

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Page 9: [1] Comment [GM12] Greg Mackey 12/17/2013 11:23:00 AM

Moving to a PIT based steelhead spawner survey methodology can provide data that we never had before. Standard redd surveys tell us nothing about steelhead straying. There is no perfect way to estimate steelhead strays because we simply cannot readily document where fish spawn. Steelhead are known to move a lot in the late summer/fall/early winter preceding spawning. We also know that few steelhead appear to hold in the upper reaches of the Methow basin overwinter. Therefore, the vast majority of fish move up beginning in March. These are the fish that will most likely be spawners, and the most likely to be true strays. As we implement this approach, we can improve it over the years. More sophisticated analysitcal methods could make more accurate estimates, but would probably only offer incremental improvement.

Page 9: [2] Comment [CS13] Snow, Charles (DFW) 12/12/2013 10:12:00 AM

This is a methodology-related comment not really relevant to budgeting purposes. I think Greg was assuming that this is the way we would estimate stray rates in the tributaries using PIT arrays, which is generally true because few fish enter the tribs to spawn before mid-March anyway. The mainstem Methow is a little different and could be estimated using the method Kirk suggests, but it has problems also. Should a fish detected at the lower Methow array in October and not again anywhere else be considered a stray? What if it was killed in a fishery and removed as so many of them are? In short, I don't think we have a set methodology for this but we are collecting all the data necessary to evaluate stray rates by either of the proposed methods.

Page 9: [3] Comment [CS14] Snow, Charles (DFW) 12/12/2013 10:21:00 AM

My understanding is that we will be conducting remote PIT tagging the Twisp and Methow Rivers for both spring Chinook and steelhead parr. I think Greg has this in here because they (Greg and Rebecca) believe that a different approach to tagging (using GRTS or something similar) will provide a better data-set for the model they are developing than our typical method of choosing sites (based on redd distribution and local knowledge of good rearing habitats). This other approach is an additional last-minute thing that was inserted in here and I did not add additional money in our budget because I figured this would not amount to additional work for us, just a shifting of methodology of the work we are already doing. Further, the analysis and reporting I was presuming would be accomplished by Rebecca.

Confederated Tribes of the Colville Reservation

Fish and Wildlife Division

Wenatchee Field Office, 470 9th Street N.W, East Wenatchee WA. 98802
(509) 978-8031

To: HCP Hatchery Committee; PRCC Hatchery Sub-Committee

From: Kirk Truscott, Anadromous Fish program Manager, Colville Tribes

Subject: Wells Steelhead Broodstock Replacement

Date: December 17, 2013

During the November 2013 HCP HC meeting, the Committee was apprised that there had been an unfortunate mortality event at Wells FH that resulted in the loss of 178 of 200 hatchery-origin steelhead broodstock. A portion of these lost broodstock was to support approximately 80,000 smolt production for release in the Okanogan Basin.

During the meeting, the committee agreed to replace broodstock shortage via hatchery-origin steelhead collections from the volunteer ladder at Wells FH. After some Colville Confederated Tribes (CCT) internal discussions, CCT believes that the most appropriate replacement boodstock supporting the Okanogan non locally-adapted program production (80,000 smolts) should be collected from the Okanogan River Basin to the extent possible.

CCT's collection efficiency in the Okanogan Basin has been variable in the recent past, and providing broodstock to support Grant PUD's mitigation obligations is central to the Priest Rapids Salmon and Steelhead Settlement Agreement, as such, the CCT proposes the following strategy to acquire the replacement broodstock for the Okanogan production: (1) WDFW will collect the full broodstock to replace the shortfall for the Okanogan production of 80,000 smolts from the Wells FH Volunteer Ladder (assures production obligations are met); (2) CCT will collect and PIT tag hatchery-origin steelhead broodstock collected in the Okanogan River Basin required to meet 80,000 smolts, and replace at a one-to-one ratio, those Okanogan production replacement brood collected at Wells FH Volunteer ladder to the extent possible given the spawn timing of volunteer ladder collected replacement broodstock; and (3) any overage of broodstock required resulting from the volunteer ladder collections be surplused prior to spawning, released if required to meet spawn escapement or incorporated into other Wells FH production components relying upon hatchery-origin broodstock as necessary to meet production objectives.

Although I will be unable to attend the December 18th HCP HC meeting, I'm providing this proposal for HCP HC discussion on December 18th and as a primer for discussion at the December 19th PRCC HSC meeting, which I will be in attendance. There is some time before these actions would be implemented, so we have time to discuss if needed; however, if the Committees agree with the proposal, I'd be fine with agreement during the HCP and PRCC Hatchery Committee meetings on December 18th and 19th.

DRAFT

Addendum to the Chelan County PUD Hatchery Monitoring and Evaluation Implementation Plan

Wenatchee Sockeye Salmon

2014

Prepared by:

Alene Underwood and Catherine Willard

December 2013

CHELAN COUNTY POWER P.U.D.

Contents

1. Introduction

The Chelan PUD is proposing to conduct monitoring and evaluation (M&E) activities to track key population attributes related to Lake Wenatchee sockeye salmon beginning in 2014 (Table 1). In the absence of a sockeye hatchery program, M&E activities are no longer rooted in the context of evaluating the effects of sockeye salmon supplementation, but instead focus directly on the performance of the natural population, which is a unique departure from historic monitoring obligations. Broadly, the proposed M&E activities cover juvenile and adult life history stages and provide the data necessary to track or estimate viable salmonid population parameters (VSP): abundance, productivity, spatial structure and diversity (McElhaney et al. 2000). The data collected may also have utility in future hatchery compensation recalculation efforts (e.g., Table 2 provides a summary of the data used previously for Lake Wenatchee sockeye recalculation).

Chelan PUD is conducting these M&E activities to support commitments made under the 2011 hatchery recalculation effort, which also included a steelhead production commitment for a sockeye species swap (SOA 2011). This plan describes the specific commitments by juvenile and adult life history stages.

2. Juvenile Monitoring

Chelan PUD will conduct or fund activities to monitor and evaluate the temporal distribution and size of outmigrating sockeye smolts and their contributions to subsequent adult return years (Table 3). Chelan PUD will also develop estimates of smolt production based on adult return data. Collectively, these activities include: (1) funding of the lower Wenatchee River smolt trap concurrent with efforts aimed at evaluating Chelan PUD funded supplemented populations in the Wenatchee River subbasin; (2) providing up to 5,000 PIT tags for natural-origin juveniles encountered during smolt trapping activities at this location; and (3) analyzing historic information to model future smolt production levels based on spawning escapement.

The monitoring data obtained will provide a useful set of tools for evaluating the performance of natural origin sockeye salmon within the basin and downstream and also support the evaluation of VSP parameters [e.g., outmigration timing and size of smolts (diversity); and PIT tagging juveniles for SAR estimates (productivity)].

3. Adult Monitoring

Several M&E activities associated with adult returns of Lake Wenatchee sockeye salmon will be conducted and/or funded by Chelan PUD beginning in 2014 (Table 3). These efforts include (1) continuation of accurate adult counts at Rock Island, Rocky Reach, and Tumwater dams; (2) sampling of scales for age distribution, sex ratio determination, and returns of PIT-tagged adults at Tumwater Dam; (3) reach-specific conversion estimates between Rock Island Dam and spawning grounds in the White and Little Wenatchee rivers (i.e., Rock Island to Tumwater Dam to spawning tributaries); and (4) providing 250 PIT tags to estimate adult spawning escapement in the Little Wenatchee and White rivers utilizing PIT tags and mark-recapture techniques (the software program Sample Size 2.0.7, developed by the University of Washington School of Aquatic and Fisheries Science (P. Westhagen, J. Lady, and J. Skalski) was used to determine the minimum number of tags required (i.e., 250) to estimate adult sockeye escapement at a +/- 7 percent confidence interval). Chelan PUD will adjust the number of PIT-tagged individuals in order to maintain precision in estimates at the lowest rate of interference to migrating populations, if it is warranted due to annual changes in escapement and detection probabilities.

Collectively, these data will provide reliable metrics of adult returns and spawning escapement (abundance), recruits-per-spawner (productivity), distribution of spawners among tributaries (spatial structure), and run-timing and age structure for adult immigrants (diversity).

Table 1. Chelan PUD's proposed Lake Wenatchee sockeye salmon monitoring and evaluation activities.

Life History Stage	M&E Activity	Entity Performing the Activity	Related analysis	VSP parameter addressed
Juvenile	Concurrent operation of the lower Wenatchee smolt trap to collect juvenile outmigration data	WDWF	Generate distribution of outmigration timing and determine average smolt size.	Diversity
Juvenile	PIT tagging smolts at lower Wenatchee smolt trap (up to 5,000 fish annually)	WDWF	Estimate smolt-to-adult returns	Productivity
Juvenile	Develop spawner-smolt production estimates	WDWF	Use previously collected data to quantify the relationship between spawner abundance and smolt production	Productivity
Adult	Rock Island and Rocky Reach Dam adult counts	CPUD	Initial spawner abundance (Okanogan stock separation)	Abundance and spatial structure
Adult	PIT tag subsample (250 adults) of returning adults at Tumwater Dam to support mark-recapture evaluation	WDWF	Calculate spawner abundance and relative distribution in tributaries	Abundance and spatial structure
Adult	Collect and age scales[1] and determine sex via ultrasound from returning adults at Tumwater Dam	WDWF	Estimate age-at-return, sex ratio, and relative productivity of contributing spawner cohorts	Productivity and diversity
Adult	Tumwater Dam adult counts	WDWF	Estimate potential spawner abundance (pre Lake-Wenatchee harvest), potential productivity (recruits/spawner), and run timing distribution	Abundance and diversity
Adult	Operate PIT detection arrays on Little Wenatchee and White River	WDWF	Calculate spawner abundance (post-Lake Wenatchee harvest and other mortality), actual productivity (recruits/spawner), and entry-to-spawning-habitat timing distribution, and spatial spawner distribution	Abundance, productivity, spatial structure, and diversity
All	Data management, analysis, and reporting	BioAnalysts CPUD	------	NA

[1] Scales would be collected concurrently from adults that are PIT tagged at Tumwater Dam

Table 2. Previous use of adult data to calculate hatchery compensation levels for Lake Wenatchee sockeye salmon.

Input Data			Derived Data		
Rock Island Survival	Average Observed Adult Returns	Average Hatchery SAR	Average Expected Adult Returns	Average Adults Owed	Hatchery Compensation
93.27%	**21,045**	**3.31%**	**22,564**	**1,519**	**45,891**

4. References

McElhany, P., M. H. Ruckelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of Evolutionarily Significant Units. NOAA Technical Memorandum.

Statement of Agreement (SOA); ChelanPUD Hatchery Compensation, Release Year 2014-2023, approved December 14, 2011.

CHELAN COUNTY

Memorandum

To: Rock Island and Rocky Reach HCP Hatchery Committees

From: Chelan County PUD

Date: December 10, 2013

Re: Summary of HC notes regarding the use of mark-recapture methodology to estimate Wenatchee sockeye escapement

Note-the following are excerpts from final HC meeting notes pertaining to the use of mark-recapture methodology to estimate Wenatchee sockeye escapement.

From March 2010 HC meeting minutes

In February 2009, Chelan PUD implemented an approach to estimating the number of returning sockeye to the White and Little Wenatchee rivers using PIT-tag detection arrays. The enumeration study was designed to provide an alternative method of describing escapement and run-timing characteristics versus a visual observation approach that may be biased as a result of turbidity. In 2009, PIT-tag detectors were installed in the White and Little Wenatchee Rivers and they were operational by June 1. Data from both of these arrays has been archived in the PIT Tag Information System (PTAGIS). Analyses are in progress to calculate spawner abundance and run timing for the 2009 run.

From May 2011 HC meeting minutes

Wenatchee Sockeye Escapement Using Mark-Recapture Methodology (Josh Murauskas)

Josh Murauskas said that Chelan PUD's 2009-2010 Wenatchee sockeye escapement estimates based on PIT-tag detections had been previously reported to the Committees. He said Chelan PUD is proposing to continue PIT-tagging sockeye in 2011 for use in enumerating adult escapement and to continue carcass recovery of CWTs for use in determining adult origin and spawner composition. Murauskas said that with the double PIT-tag arrays at the entrance to the White River, he estimated that only 250 PIT-tagged adults would be needed to estimate adult sockeye escapement at a +/- 7 percent confidence interval (CI). The minimum number of tags required (i.e., 250) was presented to illustrate the power of the mark-recapture approach. Additional tags will be available if needed.

Mike Tonseth said he recommends Chelan PUD continue redd counts and spawning ground surveys in the Little Wenatchee River to ground-truth PIT-tag adult escapement estimates.

Kirk Truscott said that given that the Little Wenatchee River has such relatively low spawner abundance, clear water conditions, and little redd superimposition, it offers reliable conditions for estimating spawning abundance based on redd counts. Joe Miller agreed to continue full spawning ground surveys in the Little Wenatchee River as a component of the carcass surveys. The Hatchery Committees agreed to Chelan PUD's proposal.

From February 2011 HC meeting minutes

Discussion: 2010 PIT Tag-based Wenatchee River Basin Sockeye Escapement Results (Josh Murauskas)

Josh Murauskas presented preliminary results of the 2009/2010 Wenatchee Basin sockeye escapement study (Attachment A). The purpose of the study was to obtain more accurate escapement estimates based on detections of passive integrated transponder (PIT)-tagged adults by in-river arrays (as opposed to estimates based on visual observations). Returning adult sockeye were PIT-tagged at Bonneville Dam (by Columbia River Inter-Tribal Fish Commission [CRITFC] staff) and at Tumwater Dam. Detection arrays are located in the Little Wenatchee River, White River, Nason Creek, Chiwawa River, and at Tumwater Dam. A second array was installed in the White River in 2010 just downstream from the original White River PIT-tag detection array to provide for estimation of detection efficiency and provide directionality.

Preliminary results indicated that most sockeye tagged at Tumwater Dam return to the White River, where detection efficiency was over 90 percent. Bill Gale asked how undetected fish were accounted for in the analysis. Murauskas said that based on common methodologies described in the literature, 10 percent was used as an estimate of non-detections. Murauskas presented the escapement estimates, alongside recreational harvest (assuming that marked fish were all released), for the Little Wenatchee River, the White River, and combined, for 2009 and 2010, and as a proportion of the Tumwater Dam count.

Murauskas concluded that the second White River PIT-tag array proved very beneficial in improving detection efficiency, and that there was a substantial under-estimation of escapement using traditional spawner survey methods. He noted the difficulties in counting adults during spawning ground surveys in the White River with the low visibility that is compounded by high escapement in some years. Tom Scribner asked Murauskas what changes to estimating escapement are recommended based on the 2009 and 2010 study. Murauskas said Chelan PUD planned to continue the PIT-tagging program, and had asked John Skalski to evaluate existing data to determine the optimal number of fish needed to achieve a level of statistical confidence. Murauskas said a draft report will be available by the March Committees meeting. He suggested that with the continuation of this program, Chelan PUD may eliminate spawning ground surveys of sockeye salmon since escapement based on PIT-tag data is more accurate. The Hatchery Committees discussed the continued value of spawner surveys as a means of documenting spawner distribution. Murauskas stated that Chelan would continue spawner distribution through carcass surveys, but ask that the inaccurate portions of survey efforts be eliminated.

Use of PIT Technology to Estimate Adult Sockeye Salmon Escapement in the Upper Wenatchee River Basin, 2009-2010

Prepared by:

J.G. Murauskas[1]

Prepared for:

Rock Island and Rocky Reach HCP
Hatchery Committee
Wenatchee, Washington

March 23, 2011

[1] Sr. Fisheries Biologist, Chelan County Public Utilities District

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Introduction

Chelan County Public Utility District (Chelan PUD) proposed to utilize Passive Integrated Transponder (PIT) technology to monitor adult sockeye salmon *Oncorhynchus nerka* during the spawning migration into the upper Wenatchee River Basin (Figure 1). The primary objective of this effort was to provide an accurate estimation of escapement into the Little Wenatchee and White rivers. Results from the 2009 migration was presented to the HCP Hatchery Committee in May 2009. A second array was added to the White River, allowing for a more precise estimate for escapement.

Figure 1. Map of study area, including the Tumwater Dam (purple) and in-stream detection arrays (yellow).

Methods

Adult sockeye salmon were removed from the adult fishway at Tumwater Dam on the Wenatchee River, northwest of Leavenworth, Washington during the 2009 and 2010 migration. Fish were anesthetized, tagged with a PIT, and released into the forebay consistent with techniques used by the Washington Department of Fish and Wildlife. Resulting tag files were queried in PTAGIS (2010), providing detection histories for each study fish. Adult sockeye salmon were tagged at Bonneville Dam by another organization in 2009 and 2010; fish from this tag group that were detected at Tumwater Dam were also used in the analyses. Total passage of adult sockeye salmon through Tumwater Dam were obtained from Columbia River Data Access in Real Time (DART 2010).

Detection efficiency of in-stream arrays was calculated for the Little Wenatchee River in both 2009 and 2010; efficiency was calculated for the White River arrays after the 2010 migration since only a single array was available during 2009. The in-stream arrays include a series of upstream and downstream coils (i.e., Figure 2). Combined, these coils represented the upstream and downstream detection arrays, respectively. Overall detection efficiency P_{all} of the arrays was calculated based on observed detection probabilities of individual arrays:

$$P_{all} = 1 - (1 - P_{array\,1})(1 - P_{array\,2})$$

where the probability of missing a fish on both the upstream $P_{array\,1}$ and downstream $P_{array\,2}$ arrays are combined for an overall efficiency P_{all} (Connolly et al. 2008).

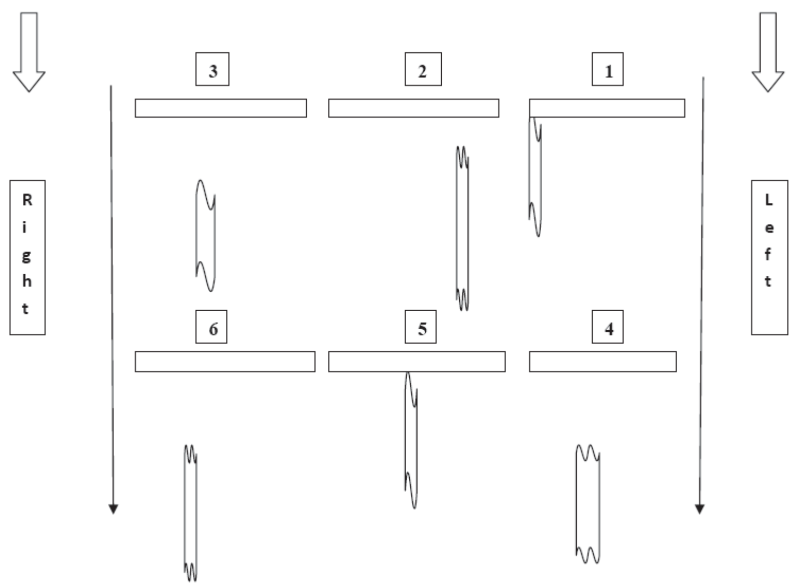

Figure 2. PIT array configuration on the Little Wenatchee River, 2009.

Resulting data from passage at Tumwater Dam, mark and recapture using PITs, and detection efficiency estimates can provide estimation of escapement to spawning tributaries. Basic assumptions include: (1) the study population is “closed,” i.e., no individuals die or emigrate between the initial mark and subsequent recaptures; (2) tags are not lost and detections are correctly identified; (3) all individuals have the same probability of being detected; and (4) the number of recapture events are proportional to the total population. Lastly, it is assumed that PIT-tagging efforts at Tumwater have negligible influence on fish behavior and tagged individuals behave similarly to untagged individuals. The resulting escapement rate, adjusted for detection efficiency, can then be applied to the total population as such:

$$Escapement = \left(\frac{\left(\frac{Obs_{LWN}}{Eff_{LWN}} + \frac{Obs_{WTL}}{Eff_{WTL}} \right)}{PITs_{TUM}} \right) \times Counts_{TUM}$$

where the PIT detections (*Obs*) at the Little Wenatchee (*LWN*) and lower White River (*WTL*) are adjusted for detection efficiency (*Eff*) at both sites, compared to the number released (*PITs*) at Tumwater Dam (*TUM*), and the resulting proportion is applied to the population observed (*Counts*) passing Tumwater Dam.

Results and Analyses

Marking and Recapture Events

During the adult spawning migrations of 2009 and 2010, 998 and 1,054 adult sockeye salmon were trapped, PIT-tagged, and released in the forebay at Tumwater Dam, respectively. Most fish were of wild origin (90.3%), and tagging occurred throughout the natural run timing: a majority of fish were tagged between mid-July and early August both years (PTAGIS 2010; DART 2010). A group of 55 adults were released late in 2010 (September 20th) as un-spawned broodstock. Additional adult sockeye salmon of unknown origin were trapped, PIT-tagged, and released by the Columbia River Inter-Tribal Fisheries Commission into the Bonneville Dam adult fishway in 2009 and 2010, totaling 838 and 910 fish, respectively. Releases at Bonneville Dam generally occurred between mid-June and early July both years. A portion of these fish were detected at Tumwater Dam, including 87 in 2009 and 110 in 2010, and will be used in escapement analyses.

Detections of fish released at Tumwater and Bonneville dams occurred at five locations upstream of Tumwater, including the lower and upper Chiwawa River arrays, the lower Nason Creek array, and the Little Wenatchee and White River arrays (Table 1). Detections upstream of Tumwater Dam in 2009 and 2010 identified 413 and 584 of adults tagged at Tumwater, and 40 and 44 of adults tagged at Bonneville, respectively. The lower White River array accounted for a majority of all detections (86.2%, both years combined), and the upper Chiwawa River array accounted for the fewest (0.3%). The stray rate of fish above Tumwater Dam was roughly double for fish tagged at Tumwater compared to fish tagged at Bonneville over the two-year period (4.7% vs. 2.3%, respectively).

Table 1. Individual detections (not adjusted for detection efficiency) of PIT-tagged adult sockeye at and upstream of Tumwater Dam, by location, 2009-2010.

Year	Release site	Tumwater	Lower Chiwawa	Upper Chiwawa	Lower Nason	Little Wenatchee	Lower White
2009	BONAFF	87	2	0	0	4	34
	TUMFBY	3	33	2	7	34	347
2010	BONAFF	110	0	0	0	6	41
	TUMFBY	2	2	1	1	61	530
Combined		*202*	*37*	*3*	*8*	*105*	*952*

Detection Efficiency

Detection efficiency on the Little Wenatchee River was calculated both years with the 105 individuals that were detected in the array. Detection efficiency on the White River was calculated in 2010 based on the 571 individuals detected in the array. Calculated efficiency for the array in place for the 2009 migration was used to expand 2009 observations for estimation of escapement. The Little Wenatchee array had an overall efficiency of 0.971 in 2009 ($P_{array\ 1}$ = 0.447, $P_{array\ 2}$ = 0.947) and 1.000 in 2010 ($P_{array\ 1}$ = 0.687, $P_{array\ 2}$ = 1.000; Table 2). The White River array had an overall efficiency of 0.900 in 2010 ($P_{array\ 1}$ = 0.406, $P_{array\ 2}$ = 0.832; Table 3). The 2010 observed $P_{array\ 1}$ = 0.406 for the White River was applied to the 2009 observed detections to estimate escapement.

Table 2. Detection sequences used to determine probability of detection on the Little Wenatchee River PIT arrays, 2009-2010.

Year	Hit-Hit (Array 1: Array 2)	Hit-Miss (Array 1: Array 2)	Miss-Hit (Array 1: Array 2)	Grand Total	P_1	P_2	Overall
2009	15	21	2	38	0.447	0.947	0.971
2010	46	21	-	67	0.687	1.000	1.000
Grand Total	*61*	*42*	*2*	*105*	*0.600*	*0.981*	*0.992*

Table 3. Detection sequences used to determine probability of detection on the White River PIT arrays, 2009-2010.

Year	Hit-Hit (Array 1: Array 2)	Hit-Miss (Array 1: Array 2)	Miss-Hit (Array 1: Array 2)	Grand Total	P_1	P_2	Overall
2009	-	381	-	381	-	-	-
2010	136	339	96	571	0.406	0.832	0.900
Grand Total	136	720	96	952	-	-	-

Escapement

Fishway enumeration at Tumwater Dam indicated that 16,034 and 35,821 adult sockeye salmon passed the facility during the 2009 and 2010 migrations, respectively. The recreational harvest removed an estimated 2,229 and 4,129 fish during the two years, respectively; although, anglers were requested to released marked fish. PIT tags were implanted in 1,085 and 1,164 of these fish prior to subsequent detections in nearby tributaries. Based on the recapture of PIT-tagged adult sockeye and assigned detection efficiencies, total estimated escapement from Tumwater Dam to the White and Little Wenatchee rivers was 14,452 in 2009, including 13,876 fish in the White River and 576 fish in the Little Wenatchee River. Estimated escapement in 2010 totaled 21,604, including 19,542 fish in the White River and 2,062 fish in the Little Wenatchee River. Combined escapement rates represented 0.901 of the population in 2009, and 0.603 in 2010.

Table 4. Number of adult sockeye salmon PIT-tagged, released, and detected upstream of Tumwater Dam in 2009 and 2010, including escapement estimates of PIT-tagged fish based on array detection probabilities.

Release Location	Number Released	White River [3]		L. Wenatchee River [4]		Chiwawa R.	Nason Creek
		Observed	*Estimated*	Observed	*Estimated*	Observed	Observed
Tumwater (2009) [1]	998	347	*855*	34	*35*	35	7
Bonneville (2009) [2]	87	34	*84*	4	*4*	2	0
Tumwater (2010) [1]	1,054	530	*589*	61	*61*	3	1
Bonneville (2010) [2]	110	41	*46*	6	*6*	0	0
Combined (2009)	1,085	381	*939*	38	*39*	37	7
Combined (2010)	1,164	571	*635*	67	*67*	3	1

[1] Also includes fish detected downstream of release point (fallbacks).
[2] Number of fish released at Bonneville and subsequently detected at Tumwater Dam.
[3] Based on a detection efficiency p_{all} = 0.406 in 2009 (assigned from 2010 data) and p_{all} = 0.900 in 2010.
[4] Based on a detection efficiency p_{all} = 0.971 in 2009 and p_{all} = 1.000 in 2010.

Table 5. Estimated escapement of adult sockeye salmon to Little Wenatchee and White rivers based on mark-recapture events, in-stream detection efficiency, and adult enumeration at Tumwater Dam, 2009-2010.

Year	Tumwater count	Recreational harvest	Little Wenatchee	White River	Combined	Escapement
2009	16,034	2,229	576	13,876	14,452	0.901
2010	35,821	4,129	2,062	19,542	21,604	0.603
Total	*51,855*	*6,358*	*2,638*	*33,418*	*36,056*	*0.695*

Discussion

The use of PIT-tagged adult sockeye salmon to estimate escapement proved to be a useful and accurate method. Particularly, the addition of the second White River PIT array allowed a precise estimate of detection efficiency in the tributary where a majority of sockeye spawn. Further, standard error associated with the mark-recapture estimates can be derived from the program Sample Size 2.0.7, developed by the University of Washington School of Aquatic and Fisheries Science (P. Westhagen, J. Lady, and J. Skalski), as opposed to observation-based estimates with unknown precision currently in place. The difference in escapement estimates between these methodologies may be drastic. For example, the escapement results from observation-based spawning surveys may under-estimate fish returning to the White River due to low water clarity. PIT-based escapement estimates indicated that the spawning surveys may have underestimated returns to the White River, leading to a roughly 2.5%

offset in the estimated distribution in returns (Figure 3). This disparity was greater in 2009, though the lack of the second White River array precludes assigning a precision value to this estimate. Nonetheless, PIT-based escapement estimates provide greater reliability and a means to assign precision to results.

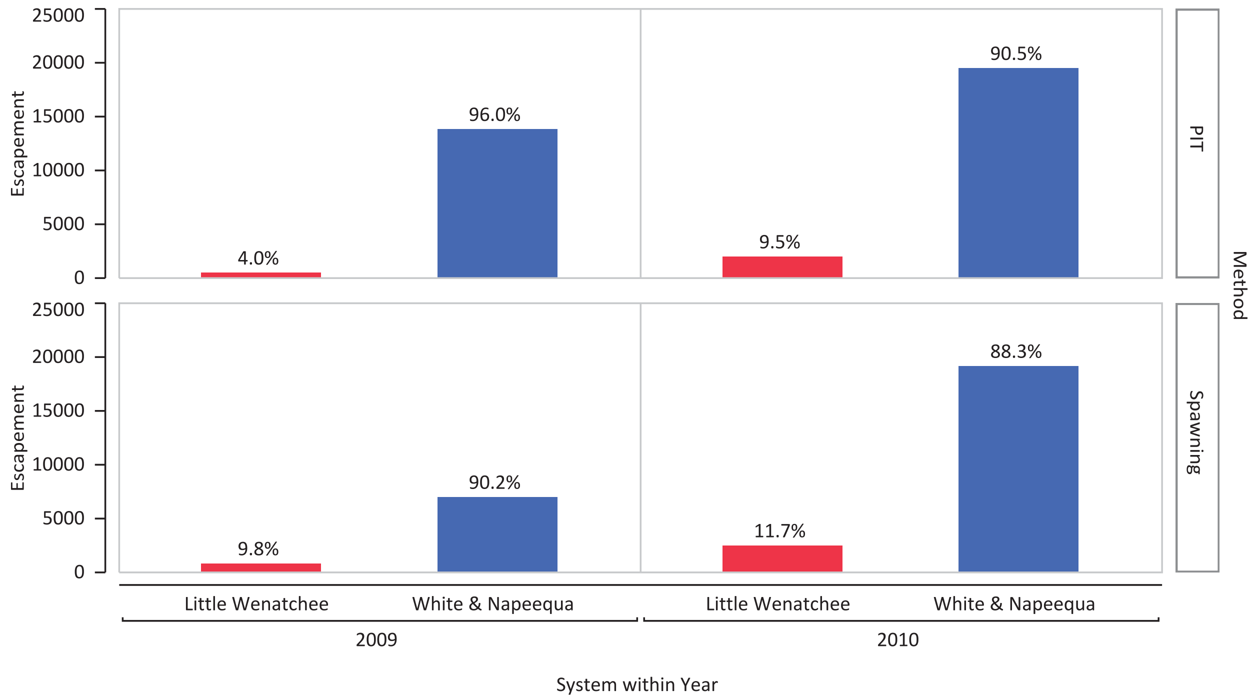

Figure 3. Comparison of PIT- and spawning survey-based escapement estimates of adult sockeye in the Wenatchee River Basin by system and method, 2009-2010.

The results of the 2009 and 2010 adult sockeye salmon escapement study ultimately demonstrated great potential in estimating escapement in the upper Wenatchee River Basin. The foremost recommendation to achieve the project objective is to maintain the White River arrays to obtain accurate detection efficiency estimates, as well as increase the probability of recapturing marked fish. This alone will provide the ability to generate reasonable escapement estimates. Further monitoring of the recreational fishery in Lake Wenatchee, along with inclusion of harvest probability into the escapement model, would also have considerable benefit to the reliability of escapement estimations. Lastly, continued monitoring of potential tagging and handling effects of fish released at Tumwater Dam is recommended.

References

Connolly, P.J, I.G. Jezorek, K.D. Martens, and E.F. Prentice. 2008. Measuring the performance of two stationary interrogation systems for detecting downstream and upstream movement of PIT-tagged salmonids. North American Journal of Fisheries Management. 28(2):402-417.

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Viola, A. 2009. Memo to J. Korth, subject: 2009 Lake Wenatchee sockeye creel survey summary. State of Washington Department of Fish and Wildlife, Fish Program – Region 2 – Wenatchee District Office. Wenatchee, WA.

Memorandum

To: Rock Island and Rocky Reach HCP Hatchery Committees

From: Chelan County PUD

Date: December 10, 2013

Re: Summary of sockeye salmon escapement estimates based on spawning ground surveys and passive integrated transponder (PIT)-tag detections of returning adults in 2009-2012

Introduction

Chelan County Public Utility District (Chelan PUD) utilized Passive Integrated Transponder (PIT) technology to monitor adult sockeye salmon *Oncorhynchus nerka* during the spawning migration into the upper Wenatchee River Basin beginning in 2009. The primary objective of this memo is to summarize sockeye salmon escapement estimates based on spawning ground surveys and passive integrated transponder (PIT)-tag detections of returning adults. Escapement estimates from 2009 through 2012 are provided.

Methods

Sockeye Spawning Abundance

In 2009, 2010, 2011, and 2012, sockeye abundance was enumerated using two methods: (1) on-the-ground surveys using an "area-under-the-curve" (AUC) approach and (2) a PIT-tag-based mark recapture study.

AUC Method:

Sockeye spawning ground surveys generally begin in August and end in October. When conditions allow, spawning areas are surveyed at least once per week. The AUC method is based on the number of live spawners counted. Using AUC, the number of fish observed in a survey is plotted against the day of the year and the number of fish-days estimated using an algorithm. The number of fish spawning is then estimated by dividing the cumulative fish-days by the estimated mean number of days that the average spawner was alive in the survey area (survey- or stream-life) and then multiplied by a correction factor for fish visibility (observer efficiency; Hillborn et al. 1999). Hillborn et al. (1999) outlined what is termed as the most commonly used form of AUC, *trapezoidal approximation*:

$$AUC = \sum_{i=2}^{n} (t_i - t_{i-1}) \frac{(x_i + x_{i-1})}{2}$$

where t_i is the day of the year and x_i is the number of salmon observed for the *i*th survey. Attempts were made to initiate surveys before the presence of fish; however, when the first or last survey was not zero, then the above algorithm was not valid and Hillborn et al. (1999) recommend using the rules that the Alaska Department of Fish and Game use:

$$AUC_{first} = (x_i s)/2$$

where s is the survey life. Survey attempts should also be made until all salmon die, but when this was not possible, then the final survey should be calculated as:

$$AUC_{last} = (x_{last} s)/2$$

Then total escapement (E) is estimated as:

$$\hat{E} = \frac{AUC}{s} v$$

where v is a correction for observer efficiency. Since survey life has not been empirically estimated for the Wenatchee system, we used 11 days based on Perrin and Irvine (1990) and Hyatt et al. (2006).

Mark Recapture Method:

Adult sockeye salmon are removed from the adult fishway at Tumwater Dam during migration. Fish are anesthetized, tagged with a PIT tag, and released into the forebay consistent with techniques used by the Washington Department of Fish and Wildlife. Resulting tag files are queried in PITAGIS, providing detection histories for each study fish. Adult sockeye salmon may also be tagged at Bonneville Dam by other organizations. Total passage of adult sockeye salmon through Tumwater Dam was obtained from Columbia River Data Access in Real Time (DART).

Detection efficiency of in-stream arrays is calculated for the Little Wenatchee River and White River. The in-stream arrays include a series of upstream and downstream coils (Figure 1). Combined, these coils represented the upstream and downstream detection arrays, respectively. Overall detection efficiency P_{all} of the arrays is calculated based on observed detection probabilities of individual arrays:

$$P_{all} = 1 - \left(1 - P_{array\ 1}\right)\left(1 - P_{array\ 2}\right)$$

where the probability of missing a fish on both the upstream P_{array1} and downstream P_{array2} arrays are combined for an overall efficiency P_{all} (Connolly et al. 2008).

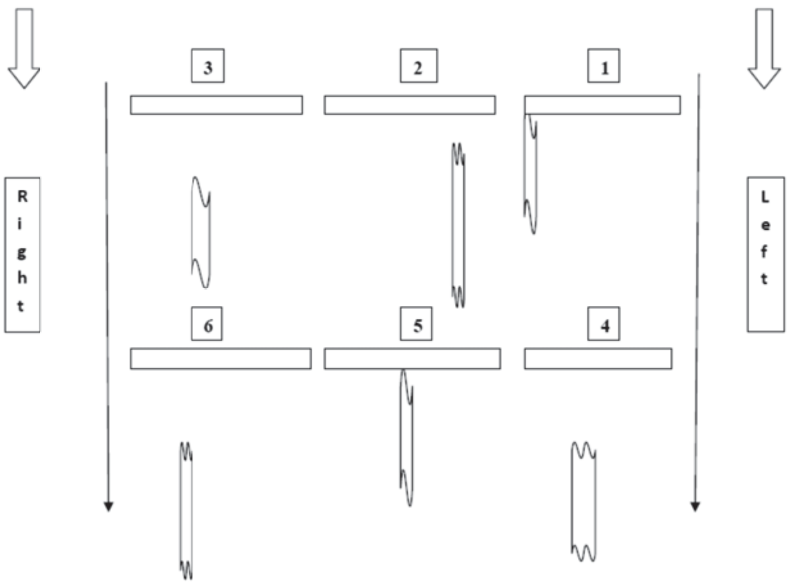

Figure 1. PIT array configuration on the Little Wenatchee River (2009-2012) and White River (2010-2012).

Resulting data from passage at Tumwater Dam, mark and recapture using PIT tags, and detection efficiency estimates can provide estimation of escapement to spawning tributaries. Basic assumptions include: (1) the study population is “closed,” i.e., no individuals die or emigrate between the initial mark and subsequent recaptures; (2) tags are not lost and detections are correctly identified; (3) all individuals have the same probability of being detected, and (4) the number of recapture events are proportional to the total population. Lastly, it is assumed that PIT-tagging efforts at Tumwater have negligible influence on fish behavior and tagged individuals behave similarly to untagged individuals. The resulting escapement rate, adjusted for detection efficiency, is then applied to the total population as such:

$$Escapement = \left(\frac{\left(\frac{Obs_{LWN}}{Eff_{LWN}} + \frac{Obs_{WTL}}{Eff_{WTL}}\right)}{PITs_{TUM}}\right) \times Counts_{TUM}$$

where the PIT detections (*Obs*) at the Little Wenatchee (*LWN*) and lower White River (*WTL*) are adjusted for detection efficiency (*Eff*) at both sites, compared to the number released (*PITs*) at Tumwater Dam (*TUM*), and the resulting proportion is applied to the population observed (*Counts*) passing Tumwater Dam.

Results

Data obtained from 2009-2012 Monitoring and Evaluation of the Chelan County PUD Hatchery Program Annual Reports.

Area-under-the-curve method

Table 1. Estimated escapement of adult sockeye into the Little Wenatchee and White River basins for return years 2009-2012. Escapement was based on the AUC method.

Return year	Tumwater dam count	Recreational harvest	Little Wenatchee escapement	White River escapement	Total spawning escapement
2009	16,034	2,229	763	7,004	7,767
2010	35,821	4,129	2,543	19,157	21,700
2011	18,634	0	2,431	14,582[a]	17,013
2012	66,520	12,107	5,686	NA[b]	NA

[a] Spawning escapement was not estimated utilizing the AUC in 2011; White River spawning escapement in 2011 was calculated using historic AUC counts and a regression model.

[b] Spawning escapement was not estimated utilizing the AUC in 2012.

Mark-recapture method

Table 2. Estimated escapement of adult sockeye into the Little Wenatchee and White River basins for return years 2009-2012. Escapement was based on recapture of PIT tagged fish.

Return year	Tumwater Dam count	Recreational harvest	Little Wenatchee escapement (detection efficiency)	White River escapement (detection efficiency)	Total spawning escapement
2009	16,034	2,229	576 (0.971)	13,876 (NA[a])	14,452
2010	35,821	4,129	2,062 (1.000)	19,542 (0.900)	21,604
2011	18,634	0	1,803 (0.981)	14,582[b]	16,385
2012	66,520	12,107	4,607 (0.9541)	23,866 (0.9157)	28,473

[a]The White River PIT tag array consisted of a single coil in 2009; therefore, detection efficiency was not calculated.

[b] The White River PIT tag array malfunctioned in 2011; White River spawning escapement in 2011 was calculated using historic AUC counts and a regression model.

Discussion

The use of PIT-tagged adult sockeye salmon to estimate escapement proved to be a useful and accurate method. Particularly, the addition of the second White River PIT array in 2010 allowed a precise estimate of detection efficiency in the tributary where a majority of sockeye spawn. Further, standard error associated with the mark-recapture estimates can be derived from the program Sample Size 2.0.7, developed by the University of Washington School of Aquatic and Fisheries Science (P. Westhagen, J. Lady, and J. Skalski), as opposed to observation-based estimates with unknown precision currently in place. Additionally, low water clarity on the White River can often preclude spawner escapement estimates using the AUC method.

In general, annual spawner escapement estimates for the Little Wenatchee River were slightly greater utilizing the AUC method versus the mark recapture method for all years (2009-2012). However, it is unlikely that observer efficiency is 100% accurate (i.e., fish may be over counted or under counted); thus spawning escapement based on AUC may be biased. Escapement year 2010 was the only year that allowed for comparison of spawner escapement estimates on the White River; both methods produced similar estimates (AUC=19,157 and mark-recapture = 19,542).

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Summary of Rocky Reach ladder trapping of Adipose fin clipped Spring Chinook mid May-mid June 2013

Dates of Trapping	Time spent Trapping	Hours spent Trapping	Trapping opportunities	# of fish successfully Trapped	Time Trapped	Time of release
5/16/13	0930-1145, 1330-1500	3.75	2	0	-	-
5/17/13	0800-1115, 1230-1300	5.75	2	1	1115	1215[1]
5/20/13	0900-1030	1.5	0	0	-	-
5/23/13	1330-1500	1.5	0	0	-	-
5/24/13	1115-1300, 1330-1500	3.25	1	0	-	-
5/28/13	1145-1330, 1330-1500	3.25	2	2	1223, 1259	1224,1300
5/29/13	0950-1220, 1300-1500	4.5	4	0	-	-
5/30/13	0830-1100, 1145-1445	5.5	2	0	-	-
5/31/13	0810-1110, 1145-1445	6.0	3	0	-	-
6/4/13	0800-0930, 1030-1200,1230-1500	5.5	0	0	-	-
6/5/13	1355-1455	1.0	0	0	-	-
6/6/13	0800-1100, 1215-1500	5.75	1	1	1430	1431
6/7/13	0900-1200, 1245-1500	5.25	1	0	-	-
6/10/13	0850-1150, 1245-1500	5.25	10	3	1133, 1351, 1437	1138, 1354, 1438
6/11/13	1345-1500	1.25	6	1	1447	1448

[1] Unable to see that a fish had been trapped due to poor water clarity-very turbid. Passage was available during this time. Protocol changed after this trapping event to raise the hopper after every trapping attempt to ensure no fish remained in the hopper.

Total days spent trapping	Total hours spent trapping	Total # of trapping opportunities	Total # of target fish trapped
15	**59**	**34**	**8**

Video taping of all the trapping efforts were also taken

APPENDIX C
HABITAT CONSERVATION PLAN TRIBUTARY COMMITTEES 2013 MEETING MINUTES

Note: The Tributary Committees did not meet in April, July, October, or December of 2013.

Wells, Rocky Reach, and Rock Island HCP Tributary Committees Notes 10 January 2013

Members Present: Carmen Andonaegui (WDFW), Dale Bambrick (NOAA Fisheries), Lee Carlson (Yakama Nation), Chris Fisher (Colville Tribes), Steve Hays (Chelan PUD), Tom Kahler (Douglas PUD), Kate Terrell (USFWS), and Tracy Hillman (Committees Chair).

Others Present: Becky Gallaher (Tributary Project Coordinator) and Jeremy Cram (WDFW). Denny Rohr (PRCC Habitat Subcommittee Chair), David Duvall (Grant PUD), Derek Van Marter (UCSRB Associate Director), and Susan Dretke (Cascadia Conservation District) joined the last hour of the meeting.

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans Tributary Committees met in the Chelan PUD Auditorium in Wenatchee, Washington, on Thursday, 10 January 2013 from 9:30 am to 12:15 pm.

I. Review and Adopt Agenda

Tracy Hillman welcomed everyone to the meeting and the Committees adopted the proposed agenda with the following addition:

- Okanagan River Restoration Initiative Monitoring Project.

II. Review and Approval of Meeting Minutes

The Committees reviewed and approved the 8 November 2012 meeting notes.

III. Monthly Update on Ongoing Projects

Becky Gallaher gave an update on funded projects. Most are progressing well or had no salient activity in the past month.

- Lower Wenatchee Instream Flow Enhancement Project – The contractor (P.O.W. Contracting from Pasco, WA) began ground breaking on 8 November. They completed the excavation of the pump station site and the access road to the pump station. A total of 1,500 truckloads of material was removed. The site was graded without any complications and the contractor began installing the coffer dam, which is needed to install the fish screen and suction line. In January, they will begin in-water work. The five miles of earthen channel is 80% filled and graded flat. They have about 2,600 feet of the 3,000 feet of HDPE pipe welded together. Pipe will be installed during early January.
- Chewuch River Instream Flow Project – The Washington Parks easement is waiting on the fee agreement. The sponsor (Trout Unlimited – WWP) began developing a case for a lower fee. There are some monitoring and operational issues to resolve between Ecology and the Chewuch Canal Company (CCC). Ecology, CCC, and the sponsor continue to

refine the reservoir permit. Work on other tasks has stopped to save funding until the reservoir permit is agreed to and finalized.

- Nutrient Enhancement Assessment – The contractor (Water Quality Engineers) has summarized the first year of results and presented them to the Cascade Columbia Fisheries Enhancement Group (CCFEG) Board on 16 November. They will present their findings to Ecology on 9 January and the Upper Columbia Regional Technical Team on 13 February. They will also discuss upcoming activities, seek funds for implementation in 2014, and develop an MOA between CCFEG and Ecology.
- Large Wood Atonement Project – The U.S. Fish and Wildlife Service is finalizing specifications for the wood pilings and whole trees, and will complete a one-dimensional modeling exercise for the treatment reach. They will hold a landowner meeting on 16 January to discuss the latest information and results.
- Nason Creek Lower White Pine Alcove Acquisition Project – The sponsor (Chelan-Douglas Land Trust) expects to have signed options this month and retain the appraisals for both properties (Parker and Click). The sponsor intends to use Larry Rees as the appraiser.
- Coulter Creek Barrier Replacement Project – Funding for this project is contingent upon the successful implementation of the railroad reconnection project, which has not yet happened.
- Wenatchee Levee Removal and Riparian Restoration Project – In November, the sponsor (Chelan County Natural Resources Department) met with the landowner to discuss the project and the water right change application. The landowner wanted assurance that the project would not affect his water right for his orchard and production abilities. After discussion, the landowner was satisfied with the water right modification.
- Entiat Stormy Reach Phase 2 Acquisition – The project is complete and a final report will be submitted to the Rocky Reach Tributary Committee.

IV. Review of Policies and Procedures Documents

Tracy Hillman asked if the Committees had any changes or edits to the Policies and Procedures for Funding Projects and the Tributary Committee Operating Procedures documents. In the Policies and Procedures document under Section 3.4, The General Salmon Habitat Program, the Committees agreed to increase the minimum size proposal value from $50,000 to $100,000 (total project cost). The Committees may provide lesser amounts for phased projects. Under Section 4.4, Administrative and Support Costs, the Committees will include language about the use of approved appraisers. Tom Kahler will provide draft language for the Committees to review in February.

V. Wells HCP Action Plan for 2013

Tom Kahler provided the Committees with the Draft Wells HCP Tributary Committee Action Plan for 2013. The 2013 Draft Action Plan for the Wells Tributary Committee is as follows:

Plan Species Account Annual Contribution

- $176,178 in 1998 dollars: January 2013

Annual Report – Plan Species Account Status

- Draft to Tributary Committee (TC): February 2013

- Approval Deadline: March 2013
- Period Covered: January to December 2012

2013 Funding-Round: General Salmon Habitat Program

- Request for Project Pre-proposals *To be determined* (March)
- Pre-proposal to TC *To be determined* (early May)
- Tours of Proposed Projects *To be determined* (late May)
- Project Sponsor Presentations to TC *To be determined* (early June)
- Final Project Proposals to TC *To be determined* (late June)
- RTT Project Rating Decision *To be determined* (early July)
- Supplemental Sponsor Presentations *To be determined* (September)
- TC Final Funding Decisions *To be determined* (before Dec.)

Small Projects Program

- Project Review and Funding Decision January – December 2013

Tributary Assessment Program

- Draft report to TC on Year 5 of 5 and all years April 2013
- Final report to TC June 2013

The Wells Tributary Committee approved the Wells Action Plan for 2013. The Committees will review the Rocky Reach and Rock Island 2013 Draft Action Plans in February.

VI. Information Updates

The following information updates were provided during the meeting.

1. Approved Payment Requests in December and January:

   Rock Island Plan Species Account:

   - $482.72 to Chelan County PUD for project coordination during the fourth quarter of 2012.

   Rocky Reach Plan Species Account:

   - $482.71 to Chelan County PUD for project coordination during the fourth quarter of 2012.
   - $6,407.50 to Trout Unlimited for the Chewuch River Permanent Instream Flow project.

   Wells Plan Species Account:

   - $440.22 to Chelan County PUD for project coordination during the fourth quarter of 2012.

2. Tracy Hillman reported that he and Becky Gallaher are writing Section 2.6 (Tributary Committees and Plan Species Accounts) for the Annual Report of Activities under the Anadromous Fish Agreement and Habitat Conservation Plan for each hydroelectric project. Members of the Committees should soon receive the draft reports for their

review. The final reports will be submitted to the Federal Energy Regulatory Commission in April.

3. Tracy Hillman reported that he and Becky will be meeting with the UCSRB, SRFB, BPA, and the Lead Entity at the end of the month to discuss the schedule for proposal development, submission, and review of 2013 SRFB/GSHP/BPA projects. In the past, this meeting has generated questions from project sponsors regarding the Tributary Committees scoring criteria and types of projects the Committees prefer to fund. After discussion, the Committees provided Tracy and Becky with the following information. The Committees evaluate proposed projects based on (1) the benefit of the proposed action to Plan species, (2) whether the action addresses important limiting factors, (3) the location, size, and expected longevity of the project, and (4) the cost of the project. As part of the evaluation process, the Committees also consider the scores and comments provided by the Regional Technical Team. The types of projects the Committees tend to fund include barrier removal projects, levee removals, meaningful streamflow additions, floodplain reconnections, and acquisition or conservation of “at risk” properties.
4. Tracy Hillman reported that funds will be deposited into each of the Plan Species Accounts at the end of January. The amounts deposited will be about $675,000 into the Rock Island Account, $324,000 into the Rocky Reach Account, and $250,000 into the Wells. Exact amounts deposited into each account will be provided during the February meeting.
5. Tracy Hillman said that the Tributary Committees will continue to meet on the second Thursday of each month in 2013. Those meeting dates are as follows:
    - Jan. 10
    - Feb 14
    - Mar 14
    - Apr 11
    - May 9
    - Jun 13
    - Jul 11
    - Aug 8
    - Sep 12
    - Oct 10
    - Nov 14
    - Dec 12
6. Dale Bambrick reported that Mike Kaputa, Chelan County Natural Resources Department, has distributed a scope of work on the Peshastin and Icicle Irrigation Districts Pump Exchange Project Feasibility Study (Phase II). The purpose of the study is to evaluate alternatives to divert water from the Wenatchee River near Dryden and deliver the water to the Peshastin Irrigation District (PID) canal. This would allow for reduced diversions and increased flows in the lower 2.4 miles of Peshastin Creek. The study would define pump station operations (design flow, duration, and timing), habitat benefits, and design. Dale asked the Committees if this is something that would provide biological benefit. The Committees agreed that the project would be beneficial, especially if it reduces diversions from Icicle Creek. Currently, flows diverted from Icicle Creek are delivered to PID through a bifurcation on the Icicle Irrigation District (IID) Diversion 2 Canal to supplement PID’s supply. If the pump station could be used to deliver flows directly to the IID Canal to reduce diversion from Icicle Creek, the project would have larger biological benefit and would gain greater support from the Committees.
7. Tom Kahler reported that in May 2012 the Wells Tributary Committee recommended that Douglas PUD fund the fifth and final year of Okanagan River Restoration Initiative (ORRI) monitoring. The cost of the monitoring approved by the Committee and Douglas PUD during the fifth year was $18,984. The Okanagan Nation Alliance (ONA) proposes to produce a final report that describes results from the five years of monitoring. The

report will also include the many additional data sources and analyses conducted as part of the monitoring program. To that end, the ONA asked the Wells Tributary Committee for an additional $6,799 to complete the final report. Thus, the total amount for the fifth year would be $25,783. After discussion, ***the Wells Committee approved the increase and directed Douglas PUD to fund via the Tributary Assessment Program (Wells HCP Section 7.5) the additional funding needed to complete the final report.*** In addition, ***the Wells Committee approved a two-month time extension for the project.*** Thus, the contract period will end on 31 August 2013. At the end of the project, the Committee expects to see a report that summarizes the results of the five-year study. The Committee also requested that the final report include a "lessons learned" section.

VII. Public Outreach and Coordination Discussion

During the October 2012 meeting, Lee Carlson and Becky Gallaher reported that Cascadia Conservation District (CCD), Chelan County, Upper Columbia Salmon Recovery Board, and other entities identified the need for funding to assist with outreach and coordination in the Upper Columbia. As a result of the discussion in October, the Committees asked if Derek Van Marter (UCSRB) and Susan Dretke (Cascadia Conservation District) would talk briefly to the Committees about messaging and funding needs.

Both Derek and Susan talked about the current outreach and coordination process in the Upper Columbia. Derek described some of the results from a Findings Report funded by the Bonneville Environmental Foundation and prepared by Pyramid Communications. Pyramid Communications conducted research in the Methow and Entiat basins from January to March 2012. Their research included a web scan of watershed restoration organizations, review of communication materials used in the Entiat and Methow basins and by the UCSRB, interviews with key opinion leaders, and facilitated discussions with restoration partners in the Upper Columbia. Their report, appended as Attachment 1, summarizes findings and implications for messaging and provides the foundation for a communication strategy. Some of the important findings included:

- Most participants see positive effects of watershed restoration.
- Stakeholders recognize the collective effort.
- Some participants are unsure about the effect on the health of the fish.
- Landowners are committed to protecting their property.
- Liability concerns are widely shared.
- Inconsistent communication leads participants to draw their own conclusions.
- Stakeholders are confused about who is in charge.
- There are concerns about "outsider" influence.

These findings resulted in the following messaging implications:

- Treat the multiple-personality disorder. Decide and agree whose voice is really in charge.
- People already went through high school biology class. Do not ask them to do it again.
- Cut through the clutter. Say it and say it like you mean it.
- Prioritize your audiences. Pay as much attention to what they do not care about as well as what they do.
- Just like Jerry Maguire, "Help me help you." What is good for one is good for everyone.

Derek then shared with the Committees the 2012-2015 Communication and Outreach Plan for the Entiat and Methow Watersheds, which was funded by the Bonneville Environmental Foundation and prepared by Pyramid Communications (see Attachment 2). The Plan identified the following communication and outreach strategies, which are intended to support restoration project priorities, elevate the benefits of restoration work, and strengthen communication among partners in the Entiat and Methow basins.

- Create more formal collaboration with partners throughout the watershed.
- Create clear, plain language communication tools anchored in the message platform.
- Strengthen ongoing relationships with landowners.
- Educate opinion leaders on the positive benefits of watershed restoration.
- Forge strong relationships with media.

Susan then described outreach efforts by CCD in the Entiat basin. The CCD outreach efforts currently include:

- Quarterly Conservation District Newsletters.
- A corner/column in the Monthly Chamber of Commerce newsletter.
- Monthly Entiat Habitat Subcommittee meetings.
- Attend monthly Chamber of Commerce luncheons.
- Quarterly Entiat Watershed Planning Unit Meetings.
- Ad Hoc Entiat Landowner Steering Committee Meetings.
- Annual Entiat Report.
- Conservation District web site.
- Annual Entiat River Appreciation Event.
- SwallowFest presence.
- Earth Day presence.
- SummerFest presence.
- One on one landowner meetings.
- At least one public meeting per year in the community.
- Watershed signs.
- Landowner outreach for monitoring (contact over 200 landowners).
- Monitoring report mailed to over 200 landowners.
- Project specific outreach associated with project development with specific landowners.
- Meeting monthly with County Commissioners to provide updates on efforts.
- Began implementation of the Public Outreach Strategy Team.

Susan noted a demographic difference along the length of the Entiat River. Downstream from about RM 16, there is more agriculture and landowners tend to be long-term/multi-generational with strong connections to the basin and support for restoration projects. Upstream from RM 16, landowners tend to be part-timers who are focused on recreational interests with less connection to working in the basin and less support for restoration actions.

Susan indicated that it costs about $35,000 per year for coordination and outreach in the Entiat basin. At this time, they do not know what it would cost to improve coordination and outreach throughout the Upper Columbia. Derek indicated that he would continue to share future outreach and communication needs with the Tributary Committees.

VIII. Next Steps

The next meeting of the Tributary Committees will be on Thursday, 14 February 2013 at Chelan PUD in Wenatchee.

Meeting notes submitted by Tracy Hillman (tracy.hillman@bioanalysts.net).

Attachment 1

Bonneville Environmental Foundation Findings Report

Attachment 1

BONNEVILLE ENVIRONMENTAL FOUNDATION

FINDINGS REPORT

Prepared by:

PYRAMID COMMUNICATIONS
239 NW 13th Avenue
Suite 215
Portland, OR 97209

MARCH 21, 2012

PYRAMID COMMUNICATIONS

OVERVIEW

Watershed restoration efforts in the Entiat and Methow watersheds span more than a decade. Armed with sound science and a passion for the work, public and private partners have made significant contributions across the Upper Columbia with hard work and cooperative efforts. With the ongoing implementation of restoration projects on the horizon, a communications and outreach plan can strengthen existing relationships and help build new partnerships with local landowners.

From January to March 2012, Pyramid Communications conducted an array of research to inform effective communications planning and outreach in both watersheds. This research included a web scan of watershed restoration organizations, review of communication materials used in the Entiat and Methow watersheds and by the Upper Columbia Salmon Recovery Board, interviews with key opinion leaders, and facilitated discussions with restoration partners in the Upper Columbia.

This report summarizes findings and implications for messaging and provides the foundation for communication strategy moving forward.

WEB SCAN METHODOLOGY AND FINDINGS

A website is the key public-facing medium organizations use to communicate their market position, program priorities, and credibility with their audiences. Websites provide insight to how organizations see themselves and how they want target audiences to see them.

Pyramid conducted a web scan of watershed restoration organizations, documenting how each organization approaches and describes its work, defines goals, reports outcomes and engages with target audiences. A mix of both local and national organizations were selected, all active in watershed restoration in the West:

- Alaska Conservation Foundation (Alaska)
- North Fork John Day Watershed Council (Oregon)
- Oregon Watershed Enhancement Board (Oregon)
- South Santiam Watershed Council (Oregon)
- Stewardship Partners (Washington)
- The Nature Conservancy (Alaska, California, Colorado, Montana, Oregon and Washington)
- Trout Unlimited (Alaska, Arizona, California, Colorado, Idaho, Nevada, Oregon, Utah, Washington, and Wyoming)
- Whole Watershed Restoration Initiative (Idaho, Oregon, and Washington)

FINDINGS

Watershed restoration initiatives are predominantly partnership-driven. Partnerships are the foundation of most of these efforts. Partners work together to increase the scope and scale of watershed restoration projects, deploy the varied skills of each partner, increase credibility and reduce duplication of effort to get better results.

Partnerships are complicated and operate in a crowded landscape. Partnerships cross public and private sectors to include tribes, local, state and federal governments, corporations, non-profits, schools and other educational institutions and other non-governmental community groups. The role of the partnership and the function of individual partners are not always clear. This can create confusion about coordination and collaboration.

Many organizations communicate with audiences across multiple channels. Not surprisingly, national organizations use more sophisticated and resourced communication strategies and tools. While varying in scale, most groups incorporate multiple channels, including face-to-face meetings, public meetings, Facebook, Twitter and e-newsletters. Organizations use each channel to support further communication and engagement with key audiences.

Cultivating and educating young people is a priority. Organizations across the board recognize that young people are critical to long-term support of watershed restoration. By offering internships, classroom instruction and hands-on experience, organizations invest in the next generation of conservation leaders. It is also likely that in many communities, schools are relatively easy partners to work with.

There is an enormous amount of information with few clear calls to action. Organizations convey a lot of information and data to a lot of audiences. The sheer volume of content is intimidating to the reader and creates unintended barriers. Key messages are lost in the complexity and mass of content. Much of the content is information reported out with few clear calls to action and few avenues for audiences to engage effectively with the work.

There is little common, consistent language. Organizations describe restoration projects in a variety of ways. Conflicting terminology can be confusing and create further barriers to communicating effectively. Descriptions of in-stream projects that put wood in rivers offer an illustration:

- Trout Unlimited describes this work as “large woody debris;”
- The Nature Conservancy calls it “wood restoration;”
- Stewardship Partners use the term “log structure;” and
- Oregon Watershed Enhancement Board describes these projects as “placing logs” or “placing large wood” in waterways.

Organizations also often use highly technical terms and jargon that laypeople find confusing, if not alienating:

> *“The South Santiam Watershed is deficient in large woody debris due to past timber management, stream cleaning practices and torrential flows that removed woody debris*

> *in the 1970's and 1996. This deficiency limits the ability of the watershed to dissipate streamflow energy and prevent erosion, retain spawning gravel and nutrients, or to create and maintain instream habitat complexity. LWD is severely lacking in lower reaches of the basin, but even upper reaches have low habitat complexity and would benefit from increased LWD."* – South Santiam Watershed Council
>
> *"The existing culverts are undersized and perched, impeding juvenile salmonid passage under most conditions and often restricting adults. Replacing these structures with properly sized bottomless arch culverts will make 2½ miles of quality habitat accessible to all life-stages of steelhead and Chinook. Overall water quality will also be protected by removing the potential for culvert failure and resultant massive sediment loading to the stream."* – North Folk John Day Watershed Council
>
> *"Existing pools were excavated to increase rearing and refugia habitat and nearly 40 log structures were placed to improve habitat. Additional gravel was added to enhanced spawning areas and stream banks were pulled back at a 3 to 1 slope, widening the floodplain and decreasing erosion. This fall, spawning salmon were observed using the newly enhanced cover and spawning habitat. This project enhanced a total of 750 feet of stream channel."* – Stewardship Partners

Communication focuses on process and project descriptions—not impacts.
While organizations provide great detail on the function, costs and other characteristics of restoration projects, they rarely highlight the impacts of their work. For example, Trout Unlimited describes over twenty-five projects involved in their Home Rivers Initiative. However, stories are not shared to illustrate the impact of their work on the economy, fish populations, water quality or other elements.

COMMUNICATION MATERIALS REVIEW METHODOLOGY AND FINDINGS

To assess the strength, consistency and effectiveness of messages in both watersheds, Pyramid reviewed an array of communication materials. Please refer to Appendix A for a complete list of materials reviewed. In addition, in-depth interviews were held with key working group members to explore past communications and outreach efforts and identify unique attributes of each watershed.

FINDINGS

Both watershed groups have existing, successful track records with landowners. There is a long history of landowner involvement. Successful partnerships have been developed and projects implemented on private lands in each watershed. This history is a critical prerequisite to developing relationships with new landowners.

There is a lot of data available that measures things people care about. Monitoring efforts in both watersheds are significant. In addition to assessing impacts of restoration activities on fish populations and habitat conditions, the data also measures factors more people might care about, including water quality and river health.

Volunteer activities in the Entiat promote citizen involvement and environmental stewardship. Volunteer events are visible avenues for community outreach and opportunities for citizens to demonstrate support for restoration to the broader community.

Watershed restoration groups in the Methow highlight their partnerships. By raising the visibility of existing partnerships, the Methow elevates a breadth of community involvement among citizens, non-profit organizations and government.

Landowner outreach includes public meetings, newsletters, one-on-one meetings, community forums and events. Both groups use traditionally effective methods to communicate with landowners. Much of the outreach to date has focused on landowners directly affected by restoration projects.

Partners in the Entiat communicate without defensiveness. Interactions with the community are open and honest. This communication fosters trust and builds stronger relationships.

> *"We all dropped the ball on public outreach. We could have done better."* – Mike Kaputa

However, it can also have an unintended effect. There is a fine line between communicating without defensiveness and invoking concern by calling attention to unanswered questions about the work.

> *"Millions of dollars are spent each year...questions remain regarding the individual and combined effectiveness of restoration efforts implemented thus far."* – Conservation Quarterly Winter 2010

Salmon recovery is the consistent primary message. Benefits to fish are a focal point in both watersheds. Yet, restoration projects provide the Upper Columbia, and its communities, with additional benefits, which are not always elevated.

> *Cascadia strives to restore in-stream habitat in the Wenatchee and Entiat watersheds to provide salmon, steelhead and bull trout with the necessary conditions to live and prosper.* – Conservation Quarterly Winter 2012

> *This large-scale effort to monitor how fish use the river, both before and after M2 project construction, will help quantify the effects of habitat improvement work in the Middle Methow.* – Middle Methow News July 2011

The information communicated is often technical and filled with data. The data is not often accompanied by an explanation of what it means for the larger community. This makes it difficult for people not directly involved with restoration to understand its value to the community.

> *"The projects will create high quality side channel rearing habitat, improve surface and groundwater connection to the floodplain, and enhance riparian vegetation. Both projects propose to supplement existing large wood with a variety of log structures and placements to provide more habitat complexity and pool depth in both the side channels and the mainstem of the river."* – Middle Methow News January 2012

The focus of restoration communications is on project characteristics and cost—sometimes at the expense of communicating results. Restoration activities are described in great detail but project outcomes are not always emphasized. Success stories and positive impacts are a missing piece of communication.

> *The stream channel was lengthened to 220 linear feet by installing meanders and other fish habitat features in the stream, such as woody debris, placed to ensure unimpeded upstream fish passage. Weed removal and restoration of native vegetation occurred over an area of 0.35 acres along the Yaksum Creek streambank. The producer and his family were very satisfied with the result of the restoration. This project will serve as a demonstration site for water quality and fish and wildlife projects.* – Conservation Quarterly Winter 2011

> *We carefully obtained onsite many of the necessary materials for construction, placing large boulders to form a low-flow notch and recycling fallen trees to create cover for fish when high water overtops the rock sill and flows into the side channel in the spring.*
> – www.methowsalmon.org

STAKEHOLDER INTERVIEW METHODOLOGY AND FINDINGS

Pyramid conducted confidential interviews with eight community leaders and landowners from each watershed. The interviews were designed to assess their awareness and perceptions of watershed restoration and fish recovery efforts in their communities. Working group members identified participants—all of whom are knowledgeable and have a stake in restoration efforts in their community. Participants were consistently candid and thoughtful with their comments. Interview participants are listed below:

Entiat Watershed:

- John Craven, landowner
- Doug England, Chelan County Commissioner District 3
- Sharon Rose, landowner
- Keith Vradenburg, Mayor, City of Entiat

Methow Watershed

- Hank Konrad, owner of Hank's Market
- Bob Lloyd, Town of Twisp Council Member
- Sheela McLean, writer for Methow Valley Grist
- Vic Stokes, landowner

FINDINGS

Most participants see positive impacts of watershed restoration. When asked to describe the impact of watershed restoration and fish recovery, interview participants note a range of positive results, including benefits to the economy, reducing erosion and improving water quality.

- The majority of participants, and community leaders in particular, see the positive impact watershed restoration has on their local economy.

  "It creates more recreation and is a mainstay of the Valley's economy." (Methow)

  "Everybody wants to be able to fish again. And the fishing really helps the economy of our town." (Entiat)

- Participants see reducing erosion as another benefit of watershed restoration. Both groups value the land and see restoration as a means to protect it.

  "*Past projects have been beneficial in preventing erosion."* (Entiat)

  "*It stabilizes banks that are highly erosive*." *(*Methow)

- Participants from both groups value water quality. They recognize the positive impact watershed restoration has on improving the quality of water in their communities.

  "We all benefit from having a cleaner river." (Entiat)

  "It's been successful in terms of improving water quality." (Methow)

It's important to note that these interview participants do not mention changes in fisheries heath as a positive impact of restoration. They may attach other positive impact as a benefit of healthier fisheries (as a Methow participant notes, "Improvement to the fisheries is a big deal. That pulls a lot of economic power into this area."), but healthier fish populations do not emerge as an independent positive impact.

Stakeholders recognize the collective effort. The majority of participants can identify four or more groups involved in watershed restoration. Chelan County and Cascadia Conservation District are identified most frequently in the Entiat watershed while the Yakama Nation, Methow Conservancy and the Bureau of Reclamation are named in the Methow watershed.

Additional agencies and/or organizations mentioned by Entiat participants:

- Chamber of Commerce
- City of Wenatchee
- Entiat Watershed Planning Unit
- Forest Service
- Irrigation Districts
- Landowner Steering Committee
- State of Washington

- US Bureau of Reclamation
- Upper Columbia Salmon Recovery Board
- Yakama Nation

Additional agencies and/or organizations mentioned by Methow participants:

- Big Valley Ranch
- Bonneville Power Administration
- Federal Energy Regulatory Commission
- Fly Fishing Club
- Forest Service
- Methow Salmon Recovery Foundation
- Natural Resource Conservation Service
- Okanogan Public Utility District
- Trout Unlimited
- U.S. Geological Survey
- Washington Department of Fish and Wildlife
- Washington Department of Natural Resources

Over half of the landowners feel there are additional groups or agencies involved, although they could not identify them by name.

> *“There are lots of people behind the scenes.”* (Methow)

> *“Probably more agencies involved than I know about.”* (Entiat)

Some participants are unsure about the impact on the health of the fish. When asked if fish populations are healthier today than they were ten years ago, responses are split. Half of participants feel the fish are healthier while the other half say they do not know or do not care.

> *“It’s widely believed that the fish are healthier now.”* (Entiat)

> *“I don’t know if the fish runs are healthier. If we left things alone, they’d continue to repopulate.”* (Entiat)

Landowners are committed to protecting their property. Landowner participants are most concerned about the integrity and health of their land. Landowners want to know how projects will improve their livelihoods.

> *“My first concern is my riverbank*.” (Entiat)

> *“Helps me, as a farmer, be more efficient in water use and other things…it has a positive economic impact for me.”* (Methow)

> *“Landowners have been happy because there’s no or little cost. They see value in saving some of their property.”* (Methow)

Liability concerns are widely shared. Landowners and community leaders want to know if liability protections are in place in the event of personal injury or property damage caused by restoration projects on private land.

> *"Landowners are wondering who is accountable if the woody debris comes loose and causes damage."* (Entiat)

> *"We have real concerns about liability—and it's real hard for the agencies to get around that."* (Methow)

> *"What happens if a bridge is taken out?"* (Entiat)

Inconsistent communication leads participants to draw their own conclusions. There is general confusion about restoration projects, leading to skepticism about roles and responsibilities of groups engaged in restoration projects, as well as concerns about results and costs. Participants do not understand the end game and how success is defined.

> *"They're doing a better job talking among themselves, but honestly, I don't know if they're doing a reasonable job talking to others."* (Methow)

> *"The different people you talk to use different terms in different ways. Makes the discussion confusing. "* (Entiat)

> *"Where are we going and how will we know it when we're there?"* (Methow)

- Participants are unclear who is responsible for ongoing maintenance of restoration projects. They want reassurance that necessary repairs are made to projects in the river.

  > *"What's the life of a log? Is there a plan for maintenance?* (Entiat)

  > *"People need a way to report damages, like if a log breaks free, there's a number to call to get the responsible agency to come pull it out."* (Methow)

- Participants recognize that millions of dollars are spent on watershed restoration. They question whether projects yield enough benefits to make it a good use of public dollars.

  > *"Is this an efficient use of our dollars?"* (Methow)

  > *"Millions of dollars being are aimed this direction and nobody really knows if the fish are going to benefit enough to justify all the expense."* (Entiat)

- Some participants are skeptical about the effectiveness of restoration projects. They are not sure these projects will deliver the desired outcome.

  > *"No one knows the benefits of larger projects. No one knows what will happen."* (Entiat)

> *"The people involved don't know what the outcome is going to be and what the numbers are—how many fish are going to come back—it's a study in progress."* (Entiat)

Stakeholders are confused about who is in charge. Half of the participants in the Entiat watershed see Cascadia leading restoration efforts. Most participants in the Methow watershed do not know who is leading the efforts.

> *"It's a struggle to say who has a say on this and who has a say on that."* (Methow)

> *"Lots of different groups involved. Not sure how projects are selected/prioritized."* (Methow)

Concern about "outsiders" influence. Stakeholders in the Entiat perceive some restoration partners as outsiders and question whether they have a real stake in the work. They see anyone who does not live in the watershed as an outsider. When asked to identify the outsiders involved in restoration work, participants name consultants, funders and board members. (This concern also came up in partner discussions with stakeholders in the Methow)

> *"Some of the people involved don't live here and don't care about what happens down river."* (Entiat)

> *"Folks involved in this work don't necessarily live in the Entiat."* (Entiat)

PARTNER DISCUSSIONS METHODOLOGY AND FINDINGS

Pyramid held five discussions with eight watershed restoration partners, representing six organizations/agencies in the Entiat and Methow. Four discussions were conducted in-person in Wenatchee and Winthrop and two discussions were by phone. Please refer to Appendix D for a complete list of partner discussion participants.

The discussions were fluid conversations ranging from 45 to 90 minutes, explored perceptions of partner collaboration and solicited insight about communication and outreach with both landowners and the broader community.

FINDINGS

Funding and timelines are driving a new sense of urgency. The timelines of BPA funding (including the Accords with Yakama) create a timeline not necessarily consonant with the most effective restoration strategies. Partners do not have the luxury of moving at a different pace to reflect the unique dynamics of their own watershed and communities.

Collaboration is seen as more important than ever. Given the number of groups implementing projects throughout the Upper Columbia, collaboration is vital to align efforts and build the awareness and support of landowners and community leaders.

Cascadia Conservation District is the clear leader in the Entiat. Partners recognize that Cascadia is the communication hub in the Entiat. They are seen as the organization to call for questions or clarification.

People are looking for more clarity in the Methow. The structure of the partnership in the Methow makes it difficult to identify a clear leader. Some partners are looking to the Methow Salmon Recovery Foundation to serve as a more visible hub.

There is desire on all sides to work better with the Yakama Nation. For a variety of reasons, the visible collaboration with Yakama can be strengthened. There is clear consensus that this is both necessary and doable, and will deepen the impact of restoration efforts.

There is ongoing concern about liability in the Entiat. Partners are not sure how to address liability concerns that continue to arise in the community. They are looking for responses to address these concerns.

Liability is an emerging issue in the Methow. This presents an opportunity for partners to get ahead of the issue and tackle concerns head on.

Relationship building with landowners needs to be ongoing. Current landowner outreach is generally focused on a deal-by-deal approach. These transactions are generally viewed as successful. However, ongoing communication and relationship with landowners after the project is in place can be more visibly strengthened. Many participants also noted the need and opportunity to communicate with landowners up and down river from projects to create greater awareness, answer questions and forestall concerns.

MESSAGING IMPLICATIONS

Treat the multiple-personality disorder. Decide and agree whose voice is really in charge. Landowners are perplexed when multiple people approach them to participate in different aspects of fish recovery. While many nod their heads in support at the onset of these conversations, they call their neighbors immediately afterwards to get the unvarnished truth. This has come about because the initial design for each watershed coalition was intentionally loose and largely decentralized. As the number of partners grew, communications with the public and with each other unraveled. That early spirit of democracy inadvertently created unintended consequences. “The buck stops here” needs to be clear and evident within each watershed, both in terms of messenger and messages.

People already went through high school biology class. Don’t ask them to do it again. Simplify the complexity of your work and what you do. Science, acronyms, engineering jargon, and species terminology alienate residents and landowners. Landowners and residents aren’t experts in fish recovery or water quality and they don’t want to feel dumb. Experience tells us that when people are confused, they don’t support the work. Prevent this by keeping the science in the textbooks.

Cut through the clutter. Say it and say it like you mean it. Explain your work so that a fourth-grader can understand it. Be clear, be convincing, show your excitement. Practice the elevator pitch with a kid. If s/he doesn't immediately understand what it's all about, you need to simplify your story. This isn't the same as dumbing down. It is why Mark Twain said, "If I'd had more time, I would've written a shorter letter."

Prioritize your audiences. Pay as much attention to what they *don't* care about as what they do. It's easy to fall into the trap of thinking you have to talk with everyone, all the time, about every aspect of what's happening in the watershed. The primary audiences identified in the Message Platform *[separate document]* are essential. Spend 80% of your time and energy educating and energizing these groups about the overarching goals and what it means for the economy and for property values. Reassure them about the steps you are taking to address liability; give them peace of mind so they are open and willing to hear about the economic and property value benefits. Spend 20% of your time on the secondary audiences.

Just like Jerry Maguire, "*Help me help you.*" What's good for one is good for everyone. The competition for environmental funding is fierce and philanthropy is no longer a reliable revenue stream for non-profits. It's no wonder that partners put out their elbows to take credit when the funding stakes are high. Given the number of groups working in each watershed—each with a different purpose for being there—it's essential to join together around unified programs and messages. Funders will be drawn to the big-picture results that come about from being part of integrated effort with positive impact for the entire watershed, not a 100-yard stretch of riverbank overseen by a single group.

APPENDIX A

WORKING GROUP MEMBERS

Bonneville Environmental Foundation:

- Robert Warren, Model Watershed Program Director

Entiat Watershed:

- Susan Dretke, Resource Specialist II, Cascadia Conservation District
- Mike Rickel, Program Manager, Cascadia Conservation District

Methow Watershed:

- John Crandall, Biologist, Wild Fish Conservancy
- Chris Johnson, Board President, Methow Salmon Recovery Foundation
- Jennifer Molesworth, Methow Subbasin Liaison, Bureau of Reclamation

Upper Columbia Salmon Recovery Board:

- Don McIvor, Natural Resources Coordinator
- Derek Van Marter, Associate Director

APPENDIX B

COMMUNICATION AND OUTREACH MATERIALS REVIEWED

Entiat Watershed:

- Cascadia Annual Report
- Community assessment survey April 2010
- Conservation Quarterly newsletters
- Entiat BEF work plan
- IMW implementation plan
- Entiat Watershed Planning Unit meeting minutes
- Script treatment for the Story of the Entiat video
- Wenatchee World articles
- www.cascadiacd.org

Methow Watershed:

- Building a shared future talking points
- Methow BEF work plan
- Methow Grist articles
- Middle Methow newsletters
- Methow Restoration Council 2011 outreach and education communications plan
- Methow sub-basin monitoring assessment
- Methow sub-basin model watershed proposal
- Methow Valley News articles
- www.methowsalmon.org

Regional:

- Reach assessments for Entiat and Methow sub-basins
- The Power of Partnership news release
- The Power of Partnership video
- Upper Columbia salmon habitat implementation schedule and projects
- Upper Columbia Salmon Recovery Board 2011 legislative brochure
- Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan
- www.ucsrb.com

APPENDIX C

STAKEHOLDER INTERVIEW GUIDE

INTRO TO ENTIAT GUIDE (2 minutes)

Thanks for taking the time to talk about fish recovery and watershed restoration in the Entiat River Watershed. I will be respectful of your time and get through everything in about 30 minutes. We can spend a bit more time at the end of our interview— if you've got it – covering issues you'd like to discuss in more depth.

Pyramid Communications is working with the Cascadia Conservation District and the Upper Columbia Salmon Recovery Board to help strengthen communication around fish recovery and watershed restoration efforts in the watershed. To do that, we're talking with a handful of community leaders like you to better understand what's working and what needs improvement.

This interview is confidential. The findings that we report back will be about general themes. No specific comments will be attributed to you or other participants. We are looking for your honest, candid input.

INTRO TO METHOW GUIDE (2 minutes)

Thanks for taking the time to talk about fish recovery and watershed restoration in the Methow River Watershed. I will be respectful of your time and get through everything in about 30 minutes. We can spend a bit more time at the end of our interview— if you've got it – covering issues you'd like to discuss in more depth.

Pyramid Communications is working with a coalition of organizations in the Methow and the Upper Columbia Salmon Recovery Board to help strengthen communication around fish recovery and watershed restoration efforts in the watershed. To do that, we're talking with a handful of community leaders like you to better understand what's working and what needs improvement.

This interview is confidential. The findings that we report back will be about general themes. No specific comments will be attributed to you or other participants. We are looking for your honest, candid input.

AWARENESS

Entiat: For our conversation today, we are talking about fish recovery and watershed restoration in the Entiat River, specifically, on the upper reaches of the river, about 20 plus miles up the Entiat River Road from the mouth of the river. In two years, restoration projects will occur on the lower 7 miles of the river, from the fish hatchery to the mouth of the river.

Methow: For our conversation today, we are talking about fish recovery and watershed restoration in the Methow River, specifically, upstream of Carlton along the main stem of the

Methow River, the lower 12 miles of the Twisp River, the lower 9 miles of the Chewuch River and the lower 6 miles of Beaver Creek.

1) Can you describe for me what you know about watershed restoration efforts in the Entiat/ Methow River? How would you describe them?

(Probes: specific projects, kinds of projects; note any distinctions made between restoration, conservation and preservation)

2) How would you describe the impacts of this work?

(Probes: general river health, water quality, impact on fish, community/economic benefits)

3) What organizations come to mind that are involved in these watershed restoration efforts?

(Probes: who's leading these efforts; responsible for ensuring the work is effective; championing)

PERCEPTION OF IMPACTS

4) The listing of spring Chinook salmon as endangered – and bull trout and steelhead as threatened – really sparked these recovery and restoration efforts.

How would you describe the health of the salmon, bull trout and steelhead populations now? Do you think these populations are healthier today than 10 years ago?

(Probe: Is it important to have a healthy fish population here? What's the consequence of not having a healthy population?)

5) Are there other benefits of the fish recovery efforts to the river or the land or the community?

YES/NO

5A. If YES: How would you describe those benefits?

5B. If NO: Why not?

Entiat: 6) The restoration projects involve the installation of what's called woody debris, essentially, placing large logs in the river to provide shelter and areas of rest for fish. Is this project different from others you've seen in the past? If so, how?

Methow: 6) Where appropriate, the restoration projects involve things like creating logjams, removing levees, placing large wood structures in the river, replanting riparian areas and reestablishing wetlands. Are these projects different from others you've seen in the past? If so, how?

7) How would you describe the impacts of these kinds of woody debris projects?

(Probes: benefits, negative impacts)

8) Given these concerns, what do you think the partners in this effort need to do to address them?

(Probes: aesthetics, liability, access, communication, involvement)

9) Let's step back and think about landowners, particularly those directly involved with or affected by these restoration projects that we just talked about. What are you hearing from landowners and their feelings about it? Do you think they see the value in the work?

(Probes: barriers, stumbling blocks, positive attributes)

10) What's one thing partners working on the ground can do-- that they aren't already doing— to help build support from landowners and others?

(Probes: specific concerns, communication or outreach, messengers)

11) Thinking about everything we've talked about today, what's the hardest thing to explain about this work to people who aren't involved?

(Probe: Where are people getting hung up? How should this work be talked about?)

12) We've talked about a lot today. Is there anything I should know that hasn't come up yet?

APPENDIX D

PARTNER DISCUSSION PARTICIPANTS

Entiat Watershed:

- Jason Hatch—Trout Unlimited, Project Manager
- Mike Kaputa—Chelan County, Director, Natural Resources
- Robes Parrish —US Fish & Wildlife Service, Hydrologist

Methow Watershed:

- Tom McCoy— Methow Wildlife Area of Washington Department of Fish and Wildlife, Manager
- Jason Paulsen— Methow Conservancy, Executive Director
- John Sunderland— Methow Conservancy, Land Program Manager

Yakama Nation:

- Lee Carlson— Yakama Nation, Habitat Coordinator
- Brandon Rogers—Yakama Nation, Upper Columbia Watershed Restoration Specialist

APPENDIX E

PARTNER DISCUSSION GUIDE

INTRODUCTION

- Thanks for participating.
- We are working with Bonneville Environmental Foundation and a coalition of organizations in the Methow and the Entiat– including Cascadia Conservation District, Salmon Recovery Foundation, Wild Fish Conservancy, Bureau of Reclamation and the Upper Columbia Salmon Recovery Board – to help strengthen communication around fish recovery and watershed restoration efforts with landowners and the broader community.
- You have been selected to participate in this discussion because we see you as a leader in this field who has a good perspective on what's working and what might need more attention.
- This interview is confidential, used to sharpen and help align communications with landowners and community members.

QUESTIONS

CONTEXT

1 There are a lot of players contributing to watershed restoration efforts in the Upper Columbia and the Entiat/Methow watershed more specifically. How do you see yourself fitting in? What's the most critical problem you are trying to solve? What the most critical piece of your work that everything hangs off of?

(Probe: Shared goal around fish recovery; vision of success)

AWARENESS

2 Thinking about fish recovery efforts in the Entiat/Methow watershed, who are your allies? Who do you work with the best? Why?

(Probe: Upper Columbia Salmon Recovery Board)

3 Who are you not working with as much that maybe in the back of your head you think you should?

4 Who is getting in the way of recovery efforts?

(Probe: landowners)

PERCEPTION

5 To be really clear, our job is not to change how you all are doing fish recovery and watershed restoration. The projects don't change. Our job is to take better advantage of all the great work being done and communicate more effectively to landowners to make

your jobs easier. We want to make sure landowners understand what you are doing, see the need and connect the dots so that they support the work.

With this is mind, how can we improve coordination among all the groups working on fish recovery so that information falls to landowners in a cohesive way?

COMMUNICATIONS AND OUTREACH TO THE COMMUNITY

6 Thinking specifically about landowners, tell me what you are hearing from them. What are you asking them to do? Have you had any problems getting their support? What are you saying to them? How are you dealing with any issues that have come up? Any missteps? What would you like to be doing?

7 How are you reaching landowners? What's worked well? What hasn't worked?

8 What's one specific thing you want landowners to know about the work in order to support it?

Attachment 2

Bonneville Environmental Foundation 2012-2015 Communication and Outreach Plan for the Entiat and Methow Watersheds

Attachment 2

BONNEVILLE ENVIRONMENTAL FOUNDATION

2012 – 2015 COMMUNICATION AND OUTREACH PLAN
ENTIAT AND METHOW WATERSHEDS

PREPARED BY:
PYRAMID COMMUNICATIONS
MAY 8, 2012

OVERVIEW

Watershed restoration efforts in the Upper Columbia River Basin have been challenging and inspiring local communities across the region for many years. Tribes, local, state and federal governments, non-profit organizations and local landowners have all been working to address the decline in spring Chinook salmon, bull trout and steelhead populations across the region.

Currently, watershed restoration is guided by the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan, adopted in 2007. Funding to conduct restoration work has increased significantly since the Plan's adoption, with large investments by multiple funders. As a result, restoration and recovery projects on the ground have grown in breadth, scale and visibility throughout the Upper Columbia.

Recognizing both need and opportunity, the Bonneville Environmental Foundation (BEF) has embarked upon ten-year partnerships with the Entiat and Methow watersheds. BEF has identified the Entiat and Methow watershed programs as models for taking community-based, strategic, watershed-scale approaches to restoration and rigorous, sustained monitoring.

Pyramid Communications worked closely with BEF and partners in the Entiat and Methow to craft a communications and outreach plan to build awareness and support for restoration efforts in their communities. This three-year plan establishes a structure and the capacity for long-term stakeholder engagement and communication; both are necessary for long-term, widely supported natural resources management and conservation in these watersheds. This communication and outreach plan takes advantage of the existing cycle of instream restoration projects, allowing partners to connect effectively with audiences at each major stage, from design to ongoing monitoring. It also takes advantage of the existing connections partners have established in each watershed to create new aligned strategies that allow audiences to experience relevant, consistent communication and provide clear, simple ways to engage with the work.

Most importantly, this plan is actionable. In the first year, it identifies core elements to build momentum and strengthen the organizational capacity of coalition partners. It creates an ambitious but manageable annual cycle of events and respects the unique challenges of each community. It also helps to release the passion that participating organizations bring to this work; passion that is sometimes muted by scientific language and hidden by individual efforts. There is an exciting story to tell about the impact of restoration on the communities and waterways of the Entiat and Methow.

IMPLICATIONS OF THE RESEARCH

From January to March 2012, Pyramid Communications conducted an array of research to inform effective communications planning and outreach in both watersheds. This research included:

- Web-scan of effective watershed restoration organizations
- Review of communication materials used in the Entiat and Methow watersheds and by the Upper Columbia Salmon Recovery Board (UCSRB)
- Stakeholder interviews with landowners and opinion leaders
- Facilitated discussions with restoration partners

Full research findings are found in the March 2012 report from Pyramid. The following are implications of the findings for communications and outreach strategies, consistent for both watersheds:

Clarify who's "in charge" of the collective effort. The majority of people interviewed can identify four or more groups involved in watershed restoration. Chelan County and Cascadia Conservation District are identified most frequently in the Entiat watershed while the Yakama Nation, Methow Conservancy and the Bureau of Reclamation are named in the Methow watershed. (Methow Salmon Recovery Foundation was mentioned once.) While stakeholders recognize the groups doing the work, they are unsure who is in charge. Half of the participants in the Entiat Watershed see Cascadia leading restoration efforts while most participants in the Methow Watershed do not know.

Expand the frame of the positive impacts of watershed restoration. When asked to describe the impact of watershed restoration and fish recovery, interview participants note a range of positive results, including benefits to the economy, reducing erosion and improving water quality. It's important to note that these interview participants do not mention healthier fish populations as a positive impact of restoration. They may attach healthier fish populations to other benefits (As a Methow participant notes, "Improvement to the fisheries is a big deal. That pulls a lot of economic power into this area.") but fish populations do not emerge as an independent positive impact.

Simplify the language. Current print and digital communications are often technical, filled with data and focus on salmon recovery**.** The data are not often accompanied by an explanation of what it means for the larger community. This makes it difficult for people not directly involved with restoration to understand the value of the work.

Focus on the results of restoration. Restoration activities and characteristics are described in great detail, but project outcomes are not always emphasized. Success stories and positive impacts are a missing piece of communication.

Strengthen the consistency of communication. Stakeholders are confused about restoration projects and do not understand how success is defined. They are unclear as to who is responsible for ongoing maintenance, and they want reassurance that necessary repairs are made to projects in the river. Stakeholders recognize that millions of dollars are spent on watershed restoration. They question whether projects yield enough benefits to make it a good use of public dollars. Some are skeptical about the overall effectiveness of restoration projects and whether they will deliver the desired outcome.

Recognize that BPA funding and timelines make collaboration more important than ever. The timelines of BPA funding (including the Accords with Yakama) create a timeline not necessarily consonant with the most effective restoration strategies. Restoration partners do not have the luxury of moving at a different pace to reflect the unique dynamics of their own watershed and communities. Given the number of groups implementing projects throughout the Upper Columbia, collaboration is vital to align efforts and build the awareness and support of landowners and community leaders.

Build relationships with landowners for the long-term. Current landowner outreach is generally focused on a deal-by-deal approach. These transactions are generally viewed as successful. However, ongoing communication and relationship building with landowners after the project is in place can be more visibly strengthened. Many partners note the need and opportunity to communicate with landowners up- and down-river from projects to create greater awareness, answer questions and forestall concerns.

STRATEGIC ASSUMPTIONS

Both the Entiat and Methow groups face a similar set of dynamics in the environments in which they operate. As noted above, the research revealed a set of common perceptions and strengths on which to build, as well as some concerns and landmines to pay attention to. The following strategic assumptions reflect these dynamics and establish a framework for the recommendations of an actionable communications and outreach plan:

- **Bridge the gap between what people care about and watershed restoration.** Current restoration efforts in the Entiat and Methow watersheds are anchored in the recovery of endangered fish populations by both law and funding. Yet the benefits of restoration extend beyond that and, in fact, audiences targeted in this plan—and key to greater awareness and support—place more value and see greater visibility in additional positive benefits. Embracing and communicating broader impacts create stronger connections to the values of priority audiences.

- **Anticipate concerns before they become bigger problems.** The sheer accumulation of events—from the increasing visibility of projects to the successes and inevitable glitches that come with them—will increase public awareness and scrutiny. Be prepared with regular, clear and consistent information to stakeholders.

- **Recognize that not everything can be controlled.** This work is subject to the vagaries of funding and timelines that don't dovetail naturally with ecological or community readiness. There are also an array of groups with their own missions and messages doing related work. The media can pick up stories that may not reflect the complexity or reality of the work being done. These constraints are part of reality: be ready when they get in the way.

- **Landowners require ongoing connections.** Successful restoration projects with landowners are a basis for ongoing relationships that build trust and create positive buzz with friends and neighbors. Light but regular communication can have big impacts on cementing effective relationships.

- **Make the Upper Columbia effort a friend.** Watershed restoration is specific to particular, local places. But its benefits affect economies, habitats and species up and down our rivers. Take advantage of information, resources and successes in other parts of the Upper Columbia region to tell the story.

- **An organized partnership is an effective partnership.** Successful collaboration means partners agree on common purpose and acknowledge different roles for different players. It's most successful when a partner is charged to be the steward or manager of the collaboration, helping align agendas and creating forums to solve problems and exchange ideas.

GOALS

Clearly defined goals build clarity of purpose, focusing energy and creating parameters for disciplined execution of priorities. This communications and outreach plan is designed to accomplish the following:

- Build support for watershed restoration among landowners, opinion leaders and the media.
- Increase awareness and understanding of the economic, recreational and environmental benefits of restoration.
- In each watershed, strengthen collaboration among watershed restoration partners to deliver clear, effective and consistent communication.

MESSAGING

Clear and consistent messages are key to successful communications. Effective messages should be sound bite quality, able to stand on their own and incorporated into broader storytelling opportunities that are relevant and significant to key audiences. The message framework arms partners with consistent, unified language that puts a sharp focus on the key benefits of watershed restoration.

VOICE AND TONE

The following attributes capture the personality and tone of restoration communication in the Entiat and Methow watersheds. Do not share these adjectives publicly. Instead, use them to animate all communications.

- Collaborative
- Trustworthy
- Experienced
- Straight-forward
- Professional
- Transparent
- Inclusive

KEY AUDIENCES

- Tier 1: These audiences are the primary targets for communication. Spend 75% of time and energy educating and energizing these groups.
  - Land owners
  - Business owners
  - Local elected officials
  - Chamber of Commerce, tourism and real estate leaders
  - Upper Columbia Salmon Recovery Board
- Tier 2: The opinions and actions of these groups influence Tier 1 audiences. Spend 25% of time and energy on Tier 2 audiences.

  - Media
  - Local residents touched by restoration and conservation issues
  - Fishing, hunting, hiking and outdoor recreation affinity groups

KEY MESSAGES

Elevator Statement

A good elevator statement doesn't try to be all things to all people. Rather, it conveys a clear, convincing idea in a short amount of time to elicit excitement and inspiration. Use the statements below to speak to the value of restoration work in the Entiat and Methow watersheds.

- This region is legendary for its natural beauty and strong sense of community. We all know someone who came for a visit and left dreaming about one day relocating here.

- Healthy rivers are a fundamental part of this area. They're more than just pretty to look at; they are a critical economic engine.

- That's why dozens of groups and individual landowners are working together to protect and restore the Entiat/Methow River. Our economy and our way of life depend on it.

Boilerplate

The statements below provide standard language that can be used in a variety of materials to describe watershed restoration and the partnership in the Entiat and Methow watershed. Using this language will create a unified image and promote better understanding among key audiences. This language can be used in news releases at the end of the release, in public service announcement copy—for TV, radio, print or web—in newsletter articles and publications when discussing watershed restoration and how partners collaborate, etc.

- Work to protect and restore the Entiat/Methow River is supported by a growing list of landowners, farmers, conservationists and scientists.

- We work together at the grassroots level to integrate ecologic and economic interests for waterways in the region.

- Funding is provided by a variety of sources.

Talking Points

The set of talking points below are for communicating to target audiences. When developing materials for a particular audience, tailor the text to that specific audience. Use these talking points consistently to ensure partners convey the same clear messages in a similar voice and tone.

- **#1: Restoring the Entiat/Methow River is more than an environmental imperative. It's an economic imperative.**
  - People come from all over the Northwest to fish our legendary waters. Restaurants, hotels, guides and outfitters depend on healthy rivers for their businesses to thrive.

  - People also come here to ski, camp, swim and float the river.
  - Tourism in Chelan County generates $350M/year* for our region.
  - Tourism in Okanogan County generates $130M/year* for our region.
  - Farmers and ranchers depend on the river for their livelihoods.
  - For people who live on or near the water, the view is important to the market value of their property.

  * Washington State Department of Commerce*, Travel Impacts,* September 2010.

- **#2: Landowners are our most important partners and we want to protect them.**
  - We rely on landowners to help make good things happen for the river and our economy. Our work is only successful when we partner with landowners and with each other.
  - Many landowners have lived here their entire lives and fished the river as kids. Restoring the Entiat/Methow is important to ensuring our children and grandchildren have the opportunity to fish and play on the river.
  - We are committed to doing all we can to address liability concerns. That's why we're urging the Washington legislature to pass a law that protects landowners from situations beyond their control (HB 2597).
  - We have dedicated resources to monitor and maintain every project, now and in the future.
  - Because rivers are inherently dangerous, we are committed to doing our best to inform recreationists about the risks.

- **#3: Our work is making a positive impact.**
  - The work we're doing here is happening across the entire Upper Columbia region. We're excited to be part of a bigger effort to preserve the beauty and way of life that makes this region extraordinary.
  - Communities in other states are looking to us as a model for collaboration and results.
  - Our partners are efficient about how they spend their resources to improve the health of our streams. We are mindful about making every dollar count.
  - We're excited about the results we're getting:
    - Helping farmers and ranchers save money by using more efficient irrigation techniques.
    - Helping preserve green spaces along the river for the public and wildlife.
    - Seeing more fish in the river.

STRATEGIES AND TACTICS

The goals and message platform come to life in the communication and outreach strategies. Clearly defined strategies and specific tactics supporting them help determine which methods, used well and at the appropriate times will deliver the desired results.

The following communication and outreach strategies support restoration project priorities, elevate the benefits of restoration work and strengthen communication among partners in the Entiat and Methow watersheds.

Communication Strategies:

- Create more formal collaboration with partners throughout the watershed.
- Create clear, plain language communication tools anchored in the message platform.

Outreach Strategies:

- Strengthen ongoing relationships with landowners.
- Educate opinion leaders on the positive economic benefits of watershed restoration.
- Forge strong relationships with media.

Strategy 1: Create more formal collaboration with partners throughout the watershed.

Tactics:

- **Build an inclusive partnership.** A strong coalition is crucial to align communication throughout the watershed and help create the clarity and consistency priority audiences need. In each watershed, identify the agencies and organizations with missions, funding and activities supporting watershed restoration. Present their involvement in the coalition as a resource and value-add to their work.

  First steps to build the coalition include:
  - Invite them to participate in a planning session to better coordinate projects and outreach.
  - Use the communications research and messaging as an organizing tool to recruit coalition members.
  - Hold an organizing meeting to establish a common purpose and formalize a structure for the coalition.
  - Acknowledge individual strengths and approaches, map and identify roles of each partner.
  - Identify a handful of common strategic outcomes agreed upon by partners.
  - Agree on a coordinator to manage the activities of the coalition. This is not a lead spokesperson for the coalition but one that plays a "behind the scenes" management role.
  - Develop a coalition flow chart and tag responsibilities to different coalition members.

- **Train partners on messaging.** Share the message platform, be clear about how to adapt messaging to fit their mission and conduct message trainings.

- **Work together.** Create ways for partners to work together on common problems, issues and opportunities. Use monthly or bimonthly meetings for joint planning and problem solving, rather than merely sharing information. Exchange emails and provide general updates as issues arise.

- **Promote an environment of trust and mutual support.** Hold formal and informal meetings as often as necessary to help partners know and trust each other. Encourage partners to give input at key points.

- **Take advantage of regional work.** Reinforce the UCSRB's role as a convener and learning resource. Create opportunities to strengthen collaborative efforts and coordination across the region. Show the *Power of Partnership* video to illustrate successful collaboration. Explore with

UCSRB holding annual meetings and regular conference calls, webinars, trainings or other learning opportunities for partners in the region.

- **Create ways for the UCSRB to solicit feedback, including identifying support and assistance local partners might need.** Develop short online surveys for partners in each watershed to identify topics of interest and areas of expertise. Use this information to create a community of practice and offer local organizations more capacity to tell their story in a regional context. Involve partners in the scheduling of calls, trainings or meetings to boost participation. Establish an open-door policy for partners to solicit advice or counsel from the UCSRB.

Additional recommendations for the Entiat Watershed

- **Brand the coalition of agencies and organizations in the Entiat Watershed**. Use the Entiat Watershed Planning Unit as a starting point to build membership. Create a friendlier, less bureaucratic name for the coalition. Develop a consistent look and feel for all materials, using a consistent logo and similar design elements (such as color scheme, font, text size and layout).

- **Elevate Cascadia as coordinating partner.** The organization currently serves in a similar capacity. Staff is well poised to coordinate and facilitate coalition meetings and communicate effectively with members to promote collaboration, negotiation and problem solving.

- **Create a microsite for quick and easy access to information.** Leverage digital communications to enhance the coalition's visibility and credibility. Build a microsite, also known as a brochure site, using five to eight pages of content with a strong, consistent visual theme that binds them together. Base content on newly refined collateral but embed interactive links to educational materials, news, social media connections, program updates and contact information. Make sure the microsite is easy to navigate and segmented to target audiences. Select a vanity URL that is relevant to watershed restoration work and easy to remember

- **Create a Facebook page**. Grant partners posting permissions. Use posts to engage audiences and drive traffic to the microsite for more information.

- **Use existing community and other events to build visibility for the coalition.** Identify methods to tap into existing events by hosting informational booths, being an official sponsor, recruiting speakers, etc. Organize an annual coalition event to raise visibility for the coalition.

Additional recommendations for the Methow Watershed

- **Brand the Methow Restoration Council (MRC).** Use the existing council as a starting point to strengthen the visibility and activities of a coalition of partners. Brand the MRC to represent the partnership in the most simple, straightforward way possible. Create a consistent look and feel in all materials using a consistent logo and similar design elements (such as color scheme, font, text size and layout).

- **Designate a coordinating partner.** This requires strong leadership that is responsive and collaborative, not directive. The ability to identify, balance and create common purpose with competing interests is essential. Think of this as a stewardship role among partners with strong, independent views.

- **Create a microsite for quick and easy access to information.** Leverage digital communications to enhance the coalition's visibility and credibility. Build a microsite, also known as a brochure site, using five to eight pages of content with a strong, consistent visual theme that binds them together. Base content on newly refined collateral but embed interactive links to educational materials, news, social media connections, program updates and contact information. Make sure the microsite easy to navigate and segmented to target audiences. Select a vanity URL that is relevant to watershed restoration work and easy to remember.

- **Create a Facebook page**. Grant partners posting permissions. Use posts to engage audiences and drive traffic to the microsite for more information.

- **Use existing community and other events to build visibility for the Methow Restoration Council.** Identify way to tap into existing events by hosting informational booths, being an official sponsor, recruiting speakers, etc. Organize an annual coalition event to raise visibility for the coalition.

Strategy 2: Create clear, plain language communication tools anchored in the message platform.

Tactics:

- **Review existing digital and print materials used by partners.** Strive to ensure partners' materials reflect the key messages and use plain language to communicate their role in restoration. Support and encourage them to refine their materials, including websites, Facebook pages, newsletters, brochures, fact sheets and talking points. Make the information simple, straightforward and easy to digest so that a fourth-grader can understand it. Use as few technical or scientific (as well as unintentionally bureaucratic) terms as possible.

- **Build a library of reusable content to use and share with partners.** Working from the key messages, prepare information to use in future communications. Potential materials include:
  - One page fact sheet, highlighting economic benefits to the local economy
  - Short success stories, providing snapshots of success (150 words or less) that emphasize impacts more than project descriptions and include quotes
  - Landowner profiles and testimonials, using pictures, quotes and background information to provide compelling details about why featured landowners were involved with the work and what it means for the community
  - Landowner FAQ, addressing questions around liability and other practically relevant issues
  - Quotes from opinion leaders, using a variety from a diverse group who help elevate the benefits of watershed restoration
  - Restoration partners reference list, identifying contact information, websites and Facebook pages

- **Work with the UCSRB to identify additional data points demonstrating the local economic impact.** Choose data that makes watershed restoration relevant to the local community. Data points of restoration must be easy to remember, compelling and defensible. Use data on tourism, the local economy, agriculture, water quality, etc.

Strategy 3: Strengthen ongoing relationships with landowners.

Tactics:

- **Collect contact information from landowners at every point of engagement.** Maintain a database of landowner contacts. Use it to deliver light but consistent communication. Keep the database current, and promptly unsubscribe those who no longer wish to receive mailings or emails.

- **Create a quarterly e-newsletter to share updates.** Keep it short. Select one to three topics for each edition, and keep the text brief. Provide links to drive landowners to the microsite for more in-depth material—this helps strengthen the website as an important, consistent source of information for them.

- **Deploy partners for one-on-one, informal discussions throughout the year.** Face-to-face conversations over coffee or food build relationships and trust. These ongoing, informal touches enable partners to solicit input and demonstrate their commitment to understanding landowner concerns.

- **Train three landowners as media spokespeople.** Landowners are credible messengers, with experiences and values that resonate with key audiences. Spokespeople should be articulate and well versed in watershed restoration, as well as liability issues. Brief them on the key messages and work with them prior to each interview to review potential questions. Provide feedback following the interview to reinforce positive behavior or suggest techniques for improvement.

- **Host a summer barbeque to get to know landowners and build trust.** Keep the event light and informal. Hold informal conversations with landowners to find commonalities and shared interests. Use these events as a way to continue building relationships.

- **Send a friendly email within 48 hours of every meeting, forum, event or individual discussion.** Following up promptly helps keep momentum and ensures the relationships continue to grow after every interaction.

Strategy 4: Educate opinion leaders on the positive benefits of watershed restoration.

Tactics:

- **Using key messages, brief supportive business owners, community and church leaders and elected officials on restoration activities.** Hold briefings with members across stakeholder groups. Opinion leaders like to know the other leaders and organizations engaged in the issues; it illustrates support and provides additional reasons to support watershed restoration. Include a review of key research findings to help ground the plan. Conclude by offering tangible ways they can show support.

- **Identify and train media spokespeople.** Recruit supportive, influential opinion leaders and brief them on key messages. Anticipate difficult questions and coach spokespeople with role-playing activities prior to media or public events. Provide feedback following each interview to reinforce positive behavior or suggest techniques for improvement.

- **Recruit three opinion leaders to weigh in on blog conversations and online news stories (see Appendix A).** Watershed restoration issues are being discussed in blogs and online news stories now. Make it easy for opinion leaders to participate in these digital conversations. Email them links to the blog along with key message points.

- **Collect quotes for print, digital and media materials.** Be attentive to collecting quotes from opinion leaders that demonstrate their support for watershed restoration. Listen for statements that emphasize the economic, property protection and water quality benefits of watershed restoration. Leverage these quotes whenever possible to reinforce key messages.

- **Ghost write op-eds and letters to the editor.** Letters to the editor and op-eds are some of the most frequently read sections of newspapers. It is an ideal place to earn media attention and respond to criticism or concerns. Pieces should be brief and persuasive. Draft the piece and ask respected opinion leaders in the community to sign.

- **Invite opinion leaders to speak at restoration events.** Use these speaking opportunities to deliver messages about the economic and community benefits of watershed restoration. Recruit unusual suspects to serve as speaker. When powerful and unexpected messengers speak on behalf of watershed restoration, these issues receive more attention from the media and with landowners. Such speakers include local restaurant owners, clergy members, or artists.

Strategy 5: Forge strong relationships with media.

Tactics:

- **Conduct briefings with reporters (see Appendix B).** Identify key media and meet with them at each major stage of projects, including design, implementation and follow-up. Include reporters who have written negative stories in the past. Use these briefings to increase their awareness of watershed restoration issues. Emphasize the economic benefits of watershed restoration and be prepared to pivot back to key messages.

- **Conduct tours of project sites.** Hold tours to establish stronger relationships with reporters. Present information about what's underway and on the docket.

- **Create press materials to make messaging and data readily available.** Make it easy for reporters who are on a deadline and working on way too many things. Position the coalition as a resource for the information they need, including referrals and interviews with diverse spokespeople. Make them feel that the coalition is the go-to-entity for accurate and up-to-date information. A packet may include:
    - Information about the coalition of partners in each watershed, including a list of partners and the coalition's mission and goals
    - Contact information for the press spokesperson
    - Background data and fact sheets
    - Frequently asked questions
    - Positive press coverage of watershed restoration issues
    - Information on how watershed restoration benefits the local economy

- **Develop a rolling list of story ideas and pitch**. Create a rhythm of coverage by regularly pitching ideas—quarterly and/or when newsworthy events take place. Such events may include securing new funding sources, announcing an important project milestone or launching a new coalition.

- **Anticipate when a project, action, decision or event is likely to spark media coverage.** Develop three key message points and a response strategy. Help frame the story by preparing to respond to tough questions and acting in a timely fashion. Deploy trained messengers who are prepared to speak to media.

- **Contact reporters as issues emerge.** Reporters won't listen just because the information is right; they pay attention to what's relevant. Think in terms of what a reporter and her boss, the editor, would consider newsworthy. Reporters are faced with dozens of issues and stories. Set watershed restoration issues apart from the others and make it compelling. Find hooks to make the story relevant.

- **Generate responses to coverage of restoration-related stories and events.** Reference previously published articles when submitting letters to the editor or op-eds. This increases the likelihood of earning coverage. Avoid arguments over data and project specifics. Instead, generate responses that elevate the positive benefits and economic impact of watershed restoration.

MEASURING SUCCESS

Track the impact of outreach by setting up metrics for success. The success of a comprehensive communications and outreach plan will be measured by the effectiveness and impact of the strategies and tactics. Create detailed measures of success for each goal in advance. Measures should be both qualitative and quantitative, including:

The quality of:

- Landowner testimonials and profiles
- Collected quotes
- One-on-one conversations
- Written feedback collected at meetings
- Opinion leader and media briefings

The number of:

- Coalition members recruited
- Media hits generated
- Events and participants attending
- E-communication open rates
- Data from online surveys such as Survey Monkey or Zoomerang to conduct quick temperature-checks

Evaluate these measures on an annual basis. Use the evaluation as a learning tool to strengthen communications and outreach work moving forward. The point of measurement is to assess efforts and find ways to improve, whenever possible. Test along the way and routinely review and adjust the approach as needed.

TIMELINE

MAY–JUNE 2012

PARTNER COLLABORATION	▪ Review communications plan with working group in each watershed; assign near-term roles and responsibilities ▪ Compile a list of agencies and organizations in the watershed relevant to restoration that should be involved in the coalition ▪ Recruit potential partners to attend initial organizational meeting ▪ Hold the organizational meeting (model group decision-making and problem-solving) o Brief partners on the research findings and communications and outreach plan o Establish common purpose o Discuss proposed coalition structure o Select a consistent meeting time ▪ Hold first official coalition meeting within 30 days o Revise and finalize official coalition structure and statement of purpose o Affirm Cascadia as coordinating partner in the Entiat o Rename the coalition in the Entiat o Create logo and brand for the MRC o Select coordinating partner in the Methow o Identify roles and responsibilities of each partner ▪ Develop a coalition flow chart and tag responsibilities to different coalition members ▪ Create partners reference list, including contact information, websites and Facebook pages ▪ Create a comprehensive calendar of community events to attend, sponsor or host a coalition booth ▪ Train coalition partners on key messages
MEDIA	▪ Monitor local media and generate responses as needed (identify interim lead to manage)

KEY DELIVERABLES:

- Formal coalition structure with coordinating partners in place
- Coalition flow chart
- Partners reference list
- Calendar of community events
- Message training for coalition partners
- Interim media monitor in place

JULY–SEPTEMBER 2012

PARTNER COLLABOR-ATION	▪ Create a practical evaluation framework to measure the success of communication and outreach strategies and tactics ▪ Hold regular (monthly or bimonthly) coalition meetings

COMMUNICATION TOOLS	▪ Begin review of partners' existing communication materials
	  o Identify materials that need refinement to align with key messages
	  o Assess additional materials needs, including landowner FAQ and one-pager on economic benefits
	▪ Create print and digital materials, starting with landowner FAQ and one-pager on economic benefits
	  o Work with USCRB to identify data points for materials
	▪ Develop a library to begin collecting quotes from landowners and opinion leaders

LANDOWNERS	▪ With input from coalition, create initial list of landowners, including those involved with past and current projects and those targeted for relationship building
	  o Identify landowners to recruit for earned media efforts
	▪ Host summer barbeque with targeted landowners and opinion leaders
	  o Send follow up email to all invited and present participants
	▪ Create coalition e-newsletter
	  o Design template
	  o Write content
	  o Distribute through coalition channels

OPINION LEADERS	▪ With input from coalition, create initial list of opinion leaders, including those involved with past and current projects and those targeted for relationship building o Identify opinion leaders to recruit for earned media
MEDIA	▪ Monitor local media and generate responses when needed ▪ Create press packet ▪ Identify targeted local media and invite them to tour project site ▪ Build a list to track story ideas to pitch to media

KEY DELIVERABLES:

- Priority communication materials, including landowner FAQ, press packet and economic benefits one-pager
- Coalition e-newsletter
- Summer barbeque
- Project site tours with media

OCTOBER–DECEMBER 2012

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings ▪ Assess progress using the evaluation framework
COMMUN-ICATION TOOLS	▪ Collect quotes from landowners and opinion leaders ▪ Write and assemble landowner profiles and testimonials
LAND-OWNERS	▪ Distribute first quarterly e-newsletter ▪ Create a list of landowners to target for one-on-one conversations ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer
OPINION LEADERS	▪ Brief targeted opinion leaders on research findings, communications and outreach
MEDIA	▪ Monitor local media and generate responses as needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Begin local media outreach and share current and upcoming restoration projects ▪ Add to rolling list of story ideas to pitch to media ▪ Pitch story to key local media

KEY DELIVERABLES:

- Coalition e-newsletter
- Landowner profiles and testimonials
- Opinion leader briefings
- Media brief and pitch

JANUARY–MARCH 2013

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings
COMMUN-ICATION TOOLS	▪ Distribute quarterly e-newsletter ▪ Continue to collect quotes from landowners and opinion leaders
LAND-OWNERS	▪ Hold two to three one-on-one landowner conversations over coffee, food or beer
OPINION LEADERS	▪ Identify opportunities for speaking engagements ▪ Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses as needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Add to rolling list of story ideas to pitch to media ▪ Recruit targeted landowners and opinion leaders for media training ▪ Conduct media training

KEY DELIVERABLES:

- Coalition e-newsletter
- Media training for landowners and opinion leaders

APRIL–JUNE 2013

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings ▪ Update the annual calendar of community events to attend, sponsor or host a coalition booth ▪ Create coalition microsites and Facebook pages o Launch microsites and Facebook pages for coalitions
COMMUN-ICATION TOOLS	▪ Continue to collect quotes from landowners and opinion leaders
LAND-OWNERS	▪ Distribute quarterly e-newsletter to landowners ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer
OPINION LEADERS	▪ Identify opportunities for speaking engagements ▪ Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses when needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Brief key local media on project updates ▪ Add to rolling list of story ideas to pitch to media ▪ Pitch story to key local media

KEY DELIVERABLES:

- Coalition e-newsletter
- Media brief and pitch
- Calendar of events
- Coalition microsites

JULY–SEPTEMBER 2013

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings
COMMUN-ICATION TOOLS	▪ Continue to collect quotes from landowners and opinion leaders
LAND-OWNERS	▪ Distribute quarterly e-newsletter ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer ▪ Host summer barbeque with targeted landowners and opinion leaders o Send follow up email to all invited and present participants
OPINION LEADERS	▪ Identify opportunities for speaking engagements o Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses when needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Add to rolling list of story ideas to pitch to media ▪ Hold project site tour for local media

KEY DELIVERABLES:

- Coalition e-newsletter
- Summer barbeque
- Project site tours with media

OCTOBER–DECEMBER 2013

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings ▪ Assess progress using the evaluation framework
COMMUN-ICATION TOOLS	▪ Continue to collect quotes from landowners and opinion leaders ▪ Update landowner profiles and testimonials in web materials
LAND-OWNERS	▪ Distribute quarterly e-newsletter ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer
OPINION LEADERS	▪ Identify opportunities for speaking engagements o Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses when needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Add to rolling list of story ideas to pitch to media ▪ Pitch story to key local media

KEY DELIVERABLES:

- Coalition e-newsletter
- Landowner profiles and testimonials
- Media brief and pitch

JANUARY–MARCH 2014

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings
COMMUN-ICATION TOOLS	▪ Continue to collect quotes from landowners and opinion leaders ▪ Update landowner profiles and testimonials in web materials
LAND-OWNERS	▪ Distribute quarterly e-newsletter ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer
OPINION LEADERS	▪ Identify opportunities for speaking engagements o Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses when needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Add to rolling list of story ideas to pitch to media ▪ Hold media training for any new coalition members or community spokespeople

KEY DELIVERABLES:

- Coalition e-newsletter
- Media training for landowners and opinion leaders

APRIL–JUNE 2014

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings ▪ Update the annual calendar of community events to attend, sponsor or host a coalition booth
COMMUN-ICATION TOOLS	▪ Continue to collect quotes from landowners and opinion leaders
LAND-OWNERS	▪ Distribute quarterly e-newsletter ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer
OPINION LEADERS	▪ Identify opportunities for speaking engagements o Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses when needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Brief key local media on project updates ▪ Add to rolling list of story ideas to pitch to media ▪ Pitch story to key local media

KEY DELIVERABLES:

- Coalition e-newsletter
- Media brief and pitch
- Calendar of events

JULY–SEPTEMBER 2014

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings
COMMUN-ICATION TOOLS	▪ Continue to collect quotes from landowners and opinion leaders
LAND-OWNERS	▪ Distribute quarterly e-newsletter ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer ▪ Host summer barbeque with targeted landowners and opinion leaders o Send follow up email to all invited and present participants
OPINION LEADERS	▪ Identify opportunities for speaking engagements o Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses when needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Add to rolling list of story ideas to pitch to media ▪ Hold project site tour for local media

KEY DELIVERABLES:

- Coalition e-newsletter
- Summer barbeque
- Project site tours with media

OCTOBER–DECEMBER 2014

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings ▪ Assess progress using the evaluation framework ▪ Conduct internal assessment of communications strategy and revise as needed
COMMUN-ICATION TOOLS	▪ Continue to collect quotes from landowners and opinion leaders ▪ Update landowner profiles and testimonials in web materials
LAND-OWNERS	▪ Distribute quarterly e-newsletter ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer
OPINION LEADERS	▪ Identify opportunities for speaking engagements o Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses when needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Add to rolling list of story ideas to pitch to media ▪ Pitch story to key local media

KEY DELIVERABLES:

- Coalition e-newsletter
- Landowner profiles and testimonials
- Media brief and pitch

JANUARY–MARCH 2015

PARTNER COLLABOR-ATION	▪ Hold regular coalition meetings ▪ Implement communications and outreach strategy changes as needed
COMMUN-ICATION TOOLS	▪ Continue to collect quotes from landowners and opinion leaders ▪ Update landowner profiles and testimonials in web materials
LAND-OWNERS	▪ Distribute quarterly e-newsletter ▪ Hold two to three one-on-one landowner conversations over coffee, food or beer
OPINION LEADERS	▪ Identify opportunities for speaking engagements o Recruit and prep opinion leaders to speak
MEDIA	▪ Monitor local media and generate responses when needed o If response is needed, send designated landowners email alerts with talking points and online links to comment on news articles or submit letters to the editor ▪ Add to rolling list of story ideas to pitch to media ▪ Hold media training for any new coalition members or community spokespeople

KEY DELIVERABLES:

- Coalition e-newsletter
- Media training for landowners and opinion leaders

APPENDIX A

ELECTED OFFICIALS

County Commissioners

Chelan County:

- Ron Walter, Commissioner District 1, ron.walter@co.chelan.wa.us, 509-667-6215
- Keith Goehner, Commissioner District 2, keith.goehner@co.chelan.wa.us, 509-667-6215
- Doug England, Commissioner District 3, doug.england@co.chelan.wa.us, 509-667-6215

Okanogan County:

- Andrew Lampe, Commissioner District 1, 509-422-7100
- Don (Bud) Hover, Commissioner District 2, 509-422-7100
- Jim Detro, Commissioner District 3, 509-422-7100

Mayors

Entiat:

- Keith Vradenburg, kvradenburg.city@entiat.org, 509-784-1500

Twisp:

- Mayor Soo Ing-Moody, townmayor@townoftwisp.com, 509-997-4081

Wenatchee:

- Mayor Frank Kuntz, 509-888-6204

Winthrop:

- Mayor Dave Acheson, mayor@townofwinthrop.com, 509-966-2320

City Council

Entiat:

- Bill Haven, Mayor Pro Tem, notbhaven1@yahoo.com, 509-784-1500
- Tom Martin, Council Position 1, 509-784-1500
- Ellen Warren, Council Position 3, 509-784-1500
- Cheri Wire, Council Position 4, 509-784-1500
- Lalla Przespolewski, Council Position 5, 509-784-1500

Twisp:

- Bob Lloyd, Council Position 1, 509-997-4081

- Clinton Estes, Council Position 2, 509-997-4081
- Traci Day, Council Position 3, 509-997-4081
- John Fleming, Council Position 4, 509-997-4081
- Hans Smith, Council Position 5, 509-997-4081

Wenatchee:

- Jim Bailey, Council Position 1, 509-662-2751
- Tony Veeder, Council Position 2, 509-665-6981
- Karen Rutherford, Council Position 3, 509-662-2039
- Doug Miller, Council Position 4, 509-393-6323
- Mark Kulaas, Council Position 5, 509-884-7173
- Linda Herald, Council Position 6, 509-630-0309
- Bryan Campbell, Council Position 7, 509-630-0725

Winthrop:

- Rick Northcott, Council Position 1, council@townofwinthrop.com, 509-996-2320
- Tiffany Langdalen, Council Position 2, council@townofwinthrop.com, 509-996-2320
- Gaile Bryant-Cannon, Council Position 3, council@townofwinthrop.com, 509-996-2320
- Lance Christensen, Council Position 4, council@townofwinthrop.com, 509-996-2320
- Mortee Banasky, Council Position 5, council@townofwinthrop.com, 509-996-2320

APPENDIX B

MEDIA OUTLET CONTACT INFORMATION

Newspapers

Chelan:

- ***Lake Chelan Mirror***, http://www.lakechelanmirror.com, mirror@lakechelanmirror.com, 509- 682-2213

Entiat:

- ***The Entiat Leader***, entiatleader@yahoo.com, 509-264-0783

Twisp:

- ***Methow Valley News***, http://www.methowvalleynews.com, editor@methowvalleynews.com, 509-997-7011

Wenatchee:

- ***The Wenatchee Business Journal***, http://wbjtoday.com/, wbjnews@businessjournal.org, 509-663-6730
- ***Wenatchee World***, http://www.wenatcheeworld.com, newsroom@wenatcheeworld.com, 509-663-5161

Radio

Chelan:

- KOZI, http://kozi.com, jay@kozi.com, 509- 682-4033

Twisp:

- KCSY-FM, http://www.kcsyfm.com, sunnyfm@kcsyfm.com, 509-997-5857

Wenatchee:

- KAAP-FM, http://www.applefm.com, news@fisherwen.com, 509-665-6565
- KKRT-AM, http://www.kkrt.com, gary.patrick@morris.com, 509-663-5186
- KKRV-FM, http://www.kkrv.com, 509-663-5186
- KPLW-FM, http://www.plr.org, kplw@plr.org, 509-665-6641
- KPQ-AM, http://www.kpq.com, info@kpq.com, 509-663-5121
- KPQ-FM, http://www.thequake1021.com, news@kpq.com, 509-663-5121
- KWLN-FM, http://www.lanuevaradio.com, 509-663-5186
- KWNC-AM, http://www.lasuperz.com, kwnc@crcwnet.com, 509-664-6424
- KWWW-FM, http://www.kw3.com, jconnor@cherrycreekradio.com, 509-665-6565
- KWWX-FM, http://www.lasuperz.com, eesparza@cherrycreekradio.com, 509-665-6565

- KYSN-FM, http://www.kysn.com, swright@cherrycreek.com, 509-665-6565
- KZNW-AM, http://www.lasuperz.com, 509-665-6565

Winthrop:

- KTRT-FM, http://www.radioroot.com, 509-996-8200

Television

Spokane:

- KAYU-TV, http://www.myfoxspokane.com, kayutv@kayutv.com, 509-448-2828
- KGPX-TV, http://www.ionline.tv, 509-340-3405
- KHQ-TV, http://www.khq.com, q6news@khq.com, 509-448-4656
- KREM-TV, http://www.krem.com, newsdesk@krem.com, 509-448-2000
- KSKN-TV, http://www.krem.com/cwtv, feedback@krem.com, 509-448-2000
- KSPS-TV, http://www.ksps.org, ksps@ksps.org, 509-354-7800
- KXLY-TV, http://www.kxly.com, news4@kxly.com, 509-324-4004
- KXMN-TV, http://www.mykxmn.com, 509-324-4004

Wells, Rocky Reach, and Rock Island HCP Tributary Committees Notes 14 February 2013

Members Present: Dale Bambrick (NOAA Fisheries), Lee Carlson (Yakama Nation), Jeremy Cram (WDFW), Chris Fisher (Colville Tribes), Steve Hays (Chelan PUD), Tom Kahler (Douglas PUD), and Tracy Hillman (Committees Chair).

Members Absent: Kate Terrell (USFWS).

Others Present: Becky Gallaher (Tributary Project Coordinator).

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans Tributary Committees met in the Chelan PUD Auditorium in Wenatchee, Washington, on Thursday, 14 February 2013 from 10:00 am to 12:15 pm.

I. Review and Adopt Agenda

Tracy Hillman welcomed everyone to the meeting. Tracy introduced Jeremy Cram as the WDFW representative on the Tributary Committees. Carmen Andonaegui will serve as the alternate.

The Committees reviewed and adopted the proposed agenda with the following additions:

- Wenatchee Nutrient Enhancement Study Update.
- Icicle Diversion Update.
- Shingle Creek Update.

II. Review and Approval of Meeting Minutes

The Committees reviewed and approved the 10 January 2013 meeting notes with edits.

III. Monthly Update on Ongoing Projects

Becky Gallaher gave an update on funded projects. Most are progressing well or had no salient activity in the past month.

- Chewuch River Instream Flow Project – The sponsor (Trout Unlimited – WWP) continues to refine the reservoir permit. A meeting is planned for mid-February to resolve any issues. All other work is on hold until the reservoir permit is resolved.
- Coulter Creek Barrier Replacement Project – Funding for this project is contingent upon the successful implementation of the railroad reconnection project, which has not yet happened.
- Wenatchee Levee Removal and Riparian Restoration Project – The sponsor (Chelan County Natural Resources Department) continues to coordinate with the landowner on water rights issues. The landowner is working with the irrigation district to ensure all of his water needs will be met in case there are issues with his current claim.

- Entiat Stormy Reach Phase 2 Acquisition – The project is complete and the project sponsor submitted a final report.

Becky indicated that she is having difficulty receiving project updates from sponsors. The Committees suggested adding a clause in future contracts that states that payments may be withheld if sponsors do not submit monthly updates on project status.

IV. Review of Policies and Procedures Documents

The Committees reviewed the edits made by Tracy Hillman and Tom Kahler. Tom described some of the issues he identified in the Policies and Procedures for Funding Projects document. What follows are the issues identified by Tom.

- Under Section 3.8 (Management Guidelines for Conservation Easements/Acquired Lands), there is language that indicates that the Committees "reserve the right to require public access on conservation easements or lands acquired with Plan Species Account funds." This statement is inconsistent with the July 2012 meeting notes, which state that all protection projects funded by the Committees will have public access. The Committees agreed that the Policies and Procedures document should say that all protection projects funded by the Committees will have public access except under extraordinary circumstances. In addition, the Committees agreed to include language in this section that states that the project sponsors will allow restoration if deemed necessary and that the restoration actions must be approved by the Committees.
- Under Section 4.2 (Eligible Projects and Elements), the Committees agreed to add language that indicates that they may provide a one-time fee for the development of a stewardship plan for acquisition projects.
- After reviewing the revised SRFB manual (SRFB Manual 3 Acquisition Projects), Tom identified additional elements that could be added to the list of administration costs associated with acquisitions. These elements are listed under Section 4.4 (Administrative and Support Costs) in the Policies and Procedures document. The Committees reviewed the list provided by Tom and agreed to most of the elements. Advertising and contract award correspondence were elements not approved by the Committees.
- Tom indicated that the revised SRFB manual (SRFB Manual 5 Restoration Projects) also included additional elements associated with Architectural and Engineering Services (A&E) and Administrative costs for restoration projects (identified under Section 4.4 in the Policies and Procedures document). Currently, A&E costs cannot exceed 15% of the total restoration cost and administration costs cannot exceed 15% of the total restoration cost. Although the Committees questioned the percentages, they agreed to be consistent with the SRFB. They were unclear as to how one calculates and codes the percentages. For example, are subcontractor A&E and admin costs included in the 30%? Dale Bambrick indicated that he will speak with the Washington State Recreation and Conservation Office on how they calculate and code A&E and admin costs for restoration projects. Chris Fisher said that he will contact his engineer to see what they include as A&E and admin costs.

Based on these discussions, Tracy Hillman and Tom Kahler will update the language in the Policies and Procedures document. The Committees will review the revised language during their March meeting.

The Committees also reviewed their Operating Procedures. They approved the minor edits made to the document (i.e., changed the name of the WDFW representative on the Committees).

V. Rocky Reach and Rock Island HCP Action Plans for 2013

Steve Hays provided the Committees with the Draft Rocky Reach and Rock Island HCP Tributary Committees Action Plans for 2013. The 2013 Action Plan for both Rocky Reach and Rock Island Tributary Committees is as follows:

- Plan Species Account Deposit: January 2013
- GSHP Project solicitation: March through July 2013
- GSHP Project Approval: May through August 2013
- GSHP Project Implementation: Ongoing
- Small Project Review and Approval: January through December 2013
- Small Project Implementation: Ongoing

The Rocky Reach and Rock Island Tributary Committees approved the Rocky Reach and Rock Island Action Plans for 2013.

VI. Small Projects Program Application: Okanogan Basin Stream Discharge Monitoring Project

The Committees reviewed a Small Projects Program application from the Confederated Tribes of the Colville Reservation titled *Okanogan Basin Stream Discharge Monitoring Project*.

Okanogan Basin Stream Discharge Monitoring Project

The purpose of this project is to fund the monitoring of stream flows for two years within two tributaries to the Okanogan River (likely Loup Loup and 9-Mile creeks). The two-year period will allow the Colville Tribes enough time to find a long-term funding source. The total cost of the project is $94,924. The sponsor requested $62,984 from HCP Tributary Funds. Because of a lack of information, the Committees were unable to make a funding decision. They identified the following issues:

1. The sponsor needs to confirm that the gauges will be placed in Loup Loup and 9-Mile creeks. The proposal indicates that they will likely be placed in these streams. The Committees would like more certainty that they will indeed be placed in these streams.
2. The sponsor needs to provide information indicating that the water that is being monitored in the two streams is protected in trust (i.e., the water is not available for agricultural consumption).
3. The sponsor needs to describe the monitoring equipment and whether it is already at the USGS sites, or if it needs to be installed at the sites.
4. The sponsor needs to fix the budget so the Committees know the exact amount they are requesting from the Committees and the total amount of the project. The budget on the first page is inconsistent with the detailed budget on the last page. In addition, the amounts in the detailed budget add up to $106,924, which exceeds the upper limit for the Small Projects Program.

The Committees directed Tracy Hillman to share these concerns with the project sponsor. In addition, if the sponsor is able to send an electronic copy of the revised proposal to the Committees, the Committees will make a funding decision before their next meeting.

VII. Information Updates

The following information updates were provided during the meeting.

1. Approved Payment Requests in January and February:

   Rock Island Plan Species Account:

   - $92,748.13 to Trout Unlimited – Washington Water Project for pipe for the Lower Wenatchee Instream Flow Enhancement Project.

   Rocky Reach Plan Species Account:

   - $1,904.12 to Chelan-Douglas Land Trust for the Entiat Stormy Reach Phase 2 Acquisition. This is the final invoice for this project.

   Wells Plan Species Account:

   - $198.28 to the Methow Salmon Recovery Foundation for the Twisp River Acquisition (Hovee Property). This is the final invoice for this project.

2. Tracy Hillman reported that he and Becky Gallaher completed Section 2.6 (Tributary Committees and Plan Species Accounts) for the Annual Report of Activities under the Anadromous Fish Agreement and Habitat Conservation Plan for each hydroelectric project. Members of the Committees should soon receive the draft reports for their review. The final reports will be submitted to the Federal Energy Regulatory Commission in April.

3. Becky Gallaher reported that the PUDs deposited funds into each of the Plan Species Accounts at the end of January. Chelan PUD deposited $690,515 into the Rock Island Account and $327,041 into the Rocky Reach Account. Douglas PUD deposited $250,729 into the Wells Account.

4. Tracy Hillman reported that he and Becky will attend the Annual 13th Funding Round Debrief meeting in Chelan on 21 February. The purpose of the meeting is to discuss potential changes to the funding process, identify potential concerns and solutions, and outline the funding schedule. Steve Hays indicated that he will also try to attend the debrief meeting.

5. Tracy Hillman shared with the Committees the draft Funding Process Schedule (see Attachment 1). Pre-proposals will be delivered to the Tributary Committees on 7 May and the Committees will review the pre-proposals during their May and June meetings (9 May and 13 June). Project tours are scheduled for 29-30 May (Methow and Okanogan) and 5-6 June (Wenatchee and Entiat). Pre-proposal presentations will occur on 12 June. Final proposals will be delivered to the Tributary Committees on 12 July. The Committees will make funding decisions on 8 August. This gives the Committees about 3.5 weeks to review the final proposals.

6. Tracy Hillman reported that Jason Lundgren gave a presentation to the RTT on the Wenatchee Nutrient Assessment – Treatment Design Project, which was funded in part by the Rock Island Tributary Committee. The baseline results indicate that the Wenatchee River basin is nutrient poor (oligotrophic). The researchers reported low levels of nutrients and low levels of periphyton. They also indicated that macroinvertebrate abundance was low, but species richness was relatively high. Tracy asked the Committees if they would like to invite Jason to the March meeting to discuss his results. The Committees said they would like to see a copy of the PowerPoint presentation, but there is no need for Jason to present to the Committees at this time. The presentation is appended to these notes as Attachment 2.

7. Dale Bambrick indicated that he attended a meeting last week to discuss an integrated plan for the Peshastin and Icicle Creek diversions. Dale said that he is recommending that

the water pump station be located on the Wenatchee River upstream from the Peshastin Creek confluence. This would be a more reasonable approach than placing the pump station downstream from the Peshastin Creek confluence (near Alice Avenue). The pump station would contribute water to both the Peshastin Irrigation District canal and the Icicle Irrigation District canal.

8. Chris Fisher reported that the managers, engineers, and bios met to discuss the three options for fish passage at Shingle Creek Dam. Recall that the three options were (1) backwater the dam with a series of riffles, (2) notch the dam and backwater with a series of riffles, and (3) remove the dam. Chris said that because of deterioration of the dam, the engineers and managers recommended that the dam be removed. This is consistent with the recommendation from the Tributary Committees in November 2012.

VIII. Next Steps

The next meeting of the Tributary Committees will be on Thursday, 14 March 2013 at Chelan PUD in Wenatchee.

Meeting notes submitted by Tracy Hillman (tracy.hillman@bioanalysts.net).

Attachment 1

Proposed 2013 SRFB/GSHP/BPA Process Schedule

DRAFT Upper Columbia Lead Entity Funding Process Schedule				
DATE	**ACTIVITY/MILESTONE**	**PARTICIPANTS**	**LOCATION**	**LEAD**
FEBRUARY				
Feb 21	**Meeting**: SRFB/TRIB Debrief for 2012	LE, RTT, Sponsors, TRIB	Lake Chelan PUD	LE
February	**Meeting:** Sponsor Meetings Begin	Project Sponsors, LE, Data Steward	Wen, Okan, Methow	LE
MARCH				
March 13	**Meeting:** RTT Biological Strategy Approved & Sponsor RTT Dialog	Sponsors, BOR, RTT	TBD	RTT
March 15	**Deadline:** All active and completed projects updated in HWS	Sponsors, data steward	HWS	Data Steward
March 27	**Meeting**: SRFB/TRIB/BPA Kickoff Meeting for the Region	LE, RTT, TRIB, BPA, Sponsors, RCO	Chelan	LE
APRIL				
April (TBD)	**Meeting/Workshop:** Sponsor Science Workshop	Sponsors, BOR, RTT, Agencies, Independent scientists, LE	TBD	LE/Region
April 30	**Deadline**: Projects are submitted to PRISM via HWS to initiate a new project	Sponsors, Data Steward, LE	HWS	LE
MAY				
May 7	**DEADLINE: DRAFT PROPOSALS DUE (*must be 3 weeks prior to tours*)**	Sponsors, LE, RCO, SRP, RTT, CAC, TRIB, BPA	Prism	LE

DRAFT Upper Columbia Lead Entity Funding Process Schedule				
DATE	**ACTIVITY/MILESTONE**	**PARTICIPANTS**	**LOCATION**	**LEAD**
MAY				
May 12	**Meeting/Call**: Discuss project tour logistics	RTT, LE, TRIB, SRFB Panel Members, and Sponsors?	Call	LE
May 29 & 30	**Meeting/Tours**: SRFB/TRIB/BPA Project Tours · 29th Methow (Wed) · 30th Okanogan (Thur)	RTT, LE, TRIB, BPA, SRFB SRP, and Project Sponsors	TBD	LE
JUNE				
June 5 & 6	**Meeting/Tours**: SRFB/TRIB/BPA Project Tours · 5th Wenatchee (Wed) · 6th Entiat (Thur)	RTT, LE, TRIB, BPA, SRFB SRP, and Project Sponsors	TBD	LE
June 12	**Meeting/Presentations**: Draft Proposal Presentations to Reviewers	Project Sponsors, CAC, RTT, LE	River Bank, Twisp	LE
June 13	**Action:** TRIB reviews draft proposals	TRIB	Tributary Committee Meeting	TRIB
June 20	**Action:** TRIB provides comments on draft proposals	TRIB	Tributary Committee Meeting	TRIB
JULY				
July 12	**DEADLINE: FINAL PROPOSALS DUE** to LE for regional review	Sponsors, LE, RTT, CAC, TRIB, BPA	Prism	LE

DRAFT Upper Columbia Lead Entity Funding Process Schedule				
DATE	**ACTIVITY/MILESTONE**	**PARTICIPANTS**	**LOCATION**	**LEAD**
July 17/18 or 24/25 31/Aug1 (TBD)	**Meeting/Presentations**: Proposal Presentations to CACs	Project Sponsors, CAC, RTT, LE	River Bank, Twisp	LE
AUGUST				
August 8	**Action:** TRIB reviews final proposals	TRIB	Tributary Committee Meeting	TRIB
August 14	**Action:** RTT Meeting formal project reviews and technical ranking	RTT, CAC, LE, Region, BPA, BOR	RTT Meeting	LE
August 14	**DEADLINE: FINAL PROPOSALS DUE** to RCO	Sponsors, LE, RCO, SRP, RTT, CAC, TRIB, BPA	Prism	LE
August 20	**Action:** TRIB preliminary decisions	TRIB, LE	Email via LE	TRIB
August 21 or 22 (TBD)	**Meeting**: Chelan CAC project rankings	CAC, LE	Wenatchee	LE
August 21 or 22 (TBD)	**Meeting**: Okanogan CAC project rankings	CAC, LE	River Bank Twisp	LE
August 28 or 29 (TBD)	**Meeting**: Regional joint CAC approves final combined ranked list	Joint CAC, LE	Lake Chelan PUD?	LE
SEPTEMBER				
Sept 6	**Deadline:** LE & Regional Organization submits Final Ranked List to SRFB	LE/Region	Email	LE
OCTOBER				

DRAFT Upper Columbia Lead Entity Funding Process Schedule				
DATE	**ACTIVITY/MILESTONE**	**PARTICIPANTS**	**LOCATION**	**LEAD**
Oct 17	**Deadline:** Response from Project Sponsors to SRP comment forms	Project Sponsors, LE	email	LE
Oct 21-24	**Meeting/Presentations**: LE and project sponsors present projects (*only projects identified by SRP*)	Select Project Sponsors, LE, Region	Olympia	LE/Region
Oct 30	**Action**: SRP panel finalizes comments	SRP	Email	SRP
NOVEMBER				
November	**Action:** TRIB decisions	TRIB	Email	TRIB
November	Final report by SRP to SRFB	RCO		RCO
DECEMBER				
December	**Action: SRFB Decisions**	SRFB	Olympia	RCO
December	TRIB supplemental decisions	TRIB		TRIB

Acronyms

- *CAC Citizen's Advisory Committee*
- *BPA Bonneville Power Administration*
- *LE Lead Entity Program*
- *RCO Recreation and Conservation Office*
- *Region UCSRB*
- *RTT Regional Technical Team*
- *SRP State Review Panel*
- *SRFB Salmon Recovery Funding Board*
- *TRIB Tributary Committee*

Attachment 2

PowerPoint Presentation on the Wenatchee Nutrient Assessment – Treatment Design Project

ATTACHMENT 2:

PowerPoint Presentation on the Wenatchee Nutrient Assessment – Treatment Design Project

Wenatchee Nutrient Assessment - Treatment Design

Regional Technical Team Presentation
February 13, 2013

Cascade Columbia Fisheries Enhancement Group

Washington Water Project of Trout Unlimited

Background

- Previous Nutrient Treatment by USFWS
- Ongoing Nutrient Assessments in Methow by Yakama Nation
- 2010 – SRFB/Trib "Fish Toss" (WDFW/UCRFEG)
- 2011 – Nutrient Enhancement Feasibility
- 2011 – Open solicitation – Wenatchee Nutrient Assess. Treatment Design
- 2012 – First Year Effort

Project Need

- "The need and magnitude of adding nutrients is not well understood and this assessment unit should be part of an ESU wide plan to **determine where, how and how much nutrient supplementation is required**." *RTT Biological Strategy*
- UCSRP: nutrient restoration as important "delivering food for juvenile salmon, nutrients for riparian plants and benthic macro invertebrates."
- "many factors that must be evaluated prior to nutrient enrichment; these include baseline nutrient status" *RTT: 2010 Analysis Workshop Synthesis Report*
- Nutrient Enhancement, Tier 2 Priority Action, Wenatchee Sub basin Wide. *RTT Priorities for Reaches*

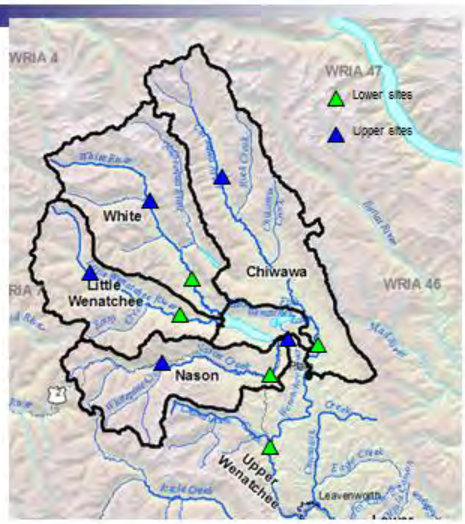
Wenatchee Nutrient Assessment – Treatment Design

- YEAR 1 SUMMARY: 2012

OUTLINE

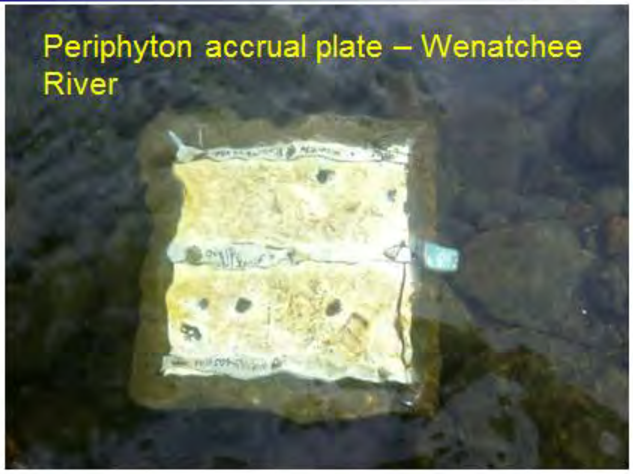
- YEAR 1 WORK SUMMARY
- SUMMARY OF RESULTS OF SAMPLING
  - WATER & PERIPHYTON
  - NUTRIENT LIMITATION METRICS
- OVERVIEW OF WATERSHED LOADS AND RESTRICTIONS
- OPPORTUNITIES FOR NUTREINT ENHANCEMENT
  - OTHER INFORMATION NEEDED
- MOVING FORWARD – 2013 AND BEYOND
- Notes:
  - TMDL refers to total maximum daily load for pH and DO that limits P loads in Wenatchee Watershed
  - ug/L = ppb

Attachment 2



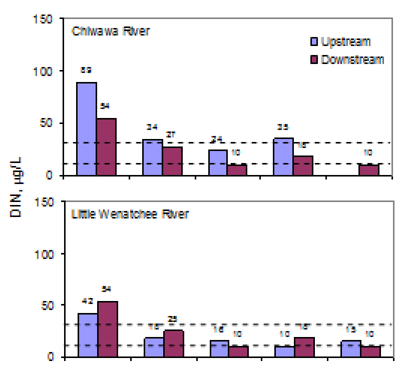
WORK SUMMARY

- Quality Assurance Project Plan (QAPP) - June
  - 10 sites, upper and lower sites on each river
- Water Sampling -
  - Grabs – 1x per month; JUNE – OCTOBER
    - TP, TDP, ORTHO-P, TN, NOx-N, NH_4-N, DO, pH, turbidity, temperature
  - Continuous logger - one week in late August
    - 5 stations (lower river sites)
    - pH, DO, temp, conductivity
    - Evaluate natural conditions for temp, pH and DO
- Periphyton -
  - Accrual plates – Lower river sites; JULY 31 – SEPTEMBER 30TH
    - Rate of growth f(nutrients, temp, flow)
    - Pendant logger attached records temperature and light.
  - Peak biomass sampling – Rock scraping 1x in September all 10 sites
- Invertebrates –
  - Secondary productivity – 1x per month on White River, June – Oct
  - Annual bioassessment – September all 10 sites



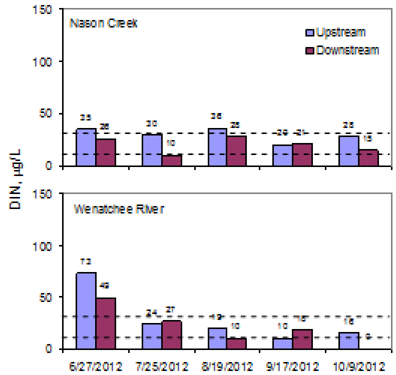
Invertebrate sampling –
EWU Dr. Camille McNeely and Conor Giorgi

Water Sampling – Dissolved inorganic nitrogen DIN = sum of NH4-N, NOx-N



N deficient < 30 – 50 ug/L

Detection limit = 10 ug/L

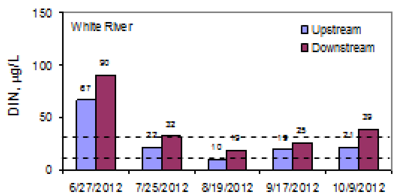


N deficient < 30-50 ug/L

Detection limit = 10 ug/L

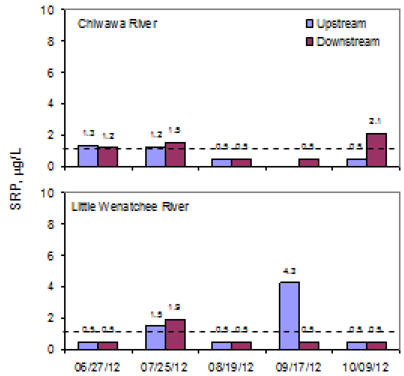
N deficient < 30-50 ug/L

Detection limit = 10 ug/L



Water sampling results -
Soluble reactive phosphorus (srp)
Most bioavailable form of phosphorus

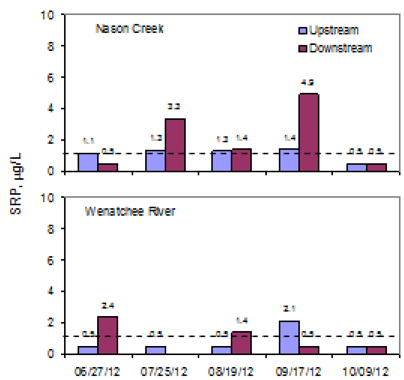
Attachment 2



P deficient <1 ug/L

Detection limit = l ug/L

Target during nutrient enhancement 3 -5 ug/L



P deficient <1 ug/L

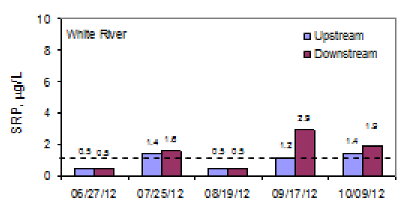
Detection limit = l ug/L

Target during nutrient enhancement 3 -5 ug/L

P deficient <1 ug/L

Detection limit = l ug/L

Target during nutrient enhancement 3 -5 ug/L



Preliminary Nutrient Assessment

Type of periphytic nutrient limitation (P, N, N&P, saturation) during the growing season (July - Oct) concluded from first year of water and periphyton sampling (mean:type of limitation, e.g. 2: N&P)

	N & P Limitation Threshold				
	srp	TDP	DIN	DIN/srp	Summary
	<1 ug/L[1]	<2 - 5 ug/L[1]	<50 - 50ug/L	>10	of Limits
Wenatchee River					
Lower	1: P	2: P	28: N	22: P	N&P
Upper	1: P	2: P	29: N	35: P	N&P
Nason Creek					
Lower	2: X	5: X	20: N	9: X	P
Upper	1: P	2: P	30: N	26:P	N&P
Little Wenatchee River					
Lower	1: P	2: P	24: N	30: P	N&P
Upper	1: P	2: P	20: N	14: P	N&P
White River					P
Lower	2: X	5: X	59: X	22: P	
Upper	1: P	1: P	28: N	28: P	N&P
Chiwawa River					
Lower	1: P	2: P	24: N	20: P	N&P
Upper	1: P	1: P	46: X	51: P	P

TDP = total dissolved phosphorus; NS: No sample;

DIN: dissolved inorganic nitrogen (NH4-N, NO3-N and NO2-N)

[1] Ashley, K. I., and J. G. Stockner. 2003. Protocol for Applying Limiting Nutrients to Inland Waters. In: Nutrients in Salmonid Ecosystems: Sustaining Production and Biodiversity. Ed. J. Stockner. American Fisheries Society Symposium 34.

Periphyton Analysis:
(end of season rock scraping)

Periphyton Accumulation	AFDW	Chl-a	
	g/m2	mg/m2	
Nason Creek			
Lower	4	11	
Upper	2	6	
Yakama Coho EIS	5 - 16	10 - 13	
Little Wenatchee R.			
Lower	5	8	
Upper	2	6	
White R.			
Lower	3	7	
Upper	2	12	
Chiwawa R.			
Lower	12	15	
Upper	NS	NS	fires
Wenatchee R.			
Sleepy Hollow Bridge (RM 3.2)	14	47	
WA DOE RM 2.5 &10.5	21, 24	--	
WA DOE RM 21.0	74	--	
Lower (RM 35.4)	8	14	
WA DOE RM 35.4	5	--	
Upper	11	21	
WA DOE samples collected for TMDL			

Elwha River: AFDW (above dams) ranged from 1 – 7 g/m2 (Morley et al. 2008)

Periphyton Analysis

- Chl-a density (mg/m2) and Ash Free dry weight similar to other ultra oligotrophic rivers
- Species diversity is low, productivity is low, indicative of lack of nutrients

Preliminary results and conclusions

Summary of Year 1 Assessment

- All rivers appear very low in nutrients (ultra oligotrophic <4 ug/L TDP and srp)
- Year 1 data and TMDL data
  - Mean srp (ug/L) = 1.4 (n = 26)
  - TMDL Background srp not to be exceeded = 4.7 ug/L
  - All rivers much lower than background level
- Should be "room" for nutrient enhancement
- *Second year of data will strengthen dataset*

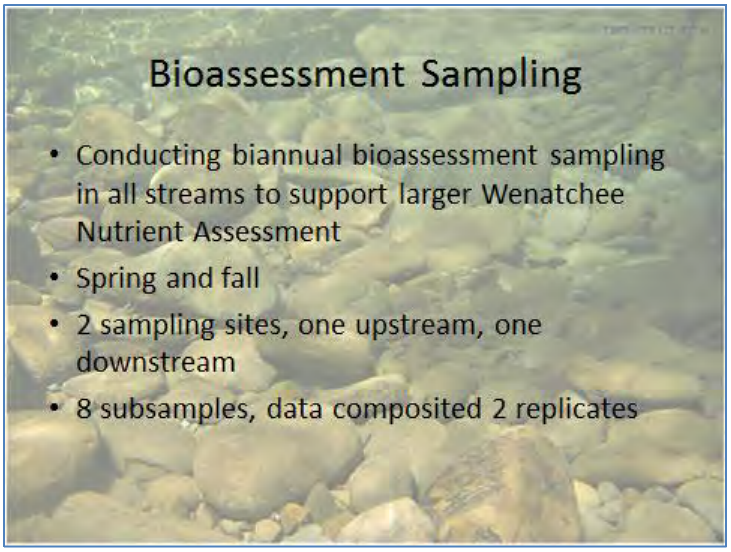
Wenatchee Nutrient Assessment – Benthic Macroinvertebrates –

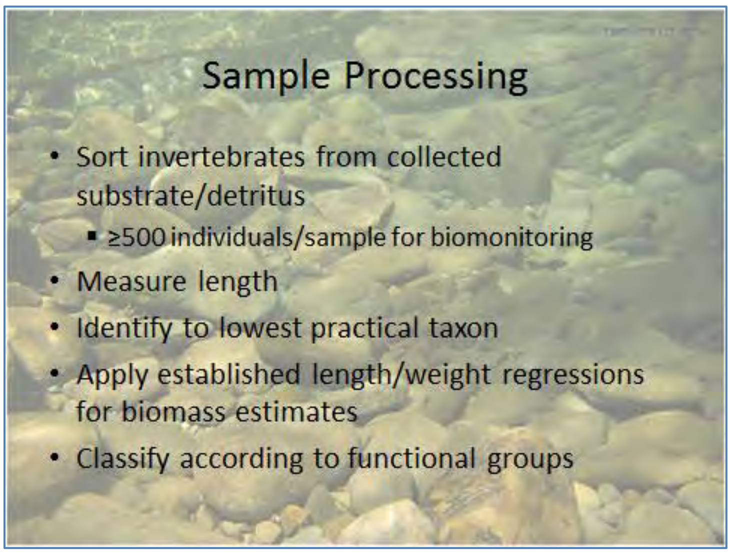
Conor Giorgi

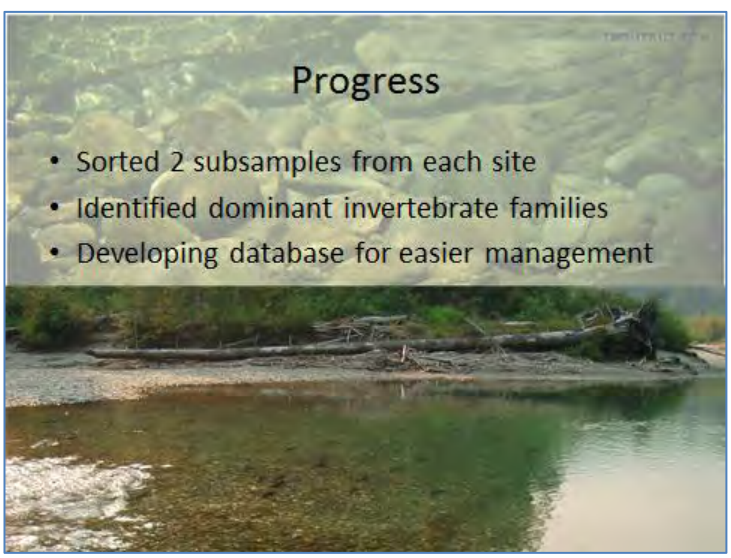
Eastern Washington University

Objectives

1. Conduct a bioassessment of all rivers
   a) Use indices of stream health (e.g. Hilsenhoff Biotic Index) and other macroinvertebrate metrics
   b) Characterize macroinvertebrate community by taxa and functional groups
2. Determine the impact of a salmon mediated nutrient subsidy on macroinvertebrate production in the White River
   a) Use error propagation to calculate 95% confidence intervals for production above and within spawning reach


Bioassessment Sampling
• Conducting biannual bioassessment sampling in all streams to support larger Wenatchee Nutrient Assessment
• Spring and fall
• 2 sampling sites, one upstream, one downstream
• 8 subsamples, data composited 2 replicates


Sample Processing
• Sort invertebrates from collected substrate/detritus
▪ ≥500 individuals/sample for biomonitoring
• Measure length
• Identify to lowest practical taxon
• Apply established length/weight regressions for biomass estimates
• Classify according to functional groups


Progress
• Sorted 2 subsamples from each site
• Identified dominant invertebrate families
• Developing database for easier management

Attachment 2

Bioassessment Metrics

Metric	Units
Density	Numbers/m²
Biomass	g/m²
Richness	Overall number of species sampled
Evenness	Relative abundance of species
EPT Richness	Number of species in Ephemeroptera, Plecoptera and Trichoptera
% EPT	% of species in Ephemeroptera, Plecoptera and Trichoptera
Predator richness	Number of species in "Predator" functional group
Scraper richness	Number of species in "Scraper" functional group
% Filterers	% of "Filterer" functional group
% Predator	% of "Predator" functional group
% Scraper	% of "Scraper" functional group
Shannon	Shannon's index of diversity
Hilsenhoff Biotic Index	HBI Scores

Preliminary Results

- Invertebrate communities of all systems are taxonomically similar
  - Dominant Taxa:

  - Rare taxa also present
  - High richness
  - Low abundance

Preliminary Results - HBI

- HBI Scores (0 = great, 10 = bad)
  - Dominant Taxa mostly ≤4
  - Some 1's and 0's
  - Chironomids = 6

Preliminary Results – Functional Groups

Habit
- Clingers
- Swimmers
- Burrowers

Feeding
- Scrapers
- Gatherers

White River Secondary Production

- 2 sampling sites, one above, one within spawning reach
- Regular sampling intervals over 1 year
- 5 replicate samples per site, per event
- Total 130 samples

Calculating Production: Size-Frequency Method

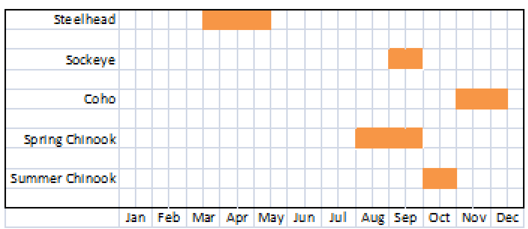
- Taxon specific
- Individuals sorted into size (length) classes
  - Track change in density and weight of individuals over time
- Correct for cohorts per year
- Calculation requires 1 year of data, anticipated completion December 2013
- Error Propagation to generate 95% confidence intervals of production, compare reaches

Implications

- High water quality with low pollutants (including dissolved nutrients)
- Low relative abundance
- Production estimates in White River may give insight to if and how other systems are limited

Enhancement? Where, When, How

- TMDL –
  - Applies to Nason Creek, Chiwawa River, and upper Wenatchee River
  - Load restrictions from March – October
- First approach –
  - Simulate Coho returns – Enhancement in November, and December on all rivers
  - Second year and final report to determine where



Enhancement? Where, When, How

- Second Approach
  - Enhancement during late summer or early fall on all rivers
  - Need depends on completes assessment
  - Where (based on Yr 1 results and watershed conditions)
    - Little Wenatchee – summer, fall, winter
    - White River? Already has big sockeye run, does it need more?
    - Nason Creek? Deficient but must condider Steven Pass wastewater facility discharge
    - Chiwawa River? Where?
    - Upper Wenatchee River? Where?
  - Clarify locations in final report


Salmon Analogs

Moving Forward

- Open Solicitation - Application for Nutrient Enhancement in 2013
  - Define geographic scope, loading, costs, and logistics.
- Final Report in 2013
  - Guidelines for monitoring, permitting, and implementation (where, how, when)
  - Developed with WA DOE
- Outreach to stakeholders and public

Acknowledgements

- PRCC, Yakama Nation, Tributary Committee, SRFB
- WDOE (Jim Yates, Charlie McKinney, Sanjay Barik)
- John Jorgenson, Keely Murdoch, Yakama Nation, Andrew Murdoch, Ken Bevis, WDFW, Casey Baldwin, Colville Confederated Tribe, Tony Meyer, Lower Columbia RFEG, CCFEG Board, many others who have helped and provided info along the way.

Wells, Rocky Reach, and Rock Island HCP Tributary Committees Notes 14 March 2013

Members Present: Dale Bambrick (NOAA Fisheries), Lee Carlson (Yakama Nation), Jeremy Cram (WDFW), Chris Fisher (Colville Tribes), Steve Hays (Chelan PUD), Tom Kahler (Douglas PUD), Kate Terrell (USFWS), and Tracy Hillman (Committees Chair).

Others Present: Becky Gallaher (Tributary Project Coordinator).

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans Tributary Committees met in the Chelan PUD Auditorium in Wenatchee, Washington, on Thursday, 14 March 2013 from 10:00 am to 12:15 pm.

I. Review and Adopt Agenda

Tracy Hillman welcomed everyone to the meeting and the Committees adopted the proposed agenda with the following additions:

- Review a Small Projects Application from Cascade Columbia Fisheries Enhancement Group.
- Peshastin Creek Riparian Restoration Project.
- Shingle Creek Update.

II. Review and Approval of Meeting Minutes

The Committees reviewed and approved the 14 February 2013 meeting notes with edits.

III. Monthly Update on Ongoing Projects

Becky Gallaher gave an update on funded projects. Most are progressing well or had no salient activity in the past month.

- Twisp River Riparian Protection Project (Zinn) – The conservation easement has been negotiated and is near final draft. All due diligence is complete, pending a final site inspection. The stewardship plan is in development and closing should occur in early May.
- Nason Creek Upper White Pine Reconnection – Chelan PUD Powerline Reconnection Alternatives Analysis – The sponsor (Chelan County Natural Resources Department) will meet with Chelan PUD and US Forest Service upper management to determine how to address the PUD corridor in the project area. The sponsor hopes to receive direction from both parties on how to proceed with the powerline relocation and restoration activities.
- Nutrient Enhancement Assessment – Data from the first year of sampling have been compiled and presented to stakeholders. The contractor (Water Quality Engineers) collected water samples at the monitoring sites during late February 2013. Researchers are still analyzing the macroinvertebrates collected last fall. The sponsor (Cascade

Columbia Fisheries Enhancement Group) will hold a meeting with Washington Department of Ecology (WDOE) on 14 March to begin the process of developing an interim agreement for implementing nutrient enhancement based on initial findings.

- Large Wood Atonement Project – The sponsor (Cascade Columbia Fisheries Enhancement Group) has convened four small-scale public meetings (included a subset of Lake Wenatchee and White River residents). The purpose of the meetings was to help identify and work through issues. Although the project has been progressing well, recently, one resident has voiced skepticism. However, the sponsor believes they are making progress on both social and technical issues. A public meeting will be held on 30 March. The sponsor prepared a "Recreational Considerations" paper to address potential concerns from recreationalists. The sponsor also floated the project reach on 26 February to determine how much new wood was recruited to the channel from the recent winter storms. The sponsor counted about 25 new pieces of wood within a four-mile reach. Implementation is scheduled to occur in 2013; however, it may need to be pushed into 2014 pending community support.

  The Rock Island Committee voiced concern over the possible delay in the implementation of the project. If the contract ends in 2013, the Committee directed Tracy Hillman to send an e-mail to the project sponsor indicating that the Rock Island Committee encourages the sponsor to implement the project in 2013. *Following the meeting, Becky reviewed the contract and noted that the contract terminates at the end of 2014. Therefore, there is no need for Tracy to send an e-mail to the sponsor.*

- Nason Creek Lower White Pine Alcove Acquisition Project – The sponsor (Chelan-Douglas Land Trust) has secured options on all three parcels. Larry Rees (Committees' approved appraiser) will begin the appraisals mid to late March, with appraisals completed in late May. The Yakama Nation is planning to implement a restoration project on the property.

- Coulter Creek Barrier Replacement Project – Funding for this project is contingent upon the successful implementation of the railroad reconnection project, which has not yet happened.

- Lower Foster Creek Steelhead Habitat Enhancement Project – Becky sent the Tributary Committee/Sponsor Agreement to the sponsor (Foster Creek Conservation District) for their review.

- Twisp River-Poorman Creek Wetland Habitat Acquisition – The sponsor (Methow Salmon Recovery Foundation) has requested the initiation of an appraisal. Becky has requested necessary information from the sponsor for engaging the appraiser, but has not yet received the information from the sponsor.

- Shingle Creek Fish Passage Project – The Tributary Committee/Sponsor Agreement is ready for signature.

IV. Review of Policies and Procedures Documents

The Committees reviewed and approved the edits made by Tracy Hillman and Tom Kahler to the Policies and Procedures for Funding Projects document. The Committees reviewed Section 4.4 (Administrative and Support Costs) of the Policies and Procedures document. They also reviewed the elements associated with Architectural and Engineering Services (A&E) and Administrative costs for restoration projects identified in the Salmon Recovery Funding Board (SRFB) Manual 5 Restoration Projects document. After discussion, the Committees agreed that the items described in the SRFB document were appropriate and should be included in the Policies and Procedures document. Rather than listing all the items in the Policies and Procedures document, the Committees agreed to reference the SRFB document. Thus, the language in the Policies and Procedures document reads:

> *Acceptable Architectural and Engineering Services and Administrative costs are provided on pages 11-15 in Section 2 of the SRFB Manual 5 Restoration Projects document (see: http://www.rco.wa.gov/documents/manuals&forms/Manual_5.pdf). A&E costs cannot exceed 15% of the total restoration cost and Administrative costs cannot exceed 15% of the total restoration cost.*

The Committees will share the revised Policies and Procedures document with project sponsors during the SRFB/TC/BPA kick-off meeting on 27 March in Chelan, WA.

V. Small Projects Program Applications

In February, the Committees reviewed a Small Projects Program application from the Confederated Tribes of the Colville Reservation titled *Okanogan Basin Stream Discharge Monitoring Project*. The purpose of this project was to fund the monitoring of stream flows for two years within two tributaries to the Okanogan River. The two-year period will allow the Colville Tribes enough time to find a long-term funding source. The total cost of the project was $94,924. The sponsor requested $62,984 from HCP Tributary Funds. The Committees were unable to make a funding decision in February and asked the sponsor for additional information.

On 20 February, the Colville Tribes submitted a revised proposal, which the Committees reviewed prior to the March meeting. The Colville Tribes indicated that the gauges would be placed in Loup Loup and Nine-Mile creeks. In addition, the Tribes revised the budget. The total cost of the project is $90,954. The Tribes requested $74,984 from the HCP Tributary Funds. ***The Rocky Reach Tributary Committee approved funding for this project.***

In March, the Committees received a Small Projects Program application from Cascade Columbia Fisheries Enhancement Group titled *Methow/Chewuch Shallow Groundwater Monitoring Project*.

Methow/Chewuch Shallow Groundwater Monitoring Project

The purpose of this project is to establish groundwater monitoring sites on three floodplain parcels owned by WDFW to determine if it is feasible to pursue habitat restoration projects in these areas. The three parcels are the Silver Side Channel Complex (Methow River downstream from Twisp), Lewisia Floodplain (middle Methow River), and the Burns-Garrity Floodplain (lower Chewuch River). These sites were selected because they contain remnant channel features and there is evidence of shallow groundwater. The total cost of the project is $39,390. The sponsor requested $35,790 from HCP Tributary Funds. ***The Wells Tributary Committee approved funding for this project.*** However, the Committee identified the following conditions and concerns:

- The cost of the monitoring project appeared excessive and the sponsor provided little detail in the budget. The Committee requested that the sponsor provide a more detailed budget. [*Following the meeting, the sponsor provided the Committee with a revised budget: total cost = $34,180; request from the Wells Committee = $30,580*]
- The project requires the purchase of 12 piezometers equipped with continuously recording water surface elevation and temperature data loggers. The Committee will provide the sponsor with the funding needed to purchase the monitoring equipment. Once the monitoring work is completed, the sponsor will need to return the equipment to the Wells Committee.

VI. SRFB/TC Debrief Meeting

Tracy Hillman, Becky Gallaher, and Steve Hays attended the SRFB/TC Debrief Meeting in Chelan, WA, on 21 February 2013. The purpose of the meeting was to discuss potential changes to the funding process, identify potential concerns and solutions, and outline the funding schedule. Most of the issues discussed during the meeting dealt with the SRFB process. However, a few project sponsors had concerns or questions for the Tributary Committees. For example, Julie Grialou, Methow Conservancy, voiced her concern about the Committees' policy that requires public access on conservation easements and lands acquired with Plan Species Account funds. She understood that access was for bird watching and river access, but wondered who would police activities such as camping, picnics, parties, keggers, etc. She was concerned that public access would also result in bank and vegetation disturbances and littering. She asked if the Committees would provide additional funds to police, clean up, and restore the property. She also asked if the policy applied to all past protection projects funded by the Committees. Jessica Goldberg, Methow Salmon Recovery Foundation, voiced concerns about using the Committees' appraisers, who lack knowledge about the local markets.

With regard to the public access concerns, the Committees laid out specific guidelines for public access in the Policies and Procedures document. Although public access shall be provided on all conservation easements and lands acquired with Plan Species Account funds, there is no requirement to post public access signs, establish trails, or provide parking. The requirement is that public access is restricted to foot access and will be provided at all times. There shall be no impediments to foot access (e.g., fences) and the access cannot devalue the habitat being protected. The Committees do not require the easement or property-title holder to provide any improvements to facilitate access or to accommodate ADA standards. The public access policy applies to all protection projects funded by the Committees beginning in 2012.

An outcome of the debrief meeting was a final funding schedule for 2013 (see Attachment 1). The following dates are relevant to the Tributary Committees. Pre-proposals will be delivered to the Tributary Committees on 7 May and the Committees will review the pre-proposals during their May and June meetings (9 May and 13 June). Project tours are scheduled for 29-30 May (Methow and Okanogan) and 5-6 June (Wenatchee and Entiat). Pre-proposal presentations will occur on 12 June. Final proposals will be delivered to the Tributary Committees on 12 July. The Committees will make funding decisions on 8 August. This gives the Committees about 3.5 weeks to review the final proposals.

VII. Information Updates

The following information updates were provided during the meeting.

1. Approved Payment Requests in February and March:

   Rock Island Plan Species Account:

   - $16,920.32 to Trout Unlimited – Washington Water Project for contract labor on the Lower Wenatchee Instream Flow Enhancement Project.
   - $8,770.08 to Chelan County Natural Resources Department for the Wenatchee Levee Removal and Riparian Restoration Project.

   Rocky Reach Plan Species Account:

   - $8,247.50 to Trout Unlimited – Washington Water Project for permitting on the Chewuch River Instream Flow Project.

2. Dale Bambrick indicated that WDOE's Office of the Columbia River is interested in helping fund pump stations for the Peshastin Irrigation District canal and the Icicle Irrigation District canal. Dale said that his idea of developing one pump station, located on the Wenatchee River upstream from the Peshastin Creek confluence, would not work for both canal systems. Operation of a single pump station would be too expensive. Therefore, parties would like to conduct a feasibility study to evaluate the development of two pump stations. The feasibility study would cost about $325,000. The Priest Rapids Coordinating Committee (PRCC) Habitat Subcommittee is reviewing the project and may contribute up to $200,000 toward the feasibility study.
3. Chris Fisher reported that the Cascadia Conservation District met with him to discuss riparian restoration work on lower Peshastin Creek. Recall that in October and again in November 2012, Cascadia Conservation District submitted a Small Projects Application seeking funds to improve and restore riparian areas along a contiguous section of Peshastin Creek from RM 0.6 to 1.4. The Committees elected not to fund the project because it appeared the proposed project fit better with Farm Bill Programs such as the Conservation Reserve Enhancement Program (CREP) and the proposed approach would have questionable success. The Committees said that the sponsor should use smaller plants (plugs) and plant them deep so the roots could tap into groundwater. This would minimize the need for irrigation. Chris indicated that the sponsor is willing to use plugs and plant them late in the season. This should address some of the concerns the Committees raised with the original proposal. Chris asked the Committees if they would like to see a new proposal from the sponsor. The Committees indicated that they would be more interested in the project if the reestablishment of riparian vegetation was part of a bank protection/stabilization project. The Committees believe that planting without bank stabilization would be unsuccessful because of the high energy, unstable nature of the channel in the proposed reach. Chris will share this information with Cascadia Conservation District.
4. Chris Fisher reported that the managers, engineers, and bios met in February to discuss the three options for fish passage at Shingle Creek Dam. The three options were (1) backwater the dam with a series of riffles, (2) notch the dam and backwater with a series of riffles, and (3) remove the dam. Chris said that because of deterioration of the dam, the engineers and managers recommended that the dam be removed. Dam removal was selected as the preferred alternative. This is consistent with the recommendation from the Tributary Committees in November 2012. The Okanagan Nation Alliance will develop a cost estimate by May 2013. The project should be completed by September 2013.

VIII. Next Steps

If necessary, the next meeting of the Tributary Committees will be on Thursday, 11 April 2013 at Chelan PUD in Wenatchee.

Meeting notes submitted by Tracy Hillman (tracy.hillman@bioanalysts.net).

Attachment 1

Final 2013 SRFB/GSHP/BPA Process Schedule

Final Upper Columbia SRFB Lead Entity & TRIB Funding Process Schedule				
DATE	**ACTIVITY/MILESTONE**	**PARTICIPANTS**	**LOCATION**	**FACILITATOR/ COORDINATOR**
MARCH				
March 25	**Meeting/Webinar**: SRFB Application Workshop	Sponsors, RCO	Online Webinar	RCO
March 27	**Meeting**: SRFB/TRIB/BPA Kick-Off Meeting	LE, RTT, TRIB, BPA, Sponsors, RCO	Chelan, WA. Fire District	LE
March 31	**Deadline:** All active and completed projects updated in HWS	**Sponsors**, LE	HWS	LE
APRIL				
Beginning in April	**Meeting:** Sponsor Meetings Begin	LE, Sponsors	Region wide	LE
April 30	**Deadline**: Projects are submitted to HWS to initiate a new project in Prism	**Sponsors**, LE	HWS	LE
MAY				
May 7	**DEADLINE: DRAFT PROPOSALS DUE**	**Sponsors**, LE, RCO, SRP, RTT, CAC, TRIB, BPA	Prism	LE
May 12	**Meeting/Call**: Discuss project tour logistics	LE, RTT, TRIB, SRP, Sponsors	Call	LE
May 14 & 15	**Salmon Recovery Conference**	All	Vancouver, WA	RCO

Final Upper Columbia SRFB Lead Entity & TRIB Funding Process Schedule

DATE	ACTIVITY/MILESTONE	PARTICIPANTS	LOCATION	FACILITATOR/ COORDINATOR
May 29 & 30	**Meeting/Tours**: SRFB/TRIB/BPA Project Tours ~29th Methow (Wed) ~30th Okanogan (Thur)	**Sponsors**, LE, RTT, TRIB, BPA, SRFB SRP	TBD	LE
		JUNE		
June 5 & 6	**Meeting/Tours**: SRFB/TRIB/BPA Project Tours ~5th Wenatchee (Wed) ~6th Entiat (Thur)	**Sponsors**, LE, RTT, TRIB, BPA, SRFB SRP	TBD	LE
June 12	**Meeting/Presentations**: Draft Proposal Presentations to RTT and other Reviewers	**Sponsors**, RTT, CAC, LE	TBD	RTT Chair
June 13	**Action:** TRIB reviews draft proposals	TRIB	Tributary Committee Meeting	TRIB
June 20	**Action:** TRIB provides comments	TRIB	Email	TRIB
June 20	**Action:** RTT provides comments	RTT	Email via LE	RTT Chair
June 21	**Action:** SRP provides comments	SRP	Email via LE	RCO
June 24 or 25	**Meeting/Workshop:** Sponsor Science Workshop	LE, Sponsors, BOR, RTT, Agencies	TBD	LE/Science and Reporting Program
		JULY		

Final Upper Columbia SRFB Lead Entity & TRIB Funding Process Schedule				
DATE	**ACTIVITY/MILESTONE**	**PARTICIPANTS**	**LOCATION**	**FACILITATOR/ COORDINATOR**
July 12	**DEADLINE: FINAL PROPOSALS DUE** for Regional Review	**Sponsors**, LE, RTT, CAC, TRIB, BPA	Prism	LE
AUGUST				
August 8	**Action:** TRIB reviews final proposals	TRIB	Tributary Committee Meeting	TRIB
August 14	**Action:** RTT technical ranking	RTT, CAC, LE, BPA, BOR	RTT Meeting (TBD)	RTT
August 14	**DEADLINE: FINAL PROPOSALS & PRISM UPLOAD DUE** to RCO	**Sponsors**, LE, RCO, SRP	Prism	LE
August 20	**Action:** TRIB Decisions	TRIB	Email/Letter	TRIB
August 20-22 (TBD)	**Meeting/Presentations**: Presentations to Chelan and Okanogan CACs	**Sponsors**, CAC, RTT, LE	Wenatchee Irrigation Dist. & River Bank, Twisp	LE
August 27 -29 (TBD)	**Meeting**: Chelan/Okanogan CAC project rankings	CAC, LE	Wenatchee Irrigation Dist. & River Bank, Twisp	LE
SEPTEMBER				
Sept 3 or 4 (TBD)	**Meeting**: Regional joint CAC approves Final Ranked Project List	Joint CAC, LE	Chelan PUD, Chelan WA	LE
Sept 6	**Deadline:** LE submits Final Ranked Project List to SRFB	LE	Email	LE
OCTOBER				

Final Upper Columbia SRFB Lead Entity & TRIB Funding Process Schedule				
DATE	**ACTIVITY/MILESTONE**	**PARTICIPANTS**	**LOCATION**	**FACILITATOR/ COORDINATOR**
Oct 4	**Action**: SRP panel provides comments	SRP	Email via LE	SRP
Oct 17	**Deadline:** Response from Project Sponsors to SRP comments	**Sponsors**, LE	Email via LE	LE
Oct 21-24	**Meeting/Presentations**: LE and project sponsors present projects (*only projects identified by SRP*)	Select **Sponsors**, LE, Region	Olympia, Washington	LE
Oct 30	**Action**: SRP panel finalizes comments	SRP	Email via LE	SRP
NOVEMBER				
November	**Upper Columbia Science Conference**	All	Wenatchee, WA	UCSRB
November	Final report by SRP to SRFB	RCO		RCO
DECEMBER				
December	**Action: SRFB Decisions**	SRFB	Olympia, WA	RCO

Acronyms

CAC- Citizen's Advisory Committee
BPA- Bonneville Power Administration
LE- Lead Entity Program
RCO- Recreation and Conservation Office
SRP- State Review Panel
SRFB- Salmon Recovery Funding Board
TRIB- Tributary Committee
UC- Upper Columbia Region
UCRTT- Upper Columbia Regional Technical Team
UCSRB- Upper Columbia Salmon Recovery Board

Timeline Legend	
Meetings	Blue
Deadlines	Red
Conferences	Purple
Actions	Black

Wells, Rocky Reach, and Rock Island HCP Tributary Committees Notes 9 May 2013

Members Present: Dale Bambrick (NOAA Fisheries), Lee Carlson (Yakama Nation), Jeremy Cram (WDFW), Chris Fisher (Colville Tribes), Steve Hays (Chelan PUD), Tom Kahler (Douglas PUD), Kate Terrell (USFWS), and Tracy Hillman (Committees Chair).

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans Tributary Committees met in the Chelan PUD Auditorium in Wenatchee, Washington, on Thursday, 9 May 2013 from 10:00 am to 12:05 pm.

I. Review and Adopt Agenda

Tracy Hillman welcomed everyone to the meeting and the Committees adopted the proposed agenda with the following additions:

- Request from the Upper Columbia Salmon Recovery Board (UCSRB).
- Methow Valley Irrigation District (MVID) developments.

II. Review and Approval of Meeting Minutes

The Committees reviewed and approved the 14 March 2013 meeting notes.

III. Monthly Update on Ongoing Projects

Tracy Hillman gave an update on funded projects. Most are progressing well or had no salient activity in the past month.

- Lower Wenatchee Instream Flow Enhancement Project – The project is complete. The new irrigation system was up and running by 5 April. All service connections were installed by the end of April, and the six miles of ditch (now a road) and the pump station site have been cleaned up and vegetated. Shareholders who have connected to the system are pleased with the water pressure. The Rock Island Tributary Committee will receive a final report soon.
- Twisp River Riparian Protection Project (Zinn) – Closing on this property will occur in early May. The Rock Island Committee is waiting for the Purchase and Sale Agreement before transferring funds to escrow.
- Nutrient Enhancement Assessment – On 8 April, the sponsor (Cascade Columbia Fisheries Enhancement Group), Trout Unlimited, and Water Quality Engineering met with Tracy Hillman, Jeremy Cram, Keely Murdoch, and John Jorgenson to discuss how to proceed with establishing a nutrient enhancement treatment in the Upper Wenatchee Tributaries, and to what extent they should try to capture a treatment response. The sponsor is developing a nutrient treatment plan to submit through the open solicitation process, but they are struggling with how much effectiveness monitoring is needed and

how to get monitoring funded. An AmeriCorps member has been assisting the subcontractors with data collections.

- Large Wood Atonement Project – The sponsor (Cascade Columbia Fisheries Enhancement Group) convened a public meeting on 30 March. The decision to implement the project next year (2014) comes down to a few critical components: (1) WDFW does not have time to engage as a landowner/stakeholder this year because of staff constraints; (2) the sponsor needs to continue building public support; and (3) they have some technical and recreational elements to more fully develop before the sponsor can say they have done their due diligence. Because of the location of the project and experience with the Grant PUD acclimation project, the community is sensitive to anything being proposed in the White River basin. The sponsor has spent most of April following up with people from the meeting and strategizing with the USFWS and the CCFEG Board of Directors about how to move the project forward. On 3 April, the sponsor and the USFWS presented the project to the Chelan-Douglas Land Trust (CDLT) Stewardship Committee. The Committee raised no major concerns.

- Coulter Creek Barrier Replacement Project – Funding for this project is contingent upon the successful implementation of the railroad reconnection project, which has not yet happened.

- Wenatchee Levee Removal and Riparian Restoration Project – The sponsor (Chelan County Natural Resources Department) met with the landowner and discussed alternatives to moving his diversion. The landowner is concerned about converting the existing surface diversion to a well, primarily because of poor water quality from the well and potential water-rights issues. However, the landowner does want to move forward with removing the levee and restoring the riparian area. The sponsor is coordinating with WDFW to determine the best approach for removing the levee, short and long-term maintenance of the diversion, improving the existing diversion, and obtaining all necessary permits. Once the sponsor secures the necessary permits, they will quickly remove the levee. WDFW indicated that the current side channel does provide off-channel habitat, which is limiting in the lower Wenatchee River. Improving the current surface diversion along with improvements to the side channel, including removal of the levee and restoring riparian vegetation, may be the best approach at this time. The landowner will decide next week if the diversion should be moved.

- Upper Beaver Habitat Improvement Channel Restoration Project – This project is scheduled to begin autumn 2013. The sponsor (Methow Salmon Recovery Foundation) has been working with the project engineer (Anchor QEA) and the permitting staff to ensure that project elements are fully detailed and reviewed before implementation at the end of the irrigation season. The primary issues being resolved during this period include: (1) coordination with WDFW to ensure that the fish screen / screen box satisfies passage requirements for the flow reduction associated with the 2011 Trout Unlimited water purchases and (2) coordination with the ditch users to identify and resolve any outstanding design or maintenance concerns. The Batie Ditch users do not have a formal organization or formal decision-making process, requiring substantial individual efforts to ensure that each landowner has had the opportunity to raise issues for consideration and action where appropriate. The final task requiring attention during this period has been the ongoing coordination with Okanogan County Public Works for those portions of the project where work is required within or adjacent to the Okanogan County right-of-way. The sponsor expects all of these issues to be resolved well in advance of the construction schedule.

- Lower Foster Creek Steelhead Habitat Enhancement Project – Becky Gallaher sent the Tributary Committee/Sponsor Agreement to the sponsor (Foster Creek Conservation District) for their review.
- Twisp River-Poorman Creek Wetland Habitat Acquisition – The sponsor (Methow Salmon Recovery Foundation) has requested the initiation of an appraisal. The appraisal is scheduled to begin the first week of May and should be completed by mid-May.
- Shingle Creek Fish Passage Project – Chris Fisher reported that he and Wayne Cornwall, Colville Confederated Tribes engineer, met with the Okanagan Nation Alliance to discuss the removal of Shingle Creek Dam. He said that the Penticton Indian Band needs to decide if they want the wing wall removed. If they do, Wayne will design a hardened-rock toe in place of the wall. There should be a decision soon. Chris also noted that all the regulatory agencies that would approve permits are aware of the project. Chris believes that the final design will be completed in late-May or June. Wayne is currently in the final process of getting his certification so he can work in Canada. Construction should occur sometime in August or September. Wayne believes it will take only two weeks to complete the project.
- Methow/Chewuch Shallow Groundwater Monitoring Project – The sponsor (Cascade Columbia Fisheries Enhancement Group) continued to coordinate with WDFW and Fogle Pump & Supply on logistics and installation of monitoring equipment. The sponsor installed a water-level logger on the Silver Side Channel and measured discharge there. They attempted to install monitoring wells in April, but found that large cobbles prevented them from digging the wells by hand. Therefore, the contractor used a small, rubber-tracked mini-excavator to help dig monitoring wells. Groundwater monitoring wells are now installed and water-level loggers have been deployed. Continuous water-level data are being collected in all groundwater monitoring wells and the Silver Side Channel.

IV. Small Projects Program Applications

The Committees reviewed two Small Projects Program applications, both from Trout Unlimited-Washington Water Projects.

Beaver Creek Late Season Well Installation Project

The purpose of this project is to determine the feasibility of removing a landowner from a surface diversion on Beaver Creek during the period 1 August to 15 September. The sponsor will install a well and conduct a pump test to assess the production of the well. If the pump test is successful, the sponsor will seek funds for the second phase of the work, which is to install the pumps, mainline, and electrical hookup. If the conversion from surface water to well water is successful, a total of about 0.3 cfs could be saved permanently in trust. The total cost of the project is $16,396.72. The sponsor requested $16,396.72 from HCP Tributary Funds. After careful review of the proposal, ***the Tributary Committees were unable to make a funding decision,*** because additional information is needed from the sponsor. The Committees identified the following questions:

1. Will the Redshirt Ditch be completely shut down for the entire year and the point-of-diversion removed, or will the ditch be used during periods other than August through mid-September?
2. If the ditch is used during other periods of the year, has the point-of-diversion been upgraded and are the fish screens in compliance with state regulations?

3. If the diversion is screened, what is the cost of maintaining the screen?
4. Why would the well only be used during the August through mid-September period?

The Committees indicated that the sponsor can respond to these questions in an e-mail. They do not need to submit a revised proposal. After the Committees receive and review responses to their questions, they will make a funding decision.

Antoine Creek Feedlot Relocation Project

The purpose of this project is to improve water quality and riparian conditions in Antoine Creek, a steelhead stream in the Okanogan River basin, by moving an existing feedlot about 1.5 miles away from the stream. This action will significantly reduce nutrient loading and habitat degradation along 3,450 feet of Antoine Creek, and increase instream flows by about 18.2 gpm from October through February. The total cost of the project is $97,533. The sponsor requested $37,533 from HCP Tributary Funds. After careful review of the proposal, ***the Tributary Committees decided to table the proposal,*** because there is a possibility that the Colville Confederated Tribes will fund the entire project. Chris Fisher indicated that he will check internally to see if the Tribes can fund the entire project. He will report his findings to the Committees before the next meeting.

V. Budget Amendment Request

The Wells Tributary Committee received a budget amendment request from Cascade Columbia Fisheries Enhancement Group (CCFEG) on the Methow/Chewuch Shallow Groundwater Monitoring Project. The sponsor indicated that a Cultural Resource Survey was not necessary for this project. Therefore, they asked to move the Cultural Resource Survey funds ($4,500) to Sponsor Salaries and Benefits, and Contract Labor. Specifically, they asked to move $3,000 to Sponsor Salaries and Benefits, and $1,500 to Contract Labor.

After reviewing the request, **the Wells Committee was unable to approve the amendment request** without additional information. The Committee questioned why the sponsor proposed to shift $3,000 to Sponsor Salaries and Benefits. The Committee thought that the entire $4,500 should be moved to Contract Labor. The Committee requested that the sponsor describe why they want to move a large percentage of the Cultural Resource Survey funds to Sponsor Salaries and Benefits. Finally, the Committee asked that the sponsor provide written documentation indicating that a Cultural Resource Survey is not necessary. The Committee found it odd that no Cultural Resource Survey is required.

VI. General Salmon Habitat Program (GSHP) Pre-Proposals

The Committees received a list of the General Salmon Habitat Program and Salmon Recovery Funding Board pre-proposals. Of the 23 pre-proposals on the list, 14 requested funds from the Tributary Committees. The Committees reviewed the list of pre-proposals with the intent of identifying which projects the Committees would like to visit in the field. During the June meeting, the Committees will identify which pre-proposals will have no chance or a low likelihood of receiving funding from the Tributary Committees. The following table summarizes which projects the Committees would like to visit.

Project Title	Sponsor	Request Site Visit
Entiat Canal System Phase III Project	Cascadia Conservation District	No
Chiwawa Nutrient Enhancement Project	Cascade Columbia Fisheries Enhancement Group	No
Nason Creek RM 4.6 Side Channel Reconnection Project	Chelan County Natural Resources Department	No
Peshastin Irrigation District Pump Exchange Design Project	Chelan County Natural Resources Department	No
Peshastin BRG Channel Construction Project	Chelan County Natural Resources Department	Yes
Camas Creek Fish Passage Project	Chelan County Natural Resources Department	Yes
Entiat Stillwaters Grayreach Acquisitions	Chelan-Douglas Land Trust	Yes
Nason Creek UWP Horseshoe Bend Acquisitions	Chelan-Douglas Land Trust	Yes
Silver Side Channel Design	Cascade Columbia Fisheries Enhancement Group	Yes
Janis Rapids Side Channel Project	Cascade Columbia Fisheries Enhancement Group	Yes
Twisp to Carlton Reach Assessment	Cascade Columbia Fisheries Enhancement Group	No
M2 3R Floodplain and Side Channel Project	Methow Salmon Recovery Foundation	Yes
Similkameen RM 3.8 Spawning Habitat Design	Okanogan Conservation District	Yes
MVID Instream Flow Improvement Project	Trout Unlimited	Yes

Project tours are scheduled for 29-30 May in the Okanogan and Methow basins, and 5-6 June in the Wenatchee and Entiat basins. Becky Gallaher and Tracy Hillman will participate on the conference call on Thursday, 16 May, to coordinate the project tours. Sponsors will give presentations to the Tributary Committees and Upper Columbia Regional Technical Team on Wednesday, 12 June. The Committees will then meet on Thursday, 13 June to conduct their final evaluation of pre-proposals.

VII. Information Updates

The following information updates were provided during the meeting.

1. Approved Payment Requests in April and May:

   Rock Island Plan Species Account:

   - $1,320 to Trout Unlimited – Washington Water Project for the Lower Wenatchee Instream Flow Enhancement Project.

- $104,996 to Inland Professional Title for the Twisp River Protection Project – Zinn Property.
- $3,494.50 to Cascade Columbia Fisheries Enhancement Group for the White River Large Wood Atonement Project.
- $951.36 to Chelan PUD for project coordination during the first quarter of 2012.

Rocky Reach Plan Species Account:

- $9,455 to Trout Unlimited – Washington Water Project for the Chewuch River Instream Flow Project.
- $1,248.42 to Chelan PUD for project coordination during the first quarter of 2012.

Wells Plan Species Account:

- $10,931.93 to Cascade Columbia Fisheries Enhancement Group for the Methow/Chewuch Shallow Groundwater Monitoring Project.
- $1,205.25 to Chelan PUD for project coordination during the first quarter of 2012.

2. Tracy Hillman reported that he received a call from Mike Kaputa, Chelan County Natural Resources Department, asking if he could speak with the Committees about the Peshastin/Icicle Pump Exchange Project at the June or July meeting. Although the Committees appreciated his offer, they indicated that his visit is not necessary at this time. Members of the PRCC Habitat Subcommittee who are also on the Tributary Committees have been providing the Tributary Committees with updates on the project. Dale Bambrick and Kate Terrell provided some history regarding the Peshastin/Icicle Pump Exchange Project. The PRCC Habitat Subcommittee will be reviewing two different proposals requesting funds to do a feasibility study. One is a proposal from Chelan County Natural Resources Department with a cost estimate of about $230,000 (they are not requesting the entire amount from the PRCC Habitat Subcommittee). The other is from Trout Unlimited with a cost estimate of about $175,000. Kate and Dale will continue to update the Committees on the status of the Pump Exchange Project.
3. Tracy Hillman indicated that he received an e-mail from Derek Van Marter, Associate Director of the Upper Columbia Salmon Recovery Board, asking if the Tributary Committees would be interested in funding the completion of Appendix C (Monitoring Plan for the Methow Basin) to the Upper Columbia Monitoring Strategy, which is part of the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan. Derek indicated that the total cost of the project is about $25,000, of which $13,000 has already been secured and spent. They need $12,000 to complete the plan. After discussion, **the Committees indicated that they would not be interested in reviewing a proposal seeking funds to complete the Monitoring Plan for the Methow Basin**.
4. Dale Bambrick reported that he recently spoke with John Sunderland with the Methow Conservancy (MC) about acquisitions and appraisals for the Methow Valley Irrigation District (MVID) Flow Enhancement Project. According to Dale, the MC is trying to keep the costs down for the acquisitions required by the MVID project, and getting them done in an expeditious manner. MVID will be acquiring easements for a well field, storage tank, and pipelines on the Westside, and an easement for a spill from the intake above Mill Hill on the Eastside.

MC has been working with Rick Witt, who has expertise on pipeline and well-field easement values, because of his research recently completed for expert testimony in a condemnation case. Rick estimates that the well-field easement value and the storage-tank easement values will be about $15,000 each (exclusive of any additional "damages" suffered by the landowners), because of the visual obtrusiveness of the infrastructure and the fact that the easement area will not be available for use by the landowners. The pipeline easement values will be about $5,000 each, based on Rick's research and analysis for the condemnation case.

Because the standards MC must meet for appraisals require a complete, self-contained report, the appraisal costs for each of the pipeline easements will be $2,500 for each of the four appraisals, and another $1,000 for each of the reviews if Rick does the appraisals. This is $14,000 that MC does not want to spend. They would like to dispense with the appraisals for the pipeline easements and pay $5,000 for each of the pipeline easements.

MC believes they can save money on the well-field and storage-tank easements by using Rick Witt. Rick performed a well-field easement appraisal for the MC on the Jumars property last winter. Because of the similarity between the Jumars well-field easement and the one currently contemplated by the preferred alternative on the Schultz property, Rick's appraisal cost is likely to be lower than any other appraiser, most of whom will need to develop information on easement values from scratch. Rick has offered a cost estimate of $3,100 for the appraisal. It is this high because of the "damages" calculations and write-up related to the 30 apple trees in production that must be removed for project implementation. In addition, the MVID project is time critical. The preferred alternative that the MVID board will select is only possible if the acquisition of easements between the well field and the existing canal takes place. Rick has promised MC an appraisal for the well-field easement by 4 June.

Dale asked the Committees if they would be interested in reviewing a proposal that would include the costs of the pipeline easements, but dispense with the appraisal. In addition, he asked if the Committees would approve the use of an appraiser who is not on the Committees' approved list. The latter question resulted in a discussion by the members about who was on the approved list and why there was only one approved appraiser and three reviewers. Most members remembered that the decision was to have a pool of three or four potential appraisers and one reviewer. Tracy Hillman and Tom Kahler directed the members to the July 2012 meeting notes, which state:

> *As noted during the June meeting, the Committees will use Larry Rees as their primary appraiser and Michael Gentry, Peter Shorett, and Fred Strickland as reviewers. The Committees directed Tracy Hillman and Becky Gallaher to contact the appraisers and ask them for rates and qualifications.*

Tracy noted that the Committees can change their policy on appraisers. Dale suggested that we see how the process works with the Twisp River-Poorman Creek Wetland Habitat Acquisition Project and then evaluate if we need to make changes. The Committees agreed. They also agreed to add appraisers if having only one available causes significant delays. Chris Fisher indicated that this is the process used by the Tribes.

Although there was no official vote, the Committees seemed to support the idea of not doing an appraisal on the pipeline easements. In addition, they would like to hear more about Rick Witt and his ability to provide cost-effective appraisal services.

VIII. Next Steps

The next meeting of the Tributary Committees will be on Thursday, 13 June 2013 at Chelan PUD in Wenatchee. At that time, the Committees will review GSHP pre-proposals.

Meeting notes submitted by Tracy Hillman (tracy.hillman@bioanalysts.net).

Wells, Rocky Reach, and Rock Island HCP Tributary Committees Notes 13 June 2013

Members Present: Dale Bambrick (NOAA Fisheries)[1], Lee Carlson (Yakama Nation), Jeremy Cram (WDFW), Chris Fisher (Colville Tribes), Steve Hays (Chelan PUD), Tom Kahler (Douglas PUD), Kate Terrell (USFWS), and Tracy Hillman (Committees Chair).

Others Present: Becky Gallaher (Tributary Project Coordinator).

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans Tributary Committees met in the Chelan PUD Auditorium in Wenatchee, Washington, on Thursday, 13 June 2013 from 9:00 am to 12:00 pm.

I. Review and Adopt Agenda

Tracy Hillman welcomed everyone to the meeting and the Committees adopted the proposed agenda with the following additions:

- Change in November Meeting date.

II. Review and Approval of Meeting Minutes

The Committees reviewed and approved the 9 May 2013 meeting notes.

III. Monthly Update on Ongoing Projects

Becky Gallaher gave an update on funded projects. Most are progressing well or had no salient activity in the past month.

- Lower Wenatchee Instream Flow Enhancement Project – The project is complete. The Rock Island Committee will soon receive a final report.
- Twisp River Riparian Protection Project (Zinn) – The project is complete. The Rock Island Committee received a final report.
- Nason Creek Upper White Pine Reconnection – Chelan PUD Powerline Reconnection Alternatives Analysis – The US Forest Service has initiated public scoping for the NEPA process and is accepting public comments through June. Chelan PUD has requested written clarification from the Forest Service as to whether or not a replacement easement is feasible if the powerlines are re-located to accommodate restoration actions.
- Chewuch River Instream Passage Project – The sponsor (Trout Unlimited) continued coordination with the Chewuch Canal Company on options to consider regarding schedule, funding, reservoir permitting, and cost saving strategies. The reservoir permit has been signed and the Record of Examination (ROE) was issued on 30 April with public comment ending on 30 May. With the issuance of the ROE, the HPA process

[1] Dale called into the meeting.

began. The construction estimate provided by Reclamation was $2.9 million and exceeds the amount of funding available ($1.75M). The Sponsor has hired an engineering firm to review the estimate in order to be more certain of the funding needs and to have a strong basis for addition funding requests.

Because of unforeseen delays in permitting, the sponsor asked the Rocky Reach Tributary Committee for a contract extension. The project was scheduled to end on 30 June 2013. The sponsor requested an extension to 31 December 2013. ***The Rocky Reach Tributary Committee approved the contract extension.***

- Nutrient Enhancement Assessment – The sponsor (Cascade Columbia Fisheries Enhancement Group) continued water quality and macroinvertebrate sampling throughout May and into June. The Sponsor has started developing a treatment plan. Determining appropriate loading rates, geographic scope, and effectiveness monitoring protocols remain subjective. The sponsor met with Tracy Hillman, Jeremy Cram, Keely Murdoch, and John Jorgensen on 8 April to discuss how to proceed with establishing a nutrient enhancement treatment in the Upper Wenatchee tributaries.
- Large Wood Atonement Project – The sponsor (Cascade Columbia Fisheries Enhancement Group) hosted a public hike on the lower White River on 2 May to provide another opportunity for community members to engage in the restoration process. Overall, the dialog was constructive and at the end of the visit, the group talked about how to mitigate for the potential hazards caused by installing pilings in the river. When the discussion shifted from "why are you doing this" to "how can we make this work for everyone," the sponsor felt like they made a major breakthrough with the public. As a result of this site visit, the sponsor is scheduling a meeting with WDFW and Chelan-Douglas Land Trust to discuss installing a trail that would roll through the forest and along the river as a means of providing a route for boaters to scout the river for hazards. The sponsor believes a low impact trail would be an acceptable solution to move this project forward, appease the recreating public, and provide the public with the opportunity to appreciate the publicly funded conservation properties on the lower White River.
- Nason Creek Lower White Pine Alcove Acquisition Project – The appraisal and review of the appraisal are complete. Because the appraisal for the Click property was greater than estimated, the sponsor (Chelan-Douglas Land Trust) asked the Rocky Reach Tributary Committee for an extra $27,300. ***The Rocky Reach Tributary Committee approved the cost increase.***
- Coulter Creek Barrier Replacement Project – Funding for this project is contingent upon the successful implementation of the railroad reconnection project, which has not yet happened.
- Twisp River Well Conversion – The well that was installed was repaired and a second pump test was conducted. There are now sufficient gallons per minute to operate the system. Excavation is scheduled to begin on 10 June. The irrigation pump and variable frequency drive are on back order. Electrical and mainline installations are scheduled to be completed by the end of June or mid-July.

  Because of unforeseen delays, the sponsor (Trout Unlimited) asked the Wells Tributary Committee for a contract extension. The project is scheduled to end on 30 June 2013. The sponsor requested an extension to 31 October 2013. ***The Wells Tributary Committee approved the contract extension.***

- Wenatchee Levee Removal and Riparian Restoration Project – The sponsor (Chelan County Natural Resources Department) met with WDFW staff at the project location to discuss project details and evaluate the existing diversion screen. It was determined that the existing screen meets WDFW's screening requirements. The sponsor also met with the landowner and at this time the landowner does not want to proceed with converting from surface diversion to well because of uncertainties associated with water quality and quantity. The landowner has agreed to levee removal.
- Upper Beaver Habitat Improvement Channel Restoration Project – This project is scheduled to begin autumn 2013. The sponsor (Methow Salmon Recovery Foundation) has completed and submitted SEPA and JARPA, and has met with the design engineer (Anchor QEA) to update the final design. The USFWS offered onsite construction oversight and additional financial support for site restoration.
- Lower Foster Creek Steelhead Habitat Enhancement Project – Becky Gallaher sent the Tributary Committee/Sponsor Agreement to the sponsor (Foster Creek Conservation District) for their review.
- Twisp River-Poorman Creek Wetland Habitat Acquisition – The sponsor (Methow Salmon Recovery Foundation) met with the landowners to review the appraisal process and purchase options. The sponsor also met with the appraiser to discuss the definition of the acquisition parcel. The appraisal should be complete by mid-June.
- Shingle Creek Fish Passage Project – Chris Fisher reported that Wayne Cornwall, Colville Confederated Tribes engineer, passed the necessary requirements for practicing in British Columbia. The proposed approach is to remove the dam, leave the wing wall, and construct four grade-control structures. The Okanagan Nation Alliance is reviewing the proposal. If they approve the proposal, they will apply for all the necessary permits. Chris thought that it would take about two weeks to complete the construction of the project. He would like the project completed this fall; however, depending on the amount of time needed to secure permits, the project may not happen until 2014.
- Lower Chewuch Beaver Restoration Project – See attachment 1.
- Methow/Chewuch Shallow Groundwater Monitoring Project – The sponsor (Cascade Columbia Fisheries Enhancement Group) continued to coordinate with WDFW and Fogle Pump & Supply on logistics and installation of monitoring equipment. The sponsor installed a water-level logger on the Silver Side Channel and measured discharge there. They attempted to install monitoring wells in April, but found that large cobbles prevented them from digging the wells by hand. Therefore, the contractor used a small, rubber-tracked, mini-excavator to help dig monitoring wells. Groundwater monitoring wells are now installed and water-level loggers have been deployed. Continuous water-level data are being collected in all groundwater monitoring wells and the Silver Side Channel.

IV. Small Projects Program Applications

In May, the Committees reviewed two Small Projects Program applications, both from Trout Unlimited-Washington Water Projects.

Beaver Creek Late Season Well Installation Project

The purpose of this project was to determine the feasibility of removing a landowner from a surface diversion on Beaver Creek during the period 1 August to 15 September. The sponsor will install a well and conduct a pump test to assess the production of the well. If the pump test is successful, the sponsor will seek funds for the second phase of the work, which is to install the pumps, mainline, and electrical hookup. If the conversion from surface water to well water is successful, a total of about 0.3 cfs could be saved permanently in trust. The total cost of the project is $16,396.72. The sponsor requested $16,396.72 from HCP Tributary Funds. After careful review of the proposal in May, the Committees requested additional information from the sponsor. Below are the responses from the sponsor to the Committees request.

1. Will the Redshirt Ditch be completely shut down for the entire year and the point-of-diversion removed, or will the ditch be used during periods other than August through mid-September?

   *As the plan is currently conceived, the Redshirt Ditch will not be shut down for the entire year and the point of diversion will not be removed. The Redshirt ditch will be used during the period of May 1st through July 31st by both the Water Right holder addressed in this proposal and the other Water User on the Redshirt. Annually on August 1st, in perpetuity, during the **critical** flow period of Beaver Creek, the landowner addressed in this proposal will cease diverting flows out of the Redshirt Ditch and begin to use a well (if funded). This is important because Trout Unlimited has secured a permanent late season acquisition for the other user on the ditch on August 1st, annually. In summary, if this proposal is supported and the well installation is successful, from August 1st-September 15th, no flow will be diverted from the Redshirt Ditch. This would improve instream flow by at least 0.76 cfs in Beaver Creek.*

2. If the ditch is used during other periods of the year, has the point-of-diversion been upgraded and are the fish screens in compliance with state regulations?

   The headgate on the Redshirt's point of diversion was improved in 2007 and the fish screen was upgraded in 2008, both are in compliance with state regulations.

3. If the diversion is screened, what is the cost of maintaining the screen?

   The diversion is screened and as it is relatively new there are currently minimal costs to maintain the screen. Currently the only costs of maintaining the screen are routine cleaning of debris and weekly adjustments, if necessary.

4. Why would the well only be used during the August through mid-September period?

   The landowner and Trout Unlimited want to ensure that the aquifer for the well remains adequate for perpetual use from August 1st-September 15th. Local knowledge and discussions with well drillers indicate that the highest rate of success would be limiting the withdrawal of water from the aquifer and allowing the longest term of recharge to take place. The landowner has shown interest in using this well for more than August 1st-September 15th if it can perform adequately with relatively limited overall drawdown for a few years. It is important to note that even if the landowner went to the well all season long, the Redshirt Ditch would still remain active from May 1st-July 31st due to the additional Water User.

After carefully evaluating the proposal and the response to questions, ***the Tributary Committees elected not to fund this project***. The Committees would like to see the ditch shut down and the point of diversion removed.

Antoine Creek Feedlot Relocation Project

The purpose of this project was to improve water quality and riparian conditions in Antoine Creek, a steelhead stream in the Okanogan River basin, by moving an existing feedlot about 1.5 miles away from the stream. This action will significantly reduce nutrient loading and habitat degradation along 3,450 feet of Antoine Creek, and increase instream flows by about 18.2 gpm from October through February. The total cost of the project is $97,533. The sponsor requested $37,533 from HCP Tributary Funds. In May, the Committees tabled this project because there was a possibility that the Colville Confederated Tribes will fund the entire project. Following the May meeting, the Tribes elected to fund the entire project.

V. Budget Amendment Request

In May, the Wells Tributary Committee received a budget amendment request from Cascade Columbia Fisheries Enhancement Group (CCFEG) on the Methow/Chewuch Shallow Groundwater Monitoring Project. The sponsor indicated that a Cultural Resource Survey was not necessary for this project. Therefore, they asked to move the Cultural Resource Survey funds ($4,500) to Sponsor Salaries and Benefits, and Contract Labor. Specifically, they asked to move $3,000 to Sponsor Salaries and Benefits, and $1,500 to Contract Labor.

During the May meeting, the Wells Committee was unable to approve the amendment request without additional information. Following the May meeting, ***the Wells Committee received the information they requested and approved the budget amendment***.

VI. General Salmon Habitat Program (GSHP) Pre-Proposals

The Committees received 13 General Salmon Habitat Program draft proposals. The Committees reviewed each draft proposal and selected those that they believe warranted a full proposal. Projects that the Committees dismissed were either inconsistent with the intent of the Tributary Fund or did not have strong technical merit. The Committees assigned draft proposals to one of two categories: Fundable and Not Fundable. It is important to note that these are ratings of draft proposals and do not reflect ratings of full proposals. The Committees directed Tracy to notify sponsors with appropriate projects to submit a full proposal, with a discussion of the questions/comments identified for each draft proposal listed below. Tracy will also notify sponsors with projects that have no chance or a low likelihood of receiving funding from the Tributary Committees.

Chiwawa Nutrient Enhancement Project (Fundable)

The Committees recommend that the project sponsor (Cascade Columbia Fisheries Enhancement Group) consider the following comments/suggestions as they develop the full proposal:

- Consider reducing the spatial scope of the work and increasing the nutrient loading. The Committees believe it would be better to load the section of the Chiwawa River between Schaefer Campground (RM 22.5) and Nineteenmile Campground (RM 27). This area supports some of the highest densities of juvenile spring Chinook. Although it may not be possible, increasing the loading to 0.5 kg/m^2 would be preferable.
- Describe why the analog approach is preferred over a drip system for delivering nutrients.
- Given that the monitoring component of this project was removed, how will you define success?
- What are the possible management implications from either positive or negative results?

Entiat Canal System Conversion Phase 3 Construction Project (Not Fundable)

The Committees recommend that this project, sponsored by the Cascadia Conservation District, should not be submitted as a full proposal to the Tributary Committees for the following reason:

- The Committees believe that the addition of about 2.2 cfs to the lower Entiat will have little biological benefit.

Janis Rapids Side Channel Project (Not Fundable)

The Committees recommend that this project, sponsored by the Cascade Columbia Fisheries Enhancement Group, should not be submitted as a full proposal to the Tributary Committees for the following reason:

- The Committees believe that the proposed phase (phase 1) will have little biological benefit. The Committees believe the greatest benefit will come from activating the side channels (phase 3). To that end, they would review a final proposal for phase 3.

Silver Side Channel Design Project (Fundable)

The Committees recommend that the project sponsor (Cascade Columbia Fisheries Enhancement Group) consider the following comment/suggestion as they develop the full proposal:

- Describe clearly how groundwater monitoring will be used to guide or direct proposed restoration actions. Providing examples would be helpful.

Twisp to Carlton Reach Assessment Project (Fundable)

The Committees recommend that the sponsor (Cascade Columbia Fisheries Enhancement Group) submit a full proposal.

Camas Creek Fish Passage Design and Construction Project (Not Fundable)

The Committees recommend that this project, sponsored by the Chelan County Natural Resources Department, should not be submitted as a full proposal to the Tributary Committees for the following reason:

- The Committees do not believe there is enough known about Camas Creek to make an informed decision about potential biological benefit. That is, before the Committees are comfortable considering a full proposal, they would like to know more about fish passage issues throughout the watershed, seasonal stream flows, and potential water rights issues. Without this additional information, it will be difficult to determine biological benefit.

Nason Creek RM 4.6 Side Channel Reconnection Construction Project (Fundable)

The Committees recommend that the sponsor (Chelan County Natural Resources Department) submit a full proposal.

Peshastin Irrigation District Pump Exchange Feasibility and Design Project (Fundable)

The Committees recommend that the project sponsor (Chelan County Natural Resources Department) consider the following comments/suggestions as they develop the full proposal:

- The Committees want to see the Icicle project separated from the Peshastin project. The Peshastin project should be proposed as a standalone project.
- As a standalone project, the Peshastin Pump Station should be designed to take no more from the Wenatchee River than would otherwise have been legally and physically available to divert from Peshastin Creek. Thus, the pump should be designed to take no more than 10-12 cfs.
- The proposal must include a plan for covering O&M costs.

CDLT Entiat Stillwaters Gray Reach Acquisitions (Fundable)

The Committees recommend that the sponsor (Chelan-Douglas Land Trust) submit a full proposal.

<u>CDLT Nason Creek UWP Horseshoe Bend Acquisition (Not Fundable)</u>

The Committees recommend that this project, sponsored by the Chelan-Douglas Land Trust, should not be submitted as a full proposal to the Tributary Committees for the following reason:

- The Committees believe that there is little opportunity for reconnecting side channels because of issues with the downstream landowner. In addition, there is some concern that Chelan County will develop a park on their parcel adjacent to the properties included in this proposal.

<u>Middle Methow River Rock Reach (M2 3R) Floodplain and Side Channel Restoration Project (Fundable)</u>

The Committees recommend that the project sponsor (Methow Salmon Recovery Foundation) consider the following comments/suggestions as they develop the full proposal:

- The Committees recommend that the sponsor fill in the depressions that entrap fish as necessary to prevent fish stranding rather than the proposed extensive excavation, and let the floodplain function naturally.
- The sponsor needs to re-evaluate the budget. The Committees believe the cost of this work is excessive.

<u>MVID Instream Flow Improvement Project (Fundable)</u>

The Committees recommend that the project sponsor (Trout Unlimited) consider the following comment/suggestion as they develop the full proposal:

- Limit the amount requested from the Tributary Committees to no more than $400,000.

<u>Similkameen RM 3.8 Spawning Habitat Design Only Project (Fundable)</u>

The Committees recommend that the sponsor (Okanogan Conservation District) submit a full proposal.

Tracy will share this information with project sponsors by Thursday, 20 June. The Committees hope this feedback will help sponsors develop full proposals, which are due on 12 July. The Committees will evaluate final proposals on Thursday, 15 August.

VII. Information Updates

The following information updates were provided during the meeting.

1. Approved Payment Requests in May and June:

   Rock Island Plan Species Account:

   - $205.03 to Clifton Larson Allen for first-quarter financial management and reporting.

   Rocky Reach Plan Species Account:

   - $10,414.86 to Trout Unlimited – Washington Water Project for the Chewuch River Instream Flow Project.
   - $1,445.51 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project.
   - $205.03 to Clifton Larson Allen for first-quarter financial management and reporting.

Wells Plan Species Account:

- $10,414.86 to Trout Unlimited – Washington Water Project for the Chewuch River Instream Flow Project.
- $11,312.51 to Cascade Columbia Fisheries Enhancement Group for the Methow/Chewuch Shallow Groundwater Monitoring Project.
- $4,015.07 to the Methow Conservancy for the Lower Chewuch Beaver Restoration Project.
- A payment of $5,934.36 to Trout Unlimited – Washington Water Project for the Twisp River Well Conversion Project was denied because the costs did not reconcile with the information provided. The sponsor was asked to submit a revised payment request.

2. Tom Kahler shared with the Committees information about a video that Douglas PUD commissioned to document the development and implementation of the Fish-Water Management Tool (FWMT). The purpose of the video is to serve as a historical archive and educating tool for their employees and stakeholders, and to counter the many theories regarding the resurgence of Okanagan sockeye. To achieve those main purposes, Douglas PUD produced a short version of the video to share with the media, and a longer, more comprehensive version for everyone else. Here is a link to both the short and long FWMT videos: http://www.youtube.com/user/DouglasCountyPUD?feature=mhee

3. Tracy Hillman reported that Greer Maier with the Upper Columbia Salmon Recovery Board (UCSRB) asked if the Tributary Committees would be willing to change their November meeting date. The UCSRB has scheduled a Science Conference for 13-14 November. Currently, the Committees meeting is scheduled for 14 November. After discussion, the Committees elected to move their meeting date to Friday, 15 November.

   Kate Terrell indicated that she will not be able to attend the meeting on 8 August. Because this is the meeting during which the Committees evaluate final proposals, the Committees elected to move the meeting date to Thursday, 15 August. By changing the meeting date to the 15th, the Committees will be able to use the scores and rankings developed by the Upper Columbia Regional Technical Team.

   Chris Fisher asked if anyone would be interested in touring restoration projects in Canada during the second week of October. All except Kate Terrell and Dale Bambrick thought that they would be able to attend the tours. Brandon Rogers may attend the tour in Lee Carlson's stead.

VIII. Next Steps

If necessary, the next meeting of the Tributary Committees will be on Thursday, 11 July 2013 at Chelan PUD in Wenatchee.

Meeting notes submitted by Tracy Hillman (tracy.hillman@bioanalysts.net).

Attachment 1

Lower Chewuch Beaver Restoration Project

Attachment 1

Methow Beaver Project

Accomplishments and Outcomes

April 2013

The Methow Beaver Project

History and Establishment

In 2000, John Rohrer had an idea. As a Forest Service District Wildlife Biologist working in the Methow Valley, he thought that 'nuisance' beavers removed by Washington Department of Fish and Wildlife enforcement agents might be valuable to restore an old wetland on Forest Service land where he had seen water tables lowered and riparian vegetation lost. After a series of releases there, the beavers set up shop and began restoring the site, returning the wetland to a 23 acre complex of dams and wet meadows. For the next few years, more attempts followed, some successful, some less than successful. All of this was a backyard, spare-time effort to try to improve places that had once held beavers. An inspiration for John was a 1932 map from the Forest Service archive that showed the original beaver relocation work at 61 sites in the Methow Valley. If it was possible to re-establish beavers then, maybe now would be even more feasible.

South Fork Beaver Creek successfully restored site

The year 2000 was a crossroads for beaver restoration in Washington State because the Legislature passed a bill that year banning body gripping traps statewide, meaning that it would be more difficult for trappers to remove beavers from streams where they had become established.

In 2006 Jon Merz with the Washington Department of Ecology learned about the project and thought there might be an improvement to water quality if beavers were returned to historic places. On the day after Christmas that year he met with USFS biologist Kent Woodruff to talk about the possibility of working toward solutions to the temperature violations that had been noted in the Methow Drainage.

For the next 6 months Ecology Staff, USFS biologists and hydrologists, Methow Conservancy Stewardship Director Steve Bondi, WDFW biologists Kim Bondi and Scott Fitkin, and Pacific Biodiversity Institute spatial analyst Hans Smith met to craft a project that could begin to restore beavers to suitable habitat in historic locations in the Methow. The team proposed to Hatchery Manager Chris Pasley the idea of using the Winthrop National Fish Hatchery as a holding facility, and he enthusiastically welcomed the project.

The result was an Implementation Plan, a partnership Memorandum of Understanding, a project structure including a steering committee, and partnership financial agreements that allowed Direct Implementation Fund money granted by DOE to be shared by the group to begin relocating captured beavers in spring 2008 to places where they would be more welcome.

Project Objectives

Beaver restoration efforts can have different objectives. For this project we decided to pursue the following:

Re-establish beavers in the Methow Watershed to places they occurred historically. Work with landowners to find solutions to nuisance issues. Share information that can help our community recognize the complexities of our water quality issues and the contributions healthy beaver populations can provide. Utilize beavers' unmatched natural engineering ability to build and maintain dams high in the watershed, bringing about the following benefits:

- **Store water for later season delivery**
- **Raise ground water levels in upper reaches of watersheds**
- **Improve water quality by reducing stream temperature**
- **Reintroduce complexity and dynamism to streams that were simplified when beavers were removed**
- **Increase nutrient availability in streams**
- **Improve stream function by reconnecting floodplains**
- **Decrease sediment delivery to the stream system**
- **Improve rearing and winter habitat for salmonids and other native fish**
- **Improve and expand riparian and wetland habitat**

A substantial amount of literature supported the teams' assertion that these objectives could be met by returning beavers to places they occupied historically (see Appendix A).

The ultimate goal is to successfully return beavers to 50 locations in the Methow Watershed in 10 years. If we succeed, we are confident this will provide a measurable, lasting benefit to the watershed.

2010 successful establishment on Libby Creek

Project Methods

A project Implementation Plan has been the guiding document for the project. As part of implementation, we developed a list of tasks needed to allow for successful re-introduction. Some were programmatic like “establish goals”, “assemble appropriate partners”, and “pursue a broad education campaign”. Others involved the basic mechanics of beaver establishment and included:

1.Identify suitable habitat
2.Assess current population status
3.Evaluate individual sites for suitability
4. Determine priorities for release sites
5. Interact with landowners who have beaver issues
6. Pursue a trapping effort to remove beavers prior to lethal action
7. Provide a facility for secure, healthy, short-term husbandry and group aggregation
8. Carefully prepare the release site
9. Deliver beavers as a group to the selected location
10. Monitor beaver use
11. Document results

Project Implementation

After a very successful pilot year, an ambitious first phase effort was proposed to deliver beavers to at least 15 sites in the first four years with the goal of at least 5 sites becoming established in three watersheds. Prior to this project the success rate reported in other reintroduction projects in the Western US was about 20%. We felt like we might be able to improve upon that level of success.

In addition, because *documenting* the water quality benefits was also a project goal, we proposed to design and set up a monitoring effort to answer the questions:

- ✓ Does reintroduction of beavers affect the magnitude of water temperature in subwatersheds?
- ✓ Does reintroduction of beavers affect streamflow in small-order streams ?

To these ends, a grant was secured by the Methow Conservancy from the Washington Department of Ecology administered, Federal Clean Water Act Section 319 Program, followed by matching support contributed by the Yakama Nation, the National Fish and Wildlife Foundation, and Ecotrust.

Beaver sexing

One of the significant innovations of this project, beyond developing a strong GIS analysis of the beaver habitat, was the ability to rapidly and reliably tell male and female beavers apart. The need to determine gender is obvious, but is confounded by the confusing physical structure of beavers, with two sets of glands, internal reproductive organs, and genital openings that are difficult to discern – especially on live beavers that could inflict serious injury with their teeth.

Our initial effort was to work with the University of Idaho Genetics Laboratory lead by Lisette Waits. We helped the team there develop DNA markers for beaver males and females. We then collected hair from all beavers we captured and sent it to the lab for gender ID. This proved 100% reliable for sexing beavers and resulted in a 2011 publication (Goldberg et al. 2011). Issues were the 10 – 15 day turnaround time and the expense for the lab analysis.

In May 2011, with the generous help of beaver expert Dr. Lixing Sun at Central Washington University, we learned how to determine gender with secretions from the oil glands of beavers captured. His approach involved expressing oil from oil glands while beavers were anesthetized and examining color, odor, and viscosity. We learned that oil from male and female beavers is distinctly different. Issues were the 1-2 hour processing time for each beaver and the expense for anesthesia.

The next improvement involved connecting with the local North Cascades Smokejumper base where we asked for help designing a restraint bag that could eliminate the need for anesthesia. After a few trials, our jumper friend, J.T. Sawyer created a sturdy nylon funnel that fit over the Hancock traps and very effectively allowed us to hold a beaver immobile for our entire intake process, including sex determination, with no injury or trauma to crew members or beavers. Now, three to five minutes was the time required to remove beavers from the trap, sex, tag, and release the beavers into the holding facility. For the rest of the season we compared the crew's ability for oil gland sex determination with DNA hair analysis. At the end of the season we learned the process was 100% accurate and reliable.

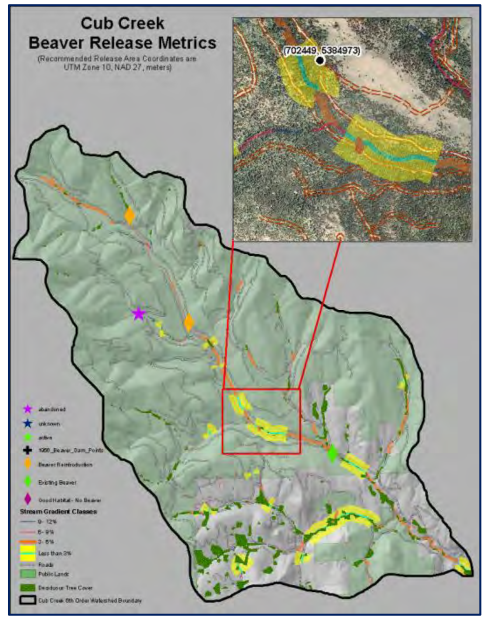



The ability to quickly and reliably determine the sex of captured beavers greatly improved our competence in making grouping choices in the holding facility. This innovation, along with providing a period of group acclimation at the facility, was perhaps the most substantial benefit to increasing the establishment rate for groups released, because we had strong assurance that compatible males and females were included in release groups.

Attachment 1

Project Benefits and Results

One of the most valuable initial connections for the project was with Hans Smith and Pacific Biodiversity Institute. They helped the project immensely by creating a model that became **the initial Geographic Information System assessment of the available beaver habitat for the entire Methow watershed.** This was an instrumental tool for evaluating beaver habitat suitability. In 2010 USFS spatial analyst Chaochung Tsai added his talent and helped refine the model that showed the places where suitable stream gradient, appropriate stream flow, and available food resources occurred together.



In 2011 the field crew helped **develop a score card used to assess individual sites in the field**, and in 2012 that was refined to the current final Release Site Score Card (Appendix B).

Our beaver intake procedures have evolved over the years. We now have **a written, thorough, detailed intake protocol** for tracking each individual beaver from capture to release and to any subsequent encounter.

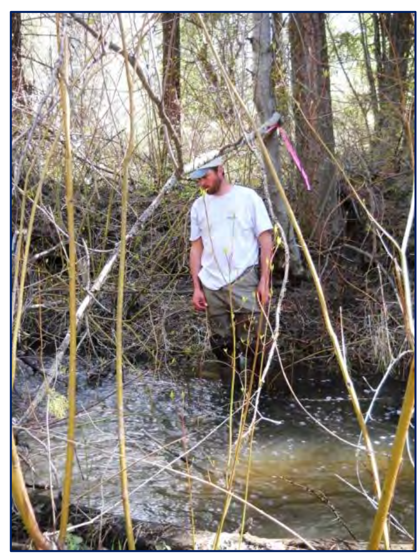
We created a comprehensive release site monitoring protocol and a standard measure of success. After release we visit the site weekly for 8 weeks, then semi-monthly for the rest of the first season. We deliver a small amount of aspen at each visit to provide some food and to help determine continuing beaver activity. We record the presence of beaver sign and look for dam and lodge building activity. If a site remains active for a period long enough to produce young, and if the beavers have maintained at least one dam sufficient to at least double the cross-sectional measure of the stream (width x depth), then the site is determined to be successful.

In 2012 we developed a **beaver handling protocol** to assure the safety and health of our crew, our visitors, and the animals we interact with each day.

We pioneered **a tagging system of FLOY ear tags for temporary identification in the holding facility, and tail injected PIT tags for permanent identification and movement analysis**. The tail tags are detected on either hand held readers for identification or instream readers used for fish monitoring and allow some indication of dispersal after release. Because the tags are permanent and require no battery, we will be able to know about beavers we have handled if they are encountered again.

Temperature and flow investigation

The substantial effort lead by Dr. Richard Woodsmith of the USFS Wenatchee Forestry Sciences Laboratory to **develop a comprehensive stream temperature and flow study using a Before-After, Control-Impact design to document the magnitude and scale of temperature improvement and the amount of flow attenuation in streams where beavers are re-introduced is unprecedented.** The scientific rigor with which we are attempting to document the changes in stream characteristics has not been attempted to date. The study plan requires a minimum of 3 years of pre-treatment (pre-beaver release) data collection and 3-5 years of post-treatment data collection before results can be analyzed. That we were able to find suitable sites for all replicates, establish and instrument all 6 flow stations, and establish and instrument all 32 temperature stations in one field season (consistent with Washington Department of Ecology SOPs and with the approved project Quality Assurance Project Plan) was nothing short of astounding. The 2011 field crew of Alexis Monetta, Carmen VanBianchi, Gabe Spence, and Chris Vennum deserve special recognition for the magnitude of their effort toward the success of the monitoring program. The data we have gathered since the sites were established will lead to a peer reviewed analysis and published results in about 5 years.



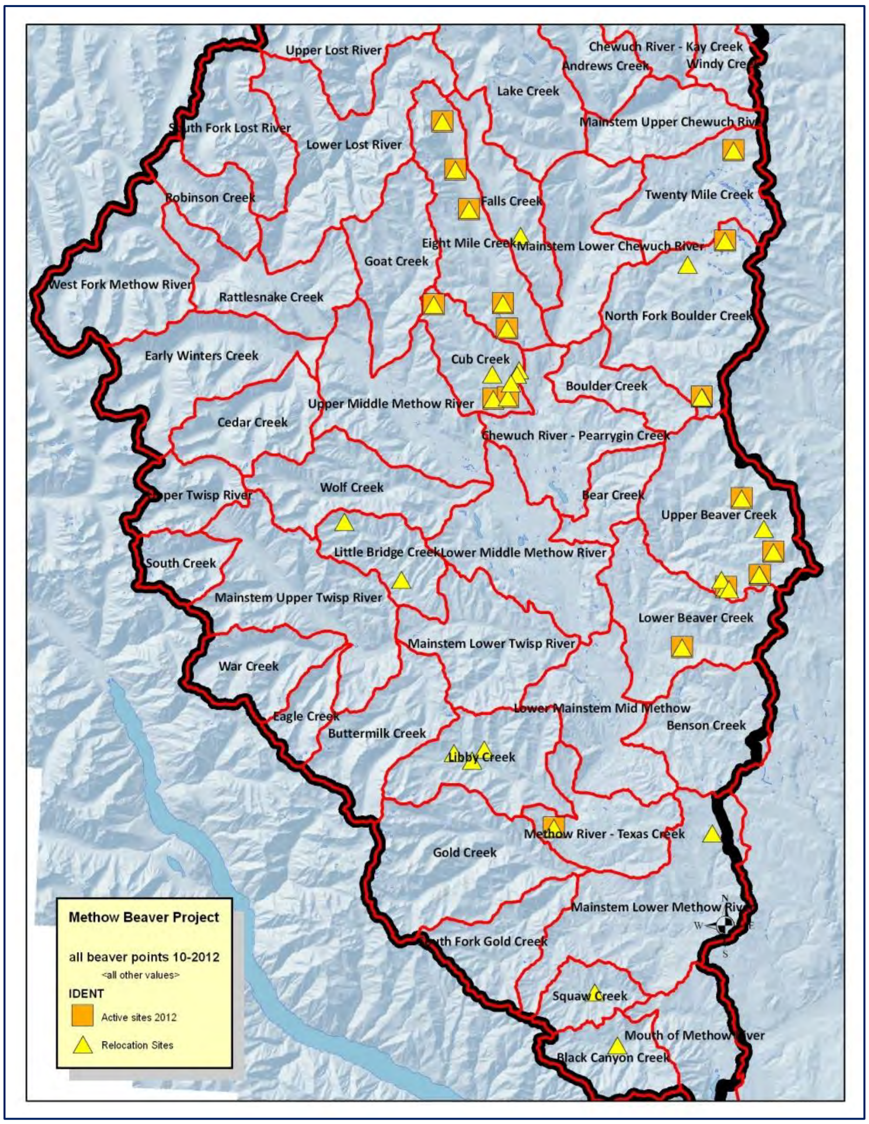
Beaver Capture and Release Outcomes

To date we have captured 181 beavers from 54 locations. In a few cases we did not keep the beaver, a few beavers died, and in 6 cases, beavers managed to escape from the holding facility. We have released 163 beavers to 35 sites. Beginning in 2011, all beavers captured were permanently marked with PIT tags for future identification. To date, because of these tags in the tail, two beavers were documented as recaptures of beavers we had previously caught and released. Both had travelled some distance. The furthest was about 37 miles from the release location.

Beaver Establishment Outcomes

Figure 1 displays the locations where we released beavers and where those efforts were successful. On October 25, 2012 17 sites were active. 14 sites have been established long enough to be considered successful

Figure 1. Methow Watershed Beaver Release Locations



Establishment examples

2012 successful establishment on South Fork Boulder Creek

2011 successful establishment near Bear Mountain

Temperature and Streamflow Data Outcomes

Figure 2 shows all the stream monitoring locations. The comprehensive study plan for this effort was completed in March 2011 and a Quality Assurance Plan was approved by the Department of Ecology. In June 2011, data gathering began at these sites for stream temperature and stream discharge. 82 temperature loggers are currently capturing baseline stream temperature in 18 subwatersheds. Six flow stations with water pressure loggers in 6 subwatersheds are currently documenting rising and lowering stream elevations. Hydrologic ratings curves for these six streams will be constructed in 2013 and flow calculations will then be derived. After the baseline period, beavers will be released at half the sites and all will be monitored for a period to determine what the effects to stream temperature and stream discharge are. We expect this to require another 3-5 years

Figure 2. Stream monitoring Stations

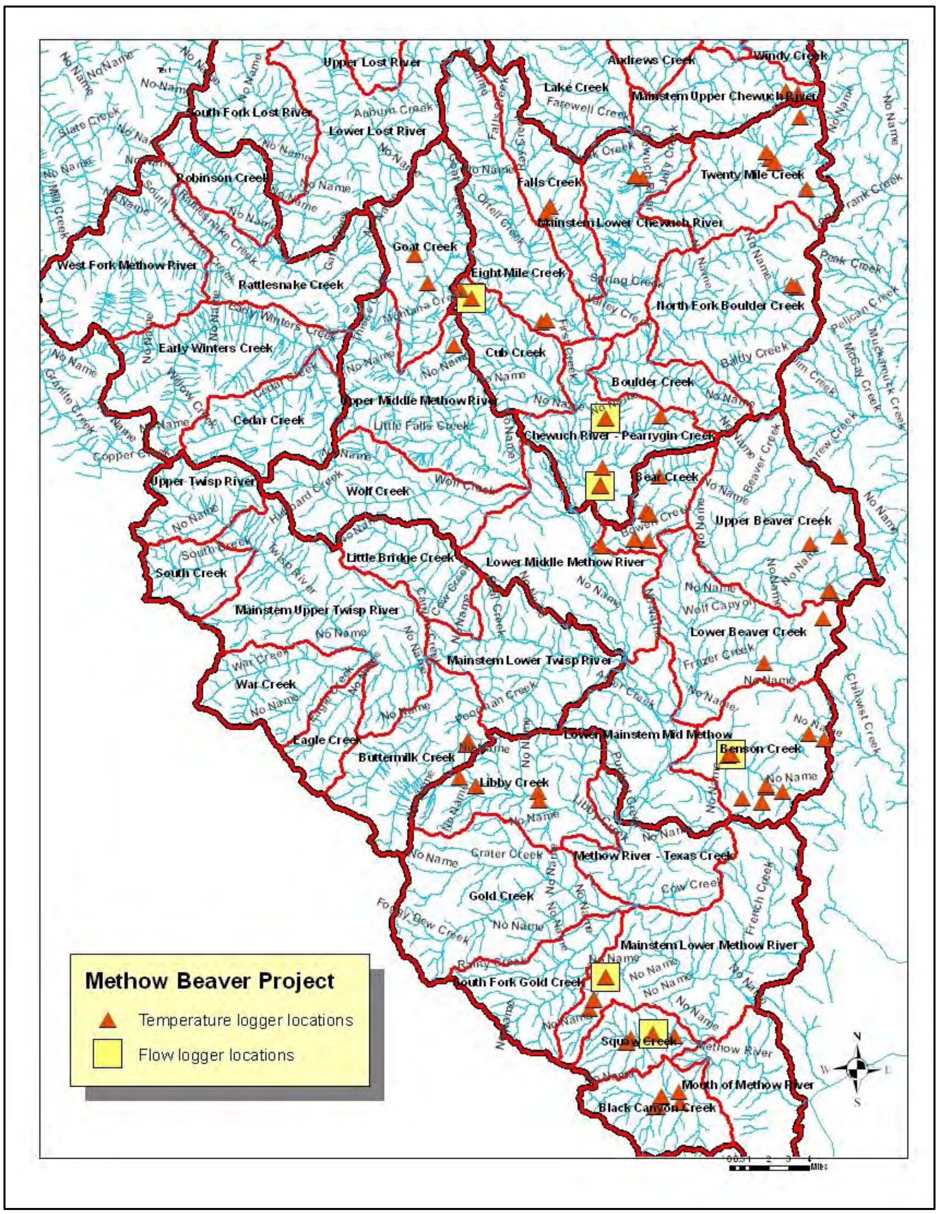


Figure 3 is an example plot of temperature records for approximately one year for <u>one</u> of the 84 temperature data loggers currently deployed. This plot is from the Chicamun Creek tributary to Libby Creek. This time period contains 17,096 records and shows a temperature range in that period from -0.06° C on February 27 to 11.47° C on August 17. **Figure 4** is a subsample plot of the same data.

Figure 3. Temperature graph for Chicamun Creek bottom monitoring station 10-6-11 to 9-26-12

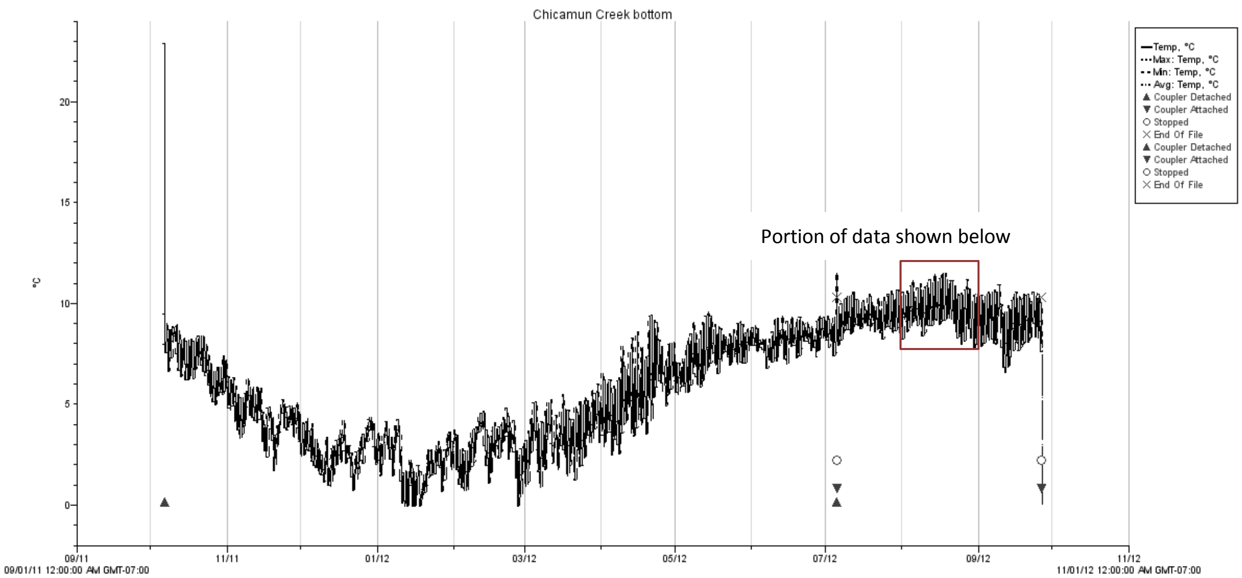
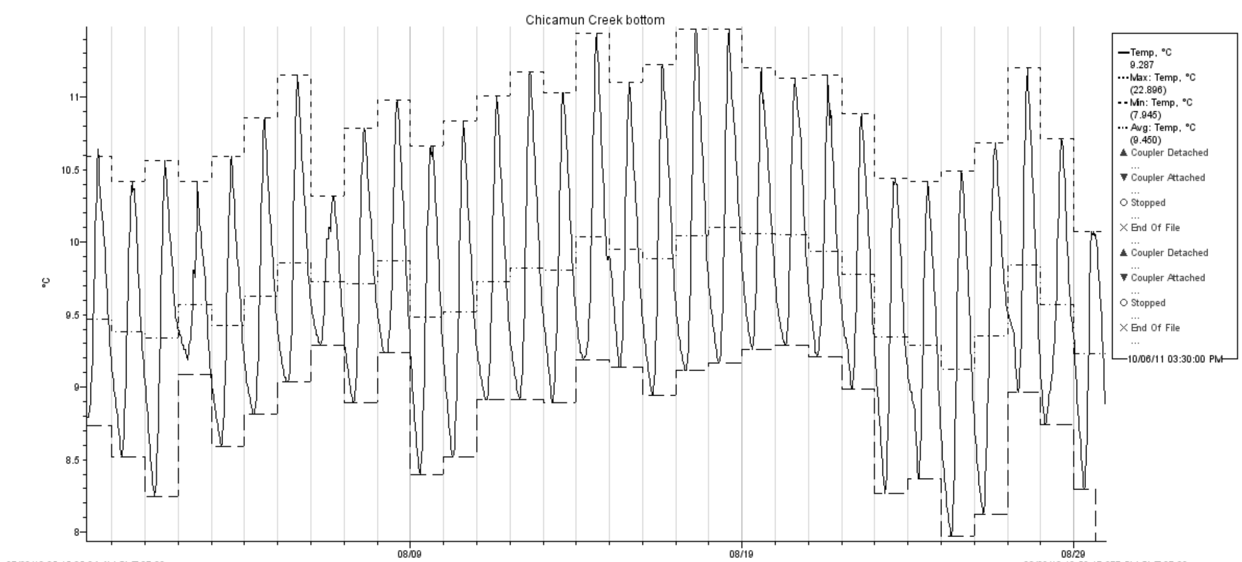


Figure 4. Temperature graph for Chicamun Creek Bottom monitoring station 7-30-2012 to 8-29-2012



Education Outcomes

The project partners developed and have implemented an Education Plan. **Table 1** shows the list of education programs and when they were provided.

***Table 1**. Education and Outreach Programs for the Methow Beaver Project as of October 15, 2012.*

Program	2008	2009	2010	2011	2012	Topic
First Tuesday Presentation	x					Beaver ecology, 150+ people.
Newspaper article	x	x		x	x	Methow Valley News 6-13-2012. Wenatchee World 8-2010.
Classroom entry	x	x	x	x		Kindergarten and elementary school-interactive ecology lessons, holding facility tours.
National Fishing Day	x	x	x	x	x	100's of families/yr see captive beavers and read interpretive materials.
Public tour	x	x	x			Beaver ecology and release site assessment.
Water quality www link	x					Water quality/beaver project information.
Other press	x	x	x	x		Methow Conservancy fall/ winter newsletter. Ruralite.
Volunteer efforts		x				Audubon of Washington sponsored bird surveys.
Project information sheet	x	x		x		One page white paper for interested people.
Water quality community program				x		One planned for in 2011-2013.
Hatchery facility exposure/ water quality message delivery	x	x	x	x	x	500 visitors annually 2010-2013.
Classroom programs	x	x	x	x	x	>2/yr in 2010-2013 regarding beavers and their benefit to water quality.
Technology transfer workshops		x	x	x	x	Two in 2010-2013, perhaps through NW beaver symposium.
Publish article				x	x	One article in 2010-2013 that promotes beaver restoration as a water quality solution and highlights the innovative collaboration of project partners. Ruralite 7-5-11
www link on Methow Conservancy www site			x			Notes the partners engaged in water quality improvement and the actions undertaken in the watershed.
Interagency Publications	x	x				USFWS and USFS Regional Newsletters,
Academic Institutions			x	x		Interact with academics at various Colleges and Universities
Presentation to Methow Conservancy Stewardship Committee				x		Update on the beaver project accomplishments

Education activities

The education effort has been very successful. Since 2008, the project has reached more than 9000 people with watershed stewardship, water quality, and habitat conservation messages. See the link on the Methow Conservancy web page http://methowconservancy.org/beaver_project.html

In 2012 we contributed one small piece of a beaver documentary produced by David Suzuki for the Canadian Broadcasting Company and airing on Canadian and US television in 2013. http://www.cbc.ca/natureofthings/beaverwhisperer/watch.html

Also in 2012, we contracted Steven Foreman to produce our own project documentary compiled from video footage that Steven made and also footage captured by an Ecotrust film crew in June 2012. That documentary is available at http://www.youtube.com/watch?v=CDXO0Yc8aOs

Perhaps the most positive education event for the project is our participation with a number of partners in the US Fish and Wildlife Service sponsored National Fishing Day event at the Winthrop Fish Hatchery. We have shared the benefits of the beaver project with more than 2000 kids and adults at that event alone.

Another education activity is regular coordination with the Methow Restoration Council. We share information regularly with participating fisheries and watershed managers at monthly MRC meetings. The MRC Outreach Committee is charged with design and delivery of key messages for stewardship of local fisheries, water quality and quantity, and habitat restoration projects, as well as data gathering and presentation of results for local scientific studies. They highlight the beaver project as one of the successes in the watershed.

We have presented information at 4 annual beaver conferences and shared the techniques and discoveries we have made.

Landowner Outcomes

Working with landowners to solve beaver related issues is a positive part of the project. Many of these people recognize the partners participating in the Methow Beaver Project and appreciate the help and advice they receive for free. Sharing messages about beavers' role in water quality and beavers' ability to enhance late season water availability are key messages. That this project might be able to help landowners where problems are occurring with beavers is a key project contribution.

Following are the contacts made to date:

Landowner/Entity	2008	2009	2010	2011	2012	Capture?
Moccasin Lake Ranch	x			x	x	Y
Town of Winthrop	x	x				Y
Spring Creek Ranch	x		x	x	x	Y
Twisp Power & Irrigation Co.	x	x	x		x	Y
Wolf Creek Irrigation District	x		x			N
Barkley Ditch Co.	x		x	x	x	Y
Libby Creek Farm		x	x	x		Y
Hugh Glassburn		x				N
Shirlee Evans			x	x		Y
Patterson Lake Cabins	x	x	x			Y
Ray Robertson	x	x	x	x		Y
Bud Stevie		x	x		x	Y
Vic Stokes	x	x	x			N
MSRF – Chris Johnson	x	x	x	x	x	Y
Don Phillips	x	x	x			Y
Tim Sprague	x					Y
Doug Breed		x	x		x	Y
Lucy Reed	x	x	x			N
Okanogan County	x	x	x			N
Chelan PUD	x	x	x			N
John O'Keefe		x				N
Melton Utley		x	x	x	x	N
Bob Hart		x	x		x	N
Sarah Ulrich		x	x			Y
Smokejumper base			x	x		Y
Bernard Wathen			x		x	Y
Dustin Evans – MVID			x			Y
Covenant church			x			N
Larry Hill			x	x	x	Y
Kings			x		x	Y
Marc Hallet			x			Y

Landowner/Entity	2008	2009	2010	2011	2012	Capture?
Kammers			x	x		Y
Buzz and Betty Ann Elly			x		x	Y
Carol and Dave Haugan			x	x	x	Y
Bill Maple			x			Y
Rick Stone			x		x	Y
Dave Ellis / Mary Graham				x		Y
Rick Lewis PLSP				x	x	Y
John Koch				x	x	Y
Buzz and Loretta Maltais				x		N
Paul Jennings				x		N
Ann Osin				x		N
Bill Hottell				x		Y
Twisp River Fish Pond				x	x	Y
Troy Accord				x	x	Y
VanBianchi				x		Y
Evans				x	x	y
Breed Ranch				x	x	Y
Josh Morgan MVID					x	N
Corky Barker						?
Alan Parker Ch. Canal Co.						?

Riparian Protection Outcomes

Several Conservation Easements were added during the last five years. Two of the more recent additions include the Tawks II and Keith properties on the Upper Methow River that protect more than 0.6 mile of riverfront from development in perpetuity. The Tawlks II Conservation Easement protects undeveloped riparian forest and wetlands along approximately 1000 feet of both sides of the Methow River, protecting 2000 feet of total shoreline. It includes a diverse mixture of native plants and provides excellent fish, songbird, amphibian, raptor and large and small mammal habitat. It provides habitat for spring Chinook salmon and steelhead trout, both of which are classified as endangered, and the bull trout, which is listed as threatened, under the Endangered Species Act.

The Keith Conservation Easement spans over 700 feet of the Methow River (and approximately 1, 320 feet of shoreline, including both sides of the river) and incorporates dense riparian vegetation and wetland habitats. This property too provides habitat for spring Chinook salmon, steelhead, and bull trout.

Since 2008 at least 65 beavers have been removed from main river corridor riparian areas and relocated to tributary systems where their actions will be beneficial in raising the raising the water table, storing water in the aquifer and expanding riparian habitat.

The Methow Conservancy, through its Cage-a-Tree project has caged 738 trees on 14 properties, most of which had either Methow Conservancy or WDFW conservation easements on them. This project is on-going to maximize its impact on the protection of riparian vegetation and the recruitment of shade producing trees.

Cooperation Outcomes

The project worked with the Methow Watershed Council and Aspect Consulting to evaluate the contributions beavers might be able to make and the suitability of some key selected sites for a **WATER STORAGE EVALUATION** for the Methow Watershed. Three key sites were noted as potentially viable beaver enhanced water storage areas: Davis Lake area, Beaver Creek, and the Walking D Ranch. The Walking D was proposed as a possible future beaver release site in Aspect's June, 2012 report.

We have shared stream temperature monitoring information with the USFS Methow Valley Ranger District Fisheries staff and the Methow Restoration Council Watershed Monitoring Project. In the Methow Basin we currently participate in a network of more than 300 temperature monitoring stations.

We have shared information with several projects that have ultimately begun their own beaver restoration efforts including the Lands Council Beaver Project in Spokane, the Yakama Nation Beaver Project, the Grand Canyon Trust beaver project in Utah, and the Yakima Basin Beaver Project in Ellensburg.

Sharing the project with others is a key project element

WDFW fisheries biologist Charlie Snow has been a very generous project cooperator. Since 2010 he has helped insure we have pit tags for all the beavers we handle and then helped load the data into the PTAGIS system so that we can 'see' when each beaver crosses one of the 27 instream readers. His contribution has allowed us to pioneer this type of movement monitoring for beavers.

Partners

The project has benefitted from very able partners. The Methow Conservancy has contributed project oversight, coordinated connections with private landowners, provided fiscal accounting and tracking, led the education effort for the project, and provided grant administration.

The Forest Service has coordinated project implementation, communication, and support, developed and maintained project records, developed and supervised monitoring efforts, identified and evaluated the best places for beaver release, and interacted with other organizations and agencies active in the Methow watershed. The Wenatchee Forestry Sciences Lab has worked out the statistical and logistic aspects of the water quality study and then very ably coached the implementation of temperature and flow data gathering

The Washington Department of Fish and Wildlife has coordinated the capture and care of beavers, assisted with beaver release and establishment, assisted with holding facility design and maintenance, conducted stream monitoring set-up and data collection, and made connections with private landowners that experience beaver damage.

Pacific Biodiversity Institute originally developed map products and conducted analyses for assessing the beaver habitat present in the Methow watershed. They passed that role to the Forest Service with staffing changes at PBI. The Forest Headquarters in Wenatchee has made significant contributions to the habitat model.

The Winthrop National Fish Hatchery has generously contributed a portion of the hatchery each year for the holding facility and hatchery staff has helped immensely with facility maintenance, construction, equipment repair, and a big part of the education effort during National Fishing Day.

Funding

We would like to acknowledge and thank the following contributors and supporters of the project.

- The Washington Department of Ecology
- The Yakama Nation
- The Nation Fish and Wildlife Foundation - Community Salmon Fund
- Ecotrust Whole Watershed Restoration Initiative
- Bureau of Reclamation – Methow Field Office
- Habitat Conservation Plan / Tributary Fund
- The Salmon Recovery Funding Board
- The Methow Watershed Council

Acknowledgements

The success of this project is completely the result of the dedication and hard work of the people involved. John Rohrer's original idea to improve the watershed with beavers was the important initial spark that began the project. Steve and Kim Bondi grew the beaver restoration idea into grant proposals that eventually paid off. Steve's passion for the project is evident in the many presentations and programs he has given over the years, and that he continues to give in his new role as Inn Owner. He speaks eloquently about the benefit that beavers bring to the watershed in the short video on the Methow Conservancy Website.

Beaver crew members Lindsay Welfelt, Dan Russell, Chris Street, Luke Yockey, Alexis Monetta, Gabe Spence, Carmen VanBianchi, Chris Vennum, Keith Douville, and Carla Jo Ehlinger all have showed amazing dedication and perseverance. Their significant contributions have been noticed and very much appreciated.

Our **friends** at the Winthrop National Fish Hatchery, including Bob Adams, Chris Dammann, Bob Gerwig, Jeremy Mail, Dave Carrie, Mike Johnson, Craig Chisam, and especially Chris Pasley have helped make sure we have had a nearly perfect holding facility and well-cared-for beavers.

The cooperation and patience of the researchers at the University of Idaho Genetics Lab were instrumental in allowing us to determine sexing methods. Caren Goldberg and Lisette Waits helped wade through the challenges of long-distance sex determination. Dr. Lixing Sun was very generous to share his techniques for sexing. His time with us in May 2011 was a game changer for the success of this project.

Northwest Trek small mammal keeper Jessica Hoffmann kindly gave us her ideas for holding facility design and feeding suggestions. High Desert Museum Wildlife Manager John Goodell was helpful in sharing ideas about husbandry as well.

A large group of veterinarians, pathologists, epidemiologists, and state health department officials helped us complete a thorough, careful evaluation of risks to staff and the trapped and wild beaver populations from water borne disease. Dr. Kristin Mansfield and Ella Rowan from WDFW, Dr. Gary Haldorson and Dr. Tom Besser from WSU, and Nicola Marsden-Haug from WA Department of Health (among many others) were tremendously helpful. This resulted in very careful handling and disinfectant procedures that will become standard for these types of projects from now on.

Mark McKinstry and Stanley Anderson of the Wyoming Coopertive Wildlife Research Unit pioneered large scale beaver restoration projects in Wyoming in the 1990s. Mark was tremendously helpful and supportive as we tried to learn techniques and develop our Implementation Plan. He generously reviewed our plans and shared his work with us to help this project get started.

Michael Pollock is the premier beaver researcher in the Northwest. He provided ideas and support from the beginning of our effort. He was helpful in his review of the study plan for temperature and flow monitoring and has been a valuable colleague to share ideas with.

The staff of the Methow Conservancy has been especially patient as we have learned what it takes to put together, fund, and implement a significant venture in ecosystem restoration. Thank you Joy, Sarah, Mary, Heide, Steve, Eric, Dawn, and Jason for lots of hard work and lots of perseverance.

Beaver establishment in a creek showing water being spread across the floodplain

Scott Fitkin has managed to wedge this project into a work schedule each year that has never had enough room for hiring, training, timesheets, field work, reporting, accident forms, vehicles, and awards – but he has pulled it off remarkably well each year.

John Rohrer continues to be steady in his relaxed encouragement to keep walking forward on the worthwhile project he imagined.

Appendix A

Literature Supporting Beaver Benefits to Watersheds

Apple, L. L. 1985. Riparian habitat restoration and beavers. Pp 489-490 *in* Riparian ecosystems and their management: reconciling conflicting uses. First North American Conference. USDA Forest Service. RM-GTR-120. Fort Collins, CO.

Beechie, T., Imaki, H., Greene, J., Wade, A., Wu, H., Pess, G., Roni, P., Kimball, J., Stanford, J., Kiffney, P. and Mantua, N. (2012), RESTORING SALMON HABITAT FOR A CHANGING CLIMATE. River Res. Applic.. doi: 10.1002/rra.2590

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Naiman, R. J., J. M. Melillo, and J. Hobbie. 1986. Ecosystem alternation of boreal forest streams by beaver (*Castor canadensis*). Ecology 67(5): 1254-1269.

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Olson, R. and W. A. Hubert. 1994. Beaver: water resources and riparian habitat manager. University of Wyoming, Laramie. 48 pp.

Pollock, M. M., M. Heim, and D. Werner. 2003. Hydrologic and Geomorphic effects of beaver dams and their influence on fishes. American Fisheries Society Symposium 37:213-233.

Stabler, D. F. 1985. Increasing summer flow in small streams through management of riparian areas and adjacent vegetation. Pp 206-210 *in* Riparian ecosystems and their management: reconciling conflicting uses. First North American Conference. USDA Forest Service RM-GTR-120. Fort Collins, CO.

Appendix B

Attachment 1

Methow Beaver Project

Release Site Score Card Date____________________

Site ID_________________________ Observer_______________________

GPS Coordinates_UTM (NAD 83)___________________________ Subwatershed__________________________

Lat Long______________________________ Location Description__________________________________

Stream Gradient of the defined habitat unit

________ **5**. ≤3% **3**. 4-6% **1**. 7-9% **0.** ≥9%

Stream Flow **Min (fall)**

_______ **Max (spring)**

	garden hose	**fire hose**	**30"culvert**	**un-wadeable**
garden hose	**1**			
fire hose	**3**	**4**		
30"culvert	**4**	**5**	**5**	
un-wadeable	**1**	**2**	**1**	**0**

Habitat Unit Size (stream length)

________ **5.** Extensive stretch of the stream **1.** Small isolated pocket

Woody Food

a. **3.** Aspen, willow **2**. Alder **1.** Other hardwoods

b. **3**. Within 10 meters **2**. Within 30 meters **1**. Within 100 meters

c. **3**. Large amount (thousands of stems) **2.** Some (hundreds of stems) **1.** Little (dozens)

_______ **Woody food score = multiply a x b x c**

Herbaceous Food

________ **3**.Grass/Forbs Present **0.** No Grass/Forbs Present

Floodplain Width

________ **5.** Wide stream bottom **0.** Narrow V Channel

Dominant Stream Substrate

________ **5.** Silt/Clay/Mud **2.**Sand **1.** Gravel **0**. Cobble -**1**. Boulders **-3**. Bedrock

Historic Beaver use

________ **10.** Old structures present **0.** No indication of previous occupancy

Lodge and dam building materials

________ **5**. A variety of 1-6" diameter woody vegetation avail. **-10.** no building material present

Browsing / Grazing impacts

________ **5.** No Impact or obvious presence of browsers / grazers **(-10).** Heavy browsing / grazing impact.

________ **Bonus**: (5 points each) 1. Easy Access. 2. Recent fire. 3. No conflict with human values. 4. Existing aquatic escape cover. 5. Landowner / user enthusiastic

______ **Total Score**

Narrative description of site and notes/ Photo ID# / sketch on back:

Wells, Rocky Reach, and Rock Island HCP Tributary Committees Notes 15 August 2013

Members Present: Lee Carlson (Yakama Nation), Jeremy Cram (WDFW), Chris Fisher (Colville Tribes), Steve Hays (Chelan PUD), Tom Kahler (Douglas PUD), Kate Terrell (USFWS), and Tracy Hillman (Committees Chair).

Members Absent: Dale Bambrick (NOAA Fisheries).[1]

Others Present: Becky Gallaher (Tributary Project Coordinator).

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans Tributary Committees met in the Chelan PUD Auditorium in Wenatchee, Washington, on Thursday, 15 August 2013 from 9:30 am to 12:00 pm.

I. Review and Adopt Agenda

Tracy Hillman welcomed everyone to the meeting and the Committees adopted the proposed agenda with the following addition:

- Review of the Committees Chairperson.

II. Review and Approval of Meeting Minutes

The Committees reviewed and approved the 13 June 2013 meeting notes.

III. Monthly Update on Ongoing Projects

Becky Gallaher gave an update on funded projects. Most are progressing well or had no salient activity in the past month.

- Lower Wenatchee Instream Flow Enhancement Project – The project is complete. The Rock Island Committee received a final report.
- Nason Creek Upper White Pine Reconnection – Chelan PUD Powerline Reconnection Alternatives Analysis – The US Forest Service has completed initial public scoping for the NEPA process. They have decided not to have a public meeting because the only public comment received was a letter from Chelan PUD. Chelan PUD requested a map showing the limits of the powerline right-of-way if the powerline is relocated to the Upper White Pine (UWP) road. In addition, the PUD requested some additional information about costs and confirmation from the Sponsor (Chelan County Natural Resource Department) that all costs will be covered if the powerlines are moved to UWP road.
- Chewuch River Instream Passage Project – After several modifications, the Washington State Parks easement is complete. The sponsor (Trout Unlimited) will acquire signatures in August. The monitoring plan for the new system was changed and now meets Ecology

[1] Dale provided his vote on decision items prior to the meeting.

requirements. The plan was submitted with an expectation that the ROE will be issued in early August. Assembly of the bid documents continues.

- Nutrient Enhancement Assessment – The sponsor (Cascade Columbia Fisheries Enhancement Group) has been sampling water quality and macroinvertebrates since June. The sponsor met with Ecology on 18 July to talk about implementation and the level of monitoring that will be required. Ecology believes that CCFEG is on the right track; however, the sponsor is going to have some difficulties with implementing nutrient enhancement work in a watershed with a TMDL. The sponsor believes they have provided adequate justification to move forward and therefore started to draft an Administrative Order, which will be the route to permit the proposed actions in the Chiwawa. The sponsor will schedule a stakeholder meeting soon to discuss possible opportunities to use surplus carcasses from Priest Rapids Hatchery.
- Large Wood Atonement Project – The sponsor (Cascade Columbia Fisheries Enhancement Group) received a letter of “no support” from a resident on the White River. The landowner attended the public meeting held on 30 March, but did not submit comments until recently. The sponsor will schedule a meeting with the landowner within the next two weeks.
- Nason Creek Lower White Pine Alcove Acquisition Project – The project has closed. The sponsor (Chelan-Douglas Land Trust) will complete the stewardship plan this autumn.
- Coulter Creek Barrier Replacement Project – Funding for this project is contingent upon the successful implementation of the railroad reconnection project, which has not yet happened.
- Twisp River Well Conversion – The sponsor (Trout Unlimited) continues to coordinate with the landowners and contractors to make sure the project stays on schedule. The first system is scheduled to be turned on in early August.
- Wenatchee Levee Removal and Riparian Restoration Project – JARPA and SEPA have been completed and submitted to WDFW and Chelan County. The sponsor (Chelan County Natural Resource Department) is now waiting for the HPA permit. The sponsor will solicit a contractor to remove the levee sometime in August.
- Upper Beaver Habitat Improvement Channel Restoration Project – Field review and coordination were conducted by Anchor QEA and the US Fish and Wildlife Service to verify the proposed channel configuration. The sponsor (Methow Salmon Recovery Foundation) has received all necessary permits. Out-of-channel efforts related to reconstructing a preferred flow channel, construction of new facilities for irrigation diversion and screen facility, parking, staging, and access areas are underway.
- Lower Foster Creek Steelhead Habitat Enhancement Project – Becky Gallaher sent the Tributary Committee/Sponsor Agreement to the sponsor (Foster Creek Conservation District) for their review; however, she has not received a response from the project sponsor.
- Twisp River-Poorman Creek Wetland Habitat Acquisition – The Committees’ appraiser completed the appraisal. The sponsor (Methow Salmon Recovery Foundation) reviewed the appraisal and has requested an independent market valuation. The sponsor felt this step was necessary because of the disparity between the indicated value and current assessed value. The sponsor indicated that they may discuss the option of a Conservation Easement rather than an acquisition with the landowner. If the sponsor elects to move forward with a Conservation Easement, they will need to submit a revised proposal.

- Okanogan Basin Stream Discharge Monitoring Project – The Tributary/Sponsor Agreement is ready for signature.
- Shingle Creek Fish Passage Project – Chris Fisher reported that they are waiting for a Resolution and Letter of Support from the Penticton Indian Council. If they receive these items, they could have all the permits by this Friday. Work is scheduled to begin on 3 September. It should take only three weeks to complete the project.
- Methow/Chewuch Shallow Groundwater Monitoring Project – The Sponsor (Cascade Columbia Fisheries Enhancement Group) and WDFW installed benchmarks and surveyed all staff plates to benchmarks on 3 July. On 12 July, the sponsor and the Bureau of Reclamation established two control points along Silver Side Channel that can be tied to future survey efforts. The sponsor monitored all wells, staff plates, and measured discharge at eight separate cross-sections along Silver Side Channel on 24 and 25 July. Water-level loggers continue to record data.

IV. Review of General Salmon Habitat Program Proposals

The Committees received nine General Salmon Habitat Program proposals. Before reviewing the proposals, Becky Gallaher reported that currently there is $3,925,213 in the Rock Island Plan Species Account, $1,683,645 in the Rocky Reach Plan Species Account, and $1,047,957 in the Wells Plan Species Account. In addition, and consistent with the Committees' Operating Procedures, members of the Committees identified potential conflicts of interest. Kate Terrell recused herself from voting on the Silver Side Channel Design project.

Silver Side Channel Design Project

Cascade Columbia Fisheries Enhancement Group is the sponsor of the Silver Side Channel Design Project. The purpose of this project is to evaluate past, current, and future desired conditions and develop permit-ready (30%) designs for the Silver Side Channel and adjacent floodplain. The Silver Side Channel is located between Twisp and Carlton on the Methow River at about RM 35. The total cost of the project is $183,733. The sponsor requested $66,000 from HCP Tributary Funds. ***The Rocky Reach Committee approved funding for this project.***

Chiwawa Nutrient Enhancement Project

Cascade Columbia Fisheries Enhancement Group is the sponsor of the Chiwawa Nutrient Enhancement Project. The purpose of this project is to increase available nutrients for primary production and provide a direct food source for juvenile salmonids within the Chiwawa River basin. Over a four-year period, carcass analogs will be distributed manually over a 4.6-mile stretch of the Chiwawa River (RM 22.4-27.0) and within select tributaries. Water quality will be monitored before and after treatments. The total cost of the project is $684,000. The sponsor requested $342,000 from HCP Tributary Funds. ***The Rock Island Committee approved funding for this project.***

Janis Rapids Side Channel Project

Cascade Columbia Fisheries Enhancement Group is the sponsor of the Janis Rapids Side Channel Project. The purpose of this project is to restore natural processes to side channels in the Okanogan River. This will be accomplished by removing a rock weir and concrete structure. In addition, the sponsor proposes to conduct a reach-scale assessment of the Wilson Side Channel. The Janis Rapids Reach is located between RM 49.8 and 50.5. The total cost of the project is $98,750. The sponsor requested $37,000 from HCP Tributary Funds.

Although the Committees generally support restoring natural processes, they see this project as having little biological benefit. Therefore, ***the Tributary Committees elected not to fund this***

project. However, the Committees would review an application to restore the Wilson Side Channels.

Twisp to Carlton Reach Assessment Project

Cascade Columbia Fisheries Enhancement Group is the sponsor of the Twisp to Carlton Reach Assessment Project. The purpose of this project is to collect and compile watershed process information, link processes with known habitat limiting factors, and develop and prioritize multiple projects in the Middle Methow (RM 29-40). The sponsor intends to use the U.S. Bureau of Reclamation's Reach Assessment methodology. The total cost of the project is $173,016. The sponsor requested $46,500 from HCP Tributary Funds. ***The Rock Island Committee approved funding for this project.***

Icicle-Peshastin Irrigation District Pump Exchange Preliminary Design Project

Chelan County Natural Resource Department is the sponsor of the Icicle-Peshastin Irrigation District Pump Exchange Preliminary Design Project. The purpose of this project is to complete preliminary (30%) designs for a pump station on the Wenatchee River with the capacity to pump 50 cfs, a pipeline to the Peshastin Irrigation District Canal, and a booster pump and pipeline to the Icicle Irrigation District canal. Ultimately, the goal of the project is to: (1) increase flows in the lower 2.4 miles of Peshastin Creek during late summer and early fall, (2) increase flows in the lower 5.7 miles of Icicle Creek during late summer and early fall, (3) increase instream flows in the mainstem Wenatchee River between RM 16.5 and 25.6, and (4) install instream structures in lower Peshastin Creek that will enhance channel complexity. The total cost of the design project is $322,000. The sponsor requested $25,000 from HCP Tributary Funds.

The Committees recognize that fish would benefit from the addition of more flow in lower Peshastin and Icicle creeks; however, they believe the sponsor should have separated the Icicle project from the Peshastin project. In addition, the absence of an estimated cost for O&M was troubling to the Committees. They are concerned that the annual costs for O&M could be so high that the benefits associated with the project would not justify the costs. Before the Committees are comfortable spending money on preliminary designs, they need an estimated cost for O&M.

Finally, there are unnecessary elements in the proposal (and methods) and uncertainty about the change in limiting factors, because claimed benefits are only speculative. That is, the proposal includes habitat components in Peshastin Creek that are out of sequence. It is unclear what instream-flow benefits will accrue in Peshastin Creek from the pumping of 20 cfs of Wenatchee River water (i.e., just because they take 20 cfs from the Wenatchee River does not mean there is 20 cfs to leave in Peshastin Creek). There is nothing in the proposal that limits the District's usage to the pumped input, and they would need to maintain flow in the canal for users between the diversion and the point where the pumped water enters the canal. With a water right of 50 cfs, they could conceivably still withdraw enough water, in addition to the pumped input, to severely dewater the lower Peshastin. As shown in Figure 1 in the proposal, in three of the six years with both gauges operating, they withdrew about the same amount as or more than would be provided by the pumped Wenatchee water. In the other three years, they used less, but left only 6, 7, and 8 cfs, respectively, in the creek, such that had pumped water been supplied down the line it remains likely that they would have still left less than 20 cfs in the creek. The claim of the proposal that the project would add 20-cfs to Peshastin Creek does not appear accurate—the water is not added to the creek, it is added to the canal and the 20 cfs pumped does not eliminate the diversion and the withdrawal necessary to water the canal. Therefore, ***the Tributary Committees elected not to fund this project***.

Nason Creek RM 4.6 Side Channel Reconnection Construction Project

Chelan County Natural Resource Department is the sponsor of the Nason Creek RM 4.6 Side Channel Reconnection Construction Project. The purpose of this project is to provide high-flow refugia and rearing habitat for adult and juvenile salmonids in Nason Creek. The project will reconnect a 4.6-acre, high-flow channel to the mainstem near RM 4.6. The total cost of the project is $525,030. The sponsor requested $88,000 from HCP Tributary Funds. ***The Rock Island Committee approved funding for this project.***

CDLT Entiat Stillwaters Gray Reach Acquisitions

The Chelan-Douglas Land Trust is the sponsor of the Entiat Stillwaters Gray Reach Acquisitions. The purpose of this project is to protect in perpetuity and maintain 77.31 acres of largely riparian habitat including 6,730 linear feet of stream bank of the Stillwaters Reach. This action will prevent degradation of spawning and rearing habitat by eliminating threats of subdivision development and associated habitat degradation, and will facilitate restoration and enhancement actions. The parcels are located between RM 17.6-17.9 and RM 16.8-17.3. The total cost of the project is $569,625. The sponsor requested $170,000 from HCP Tributary Funds. ***The Rocky Reach Committee approved funding for this project.***

As part of the Committee's contribution to this project, the Committee will use their own appraiser and reviewer to assess the value of the property. The $10,000 that the sponsor identified in their budget for appraisal and review will be covered by the Committee. Thus, the Committee will provide up to $160,000 for the purchase of the properties, plus the cost of the appraisal and review ($10,000).

Similkameen RM 3.8 Habitat Design Project

Okanogan Conservation District is the sponsor of the Similkameen RM 3.8 Habitat Design Project. The purpose of this project is to design a project that will reduce bank erosion and improve spawning and fry rearing habitat at RM 3.8 on the Similkameen River. The total cost of the project is $84,640. The sponsor requested $21,160 from HCP Tributary Funds. ***The Rocky Reach Committee approved funding for this project.***

Although the Committees recognize that this project will have little biological benefit, they believe that the landowner, who approached the Okanogan Conservation District about fixing the erosion problem, will communicate with other landowners in the Okanogan River basin. It is hoped that this communication among landowners will create a more positive environment for implementing habitat restoration actions in the basin.

MVID Instream Flow Improvement Project

Trout Unlimited – Washington Water Project is the sponsor of the MVID Instream Flow Improvement Project. The purpose of this project is to: (1) improve instream flows in the lower 4.5 miles of the Twisp River by eliminating the MVID irrigation diversion and returning up to 15 cfs, which will be placed in permanent trust; (2) improve instream flow in the Methow River by piping a portion of the east canal and permanently trusting the saved water; (3) improve instream flow (2 cfs) and wetland and side channel habitat by restoring the natural flow in Alder Creek and permanently trusting the water; and (4) prevent fish injury and mortality associated with MVID's Twisp River pushup dam, fish screen operations, and the stranding of redds and juveniles in the MVID West Canal's intake canal and fish return channel. The total cost of the project is $9,747,000. The sponsor requested $400,000 from HCP Tributary Funds. ***The Wells Committee approved funding for this project.***

Summary of Review of 2013 General Salmon Habitat Program Projects.

Project Name	Sponsor[1]	Total Cost	Request from T.C.	T.C. Contribution[2]
Silver Side Channel Design	CCFEG	$183,733	$66,000	RR: $66,000
Chiwawa Nutrient Enhancement	CCFEG	$684,000	$342,000	RI: $342,000
Janis Rapids Side Channel	CCFEG	$98,750	$37,000	$0
Twisp to Carlton Reach Assessment	CCFEG	$173,016	$46,500	RI: $46,500
Icicle-Peshastin Irrigation District Pump Exchange	CCNRD	$322,000	$25,000	$0
Nason Creek RM 4.6 Side Channel Reconnection	CCNRD	$525,030	$88,000	RI: $88,000
CDLT Entiat Stillwaters Gray Reach Acquisitions	CDLT	$569,625	$170,000	RR: $160,000
Similkameen RM 3.8 Habitat Design	OCD	$84,640	$21,160	RR: $21,160
MVID Instream Flow Improvement	TU-WWP	$9,747,000	$400,000	W: $400,000
Total:		**$12,387,794**	**$1,195,660**	**$1,123,660**

[1] CCFEG = Cascade Columbia Fisheries Enhancement Group; CCNRD = Chelan County Natural Resource Department; CDLT = Chelan-Douglas Land Trust; OCD = Okanogan Conservation District; and TU-WWP = Trout Unlimited – Washington Water Project.

[2] RI = Rock Island Plan Species Account; RR = Rocky Reach Plan Species Account; W = Wells Plan Species Account.

V. Contract Extension Request

In July, the Rock Island Tributary Committee received a contract extension request from the Chelan County Natural Resource Department on the Wenatchee Levee Removal and Riparian Restoration Project. The sponsor indicated that they needed additional time this summer and fall to complete the levee removal and riparian restoration work, and to allow time for the landowner to process the water rights changes. The sponsor asked the Committee to extend the contract from 30 June 2013 to 28 February 2014. ***The Rock Island Committee approved the contract extension***.

VI. Information Updates

The following information updates were provided during the meeting.

1. Approved Payment Requests in July and August:

   Rock Island Plan Species Account:

   - $87.50 to Clifton Larson Allen for second-quarter financial management and reporting.
   - $1,554.54 to Chelan PUD for second-quarter administration and management.

   Rocky Reach Plan Species Account:

   - $87.50 to Clifton Larson Allen for second-quarter financial management and reporting.
   - $1,913.60 to Chelan PUD for second-quarter administration and management.
   - $67,300.00 to First American Title for the purchase of the Click and Stone-Parker parcels for the Nason Creek Lower White Pine Alcove Acquisition.
   - $13,239.58 to Trout Unlimited – Washington Water Project for the Chewuch River Instream Flow Project.

- $1,113.26 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project.

Wells Plan Species Account:

- $10,157.21 (includes two invoices: $4,835.00 for January through April and $5,322.21 for May through June) to Trout Unlimited – Washington Water Project for the Twisp River Well Conversion Project.
- $1,113.26 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project.
- $147.55 to the Methow Salmon Recovery Foundation for the Twisp River-Poorman Creek Wetland Habitat Acquisition Project.
- $2,601.46 to Cascade Columbia Fisheries Enhancement Group for the Methow/Chewuch Shallow Groundwater Monitoring Project.
- $2,187.82 to the Methow Conservancy for the Lower Chewuch Beaver Restoration Project.
- $6,500.00 to Cascade Chelan Appraisal, Inc., for appraisal of the Poorman Creek Habitat Acquisition Project.
- $787.41 to Chelan PUD for second-quarter administration and management.

2. Tom Kahler reported that the Committees agreed unanimously to retain Tracy Hillman as the Chairperson for the next three-year period (2014 through 2016). Tracy accepted the appointment and asked the members for feedback on how he could better serve them as their Chairperson. Members requested that Tracy more freely offer technical information on projects.
3. Tracy Hillman reported that he received a letter from the Upper Columbia Salmon Recovery Board (UCSRB) extending an opportunity for the Tributary Committees to help sponsor the 2013 Upper Columbia Science Conference on 13 and 14 November. The UCSRB asked for a contribution of $500 or more to help organize and implement the event. After discussion, the Committees elected to contribute $3,000 ($1,000 from each of the administrative accounts [no greater than $80,000 per year] of the Plan Species Accounts).
4. Chris Fisher reported that the tour of restoration projects in Canada will occur on 9 and 10 October. The Shingle Creek project should be completed in September, alterations to Vertical Drop Structure 13 should be completed by early October, and ORRI Phase II should be completed by the end of September. All except Kate Terrell and Dale Bambrick thought that they would be able to attend the tour. Brandon Rogers may attend the tour in Lee Carlson's stead. The tour will replace the Committees' October meeting.

VII. Next Steps

The next meeting of the Tributary Committees will be on Thursday, 12 September 2013 at Chelan PUD in Wenatchee.

Meeting notes submitted by Tracy Hillman (tracy.hillman@bioanalysts.net).

Wells, Rocky Reach, and Rock Island HCP Tributary Committees Notes 12 September 2013

Members Present: Dale Bambrick (NOAA Fisheries), Lee Carlson (Yakama Nation), Chris Fisher (Colville Tribes), Steve Hays (Chelan PUD), Tom Kahler (Douglas PUD), Kate Terrell (USFWS), and Tracy Hillman (Committees Chair).

Members Absent: Jeremy Cram (WDFW).[1]

Others Present: Becky Gallaher (Tributary Project Coordinator).

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans Tributary Committees met in the Chelan PUD Auditorium in Wenatchee, Washington, on Thursday, 12 September 2013 from 10:00 am to 12:00 pm.

I. Review and Adopt Agenda

Tracy Hillman welcomed everyone to the meeting and the Committees adopted the proposed agenda with the following additions:

- Shingle Creek Contract Extension
- Review of Projects Funded by the Tributary Committees

II. Review and Approval of Meeting Minutes

The Committees reviewed and approved the 15 August 2013 meeting notes with edits.

III. Monthly Update on Ongoing Projects

Becky Gallaher gave an update on funded projects. Most are progressing well or had no salient activity in the past month.

- Nason Creek Upper White Pine Reconnection – Chelan PUD Powerline Reconnection Alternatives Analysis – Jeff Osborn reported that Chelan PUD is coordinating with Chelan County and the Bonneville Power Administration. The PUD will meet with the US Forest Service to discuss right-of-ways and easements.
- Chewuch River Instream Passage Project – The sponsor (Trout Unlimited) continues to coordinate with the Chewuch Canal Company president on options to consider regarding schedule, funding, reservoir permitting, and cost saving strategies. The landowner, who will provide access for the Winthrop-Bear Creek piping added another demand to his easement proposal. All landowners along this section of the ditch are renegotiating their agreements. Two additional piping areas were located in case it is needed. These areas will not require cultural surveys, but will require some payment. Assembly of the bid document continued in August for the Winthrop-Bear Creek part of the project. A pre-bid

[1] Jeremy provided his votes on decision items following the meeting.

walk-through was held on 29 August. Seven companies attended. The sponsor will open bids on 9 September and award the project to a contractor by 12 September 2013. Ecology issued the ROE on 2 August 2013.

- Nutrient Enhancement Assessment – During the month of August, the sponsor (Cascade Columbia Fisheries Enhancement Group) and PACE Engineering collected water quality samples, periphyton, and macroinvertebrates in all of the sub-watersheds of the upper Wenatchee River basin. The sponsor also submitted a draft Administrative Order (the permit) to Ecology for nutrient enhancement in the Chiwawa River basin. The sponsor is scheduling a meeting with the U.S. Forest Service, U.S. Fish and Wildlife Service, NOAA Fisheries, and WDFW to discuss permitting for this project.
- Large Wood Atonement Project – The sponsor (Cascade Columbia Fisheries Enhancement Group) received a non-supportive letter from a White River resident. On 22 August, the sponsor met with the concerned citizen and explained the background and logic that went into the development of the project. The sponsor left the meeting feeling that the landowner was more informed and is generally okay with proceeding. In addition, because of the new landowner liability legislation and growing "paranoia" surrounding the addition of wood to rivers, the sponsor is exploring hiring an engineer to design and stamp the project plans. This may be required given that the Department of Natural Resources owns the streambed.
- Nason Creek Lower White Pine Alcove Acquisition Project – This project has closed. The sponsor (Chelan-Douglas Land Trust) will complete the stewardship plan this autumn.
- Coulter Creek Barrier Replacement Project – Funding for this project is contingent upon the successful implementation of the railroad reconnection project.
- Silver Protection Project – The WDFW Director has approved moving forward with the Silver Conservation Easement. The portion proposed for fee acquisition will remain on hold indefinitely pending resolution on WDFW land acquisitions in Okanogan County. The Methow Salmon Recovery Foundation will purchase the property if WDFW is unable to complete the transaction.
- Twisp River Well Conversion – Construction has progressed to the point where the system was turned on and tested. This included backfilling the irrigation lines, installing the pumps and VFD, and running all electrical components. The test indicated that during spring, there was adequate water available to run the system (i.e., 150 gallons/minute). However, in August, the system was only able to produce 90 gallons/minute. The driller, hydrogeologist, and water witcher confirmed that the well needs to be drilled deeper to produce the required production. Deepening the well will increase costs, which include pulling the pumps, fabrication to lower the pumps, a booster pump, and the well driller costs. In addition, the NRCS contribution will be less than originally thought. Therefore, the sponsor (Trout Unlimited) asked the Wells Tributary Committee if they would provide additional funding for the project. The revised total cost of the project is $99,188.58 (the original cost was $87,738.87). The sponsor asked the Wells Committee if they would increase their contribution to $68,022.58 (the original contribution was $43,550.27). After carefully reviewing the request, ***the Wells Committee approved funding up to $68,022.58, an increase of $24,472.31 from the original contribution.***
- Wenatchee Levee Removal and Riparian Restoration Project – The HPA is ready and will be issued the week of 9 September 2013. Removal of the levee will likely occur after the landowner is finished with harvesting pears.

- Upper Beaver Habitat Improvement Channel Restoration Project – The sponsor (Methow Salmon Recovery Foundation) completed field staking in advance of rough channel construction. They also placed a temporary bridge across the active channel of Beaver Creek to allow access to the floodplain. They initiated rough construction work to establish a new channel route for the primary segment. Out-of-channel efforts related to reconstructing the preferred flow channel will be completed in September. Construction of new facilities for irrigation diversion and screen facility, parking, staging, and access areas are underway.
- Lower Foster Creek Steelhead Habitat Enhancement Project – Becky Gallaher sent the Tributary Committee/Sponsor Agreement to the sponsor (Foster Creek Conservation District) for their review. She has not received a response from the project sponsor.
- Twisp River-Poorman Creek Wetland Habitat Acquisition – An independent review was completed on 11 August 2013. The sponsor (Methow Salmon Recovery Foundation) then met with the landowner to discuss options and preferences. Based on the appraisal and independent review, the landowner will proceed under a conservation easement rather than an acquisition. Although the Wells Committee has not received a formal request, the sponsor would like to use a portion of the allocated Plan Species Account funds for the non-acquisition elements of the property.
- Shingle Creek Fish Passage Project – Chris Fisher reported that there were some issues with coordination between the Okanagan Nation Alliance (ONA) and the contractor (Westhills). Because there is no contract in place, rock from the quarry may not be available this year for the fish passage project. To that end, ONA asked the Wells and Rocky Reach Tributary Committees for a contract extension from 31 December 2013 to 31 December 2014. ***The Wells and the Rocky Reach Tributary Committees approved the time extension.*** Chris believes that they will be able to complete the project this year.
- Methow/Chewuch Shallow Groundwater Monitoring Project – The U.S. Fish and Wildlife Service collected discharge data at 11 cross-sections along the Silver Side Channel. The sponsor (Cascade Columbia Fisheries Enhancement Group) organized the piezometer water-level data and populated a spreadsheet that tracks flow measurements collected from the Silver Side Channel. They also compiled data from the Burns-Garrity site and sent those data to WDFW for analysis.

IV. Additional Funding Request

Tracy Hillman shared with the Committees the list of projects that were selected for possible funding by the Salmon Recovery Funding Board (SRFB) (see Attachment 1). He noted that some of the projects selected to receive Plan Species Account funds were not selected to receive matching funds from the SRFB. That is, the Silver Side Channel Design Project, Nason Creek RM 4.6 Side Channel Reconnection Construction Project, Similkameen RM 3.8 Design Project, and the Chiwawa Nutrient Enhancement Project fell below the SRFB funding line. The Cascade Columbia Fisheries Enhancement Group asked the Rocky Reach Tributary Committee if they would fund the entire Silver Side Channel Design Project. ***Because the Rocky Reach Committee sees this project as an important step in restoring important habitat for Plan species, the Committee elected to fund the entire project for $132,000.*** Chris Fisher noted, however, that the cost of the project appeared excessive.

The Committees reviewed the other three projects that were selected to receive Plan Species Account funds but did not receive SRFB matches and concluded that of the three, they would only fully fund the Similkameen RM 3.8 Design Project. This is because the Committees see this project as an important tool in developing relationships with landowners in the Okanogan Basin.

Thus, the Rocky Reach Tributary Committee elected to fund the entire Similkameen RM 3.8 Design Project for $84,640. The Committee requires, however, that the landowner establish a riparian buffer zone, which his livestock cannot enter. In addition, the sponsor (Okanogan Conservation District) needs to develop a design-build project. That is, there is no need to identify several different alternatives for this project. The sponsor is welcome to submit a proposal for additional funding if the $84,640 does not cover the entire cost of the design-build project.

V. Icicle-Peshastin Irrigation District Pump Exchange Project

In August, the Committees elected not to fund the Icicle-Peshastin Irrigation District Pump Exchange Project, because the sponsor (Chelan County Natural Resource Department) did not separate the Icicle project from the Peshastin project. In addition, the absence of an estimated cost for O&M troubled the Committees. Finally, the sponsor included unnecessary elements in the proposal (and methods) and uncertainty about the change in limiting factors, because claimed benefits are only speculative. Following receipt of the rejection letter from the Tributary Committees, Mike Kaputa contacted Tracy Hillman and asked for additional clarification. His questions and the Committees' responses follow:

1. *Would the Committees be willing to review a revised proposal this year?* The Committees indicated that the sponsor would need to resubmit the proposal during the next funding cycle, which would be next year. The Committees do not want to deviate from their current policy. They noted that if the project is time sensitive, the sponsor should seek funding elsewhere.
2. *Would the Committees be willing to help support O&M costs?* The Committees would need to know the O&M costs before they can determine if they would support the costs in part or in total. Importantly, the Committees requested this information during the pre-proposal and field review as well as during the sponsor presentations.
3. *Please indicate why the Icicle Pump Station should be separate from the Peshastin Pump Station?* The Committees do not believe the Peshastin Pump location is the most appropriate location for the Icicle Pump. They believe the most advantageous location for the Icicle Pump is downstream from Leavenworth.

The Committees directed Tracy to send an e-mail to Mike with the Committees' responses.

VI. Information Updates

The following information updates were provided during the meeting.

1. Approved Payment Requests in August and September:

   Rock Island Plan Species Account:

   - $67.50 to Clifton Larson Allen for July-August financial management and reporting.
   - $1,000.00 to the Upper Columbia Salmon Recovery Board to help sponsor the Upper Columbia Science Conference.

   Rocky Reach Plan Species Account:

   - $67.50 to Clifton Larson Allen for July-August financial management and reporting.

- $1,570.72 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project.
- $3,445.36 to Trout Unlimited – Washington Water Project for the Chewuch River Instream Flow Project.
- $2,478.63 to the Chelan-Douglas Land Trust for the Nason Creek Lower White Pine Alcove Acquisition.
- $1,000.00 to the Upper Columbia Salmon Recovery Board to help sponsor the Upper Columbia Science Conference.

Wells Plan Species Account:

- $1,570.72 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project.
- $24,737.91 to Trout Unlimited – Washington Water Project for the Twisp River Well Conversion Project.
- $14,579.98 to the Methow Conservancy for the Lower Chewuch Beaver Restoration Project.
- $2,272.00 to Douglas PUD for Fiscal Year 2013 administration and management.
- $1,000.00 to the Upper Columbia Salmon Recovery Board to help sponsor the Upper Columbia Science Conference.

2. Tracy Hillman reported that he and Jeremy Cram were asked to meet with Cascade Columbia Fisheries Enhancement Group (CCFEG) about the Chiwawa Nutrient Enhancement Project. The CCFEG asked if the Committees would be interested in reviewing a proposal that would assess the effects of nutrient supplementation in the Chiwawa River basin. The CCFEG does not believe the hatchery monitoring and evaluation program funded by Chelan PUD will be sensitive enough to detect treatment effects. After discussion, the Committees indicated that they would not be interested in reviewing a proposal to monitor the effects of the nutrient enhancement work. They would rather use the Tributary Assessment Program funds to examine off-channel habitat actions and barrier removal actions.
3. Becky Gallaher provided the Committees with a list of projects that have been funded under each Plan Species Account (see Attachment 2). The lists provide the project name, project sponsor, type of funding (Small Project or General Salmon Habitat), project type, total cost of the project, Tributary contribution, and project status.
4. Chris Fisher reported that the tour of restoration projects in Canada will occur on 9 and 10 October. The Shingle Creek project may not be complete by October; however, alterations to Vertical Drop Structure 13 should be completed by early October and ORRI Phase II should be completed by the end of September. All except Kate Terrell, Dale Bambrick, and Lee Carlson thought that they would be able to attend the tour. Brandon Rogers will attend the tour in Lee Carlson’s stead. The tour will replace the Committees’ October meeting.

VII. Next Steps

The next meeting of the Tributary Committees will be on Friday, 15 November 2013 at Chelan PUD in Wenatchee.

Meeting notes submitted by Tracy Hillman (tracy.hillman@bioanalysts.net).

Attachment 1—List of projects seeking funds from the Salmon Recovery Funding Board. Projects above the blue line were selected to receive SRFB funds.

UCSRB 2013 Lead Entity Project List								
PROJECT NAME	**SPONSOR**	**AMOUNT REQUESTED**				**RTT SCORE**	**CAC Rank**
		SRFB	TRIB	Other	Total	Benefit Score	
Roaring Creek Flow Restoration and Diversion Removal Project	Trout Unlimited (TU)	$77,000.00	$0.00	$177,000.00	$254,000.00	56.55	1
Chewuch River Permanent Instream Flow Project	TU	$318,547.00	$0.00	$1,950,000.00	$2,268,547.00	52.94	2
Nason Creek UWP Horseshoe Bend Acquisition	Chelan-Douglas Land Trust (CDLT)	$293,000.00	$0.00	$51,715.00	$344,715.00	35.49	3
MVID Instream Flow Improvement Project	TU	$750,000.00	$400,000.00	$8,777,000.00	$9,927,000.00	51.34	4
Icicle Creek Boulder Field Passage Design	TU	$179,000.00	$0.00	$0.00	$179,000.00	65.14	5
Entiat Stillwaters Gray Reach Acquisitions	CDLT	$279,625.00	$170,000.00	$120,000.00	$569,625.00	50.23	6
Twisp to Carlton Reach Assessment	Cascade Columbia Fisheries Enhancement Group (CCFEG)	$46,500.00	$46,500.00	$0.00	$93,000.00	72.59	7
Kahler Reconnection, Recruitment and Rehabilitation Design	CCNRD	$199,900.00	$0.00	$0.00	$199,900.00	58.10	8
Okanogan River Fish Screen Implementation, Phase II	Okanogan Conservation District (OCD)	$140,250.00		$24,750.00	$165,000.00	31.12	9
Silver Side Channel Design	CCFEG	$66,000.00	$66,000.00	$0.00	$132,000.00	64.05	10
Nason Creek RM 4.6 Side Channel Reconnection Construction	Chelan County Natural Resource Dept. (CCNRD)	$437,030.00	$88,000.00	$0.00	$525,030.00	35.49	11
Phase 1 Johnson Creek Barrier Passage Projects	TU	$164,900.00	$0.00	$29,100.00	$194,000.00	46.83	12
Twisp River-Poorman Creek Habitat Acquisition, Phase II RM 5.25 – 5.75	Methow Conservancy	$294,350.00	$0.00	$52,000.00	$346,350.00	35.75	13
Entiat Canal System Conversion Phase 3 Construction	Cascadia Conservation District (CCD)	$338,300.00	$0.00	$59,700.00	$398,000.00	26.79	14
Peshastin Irrigation District Pump Exchange Feasibility and Design	CCNRD	$199,900.00	$0.00	$186,000.00	$385,900.00	61.56	15
Similkameen RM 3.8 Design Only	OCD	$63,480.00	$21,160.00	$0.00	$84,640.00	40.49	16
Camas Creek Fish Passage Design and Construction	CCNRD	$105,044.00	$0.00	$18,538.00	$123,582.00	25.02	17
Janis Rapids Side Channel Project	CCFEG	$61,750.00	$0.00	$0.00	$61,750.00	32.54	18
Chiwawa Nutrient Enhancement	CCFEG	$342,000.00	$342,000.00	$0.00	$684,000.00	34.47	19
Peshastin Creek Confluence Design	Washington Department of Fish and Wildlife (WDFW)	$175,010.00	$0.00	$0.00	$175,010.00	61.56	20
Wenatchee-Entiat Rivers Fish Screen Inventory & Design	WDFW	$90,200.00	$0.00	$0.00	$90,200.00	34.13	21
	TOTAL	**$4,621,786.00**	$1,133,660.00	$11,445,803	$17,201,249		
	SRFB Allocation	$1,953,000.00					

Attachment 2—Projects funded by the Tributary Committees.

Rock Island Plan Species Account							
Project Name	**Sponsor**	**Fund Type**	**Project Type**	**Total Cost**	**Tributary Contribution**	**Tributary Contribution (actual to date)**	**Project Status**
05 White River Floodplain & Habitat Protection	Chelan-Douglas Land Trust	General	Protection	$1,986,200	$693,548	$693,548	Complete
05 Nason Creek Off-Channel Habitat Restoration	Chelan County NRD	General	Off-Channel Habitat	$125,034	$18,787	$18,787	Complete
05 Alder Creek Culvert Replacement	Chelan County NRD	General	Fish Passage	$89,804	$89,804	$89,804	Complete
05 McDevitt Diversion Project	Cascadia Conservation District	Small	Fish Passage	$5,278	$5,278	$2,831	Complete
07 LWD Removal and Relocation	Chelan County NRD	Small	Instream Structures	$5,000	$5,000	$871	Complete
07 WRIA's 45/46 Riparian Restoration	Cascadia Conservation District	Small	Administration	$50,000	$25,000	$24,779	Complete
07 Entiat PUD Canal System Conversion	Cascadia Conservation District	General	Instream Flows	$496,584	$99,360	$99,360	Complete
07 Roaring Creek Flow Enhancement	Cascadia Conservation District	General	Instrm Flows/Fish Passage	$147,069	$25,000	$987	Cancelled
07 Wildhorse Spring Creek Conservation Easement	Colville Confederated Tribes	General	Protection	$67,826	$62,826	$62,826	Complete
08 Twisp River Conservation Acquisition II	Methow Salmon Recovery Found	General	Protection	$481,814	$220,000	$200,500	Complete
08 Twisp River Riparian Protection (Zinn)	Methow Conservancy	General	Protection	$349,988	$104,996	$104,996	In progress
08 Cashmere Pond Off-Channel Habitat Project	Chelan County NRD	General	Off-Channel Habitat	$914,076	$249,110	$240,139	Complete
08 Keystone Canyon Habitat Project	Cascadia Conservation District	General	Off-Channel Habitat	$0	$0	$0	Cancelled
09 LWD/Rootwad Acquisition and Transport II	Cascadia Conservation District	Small	Instream Structures	$35,000	$35,000	$35,000	Complete
09 Sleepy Hollow Reserve Protection Feasibility	Chelan-Douglas Land Trust	Small	Assessment	$25,000	$20,000	$16,599	Complete
09 White River Nason View Acquisition	Chelan-Douglas Land Trust	General	Protection	$639,000	$76,635	$76,635	Complete

Rock Island Plan Species Account							
Project Name	**Sponsor**	**Fund Type**	**Project Type**	**Total Cost**	**Tributary Contribution**	**Tributary Contribution (actual to date)**	**Project Status**
09 Upper Methow II (Tawlks) Riparian Protection	Methow Conservancy	General	Protection	$411,943	$61,948	$61,948	Complete
09 Nason Creek UWP Floodplain Reconnection - PUD Powerline Reconnection Alternatives Analysis	Chelan County NRD	General	Assessment	$53,500	$53,500	$28,704	In progress
09 Lower Wenatchee Instream Flow Enhancement	Washington Rivers Conservancy	General	Instream Flows	$4,954,466	$167,500	$153,613	In progress
10 White River Dally-Wilson Conservation Easement	Chelan-Douglas Land Trust	General	Protection	$194,000	$120,000	$120,000	Complete
10 Mission Creek Fish Passage	Cascadia Conservation District	Small	Fish Passage/Instrm Struct	$50,000	$50,000	$0	In progress
10 Assessing Nutrient Enhancement	CC Fisheries Enhancement Group	Small	Assessment	$9,875	$9,875	$6,670	Complete
11 Boat Launch Off-Channel Pond Reconnection	Chelan County NRD	General	Off-Channel Habitat	$136,500	$62,000	$62,000	Complete
11 White River Van Dusen Conservation Easement	Chelan-Douglas Land Trust	General	Protection	$440,000	$60,000	$60,000	Complete
12 Wenatchee Nutrient Enhancement - Treatment Design	CCFEG	General	Assessment/Instream Structures	$240,000	$80,000	$59,862	In progress
12 White River Large Wood Atonement	CCFEG	General	Instream Structures	$352,392	$100,000	$3,495	In progress
12 Lower White Pine Upper Connection B+	Chelan County NRD	General	Off-Channel Habitat	$2,162,290	$250,000	$0	On hold
12 Wenatchee Levee Removal & Riparian Restoration	Chelan County NRD	Small	Off-Channel Habitat	$67,450	$56,700	$8,770	In progress
12 Upper Beaver Habitat Improvement Channel Restoration	Methow Salmon Recovery Found	General	Off-Channel Habitat	$674,600	$102,613	$1,446	In progress
12 Wenatchee Levee Removal & Riparian Restoration	Chelan County NRD	Small	Off-Channel Habitat	$67,450	$56,700	$8,770	In progress
Total				**$15,232,139**	**$2,961,180**	**$2,242,939**	

Current Rock Island Plan Species Account Balance (unallocated): 1,095,281.00
Contribution to the Rock Island Account is made annually (January 31): $485,200 (in 1998 dollars)

Rocky Reach Plan Species Account							
Project Name	**Sponsor**	**Fund Type**	**Project Type**	**Total Cost**	**Tributary Contribution**	**Tributary Contribution (actual to date)**	**Project Status**
05 Entiat Instream Structure Engineering	Cascadia Conservation District	General	Instream Structures	$59,340	$59,340	$48,659	Complete
05 Twisp River Conservation Acquisition	Methow Salmon Recovery Found	General	Protection	$200,835	$40,000	$40,000	Complete
05 Clees Well and Pump	Okanogan Conservation District	General	Instream Flows	$40,875	$15,000	$14,924	Complete
05 Entiat Instream Habitat Improvements	Chelan County NRD	General	Instream Structures	$250,000	$37,500	$37,500	Complete
06 Entiat PUD Canal Juv Habitat Enhancement	Cascadia Conservation District	Small	Instream Structures	$23,640	$23,640	$3,059	Complete
07 LWD Removal & Relocation	Chelan County NRD	Small	Instream Structures	$5,000	$5,000	$871	Complete
07 LWD/Rootwad Acquisition & Transport	Cascadia Conservation District	Small	Instream Structures	$24,600	$24,600	$24,600	Complete
07 Harrison Side Channel	Chelan County NRD	General	Off-Channel Habitat	$797,300	$90,105	$68,647	Complete
08 Entiat PUD Canal Log-Boom Installation	Cascadia Conservation District	Small	Instream Structures	$10,660	$7,160	$4,526	Complete
08 Twisp River Riparian Protection (Buckley)	Methow Conservancy	General	Protection	$299,418	$89,825	$89,825	Complete
08 Below the Bridge	Cascadia Conservation District	General	Instream Structures	$398,998	$150,000	$115,353	Complete
09 Foreman Floodplain Reconnection	Chelan County NRD	General	Off-Channel Habitat	$0	$0	$0	Cancelled
09 Entiat NFH Habitat Improvement Project	Cascadia Conservation District	General	Off-Channel Habitat	$285,886	$61,373	$61,373	Complete
10 Methow Subbasin LWD Acquisition & Stockpile	Methow Salmon Recovery Found	Small	Instream Structures	$50,000	$50,000	$49,914	Complete
11 Chewuch River Permanent Instream Flow Project	TU – Washington Water Project	General	Instream Flow	$1,200,000	$325,000	$158,432	In Progress
11 Christianson Conservation Easement	Methow Conservancy	Small	Protection	$16,350	$15,000	$15,000	Complete
12 Entiat Stormy Reach Phase 2 Acquisition	Chelan-Douglas Land Trust	General	Protection	$165,000	$46,800	$44,003	Complete
12 Silver Protection	WA Dept. of Fish & Wildlife	General	Protection	$660,000	$125,000	$0	In progress

Rocky Reach Plan Species Account							
Project Name	**Sponsor**	**Fund Type**	**Project Type**	**Total Cost**	**Tributary Contribution**	**Tributary Contribution (actual to date)**	**Project Status**
12 Nason Creek Lower White Pine Coulter Creek Barrier Replacement	Chelan County NRD	General	Fish Passage	$83,126	$12,469	$0	In Progress
12 Nason Creek LWP Alcove Acquisition	Chelan-Douglas Land Trust	General	Protection	$353,000	$72,000	$69,779	In Progress
13 Fish Passage at Shingle Creek Dam	Okanagan Nation Alliance	General	Fish Passage	$59,225	$180,950	$0	In progress
13 Upper Beaver Habitat Improvement Channel Restoration	Methow Salmon Recovery Found	General	Channel Restoration	$674,600	$102,613	$4,129	In Progress
13 Okanogan Basin Stream Discharge Monitoring	Colville Confederated Tribes	Small	Instream Flows	$90,954	$74,984	$0	In Progress
Total				**$5,748,807**	**$1,608,359**	**$850,594**	

Current Rocky Reach Plan Species Account Balance (unallocated): $1,274,933.90
Contribution to the Rocky Reach Account is made annually (January 31): $229,800 (in 1998 dollars)

Wells Plan Species Account							
Project Name	**Sponsor**	**Fund Type**	**Project Type**	**Total Cost**	**Tributary Contribution**	**Tributary Contribution (actual to date)**	**Project Status**
05 Okanagan River Restoration – Phase III	Okanagan Nation Alliance	General	Instream Structures	$219,121	$219,121	$197,681	Complete
05 Methow Riparian Protection (Heath)	Methow Conservancy	General	Protection			$812,700	Complete
05 Methow Riparian Protection (Prentice)	Methow Conservancy	General	Protection	$2,684,500	$1,177,500	$1,749	Complete
05 Methow Riparian Protection (MacDonald)	Methow Conservancy	General	Protection			$345,400	Complete
07 Lower Beaver Creek Livestock Exclusion	Okanogan Conservation District	Small	Riparian Habitat	$24,670	$18,559	$16,561	Complete
07 Heath Floodplain Restoration	Methow Salmon Recovery Found	Small	Off-Channel Habitat	$48,695	$48,695	$43,915	Complete
07 Okanogan River Restoration – Phase IV	Okanagan Nation Alliance	General	Instream Structures	$1,022,000	$411,000	$411,000	Complete
08 Riparian Regeneration & Restoration Initiative	Methow Conservancy	Small	Riparian Habitat	$22,737	$15,537	$15,537	Complete
08 Fort Thurlow Pump Project	Methow Salmon Recovery Found	Small	Instream Flows	$48,150	$7,000	$7,009	Complete
08 Goodman Livestock Exclusion Project	Okanogan Conservation District	Small	Riparian Habitat	$8,080	$7,980	$6,829	Complete
08 Poorman Creek Barrier Removal	Methow Salmon Recovery Found	General	Fish Passage	$191,579	$53,748	$53,748	Complete
08 Twisp River Riparian Protection (Pampanin)	Methow Conservancy	General	Protection	$119,720	$48,649	$48,649	Complete
08 Twisp River Riparian Protection (Neighbor)	Methow Conservancy	General	Protection	$260,000	$55,000	$55,000	Complete
08 Twisp River Riparian Protection (Speir)	Methow Conservancy	General	Protection	$79,976	$23,993	$23,993	Complete
~~10 Prevent Fish Entrainment on Inkaneep Creek~~	~~Okanogan Nation Alliance~~	~~Small~~	~~Instream Flows~~	~~$24,000~~	~~$24,000~~	~~$0~~	~~In Progress~~
11 Methow River Acquisition MR 39.5 (Hoffman)	Methow Salmon Recovery Found	General	Protection	$195,048	$74,415	$74,415	Complete
11Methow River Acquisition MR 48.7 (Bird)	Methow Salmon Recovery Found	General	Protection	$292,140	$111,680	$109,786	Complete
11 Methow River Acquisition MR 41.5 (Risley)	Methow Salmon Recovery Found	General	Protection	148,209.92	31,853.92	$26,518	Complete

Wells Plan Species Account							
Project Name	**Sponsor**	**Fund Type**	**Project Type**	**Total Cost**	**Tributary Contribution**	**Tributary Contribution (actual to date)**	**Project Status**
12 Twisp River Acquisition 2011 (Hovee)	Methow Salmon Recovery Found	General	Protection	140,700.00	29,000.00	$1,074	Complete
12 Silver Protection	WA Dept. of Fish & Wildlife	General	Protection	660,000.00	125,000.00	$0	In Progress
12 Twisp River Well Conversion	Trout Unlimited	Small	Instream Flows	87,738.87	43,550.27	$34,895	In Progress
13 Twisp River Poorman Crk Wetland Acquisition	Methow Salmon Recovery Found	General	Protection	423,000.00	63,450.00	$148	In Progress
13 Fish Passage at Shingle Creek Dam	Okanagan Nation Alliance	General	Fish Passage	180,950.00	59,225.00	$0	In Progress
13 Methow/Chewuch Groundwater Monitoring	Cascade Columbia Fisheries Enhancement	Small	Instream Flows	34,180.00	30,580.00	$24,846	In Progress
13 Upper Beaver Habitat Improvement Channel Restoration	Methow Salmon Recovery Found	General	Channel Restoration	674,600.00	102,612.50	$4,129	In Progress
13 Lower Chewuch Beaver Restoration	Methow Conservancy	General	Off-Channel Habitat	247,985.00	27,000.00	$20,783	In Progress
Total				**$7,837,780**	**$2,809,149**	**$2,336,365**	

Current Wells Plan Species Account Balance (unallocated): $833,943.27
Contribution to the Wells Account will be made annually beginning in 2010: $176,178 (in 1998 dollars)

Wells, Rocky Reach, and Rock Island HCP Tributary Committees Notes 15 November 2013

Members Present: Lee Carlson (Yakama Nation), Jeremy Cram (WDFW), Chris Fisher (Colville Tribes), Steve Hays (Chelan PUD), Tom Kahler (Douglas PUD), Kate Terrell (USFWS), and Tracy Hillman (Committees Chair).

Members Absent: Dale Bambrick (NOAA Fisheries).

Others Present: Becky Gallaher (Tributary Project Coordinator) and Jeff Osborn (Chelan PUD).

The Wells, Rocky Reach, and Rock Island Hydroelectric Projects Habitat Conservation Plans Tributary Committees met in the Chelan PUD First Floor Conference Room in Wenatchee, Washington, on Friday, 15 November 2013 from 9:30 am to 12:00 pm.

I. Review and Adopt Agenda

Tracy Hillman welcomed everyone to the meeting and the Committees adopted the proposed agenda.

II. Review and Approval of Meeting Minutes

The Committees reviewed and approved the 12 September 2013 meeting notes with edits.

III. Monthly Update on Ongoing Projects

Becky Gallaher gave an update on funded projects. Most are progressing well or had no salient activity in the past month.

- Nason Creek Upper White Pine Reconnection – Chelan PUD Powerline Reconnection Alternatives Analysis – The Forest Service has completed their resource surveys and is preparing an Environmental Assessment for NEPA. The U.S. Bureau of Reclamation has hired Interfluve to develop 30% restoration design plans, which should be completed this winter. The Sponsor (Chelan County Natural Resources Department; CCNRD) recently held a regulatory agency meeting on site with representatives from WDFW, NOAA Fisheries, USFWS, U.S. Forest Service, Bureau of Reclamation, CCNRD, and Interfluve to discuss the proposed restoration alternative. Jeff Osborn noted that Chelan PUD has written a letter of agreement with Chelan County on moving the power lines. The letter will go to BPA for their review.
- Chewuch River Instream Passage Project – The contractor, Selland Construction, spent the first part of the month mobilizing and sorting out clarifications with Trout Unlimited (project sponsor). This work was complicated because the Bureau of Reclamation (BOR) engineers, who designed the project, were on government furlough. As a result, the sponsor created a short-term contract with Anchor QEA to keep things moving while BOR engineers were unavailable. Selland Construction has focused on two of the three project stages: Lake Creek and the Winthrop-to-Bear Creek piping. Lake Creek is the primary focus because of the need to redo the Lake Creek intake while the reservoir is low. A second crew is working on the Winthrop-to-Bear Creek piping and progressing at about 500 feet per day. The sponsor also worked to address

all of the remaining easement issues with State Parks, secured all of the landowner access agreements, and provided project management support.

- Large Wood Atonement Project – Proposals for engineering assistance were due on 25 September. However, because of the government shutdown, a firm was not selected until the end of October. The sponsor (Cascade Columbia Fisheries Enhancement Group) and the USFWS selected Natural Systems Design (NSD) to help with engineering. The sponsor and the USFWS are working on finalizing the scope of work and are planning a float trip with NSD on 12 November.
- Wenatchee Levee Removal and Riparian Restoration Project – Rayfield Brothers Excavation has completely removed the levee. The contractor removed about 2,500 cubic yards of material, which formed the 300-foot long levee. The sponsor (Chelan County Natural Resources Department) will re-plant the area where the levee was removed next spring.
- Upper Beaver Habitat Improvement Channel Restoration Project – Construction is nearly complete on the channel realignment, new diversion structure, new screen structure, upper canal pipeline, and decommissioning of the historic alignment adjacent to Beaver Creek Road.
- Lower Foster Creek Steelhead Habitat Enhancement Project – Becky Gallaher sent the Tributary Committee/Sponsor Agreement to the sponsor (Foster Creek Conservation District) for their review. She has not received a response from the project sponsor. Kate Terrell recommended that Becky contact the project sponsor and find out the status of the agreement and enhancement project. Kate mentioned that there is a possibility that Cascade Columbia Fisheries Enhancement Group could implement the project if the Conservation District is unable to do so.
- Twisp River-Poorman Creek Wetland Habitat Acquisition – The Sponsor (Methow Salmon Recovery Foundation; MSRF) is working to build a collaborative project through the Methow Conservancy, Trout Unlimited, and MSRF. The intent is to secure the largest possible benefit on the Reynaud property in conjunction with Bonneville Power Administration funding awarded for the larger Twisp River floodplain project. During October, the group completed identification of project elements and partner responsibilities. The sponsor continues to coordinate efforts with Bonneville Power Administration, Bureau of Reclamation, and the Upper Columbia Salmon Recovery Board to develop a scope of work to prioritize and identify data gaps and restoration objectives. The sponsor has recently initiated data collection efforts. The sponsor has not yet requested a scope change with the Wells Tributary Committee (change from a conservation easement to an acquisition).
- Methow/Chewuch Shallow Groundwater Monitoring Project – The USFWS measured flows within the Silver Side Channel on 21 October. In addition, the USFWS installed eight temperature loggers along Silver Side Channel the last week of October. The Sponsor (Cascade Columbia Fisheries Enhancement Group) began looking into the feasibility of a possible pump drawdown test at the Burns-Garrity site.

IV. Wenatchee Levee Removal and Riparian Restoration Project Budget Amendment

The Rock Island Tributary Committee received a budget amendment request from Chelan County Natural Resources Department on the *Wenatchee Levee Removal and Riparian Restoration Project*. The sponsor asked to move $7,000 from contract labor to sponsor salaries and benefits. The total cost of the project will not change. After discussion, the Committee was unable to approve the amendment request because the Committee needs more information on why additional funds are needed for sponsor salaries and benefits. Although the construction work was completed under budget, it was not clear why additional funds are needed for salaries and benefits. The Committee directed Tracy to seek additional information from the project sponsor. The Committee will revisit this request after they receive the additional information from the project sponsor.

V. Methow/Chewuch Shallow Groundwater Monitoring Project Scope Change and Budget Amendment

The Wells Tributary Committee received a scope change and budget amendment request from Cascade Columbia Fisheries Enhancement Group on the *Methow/Chewuch Shallow Groundwater Monitoring Project*. The sponsor would like to conduct a pump-drawdown test in two or three locations to measure groundwater quantity and recharge on the Burns-Garrity property. Because excavation of the test pits will require the presence of an archeologist, the sponsor would like to move $1,000 from contract labor to professional services. After discussion, the Committee was unable to approve the scope change and budget amendment because the Committee needs more information on the pump rate (gpm). The Committee directed Tracy to seek additional information from the project sponsor.

Following the meeting, the project sponsor provided the following responses to the Committee's questions:

Question: For clarification, your proposed drawdown test will cost about $800-$1,500, and the cost of the archeologist will add $1,000 more to the cost of the test for a total of $1,800-$2,500. Do we have that right?

Answer: *"The total cost of the entire pump test will cost between **$800-1500**. If all goes well the archeologist will only be on site for 1-2 hrs and reporting will be minimal. I am asking for $1000 dollars to be moved to professional services, although I am anticipating it costing less than that. I want to make sure I have enough so I don't have to bother all of you again. The other portion of the $1500 budget will be to hire a laborer from a local contractor who has the required equipment (pump, hoses, etc.). This portion of the budget is already in place under Contract Labor. WDFW is providing technical assistance as well as the backhoe and operator for free."*

Question: Back in May we moved all of the money out of the professional services category (since an archeologist was not needed) into the salaries and benefits and materials/equipment categories. Are you asking to move $1,000 back to professional services if the money's available from elsewhere in the budget?

Answer: *"Yes, that is correct. After inviting potential funders to the site, some concerns were voiced about groundwater productivity and it was suggested that we do a pit and or slug test to further investigate. This level of monitoring is not in the SOW, however I see it as a good low cost opportunity to quantify groundwater productivity and if positive move this project forward."*

Question: What pump rate (gpm) will be used to conduct the drawdown test?

Answer: "*We are preparing to do two types of tests - slug and drawdown. The drawdown will involve two pumping rates to achieve a static drawdown level. Right now I am estimating 50 GPM and 100 GPM, but the actual rates will be determined by how strongly the water level draws down in response to pumping... In other words, if the aquifer is highly productive, we will pump at two higher rates and if productivity is low, we will pump at two lower rates."*

Question: Is the intent of this project to provide groundwater to activate relic channels, or to supplement channels that are currently active with surface water? If it is the former, it is probably not worth the effort or money to test 50 gpm as this is unlikely to result in any biological benefit, unless it is for plant growth. The 100 gpm may have value if it is supplemental to a channel that is active.

Answer: *"The pumping rates are to create a staged drawdown. That will quantify shallow aquifer transmissivity. With the purpose of understanding the potential groundwater inflow to an improved channel. Intent is to improve a seasonally active groundwater fed channel to a perennially active* *channel. The intent or development of this project could very well change based upon findings from the pump test. This seems like a likely next step."*

Based on the responses from the project sponsor, ***the Wells Tributary Committee approved the scope change and budget amendment.*** The Committee recommended that the drawdown test be conducted at a pumping rate of no less than 100 gpm.

VI. Okanagan Project Tour

Tracy Hillman, with support from Chris Fisher, Tom Kahler, Steve Hays, and Jeremy Cram, provided a briefing on their trip to the Okanagan River in Canada. The Okanagan Nation Alliance (ONA) conducted the site tours. During the first day of the fieldtrip (9 October), members visited the lower portion of Shuttleworth Creek. The lower portion of Shuttleworth Creek was designed to act as a sediment trap. About every five-ten years, the Ministry of Environment removes the sediment from the channel. This results in what looks like a bombing range. A rock dam located just upstream from the mouth of the stream maintains the sediment trap. Restoration actions under consideration include removing the barrier, reconfiguring the channel, and restoring riparian vegetation. Reconfiguration would result in a step-pool sequence, which would allow the Ministry of Environment to clean annually the first few pools in the sequence. Restoration would open about 31 km of tributary habitat. This stream is an important spawning and rearing area for steelhead/rainbow. The Committees suggested that ONA also consider actions to reduce sediment recruitment to the channel. In addition, in the future, the Committees would like to visit the upper watershed.

Members then visited the Shuttleworth Creek diversion, which is located at Rkm 3.5. Surface water is diverted through an unscreened intake into a 300-m long open ditch that feeds into Hody Lake. The water is then piped to the Water Users' Community (WUC) properties. The system significantly reduces stream flows and habitat conditions in Shuttleworth Creek, and strands rainbow/steelhead in pools. The goal of the restoration project is to transfer the WUC from surface water to groundwater, and decommission the existing intake and diversion. The PRCC Habitat Subcommittee approved funding for the conversion to groundwater. So far, ONA has completed the drilling of wells, tested the wells and completed part of the irrigation pipeline. The remaining pipeline and irrigation system will be completed by late March 2014.

Following the site visit on Shuttleworth Creek, members visited the site of the new sockeye hatchery near the mouth of Shingle Creek and the irrigation dam on Shingle Creek. The dam is located at Rkm 2.3 and blocks access to 35.4 km of spawning and rearing habitat for steelhead and Chinook (once passage is provided at Okanagan Falls Dam). The dam will be removed and a series of vortex weirs will be installed to stabilize the channel and to create a series of riffles. Construction work is scheduled to begin during summer 2014. Re-vegetation work will occur during autumn 2014.

On the second day (10 October), ONA discussed restoration options for the Penticton Channel (Okanagan River upstream from Okanagan Falls Dam), which was channelized in the 1950s. About 100 meters of spawning gravels were added to the channel in the mid-1970s. Kokanee spawn extensively in these gravels. The ONA intends to add about four spawning gravel ramps to the Penticton Channel that will be used by sockeye after passage is provided at Okanagan Falls Dam. Because of controlled flows, the gravels should remain stable in the channel. ONA has completed hydraulic analyses for conceptual design options and started pretreatment monitoring. They have also started working on engineering designs and permits.

Member then visited the Okanagan River Restoration Initiative (ORRI) Project, which is located just upstream from the Town of Oliver. The first phase of implementation, which is complete, was to rebuild the setback dike in the lower portion of the project area. Members observed the completed side channel and instream rock structures, and noted the gravel bar forming in the main channel upstream of the side channels. They also visited the second phase of the project, which is the reconnection of a 300-m long side channel with the main channel. This was accomplished by placing bottomless, concrete structures at the upstream and downstream ends of the side channel. Members questioned the opening to the side channel, noting that the long rock barb extending upstream will likely be modified during spring flows. The intake may need period maintenance in order to keep the side channel connected at all flows.

Lastly, members visited Vertical Drop Structure (VDS) 13, which was modified by removing four V-shaped concrete components within the two middle bays of the structure. This should improve fish passage at the structure and enhance fish habitat (velocities and substrates) upstream from the structure. Large numbers of sockeye were spawning just upstream from VDS 13. ONA will monitor the effects of the modification on changes in slope, water velocities, water depths, and incubating sockeye eggs.

VII. Information Updates

The following information updates were provided during the meeting.

1. Approved Payment Requests in October and November:

   Rock Island Plan Species Account:

   - $688.96 to Chelan PUD for Rock Island Tributary Committee administration and coordination.
   - $13,886.27 to Trout Unlimited – Washington Water Project for the Lower Wenatchee Instream Flow Project.
   - $6,867.06 (Oct invoice) and $1,009.47 (Nov invoice) to Cascade Columbia Fisheries Enhancement Group for the Wenatchee Nutrient Assessment Project.
   - $4,371.63 to Chelan County for the Nason Creek Upper White Pine Reconnection – PUD Powerline Reconnection Alternatives Analysis Project.

   Rocky Reach Plan Species Account:

   - $1,196.02 to Chelan PUD for Rocky Reach Tributary Committee administration and coordination.
   - $947.56 (Oct invoice) and $2,007.20 (Nov invoice) to Trout Unlimited – Washington Water Project for the Chewuch River Instream Flow Project.
   - $1,949.45 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project (for work in August).
   - $18,908.03 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project (for work in September and October).

   Wells Plan Species Account:

   - $1,449.97 to Chelan PUD for Wells Tributary Committee administration and coordination.
   - $1,949.45 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project (for work in August).
   - $19,035.64 to the Methow Salmon Recovery Foundation for the Upper Beaver Habitat Improvement Channel Restoration Project (for work in September and October).
   - $17,731.07 to Trout Unlimited – Washington Water Project for the Twisp River Well Conversion Project.
   - $670.03 to Cascade Columbia Fisheries Enhancement Group for the Methow/Chewuch Shallow Groundwater Project.

- $5,595.42 to the Methow Conservancy for the Lower Chewuch Beaver Restoration Project.

2. Becky Gallaher reported that Mike Kane, Chelan County Natural Resources Department, asked her if he could give a presentation on the *Lower White Pine B+ Project* to the Tributary Committees. Following discussion, members agreed that it is too early for a presentation. If the presentation is similar to the one they gave to the PRCC Habitat Subcommittee, it would not be worth the Committees' time. The County needs to coordinate and communicate with the Railroad and Bonneville Power Administration (BPA) before they are ready to present to the Committees. For example, the County needs approval from BPA on a right-of-way. In addition, they need to find out if they can go through the railroad grade. Becky will share these concerns with Mike Kane.

3. Last month, the Rocky Reach Committee received an information request from the Okanogan Conservation District regarding the *Similkameen RM 3.8 Habitat Design Project*. The purpose of this project is to design and build a project that will reduce bank erosion and improve spawning and fry rearing habitat. As part of funding for this project, the Rocky Reach Committee required that the landowner establish a riparian buffer zone that would protect the restored bank from livestock. The sponsor asked the Committee to recommend a width for the required riparian buffer zone. ***In October, the Committee agreed that the buffer should be no less than 100 feet from the ordinary high-water mark***.

4. Last month, the Wells Tributary Committee received a request from Trout Unlimited - Washington Water Project to extend the *Twisp River Well Conversion Project* contract. Because of a lack of available contractors, the onset of winter, and the fact that the irrigation system has been drained and will not be turned on until spring, the sponsor requested that the contract be extended from 31 October 2013 to 30 June 2014. This will give the sponsor time to complete the project when the system is turned on in the spring. ***In October, the Wells Committee approved the extension with no change in the budget***. During the meeting, Tom Kahler noted that the extension may not be sufficient. The original well was in such close continuity with the river that it became apparent that the well was not deep enough even before the river flows approached base levels. Therefore, extending the contract until late June may not provide an opportunity to determine if the deepened well accomplishes the intended purpose.

5. Most members of the Committees attended the Upper Columbia Science Conference that was held in Wenatchee on 13-14 November. Members were pleased with the outcome of the conference and commented that, although it tended to be hatchery centric, it provided useful information that can be used in evaluating habitat restoration proposals. For example, the presentation by Tim Beechie on habitat restoration under a changing climate was informative and will help practitioners develop restoration actions to accommodate climate change. The Committees discussed other presentations that they found informative. Presentations can be found at the following site: http://www.ucscience.org/index.php?conference=2013conf&schedConf=2013conf&page=schedConf&op=presentations

VIII. Next Steps

If necessary, the next meeting of the Tributary Committees will be on Thursday, 12 December 2013 at Chelan PUD in Wenatchee.

Meeting notes submitted by Tracy Hillman (tracy.hillman@bioanalysts.net).

APPENDIX D
LIST OF ROCKY REACH HCP COMMITTEE MEMBERS

Rocky Reach Mid-Columbia HCP Committees, 2013

Coordinating Committees

Name	Organization
Michael Schiewe (Chair)	Anchor QEA, LLC
Kirk Truscott	Colville Confederated Tribes
Steve Hemstrom	Chelan PUD
Bryan Nordlund	NMFS
Jim Craig	USFWS
Teresa Scott (Jan-Sep) Jeff Korth (Oct-Dec)	WDFW
Bob Rose	Yakama Nation

Hatchery Committees

Name	Organization
Michael Schiewe (Chair)	Anchor QEA, LLC
Kirk Truscott	Colville Confederated Tribes
Josh Murauskas (Jan-May) Alene Underwood (Jun-Dec)	Chelan PUD
Lynn Hatcher	NMFS
Bill Gale	USFWS
Mike Tonseth	WDFW
Tom Scribner	Yakama Nation

Tributary Committees

Name	Organization
Tracy Hillman (Chair)	BioAnalysts
Chris Fisher	Colville Confederated Tribes
Tom Kahler	Douglas PUD
Steve Hays	Chelan PUD
Dale Bambrick	NMFS
Kate Terrell	USFWS
Carmen Andonaegui (Jan) Jeremy Cram (Feb-Dec)	WDFW
Lee Carlson	Yakama Nation

Policy Committees

Name	Organization
Michael Schiewe (Facilitator)	Anchor QEA, LLC
Randy Friedlander	Colville Confederated Tribes
Kirk Hudson	Chelan PUD
Keith Kirkendall	NMFS
Jessica Gonzales	USFWS
Bill Tweit	WDFW
Steve Parker	Yakama Nation

APPENDIX E
2013 STATEMENTS OF AGREEMENT FOR COORDINATING COMMITTEES

Final
Rocky Reach and Rock Island HCP Coordinating Committee
Statement of Agreement

Phase III Standards Achieved for 91% Combined Adult and Juvenile Survival
Rocky Reach and Rock Island Projects, January 2013

Agreement Statement
The Rocky Reach and Rock Island HCP Coordinating Committee (CC) has reviewed project conversion rates for adult steelhead, adult spring-run Chinook salmon, and adult sockeye salmon at the Rocky Reach and Rock Island Projects. Together with previously achieved HCP Juvenile Project Survivals, the CC approves Phase III Standards Achieved for the Combined Adult and Juvenile Survivals at Rocky Reach and Rock Island for the HCP Plan Species shown below.

Rocky Reach Adult and Juvenile Combined Survival
- Steelhead - 94.77%
- Sockeye - 92.58%

Rock Island Adult and Juvenile Combined Survival
- Steelhead - 96.08%
- Spring-run Chinook - 93.65%
- Sockeye - 91.75%

Background
The Rocky Reach and Rock Island HCP Passage Survival Plans (HCPs Section 5) require achievement of the 91% Combined Adult and Juvenile Survival Standard when both components can be measured (Table 1). Juvenile Project Survival was tested and achieved at the Rocky Reach Project from 2004 through 2011, and for the Rock Island Project in years 2007 through 2010 for yearling Chinook, steelhead, and sockeye (Table 2). Adequate numbers of PIT tagged adult fish allowed subsequent measurement of adult passage survival at Rocky Reach for spring-run Chinook in migration years 2009-2011, followed by migration years 2010-2012 for adult steelhead and sockeye. Rock Island adult passage survival was also estimated using migration years 2010-2012 (Table 1).

Table 1. HCP Juvenile, Adult, and Combined Survivals for steelhead, Chinook, and sockeye at the Rock Island and Rocky Reach Projects.

Project	Species	Juvenile Survival	Adult Survival	Combined[6]
Rock Island	Steelhead	96.75%	99.31% [2]	**96.08%**
	Spring Chinook	93.75% [1]	99.89% [3]	**93.65%**
	Sockeye	93.27%	98.37% [2]	**91.75%**
Rocky Reach	Steelhead	95.79%	98.93% [2]	**94.77%**
	Spring Chinook	92.37% [1]	99.90% [3, 4]	**92.28%**
	Sockeye	93.59%	98.92% [5]	**92.58%**

[1] Spring-migrating, yearling Chinook salmon.
[2] Estimate does not account for fish losses due to recreational harvest in any years
[3] No recreational harvest occurred for adult spring Chinook
[4] Adult conversion rate and Combined Project Survival approved for Rocky Reach Project on August 30, 2011 using 2009-2011 adult spring Chinook passage data.
[5] Estimate adjusted for loss of fish from recreational harvest in 2010 and 2011, but not for harvest losses in 2012.
[6] Combined survival is the product of juvenile and adult survival estimates (e.g., 98% × 93% = 91%)

Table 2. Study years and juvenile survival estimates used in Phase Designations at the Rock Island and Rocky Reach projects, 2004-2011. See 2013 Comprehensive Progress Report for more detailed description of individual studies.

Project	Species	Juvenile Survival	HCP Study Years
Rock Island	Steelhead	96.75%	2008, 2010 (n = 2)[1]
	Spring Chinook [1, 2]	93.75%	2007-2010 (n = 3)[1]
	Sockeye	93.27%	2007-2009 (n = 3)[1]
Rocky Reach	Steelhead	95.79%	2004-2006 (n = 3)
	Spring Chinook [2]	92.37%	2004-2005, 2010-2011 (n = 4)
	Sockeye	93.59%	2006-2009 (n = 3)

[1] Juvenile survival standards tested at the Rock Island Project under a 10% project spill level.
[2] Spring-migrating, yearling Chinook salmon.

Final
Rock Island and Rocky Reach Habitat Conservation Plans
Coordinating Committee

Statement of Agreement

Approval of Rock Island and Rocky Reach HCPs 2013 Comprehensive Progress Report

(For Approval February 26, 2013)

Agreement Statement
The Rock Island and Rocky Reach Habitat Conservation Plans' (HCPs) Coordinating Committee (CC) has reviewed and approved Chelan PUD's 2013 Comprehensive Progress Report for the Rock Island and Rocky Reach HCPs. This report describes the status in achieving No Net Impact (NNI) for each Plan Species, at each project, and satisfies Chelan PUD's ten-year Progress Report requirement described in Section 4.8 of the HCPs.

Background

Section 4.8 of the Rocky Reach and Rock Island HCPs includes a requirement for Chelan PUD to prepare a comprehensive progress report "at the direction of the Coordinating Committee" by March 2013. More specifically:

> *"By March 2013, a comprehensive progress report shall be prepared by the District, at the direction of the Coordinating Committee assessing overall status in achieving NNI, and shall include the status of each Plan Species."* (See Sections 4.8: Progress Reports, from Rock Island and Rocky Reach HCPs)

Chelan PUD will continue to prepare Comprehensive Progress Reports on the status of NNI at successive ten-year intervals.

FINAL
Rock Island and Rocky Reach Habitat Conservation Plans
Coordinating Committees

Statement of Agreement

Maintain Rock Island and Rocky Reach Subyearling Chinook in Phase III (Additional Juvenile Studies) for up to three years

(Approved June 25, 2013)

Agreement Statement

The Rock Island and Rocky Reach HCP Coordinating Committees (CC) were presented data regarding the status of tag technology and life-history attributes for subyearling summer Chinook in the Mid-Columbia and agree that juvenile project survival measurements are not currently feasible. The CC agrees to maintain subyearling Chinook in Phase III (Additional Juvenile Studies) for up to three years (June 2016) at Rock Island and Rocky Reach and to annually assess improvements in tag technology and study design to evaluate survival study feasibility by 2016.

Background

In April, 2013, the HCP CCs were presented key information on subyearling summer Chinook including applicable advancements in active-tag technology since 2009.

Acoustic tag technology remains insufficient to conduct Project survival studies required by the HCPs. Tag miniaturization resulting in smaller batteries and reduced battery life are insufficient for full project survival estimations, with tags still too large for small run of river subyearling Chinook originating from the Mid-Columbia. These factors, in combination with yet unknown proportions of migrant vs. non-migrant juvenile fish in the population remain impediments to project survival estimations for subyearling Chinook.

APPENDIX F
2013 STATEMENTS OF AGREEMENT FOR HATCHERY COMMITTEES

Rock Island and Rocky Reach HCP Hatchery Committees

Statement of Agreement

Carlton Acclimation Facility Capacity Utilization

April 17, 2013

Statement

The Rock Island and Rocky Reach HCP Hatchery Committees agree that the capacity exists (per Grant PUD's Basis of Design, 2012) for Chelan PUD's Methow spring Chinook mitigation obligation (60,516 smolts) to be overwinter reared in the new Carlton Acclimation Facility, to be constructed by Grant PUD in 2013. Fish management for both Chelan PUD's 60,516 spring Chinook and Grant PUD's 200,000 summer Chinook will be targeted to accommodate the following criteria:

Program	Release number	Size at release	Length at release	Density index	Flow index	Flow demand/tank	# 30-ft. tanks
Grant PUD	200,000	15 fpp	5.7"	0.10 lb/cf/in	1.0 lb/cf/in.	388 gpm	6
Chelan PUD	60,516	15 fpp	6.0"	0.087 lb./cf/in	0.6 lb./gpm/in	560 gpm	2

This agreement approves the existence of sufficient capacity at Carlton but does not obligate the HCP Hatchery Committees to support Carlton as a permanent location for overwinter rearing Chelan's spring Chinook obligation. The use of Carlton as a long term location for overwinter rearing will be determined in the future by the Committees. The Committees have previously agreed to using Carlton for the 2013 brood.

Background

As part of the recalculated hatchery compensation levels approved by the Committees on December 14, 2011, Chelan PUD has a mitigation obligation to produce 60,516 Methow spring Chinook. In February 2013, Chelan PUD and Grant PUD executed a lease agreement which allowed Grant PUD to construct a new overwinter acclimation facility on Chelan PUD property. Within this lease, Grant PUD agreed to provide Chelan PUD with capacity to overwinter acclimate 60,516 Methow spring Chinook within the new facility.

Rock Island and Rocky Reach HCP Hatchery Committees
Statement of Agreement

Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013

Statement

The Rock Island and Rocky Reach HCP Hatchery Committees approves the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013. Any future appendices for the plan will require HCP Hatchery Committee approval.

Background

The Rock Island and Rocky Reach HCPs, Section(s) 8.5, require the HCP Hatchery Committee to develop a five-year monitoring and evaluation plan that is updated every five years. This document, Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update, dated April 17, 2013, is the first five-year update of the hatchery monitoring and evaluation plan.

APPENDIX G
CHELAN PUD FINAL 2013 COMPREHENSIVE NNI PROGRESS REPORT

Rock Island and Rocky Reach Anadromous Fish Agreements and Habitat Conservation Plans

2013 Comprehensive Progress Report

FINAL

Prepared by

Joshua Murauskas
Steve Hemstrom
Joe Miller
Lance Keller
Public Utility District No. 1 of Chelan County
Natural Resources Department

Prepared for

Rock Island and Rocky Reach HCP Coordinating Committee
Wenatchee, Washington

February 2013

Executive summary

This comprehensive progress report documents ten years of successful collaboration between Public Utility District No. 1 of Chelan County (District) and tribal, state, and federal fisheries managers to implement the Rock Island and Rocky Reach Anadromous Fish Agreements and Habitat Conservation Plans (HCPs). Specifically, this report summarizes the progress towards and achievement of No Net Impact (NNI) for Plan Species (spring and summer/fall Chinook salmon, sockeye salmon, coho salmon, and steelhead) by the HCPs' signatory parties: The District, the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the Washington Department of Fish and Wildlife (WDFW), the Confederated Tribes of the Colville Reservation (Colville), and the Confederated Tribes and Bands of the Yakama Indian Nation (Yakama).

As defined in the HCPs, NNI has two basic components: (1) 91% combined adult and juvenile Project Survival achieved through project improvement measures; and (2) up to 9% compensation for Unavoidable Project Mortality provided through hatchery and tributary programs, with 7% compensation provided through hatchery programs and 2% compensation provided through tributary programs. The first component, Project Survival, is addressed through Passage Survival Plans and the second component, Unavoidable Project Mortality, is addressed through Hatchery Compensation Plans and Tributary Conservation Plans. The plans are implemented by the signatories' representatives in the Coordinating, Hatchery, and Tributary committees, respectively. The committees rely on adaptive management and a unanimous vote to approve plan decisions and actions. This ensures that the best available science, as well as the interests of each signatory, guides the path to NNI.

Collectively, the HCPs' Passage Survival Plans, Hatchery Compensation Plans, and Tributary Conservation Plans have been successfully implemented to achieve NNI for both Rock Island and Rocky Reach projects. The Coordinating Committees have provided oversight and approval of infrastructure and operational changes at the projects and in the project areas to increase survival of migrating salmon and steelhead. These efforts have led to Phase III (Standards Achieved) for sockeye, steelhead, and yearling Chinook at both projects. Coho and sub-yearling summer/fall Chinook also have Phase III designations, though it is recognized that the coho reintroduction effort will continue and additional studies are required for sub-yearlings. The Hatchery Committees have successfully guided the construction of hatchery capacity and implementation of programs for conservation and harvest augmentation. The next ten years of NNI production levels have been identified and agreed to by the Hatchery Committees. The Tributary Committees have successfully managed the Plan Species Accounts, funding many projects that provide benefits to Plan Species. Many of the positive effects of the HCPs were amplified by the willingness of committee members to try new methods or apply innovative approaches to problem solving.

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Table of Contents

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Introduction

This comprehensive progress report documents ten years of successful collaboration between Public Utility District No. 1 of Chelan County (District) and tribal, state, and federal fisheries managers to implement the Rock Island and Rocky Reach Anadromous Fish Agreements and Habitat Conservation Plans (HCPs). Specifically, this report summarizes the progress towards and achievement of No Net Impact (NNI) for Plan Species (spring and summer/fall Chinook salmon, sockeye salmon, coho salmon, and steelhead) by the HCPs' signatory parties: The District, the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), the Washington Department of Fish and Wildlife (WDFW), the Confederated Tribes of the Colville Reservation (Colville), and the Confederated Tribes and Bands of the Yakama Indian Nation (Yakama).

As defined in the HCPs, NNI has two basic components: (1) 91% combined adult and juvenile Project Survival achieved through project improvement measures; and (2) up to 9% compensation for Unavoidable Project Mortality provided through hatchery and tributary programs, with 7% compensation provided through hatchery programs and 2% compensation provided through tributary programs. The first component, Project Survival, is addressed through Passage Survival Plans and the second component, Unavoidable Project Mortality, is addressed through Hatchery Compensation Plans, and Tributary Conservation Plans. The plans are implemented by the signatories' representatives in the Coordinating, Hatchery, and Tributary committees, respectively. The committees rely on adaptive management and a unanimous vote to approve plan decisions and actions. This ensures that the best available science, as well as the interests of each signatory, guides the path to NNI.

This report is organized in a manner that illustrates the NNI status of each Plan Species within context of the HCPs' Passage Survival Plans, Hatchery Compensation Plans, and Tributary Conservation Plans. The intent is to provide a detailed review of plan accomplishments over the past decade and highlight notable HCP achievements.

Passage Survival Plan

Overview

The HCPs' Passage Survival Plans require the implementation of juvenile measures, adult measures, and predator control activities with the primary objective of achieving specific survival standards for each Plan Species. The focal point of this section is the achievement of survival standards and their applicability to NNI.

The Passage Survival Plans use an integrated decision matrix process and phase designation system for implementing survival standards (Section 5 of the HCPs). The first step in the decision matrix is the evaluation of combined adult and juvenile survival (Combined Adult and Juvenile Project Survival standard of 91%). If the combined survival goal is not measurable (e.g., inability to differentiate between natural and project related adult mortality), the decision matrix requires measurement of juvenile survival (Juvenile Project Survival standard of 93% or Juvenile Dam Passage Survival of 95%). If the juvenile Project survival standards are not measurable, dam passage survival may be calculated using the best available information, as determined by the Coordinating Committee. The HCPs' survival standards apply to fish actively migrating through the Rocky Reach and Rock Island and reservoirs, Forebays, Dams and Tailraces in the mainstem Columbia River and do not include mortality occurring in other locations (i.e., does not include ocean or tributary mortality).

Studies conducted under the Passage Survival Plan employ state-of-the-art scientific methods approved by the Coordinating Committee. Valid studies require that testing occur under representative flow conditions and project operations, with design criteria evaluated and accepted by the Coordinating Committee. Individual studies are required to measure survival at a 95% confidence level, with a standard error of the estimate within ± 2.5%. The arithmetic mean of three valid survival estimates is used to compare against the pertinent survival standard, unless otherwise approved by the Coordinating Committee. The HCPs recognize that the inability to measure a standard due to limitations of technology will not be construed as a success or failure to achieve NNI.

The HCPs provide a detailed phase designation system (Phase I to III described in Section 5.3 of HCPs) for planning, testing, and confirming progress towards achieving survival standards. The primary objective is reaching Phase III which indicates that the appropriate standard has been achieved or is likely to have been achieved but requires additional or periodic monitoring to ensure that the survival of the Plan Species remains in compliance with survival standards. The phase designation system may require the development of additional passage measures if survival standards are not met. If the Coordinating Committee cannot agree on phase designation, the Coordinating Committee may require an additional year of study or a signatory party may institute the dispute resolution process to make a phase determination. To date, the Coordinating Committee has succeeded in implementing the Passage Survival Plan according to the decision matrix and phase designation system by unanimous consensus.

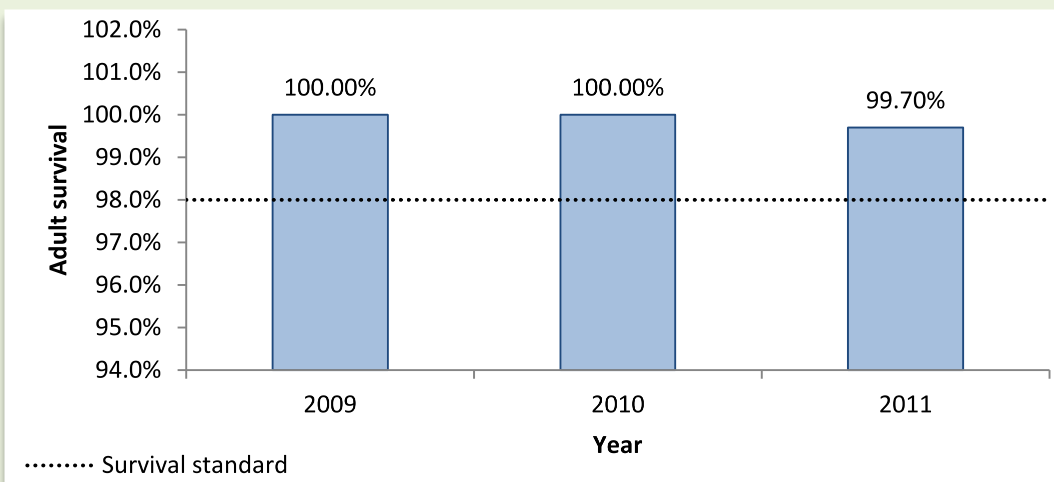
Rocky Reach and Rock Island projects have achieved the survival standards for all spring migrants (spring Chinook yearlings, sockeye, and steelhead) based on measured Juvenile Project Survival or Combined Adult and Juvenile Project Survival (Phase III Standards Achieved; Table 1). Coho are being reintroduced to the Upper Columbia Basin by the Yakama Nation and compliance with the Passage Survival Plan is currently based on assumed project survival (93%) and funding the reintroduction effort (Phase III Standards Achieved-Interim; Table 1). For sub-yearling summer/fall Chinook, the size and behavior of this species has precluded making accurate estimates of survival with existing tag technology. The Coordinating Committee is currently evaluating out-migration behavior of Upper-Columbia summer/fall Chinook as it applies to paired-release survival study methodology (Phase III Additional Studies; Table 1).

Juvenile and Adult Measures

The HCPs require the District to conduct activities and measures to enhance juvenile and adult Plan Species survival at Rocky Reach and Rock Island projects. Specific Juvenile Measures include spill (Rocky Reach and Rock Island; Table 2) and juvenile bypass operations (Rocky Reach) for 95% of each Plan Species' migration. Specific spill dates are refined annually based upon occurrence of Plan Species at the projects and a pattern-matching-model that supports real-time cumulative passage estimates. The primary difference between the two projects is the method used seasonally to provide passage for juvenile migrants: Rock Island relies on spring and summer spill whereas Rocky Reach relies on spill during the summer and the juvenile fish bypass system (Table 2) that operates through both spring and summer (April 1-Aug 31). The District submits annual spill and bypass operation plans to the Coordinating Committee for review and approval. The implementation of current Juvenile Measures reflects the outcome of survival studies conducted under representative conditions as approved by the Coordinating Committees.

HCP Highlight – Conversion rates of adult spring Chinook salmon

Section 5.4.2 of the Rocky Reach HCP states, "*The District shall emphasize adult project passage Measures in order to give high priority to adult survival in the achievement of 91% Combined Adult and Juvenile Project Survival for each Plan Species*." 2011 marked the first year where adequate sample size of known-origin adult spring Chinook was available to generate adult survival estimates with precision required in the HCP. Spring Chinook are generally not subject to recreational harvest in the mid-Columbia River and therefore a confounding factor is eliminated in estimating adult passage survival. Spring Chinook conversion rates – or the proportion of both wild- and hatchery-origin PIT-tagged adults that successfully passed through the project – were 100% in both 2009 and 2010, and 99.7% in 2011, for an average of 99.9% adult survival, exceeding the HCP goal of 98%. In combination with juvenile survival estimates, in 2011 the Rocky Reach HCP Coordinating Committee was able to determine that the combined survival standard of 91% was exceeded for ESA-listed spring Chinook for the first time since the inception of the mid-Columbia River HCPs.



At both projects, the HCPs also require the District to implement Adult Measures. These include maintaining and operating adult fishways according to the criteria approved by the Coordinating Committee (annual monitoring is reported in HCP Annual Reports), identifying fall-back rates (completed and approved by Coordinating Committee on January 25, 2005), and evaluating the feasibility of accurately measuring adult survival as it contributes to the Combined Adult and Juvenile Project Survival standard. Ultimately, measured adult survival provides the best metric for cumulatively evaluating all Adult Measures. In the case of Rocky Reach and Rock Island, the District has been successful in determining accurate adult survival for ESA-listed spring Chinook and steelhead, as well as sockeye.

In addition to specific Juvenile and Adult Measures, an extensive predator control program is conducted each year to control both northern pikeminnow and piscivorous birds in the Rock Island and Rocky Reach projects. These predators may represent a significant source of mortality for migrating juvenile salmon and steelhead in the Rock Island and Rocky Reach projects. Anglers, trapping, and longlines are used to remove up to 90,000 pikeminnow annually. Piscivorous bird populations are also addressed using a variety of hazing techniques during juvenile outmigration.

Table 1. Summary of phase designations and project survival at Rock Island and Rocky Reach by Plan Species, survival standard, and date achieved.

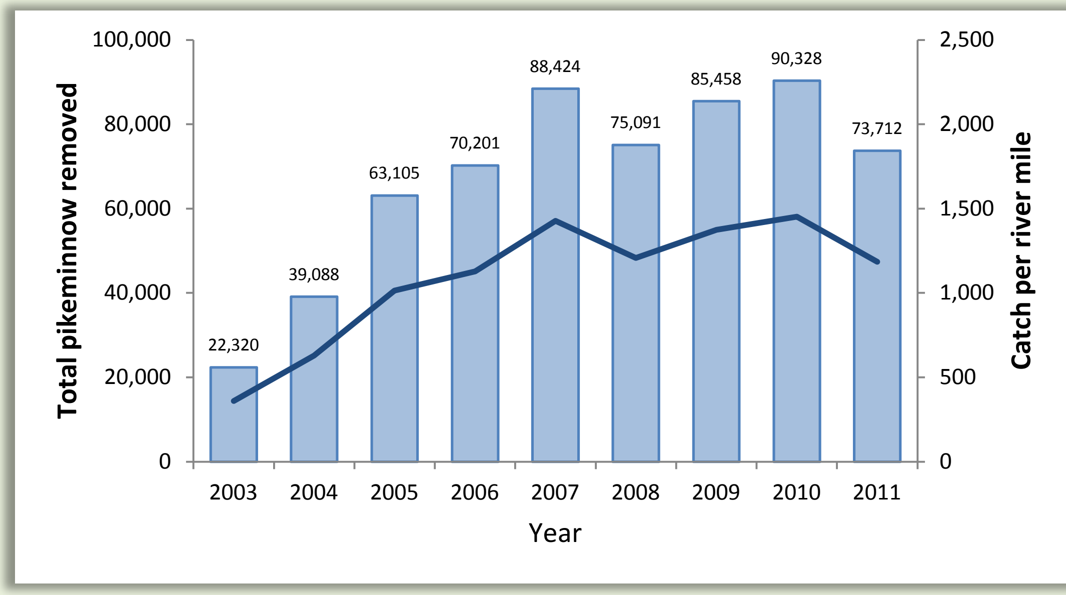
HCP Plan Species	Rock Island Phase Designation	Rocky Reach Phase Designation
Spring Chinook Yearlings (ESA Listed)	Phase III Standard Achieved 93.75 % Juvenile Project (Nov 16, 2010) and 93.65% Combined Adult and Juvenile (January 2013)	Phase III Standard Achieved 92.28 % Combined Adult & Juvenile (Aug 30, 2011)
Steelhead (ESA Listed)	Phase III Standard Achieved 96.75 % Juvenile Project (Nov 16, 2010) and 96.08% Combined Adult and Juvenile (January 2013)	Phase III Standard Achieved 95.79 % Juvenile Project (Oct 24, 2006) and 94.77% Combined Adult and Juvenile (January 2013)
Sockeye (Not Listed)	Phase III Standard Achieved 93.27 % Juvenile Project (Dec 15, 2009) and 91.75% Combined Adult and Juvenile (January 2013)	Phase III Standard Achieved 93.59 % Juvenile Project (Dec 17, 2010) and 92.58% Combined Adult and Juvenile (January 2013)
Coho (Not Listed)	Phase III Standard Achieved-Interim (June 20, 2007)	Phase III Standard Achieved-Interim (June 20, 2007)
Summer/fall Chinook Sub-yearlings (Not Listed)	Phase III Additional Juvenile Studies (June 24, 2008)	Phase III Additional Juvenile Studies (June 24, 2008)

Table 2. Summary of current seasonal spill at Rocky Reach and Rock Island projects.

Project	Season	Spill Percent of Daily Estimated Flow	Approximate Spill Dates for Passing 95% of Plan Species Juveniles
Rocky Reach	Summer	9%	June-August
Rock Island	Spring	10%	April 17 - May
	Summer	20%	June-August

HCP Highlight – Rocky Reach and Rock Island Pikeminnow Removal

Chelan PUD increased its aggressive predator control program in 2003 and again in 2005 under the goals of the Rock Island and Rocky Reach HCPs. Efforts in the 62 combined miles of the Rock Island and Rocky Reach projects have since removed over a half million northern pikeminnow, with catches up to 90,328 fish annually. Annual funding has routinely exceeded $500,000, resulting in over 1,000 pikeminnow removed per river mile in Rock Island and Rocky Reach reservoirs since 2005. Pikeminnow in the Rock Island and Rocky Reach projects have since experienced significant declines in both average fish size and total population abundance. Since 2004, mean length of pikeminnow has decreased from 239 mm to 229 mm, and fishway counts of Pikeminnow at Rocky Reach Dam have decreased by over 72%.



Innovation

In addition to the goal of achieving specific survival standards, the HCPs' Passage Survival Plans have also opened the door to significant innovation. One major example is the juvenile bypass system that was installed at Rocky Reach in 2002. The $107M project included a collector system and tube bypass extending 4,600 feet along the powerhouse and nearly 1/3rd of a mile downstream. Survival of juvenile salmon using the bypass system is nearly 100% and operation is continuous between April 1st and August 31st. Another key example is the District's role in development of acoustic tag technology that has allowed measurement of Juvenile Project Survival for sockeye salmon. Using the HCPs adaptive framework and the Coordinating Committees' support, acoustic tags were developed as practical alternative to PIT tags and have been successfully used at both Rocky Reach and Rock Island Projects to measure and meet survival standards. At the time the HCPs were written, measuring project survival for this species was not yet possible.

HCP Highlight – Rocky Reach Juvenile Fish Bypass System

Starting in 1985, Chelan PUD developed laboratory models and tested prototype fish bypass systems for intercepting and moving juvenile fish around Rocky Reach as they travel downriver to the ocean. Turbine intake screens were designed to collect juvenile salmon and steelhead, but lacked the efficiency experienced at other projects. A new approach was taken in 1995, when engineers and biologists designed a surface bypass and collection system. This differs from conventional intake screens, which require fish to dive into the turbine intakes before they are intercepted. By 2000 and 2001, Chelan PUD, in coordination with fishery managers, determined that the configuration of the fish bypass system had been tested satisfactorily and installation of a permanent system was warranted. Construction of the $107 million Juvenile Bypass System (JBS) was initiated in late 2002 and completed prior to the 2003 juvenile salmon migration. Since then, the JBS operates continuously between April 1 and August 31 and juvenile fish are intermittently sampled by biologists to identify species composition and condition. Chelan PUD has since conducted nine additional years of project passage and survival studies following permanent construction, confirming its efficiency and that survival of young fish using the bypass system is nearly 100 percent. Millions of juvenile salmon have since utilized the JBS for safe, effective, and volitional downstream passage.

Passage Survival Plan Phase Designations

Rock Island

Yearling Chinook

Chelan PUD conducted seven years of valid survival studies with juvenile yearling Chinook salmon at the Rock Island Project between 2002 and 2010. Each study achieved the necessary precision of ≤ 2.5% SE. The most recent arithmetic mean for these studies (three years between 2007 and 2010) was 93.75%, exceeding the HCP Juvenile Project Survival Standard of 93%. On November 16th, 2010, the Rock Island HCP Coordinating Committee approved Phase III Standard Achieved for juvenile yearling Chinook salmon at the Rock Island Hydroelectric Project. This achievement followed the first attainment of Phase III juvenile survival in 2005 (94.30%) under the initial project operations (i.e., 20% spill). Three years of adult passage of ESA-listed spring Chinook salmon were evaluated in 2010, 2011, and 2012. The combined survival of juvenile (93.75%) and adult (99.89%, *SE* = 0.11%) Chinook salmon at the Rock Island Hydroelectric Project was 93.65%, exceeding the HCP standard of 91%.

Steelhead

Chelan PUD conducted five years of valid survival studies with juvenile steelhead at the Rock Island Project between 2004 and 2010. Each study achieved the necessary precision of ≤ 2.5% SE. The most recent arithmetic mean for these studies (two years between 2008 and 2010) was 96.75%, exceeding the HCP Juvenile Project Survival Standard of 93%. On November 16th, 2010, the Rock Island HCP Coordinating Committee agreed that Phase III Standard Achieved was once again met for juvenile steelhead at the Rock Island Hydroelectric Project. This achievement followed the first attainment of Phase III juvenile survival in 2004 (94.04%) under the initial project operations (i.e., 20% spill) beginning. Three years of adult passage of ESA-listed steelhead were evaluated in 2010, 2011, and 2012. The combined survival of juvenile (96.75%) and adult (99.31%, *SE* = 0.24%) steelhead, unadjusted for harvest, at the Rock Island Hydroelectric Project was 96.08%, exceeding the HCP standard of 91%.

Sockeye

Chelan PUD conducted six years of valid survival studies with juvenile sockeye salmon at the Rock Island Project between 2003 and 2009. Each study achieved the necessary precision of ≤ 2.5% SE. The most recent arithmetic mean for these studies (three years between 2007 and 2009) was 93.27%, exceeding the HCP Juvenile Project Survival Standard of 93%. On December 15th, 2009, the Rock Island HCP Coordinating Committee agreed that Phase III Standard Achieved was met for juvenile sockeye salmon at the Rock Island Hydroelectric Project. This achievement followed the first attainment of Phase III juvenile survival in 2006 (96.61%) under the initial project operations (i.e., 20% spill). Three years of adult passage of sockeye salmon were evaluated in 2010, 2011, and 2012. The combined survival of juvenile (93.27%) and adult (98.37%, *SE* = 0.16%) sockeye, unadjusted for harvest, at the Rock Island Hydroelectric Project was 91.75%, exceeding the HCP standard of 91%.

Coho

On June 26th, 2007, the Rock Island and Rocky Reach HCP Coordinating Committees agreed that a coho hatchery compensation program fulfills NNI obligations, as detailed in Section 8.4.3 of the respective HCPs. District funding is provided to the Yakama Nation to support the Coho Reintroduction Program. The HCPs further acknowledge that compensation for coho will be reassessed if a naturally reproducing population of coho is established by efforts occurring outside of the HCPs. As such, the Coordinating Committees agreed that a survival value of 93% is assumed and that survival studies are not required unless there is compelling information that demonstrates project-related mortality exceeding seven percent on coho salmon. Adult returns of coho salmon during the most recent return (31,045 adults in 2011) were 419% percent greater than those observed during the signing of the HCP, and significantly greater than the negligible returns during the 1990s (average of 35 adults passing Rock Island annually).

Summer/fall Chinook

Measurement of sub-yearling juvenile project survival was deemed impractical due to technology limitations and uncertainties surrounding the sub-yearling life history of summer/fall Chinook salmon in the mid-Columbia River Basin (Phase III – additional juvenile studies assigned June 24, 2008). The Coordinating Committee convened a panel of experts in 2010 to discuss challenges and uncertainties associated with measuring sub-yearling survival in the mid-Columbia River. The District and HCP committees are currently investigating sub-yearling life history through monitoring at the Rocky Reach Juvenile Bypass System and regional monitoring and evaluation work conducted in the Wenatchee, Methow, and Okanogan rivers. The District continues to compensate for unavoidable project mortality through the Hatchery Compensation and Tributary Conservation plans. Numerical abundance of summer/fall Chinook the mid-Columbia River has increased significantly since returns in the 1990s. Adult returns of summer/fall Chinook to Rock Island averaged 18,650 adults in the 1990s, whereas returns since implementation of the HCPs have averaged 65,976 – a near four-fold increase (2004-2011).

Rocky Reach

Yearling Chinook

Chelan PUD conducted four years of valid survival studies with juvenile yearling Chinook salmon at the Rocky Reach Project, including paired release studies in 2004, 2005, 2010, and 2011. Three years of adult passage of ESA-listed spring Chinook salmon were evaluated in 2009, 2010, and 2011. The combined survival of juvenile (92.37%) and adult (99.90%, *SE* = 0.0006) Chinook salmon at the Rocky Reach Hydroelectric Project was 92.28%, exceeding the HCP standard of 91%. Each study achieved the necessary precision of ≤ 2.5% SE. On August 30th, 2011, the Rocky Reach HCP Coordinating Committee agreed that Phase III Standard Achieved was met for combined spring Chinook adult and yearling Chinook salmon at the Rocky Reach Hydroelectric Project.

Steelhead

Chelan PUD conducted three years of valid survival studies with juvenile steelhead at the Rocky Reach Project between 2004 and 2006. Each study achieved the necessary precision of ≤ 2.5% SE. The three-year arithmetic mean for these studies was 95.79%, exceeding the HCP Juvenile Project Survival Standard of 93%. On October 24th, 2006, the Rocky Reach HCP Coordinating Committee agreed that Phase III Standard Achieved was met for juvenile steelhead at the Rocky Reach Hydroelectric Project. Three years of adult passage of ESA-listed steelhead were evaluated in 2010, 2011, and 2012. The combined survival of juvenile (95.79%) and adult (98.93%, *SE* = 0.45%) steelhead, unadjusted for harvest, at the Rocky Reach Hydroelectric Project was 94.77%, exceeding the HCP standard of 91%.

Sockeye

Chelan PUD conducted three years of valid survival studies with juvenile sockeye salmon at the Rocky Reach Project between 2006 and 2009. Each study achieved the necessary precision of ≤ 2.5% SE. The three-year arithmetic mean for these studies was 93.59%, exceeding the HCP Juvenile Project Survival Standard of 93%. On December 17th, 2010, the Rocky Reach HCP Coordinating Committee agreed that Phase III Standard Achieved was met for juvenile sockeye salmon at the Rocky Reach Hydroelectric Project. Three years of adult passage of sockeye salmon were evaluated in 2010, 2011, and 2012. The combined survival of juvenile (93.59%) and adult (98.92%, *SE* = 0.22%) sockeye, adjusted for harvest as reported by WDFW in 2010 and 2011 (2012 harvest data were not yet available), at the Rocky Reach Hydroelectric Project was 92.58%, exceeding the HCP standard of 91%.

Coho

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Summer/fall Chinook

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Table 3. HCP juvenile, adult, and combined survival rates at Rock Island and Rocky Reach. Adult conversion rates calculated from adult passage data for years 2010-2012 (Buchanan and Skalski, University of Washington 2012). HCP Combined Adult and Juvenile Project Survival standard is 91%. The HCP juvenile adult and combined survival estimates apply to fish actively migrating through the Rock Island and Rocky Reach hydroelectric projects in the mainstem Columbia River and do not include mortality occurring in other locations (i.e., does not include ocean or tributary mortality).

Project	Species	Juvenile Survival	Adult Survival	Combined [5]
Rock Island	Steelhead	96.75%	99.31% [2]	**96.08%**
	Spring Chinook	93.75% [1]	99.89% [3]	**93.65%**
	Sockeye	93.27%	98.37% [2]	**91.75%**
Rocky Reach	Steelhead	95.79%	98.93% [2]	**94.77%**
	Spring Chinook	92.37% [1]	99.90% [3]	**92.28%**
	Sockeye	93.59%	98.92% [4]	**92.58%**

[1] Spring-migrating yearling Chinook.
[2] Estimate does not account for fish losses due to recreational harvest in any years
[3] No recreational harvest occurred.
[4] Estimate adjusted for fish losses from recreational harvest in 2010 and 2011, but not for harvest losses in 2012.
[5] Combined survival is the product of juvenile and adult survival estimates (e.g., 98% × 93% = 91%).

Hatchery Compensation Plan

Overview

The Rock Island and Rocky Reach HCPs require compensation for all Plan Species. These include spring Chinook, summer/fall Chinook, sockeye, and coho salmon, and steelhead. The implementation of the hatchery program has been consistent with the overall objectives of rebuilding natural populations and achieving NNI as well as supporting harvest. The requirement for unanimous vote to approve plan decisions and actions ensures that each objective is met and the signatories' interests and regulatory obligations are reflected in the implementation of the plans.

Funding and capacity is provided by the District to meet the compensation levels necessary to achieve NNI for all Plan Species. Initial estimated hatchery production levels were based on average adult returns of Plan Species for a baseline period, a 7% compensation requirement, and baseline adult to smolt survival rates for existing mid-Columbia River hatcheries. Compensation may include measures to increase off-site survival of naturally spawning fish or their progeny. Hatchery compensation for Plan Species is implemented in accordance with Section 8 of the Rock Island and Rocky Reach HCPs, ESA Section 10 permits, and in consultation with the Hatchery Committees. Additional hatchery production in excess of the 7% compensation requirement was agreed to as a portion of "initial production" through the 2013 smolt releases. Adjustment of hatchery production levels occurs every ten years, beginning in 2013 (to adjust production for release years 2014-2023). Adjustments are intended to account for changes in average adult returns, adult-to-smolt survival, and smolt-to-adult survival from hatchery production facilities. The HCPs allow Chelan PUD to enter into agreements with other entities for the rearing, release, and monitoring and evaluation of hatchery production. The Hatchery Committee must approve any proposed agreements or trades of production, though it is Chelan PUD's responsibility to ensure that obligations under the Hatchery Compensation Plan are satisfied. The District has received Hatchery Committee approval for its compensation plan (Approved December 14, 2011) and has built the necessary capacity to meet NNI requirements (Table 4).

Hatchery Capacity

To meet hatchery compensation requirements in the Rocky Reach and Rock Island HCPs, the District has built production capacity or contributed funding to operate over twelve hatchery facilities in the mid-Columbia River Basin. These facilities include full life-cycle hatcheries: Chelan Hatchery and Eastbank Hatchery/Rocky Reach Annex; over-winter acclimation facilities: Chiwawa Ponds, Similkameen Ponds, and Chelan Falls Ponds; and other acclimation facilities such as Turtle Rock Island, Dryden Ponds, Carlton Ponds, and Lake Wenatchee Net Pens (Figure 1). Additionally, the District has provided funding and capacity at other facilities not owned by the District, such as the Methow and Ringold hatcheries, and Bonaparte and Blackbird acclimation ponds, and is currently co-funding with Grant PUD the construction of the Penticton Sockeye Hatchery in British Columbia. The District will also provide operational funding for the new Chief Joseph Hatchery upon its completion.

Aside from hatchery culturing capacity, the District also funds the operation and maintenance of several traps and weirs to support broodstock collection and management activities in the Wenatchee Basin. These include Tumwater trapping facility, Dryden Left-Bank and Right-Bank trapping facilities, and the Chiwawa Weir. Although their primary function is to support the HCPs' hatchery programs, they also contribute to the management and research goals of the Yakama Nation, National Marine Fisheries Service, US Fish and Wildlife Service, and Washington Department of Fish and Wildlife.

Table 4. Hatchery Compensation Plan production to fulfill NNI requirements under the Rock Island and Rocky Reach HCPs. Initial production levels expire with the 2013 smolt releases; recalculated production levels are set for the 2014-2023 releases. Inundation production levels are not subject to recalculation. Recalculated production includes adjustments for increased project survival and hatchery performance, in addition to changing population dynamics in the mid-Columbia River Basin.

		Annual NNI Production				
Plan	**Species**	**Inundation (fixed)**	**Initial production (through 2013)**	**Calculated 7% (Reference)**	**Recalculated production (2014-2023)**	**Location(s)**
Rock Island	Spring Chinook	-	672,000 [1]	298,853	144,026	Chiwawa
		-	144,000 [1]	0	0	Methow
		-	0	0	52,313	Chief Joseph [2]
	Steelhead	-	200,000	51,275	73,300 [3]	Chiwawa [4]
	Summer/fall Chinook	-	864,000 [1]	324,831	318,000 [5]	Dryden
		-	576,000 [1]	216,554	75,563 [2]	Similkameen
		-	200,000 [1]	0	0	Carlton
		-	0	0	45,570	Chief Joseph (subs) [2]
	Sockeye	-	200,000	571,040	0 [6]	Lake Wenatchee
		-	-	-	Skaha program (capacity for 5M fry annually)	Penticton
Rocky Reach	Spring Chinook	-	144,000 [1]	90,000	60,516	Methow/New program
		-	0	0	63,000	Chief Joseph [2]
	Steelhead	165,000	35,000	30,000	9,000	Chiwawa [4]
	Summer/fall Chinook	400,000 [7]	0	0	0	Chelan Falls [4]
		-	200,000	200,000	176,000	Chelan Falls [4]
		-	200,000 [1]	0	0	Carlton
		-	0	0	91,000 [2]	Similkameen
		-	0	0	49,000	Chief Joseph (subs) [2]
	Sockeye	-	0	300,000	Skaha program (capacity for 5M fry annually)	Penticton

[1] Initial production levels greater than that required to compensate for unavoidable project mortality (produced to maintain capacity through the 2013 releases).

[2] Mitigation at Similkameen will be coordinated with the new Chief Joseph Hatchery based on proportion of total releases.

[3] Including 13,000 for NNI production and 60,300 for a species trade with Lake Wenatchee sockeye.

[4] Production historically reared on Turtle Rock Island.

[5] Production allocations between Dryden and Similkameen were originally set at 60/40 of the initial 1.64M smolts (less 200,000 at Carlton for initial production).

[6] Recalculated sockeye production in Lake Wenatchee (46,000) was traded for 60,300 steelhead. Natural-origin sockeye often have greater replacement rates than hatchery-origin sockeye.

[7] Summer/fall Chinook inundation production was initially met through production of 1.62M sub-yearling releases from Turtle Rock Island. The Hatchery Committee subsequently converted this production to yearling releases and moved the program to Chelan Falls Acclimation Ponds.

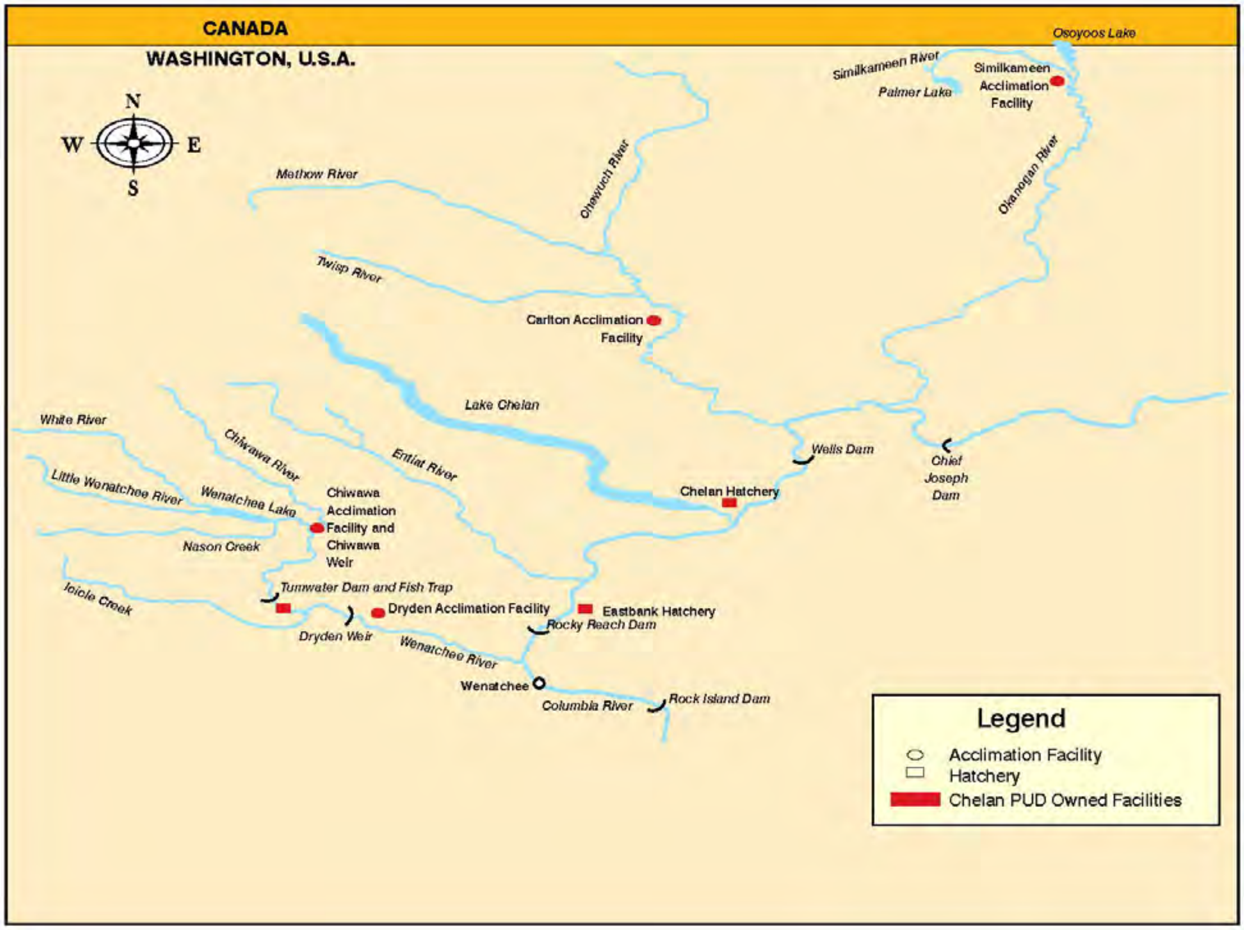


Figure 1. Location of Chelan PUD-owned hatchery facilities in the mid-Columbia River Basin. Chelan PUD provides funding for additional hatchery programs, including the Methow and Chief Joseph hatcheries, along with the new Penticton Hatchery for the Skaha Sockeye Reintroduction Program in the upper Okanogan River Basin.

Monitoring and Evaluation

The hatchery programs implemented by Chelan PUD as part of the Rock Island and Rocky Reach HCPs have the goal of "*contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest*." Accordingly, there are two different types of artificial propagation strategies that address the different goals of the program: supplementation and harvest augmentation. The supplementation programs primarily focus on increasing the natural production of fish in tributaries. A fundamental assumption of this strategy is that hatchery fish returning to the spawning grounds are "reproductively similar" to naturally produced fish. The second program type, harvest augmentation, focuses on increasing harvest opportunities. This is accomplished by releasing or managing hatchery fish in a manner that segregates them from the naturally spawning populations in tributaries.

Monitoring is used to determine if the programs are performing as intended. The HCP Hatchery Committee adopted a monitoring and evaluation (M&E) approach that guides the assessment of the hatchery programs. The M&E program includes several objectives that focus on monitoring in-hatchery and in-river performance of hatchery-reared smolts, along with long-term monitoring to determine if the hatchery programs are contributing to rebuilding natural populations while conserving their long-term fitness. Monitoring activities include documenting broodstock collection, collection of life-history information, documenting hatchery spawning and rearing activities, juvenile monitoring within streams, and redd and carcass surveys. Data from reference areas are obtained to the extent currently possible. For all species the M&E program provides broodstock information; hatchery rearing history, release data, and survival estimates; disease information; juvenile migration and productivity estimates; redd counts, distribution, and spawn timing; spawning escapements; and life-history characteristics. The M&E program also addresses compliance with the Endangered Species Act and HCP mandates. In addition to annual reports that have been generated in each year of the HCPs' implementation, the first comprehensive five year Monitoring and Evaluation report (for Rocky Reach and Rock Island compensation) was completed in May of 2012. [1]

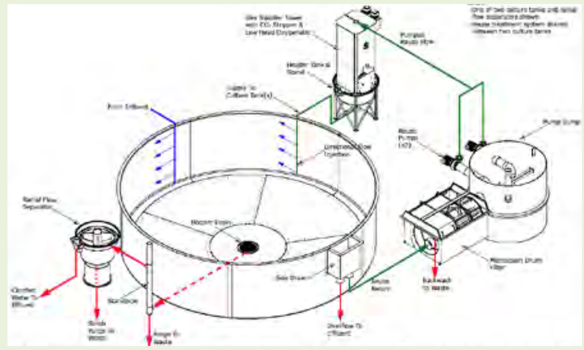
Innovation

The implementation of the HCPs' hatchery programs has led to a number of noteworthy success stories that may contribute to increased performance of hatchery releases and the overall abundance of Plan Species for years to come. The first example is water re-use/circular tank technology, which originally was piloted as a means to conserve water but also improved the performance of hatchery releases. In the first years of the pilot, summer/fall Chinook reared in the water re-use circular tanks migrated more quickly downstream and had higher survival than their raceway counterparts. In the years following, the story improved with fish returning at older ages and greater smolt-to-adult returns. These encouraging results have led other Columbia River hatcheries to incorporate circular partial water re-use in their programs.

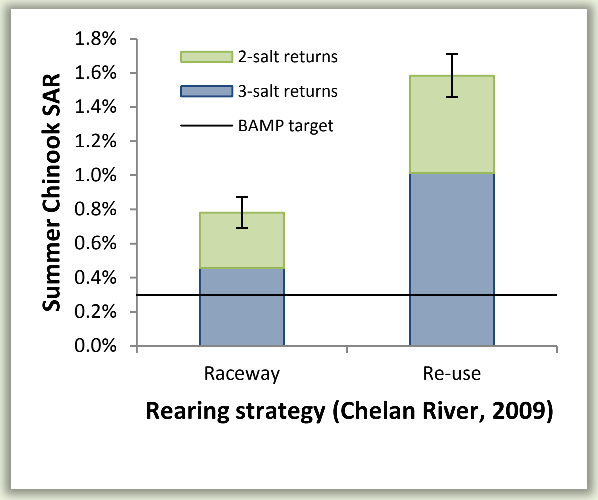
Another example of innovation is the Skaha Sockeye Reintroduction program developed by the Okanogan Nation Alliance and supported by the District. This hatchery program is intended to open significant new rearing habitat in the Okanogan Basin and provide a founding population for future colonization. The Hatchery Committees approved this program as part of the Rocky Reach and Rock Island Hatchery Compensation Plans and so far the results have been beyond expectations: (1) First Nation Tribes and Canadian Managers are endorsing opening Skaha Lake to anadromous passage and (2) early returns from the hatchery program have been highly successful, contributing to the record abundance in recent years.

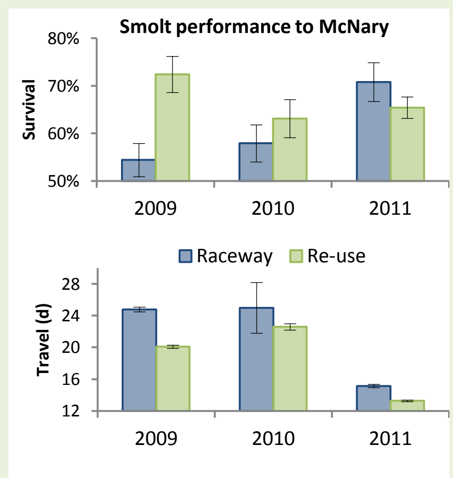
[1] Hillman, T., M. Miller, A. Murdoch, T. Miller, J. Murauskas, S. Hays, and J. Miller. 2012. Monitoring and evaluation of the Chelan County PUD hatchery programs: five-year (2006-2010) report. Report to the HCP Hatchery Committee, Wenatchee, WA.

HCP Highlight –Water re-use technology and circular vessels

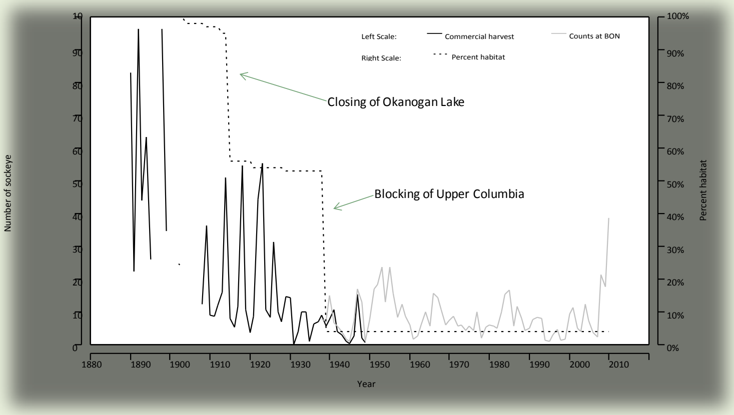


Chelan PUD installed a partial water reuse culture system at the Eastbank Hatchery for the purpose of water conservation and comparing this technology with conventional flow-through culture systems. Partial water reuse decreases demand on the regional aquifer, thus decreasing our environmental footprint while enhancing salmon populations in the mid-Columbia River. Chelan PUD invested in passive integrated transponders (PIT), physiological assessments, and health monitoring throughout the pilot study. Partial water reuse vessels at Eastbank have produced summer-run Chinook smolts with exceptional health and in-river performance compared to traditional rearing strategies. Monitoring results have shown improved smolt performance and increased adult returns. The use of this technology has since expanded to the Chiwawa and Chelan Falls hatcheries for steelhead and Chinook, respectively.



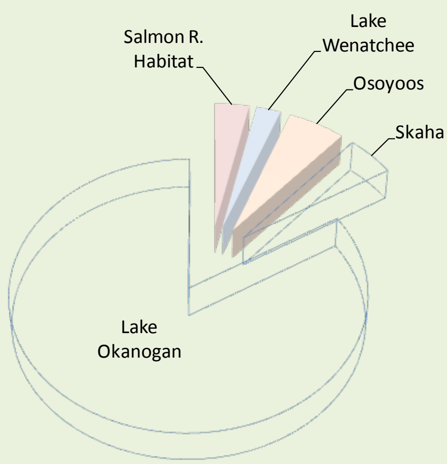


HCP Highlight – Skaha Lake Reintroduction Program



Artificial production of sockeye has been largely unsuccessful in the Columbia River Basin and contributes a negligible number of returning adults (< 1% of the 2010 return). Acknowledging the difficulties associated with artificial production of sockeye, the Hatchery Committees approved Chelan PUD funding the Okanagan Nation Alliance (ONA) experimental reintroduction of sockeye in Skaha Lake in lieu of a prescribed smolt release. This re-introduction program includes construction of a multi-million dollar hatchery facility, fry production, and a monitoring program to evaluate the efficacy of reopening significant habitats in Skaha and, potentially, Okanagan Lake for natural sockeye rearing and production.

The rationale for re-introducing sockeye to Skaha and Okanagan Lakes is based primarily on the magnitude of rearing habitat they represent and the potential deterioration of existing rearing habitat in Osoyoos Lake. The predicted juvenile rearing capacity of Skaha Lake [2,010 ha] is 1,977 smolts/ha, which translates to 3.9 million smolts (roughly equivalent to Osoyoos Lake), while the potential for Okanagan Lake is much higher (35,100 ha). Okanagan Lake alone has over seven times the rearing habitat of all the existing sockeye producing lakes in the Columbia River Basin combined (including Wenatchee, Osoyoos, and Redfish lakes). Moreover, additional rearing habitat compliments improved spawning habitats (e.g., Douglas PUD's Okanagan Basin Fish Water Management Tool) that have already increased the survival of juvenile sockeye within the Okanagan Basin.



Sockeye habitat in the Columbia Basin

Chelan PUD, in collaboration with Grant PUD, is providing funding for the Skaha Program, including hatchery infrastructure, operation and maintenance, and monitoring and evaluation for a 5 million egg program through brood year 2020 with a contingency for an additional 3 million eggs pending feedback from the Canadian Okanagan Basin Technical Workgroup. Sockeye returns from the Skaha Program have already exceeded 10% of the total return to the Columbia River, providing thousands of adults for conservation and harvest opportunities.

Tributary Conservation Plan

Overview

The HCPs' Tributary Conservation Plan establishes a Plan Species Account to fund projects for the protection and restoration of tributary habitat within the Columbia River watershed from the Chief Joseph tailrace to the Rock Island tailrace (including the Okanogan, Methow, Entiat, and Wenatchee river basins). The projects are intended to compensate for up to two percent of Unavoidable Project Mortality of Plan Species. The Tributary Committees, comprising representatives from each signatory party to the HCPs, are responsible for selecting projects and approving project budgets from the Plan Species Account for purposes of implementing the Tributary Conservation Plan.

Plan Species Account

The District annually contributes $485,200 and $229,800 to the Rock Island and Rocky Reach Plan Species accounts, respectively (in 1998 dollars). Interest earned on funds remains in the account and annual contributions are adjusted according to the Consumer Price Index (CPI). During the project funding cycles, the highest priority is given to projects that protect and restore Plan Species habitat. The Tributary Committee actively evaluates and limits the relative proportion of administrative costs to maximize the on-the-ground benefit of project funds. The selection of projects also takes into consideration other conservation plans and programs where cost-sharing, matching funds, and other efficiencies add synergistic benefits.

Project Funding

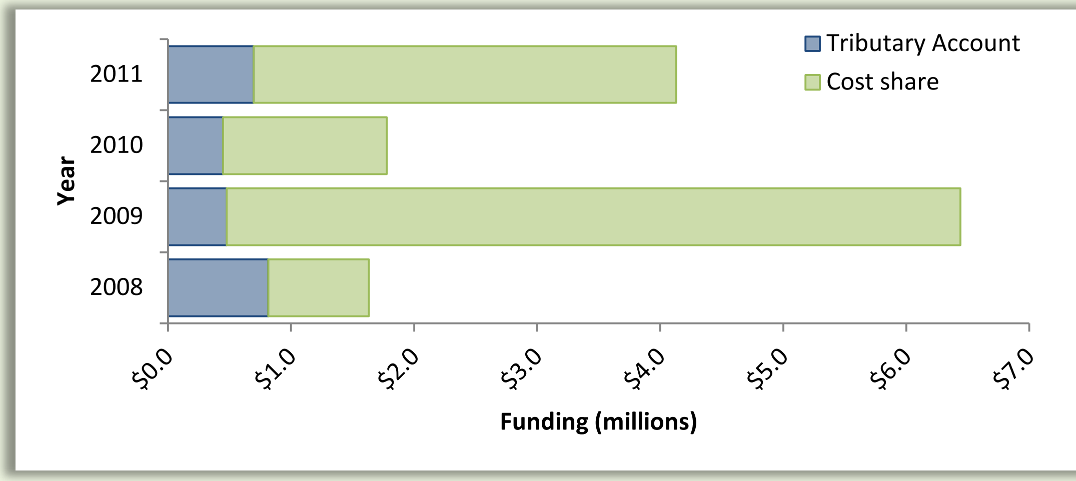
The Tributary Committees have successfully implemented the Tributary Conservation Plans for both the Rock Island and Rocky Reach HCPs to satisfy NNI requirements. As of December, 2011 the HCPs' Plan Species Account has provided over $4M dollars to fund 46 different habitat projects. Prior to the 2012 project cycle, the account balance was $3,430,596 for the Rock Island HCP and $1,905,052 for the Rocky Reach HCP (including annual contributions and interest gains, less funding disbursed for projects in 2011 and account management). In addition to enhancement projects, over 1,070 acres, including 64,100 linear feet of bank, of land acquisition and conservation easements have been preserved or restored in the Wenatchee, Entiat, Methow, and Okanogan rivers. The Rock Island and Rocky Reach Tributary Committees continue to meet on a monthly basis to manage Plan Species Accounts and review projects for funding.

Innovation

The effectiveness of the Rocky Reach and Rock Island Plan Species account has been increased significantly by the efforts of the Tributary Committee members to match and leverage funding from the HCPs with other sources of habitat funding. As a result the quantity and quality of the projects funded has increased, benefitting plan species and other fish species (e.g., ESA listed bull trout and Pacific lamprey).

HCP Highlight – Leveraging funding with the Plan Species Account

The Tributary Committee has been able to successfully cost share on a large-scale, bringing together a diverse array of project sponsors and other sources of habitat funding. Protection and restoration projects funded between 2008 and 2011 have totaled nearly $14 million, with $2.4 million originating from the Rock Island and Rocky Reach Plan Species Accounts. Sponsors of these programs include the Chelan-Douglas Land Trust, Chelan County Natural Resources Department, Methow Conservancy, Cascadia Conservation District, Washington Rivers Conservancy, Cascade Columbia Fisheries Enhancement Group, Washington Department of Fish and Wildlife, Trout Unlimited, and Methow Salmon Recovery Foundation demonstrating the breadth of organizations implementing protection and restoration measures that benefit Plan Species under the HCPs.



HCP Highlight – Tributary Restoration Efforts

Nason Creek Oxbow Reconnection (Chelan Co. Natural Resources Dept) – The construction of State Route 207 resulted in the physical and hydrological disconnection of a large oxbow on Nason Creek. Reconnection of this oxbow, using two fish passage culverts reconnected a half-mile long oxbow of Nason Creek. The biological goal of this project was to reconnect historic habitat to increase habitat diversity and off-channel rearing for salmon and steelhead.

Harrison Side Channel Project (Chelan Co. Natural Resources Dept) – The Harrison Side Channel project was designed to reconnect a relict channel and provide access to the floodplain by removing a levee and construction of a side channel to provide perennial flow to the project site. Channel construction required the removal of 2000 cubic yards and construction of four large woody debris structures.

White River Floodplain Protection (Chelan-Douglas Land Trust) – The White River is one of the most productive spawning and rearing areas in the Upper Columbia Region for endangered Spring Chinook, endangered steelhead, threatened bull trout, and it supports the largest sockeye run in the US portion of the Columbia River Basin. The acquisition of five properties will protect 305 acres of floodplain and nearly 2.5 acres of prime White River riparian habitat.

Twisp River Acquisition Project (Methow Salmon Recovery Foundation) – This project acquired two key parcels on the lower Twisp River to complete the purchase and protection of > 24 acres of contiguous riverfront, side channel, and riparian habitat. The Methow Salmon Recovery Foundation made enhancements at each site to increase fish passage and address impacts from existing development.

Conclusion: Status of Plan Species

Collectively, the HCPs' Passage Survival Plans, Hatchery Compensation Plans, and Tributary Conservation Plans have been successfully implemented to achieve NNI for Rock Island and Rocky Reach projects (Table 5 and Table 6). The Coordinating Committees have provided oversight and approval of infrastructure and operational changes at the projects and in the project areas to increase survival of migrating salmon and steelhead. These efforts have led to Phase III (Standards Achieved) for sockeye, steelhead, and yearling Chinook at both projects. Coho and sub-yearling summer/fall Chinook also have Phase III designations, though it is recognized that the coho reintroduction effort will continue and additional studies are required for sub-yearlings. The Hatchery Committees have successfully guided the construction of hatchery capacity and implementation of programs for conservation and harvest augmentation. The next ten years of NNI production levels have been identified and agreed to by the Hatchery Committees. The Tributary Committees have successfully managed the Plan Species Account, funding many projects that provide benefits to Plan Species. Many of the positive intended effects of the HCPs were amplified by the willingness of committee members to try new methods or apply innovative approaches to problem solving.

Since the inception of the HCPs, numerical abundance of all Plan Species has increased significantly, reflecting improved project passage, hatchery compensation, and tributary habitat restoration and preservation (Figure 2 and Figure 3). The HCPs are not solely responsible for every improvement in the upper Columbia Basin but they have been important contributors and provide the resources and capacity necessary for managers to meet their individual and collective goals while providing the public with sustainable energy. Moreover, the HCPs have provided a durable framework for decision making that has led to collaborative improvements without the need for a single instance of dispute resolution.

The accomplishments in the first ten years of the HCP are expected to continue in the future. Moving forward, project survival will be monitored and re-evaluated on timelines described in the HCPs. Juvenile and Adult Measures will be conducted annually. Hatchery production will occur over the next ten years according to the approved Hatchery Committee plans. It is expected that the continuation of hatchery production will require constant reconciliation with recovery efforts. To this end, the Hatchery Committees have approved and submitted Hatchery Genetic Management Plans for ESA listed spring Chinook and steelhead to NMFS and anticipate future operations will contribute to recovery. These actions, along with continued funding to the Plan Species Account, provide certainty that the HCPs will contribute to rebuilding of tributary habitat production capacity and basic productivity and numerical abundance of Plan Species.

Table 5. Rocky Reach HCP No Net Impact (NNI) progress for Plan Species.

HCP Plan Species (ESA Status)	Survival Standard Met?	Hatchery Compensation Provided?	Tributary Conservation Plan Funded?	NNI ?
Spring Chinook Yearlings (ESA Listed)	Yes-Combined Adult and Juvenile	Yes	Yes	Yes
Steelhead (ESA Listed)	Yes- Combined Adult and Juvenile	Yes	Yes	Yes
Sockeye (Not Listed)	Yes- Combined Adult and Juvenile	Yes	Yes	Yes
Summer/Fall Chinook (Not Listed)	Phase III Additional Studies	Yes	Yes	Yes-compensation provided but additional studies required
Coho (Not Listed)	Yes-Interim Value	Yes	Yes	Yes

Table 6. Rock Island HCP No Net Impact (NNI) progress for Plan Species.

HCP Plan Species (ESA Status)	Survival Standard Met?	Hatchery Compensation Provided?	Tributary Conservation Plan Funded?	NNI ?
Spring Chinook Yearlings (ESA Listed)	Yes- Combined Adult and Juvenile	Yes	Yes	Yes
Steelhead (ESA Listed)	Yes- Combined Adult and Juvenile	Yes	Yes	Yes
Sockeye (Not Listed)	Yes- Combined Adult and Juvenile	Yes	Yes	Yes
Summer/Fall Chinook (Not Listed)	Phase III Additional Studies	Yes	Yes	Yes-compensation provided but additional studies required
Coho (Not Listed)	Yes-Interim Value	Yes	Yes	Yes

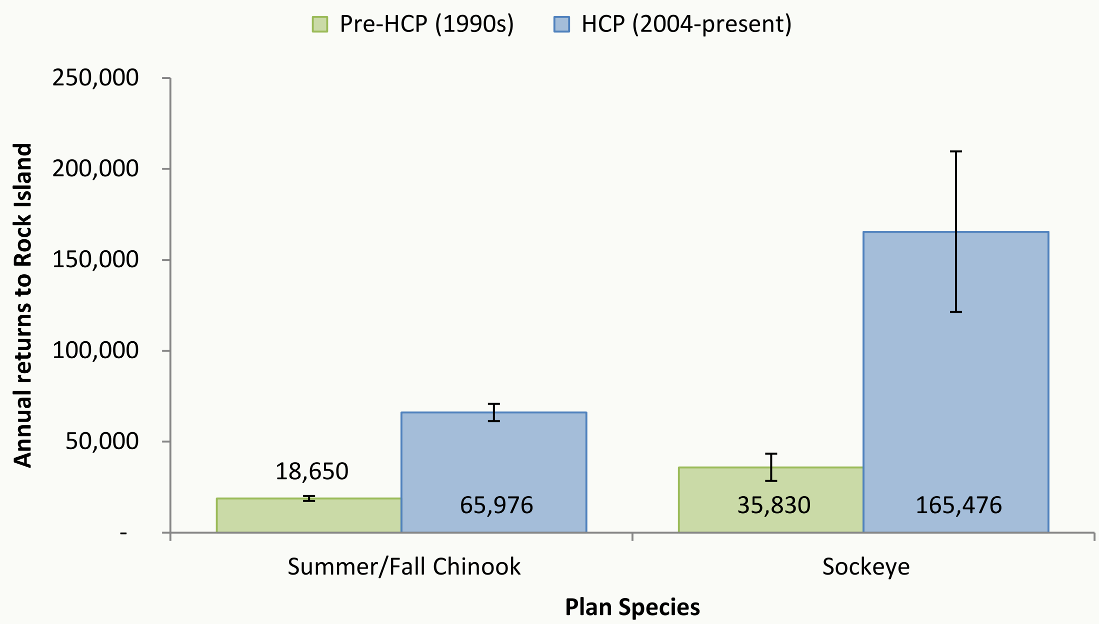


Figure 2. Average (± SE) annual passage of adult salmon at Rock Island Dam during the HCP era (2004-present) compared to runs observed prior to HCP activities (1990s). Numerical abundance of Plan Species is significantly greater compared to runs observed in the 1990s for all Plan Species, including summer/fall Chinook (median test, $p < 0.01$) and sockeye ($p < 0.01$).

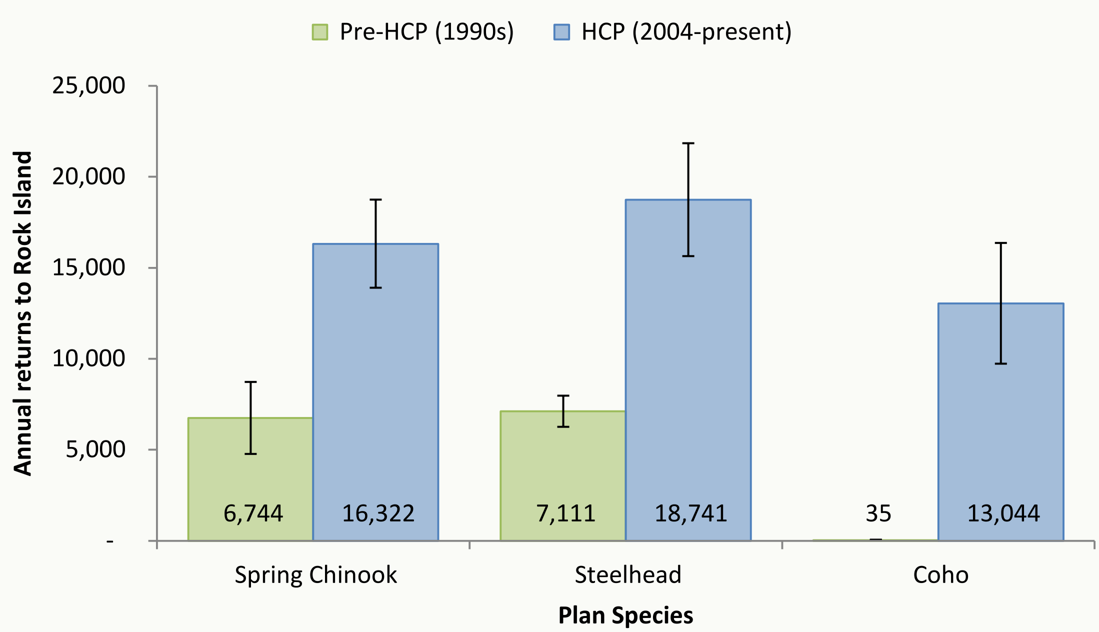


Figure 3. Average (± SE) annual passage of adult salmon at Rock Island Dam during the HCP era (2004-present) compared to runs observed prior to HCP activities (1990s). Numerical abundance of Plan Species is significantly greater compared to runs observed in the 1990s for all Plan Species, including spring Chinook (median test, $p = 0.01$), steelhead ($p < 0.01$), and coho ($p < 0.01$).

Acknowledgments

Chelan PUD is grateful for the collaborative efforts of the HCP signatory parties; their participation has contributed significantly to the success of the Passage Survival, Hatchery Compensation, and Tributary Conservation plans. Current and past coordinating Committee representatives, including Jim Craig and Brian Cates (USFWS), Jerry Marco (CCT), Bryan Nordlund and Ritchie Graves (NOAA), Bob Rose and Steve Parker (YN), Carmen Andonaegui, Bill Tweit, Teresa Scott, and Rod Woodin (WDFW), Steve Hemstrom, Lance Keller, Keith Truscott, Chuck Peven, Steve Hays, and Shaun Seaman (CPUD), are thanked for their extensive efforts to implement the Passage Survival Plans. Hatchery Committee representatives, including Craig Busack and Kristine Petersen (NOAA), Bill Gale, David Carie, and Brian Cates (USFWS), Tom Scribner and Keely Murdoch (YN), Mike Tonseth (WDFW), Kirk Truscott and Jerry Marco (CCT), Joe Miller, Josh Murauskas, Alene Underwood, Shaun Seaman, Chuck Peven, Julie Pyper, and Steve Hays (CPUD), are thanked for their extensive efforts to implement the Hatchery Compensation Plans. Tributary Committee representatives, including Dale Bambrick (NOAA), Dennis Beich (WDFW), Lee Carlson (YN), Chris Fisher (CCT), Kate Terrel and David Morgan (USFWS), Keith Truscott, Steve Hays, Julie Pyper, and Becky Gallaher (CPUD), are thanked for their extensive efforts to implement the Tributary Conservation Plans. Mike Schiewe and supporting staff, Ali Wick, Carmen Andonaegui, and Kristi Geris, (Anchor QEA) are thanked for chairing both the Coordinating and Hatchery committees. Tracy Hillman (BioAnalysts) and Bob Bugert are thanked for chairing the Tributary Committee. Lastly, Chelan PUD thanks the determined efforts of all who supported the HCPs, including many people from natural resources, operations, engineering, energy resources, and management staff, and Chelan PUD Commissioners and General Managers.

APPENDIX H
2013 CHELAN PUD HCP ACTION PLAN

2013 Rocky Reach and Rock Island
HCP Action Plan Final 1/30/13

COORDINATING COMMITTEE	Jan 2013			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
Activity	1	15	31	1	15	28	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31
RR and RI 2013 Comprehensive NNI Progress Report	→ ongoing					F																														
RR and RI Subyearlyearling Chinook Path Forward	→ ongoing										D																		F							
Deliver 2012 RR Bypass Evaluation report			D					F																												
Deliver 2013 Bypass Operations plan			D						F																											
Deliver 2013 RR Bypass Evaluation Report																																		D		F
Pikeminnow long-line control programs				S											D																		C			
Pike minnow angling control programs													S																C							
Avian Predation Programs										S														C												
Piscivorous Bird Monitoring and Report										S																										F
Northern Pikeminnow Ladder Trapping RI/RR																S								C												
Deliver 2013 RI/RR Fish Passage Plan					D			F																												
Deliver 2013 RR/RI Spill Plan							D			F																										
Deliver 2013 RR/RI Spill Report																										D			F							
RR 9% Summer Spill																S							C													
RI 10% Spring spill											S*												C													
RI 20% Summer Spill																S							C													
RR Juvenile Fish Bypass Operations										S														C												
2012 HCP Annual Report							D			F																										

*Start RI spill 4/17

HATCHERY COMMITTEE	Jan 2013			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
Activity	1	15	31	1	15	28	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31
2012 Hatchery M & E Report								D								F																				
2014 Hatchery M & E Work Plans																				D					F											
M&E Request for Proposals											S									F																
Steelhead RSS Study (Juvenile Sampling and Draft Report)	→ ongoing																																	D		
Dryden Water Quality Monitoring							S						F																							
Hatchery Operations SOP Review	→ ongoing				D							F																								
Eastbank Aquifer Modeling	→ ongoing								C																											
Summer Chinook Size Targe Review																	S																			
Chelan Hatchery Raceway Rehab																	S																			
Chiwawa Acclimation Facility Office Rehab	→ ongoing																																			
Carlton Pond Lease Agreement with Grant PUD	D						F																													
Broodstock Collection													S																						C	
Hatchery Releases										S			C																							

TRIBUTARY COMMITTEE	Jan 2013			Feb			Mar			Apr			May			Jun			Jul			Aug			Sep			Oct			Nov			Dec		
Activity	1	15	31	1	15	28	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31	1	15	31	1	15	30	1	15	31	1	15	30	1	15	31
RR and RI Plan Species Account Annual Deposit			C																																	
General Salmon Fund Project Solication Process								S												C																
General Salmon Fund Project Approval														S									C													
General Salmon Fund Project Implementation	→ ongoing																																			
Small Project Review and Appproval	S																																			C
Small Project Implemetation	→ ongoing																																			

D = Draft Document
F = Final Document

S = Start Project
C = Complete Project

APPENDIX I
2013 ROCKY REACH FISH BYPASS OPERATIONS PLAN

2013 Rocky Reach Juvenile Fish Bypass System Operations Plan

Prepared By:

Lance Keller

Public Utility District No. 1 of Chelan County
P.O. Box 1231
327 North Wenatchee Avenue
Wenatchee, Washington 98801

January 2013

Introduction

The Public Utility District of Chelan County (District) constructed and installed a permanent fish bypass system (FBS) in 2002/2003. The bypass system is designed to guide juvenile salmon and steelhead away from turbine intakes at Rocky Reach Dam. The system consists of one surface collector entrance (SC) and the intake screen (IS) system in turbine units 1 and 2. Please refer to Mosey (2004) for a detailed description of the bypass production system.

Studies and data collection at the Rocky Reach FBS fall under one of two general categories "Standard Operations" or "Special Operations" for bypass evaluations. Activities and data collection under standard operations include day to day sampling of run-of-river (ROR) fish to evaluate run timing, species composition, and fish condition after passage. Special operations may include additional sampling time to supply fish for marked fish releases.

2013 Evaluation Requirements

Run-of-river fish collected at the Juvenile Sampling Facility (JSF) to evaluate and provide fish for the following:

1. Run timing of target species:
    a. Provide standardized juvenile capture rate data to supplement Program RealTime (UW) run-timing predictions
    b. Guide decisions about initiating summer fish spill

2. Fish species composition:
    a. Guide decisions about starting or stopping spill
        i. Currently summer fish spill occurs at Rocky Reach. Chelan PUD

3. Origin of fish stocks and identification of marked individuals:
    a. PIT tags
    b. Fin clips

4. Fish condition:
    a. Ensure that the bypass system remains safe for migrating juvenile salmon and steelhead by evaluating:
        i. Descale: 20% or more scale loss on either side
        ii. Injury: Scratches, bruises, or hemorrhages
        iii. Mortality: Any fish dead on arrival to sampling facility

2013 Study Methods

For more information about the study methods please refer to Mosey (2004).

Standard Operations:

1. Sampling Periods (1 April to 31 August):
    a. Monday through Sunday
    b. Collections Times
        i. 30 minute maximum **(or)**

            i. 0800-0830
            ii. 0900-0930
            iii. 1000-1030
            iv. 1100-1130
        ii. Target number of fish
            i. 350 spring species
            ii. 125 summer species

2. Fish Condition:
    a. First 100 fish of each species are examined for condition:
        i. Descale
        ii. Injury
        iii. Mortality

3. Species Composition:
    a. ROR fish collected are enumerated by species
    b. Collect data for Program RealTime to determine start and end of spill
    c. Currently summer fish spill occurs at Rocky Reach.

4. Origin of fish stocks and identification of marked individuals:
    a. PIT tags
    b. Fin clips

Special Operations:

1. Marked Fish Releases (Prior 1 April):
    a. Prior to the 1 April system start-up, hatchery yearling Chinook will be used for marked fish releases to determine if the JFBS is causing descale, injury, or mortality. Due to the C1 outage during April, the marked fish release prior to 1 April to test for system integrity will be conducted under the altered operations (Appendix A).
        i. Releases will be conducted with hatchery summer chinook prior to the 1 April start date to determine if the JFBS is working properly and to help isolate potential sources of descale, injury, and mortality.
        ii. Fish (n = 100/release) of varying sizes will be randomly selected from hatchery chinook. Only those with no scale loss or injury will be marked.
        iii. Marked fish will be systematically released at locations upstream of the sampling screen in the bypass system and into both intake screens in units C1 and C2.
        iv. If potential problems are identified, resolve problems by 1 April system start-up.

2. Marked Fish Releases (1 April-31 August):
    a. A phased approach will be used to evaluate the descaling rate, injury rate, and mortality rate of fish passing through the bypass system. We

developed a sampling protocol and threshold percentages (Table 1) for descale, injury and mortality that will trigger study phases.

b. Identify "ambient" rates of descale, injury and mortality.

c. Once the ambient rate is estimated and if further sampling shows descale problems continuing at 5%, (3% for injury, 2% for mortality) *above* ambient level for three consecutive samples.

    i. If variable rates of descale, injury or mortality do occur between species, then collection of yearling chinook, sockeye, or steelhead may be necessary for marked releases.

    ii. Fish (n = 100/release) of varying sizes will be randomly selected at the juvenile facility and only those migrants with no scale loss or injury will be marked.

    iii. Marked fish will be systematically released at locations upstream of the sampling screen in the bypass system until the problem area is isolated.

d. Identify circumstances when we would refer to the HCP Coordinating Committee.

e. The District will consult with the Coordinating Committee if any abnormal fish conditions (within values outlined in Table 1) are observed in the sample population.

Table 1. Flow diagram of phased approach and threshold values for conducting marked-fish releases in the *juvenile bypass system at Rocky Reach Dam (Skalski and Townsend 2003)*

	Phase 1		Phase 2		Phase 3		Phase 4
Threshold		**5% initl**		**A*+5%**		**A*+15%**	
Descale	Index sampling for for descale rate	→	Mark-releases to est. ambient descale	→	In-system mark-releases to isolate descale problem	→	refer to HCP Coord. Comm.
Threshold		**3% initl**		**A*+3%**		**A*+10%**	
Injury	Index sampling for for inury rate	→	Mark-releases to est. ambient injury	→	In-system mark-releases to isolate injury problem	→	Temp. bypass shutdown refer to HCP Coord. Comm.
Threshold		**2% initl**		**A*+2%**		**A*+4%**	
Mortality	Index sampling for for mortality rate	→	Mark-releases to est ambient mortality	→	In-system mark-releases to isolate mortality problem	→	Temp. bypass shutdown refer to HCP Coord. Comm.

A* = Ambient percentage

3. Collection of Bull Trout:

    a. Document:

        i. Fork Length and weight measurements

        ii. Condition (descale, injury, or mortality)

b. Allow to recover, then release

Daily Protocol for Fish Collection

Standard Operations:

1. Deploy sampling screen at beginning of each hour (0800, 0900, 1000, 1100 hours).
2. Using direct enumeration to count fish entering the sampling facility
3. Collect for 30 minutes **or** until approximately 350 spring migrants/125 summer migrants have been collected, whichever comes first. RETRACT SCREEN IF 200 TO 300 FISH ARE COLLECTED IN FIRST TWO MINUTES.
4. Retract screen when time period or target number of fish has been reached.
5. Determine species composition of all collected fish in the hourly sample.
6. Scan/examine each fish for PIT tags, fin clips, and acoustic tags.
7. Evaluate fish condition (first 100 fish per species).
8. If needed, collect and hold fish for marked releases (Special Operations).
9. Return to step 1 for next sample period. After the 1100 hour sample, go to step 11.
10. See Special Operations
11. Allow anesthetized fish (examined for species composition and fish condition) to recover in the facility's holding tank for at least 1.5 hours.

Special Operations:

1. If fish are collected for marked fish releases, verify that the required number of target species has been set aside from the four sample periods.
2. If the required number of fish are not collected by the 1100 hour sample period, deploy the sampling screen and repeat steps 2 and 4 under standard operations.
3. Scan/check all anesthetized fish for PIT and acoustic tags.
4. Collect and hold the fish at the facility for transport and/or marking (marked fish releases).
5. Determine species composition for any remaining anesthetized fish and scan for PIT tags.
6. After fish have been collected to meet study needs, estimate the number of fish remaining in the raceway (by species to the extent practical), record the number, and immediately release the fish back into the bypass pipe.
7. Return to step 11 under Standard Operations.

Contingencies:

1. If, after start-up of the bypass system, we encounter any unforeseen problem(s) with fish collection, we will immediately consult with the HCP Coordinating Committee on how to correct the problem(s).
2. If we accumulate many fish during a collection period (e.g. just after a hatchery release), we will only handle/sample the number of fish needed to satisfy the study requirements and then immediately release the remaining fish back into the bypass pipe.

3. If we accumulate many fish during each "index" sample period, we will only evaluate species composition in the first three periods. In the final period, we will evaluate descale and injury, regardless of the number of fish. However, we will be attentive to any injury or descale that may be present among the fish in each of the first three periods. We need to allow enough time (between samples) to gather all species composition information, so that we have representative information on daily passage.

Diversion Screen and Trashrack Cleaning (Units 1 and 2):
During the last week of March, the trashracks in front of Units 1 and 2 (six intakes total) will be cleaned by divers and clammed to remove any dislodged debris. The trash rack cleaning will be repeated as differentials increase across the racks due to debris load. A mid-season cleaning will be scheduled in June. Starting 1 April, the vertical barrier and diversion screens (IS system) will be cleaned one to two times per week or as needed with an automated screen cleaner. Careful observation of trash build up will also be monitored and the screens will be cleaned on a more regular basis if warranted. Frequency of the cleanings may increase depending on debris load during spring run-off and aquatic plant load in the summer. The District will log each screen cleaning, and in the event of high descaling/injury in a single sample, the vertical barrier and diversion screens will be inspected prior to releasing marked fish.

Discussion

The 2013 biological studies at Rocky Reach will encompass the following: 1) a continuing evaluation of the juvenile bypass system, and 2) a daily sampling program to monitor fish passage for run timing. Representatives of various research agencies and the HCP Coordinating Committee will be consulted about the development of detailed study plans and protocols. A time line showing important activities and deadlines for these activities has been developed and is presented in Table 2.

Table 2. Tasks and deadlines for the Rocky Reach 2013 biological evaluations.

Task	Deadline
Present 2013 study plan to Committee	**Winter 2012-2013**
Committee discussion/comments on study plan	**Feb. 21, 2013-Mar. 20, 2013**
Pre-season JFB operations testing (marked fish releases prior to 1 April)	March 15, 2013-March 31, 2013
Begin biological evaluation of JFB	April 1, 2013
Complete 2013 biological evaluation	August 31, 2013
Present 2012 evaluation report to Committee	**December 31, 2013**
Committee comments on 2013 report	**February 1, 2014**
Present 2013 final report to Committee	March 1, 2014

****Tasks printed in bold text require action by the HCP Coordinating Committee.**

References

Mosey, T. R., S. L. Hemstrom, and J. R. Skalski. 2004. Study Plan for the Biological Evaluation for the Rocky Reach Fish Bypass System-2004. Chelan County Public Utility District, Wenatchee, Washington.

Appendix A

Rocky Reach Surface Collector Operations for April 2013 during C1 Unit Outage

Final Operating Plan for Rocky Reach Surface Collector and C2 Turbine unit
During the C1Turbine unit outage in April 2013

1) RR JFB Surface Collector (SC) will utilize three additional installed SC pumps to increase attraction flow from 6,000 to 6,660 cfs into the SC entrances (3,330 cfs each side) beginning April 1, 2013.

2) The dewatering screen cleaning system will function normally under the increased entrance flow and the cleaning process should not be affected. The automated screen cleaning routine will be more frequent if increased debris load is encountered (unlikely in April).

3) Normal water velocity (Vn) through the dewatering screens in the SC channels will increase proportionally to the SC flow-rate increase, which is approx 11%. Calculations show screen velocity will increase from 0.4 fps to about 0.444 fps (an 11% increase) under the 6,660 SC flow. Water velocity will increase uniformly (no hot spots) across the entire SC dewatering screen surface area as regulated by the tuned screen baffling.

4) RR will increase turbine unit C2 flow, from its normal *soft-limit* set-point of 12.2 kcfs to a *soft-limit* flow of 15.2 kcfs during the C1 outage.

5) RR will test this operation during the normal pre-season (last week of March) marked fish releases into the surface collector/bypass to insure there are no effects on fish condition or passage. Marked fish will be recollected and observed at the RR juvenile sampling facility.

6) RR will return to its normal SC/Bypass operation if C1 work is completed early and C1 can return to service before April 30.

APPENDIX J
2013 ROCKY REACH AND ROCK ISLAND FISH SPILL PLAN

2013 Fish Spill Plan

Rock Island and Rocky Reach Dams

Public Utility District No. 1 of Chelan County

Prepared By:

Steve Hemstrom
Senior Fisheries Biologist
Public Utility District No. 1 of Chelan County
Wenatchee, Washington

Final
March 28, 2013

Introduction and Summary

In 2013, Public Utility No. 1 of Chelan County (Chelan PUD) will implement spill operations for fish passage at the Rock Island and Rocky Reach and projects. Spill timing and volumes are specified by the anadromous Habitat Conservation Plans (HCP) for each respective project. Chelan PUD conducted juvenile project survival studies from 2002 through 2011 at Rocky Reach and Rock Island under varying spill levels in order to achieve HCP survival standards. The Rock Island Project completed multiple survival studies over a nine year period (17 total studies) for spring migrating Plan Species (Steelhead, sockeye, yearling Chinook), first using a 20 percent spill level, then a 10 percent spill level. Rock Island will continue to spill 10 percent of day average flow during the spring outmigration period through year 2020. Rocky Reach completed its suite of HCP survival studies for spring migrating Plan Species in 2011 (14 studies), under spill and no-spill operation at the dam. HCP juvenile survival standards were achieved for species tested under no spill operations (yearling Chinook, steelhead, sockeye). Project spill levels are summarized in Table 3 of this plan. Chelan PUD holds valid Incidental Take Statements (ITS) from NOAA Fisheries (NOAA) and the United States Fish and Wildlife Service (USFWS) for HCP fish spill operations at Rocky Reach and Rock Island.

For the 2013 juvenile outmigration, Chelan PUD will operate the Rocky Reach juvenile fish bypass system (JFBS) starting 1-April for the spring juvenile outmigration of yearling Chinook, steelhead, and sockeye. Spring spill at Rocky Reach Dam will consist of hydraulic spill for reservoir control. HCP Project survival standards were achieved with bypass-only operations. During the subyearling Chinook outmigration in 2013, Rocky Reach will spill 9 percent of day average river flow for a duration covering 95 percent of subyearling outmigration past the dam.

At Rock Island Dam in 2013, Chelan PUD will operate the Project with a 10 percent day-average spill level for the spring outmigration period. Rock Island has also completed HCP spring survival testing for all Plan Species with a 10 percent spill level at the dam and has achieved juvenile survival standards for yearling Chinook, steelhead and sockeye and combined adult-juvenile survival for spring-run Chinook.

During summer period in 2013, Rock Island will spill 20 percent of the day-average river flow for the outmigration of sub-yearling Chinook. Spill is the primary means of juvenile salmon and steelhead passage at Rock Island per Section 5.4.1(a) of the Rock Island HCP. Spring and summer spill will cover 95 percent of the juvenile outmigration for yearling Chinook, steelhead, sockeye, and subyearling Chinook in 2013.

Rocky Reach Spring Juvenile Bypass Operations

Rocky Reach will operate its JFBS continuously through the spring outmigration period, beginning 1-April, 2013. Daily index sampling (for juvenile steelhead, yearling Chinook, and sockeye) will be performed at the bypass sampling facility to estimate the outmigration percentiles for each species through the spring period. During "index sampling" each day, a total of four 30-minute samples (Table 1) will be taken beginning at the top of each hour, 8 am to 11am. Spring spill for fish passage is not required at Rocky Reach in addition to the JFBS operation, but periods of forced spill may occur under high river flows. Some level of forced spill (river flow above 201 kcfs turbine capacity) normally occurs at Rocky Reach in the spring. Historically, forced spill has occurred approximately 28 percent of all hours, April through June, 1992-2012.

Sampling protocols at the Rocky Reach bypass system in 2013 will remain consistent with those used in 2004-2012. Daily sampling in spring and summer periods (Monday through Sunday) will use four 30-minute "index periods" at 0800, 0900, 1000, and 1100 hours (Table 1). The sample target for each 30-minute sample will be 350 smolts during the spring period (yearling Chinook, steelhead, and sockeye combined), and 125 smolts for summer period (subyearling Chinook). If the number of fish collected in the bypass sampling raceway is estimated to reach the maximum number prior to completion of the 30-minute sample, the sampling screen will be retracted from the bypass flume and the number of fish collected in the shortened sample period will be proportionately expanded to the entire 30-minute period.

Table 1. Index sampling times at the Rocky Reach juvenile fish bypass and the number of smolts per sample in 2013. Sample times and sample targets have remained consistent since 2004.

Time	Sample Duration	Number of Smolts	Day of Week
08:00-08:30	30 minutes*	350 (spring) 125 (summer)	Monday-Sunday
09:00-09:30	30 minutes*	350 (spring) 125 (summer)	Monday-Sunday
10:00-10:30	30 minutes*	350 (spring) 125 (summer)	Monday-Sunday
11:00-11:30	30 minutes*	350 (spring) 125 (summer)	Monday-Sunday

*Sample duration may be less than 30 minutes if smolt numbers are met prior to full 30 minute sample time

Rocky Reach Summer Spill Operations

Rocky Reach Dam will spill 9 percent of the estimated day average river flow for the subyearling Chinook outmigration. Spill will commence in late May to early June upon arrival of subyearling Chinook smolts in the Rocky Reach bypass samples. Juvenile run-timing information at Rocky Reach will be used to estimate subyearling Chinook passage percentiles (from the University of Washington's Program RealTime run forecaster) and guide spill operations to cover 95 percent of the summer outmigration. Actual subyearling counts in combination with juvenile passage estimates from the University of Washington's Program RealTime run forecaster will determine spill start and stop dates for the summer spill program.

The HCP guidelines for starting and ending summer spill at Rocky Reach are as follows:

1. Summer spill will start at midnight on the day that the estimated 1-percentile passage point is reached, as indicated by Program RealTime run-forecast model. S*ubyearling* Chinook will be defined as any Chinook having a fork length from 76 mm to 150 mm.

2. Summer spill season will generally end no later than 15-August, or when subyearling index counts from the juvenile bypass sampling facility are 0.3 percent or less of the cumulative run for three out of any five consecutive days (same protocol used 2004-2012) and Program RealTime is estimating that the 96th percentile passage point has been reached.

Diel Spill Shaping at Rocky Reach and Rock Island

Daily spill volumes will be shaped within each 24-hour period at Rocky Reach during the summer, and at Rock Island during both spring and summer spill periods (Table 2). Spill shaping attempts to optimize spill water volume to maximize spill passage effectiveness for smolts. The diel spill shape functions to provide either higher or lower spill volume during periods of either higher or lower fish passage. Spill shaping is based on the observed diel (24-hour) passage distributions of smolts at each project during spring and summer (Steig et al. 2009, Steig et al. 2010, Skalski et al. 2008, Skalski et al. 2010, Skalski et al. 2011, Skalski et al. 2012). The different spill percentages and time blocks are shaped such that the summation of water volume from all time blocks within the day equals the volume of water that would have been spilled under a constant, unshaped spill level (for instance spill at 9 percent day-average river flow at Rocky Reach with no shaping). The hourly spill shape in 2013 will remain consistent with previous years, 2004-2012.

Table 2. Fish spill percentages and spill shape for the Rocky Reach spill program, 2013.

Project	Season	Spill Percent	Spill Shape	Hour Block	Time	Percent of River
Rocky Reach	Spring	none	--	--	--	--
			Med	1	00:00-01:00	9.0%
Rocky Reach	Summer*	9%	Low	6	01:00-07:00	6.0%
			Med	2	07:00-09:00	9.0%
			High	6	09:00-15:00	12.0%
			Med	9	15:00-00:00	9.0%

*Spill for subyearling Chinook

2013 Run-Timing Predictions

Chelan PUD utilizes the University of Washington (UW) to provide run-timing predictions and year-end observed values for spring and summer out-migrating percentiles for salmon and steelhead. UW's Program RealTime run-time forecasting model is used for this purpose. Program Real-Time provides daily forecasts and cumulative passage percentiles for steelhead, yearling Chinook, sockeye, and subyearling Chinook at both Rocky Reach and Rock Island. This program enables Chelan PUD to better predict the time when a selected percentage of these species will arrive, and when a given percentage of any stock has passed. The program utilizes daily fish counts from the Rocky Reach bypass sampling facility and the juvenile bypass trap at Rock Island Dam. Estimates of passage percentiles are generated with the model's forecast error and are displayed with the daily predictions at:

http://www.cbr.washington.edu/crisprt/

Historic Run Timing

Estimated mean dam passage dates (first percentile to the 95th percentile) for each species at Rocky Reach and Rock Island are summarized in Table 3. Run-timing dates are estimated from daily index sample counts at the Rocky Reach JFBS, 2004-2012, and from the Rock Island Dam smolt bypass trap, 2002-2012 (Table 3). At Rocky Reach, the subyearling Chinook run generally begins the first week of June, with the one-percentile passage date on 1-June (mean date for years 2004-2012). Rocky Reach subyearling passage reaches the 95th percentile, on average, around 9-August (2004-2012, range: 27-July to 24-August).

Rock Island Dam juvenile salmon and steelhead sampling from the Smolt Monitoring Program (SMP), 2002-2012, indicates that the first percentile (one-percent passage) mean passage date for combined spring migrants (yearling Chinook, steelhead, and sockeye) occurs around 19-April (Table 3). The latest spring spill start date for Rock Island per the HCP is 17-April. The summer outmigration of subyearling Chinook smolts at Rock Island Dam generally begins in early June (although fry are encountered earlier), and on average, reaches the 95th percentile passage point around 9-August (range: 1-August to 18-August, 2002-2012).

Table 3. Spill percentages, bypass operation dates, and mean passage percentile dates (2002-2012) for the 1st and 95th percentile passage points for HCP spring and summer outmigrants at Rocky Reach and Rock Island.

Rocky Reach	**steelhead**	**yearling Chinook**	**sockeye**	**subyearling Chinook**
Percent Spill	0% Spring	0% Spring	0% Spring	9% Summer
1st, 95th percentile Passage Dates	4/16, 5/30	4/17, 5/30	5/6, 5/27	6/1, 8/9
RR Bypass Operating?	Yes 4/1 – 8/31	Yes 4/1 – 8/31	Yes 4/1 – 8/31	Yes 4/1 – 8/31
Rock Island	**steelhead**	**yearling Chinook**	**sockeye**	**subyearling Chinook**
Percent Spill	10% Spring	10% Spring	10% Spring	20% Summer
1st, 95th percentile Passage Dates	4/24, 6/9	4/17, 5/30	4/19, 6/12	6/3, 8/9
RI Bypass Trap Operation	4/1 - 8/31	4/1 - 8/31	4/1 - 8/31	4/1 - 8/31

Source - Rock Island: http://www.cbr.washington.edu/crisprt/index_midcol2_pi.html
Source- Rocky Reach: http://www.cbr.washington.edu/crisprt/index_midcol2_che.html

Rock Island 2013 Spring Spill

In 2013, Rock Island Dam will spill 10 percent of the day average river flow starting no later than 17-April, and will end spill after 95 percent of spring outmigrants have passed the dam (usually the first week of June). Spill volume will be shaped to maximize spill efficiency (Table 4). Chelan PUD personnel will operate the Rock Island bypass trap, an upper Columbia Smolt Monitoring Program (SMP) site, continuously from 1-April through 31-August, seven days per week to provide daily smolt counts. Index counts will provide the basis to determine the start and end the spring and summer outmigration periods. HCP SOA guidelines to start and end the spring spill program at Rock Island are as follows:

1. The Rock Island spring spill program will begin when the Rock Island daily smolt passage index count exceeds 400 fish for more than 3 days (this corresponds to the approximately the 5 percent passage date), or no later than 17-April, as outlined in Section 5.4.1. (a) of the Rock Island HCP.

2. Rock Island spring spill will end following completion of the spring outmigration (95 percent passage point), and subyearling Chinook have arrived at the Project.

Rock Island 2013 Summer Spill

Rock Island will spill 20 percent of the daily average river flow for a duration covering 95 percent of the summer out migration of subyearling Chinook. Daily smolt counts from the Rock Island bypass trap will inform decisions on when to start and stop spill. The HCP Coordinating Committee's (HCPCC) agreement guidelines to start and stop the summer spill at Rock Island are outlined as follows:

1. Rock Island summer spill in 2013 will begin immediately after completion of the spring spill. The summer spill level will be 20 percent of day average flow, shaped to increase spill efficiency. Spill will continue for a duration covering 95 percent of the subyearling outmigration.

2. Summer spill will generally end no later than 15-August, or when subyearling counts from the Rock Island trap are 0.3 percent or less of the cumulative run total for any three out of five consecutive-day period, and UW's Program RealTime is estimating 95 percent run completion (same protocol used in 2004-2012).

Table 4. Spill percentages and hourly spill shape for the Rock Island spring and summer fish spill program, 2013.

Project/Season	Daily Spill Average	Spill Levels	Duration (# of hours)	Time of Day	Spill Shape %
Rock Island Spring*	10%	High	4	0000-0400	12.5
		Med	3	0400-0700	10.0
		Low	5	0700-1200	6.0
		Med	8	1200-2000	10.0
		High	4	2000-2400	12.5
Rock Island Summer**	20%	High	1	0000-0100	23.0
		Med	1	0100-0200	19.0
		low	8	0200-1000	15.0
		Med	1	1000-1100	19.0
		High	13	1100-2400	23.0

*Spring spill for yearling Chinook, steelhead, and sockeye

**Summer spill for subyearling Chinook

Spill Program Communication

Chelan PUD's fish spill coordinator will notify the HCP Coordinating Committee (HCPCC) not less than once per week when fish passage numbers indicate that specific triggers for starting or stopping spill are likely to occur in the immediate future. Chelan PUD will notify the HCPCC regarding any unforeseen issues that pertain to the spill program as the season progresses. Communications with the HCPCC on spill information will generally be made by email, pre-scheduled conference calls, and HCPCC monthly meetings.

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APPENDIX K
CHELAN PUD 2012 PIKEMINNOW CONTROL REPORT

Chelan County Public Utility District # 1

Northern Pikeminnow (*Ptychocheilus oregonensis*) Predator Control Program Rocky Reach and Rock Island Hydroelectric Projects Summary Report 2003-2012

Northern Pikeminnow *(Ptychocheilus oregonensis)*, Rocky Reach Dam, 2008.

Prepared By:

Lance Keller

Public Utility District No. 1 of Chelan County
327 North Wenatchee Avenue
Wenatchee, Washington 98801

February 2012

Abstract

The report provides information on Chelan PUD's pikeminnow control programs with the USDA for years 2003 through 2012, Columbia Research for 2005 through 2012, the East Wenatchee Rotary Club Pikeminnow Derby for 1996 through 2012, and Chelan County PUD ladder trapping program at Rocky Reach and Rock Island Dams for 2009 and 2010.

Northern pikeminnow (*Ptychocheilus oregonensis*) are one of the most abundant predators of juvenile steelhead and salmonids (*Oncorhynchus spp.*) in the Columbia River. In 1998, the American Fisheries Society (AFS) formally changed the common name of this fish from *northern squawfish* to *northern pikeminnow*. Pikeminnow may concentrate in hydroelectric project tailraces during the late spring and summer months, concurrent with the juvenile salmonid migrations. The Public Utility District No.1 of Chelan County (District) initiated a pikeminnow removal program in 1994 at Rocky Reach dam and extended the program to include Rock Island in 1995. Since 1996, the District has contracted annually with the United States Department of Agriculture Wildlife Services (USDA) to carry out this program. In addition to the USDA program, Chelan PUD conducted a pilot study using set-lines in 2005 under contract with Columbia Research. The objective of the set-line program was to remove pikeminnow from over-wintering habitats before the start of out-migration of salmonid smolts. Chelan PUD also conducted fish ladder trapping to remove pikeminnow at Rocky Reach and Rock Island Hydro Projects in 2009. Chelan PUD also provides funding for the annual Pikeminnow Derby sponsored by the East Wenatchee Rotary Club.

From 1994 to present, an overall 793,606 pikeminnow have been removed from Rocky Reach and Rock Island reservoirs (521,935 by USDA, 210,386 by Columbia Research, 50,134 by Pikeminnow Derby, 8,670 by fish ladder trapping, and 2,481 by Chelan PUD Fish and Wildlife staff).

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Introduction

Northern pikeminnow (*Ptychocheilus oregonensis*) are native to the Columbia River. Burley and Poe (1994) identified pikeminnow as the most abundant predator on out-migrating juvenile steelhead and salmonids (*Oncorhynchus spp.*) in the mid-Columbia River between Priest Rapids and Chief Joseph dams. They also concluded that the highest abundance of pikeminnow concentrate in tailrace areas. Loch et al (1994) reported that the highest consumption of juvenile salmonids takes place within the tailraces of dams and those pikeminnow densities in these areas increase during the late spring and summer. Pikeminnow are believed to become piscivorous on juvenile salmonids at approximately 250 mm (10 inches) and their predation rate on juvenile salmonids increase significantly as their size and age increases.

In an effort to reduce predation on juvenile salmonids, the Chelan County Public Utility District (District) implemented a pikeminnow removal program (Program) in 1994 in the Rocky Reach project area and in 1995 the program was expanded to include the Rock Island project area. From 1996 to present time, the District has contracted with the United States Department of Agriculture, Wildlife Service (USDA) to employ anglers to fish for pikeminnow during the summer months from the District's dams and reservoirs. For the past six years, the program has focused on increasing fishing effort, increasing pikeminnow catch over previous years, and evaluating catch data to characterize attributes of the pikeminnow populations in the reservoirs. As a result, the USDA fish for a longer duration, with an additional boat for the 2009-2010 seasons. From 2005-2010, the District contracted Columbia Research to fish for pikeminnow during the spring months in the District's reservoirs, with an extension of the effort into the months of May, June, and July for 2010. The objective of the Columbia Research effort is to remove pikeminnow congregating in deep over-wintering areas of the reservoir before the out-migration of salmon and steelhead smolts. The district also conducted a ladder trapping program at Rock Island Dam in 2010.

Program Objectives

The objectives for the 2012 pikeminnow removal project were three-fold:

1) Reduce the number of pikeminnow in the Rocky Reach and Rock Island tailraces and reservoirs in order to reduce predation on juvenile anadromous salmon and steelhead smolts:

2) Continue to evaluate the efficiency of angling methods and the timing of seasonal fish movement to improve the efficiency and harvest; and

3) Evaluate current and historic catch statistics to characterize effects of the removal program on pikeminnow populations in Rocky Reach and Rock Island reservoirs

Methods and Materials

USDA

Since 1996, the District has contracted the USDA to conduct pikeminnow fishing from Rocky Reach and Rock Island Projects. The USDA employs approximately 17 anglers to fish for pikeminnow during the summer months. Anglers are typically divided into six groups. A three-member crew fishes the Rocky Reach tailrace area from Rocky Reach Dam. One two-member crew fishes from Rock Island Dam in tailrace areas. Twelve anglers fish from four boats throughout the reservoirs, three anglers per boat. Tailrace crews fish for pikeminnow from May through the first week of August. The boat crews move between the two reservoirs to find the best fishing areas from May to mid-October.

Each angler is outfitted with two fishing rods and reels, assorted tackle, a tackle box, small ice chest (for keeping bait cool), fillet knife (for cutting bait), pliers, line clippers, personal floatation device, hard hat, 5 gallon bucket, and data sheets to record weekly catch. Each crew also carries a District radio or cell phone for communication. For more detail description of equipment used by anglers, please refer to West (2001).

Anglers fish a variety of locations within the tailraces and reservoirs in search of the most productive fish locations. Early in the fishing season when catch rates are low, anglers move in search of “hot spots.” Later in the season when flows reside, water temperatures increase, and when anglers become more familiar with pikeminnow holding areas and feeding activity, the anglers are able to concentrate their efforts in established locations.

Each crew leader is in charge of recording specific information. Data is collected weekly from each crew including: The total number of pikeminnow captured, total number of hours fished, fishing locations, and number of non-target fish captured. Twice a week anglers are required to measure the fork length on all pikeminnow in order to evaluate the size distribution. Upon capture, pikeminnow are measured, euthanized, and their carcasses are returned to the river. All non-target species are released immediately back into the reservoir.

Columbia Research

Set-lines are the primary fishing technique used by Columbia Research to capture and remove pikeminnow. Set-lines are long weighted nylon lines with buoys attached at each end. The weighted rope allows the set-line to sink and remain on the bottom of the reservoir where pikeminnow tend to congregate during the winter months. Approximately 150 small hooks are attached to each line. Each hook is tied to a leader that contains a small float, which allows the hook to float slightly off the bottom substrate. An 8-pound test leader allows non-target species to break free from the set-line upon capture. Each day, between 15 and 20 set-lines are deployed and allowed to fish for 24 hours. Deployment of set-lines occurs in the Rocky Reach and Rock Island reservoirs and varies in depth between 5 feet to 150 feet. Once set-lines are retrieved and non-target species are released, pikeminnow are measured (fork length) and turned in to the

District for rendering. Columbia Research provides the District with specific information including; the number of pikeminnow caught on each set-line, fork length (mm), depth and location of each set-line, and set-line time. They also provide the District with weekly update and a final report.

Chelan County PUD #1.
In 2007, BioAnalysts Inc. conducted a pilot study to evaluate the effectiveness of using modified lamprey traps in the adult ladder of Rocky Reach Dam to trap pikeminnow migrating pass the project. The study focused on finding the optimum trap configuration for trapping pikeminnow, and in the process trapped 908 pikeminnow. Based on the results of the 2007 pilot study, a full trapping program was contracted for 2008 at Rocky Reach Dam, as well as a trap evaluation study for the right adult ladder at Rock Island Dam. Since 2009, the district has conducted the pikeminnow trapping effort with district staff at both projects.

Traps are operated 24 hours a day from Sunday afternoon to Friday afternoon each week. Traps are sampled once daily. All non-target species are identified, counted, checked for injury, and released back into the forebay. All sensitive species (salmon, trout, and lamprey) are handled as little as possible and immediately released into the forebay. All pikeminnow captured are dispatched and sampled for fork length. Carcasses are then returned to the river.

Program Contracts and Compensation

USDA
The USDA receives compensation on an hourly basis for labor through an annual contract. The contract is typically less than 7 months in duration, from May through mid-October. In 2012, the contract payout was $353,631.60. USDA rod and reel fishing activities for the tailrace and boat crews takes place 5 days a week for 8 hours each day.

Columbia Research
In 2012, Columbia Research received $3.00 for each fish between 127 mm and 227 mm and $6.67 for each fish greater than 227 mm in fork length. Columbia Research received no compensation for fish measuring less than 127 mm. Columbia Research anglers fish 7 days a week, for up to 15 hours a day during the contract period. In 2012, Columbia Research began set-line fishing in the Rocky Reach and Rock Island reservoirs from March into August. The total contract payout was $180,000.00.

East Wenatchee Rotary Club
The District contracts with the East Wenatchee Rotary Club to hold a two-day fishing derby for northern pikeminnow. This contract is $10,000 with specific requirements for anglers to fish in Rocky Reach and Rock Island reservoirs only.

Results

USDA

Since 2003, the USDA has removed 521,935 pikeminnow from the Rocky Reach and Rock Island projects. In 2012, USDA crews removed 36,118 pikeminnow from May through mid October. (Table 1).

Table 1. Total pikeminnow removed from Rocky Reach and Rock Island projects by USDA from May through October 2003 to 2012.

Year	USDA
2003	19,754
2004	36,145
2005	39,818
2006	40,747
2007	46,240
2008	42,158
2009	50,333
2010	47,354
2011	36,401
2012	36,118
Total	**358,667**

Pikeminnow Size Distribution

The USDA submitted length measurements to the District weekly. A total 146,634 pikeminnow have been measured since 2003. Of the total pikeminnow measured, 56,105 are ≥ 251 mm (Table 2). The length distribution of pikeminnow measuring ≥ 251 mm are further separated into size categories. The majority of the pikeminnow captured by the USDA in 2012 fell into length groups between 170 mm to 310 mm for the Rock Island project, and 120 mm to 230 mm in the Rocky Reach project.

Table 2. Number of pikeminnow ≤ 250 mm and ≥ 251 mm captured in Rocky Reach and Rock Island projects during USDA fishing, 2003-2012.

Year	Rocky Reach		Rock Island	
	≤ 250 mm	≥ 251 mm	≤ 250 mm	≥ 251 mm
2003	961	299	287	162
2004	3,877	1,602	799	966
2005	6,287	2,832	3,496	3,795
2006	6,568	3,885	2,981	3,510
2007	4,965	3,518	4,618	4,869
2008	6,033	2,992	3,919	4,051
2009	6,232	4,022	5,733	4,775
2010	9,170	3,498	3,711	3,071
2011	8,526	1,752	1,889	2,156
2012	8,476	2,223	2,002	2,126

The overall mean length of pikeminnow removed from both Rocky Reach and Rock Island in 2003 was 236 mm. The overall mean length remained somewhat constant in 2004 and 2005. The overall length increased slightly in 2006, and remained unchanged for 2007. The overall mean length for pikeminnow removed decreased slightly in 2008 at 241 mm, but increased slightly in 2009 to 245 mm. Overall mean lenth has been decreasing since 2010, with the lowest overall mean length being observed in 2011 at 218 mm. The overall mean length increased slightly to 219 mm in 2012. (Table 3).

Table 3. The mean fork length (mm) of pikeminnow removed during USDA fishing at Rocky Reach and Rock Island projects, 2003 to 2012.

Year	Rocky Reach Mean Length (mm)	Rock Island Mean Length (mm)	Overall Mean Length (mm)
2003	232	249	236
2004	231	264	239
2005	223	254	237
2006	235	257	244
2007	236	251	244
2008	229	254	242
2009	239	252	245
2010	219	248	229
2011	200	262	218
2012	202	263	219

Pikeminnow Catch Rates

In 2003, 2004, and 2005 the angler hours were reported as fishing days (8 hours). From 2006 through 2011, anglers fishing from the dam reported their time as “angling hours” while boat anglers reported fishing time as “boat hours”. Angling hours were just that - defined as the number of hours the tailrace crews spent fishing. Boat hours are defined as the number of hours the boat was in the water. It does not include the time required to launch or load the boat, refuel, or purchasing equipment. The catch per angler hour (CPAH) increased every year from 2.9 in 2003 to 5.1 in 2008. CPAH remained consistent at 5.0 in 2009, but fell to 4.6 in 2010. A decline in CPAH was observed in 2011 to 3.5, with a minor decrease in CPAH being observed in 2012. During the last month of fishing in 2003, the USDA used both longlines and rod and reel fishing methods. However, since the longline fishing methods conducted in 2003 are not consistent with the rod and reel fishing methods conducted in 2004 through 2012, only rod and reel fishing techniques are illustrated in Table 4.

Table 4. The overall rod and reel CPAH for the USDA pikeminnow anglers from May to October, 2003 to 2012.

Year	Angler Hours	Fish Captured	CPAH
2003*	6,857	20,161	2.9
2004	11,676	36,145	3.1
2005	10,849	39,818	3.7
2006	9,159.5	40,747	4.4
2007	9,513.5	46,240	4.9
2008	8,317.5	42,158	5.1
2009	10,004.5	50,333	5.0

2010	10,187.5	47,354	4.6
2011	10,300.75	36,401	3.5
2012	10,261.05	36,118	3.5

*Note: USDA longline counts are not included in the 2003 angler hours or number of fish captured.

Cost Benefit Analysis

Expenditures for the USDA portion of the pikeminnow predator program have fluctuated since the initial start of the contract in 1996. The District's cost-per-fish decreased from $6.87 in 2003 to $6.41 in 2005, then increased slightly in 2006, followed by a substantial decrease to $5.48 in 2007. Since 2008, the cost-per-fish has been increasing, with the highest cost-per-fish since 2003 occuring in 2012 at $9.79 per fish.8 (Table 5).

Table 5. Cost per fish for USDA Predator Control Program, 2003 to 2012.

Program Year	Number of pikeminnow removed	Cost per fish
2003	19,754	$6.87
2004	36,145	$6.58
2005	39,818	$6.41
2006	40,747	$6.46
2007	46,240	$5.48
2008	42,158	$6.28
2009	50,333	$6.50
2010	47,354	$7.02
2011	36,401	$9.12
2012	36,118	$9.79

Non-Target Fish Species

Rod and reel angling is one preferred pikeminnow removal method because baits can be tailored to exploit primarily pikeminnow and is the least harmful to non-target species. The non-target fish species caught included, chiselmouth (*Acrocheilus alutaceus)*, peamouth (*Mylocheilus caurinus)*, large scale and bridgelip suckers (*Catostomus spp.)*, mottled scuplin *(Cottus baird)*, redside shiners (*Richardsonius balteatus*), bass (*Micropterus dolomieu*), mountain whitefish (*Prosopium williamsoni*), walleye *(Stizostedion vitreum vitreum)*, yellow perch *(Perca flavescens)*, adult and juvenile salmon, and adult steelhead and resident rainbow trout (*Oncorhynchus mykiss).* In 2011, all non-target fish were released unharmed back to the river.

Columbia Research

Columbia Research has removed 210,386 pikeminnow from Rocky Reach and Rock Island reservoirs from 2005-2012. In 2012, 29,526 pikeminnow were captured at depths between 5 feet to 150 feet (Table 6).

Table 6. Total number of pikeminnow removed from Rocky Reach and Rock Island reservoirs at depths of 0 feet to 150 feet from March through April in 2005,February through April from 2006 to 2009 (as well as May through June in the upper Wanapum reservoir and November in the Rocky Reach reservoir in 2009), and March through August in 2011 and 2012.

2005				
Depth (ft)	**February**	**March**	**April**	**Total**
0-30	-----	41	25	66
31-60	-----	117	258	375
61-90	-----	319	2,245	2,564
91-120	-----	4,299	4,725	9,024
121-150	-----	3,402	3,906	7,308
2005 Totals	**-----**	**8,178**	**11,159**	**19,337**
2006				
Depth (ft)	**February**	**March**	**April**	**Total**
0-30	4	0	0	4
31-60	7	53	508	568
61-90	511	2,764	4,433	7,708
91-120	717	3,074	4,777	8,568
121-150	522	2,093	3,101	5,716
2006 Totals	**1,761**	**7,984**	**12,819**	**22,564**
2007				
Depth (ft)	**February**	**March**	**April**	**Total**
31-60	651	1,079	2,218	3,963
61-90	1,461	2,053	3,689	7,203
91-120	2,200	2,298	2,583	7,081
121-150	849	855	1,365	3,069
2007 Totals	**5,161**	**6,285**	**9,855**	**21,301**
2008				
Depth (ft)	**February**	**March**	**April**	**Total**
61-90	2,250	4,065	2,628	8,943
91-120	2,233	3,586	2,512	8,331
121-150	888	1,454	1,893	4,235
2008 Totals	**5,371**	**9,105**	**7,033**	**21,509**
2009				
Depth (ft)	**February**	**March**	**April**	**Total**
61-90	1,247	1,677	5,708	8,632
91-120	1,001	2,216	4,575	7,792
121-150	818	1,733	2,280	4,831
Totals	**3,066**	**5,626**	**12,563**	**21,255**
Depth (ft)	**May**	**June**	**November**	**Total**
0-30	1,190	4,041	544	5,575
31-60	946	2,334	885	4,103
61-90	134	0	354	488
Totals	**2,270**	**6,375**	**1,783**	**10,428**
			Yearly Total	**31,683**

2010				
Depth (ft)	**March**	**April**	**May**	**Total**
0-30	-----		1,520	1,520
31-60	135	3,171	3,054	6,360
61-90	1,697	5,002	1,835	8,534
91-120	2,820	2,079	-----	4,899
121-150	1,271	-----	-----	1,271
Totals	**5,923**	**10,252**	**6,409**	**22,584**
Depth (ft)	**June**	**July**	-----	**Total**
0-30	3,451	1,203	-----	4,654
31-60	3,245	1,137	-----	4,382
Totals	**6,696**	**2,340**	-----	**9,036**
			Yearly Total	**31,620**
2011				
Depth (ft)	**February**	**March**	**April**	**Total**
0-30	-----	-----	-----	-----
31-60	2	-----	114	116
61-90	16	748	3,737	4,501
91-120	173	714	3,260	4,147
121-150	28	-----	-----	28
Totals	**219**	**1,462**	**7,111**	**8,792**
Depth (ft)	**May**	**June**	**July**	**Total**
0-30	-----	2,183	4,963	7,146
31-60	3,573	3,501	1,161	8,235
61-90	**3,951**	**453**	-----	**4,404**
91-120	**1,891**	-----	-----	**1,891**
Totals	**9,415**	**6,137**	6,124	**21,676**
Depth (ft)	**August**	-----	-----	**Total**
0-30	**2,378**	-----	-----	**2,378**
Total	**2,378**	-----	-----	2,378
			Yearly Total	**32,846**
2012				
Depth (ft)	**March**	**April**	**May**	**Total**
0-30	-----	-----	-----	-----
31-60	-----	-----	5,015	5,015
61-90	439	2,923	1,033	4,395
91-120	996	2,344	-----	3,340
121-150	443	298	-----	741
Totals	**1,878**	**5,565**	**6,048**	**13,491**
Depth (ft)	**June**	**July**	**August**	**Total**
0-30	3,028	6,571	4,018	13,617
31-60	2,418	-----	-----	2,418
61-90	-----	-----	-----	-----
91-120	-----	-----	-----	-----
Totals	**5,446**	**6,571**	**4,018**	**16,035**
			Yearly Total	**29,526**

Pikeminnow Size Distribution

Because the main objective of the set-line program is to remove pikeminnow ≥ 228 mm (9 inches) from deep over wintering habitats before the out-migration of salmonid smolts, Columbia Research is required to measure every pikeminnow captured. In 2005 and 2006, river depths of 91 feet to 120 feet yielded the largest number of pikeminnow 228 mm or greater. In 2007, 2008 and 2009, Columbia Research caught greatest number of pikeminnow 228 mm or greater from depths of 61 feet to 90 feet. For 2010, the greatest number of pikeminnow 228 mm or greater were caught in depths from 31 feet to 60 feet. In 2011 and 2012 the trend of a shallow productive depth for larger fish continued, with the greatest number of fish 228 mm or greater being caught in depths from 0 feet to 30 feet (Table 7).

Table 7. Number of pikeminnow ≤227 mm and ≥228 mm removed by Columbia Research in Rocky Reach and Rock Island reservoirs by river depth and month, 2005 to 2012.

2005						
Depth (ft)	**February**		**March**		**April**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤227 (mm)**	**≥ 228 (mm)**
0 – 30	-----	-----	28	13	8	17
31 – 60	-----	-----	35	82	103	155
61 – 90	-----	-----	36	283	440	1,805
91 – 120	-----	-----	174	4,125	857	3,868
121 – 150	-----	-----	146	3,256	583	3,323
Totals	**-----**	**-----**	**419**	**7,759**	**1,991**	**9,168**
2006						
Depth (ft)	**February**		**March**		**April**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤227 (mm)**	**≥ 228 (mm)**
0 – 30	1	3	0	0	0	0
31 – 60	5	2	14	39	157	351
61 – 90	93	418	480	2,284	668	3,765
91 – 120	86	631	371	2,703	693	4,084
121 – 150	50	472	209	1,884	384	2,717
Totals	**235**	**1,526**	**1,074**	**6,910**	**1,902**	**10,917**

2007						
Depth (ft)	**February**		**March**		**April**	
	≤227(mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
31 – 60	21	630	45	1,034	329	1,889
61 – 90	46	1,415	122	1,931	576	3,113
91 – 120	41	2,159	153	2,145	438	2,145
121 – 150	10	839	102	753	253	1,112
Totals	**118**	**5,043**	**422**	**5,863**	**1,596**	**8,259**
2008						
Depth (ft)	**February**		**March**		**April**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
61 – 90	316	1,934	747	3,318	696	1,932
91 – 120	328	1,905	668	2,918	594	1,918
121 – 150	82	806	388	1,066	390	1,503
Totals	**726**	**4,645**	**1,803**	**7,302**	**1,680**	**5,353**
2009						
Depth (ft)	**February**		**March**		**April**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
61 – 90	146	1,101	278	1,803	1,004	4,704
91 – 120	135	866	422	1,794	811	3,764
121 – 150	177	641	330	1,403	457	1,823
Totals	458	2,608	1,030	5,000	2,272	10,291
Depth (ft)	**May**		**June**		**November**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
0-30	544	646	2,069	1,972	231	279
31-60	416	530	1,240	1,094	383	536
61-90	64	70	0	0	133	221
Totals	**1,024**	**1,246**	**3,309**	**3,066**	**747**	**1,036**

2010						
Depth (ft)	**February**		**March**		**April**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
0-30	-----	-----	-----	-----	-----	-----
31-60	-----	-----	10	125	757	2,414
61-90	-----	-----	119	1,578	1,274	3,728
91-120	-----	-----	213	2,607	490	1,589
121-150	-----	-----	122	1,149	-----	-----
Totals	-----	-----	**464**	**5,459**	**2,521**	**7,731**
Depth (ft)	**May**		**June**		**July**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
0-30	605	915	1,334	2,117	375	828
31-60	1,106	1,948	1,297	1,948	369	768
61-90	640	1,195	-----	-----	-----	-----
91-120	-----	-----	-----	-----	-----	-----
121-150	-----	-----	-----	-----	-----	-----
Totals	**2,351**	**4,058**	**2,631**	**4,065**	**744**	**1,596**
2011						
Depth (ft)	**February**		**March**		**April**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
0-30	-----	-----	-----	-----	-----	-----
31-60	-----	2	-----	-----	16	98
61-90	2	14	69	679	777	2,960
91-120	23	150	56	658	607	2,653
121-150	0	28	-----	-----	-----	-----
Totals	**25**	**194**	**125**	**1,337**	**14,00**	**5,711**
Depth (ft)	**May**		**June**		**July**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
0-30	-----	-----	845	1,338	1,584	3,379
31-60	1,238	2,335	1,210	2,291	477	684
61-90	1,350	2,601	160	293	-----	-----
91-120	603	1,288	-----	-----	-----	-----
121-150	-----	-----	-----	-----	-----	-----
Totals	**3,191**	**6,224**	**2,215**	**3,922**	**2,061**	**4,063**
Depth (ft)	**August**					
	≤ 227 (mm)	**≥ 228 (mm)**				
0-30	475	1,903				
31-60	-----	-----				
61-90	-----	-----				
91-120	-----	-----				
121-150	-----	-----				
Totals	**475**	**1,903**				
2012						
Depth (ft)	**March**		**April**		**May**	
	≤ 227 (mm)	**≥ 228 (mm)**	**≤ 227 (mm)**	**≥ 228 (mm)**	**≤ 227(mm)**	**≥ 228 (mm)**
0-30	-----	-----	-----	-----	-----	-----
31-60	-----	-----	-----	-----	1,097	3,918
61-90	22	417	335	2,588	227	806
91-120	54	942	285	2,059	-----	-----
121-150	25	418	31	267	-----	-----
Totals	**101**	**1,777**	**651**	**4,914**	**1,324**	**4,724**
Depth (ft)	**June**		**July**		**August**	

	≤ 227 (mm)	≥ 228 (mm)	≤ 227 (mm)	≥ 228 (mm)	≤ 227(mm)	≥ 228 (mm)
0-30	396	2,632	971	5,600	1,019	2,999
31-60	683	1,735	-----	-----	-----	-----
61-90	-----	-----	-----	-----	-----	-----
91-120	-----	-----	-----	-----	-----	-----
121-150	-----	-----	-----	-----	-----	-----
Totals	**1,079**	**4,367**	**971**	**5,600**	**1,019**	**2,999**

Pikeminnow Catch Rates

In 2012, Columbia Research removed 29,526 pikeminnow during 62,592 hours of set-line effort. (Table 8).

Table 8. Monthly pikeminnow catch rates in Rocky Reach and Rock Island reservoirs by river depth and month, 2005-2012.

2005			
Depth (ft)	**February CPUE**	**March CPUE**	**April CPUE**
0 – 30	-----	0.24	0.17
31 – 60	-----	0.29	0.98
61 – 90	-----	0.75	1.17
91 – 120	-----	1.22	1.38
121 - 150	-----	1.14	1.34
Monthly CPUE*	**-----**	**1.08**	**1.28**
2006			
Depth (ft)	**February CPUE**	**March CPUE**	**April CPUE**
0 – 30	0.16	0.00	0.00
31 – 60	0.14	0.27	0.88
61 – 90	0.53	0.78	1.02
91 – 120	0.62	0.78	1.08
121 - 150	0.90	0.69	0.71
Monthly CPUE*	**0.63**	**0.74**	**1.05**
2007			
Depth (ft)	**February CPUE**	**March CPUE**	**April CPUE**
31 – 60	.33	.35	.44
61 – 90	.38	.34	.40
91 – 120	.46	.34	.39
121 - 150	.51	.37	.38
Monthly CPUE*	**0.42**	**0.35**	**0.40**
2008			
Depth (ft) 61-150	**February CPUE**	**March CPUE**	**April CPUE**
61 – 90	0.31	0.29	0.48
91 – 120	0.31	0.26	0.46
121 - 150	0.27	0.29	0.38
Monthly CPUE*	**0.30**	**0.28**	**0.44**
2009			
Depth (ft) 61-150	**February CPUE**	**March CPUE**	**April CPUE**
61 – 90	0.22	0.34	0.58
91 – 120	0.25	0.35	0.55
121 - 150	0.25	0.23	0.46
Monthly CPUE*	**0.24**	**0.30**	**0.54**
Depth (ft) 0-90	**May CPUE**	**June CPUE**	**November CPUE**
0 – 30	0.67	0.43	0.46
31 – 60	0.68	0.26	0.46
61 -90	0.47	0.00	0.49
Monthly CPUE*	**0.66**	**0.35**	**0.47**

2010			
Depth (ft)	**March CPUE**	**April CPUE**	**May CPUE**
0 – 30	-----	-----	0.28
31 – 60	0.29	0.46	0.34
61 – 90	0.37	0.47	0.41
91 – 120	0.33	0.63	-----
121 - 150	0.30	-----	-----
Monthly CPUE*	**0.33**	**0.49**	**0.33**
Depth (ft)	**June CPUE**	**July CPUE**	
0-30	0.34	0.35	
31-60	0.32	0.33	
Monthly CPUE*	**0.33**	**0.34**	
2011			
Depth (ft)	**February CPUE**	**March CPUE**	**April CPUE**
0 – 30	-----	-----	-----
31 – 60	0.03	-----	0.11
61 – 90	0.12	0.17	0.28
91 – 120	0.09	0.14	0.25
121 - 150	0.16	-----	-----
Monthly CPUE*	**0.09**	**0.15**	**0.25**
Depth (ft)	**May CPUE**	**June CPUE**	**July CPUE**
0-30	0.15	0.20	**0.15**
31-60	0.31	0.14	**0.17**
61-90	**0.38**	**0.15**	**0.29**
91-120	**0.43**	-----	-----
Monthly CPUE*	**0.35**	**0.16**	**0.16**
Depth (ft)	**May CPUE**		
0-30	0.11		
Monthly CPUE*	**0.11**		
2012			
Depth (ft)	**March CPUE**	**April CPUE**	**May CPUE**
0 – 30	-----	-----	-----
31 – 60	-----	-----	0.44
61 – 90	0.11	0.44	0.41
91 – 120	0.11	0.26	-----
121 - 150	0.11	0.18	-----
Monthly CPUE*	**0.11**	**0.32**	**0.43**
Depth (ft)	**June CPUE**	**July CPUE**	**August CPUE**
0-30	0.39	0.51	0.47
31-60	0.40	-----	-----
61-90	-----	-----	-----
91-120	-----	-----	-----
Monthly CPUE*	**0.39**	**0.51**	**0.47**

*CPUE is number of pikeminnow captured per 100 hook hours.

Cost Benefit Analysis

Columbia Research is compensated on a per-fish basis. In 2005, Columbia Research received $2.75 for fish between 127 mm to 227 mm and $5.50 for each fish greater than 227 mm in length. In 2006, Columbia Research received $3.00 a fish measuring between 127 mm to 227 mm and $6.00 for each fish greater than 227 mm. In 2007, Columbia Research received $3.00 a fish measuring between 127 mm to 227 mm and $6.25 for each fish greater than 227 mm. From 2008 through 2011, Columbia Research received $3.00 a fish measuring between 127 mm to 227 mm and $6.50 for each fish greater than 227 mm. In 2012, Columbia Research received $3.00 a fish measuring between 127 mm to 227 mm and $6.75 for each fish greater than 227 mm. No compensation was awarded for any fish measuring less then 127mm (Table 9).

Table 9. Total payout by month to Columbia Research from 2005 to 2012 for harvested pikeminnow within the upper and lower compensation length groups.

2005			
	Cost Per Fish $2.75 (127-227mm)	Cost Per Fish $5.50 (>227mm)	Total
March	$1,152.25	$42,674.50	$43,826.75
April	$5,475.25	$50,424.00	$55,899.25
Total	**$6,627.50**	**$93,098.50**	**$99,726.00**
2006			
	Cost Per Fish $3.00 (127-227mm)	Cost Per Fish $6.00 (>227mm)	Total
February	$705.00	$9,156.00	$9,861.00
March	$3,222.00	$41,460.00	$44,682.00
April	$5,255.00	$65,202.00	$70,457.00
Total	**$9,182.00**	**$115,818.00**	**$125,000.00**
2007			
	Cost Per Fish $3.00 (127-227mm)	Cost Per Fish $6.25 (>227mm)	Total
February	$300.00	$29,187.50	$29,487.50
March	$1,470.00	$42,743.75	$44,213.75
April	$4,335.00	$46,962.50	$51,297.50
Total	**$9,006.00**	**$118,893.75**	**$124,998.75**

2008			
	Cost Per Fish $3.00 (127-227mm)	Cost Per Fish $6.50 (>227mm)	Total
February	$2,598.00	$34,885.50	$37,483.50
March	$5,298.00	$42,146.00	$47,444.00
April	$4,593.00	$35,477.00	$40,070.00
Total	**$12,489.00**	**$112,508.50**	**$124,997.50**

2009			
	Cost Per Fish $3.00 (127-227mm)	Cost Per Fish $6.50 (>227mm)	Total
February	$1,374.00	$16,952.00	$18,326.00
March	$3,090.00	$29,874.00	$32,964.00
April	$5,556.00	$59,741.50	$65,297.50
May	$4,332.00	$15,249.00	$19,581.00
June	$9,624.00	$18,882.50	$28,506.50
July	$303.00	$1,046.50	$1,349.50
November	$2,241.00	$6,734.00	$8,975.00
Total	**$26,520.00**	**$148,479.50**	**$174,999.50**

2010			
	Cost Per Fish $3.00 (127-227mm)	Cost Per Fish $6.50 (>227mm)	Total
March	$1,392.00	$35,483.50	$36,875.5
April	$7,563.00	$50,251.50	$57,814.50
May	$7,044.00	$26,377.00	$33,421.00
June	$7,860.00	$26,422.50	$34,282.50
July	$2,232.00	$10,374.00	$12,606.00
Total	**$26,091.00**	**$148,908.50**	**$174,999.50**

2011			
	Cost Per Fish $3.00 (127-227mm)	Cost Per Fish $6.50 (>227mm)	Total
February	$75.00	$1,261.00	$1,336.00
March	$375.00	$8,690.50	$9,065.50
April	$4,200.00	$37,121.50	$41,321.50
May	$9,573.00	$40,456.00	$50,029.00
June	$6,645.00	$25,493.00	$32,138.00
July	$6,183.00	$26,409.50	$32,592.50
August	$1,392.00	$12,376.00	$13,761.50
Total	**$28,443.00**	**$151,807.50**	**$180,250.50**

2012			
	Cost Per Fish $3.00 (127-227mm)	Cost Per Fish $6.75 (>227mm)	Total
March	$303.00	$11,994.75	$12,297.75
April	$1,953.00	$33,169.50	$35,122.50
May	$3,972.00	$31,887.00	$35,859.00
June	$3,237.00	$29,477.25	$32,714.25
July	$2,913.00	$37,800.00	$40,713.00
August	$3,057.00	$20,236.5	$23,293.50
Total	**$15,435.00**	**$164,565.00**	**$180,000.00**

Non-Target Fish Species

The non-target fish species caught included, chiselmouth, peamouth, large scale and bridgelip suckers, mottled scuplin, mountain whitefish, burbot (*Lota lota*) and white sturgeon (*Acipenser transmontanus*). In 2012, no adult or juvenile salmon or steelhead were captured. All non-target fish were released unharmed back into the river.

Chelan County PUD

The District did not conduct any ladder trapping of northern pikeminnow in either the Rocky Reach of Rock Island adult fishways in 2012. For an overview on trap configurations, please refer to Mallas and Stevenson, 2008. For past catch data, please refer to Keller et. al., 2010.

East Wenatchee Rotary Derby

The District contracts the East Wenatchee Rotary Club with partial funding to carry out the Rotary's annual Pikeminnow Derby, which takes place during the last week in June. During this two-day event, sportsmen fish Rocky Reach and Rock Island reservoirs for pikeminnow. After each day, the anglers submit their fish for count and total weight. Prizes are awarded to individuals who catch the most pikeminnow by weight; daily prizes are awarded for the largest fish and the most fish. Derby participation and pikeminnow catches have increased nearly every year. From 1996-2012, derby participants removed 50,134 pikeminnow in 34 days of total fishing (Table 10).

Table 10. Number of pikeminnow caught during the East Wenatchee Rotary Club Annual Pikeminnow Derby, 1996 to 2012.

Year	Number of pikeminnow caught
1996	1,800
1997	2,240
1998	1,847
1999	2,294
2000	1,370
2001	1,601
2002	2,783
2003	2,568
2004	2,943
2005	3,950
2006	3,445
2007	3,812
2008	4,474
2009	3,812
2010	5,027
2011	3,274
2012	**2,894**
Total	**50,134**

Discussion

USDA

The continued success of the USDA program is likely a result from a variety of factors.
A key efficiency is credited to a core group of veteran anglers who return to work in the program each year, resulting in better catch rates overall. Experienced anglers are more productive, relying on their knowledge of pikeminnow holding areas in the reservoirs, effective baits, and presentation methods. While the USDA continues to catch similar numbers of pikeminnow each year, the overall average size remained nearly constant in 2012 when compared to 2011, which was the lowest average size observed since the start of the USDA effort. The start and duration of the USDA pikeminnow program is designed to coincide with the out migration period of juvenile salmonids. Smolts arrive at Rocky Reach and Rock Island Dams in early April, and continue passing the dams through the end of August. Pikeminnows primarily ascend the adult fish ladders during mid-May through September; peak ladder passage occurs in August at Rocky Reach and in mid-July at Rock Island Dam. The highest catch rates for pikeminnow usually occur in July and August for Rocky Reach and Rock Island.

Columbia Research

The objective for the Columbia Research set-line program was to remove large pikeminnow that congregate in deep over-wintering areas before the start of the out-migration of juvenile salmon and steelhead. Columbia Research has become very efficient at using set-lines. Since set-line angling is designed to capture fish that hold on or near the river bottom, targeting deep areas within the reservoir where pikeminnow congregate in colder months is effective. Pikeminnow likely move into deep pools where the daily water temperature remains more constant. A fish's metabolic rate decreases over winter periods, and hence it needs less food to survive (Sauter et. al, 1994). By presenting pikeminnow with food that they do not have to chase, they likely expend very little effort and energy to obtain the bait. The boat crew deployed between 12 and 20 set-lines each day at various depths and found that they had the greatest success at depths between 5 feet to 30 feet. The peak CPUE for March through July occurred at the depths of 91 feet to 120 feet in March, 61 feet to 90 feet in April, 31 feet to 60 feet in May, 31 feet to 60 feet June, 5 feet to 30 feet in July, and 0 feet to 30 feet in August. In past years, depths of 61 feet to 90 feet have yielded higher CPUE, but increased river flows and cooler river temperatures in 2012 may have influenced vertical distribution of pikeminnow in the water column.

Chelan County PUD

Rocky Reach

In 2007, much work was done to evaluate different methods and trap configurations to maximize the efficiency of capturing pikeminnow (Mallas and Stevenson 2008). In 2008 and 2009 at Rocky Reach Dam, the primary objective was to capture and remove as many pikeminnow as possible from the fishway. The structural integrity of the supports for the traps was damaged near the end of the trapping effort in 2009. Unfortunately, the installation of new supports extended into the trapping season of 2010 and no effort was conducted. In 2011, the pikeminnow migration was later than normal, causing most of the pikeminnow migration to overlap with the returning adult sockeye migration. Due to high bycatch experienced with adult sockeye in past years, The District decided to abandon trapping efforts in 2012 in the Rocky Reach adult fishway.

Rock Island

The control configuration used at Rock Island was modeled after the most successful configuration from the 2007 evaluation at Rocky Reach. Identical traps were used at both Rock Island and Rocky Reach in 2009 and 2010. Similar to Rocky Reach in 2011, the pikeminnow migration past the Rock Island project was delayed, causing it to overlap with the returning adult sockeye migration ,and due to high rates of bycatch of adult sockeye observed in past years, The District decided to abaondon trapping efforts in 2012 in the Rock Island right-bank adult fishway.

Pikeminnow Movement

Northern pikeminnow are transient in behavior. The Columbia River is an open system with significant fish movement likely, both upstream and downstream. Fish ladder observations show that pikeminnow move freely from one reservoir to the next. Tributaries to the Columbia like the Wenatchee, Entiat, Methow, Chelan, and Okanogan rivers all provide spawning and rearing habitat for pikeminnow in addition to that provided by the mainstem Columbia. Overall production of pikeminnow from the tributaries is unknown. Pikeminnow spawning and rearing in the mouths of these tributaries may also be related to the increase movement of pikeminnow. All three mid-Columbia PUDs have pikeminnow control programs, but the programs differ greatly in duration and scope.

Fish counting at both Rocky Reach and Rock Island adult fish ladders takes place from 14 April through 14 November each year. Since 1992 at Rock Island and 1996 at Rocky Reach, fish passage has been videotaped and counting occurs over a 24-hour period. The number of pikeminnow ascending through Rocky Reach and Rock Island adult fish ladders decreased when the pikeminnow program began at both projects (1994 at Rocky Reach and 1995 at Rock Island). A decrease in the number of pikeminnow ascending Rocky Reach and Rock Island ladder was observed in 1994 through 1999. However, between 2000-2004 the pikeminnow movement through the adult ladder at Rocky Reach increased. After 2004, the pikeminnow movement through Rocky Reach has continued to decrease through 2010. Pikeminnow movement through Rock Island Dam adult fish ladders greatly increased from 2000 through 2007, but counts have been declining from 2007-2010, but a slight increase was observed in 2011, followed by a decrease in 2012. Passage at Rocky Reach in 2012 decreased 16.9% from 2011 counts, while counts at Rock Island in 2012 decreased by 1.0% from 2011 counts (Table 11).

Table 11 Number of pikeminnow ascending fish ladders at Rocky Reach and Rock Island dam, April 14 – November 14, 1994-2012 (for more information about pikeminnow ascending fish ladders from 1985 to 1993, please refer to West 2001).

Year	Rocky Reach Dam	Rock Island Dam
1994	16,627 [1]	4,501
1995	11,106	3,536 [2]
1996	6,071	3,055
1997 [3]	4,007	2,413
1998	4,889	2,505
1999	3,302	2,655
2000	8,612	2,298
2001	9,253	5,062
2002	16,196	5,874
2003	22,629	9,765
2004	37,266	24,124
2005	31,603	24,634
2006	25,040	34,397
2007	25,027	48,027
2008	20,075	42,962
2009	15,963	38,752
2010	10,373	16,525
2011	12,397	17,678
2012	10,299	17,500

1. Pikeminnow removal program began at Rocky Reach Dam
2. Pikeminnow removal program began at Rock Island Dam
3. Pikeminnow counted from 15 April to 15 September

Project Recommendations

USDA

Several factors, including USDA angler skill, reservoir knowledge, increased efforts, and program duration combined to make the 2012 program successful in a high flow year. The USDA anglers continue to maintain excellent pikeminnow catch rates by documenting fish movements and holding locations - those areas associated with feeding and spawning in the reservoirs. We expect that overall catch will increase as anglers continue to learn where pikeminnow reside during the summer and fall months. If possible, the District should continue to utilize USDA anglers with experience and knowledge of the reservoirs and who are familiar and adept at the angling techniques used in the program.

Columbia Research

We recommend continuing the set-line program at or near the 2012 funding and effort level. This program is productive because it compensates on a per fish basis, with no equipment, fuel, or administrative costs. The current recommendation is to continue to start the program in

February, but to extend the contract through November in an effort to take advantage of favorable CPUE documented during an experimental fishery in November of 2009.

Chelan County PUD

The District should attempt to carry out the ladder trapping program in 2013. The District staff hired to operate the Rocky Reach Juvenile Sampling Facility and the Rock Island Juvenile Sampling Facility would include the ladder trapping as part of their duties. The District should monitor pikeminnow passage at the projects closely to possibly take advantage of early pikeminnow passage ahead of the adult sockeye return of 2013.

East Wenatchee Rotary Derby

The District should continue to fund the East Wenatchee Rotary Club Pikeminnow Derby. The derby removes a large number of fish in a short time frame of two days, which likely provides an immediate within-year benefit to juvenile survival in the reservoirs. The overall cost per fish for the 2012 derby was $3.45, with 2,894 fish harvested in a two-day period. The Rotary Club should continue the derby event concurrent with the peak smolt migrations through Rocky Reach and Rock Island Reservoirs.

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APPENDIX L
2013 BROODSTOCK COLLECTION PROTOCOLS

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
Wenatchee Research Office
3515 Chelan Hwy 97-A Wenatchee, WA 98801 (509) 664-1227 FAX (509) 662-6606

November 4, 2013

To: Craig Busack, NMFS

From: Mike Tonseth, WDFW

Subject: **FINAL 2013 UPPER COLUMBIA RIVER SALMON AND STEELHEAD BROODSTOCK OBJECTIVES AND SITE-BASED BROODSTOCK COLLECTION PROTOCOLS**

The attached protocol was developed for hatchery programs rearing spring Chinook salmon, summer Chinook salmon and summer steelhead associated with the mid-Columbia HCPs, spring Chinook salmon and steelhead programs associated with the 2008 Biological Opinion for the Priest Rapids Hydroelectric Project (FERC No. 2114) and fall Chinook consistent with Grant County Public Utility District and Federal mitigation obligations associated with Priest Rapids and John Day dams (ACOE funded), respectively. These programs are funded by Chelan, Douglas, and Grant County Public Utility Districts (PUDs) and are operated by the Washington Department of Fish and Wildlife (WDFW).

This protocol is intended to be a guide for 2013 collection of salmon and steelhead broodstocks in the Methow, Okanogan, Wenatchee, and Columbia River basins. It is consistent with previously defined program objectives such as program operational intent (i.e., conservation and/or harvest augmentation), mitigation production levels (HCPs, Priest Rapids Dam 2008 Biological Opinion), changes to programs as approved by the HCP-HC, and to comply with ESA permit provisions.

Notable in this years protocols are:

- Continuing for 2013, no age-3 males will be incorporated into spring or summer Chinook programs.
- Implementation of the draft Production Management Plan (Appendix B), for all programs where possible, to ensure mitigation production levels are met and that the permitted production ceiling is not exceeded at release.
- Chelan PUD's 2013 Methow spring Chinook Obligation of 60,516 smolts will be met through eyed egg transfers to Eastbank FH from adults collected and spawned at Winthrop National Fish Hatchery.

- Utilization of genetic sampling/assessment to differentiate Twisp River and Methow Basin natural-origin spring Chinook adults collected at Wells Dam, and CWT interrogation during spawning of hatchery spring Chinook collected at the Twisp Weir, Methow FH and Winthrop NFH to differentiate Twisp and Methow Composite hatchery fish for discrete management of Twisp and Methow Composite production components.

- Collection of only hatchery adult steelhead at Wells Dam/hatchery for MFH safety net, Winthrop conservation, and Wells Hatchery Okanogan and mainstem Columbia programs.

- Implementation of Grant PUD's Nason Creek spring Chinook program beginning with the 2013 brood contingent upon permitting.

- Targeted collection of natural origin spring Chinook at Tumwater Dam for both the Nason Creek and Chiwawa conservation programs.

- Targeted collection of 100% of the Wenatchee summer Chinook and Wenatchee hatchery origin steelhead broodstock at Dryden Dam to reduce the number of activities that may contribute to delays in fish passage at Tumwater Dam (some adult collections at Tumwater may be necessary if sufficient adults cannot be acquired at Dryden Dam).

- Targeted collection of 100% of the natural origin steelhead broodstock at Tumwater Dam

- Collection of summer Chinook broodstock from the Eastbank outfall, sufficient to meet a 576K yearling juvenile Chelan Falls program. The Wells volunteer channel will be the fallback location if insufficient females are collected in the outfall.

- Collection of 24-natural origin steelhead at the Twisp Weir in the spring of 2014. Adults will be transferred to Methow Hatchery for spawning and biosecure, isolated incubation through the eyed-egg stage after which they will be moved to Wells FH for the remainder of rearing.

- Collection of surplus hatchery origin steelhead from the Twisp Weir (up to 25% of the required broodstock) to produce the 100K Methow safety-net on-station-released smolts (up to 13 adults). The remainder of the broodstock (37) will be WNFH returns collected at WNFH and/or Methow Hatchery and surplus to the WNFH program needs. Collection of Wells stock may be used if WNFH and Twisp returns are insufficient. The collection of adults will occur in spring of 2014.

- With the CCT summer Chinook program ramping up with the 2013 brood year, only collections of summer Chinook for the Grant PUD's obligation in the Methow (Carlton program) are scheduled to occur at Wells Dam. Summer Chinook collections at Wells Dam to support the CJH program may occur if CCT broodstock collection efforts fail to achieve broodstock collection objectives.

- The collection from the Wells Hatchery volunteer channel of Wells summer Chinook to support the USFWS, Entiat NFH summer Chinook program (requires agreement of the HCP Hatchery Committee [HC]).

- Collection from the Wells Hatchery volunteer channel of Wells summer Chinook to support the YN, Yakima River summer Chinook program.

These protocols may be adjusted in-season, based on actual run monitoring at mainstem dams and/or other sampling locations. Additional adaptive management actions as they relate to broodstock objectives may be implemented as determined by the HCP-HC or PRCC-HSC and within the boundaries of applicable permits.

Above Wells Dam

Spring Chinook

Inclusion of natural-origin fish in the broodstock will be a priority, with natural-origin fish specifically being targeted. Collections of natural-origin fish will not exceed 33% of the Methow Composite (i.e., non-Twisp) and Twisp natural-origin run escapement consistent with take provisions in Section 10 (a)(1)(A) Permit 1196.

To facilitate BKD management, comply with ESA Section 10 permit take provisions, and to meet programmed production, hatchery-origin spring Chinook will be collected in numbers excess to program production requirements. Based on historical Methow FH spring Chinook ELISA levels above 0.12, the hatchery origin spring Chinook broodstock collection will include hatchery origin spring Chinook in excess to broodstock requirements by approximately 18.2% (based upon the most recent 5-year mean ELISA results for the program). For purposes of BKD management and to comply with maximum production levels and other take provisions specified in ESA Section 10 permit 1196, culling will include the destruction of eggs from hatchery-origin females with ELISA levels greater than 0.12 and/or that number of hatchery origin eggs required to maintain production at 163,249 yearling smolts. Culling of eggs from natural-origin females will not occur unless their ELISA levels are determined by WDFW Fish Health to be a substantial risk to the program. Progeny of natural-origin females, with ELISA levels greater than 0.12, will be differentially tagged for evaluation purposes. Annual monitoring and evaluation of the prevalence and level of BKD and the efficacy of culling in returning hatchery- and natural-origin spring Chinook will continue and will be reported in the annual monitoring and evaluation report for this program.

Recent WDFW genetic assessment of natural-origin Methow spring Chinook (Small et al. 2007) indicated that Twisp natural-origin spring Chinook can be distinguished, via genetic analysis, from non-Twisp spring Chinook with a high degree of certainty. The Wells HCP Hatchery Committee accepted that Twisp-origin fish could be genetically assigned with sufficient confidence that natural origin collections can occur at Wells Dam. Scale samples and non-lethal tissue samples (fin clips) for genetic analysis will be obtained from adipose-present, non-CWT, non-ventral-clipped spring Chinook (suspected natural-origin spring Chinook) collected at Wells Dam, and origins assigned based on that analysis. Natural-origin fish retained for broodstock will be PIT tagged (pelvic girdle) for cross-referencing tissue samples/genetic analyses. Tissue samples will be preserved and sent to the WDFW genetics lab in Olympia Washington for genetic/stock analysis. The spring Chinook from Wells will be retained at Methow Hatchery and spawned for each program depending on results of DNA analysis.

The number of natural-origin Twisp and Methow Composite (non-Twisp) spring Chinook retained will be dependent upon the number of natural-origin adults returning and the collection objective limiting extraction to no greater than 33% of the natural-origin spring Chinook return to the Methow Basin. Natural origin fish not assigning to the Twisp or Methow Composite (combined, these make up the entire Methow Basin spring Chinook population) will be released back into the Columbia River (Natural origin adults with some level of Carson ancestry may be retained for broodstock provided they are no less than grandparents). Based on the broodstock-collection schedule at Wells Dam (3-day/week, 16 hours/day), extraction of natural-origin spring Chinook is expected to be approximately 33% or less.

Weekly estimates of the passage of Wells Dam by natural-origin spring Chinook will be provided through stock-assessment and broodstock-collection activities. This information will facilitate in-season adjustments to collection composition so that extraction of natural-origin spring Chinook remains less than 33%. Trapping at the Winthrop NFH will be included if needed because of broodstock shortfalls.

Pre-season run-escapement of Methow-origin spring Chinook above Wells Dam during 2013 is estimated at 1,808 spring Chinook, including 1,589 hatchery and 219 natural origin spring Chinook (Table 1 and Table 2). In-season estimates of natural-origin spring Chinook will be adjusted proportional to the estimated returns to Wells Dam at weekly intervals and may result in adjustments to the broodstock collection targets presented in this document.

The following broodstock collection protocol was developed based on the re-calculated program production levels (163,249 smolts – Chelan PUD spring Chinook production of 60,516 smolts will be met through Winthrop NFH collections (likely MetComp II's) and result in transfer of eyed eggs to EB FH per HCP-HC agreements for 2013), BKD management strategies, projected return for BY 2013 Methow Basin spring Chinook at Wells Dam (Table 1 and Table 2), and assumptions listed in Table 3.

The 2013 Methow spring Chinook broodstock collection will target up to 108 adult spring Chinook (24 Twisp, 84 Methow). Based on the pre-season run forecast, Twisp fish are expected to represent 9% of the adipose present, CWT tagged hatchery adults and 10.5% of the natural origin spring Chinook passing above Wells Dam (Tables 1 and 2). Based on this proportional contribution and a collection objective to limit extraction to no greater than 33% of the natural-origin spawning escapement to the Twisp, the 2013 Twisp origin broodstock collection will total 24 fish (7 wild and 17 hatchery origin), representing 100% of the broodstock necessary to meet Twisp program production of 30,000 smolts. Methow Composite fish are expected to represent 42% of the adipose present CWT tagged hatchery adults and 89.5% of the natural origin spring Chinook passing above Wells Dam (Tables 1 and 2). Based on this proportional contribution and a collection objective to limit extraction to no greater than 33% of the natural-origin recruits, the 2013 Methow broodstock collection will total 88 spring Chinook (64 wild and 24 Hatchery). The broodstock collected for the Methow program represents 100% of the broodstock necessary to meet Methow program production of 133,249 smolts. The Twisp River releases will be limited to releasing progeny of broodstock identified as wild Twisp and or known Twisp hatchery origin fish, per ESA Permit 1196. The Methow FH releases will include progeny of broodstock identified as wild non-Twisp origin and known Methow Composite hatchery origin fish. Age-3 males ("jacks") will not be collected for broodstock.

Table 1. Brood year 2008-2010 age class-at-return projection for wild spring Chinook above Wells Dam, 2013.

Brood year	**Smolt Estimate**		**Age-at-return**								
			Twisp Basin				**Methow Basin**				
	Twisp[1/]	Methow Basin[2/]	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	SAR[3/]
2008	11,932	56,337	7	42	**7**	56	6	192	**67**	265	0.0047
2009	5,124	31,212	7	**14**	3	24	9	**120**	18	147	0.0047
2010	8,927	50,165	**2**	25	15	42	**9**	111	116	236	0.0047
Estimated 2013 Return			**2**	**14**	**7**	**23**	**9**	**120**	**67**	**196**	

[1/]-*Smolt estimate is based on sub-yearling and yearling emigration (Charlie Snow, personal communication).*
[2/]-*Estimated Methow Basin smolt emigration based on Twisp Basin smolt emigration, proportional redd deposition in the Twisp River and Twisp Basin smolt production estimate.*
[3/]- *Mean Chiwawa NOR spring Chinook SAR to the Wenatchee Basin (BY 1998-2003; WDFW unpublished data).*

Table 2. Brood year 2008-2010 age class and origin run escapement projection for UCR spring Chinook at Wells Dam, 2013.

	Projected Escapement											
	Origin								**Total**			
	Hatchery				**Wild**				**Methow Basin**			
Stock	**Age-3**	**Age-4**	**Age-5**	**Total**	**Age-3**	**Age-4**	**Age-5**	**Total**	**Age-3**	**Age-4**	**Age-5**	**Total**
MetComp	138	468	67	**673**	9	120	67	**196**	147	588	134	**869**
%Total				42%				89%				48%
Twisp	33	98	6	**137**	2	14	7	**23**	35	112	13	**160**
%Total				9%				11%				9%
Winthrop (MetComp)	98	626	55	**779**					98	626	55	**779**
%Total				49%								43%
Total	269	1,192	128	**1,589**	11	134	74	**219**	280	1,326	202	**1,808**

Table 3. Assumptions and calculations to determine the number of broodstock needed for BY 2013 production of 163,249 smolts.

Program Assumptions	Twisp standard	Twisp program	Methow standard	Methow program	Total program
Smolt Release		30,000		133,249	**163,249**
Fertilization-to-release survival	*86.5%*[1]		*84.8%*[1]		
Total egg take target		34,682		157,133	**191,815**
Egg take (production)					
Cull allowance[2/]	*10.9%*	45,455	*18.2%*	163,423	**208,878**
Fecundity[3/]	*3,626H/3,715W*		*3,719H/4,027W*		
Female Target					
Female to male ratio	*1:1*		*1:1*		
Broodstock target					
Pre-spawn survival	*91.8%*		*98.9%*		
Total broodstock collection		**7W 17H**		**64W 24H**	

1/ - Median values.
2/-Hatchery origin MetComp. component only, and is based on the projected natural origin collection and assumption that all Twisp (hatchery and wild) and wild MetComp. fish will be retained for production.
3/-Based on historical age-4 fecundities and expected 2012 return age structure (Table 1).

Trapping at Wells Dam will occur at the East and West ladder traps beginning on 01 May, or at such time as the first spring Chinook are observed passing Wells Dam, and continue through 21 June 2013. The trapping schedule will consist of 3-day/week (Monday-Wednesday), up to 16-hours/day. Two of the three trapping days will be concurrent with the stock assessment sampling activities authorized through the 2013 Douglas PUD Hatchery M&E Implementation Plan. Natural origin spring Chinook will be retained from the run, consistent with spring Chinook run timing at Wells Dam (weekly collection quota). Collection goals will be developed by Wells M&E staff to identify the most appropriate special and temporal approach to achieving the overall brood target. All natural origin spring Chinook collected at Wells Dam for broodstock will be held at the Methow FH.

To meet Methow FH broodstock collection for hatchery origin Methow Composite and Twisp River stocks, adipose-present coded-wire tagged hatchery fish will be collected at Methow FH, Winthrop NFH and the Twisp Weir beginning 01May or at such time as spring Chinook are observed passing Wells Dam and continuing through 23 August 2013. Natural origin spring Chinook will be retained at the Twisp Weir as necessary to bolster the Twisp program production so long as the aggregate collection at Wells Dam and Twisp River weir does not exceed 33% of the estimated Twisp River natural origin spawners to maximize pNOS in the Twisp. All hatchery and natural origin fish collected at Methow FH, Twisp Weir and Winthrop NFH for broodstock will be held at the Methow FH.

Steelhead

Steelhead programs located upstream of Wells Dam and at Wells Hatchery are presented in Table 4.

Table 4. 2014 brood year Steelhead Programs at Wells Hatchery and Upstream of Wells Dam

Program	Hatchery	Owner	Release Location	Release Target	Broodstock Collection Location
Twisp Conservation	Methow Hatchery (incubation); Wells Hatchery (rearing)	Douglas PUD	Twisp Acclimation Pond	48,000	Twisp WxW
Methow Safety-Net	Wells Hatchery	Douglas PUD	Methow Hatchery	100,000	HxH: Twisp Hatchery (25%) + WNFH Hatchery (75%) or WNFH to make up balance
Mainstem Columbia Safety-Net	Wells Hatchery	Douglas PUD	Wells Hatchery	160,000	HxH: Methow Hatchery returns (1st option); Wells Hatchery/Dam (Wells Stock) (2nd option)
WNFH Conservation Program	WNFH	USFWS	WNFH	100,000	Up to 25 collected at Wells Dam/Hatchery; remaining 25 collected by USFWS
Omak Creek	Wells Hatchery	Grant PUD	Omak Creek	Up to 20,000[1]	Omak Creek returns (up to 16 wild or hatchery)
Okanogan	Wells Hatchery	Grant PUD	Okanogan Basin	Up to 100,000[1]	Wells Stock collected at Wells Dam/Hatchery

[1/] The Grant PUD programs will total 100,000, with Omak Creek taking precedence. Until CCT has a new Section 10 permit authorizing more than 20,000 smolts (16 broodstock) for the endemic program, production and broodstock collections will remain consistent with the previous permit.

Steelhead mitigation programs above Wells Dam (including the USFWS steelhead program at Winthrop NFH) utilize adult broodstock collections at Wells Dam, Twisp Weir, Methow Hatchery volunteer trap, and WNFH volunteer trap (Table 5) and incubation/rearing at Wells Fish Hatchery (FH) and incubation at Methow Hatchery (Twisp program). The Wells Steelhead Program has provided eggs for UCR steelhead reared at Ringold FH, not as a mitigation requirement, but rather an opportunity to reduce the prevalence of early spawn hatchery steelhead in the mitigation component above Wells Dam. However, the Methow steelhead program is shifting to locally collected Twisp wild broodstock (Twisp conservation program), and hatchery origin broodstock representative of the Twisp and WNFH conservation programs (Methow safety-net program). Therefore, surplus broodstock will not be collected for the

Methow steelhead programs to address the spawn-timing issue of the Wells stock. The Wells Hatchery Columbia River releases will use returns to the Methow Hatchery volunteer trap to the extent possible, and will be augmented with Wells stock as required to fulfill the program. However, the local collections of broodstock in the Methow Basin will occur in the spring, 2014. To ensure the safety-net programs have broodstock, some broodstock will be collected at Wells Dam in the autumn, 2013, and held at Wells Hatchery. These autumn-collected Wells stock fish will be considered surplus to the spring-collected Methow and Okanogan broodstock, and eggs from these surplus broodstock may be transferred to Ringold Hatchery. In addition, Wells Hatchery may be used for adult management and steelhead removed for adult management may be retained for the Ringold program (Table 5).

Table 5. Broodstock collection locations, number, and origin by program.

Program	**Wells Dam or Hatchery**		**Twisp Weir**		**WNFH**		**Methow Hatchery**		**Omak Creek**	
	H	W	H	W	H	W	H	W	H	W
Twisp Conservation			0	24						
Methow Safety-Net	as needed		13	0	Up to 52 (backup)	0				
Mainstem Columbia Safety-Net	82 (backup)	0					82	0		
WNFH Conservation Program	25					26[1]				
Omak Creek									Up to 16[2]	
Okanogan	Up to 42	0								
Ringold[3]										
Total	149	0	13	24	52	26	82	0	16	

1/- Wild origin fish for WNFH program will be collected through USFWS hook and line angling efforts in the Methow in the spring of 2014.
2/- Wild origin preferred, but hatchery origin broodstock will also be collected to meet target.
3/- Broodstock derived from adult management at Wells Hatchery and surplus brood collected as backup for Methow and Okanogan programs.

The following broodstock collection protocol was developed based on mitigation program production objectives (Table 6), program assumptions (Table 7), and the probability that sufficient adult steelhead will return in 2013/2014 to meet production objectives absent a preseason forecast at the present time.

Trapping at Wells Dam will selectively retain up to 149 hatchery origin steelhead (East and West ladder collection). Ringold FH production will be based on the availability and comprised of surplus eggs/fish resultant from managing any production overruns in DC and GC PUD production. No adults for the Ringold program will be specifically targeted at Wells. In the spring of 2014, 24 wild steelhead will be targeted at the Twisp Weir and transferred to the Methow Hatchery for spawning and incubation to the eyed-egg stage after which they will be moved to Wells Hatchery for the balance of rearing. In addition, up to 13 surplus hatchery-origin steelhead (to meet the 100K Methow Safety-Net release) will be targeted at the Twisp Weir and/or Methow Hatchery and either spawned/incubated at Methow FH or moved to Wells Hatchery for spawning. Surplus WNFH hatchery returns will be used to augment the

Twisp/Methow hatchery-origin collection if needed. Should there be inadequate surplus steelhead from these two sources, steelhead captured at the Methow Hatchery volunteer trap will be used to fulfill the program. Wells stock held at the Wells Hatchery will be used as a final option if broodstock collection at the Twisp Weir, and WNFH and MH traps. Approximately 16 adult steelhead will be targeted in Omak Creek for a 20K endemic program operated by the CCT and funded by GCPUD as part of their 100K UCR steelhead mitigation obligation. Overall collection for the programs will be 255 fish (a combination of program specific and back-up adults) and limited to no more than 33% of the entire run or 33% of the natural origin return (NOR composition in the broodstock, is estimated at 17%). Hatchery and natural origin collections will be consistent with run-timing of hatchery and natural origin steelhead at Wells Dam. Ladder trapping at Wells Dam will begin on 01 August and terminate by 31 October, three days per week, up to 16 hours per day, if required to meet broodstock objectives. Trapping will be concurrent with summer Chinook broodstocking efforts through 15 September on the west ladder. If insufficient steelhead adults are encountered on the west ladder, the east ladder trap may be considered. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and Wells dams. Broodstock collection adjustments may be made based on in-season monitoring and evaluation. If collection of adults from the east ladder trap is necessary, access will be coordinated with staff at Wells Dam due to the rotor rewind project.

Table 6. Adult steelhead collection objectives for programs supported through 2013 return year adult steelhead broodstock collected at Wells Dam, Twisp Weir, WNFH, and Omak Creek (CCT endemic program).

Program	# Smolts	# Green eggs	% Wild	# Wild	# Hatchery	Total Adults
DCPUD[1/]	160,000	226,629			82	82
DCPUD[2/]	100,000	141,643			52	52
DCPUD Twisp	48,000	67,989	100%	24		24
GCPUD[3/]	80,000	113,315			42	42
GCPUD Omak	20,000	40,000	100%	16		16[4/]
USFWS	50,000	70,821			26	26
Sub-total	**458,000**	**660,397**	16%	**40**	**202**	**242**
Ringold[5/]	180,000	285,714				
Sub-total	**180,000**	**285,714**				
Grand Total[6/]	**638,000**	**946,111**	**16%**	**40**	**215**	**255**

1/- Mainstem Columbia releases at Wells Dam. Target HxH parental adults as the hatchery component.
2/- Methow hatchery release of HxH fish produced from either adults returning from the Winthrop conservation program, adults trapped at MFH, and/or surplus hatchery adults from the Twisp weir.
3/- Okanogan Basin releases as part of GCPUD's 100K summer steelhead obligation. Broodstock need is dependent on the Omak collection to achieve 100,000 smolts total.
4/- Broodstock targeted is 16 total (8 male/8 female) of mixed origin composition based upon what is trapped.
5/- Eggs/juveniles will be provided to the Ringold program consistent with management of program surpluses up to 180,000 smolts. Adults for the Ringold program will not be specifically targeted at Wells Dam/Hatchery in 2013.
6/- Based on steelhead production consistent with Mid-Columbia HCP's, GCPUD BiOp and Section 10 permit 1395.

Table 7. Program assumptions used to determine the number of adults required to meet steelhead production objectives for programs above Wells Dam.

	Standard	
Program assumptions	**Hatchery**	**Wild**
Pre-spawn survival	95.4%	97.6%
Female : Male ratio	1.0:1.0	1.0:1.0
Fecundity	5,822	5,800
Fertilization-to-yearling release	70.6%	70.6%

Summer/fall Chinook

The summer/fall Chinook mitigation program in the Methow River utilizes adult broodstock collections at Wells Dam and incubation/rearing at Eastbank Fish Hatchery. The total production level target is 200,000 summer/fall Chinook smolts for acclimation at Carlton Pond.

The TAC 2012 Columbia River UCR summer Chinook return projection to the Columbia River (Appendix A) and BY 2008, 2009 and 2010 spawn escapement to tributaries above Wells Dam indicate sufficient summer Chinook will return past Wells Dam to achieve full broodstock collection for supplementation programs above Wells Dam. The following broodstock collection protocol was developed based on initial run expectations of summer Chinook to the Columbia River, program objectives and program assumptions (Table 8).

For 2013, WDFW will retain up to 102 natural-origin summer/fall Chinook at Wells Dam east and/or west ladders, including 51females for the Methow summer Chinook program. Collection will be proportional to return timing between 01 July and 15 September. Trapping may occur up to 3-days/week, 16 hours/day. Age-3 males ("jacks") will not be collected for broodstock.

Additionally, in 2013 brood stock collection for Okanogan based summer Chinook programs will fall under the responsibility of the Colville Tribes as part of their overall summer Chinook program. Broodstock collection will be prioritized through purse seine operations, ladder returns to the Chief Joe Hatchery, tangle netting and the Okanogan weir. Should use of Wells Dams be needed to meet any shortfalls in broodstock, the CCT will notify the HCP-HC and coordinate with Douglas PUD, Grant PUD, and WDFW to facilitate additional effort. Summer Chinook broodstock collection efforts at Wells Dam, should they be required to meet CJH program objectives will be conducted concurrent with broodstock collection efforts for the Methow summer Chinook program and or steelhead collection efforts for steelhead programs above Wells Dam.

To better assure achieving the appropriate females for program production, the collection will utilize ultrasonography to determine the sex of each fish retained for broodstock.
If the probability of achieving the broodstock goal is reduced based on passage at the west ladder or actual natural-origin escapement levels, broodstock collections may be expanded to the east ladder trap and/or origin composition will be adjusted to meet the broodstock collection objective. If collection of adults from the east ladder trap is necessary, access will be

coordinated with staff at Wells Dam due to the rotor rewind project.

Table 8. Assumptions and calculations to determine the number of broodstock needed for 2013 brood summer/fall Chinook production goals in the Methow River basin and CCT summer programs as needed based upon success of planned broodstocking methods.

Program Assumptions	Metrics	Carlton Pond	CCT/Okanogan
Smolt release		**200,000**	
Fertilization-to-release survival	85.9%		
Eggtake target		**232,829**	
Fecundity	4,982		
Female target		**48**	
Female:male ratio	1:1		
Broodstock target		**96**	
Pre-spawn survival	95.5%		
Total collection target		**102**	**TBD**

Columbia River Mainstem below Wells Dam

<u>*Summer/fall Chinook*</u>

Summer/fall Chinook mitigation programs that release juveniles directly into the Columbia River between Wells and Rocky Reach dams have traditionally been supported through adult broodstock collections at the Wells Hatchery volunteer channel. Beginning in 2013, the broodstock requirement for the Chelan Falls summer Chinook program will be prioritized through broodstock collection of marked summer Chinook in the Eastbank Outfall (EBO) with the Wells volunteer channel as a back-up collection location should insufficient females be acquired at the EBO. The total production level supported by this collection is up to 576,000 yearlings for the Chelan Falls program.

Collection at the Wells FH volunteer channel will be used to collect the broodstock necessary for the Wells FH yearling (320,000) and sub-yearling (484,000) programs. Upon agreement in the HCP-HC, the 2013, summer Chinook broodstock collections at Wells FH may also include up to 266 adults for the USFWS Entiat program pending agreements between USFWS and DCPUD. If approved by the HCP Hatchery Committee, Adults for the Entiat program will be transferred to Entiat NFH by either WDFW or USFWS staff (arrangements between USFWS and DCPUD will have been made prior to implementation).

Adults returning from the Wells and Chelan Falls programs are to support harvest opportunities and are not intended to increase natural production and have been termed segregated harvest programs. These programs have contributed to harvest opportunities (Chelan Falls to a much lesser degree); however, adults from these programs have been documented contributing to adult spawning escapement in tributaries upstream and downstream from their release locations. Because of CCT concerns about sufficient natural origin fish reaching spawning grounds and to ensure sufficient NOR's being available to meet the CCT summer Chinook program, incorporation of natural origin fish for the Wells program or programs with broodstock originating from the Wells volunteer channel, will be limited to fish collected in the Wells volunteer channel. The following broodstock collection protocol was developed based on mitigation objectives and program assumptions (Table 9).

WDFW will target 544 run-at-large summer Chinook from the volunteer ladder trap at Wells Fish Hatchery outfall for the Wells sub-yearling and yearling programs, 116 for the YN Yakima summer Chinook program, and 266 for the USFWS Entiat summer Chinook program. Due to fish health concerns associated with the volunteer collection site (warming Columbia River water during late August), the volunteer collection will begin 11 July and terminate by 31 August. Age-3 males ("jacks") will not be collected for broodstock.

For 2013, broodstock collection for the Chelan Falls summer Chinook program will be prioritized at the Eastbank Outfall using in-channel seining/netting beginning July 1 (or earlier if summer Chinook are detected in the outfall) through September 15. While preliminary evaluations of feasibility late in 2012 did demonstrate the ability to collect summer Chinook, the catch was comprised primarily of males. Given concerns about acquiring sufficient females to meet production objectives, if the number of females has not been reached by August 15, the broodstock collection will default to the Wells Volunteer channel to make up the difference. The 2013 broodstock target for the Chelan Falls program is 318 adults. Age-3 males will not be incorporated into the broodstock. Confirmation of gender will be made at the time of collection using established ultrasonography techniques.

Table 9. Assumptions and calculations to determine the number of broodstock needed for summer/fall Chinook production goals for programs released at or below Wells Dam relying on adult collection at Wells Dam or Wells Hatchery in 2013.

Program Assumptions	**Standard**		**Wells FH**		**Chelan Falls FH[1/]**	**Yakama Nation**	**USFWS[2/]**	
	Sub-yearling	**Yearling**	**Sub-yearling**	**Yearling**	**Yearling**	**Green eggs**	**Adults**	**Total**
Smolt release			**484,000**	**320,000**	**576,000**			**NA**
Green egg-to-release survival	76.1%[4/]	83.6%						NA
Eggtake target			**636,005**	**382,775**	**688,995**	**250,000**		**1,957,775**
Fecundity	4,487	4,487						
Female target			**142**	**86**	**154**	**56**		**438**
Female:Male ratio	1:1	1:1						
Broodstock target			**284**	**242[3/]**	**308**	**112**		**946**
Pre-spawn survival	96.8%	96.8%						
Total collection target			**294**	**250**	**318**	**116**	**266**	**1,244**

[1/]-The Well volunteer trap will only be a fallback broodstock source should efforts to acquire broodstock in the Eastbank outfall not provide sufficient females to meet production objectives.
[2/]-Adults for USFWS summer Chinook program in the Entiat River Basin.
[3/]- Includes 70 adults collected for the Lake Chelan triploid Chinook program.

Wenatchee River Basin

Spring Chinook

In 2013 the Eastbank Fish Hatchery (FH) is expecting to rear spring Chinook salmon for the Chiwawa River and Nason Creek acclimation facilities located on the Chiwawa River and Nason Creek (2013 represents the first brood year production for the new Nason Creek program). The program production level target for the Chiwawa program in 2013 is 144,026 smolts, requiring a total broodstock collection of 74 natural origin spring Chinook (Table 10).

The spring Chinook production obligation for Grant PUD in the Wenatchee Basin is 223,670 smolts. Grant PUD's production was originally scripted to be met through a combination of 74,556 smolts in the White River and 149,114 smolts at Nason Creek. Consistent with agreements in the PRCC-PC SOA 2013-01, the White River production will be met through progeny produced at Nason Creek through 2026. Because two brood years remain in the White River captive brood program, the PRCC SOA identifies a credit of 75,000 smolts from the captive brood program toward meeting the over 223K production obligation. Additionally, if the 2013 Nason program is unable to meet the balance of the production, any additional production from the 2013 captive brood program will be credited to Grant PUD.

2013 represents the proof of concept year in determining the effectiveness of utilizing Tumwater Dam and genetic assignment methodologies to target broodstock for the Nason Creek spring Chinook program and by default for the Chiwawa spring Chinook program as well. While the Chiwawa program could be met through adult collections solely at the Chiwawa Weir without the use of Tumwater Dam, the Chiwawa NOR component makes up the preponderance of the NOR return in the Wenatchee Basin (~61% of the total return and ~72% of the Chiwawa/Nason aggregate based upon a 10-year geometric mean). As a direct result of targeting NOR's for Nason Creek, generally, more than sufficient numbers of Chiwawa fish will be handled (and retained at Eastbank FH pending genetic assignments) to meet the Chiwawa program needs. To limit excessive handling of fish (being transported to EB, sampled, transported back to the river, and subsequently intercepted at the Chiwawa Weir and transported back to EB FH or upriver of the weir as per current protocol) which could contribute to handling mortality and to limit delaying fish as a result of the handling and operation of the weir, the JFP prefer to have collections for both programs occur at Tumwater Dam. If use of Tumwater Dam demonstrates a risk to the Wenatchee Basin population which is unacceptable to co-managers and permitting authorities as a result of broodstock collection, alternate and other existing brood collection locations/methods will be considered.

Table 10. Assumptions and calculations to determine the number of broodstock needed for a combined Nason/Chiwawa spring Chinook production goal of 367,696 smolts. For 2013, the Nason Creek production will be met through a combination of smolts produced through one of two remaining captive brood years and the Nason Creek conservation program.

Program Assumptions	Standard	Chiwawa Conservation	Nason Creek[1/] Conservation	Nason Creek[1/] Safety net	Wenatchee Basin Total
Smolt Release		**144,026**	**125,000**	**98,670**	**367,696**
Fertilization-to-release survival	*85.0%*				
Total egg take target		169,442	147,059	116,082	**432,583**
Egg take (production)					
Cull allowance	*13.1%*			17,499	**450,082**
Fecundity	*4,684 W* *4,145 H*				
Female Target		36	31	32	**99**
Female to male ratio	*1:1*				
Broodstock target		72W	62W	64H	**198**
Pre-spawn survival	*97.7%W/97.7H*				
Total broodstock collection		**74W**	**64W**	**66H**	**204 (138W;66H)**

1/ Because Nason Creek is a new program beginning with the 2013 brood, hatchery performance values from the Chiwawa program were used as a surrogate to estimate the adult requirements for Nason Creek.

Inclusion of natural origin fish into the broodstock will be a priority, with natural origin fish specifically being targeted. Consistent with ESA Section 10 Permit 1196, natural origin fish collections will not exceed 33 percent of the return.

Pre-season estimates project a total of 2,732 (521 natural origin (19%) and 2,211 hatchery origin (81%) spring Chinook back to the Wenatchee Basin. Approximately 2,514 spring Chinook are destined for the Chiwawa River, of which 303 (12.1%) and 2,211 fish (87.9%) are expected to be natural and hatchery origin spring Chinook, respectively and approximately 110 natural origin spring Chinook are expected back to Nason Creek (Tables 11 and 12). These protocols, target anywhere between 110 and 175 spring Chinook to be trapped at Tumwater Dam and transported to Eastbank FH for broodstock purposes. In-season assessment of the magnitude and origin composition of the spring Chinook return above Tumwater Dam will be used to provide in-season adjustments to hatchery/wild composition and total broodstock collection, consistent with ESA Section 10 Permit 1196.

Table 11. BY 2008-2010 age class return projection for wild spring Chinook above Tumwater Dam during 2013.

Brood year	Nason Cr. Basin[1/]				Chiwawa Basin[1/]				Wenatchee Basin above Tumwater Dam[1/]				
	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	Age-3	Age-4	Age-5	Total	SAR[2/]
2008	3	175	**31**	209	18	283	**128**	429	35	688	**156**	878	0.0047
2009	2	**76**	18	96	12	**156**	74	242	27	**312**	82	421	0.0047
2010	**3**	122	21	146	**19**	261	110	390	**53**	574	125	751	0.0047
Estimated Return	3	76	31	**110**	19	156	128	**303**	53	312	156	**521**	

1/-Based upon average age-at-return (return year 2007-2011), for natural origin spring Chinook above Tumwater Dam (WDFW unpublished data).
2/-Mean Chiwawa spring Chinook SAR to the Wenatchee Basin (BY 1998-2003; WDFW unpublished data).

Table 12. BY 2008-2010 age class return projection for Chiwawa hatchery spring Chinook above Tumwater Dam during 2013.

Brood Year	**Smolt Estimate**	**Adult Returns**				
	Chiwawa[1/]	Age-3[2/]	Age-4[2/]	Age-5[2/]	Total	SAR
2008	609,789	1,229	2,839	**139**	3,476	0.0057[3/]
2009	438,651	411	**1,827**	88	2,325	0.0053[4/]
2010	346,248	**245**	1265	83	1,593	0.0046[5/]
Estimated 2013 Return		**245**	**1,827**	**139**	**2,211**	

1/-Chiwawa smolt release (Hillman et. al. 2013).
2/-Based on average age-at-return for hatchery origin spring Chinook above Tumwater Dam, 2006-2010 (WDFW, unpublished data) and total estimated BY return.
3/-Mean Chiwawa hatchery spring Chinook SAR to the Wenatchee Basin (BY 1998-2003).
4/-Mean Chiwawa hatchery spring Chinook SAR to the Wenatchee Basin (BY 2000-2004).
5/-Mean Chiwawa hatchery spring Chinook SAR to the Wenatchee Basin (BY 2001-2005).

Pending issuance of a Section 10 permit for the Nason Creek program, broodstock collection at Tumwater Dam will begin 01 June and terminate no later than 15 August Spring Chinook trapping at Tumwater Dam if operated independent of the Spring Chinook Reproduction Success Study, will follow a three day per week and up to 16 hours per day and will be consistent with weekly broodstock collection quotas that approximate the historical run timing and a maximum 33 percent retention of the projected natural-origin escapement. If the weekly quota is attained prior to the end of the trapping period, broodstock trapping will cease. If the weekly quota is not attained within the trapping period, the shortfall will carry forward to the next week.

Age-3 males ("jacks") will not be collected for broodstock.

Based upon these forecasts and assumptions, four options or alternatives for Wenatchee Basin spring Chinook were developed for discussion by the HCP-HC and PRCC-HSC (Table 13). By conference call on 4/9/13, the parties agreed to implement broodstock collection under alternative 3.

Preferred Option: Approximately 172 natural origin spring Chinook adults (86 females and 86 males) will be collected at Tumwater Dam (about 33% of the overall NOR return) through duration of the return and transferred to Eastbank FH for holding until a genetic assignments can be made to spawning aggregates (specifically Nason and Chiwawa). This should result in approximately 147 probable Nason/Chiwawa origin adults. Using an 86% probability assignment rate derived through a recent SNP's evaluation of Wenatchee spring Chinook spawning aggregates, an estimated 36 Nason and 111 Chiwawa NOR's would be identified (Table 13). The 36 Nason and 74 of the Chiwawa spring Chinook would be retained. All remaining adults either in excess of program needs or individuals not assigning to the two spawning aggregates, would be released at locations, yet to be determined above Tumwater Dam (this is to provide some offset to the delay in migration to the spawning grounds experienced by holding adults at Eastbank FH while the genetic evaluations are being conducted).

Under this alternative full production for the Chiwawa spring Chinook conservation program (144,026 smolts; Table 13) will be met. Should the NOR return fall short of expectations or if insufficient broodstock assign to the Chiwawa, additional trapping at the Chiwawa Weir for NOR's or possibly HOR's (to ensure the production level is attained) may be considered by the HCP-HC.

The Nason Creek program should achieve an estimated smolt production of 71,665 conservation program smolts (57% of the conservation program and 48% of the 2013 production target for Nason Creek). This will result in an additional 77,005 smolts (152,005 total) from the 2013 White River captive brood program being credited toward Grant PUD's Wenatchee Spring Chinook production obligation. The 2013 WR captive brood program is expected to produce approximately 259,297 smolts (Table 16). Should the NOR return fall short of expectations or if insufficient broodstock assign to Nason Creek, additional smolts may be credited to the Nason Creek program from the White River captive brood program consistent with agreements in PRCC-PC SOA 2013-01.

Table 13. Options for broodstock collection of spring Chinook for Nason and Chiwawa programs in 2013.

Alternative	NOR's Retained	# Probable Nason/Chiwawa[1/]	Chiwawa			Nason		
			Broodstock[2/]	%[3/]	Smolts	Broodstock[2/]	%[3/]	Smolts
1	140	119	74	0.244	144,026	29	0.264	55,740
2	138	115	71	0.191	135,368	29	0.209	43,795
3	172	147	74	0.244	144,026	36	0.327	71,665
4	175	149	74	0.244	144,026	36	0.327	71,665

[1/-] The number of adults retained which are of probable Nason or Chiwawa origin. The difference between the number of probable and the number of NOR's retained are fish of probable White, Little Wenatchee, and Upper Wenatchee river spawning aggregates. These fish will be returned to river at some location(s) above Tumwater Dam.

[2/-] The number of broodstock are those individuals which assign to either Nason or Chiwawa. The difference between the total of broodstock and the number of probable Nason/Chiwawa are fish which did not assign at the C.I. agreed to by the parties (using SNP's methodology) and/or adults in excess of one or both programs. These fish will be returned to river at some location(s) above Tumwater Dam.

[3/-] This is the proportion of broodstock retained for spawning to the estimated total return of the respective spawning

aggregates to Tumwater Dam.

Broodstock collection will start at Tumwater Dam on or about the week beginning June 16 depending upon permit availability. Weekly broodstock goals were developed based upon targeting the middle 90% of the spring Chinook return (Table 14). Due to variability in run timing between years, adjustments may be made in-season using passage of spring Chinook at Rock Island Dam, the lower Wenatchee PIT tag array, and passage of spring Chinook over Tumwater Dam as considerations. If the weekly quota is attained prior to the end of the trapping period, broodstock trapping will cease. If the weekly quota is not attained within the trapping period, the shortfall will carry forward to the next week.

Table 14. Weekly target of natural origin adult spring Chinook for Nason Creek and Chiwawa River conservation programs in 2013.

	Week Beginning								Total
	6/23	6/30	7/7	7/14	7/27	7/28	8/4	8/11	
Females	5	10	16	14	11	9	12	9	86
Males	5	10	16	14	11	9	12	9	86
Total	10	20	32	28	22	18	24	18	172

Trapping

Because broodstock collection will initially run concurrent with the Reproductive Success Studies(RSS) already taking place at Tumwater Dam, we will initially target brood collection on a Monday – Friday time frame to more closely fit with Hatchery staff scheduling.

Trapping at Tumwater Dam will be consistent with operational protocols developed and implemented for the 2011 (Appendix C) and 2012 (Appendix D) trapping seasons and anticipated to continue in 2013 (pending NMFS and USFWS concurrence). If broodstock collection occurs outside of activities under the RSS, trapping will default to Section 10 Permit 1196 conditions of no more than 3-days per week up to 16 hours per day (48 cumulative hours per week).

On each day of trapping, at least one hatchery personnel will be on site with a transport vehicle complete with recirculation ability and oxygen/stones. As RSS personnel work up a wild fish, gender ID will be made using a Honda 110V portable ultrasound machine, DNA (fin clips) will be collected and each fish will receive a PIT tag in the pelvic girdle. To facilitate the timely processing of fish through the Tumwater facility, hatchery personnel will take fish identified for broodstock from RSS staff and place it into the transport truck. At no time will broodstock be placed into or held in temporary tanks on the deck. When an appropriate number of fish have been loaded onto the transport truck (this number will depend upon the size and type of vehicle) or if the weekly broodstock quota has been met, fish will be transported to Eastbank FH (EBFH) for holding. All fish transfers will occur water to water.

Adult Holding/Sorting

Up to four adult raceways are expected to be utilized for holding and sorting spring Chinook collected for broodstock. As the first weeks collection is completed, (and placed into a single raceway) genetic samples will be submitted to the genetics lab in Olympia for processing. Preliminarily we anticipate approximately one to two weeks for the samples to be run and results available. During holding, fish will only receive formalin treatments to prevent external fungus. Antibiotics and other treatments will only be used on broodstock.

When assignments have been provided, hatchery and M&E staff will sort by PIT tag. Fish to be retained for broodstock will be placed into their respective vessels (i.e., Chiwawa in one pond and Nason in another). All remaining fish will be placed onto transport trucks depending upon their assignment. Fish assigning to a respective tributary will be released into that tributary or a closely as possible to mitigate for any delay in migration resultant from holding them at EBFH. Fish that do not assign to any tributary will be released at the Swift Water campground (RKM yet to be determined), well above Tumwater Dam.

Using PIT tags (and possible carcass recoveries), fish not retained for broodstock and released, will be evaluated for post release behavior, survival and spawning success when possible.

Genetic Assignments

Background

Spring Chinook migrating past Tumwater Dam include multiple stocks. To implement the Nason Creek supplementation program, the PRCC-HSC decided to genetically assign to stock each natural origin spring Chinook trapped for broodstock at Tumwater Dam. Previous work conducted by the WDFW Molecular Genetics Laboratory (WDFW-MGL) indicated that given (1) the current microsatellite baseline for individuals spawning in the Chiwawa River, Nason Creek, White River, Wenatchee Mainstem, and Leavenworth National Fish Hatchery, and (2) estimated upper Wenatchee escapement proportions into the Chiwawa (0.72), Nason Creek, (0.25), and White River (0.03), the probability of correctly identifying the Chiwawa River and Nason Creek as the source stock of individual fish, given their assignment, is approximately 95% (5% error rate) and 90% (10% error rate), respectively.

Objectives

Identify to stock (e.g., Chiwawa River or Nason Creek) natural origin spring Chinook trapped at Tumwater Dam using genetic stock identification (GSI) procedures.

Methods

Genetic samples will be collected from natural origin spring Chinook broodstock trapped at Tumwater Dam weekly starting week of 23 June and continue through approximately 16 August. Samples will be transported to the WDFW-MGL, Olympia WA, for immediate genetic analyses. Provided no instrumentation malfunctions, WDFW-MGL will provide stock-specific GSI results within 72 hours; results will be provided no later than Thursdays for samples arriving no later than noon Mondays, results will be provided on Fridays for samples arriving no later than noon Tuesdays. GSI results will be transmitted electronically to Chris Moran and Mike Tonseth at the Wenatchee Research Office and will include sample identification and GSI assignment.

Although several SNP assays are currently available, an adequate SNP baseline for Wenatchee spring Chinook is lacking. Therefore, for 2013 the GAPS microsatellite panel and existing GAPS plus WDFW spring Chinook Wenatchee baseline will be used for genotyping and GSI analyses.

Chiwawa Program Contingencies

Should the Nason Creek program not receive a Section 10 Permit in time to begin implementation in 2013, contingency plans have been requested for implementation of the Chiwawa Program. The two plans are as follows (either of these still require concurrence by the HCP-HC):

1. Continue to trap at Tumwater Dam for the Chiwawa program. The total number of fish collected would be reduced to 140 adults. Under the same assumptions as implementation of alternative 3 will yield the estimated 74 adults needed to meet the Chiwawa conservation program.

   Under this contingency, handling, transporting, and holding of non-target spring Chinook spawning aggregates will occur.

2. Trap operations would occur at the Chiwawa Weir. The total number of fish collected would be 74 adults.

   Under this contingency, operation of the weir will result in double handling of wild and hatchery adults in excess to the Chiwawa program. This is due to the presence of the RSS at Tumwater Dam. In addition, the USFWS has expressed concern over bull trout impacts and potential delays to bull trout at the weir.

Steelhead

The steelhead mitigation program in the Wenatchee Basin use broodstock collected at Dryden and Tumwater dams located on the Wenatchee River. Per ESA section 10 Permit 1395 provisions, broodstock collection will target adults necessary to meet a 50% natural origin – conservation oriented program and a 50% hatchery origin – safety net program, not to exceed 33% of the natural origin steelhead return to the Wenatchee Basin. Based on these limitations and the assumptions listed below (Table 15), the following broodstock collection protocol was developed.

WDFW will retain a total of 130 mixed origin steelhead for broodstock for a smolt release objective of 247,300 smolts (Table 14). The 66 hatchery origin adults will be targeted at Dryden Dam and if necessary Tumwater dam. The 64 natural origin adults will be targeted for collection at Tumwater Dam. Collection will be proportional to return timing between 01 July and 12 November. Collection may also occur between 13 November and 3 December at both traps, concurrent with the Yakama Nation coho broodstock collection activities. Hatchery x wild and hatchery x hatchery parental cross and unknown hatchery parental cross adults will be excluded from the broodstock collection. Hatchery steelhead parental origins will be determined through evaluation of VIE tags, adipose/cwt presence/absence, and PIT tag interrogation during collection. Adult return composition including number, origin, age structure, and sex ratio will be assessed in-season at Priest Rapids and at Dryden Dam. In-season Broodstock collection adjustments may be made based on this monitoring and evaluation. To better assure achieving the appropriate females equivalents for program production, the collection will implement the draft Production Management Plan, including ultrasonography to determine the sex of each fish retained for broodstock.

In the event steelhead collections fall substantially behind schedule, WDFW may initiate/coordinated adult steelhead collection in the mainstem Wenatchee River by hook and line. In addition to trapping and hook and line collection efforts, Tumwater and Dryden dams may be operated between February and early April the subsequent spring to supplement broodstock numbers if the fall trapping effort provides fewer than the required number of adults.

Table 15. Assumptions and calculations to determine the number and origin of 2014 brood Wenatchee summer steelhead broodstock needed for Wenatchee Basin program release of 247,300 smolts.

Program Assumptions	**Standard**	**Conservation**	**Safety Net**	**Full Program**
Smolt Release		**123,650**	**123,650**	**247,300**
Fertilization-to-release survival	*70.2%*			
Egg take target		176,140	176,140	**352,280**
Fecundity	*5,930 H* *5,787 W*			
Female Target		**31**	**30**	**32 H** **31 W**
Female to male ratio	*1:1*			
Broodstock target		**62**	**60**	**122**
Pre-spawn survival	*90.7%H/97.1%W*	64	66	
Total broodstock collection				**130**

Summer/fall Chinook

Summer/fall Chinook mitigation programs in the Wenatchee River Basin utilize adult broodstock collections at Dryden and Tumwater dams, incubation/rearing at Eastbank Fish Hatchery (FH) and acclimation/release from the Dryden Acclimation Pond. The total production level target for BY 2013 is 500,001 smolts (181,816 GCPUD mitigation and 318,185 CCPUD mitigation).

The TAC 2013 Columbia River UCR summer Chinook return projection to the Columbia River (Appendix A) and BY 2008, 2009 and 2010 spawn escapement to the Wenatchee River indicate sufficient summer Chinook will return to the Wenatchee River to achieve full broodstock collection for the Wenatchee River summer Chinook supplementation program. Review of recent summer/fall Chinook run-timing past Dryden and Tumwater dam indicates that previous broodstock collection activities have omitted the early returning summer/fall Chinook, primarily due to limitations imposed by ESA Section 10 Permit 1347 to minimize impacts to listed spring Chinook. In an effort to incorporate broodstock that better represent the summer/fall Chinook run timing in the Wenatchee Basin, the broodstock collection will front-load the collection to account for the disproportionate collection timing. Approximately 43% of the summer/fall Chinook destined for the upper Basin (above Tumwater Dam) occurs prior to the end of the first week of July; therefore, the collection will provide 43% of the objective by the end of the first week of July. Weekly collection after the first week of July will be consistent with run timing of summer/fall Chinook during the remainder of the trapping period. With concurrence from NMFS, summer Chinook collections at Dryden Dam may begin up to one week earlier. Collections will be limited to a 33% extraction of the estimated natural-origin escapement to the Wenatchee Basin. Based on these limitations and the assumptions listed below (Table 16), the following broodstock collection protocol was developed.

WDFW will retain up to 256 natural-origin, summer Chinook at Dryden and/or Tumwater dams, including 128 females. To better assure achieving the appropriate females for program production, the collection will implement the draft Production Management Plan, including ultrasonography to determine the sex of each fish retained for broodstock. Trapping at Dryden Dam may begin 01 July and terminate no later than 15 September and operate up to 7-days/week, 24-hours/day. Trapping at Tumwater Dam if needed may begin 15 July and terminate no later than 15 September and operate up to 48 hours per week.

Table 16. Assumptions and calculations to determine the number of 2013 brood Wenatchee summer Chinook salmon broodstock needed for Wenatchee Basin program release of 500,001 smolts.

Program Assumptions	Standard	Grant PUD	Chelan PUD	Total Wenatchee Program
Smolt Release		**181,816**	**318,185**	**500,001**
Fertilization-to-release survival	*77.7%*			
Egg take target		**233,997**	**409,505**	**643,502**
Fecundity	*5,085*			
Female Target		**46**	**80**	**126**
Female to male ratio	*1:1*			
Broodstock target		**92**	**160**	**252**
Pre-spawn survival	*98.3%*			
Total broodstock collection		**94**	**162**	**256**

White River Spring Chinook Captive Brood

Smolt production associated with the White River Captive Broodstock Program (75,000 smolts) is linked to implementation of the smolt production objective associated with the Nason Creek adult supplementation program and consistent with the PRCC-PC SOA 2013-01. Spawning, incubation, rearing acclimation and release will be consistent with provisions of (expired) ESA Permit 1592.

Table 17. Estimated smolt production for BY13 and BY14 White River captive brood program at Little White Salmon National Fish Hatchery based upon 5% adult female mortality per month to spawning.

Spawn Year	Release Year	Females Spawned			Green egg take	Smolts	Adjusted smolts[1/]
		Age 4	Age 5	Total			
2013	2015	346	92	439	526,225	384,144	252,610
2014	2016	0	187	187	224,556	163,926	64,691

[1/-] *Adjusted smolt release numbers are based upon reduced eye-up rates for eggs fertilized with cryo-preserved sperm.*
[2/-] *Adjusted for 50% of females crossed with cryo-preserved sperm with a mean eye-up rate of 35%.*
[3/-] *Adjusted for 100% of females crossed with cryo-preserved sperm with a mean eye-up rate of 35%.*

Priest Rapids Fall Chinook

Collection of fall Chinook broodstock at Priest Rapids Hatchery will generally begin in early September and continue through mid November. Juvenile release objectives specific to Grant PUD (5,599,504 sub-yearlings), Federal (1,700,000 sub-yearlings + 3,500,000 eggs – collection of broodstock for the federal programs are conditional upon having contracts in place with the ACOE), mitigation commitments. Biological assumptions are detailed in Table 18. Smolt release objectives for Ringold Springs occur as green eggs collected at Priest Rapids FH and incubated at Bonneville prior to eyed-egg transfers to Ringold Springs. After the new Priest Rapids FH rebuild there will no longer be incubation capacity for programs above GCPUD mitigation obligations.

For 2013, up to 1,000 adipose present, non-coded wire tagged (presumed wild) fall Chinook adults will be targeted at the OLAFT (as approved by the PRCC-HSC) with additional NOR adults targeted as a pilot study through hook-and-line angling efforts in the Hanford Reach to increase the proportion of natural origin adults in the broodstock to meet integration of the hatchery program. Close coordination between broodstock collections at the volunteer channel, the OLAFT and through hook-and-line efforts in the Hanford Reach will need to occur so over collection is minimized. Presumed NOR's collected and spawned from either hook-and-line caught broodstock or OLAFT collections will be prioritized for PRH programs (i.e. OLAFT and Hanford Reach fish will be held in a separate raceways from volunteer collected fish, spawned first each week, and to the extent possible segregated and reserved for the GPUD program).

Grant PUD staff will work closely with WDFW hatchery and M&E staff to maintain separation of gametes/progeny of OLAFT and angling collected adults at spawning and through incubation/early rearing.

Based upon the biological assumptions in Table 18, an estimated 3,281 females will need to be spawned to meet the 12,413,223 eggs required to meet the current three up-river bright (URB) programs which rely on adults collected at the Priest Rapids Hatchery volunteer channel trap, hook-and-line efforts on the Hanford Reach, and/or the Priest Rapids Dam off ladder trap (OLAFT).

To increase the probability of incorporating a higher percentage of NOR's from the volunteer channel, only adipose present, non-CWT males and females will be prioritized for retention.

Implementation Assumptions

1) Broodstock may be collected at any or all of the following locations/means: the PRD off ladder trap (OLAFT – operated 4-days per week/8 hrs/day to collect up to 1,000 presumed NOR's), hook-and-line angling in the Hanford Reach (actual numbers collected are uncertain but will contribute to the overall brood program) , and the Priest Rapids Hatchery volunteer channel trap.

2) Assumptions used to determine egg/adult needs is based upon current program performance metrics.

3) Broodstock retained from the volunteer channel will exclude age-2 and 3 males (using length at age) to address genetic risks/concerns of younger age-at-maturity males producing offspring which return at a younger age (decreased age-at-maturity) and also decrease the probability of using hatchery origin fish in the broodstock that are skewed towards earlier ages at maturity.

4) Only adipose present, non-CWT males and females will be retained for broodstock from volunteer channel collected broodstock unless a shortage is expected.

5) Only adipose present, non-wired fish encountered through hook-and-line angling and at the OLAFT will be retained for broodstock.

6) Broodstock collected from the OLAFT and by hook-and-line will exclude age-2 and to the degree possible age-3 fish to minimize genetic risks/concerns of younger age-at-maturity males producing offspring which return at a younger age (decreased age-at-maturity) and to ensure the highest proportion of NOR's in the collection (e.g. collection of 1 in 5 age-3 fish for broodstock from the OLAFT).

7) All gametes of fish spawned from hook-and-line broodstocking efforts and/or OLAFT collections will be incorporated into the GCPUD program.

Table 18. Assumptions and calculations to determine the number of fall Chinook salmon broodstock needed for a non-actively integrated Priest Rapids program release of 7,299,504 sub-yearling fall Chinook and 3,500,000 eggs for Ringold, in 2013.

Program Assumptions	**Standard**		**Program objective**
Juvenile Production Level			
Grant PUD Mitigation-PUD Funded			**5,325,543 smolts** **273,961 smolts**[3/-]
John Day Mitigation-Federally Funded			**1,700,000 smolts**
John Day Mitigation [1]*-Ringold Springs-ACOE funding.*			**3,500,000 eggs**
Total Program Objectives			**10,799,504 eggs/ smolts**
Fertilization-to-release survival	*87%*		
Egg take target			**12,413,223**
Fecundity Age-4+(~56%)	*4,300*		1,617
Age-3 (~44%)	*3,680*		1,484
Female Target			**3,101**
Female to male ratio	*2:1*		
Pre-spawn survival	*88%*		
Broodstock target	**Total**	**Volunteer Trap**	**OLAFT**
Females	***3,524***	**2,611**	**670**[4/-]
Males	***1,762***	**1,311**	**330**[4/-]

Total broodstock collection	**5,286**	**3,922**	**1,000**
Estimated NOR's from OLAFT	**540**[2/-]		
Estimated 2013 minimum pNOB	**0.102**		

[1/-] *As of brood year 2009, Priest Rapids Hatchery is taking 3,500,000 eggs for release at Ringold-Meseberg Hatchery funded by the ACOE – incubation of this program occurs at Bonneville.*
[2/-]*Estimated NOR's assumes a minimum of 178 wild males using them in the 2:1 F:M ratio and no more than 362 wild females. If the number of wild males is increased (the number of NOR females would decrease).*
[3/-]*The PRCC-HSC agreed upon smolt production by conversion of the 1M fry obligation.*
[4/-]*Estimated number of fall Chinook females and males acquired from the OLAFT in 2013.*

Appendix A

Columbia River Mouth Fish Returns Actual and Forecasts[a/]			
	2012 Forecast	**2012 Return**	**2013 Forecast**
Spring Chinook Upriver Total	**314,200**	**203,100**	**141,400**
Upper Columbia (total)	32,600	24,400	14,300
Upper Columbia (wild)	2,800	4,800	1,600
Snake River Spring/Summer (total)	168,000	109,700	58,200
Snake River (wild)	39,000	33,400	18,900
Summer Chinook	**91,200**	**58,300**	**73,500**
Sockeye	**462,000**	**521,000**	**180,500**
Wenatchee	28,800	59,800	44,600
Okanogan	431,300	460,600	135,500
Snake River	1,900	500	1,250

a/ Numbers may not sum due to rounding

Appendix B

DRAFT

Hatchery Production Management Plan

The following management plan is intended to provide life-stage-appropriate management options for Upper Columbia River (UCR) PUD salmon and steelhead mitigation programs. Consistent, significant over-production or under-production risks the PUD's not meeting the production objectives required by FERC and overages in excess of 110% of program release goals violates the terms and conditions set forth for the implementation of programs under ESA and poses potentially significant ecological risks to natural origin salmon communities.
Under RCW 77.95.210 (Appendix A) as established by House Bill 1286, the Washington Department of Fish and Wildlife has limited latitude in disposing of salmon and steelhead eggs/fry/fish. While this RCW speaks more specifically to the sale of fish and/or eggs WDFW takes a broader application of this statute to include any surplus fish and/or eggs irrespective of being sold or transferred.
We propose implementing specific measures during the different life-history stages to both improve the accuracy of production levels and make adjustments if over-production occurs. These measures include (1) Improved Fecundity Estimates, (2) Adult Collection Adjustments, (3) Within-Hatchery Program Adjustments, and (4) Culling.

<u>Improved Fecundity Estimates</u>

A) Develop broodstock collection protocols based upon the most recent 5-year mean in-hatchery performance values for female to spawn, fecundity, Green egg to eye, and green egg to release.

B) Use portable ultrasound units to confirm gender of broodstock collected (broodstock collection protocols assume a 1:1 male-to-female ratio). Ultrsonography, when used by properly trained staff will ensure the 1:1 assumption is met (or that the female equivalents needed to meet production objective are collected). Spawning matrices can be developed such that if broodstock for any given program are male limited sufficient gametes are available to spawn with the females.

<u>Adult Collection Adjustments</u>

C) Make in-season adjustments to adult collections based upon a fecundity-at-length regression model for each population/program and origin composition needs (hatchery/wild). This method is intended to make in-season allowances for the age structure of the return (i.e. age-5 fish are larger and therefore more fecund than age-4 fish), but will also make allowances for age-4 fish that experienced more growth through better ocean conditions compared to an age-5 fish that reared in poorer ocean conditions.

Within-Hatchery Program Adjustments

D) At the eyed egg inventory (first trued inventory), after adjustments have been made for culling to meet BKD management objectives, the over production will be managed in one or more of the following actions as approved by the HCP-HC:

- Voluntary cooperative salmon culture programs under the supervision of the department under chapter 77.100 RCW;
- Regional fisheries enhancement group salmon culture programs under the supervision of the department under this chapter;
- Salmon culture programs requested by lead entities and approved by the salmon funding recovery board under chapter 77.85 RCW;
- Hatcheries of federally approved tribes in Washington to whom eggs are moved, not sold, under the interlocal cooperation act, chapter 39.34 RCW; and
- Governmental hatcheries in Washington, Oregon, and Idaho; or
- Culling for diseases such as BKD and IHN, consistent with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State; or
- Distribution to approved organizations/projects for research.

E) At tagging (second inventory correction) fish will be tagged up to 110% of production level at that life stage. If the balance of the population combined with the tagged population amounts to more than 110% of the total release number allowed by Section 10 permits then the excess will be distributed in one or more of the following actions as approved by the HCP-HC:

- Voluntary cooperative salmon culture programs under the supervision of the department under chapter 77.100 RCW;
- Regional fisheries enhancement group salmon culture programs under the supervision of the department under this chapter;
- Salmon culture programs requested by lead entities and approved by the salmon funding recovery board under chapter 77.85 RCW;

- Hatcheries of federally approved tribes in Washington to whom eggs are moved, not sold, under the interlocal cooperation act, chapter 39.34 RCW; and
- Transfer to another resource manager program such as CCT, YN, or USFWS program;
- Governmental hatcheries in Washington, Oregon, and Idaho;
- Placement of fish into a resident fishery (lake) zone, provided disease risks are within acceptable guidelines; or
- Culling for diseases such as BKD and IHN, consistent with the Salmonid Disease Control Policy of the Fisheries Co-managers of Washington State; or
- Distribution to approved organizations/projects for research.

F) In the event that a production overage occurs after the above actions have been implemented or considered, and deemed non viable for fish health reasons in accordance with agency aquaculture disease control regulations (i.e. either a pathogen is detected in a population that may pose jeopardy to the remaining population or other programs if retained or could introduce a pathogen to a watershed where it had not previously been detected) then culling of those fish may be considered.

All, provisions, distributions, or transfers shall be consistent with the department's egg transfer and aquaculture disease control regulations as now existing or hereafter amended. Prior to department determination that eggs of a salmon stock are surplus and available for sale, the department shall assess the productivity of each watershed that is suitable for receiving eggs.

Appendix C

May 5, 2011

Dr. Craig Busack
Salmon Recovery Division
National Marine Fisheries Service
1201 NE Lloyd Blvd., Suite 1100
Portland, OR 97232

Mr. Steve Lewis
U.S. Fish and Wildlife Service
Central Washington Field Office
215 Melody Lane, suite 119
Wenatchee WA, 98801

Re: Tumwater Trapping Plan for operations beginning June 1, 2011

Dear Dr. Busack and Mr. Lewis:

The Washington Department of Fish and Wildlife (WDFW) and Chelan PUD (District) appreciate this opportunity to provide NMFS and USFWS with an operational plan for future trapping operations at the Tumwater Trapping Facility. The purpose of this correspondence is to request concurrence from both NMFS and USFWS that (1) the Services support the proposed plan and (2) the Services are satisfied that the plan will result in "take" of Endangered Species Act (ESA) –listed salmon, steelhead and bull trout that is consistent with the manner and extent previously approved by the Services through WDFW's Section 6 cooperative agreement, USFWS's biological opinion on Rocky Reach relicensing, and NMFS's Section 10 permits and associated biological opinions for these hatchery activities). This letter is the culmination of numerous discussions among WDFW, District, NMFS and USFWS staff and specifically addresses modifications to trapping operations to minimize passage delays.

The WDFW and District recognize the importance of the actions proposed at the Tumwater Trapping Facility and the active support that NMFS and USFWS have provided as both ESA administrators in the Habitat Conservation Plan Hatchery Committees and participants in the proposed trapping activities at Tumwater (i.e., removal of Leavenworth hatchery strays [USFWS]; and co-principal-investigators of the two ongoing relative reproductive success studies [NMFS]). It is our desire to meet the objectives of all parties benefitting from the Tumwater Trapping Facility. However, before allowing trapping to proceed on June 1 and thereafter, we must be satisfied NMFS and the USFWS concur that the operations plan minimizes any effects of trapping and that the Services view ongoing operations pursuant to the plan as covered under existing ESA approvals.

Our current understanding of the Take authorizations that have been provided to WDFW and the District are summarized in Table 1. This letter does not anticipate or request any changes in quantified take levels for any species.

Table 1. Take authorizations for trapping activities at Tumwater.

Permit Holder/Covered Party	Service Providing Take Authorization	Type of Take-Species	Activity
Chelan PUD & WDFW (permit 1196 & 1395 and associated Biological Opinions)	NMFS	Direct & Indirect-spring Chinook & steelhead	Spring Chinook and steelhead RSS studies & broodstock collection & hatchery M&E
Chelan PUD & WDFW (permit 1347 and associated Biological Opinions)	NMFS	Indirect-spring Chinook and steelhead	Unlisted broodstock collection & hatchery M&E
Chelan PUD-2008 Rocky Reach Biological Opinion	USFWS	Indirect-bull trout	Broodstock Collection & hatchery M&E
WDFW-Section 6	USFWS	Direct & Indirect-bull trout	Sampling activities conducted by WDFW at Tumwater not related to broodstock collection or otherwise HCP controlled (i.e., spring Chinook RSS)

For 2011, WDFW and the District are proposing the following plan (A summary of activities by month is summarized in Appendix 1):

1) **Real-time monitoring and trap operations:** Throughout all trapping activities described in this plan, the two PIT tag antennae arrays within the Tumwater Dam ladder (weir 15 and 18, see Appendix 2), will be monitored by WDFW and detections of previously PIT tagged fish will be evaluated to determine the median passage time of fish between first detection at weir 15 and last detection at weir 15 or weir 18. Median passage estimates will be updated with every 10 PIT-tagged fish encountering weir 15[1]. If the median passage time is greater than 48 hours[2], trapping will cease and fish will be allowed to exit via the ladder (i.e., bypass the trap). If trapping has been stopped, PIT tag passage monitoring will continue and trapping will resume if and when the median passage time is less than 24 hours. In summary, real-time PIT tag monitoring will occur both when the trap is operational and when fish are bypassed. This will provide an opportunity to evaluate trapping effects versus baseline passage rates through the ladder for future operations.

2) **Relocate broodstock collection away from the Tumwater trap**: Broodstock collection of hatchery spring Chinook for the Chiwawa spring Chinook program will be shifted entirely to the Chiwawa Weir where broodstock collection has occurred historically. Broodstock collection of sockeye for the Wenatchee sockeye program will be shifted from Tumwater Dam to the Dryden Dam left and right bank traps.

3) **Improved Fish Handling Efficiency**: The District is completing several infrastructure improvements at Tumwater that will allow WDFW and other operators to cycle through sampled fish more quickly. These improvements consist of an additional holding tank and an improved conveyance system between the trap and holding tank. The facility improvements and additional staffing by WDFW (3 operators instead of 2) during peak spring Chinook and sockeye passage (i.e. June 1 and July 15), will ensure that the trapping denil is operated constantly allowing unimpeded passage through the trap. Historically, the trapping denil has been periodically shut down while fish are being processed.

4) **Enhanced effort for Tumwater trapping operations from June 1 and July 15**: The Tumwater trap will be operated in an active-manned trapping condition (the ladder bypass will not be used however, fish may still ascend the denil [steep pass] unimpeded). The trap will be checked a minimum of 1x per day. More frequent trap checks will be made as fish numbers increase. Between June 16 and July 15 the Tumwater trap will be actively manned 24 hours/day 7 days/week utilizing two- three person crews (two people

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[1] The numbers of returning PIT tagged fish from 2008, 2009, and 2010 were n = 59, n = 198, and n = 478, respectively. The proportion of juveniles PIT tagged has remained relatively constant for the brood years contributing to the 2011 return, so there is a high expectation that there will be a significant number of tagged adults returning.

[2] Based on data reported in: Keefer, M.L., C.A. Peery, T.C. Bjornn, M.A. Jepson, and L.C. Struehrenberg. 2004. Hydrosystem, dam, and reservoir passage rates of adult Chinook salmon and steelhead in the Columbia and Snake Rivers. Transactions of the American Fisheries Society. 133(6):1413-1439.

will sample fish and the third will maintain operation of the steep pass so that it will not be closed to passage). This represents an additional person to keep the denil operating constantly.

5) **Enhanced effort and limited Tumwater trapping operations from July 16 to August 31**: The trap will be operated 3 days/week for up to 16 hours/day (not to exceed 48 hours per week) to support broodstock collection activities for summer Chinook and sockeye run composition sampling (CRITFC) and sockeye spawner escapement PIT tagging. Video enumeration and full passage will occur when trapping is not occurring.

6) **Planned Tumwater trapping operations from September 1 until mid-December:** The trap will return to a 24 hours/7day/week manned or unmanned active trapping for steelhead and Coho broodstock collection and adult steelhead management. During this time period bull trout are rare and spring Chinook are not present at Tumwater. For this trapping period, real-time monitoring will continue to be implemented.

7) **Limitation in staffing or other unforeseen problems**: If WDFW staff are not available to operate the trapping facility (according to this plan) for any reason, then full passage will be allowed (fish will be allowed to bypass the trap and exit the ladder directly), until staff are able to return.

8) **Unforeseen scenarios and in season observations**: If during the trapping period, observations from field staff warrant reconsideration of any part of the plan as described above, WDFW and the District will alert the Hatchery Committee and work cooperatively with the Services to determine whether changes are needed to further minimize incidental take or otherwise ensure that take is maintained at the manner and extent previously approved by the Services

The WDFW and the District agree that implementation of the aforementioned plan and on-the-ground improvements to facilitate efficient fish handling will significantly reduce the median passage time. Following the completion of trapping activities in 2011, an evaluation of activities and observed delays will be conducted to determine what if any modifications to the real-time monitoring and/or trap operations will need to be made for 2012 and beyond to maximize passage timing/success while conducting activities at Tumwater Dam. The contents of this plan will be included in our joint applications for Section 10 permits from NMFS.

The WDFW and District expect that future consultations regarding the Chiwawa spring Chinook and Wenatchee steelhead hatchery programs will result in long-term spring Chinook and steelhead ESA coverage for hatchery trapping activities at Tumwater through the issuance of new Section 10 permits and associated Section 7 consultations. We also anticipate coverage for bull trout through consultations by the USFWS on the issuance of the aforementioned Section 10 permits by NMFS.

As indicated above, before allowing trapping to proceed on June 1st and thereafter pursuant to the proposed plan, we require written affirmation from both NMFS and USFWS that (1) the Services support the proposed plan and (2) the Services are satisfied that the plan will result in take of ESA-listed salmon, steelhead and bull trout that is consistent with the manner and extent previously approved by the Services.

Thank you for your consideration of the information provided with this letter. We hope this provides NMFS and the USFWS with the information it requires to provide the affirmation described above so that the important trapping activities at Tumwater Dam may continue. We also look forward to input from the Services regarding any potential improvements to the plan.

Sincerely,

Joe Miller
Hatchery Program Manager
Chelan County PUD

Mike Tonseth
UCR Fisheries Biologist
Washington Department of Fish & Wildlife

April 25, 2012

Dr. Craig Busack
Salmon Recovery Division
National Marine Fisheries Service
1201 NE Lloyd Blvd., Suite 1100
Portland, OR 97232

Mr. Steve Lewis
U.S. Fish and Wildlife Service
Central Washington Field Office
215 Melody Lane, suite 119
Wenatchee WA, 98801

Re: Tumwater Trapping Plan for operations beginning June 1, 2012

Dear Dr. Busack and Mr. Lewis:

The Washington Department of Fish and Wildlife (WDFW) and Chelan PUD (District) is proposing continuation of the Tumwater Trapping Plan (Plan) submitted and approved by NMFS and USFWS (Services) in 2011 (initial correspondence dated May 5, 2011). The purpose of this correspondence is to request concurrence from both NMFS and USFWS that (1) the Services support continuation of the Plan during 2012, and (2) the Services are satisfied that the Plan will result in "take" of Endangered Species Act (ESA) –listed salmon, steelhead, and bull trout that is consistent with the manner and extent previously approved by the Services through WDFW's Section 6 cooperative agreement, USFWS's biological opinion on Rocky Reach relicensing, and NMFS's Section 10 permits and associated biological opinions for these activities.

The 2011 spring migration was the first year of implementing modified trapping protocols at Tumwater Dam. PIT tag data indicate that the Plan reduced passage delays. The proportion of fish last detected on the downstream array in the Tumwater fishway was significantly lower for both sockeye ($p < 0.0001$) and Chinook ($p < 0.0001$) compared to previous years. Likewise, the delay of fish in the Tumwater fishway was significantly shorter in duration for both sockeye ($p < 0.0001$) and Chinook ($p < 0.0001$) compared to previous years (Table 1). While environmental conditions and run sizes varied between years, the data suggest that passage under the Plan was improved.

Table 1. Median delays and proportion of adults last detected on the downstream array for previously-tagged sockeye and adult (Age 4+) spring Chinook salmon.

	Median delay		Percent last detected at Weir 15	
	2010	**2011**	**2010**	**2011**
Sockeye	210 hours	6 minutes	38 %	< 1 %
Spring Chinook	190 hours	17 hours	26 %	6 %

For 2012, WDFW and the District are proposing to continue actions identified in the Plan submitted in 2011. Specifically, these actions include (summarized from the initial Plan):

- Real-time monitoring to ensure that median delays are not exceeding 48 hours.
- Relocation of broodstock collection away from the Tumwater trap.
- Improved fish handling efficiency through infrastructure and process improvements;
- Active trapping from June 1 to July 15 to ensure that trapped fish are moved quickly and effectively. The fishway will be opened for volitional passage when staff are not present.
- Limited operations (3 days/week, ≤ 16 hours/day) from July 16 to August 31 to facilitate upstream passage of sockeye.

The WDFW and District recognize the importance of the actions proposed at the Tumwater Trapping Facility and the active support that NMFS and USFWS have provided as both ESA administrators in the Habitat Conservation Plan Hatchery Committees and participants in the proposed trapping activities at Tumwater (i.e., removal of Leavenworth hatchery strays [USFWS]; and co-principal-investigators of the two ongoing relative reproductive success studies [NMFS]). It is our desire to meet the objectives of all parties benefitting from the Tumwater Trapping Facility. However, we are asking for confirmation from NMFS and the USFWS that the operations Plan implemented in 2011 and the proposed continuation of these approaches during the 2012 migration are covered under existing ESA approvals. This letter does not anticipate or request any changes in quantified take levels for any species. Therefore, before allowing trapping to proceed on June 1st pursuant to the Plan, we require written affirmation from both NMFS and USFWS that (1) the Services support continuation of the Plan, and (2) the Services are satisfied that the plan will result in take of ESA-listed salmon, steelhead and bull trout consistent with the manner and extent previously approved by the Services.

Thank you for considering continuation of the Plan. We hope the results from 2011 provide assurance that the Plan is benefiting migratory fishes in the Wenatchee River Basin and should be continued to allow the research and management activities at Tumwater Dam. We also look forward to input from the Services regarding any potential improvements to the plan.

Sincerely,

Josh Murauskas

Senior Fisheries Biologist

Chelan County PUD

Mike Tonseth

UCR Fisheries Biologist

Washington Department of Fish & Wildlife

APPENDIX M
MONITORING AND EVALUATION FOR PUD HATCHERY PROGRAMS: 2013 UPDATE

MONITORING AND EVALUATION PLAN FOR PUD HATCHERY PROGRAMS

2013 Update

April 17, 2013

Prepared by (alphabetically):
Tracy Hillman
Tom Kahler
Greg Mackey
Josh Murauskas
Andrew Murdoch
Keely Murdoch
Todd Pearsons
Mike Tonseth

Prepared for:
HCP and PRCC Hatchery Committees

Monitoring and Evaluation Plan for PUD Hatchery Programs

This document is a revision of the monitoring and evaluation (M&E) plan of the salmon and steelhead hatchery programs funded by Douglas, Chelan, and Grant County Public Utility Districts (PUDs; see Table 4). Several programmatic changes, evaluation of data collection methods, and M&E results from the past five years, along with shifting management paradigms affect M&E needs, all of which have occurred under advancing fish culture and monitoring techniques. As required by the programs, this document is a result of a five-year review intended to expand on and coalesce previous M&E documents (BAMP 1998; Cates et al. 2005; Murdoch and Peven 2005; Hays et al. 2006; Pearsons and Langshaw 2009a, 2009b) with inclusion of new information.

Fishery management agencies developed the following general goal statements for hatchery programs, which were adopted by the HCP Hatchery Committees and PRCC Hatchery Sub-Committee (hereafter, Hatchery Committees):

1. Support the recovery of ESA-listed species by increasing the abundance of the natural adult population, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity.

2. Increase the abundance of the natural adult population of unlisted plan species, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity. In addition, provide harvest opportunities in years when spawning escapement is sufficient to support harvest.

3. Provide salmon for harvest and increase harvest opportunities, while segregating returning adults from natural tributary spawning populations.

Following the development of Hatchery and Genetic Management Plans (HGMPs), artificial supplementation programs are now characterized into three categories. The first type, integrated conservation programs, are intended to support or restore natural populations. These programs focus on increasing the natural production of targeted fish populations. A fundamental assumption of this strategy is that hatchery fish returning to the spawning grounds are reproductively similar to naturally produced fish. The second type, safety-net programs, are extensions of conservation programs, but are intended to function as reserve capacity for conservation programs in years of low returns. The safety-net provides a demographic and genetic reserve for the natural population. That is, in years of abundant returns they function like segregated programs, and in low return years they can be managed as conservation programs. Lastly harvest augmentation programs are intended to increase harvest opportunities while limiting interactions with wild-origin counterparts.

Monitoring is needed to determine if the hatchery programs are meeting the intended management objectives of conservation, safety-net, or harvest augmentation programs. Objectives for hatchery programs are generally grouped into three categories of performance indicators:

1. In-Hatchery: Is the program meeting the hatchery production objectives?

2. In-Nature: How do fish from the program perform after release?

    a. Conservation Program:
        i. How does the program affect target population abundance and productivity?
        ii. How does the program affect target population long-term fitness?

    b. Safety-Net Program:
        i. How does the program affect target population long-term fitness?

    c. Harvest Augmentation Program:
        i. Does the program provide harvest opportunities?

3. Risk Assessment: Does the program pose risks to other populations?

Objectives in this plan have been organized in a hierarchy where productivity indicators are the primary metrics used to assess if conservation and safety-net program goals have been met; harvest rates and effects on non-targeted populations are used for harvest programs. In cases where productivity indicators are not available or results are equivocal, monitoring indicators may be used to help evaluate the performance of the program. Evaluations of monitoring indicators may not provide sufficiently powerful conclusions on which to base management actions, although they may provide insight as to why a productivity indicator did or did not meet the program goal. Therefore, the relationship between hatchery programs and indicators can be viewed in a chain-of-causation: management actions within the hatchery programs affect the status of monitoring indicators, which in turn influence productivity indicators (Figure 1).

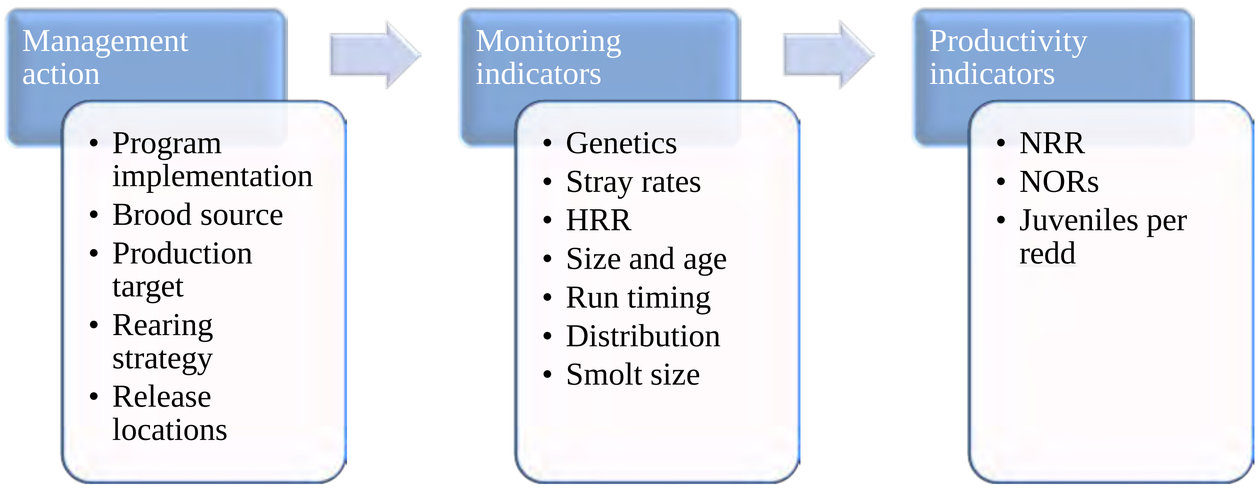

Figure 1. Relationship of indicators to the assessment of supplementation programs. Management actions affect monitoring indicators, which influence productivity indicators. Monitoring indicators may be used to hypothesize the magnitude of influence on productivity.

The primary goal of a conservation program is to contribute to the rebuilding and recovery of naturally reproducing populations within their native habitat. In this plan, natural replacement rates (NRR), recruitment of naturally-produced fish (NOR), and juvenile productivity (juveniles per redd) are important indicators for assessing the success of supplementation. These indicators are difficult to measure precisely and are quite variable in space and time. Therefore, monitoring indicators can be evaluated to help assess if productivity was related to the hatchery programs or other factors (Table 1).

A flow of information following sequential, logical steps will be employed to evaluate supplementation programs, consistent with the indicators described in Table 1. For example, a hatchery program, at a minimum, must be able to produce more adults per spawner than would occur in the natural environment. Should the program fail this test, hatchery operations should be evaluated to determine if improvements can correct the problem. If a program successfully replaces the required number of adults, it is then evaluated against a reference population or condition, if available, to determine if it has increased the overall number of naturally-spawning fish (including both hatchery- and natural-origin adults), increased the number of natural-origin spawners, and to test if productivity of the natural population has changed. When these goals are met, the program is considered successful. When these goals are not met, monitoring indicators may infer why the program is not achieving its goals

If suitable reference populations are not available, other comparisons can be used to help evaluate treatment responses. Evaluation of programs may pursue the following approaches:

- Comparison to reference population(s) that do not contain pre-treatment data
- Before treatment and after treatment comparisons
- Comparison to standard(s)
- Comparison to other suitable reference conditions

Methodologies for selecting reference streams, analyzing data from treatment and reference stream comparisons, and other comparisons are presented in Hillman et al. (2012).

The primary goals of a safety-net program are to provide demographic and genetic reserves for a population that is supplemented by a conservation program (Table 2). Harvest and adult management may be used to control escapement of spawners when appropriate. Monitoring focuses on estimating the number of fish that escape to spawn naturally and stray rates and in-hatchery performance evaluation.

The primary goal of a harvest augmentation program is to increase harvest opportunities, while segregating adults from natural spawning populations. In this plan, harvest opportunity, survival rates, and stray rates are important indicators for assessing the success of harvest augmentation. These indicators are more readily quantified compared to productivity indicators (Table 2). A flow of information will be employed to evaluate harvest augmentation programs. Since harvest augmentation programs are typically segregated, monitoring indicators will be used to determine the success of a program.

Both monitoring and productivity indicators will be used to evaluate the success of hatchery programs. In the event that the statistical power of tests that involve productivity indicators is insufficient to inform sound management decisions, some of the monitoring indicators may be used to guide management. The overarching goals of conservation, safety-net, and harvest augmentation programs, as described above, are provided below in greater detail. The flow chart (Figure 3) shows the relationship of overarching program goals, the strategies used to meet the goals, the monitoring and evaluation objectives used to evaluate the strategies and determine if goals are being met, and the adaptive management cycle associated with the programs. See Tables 1 and 2 for the indicators under each objective. The logic depicted in this flow chart shall be used to assess M&E results and apply those results to management decisions. Table 4 presents the current hatchery programs releasing fish in the Upper Columbia Basin.

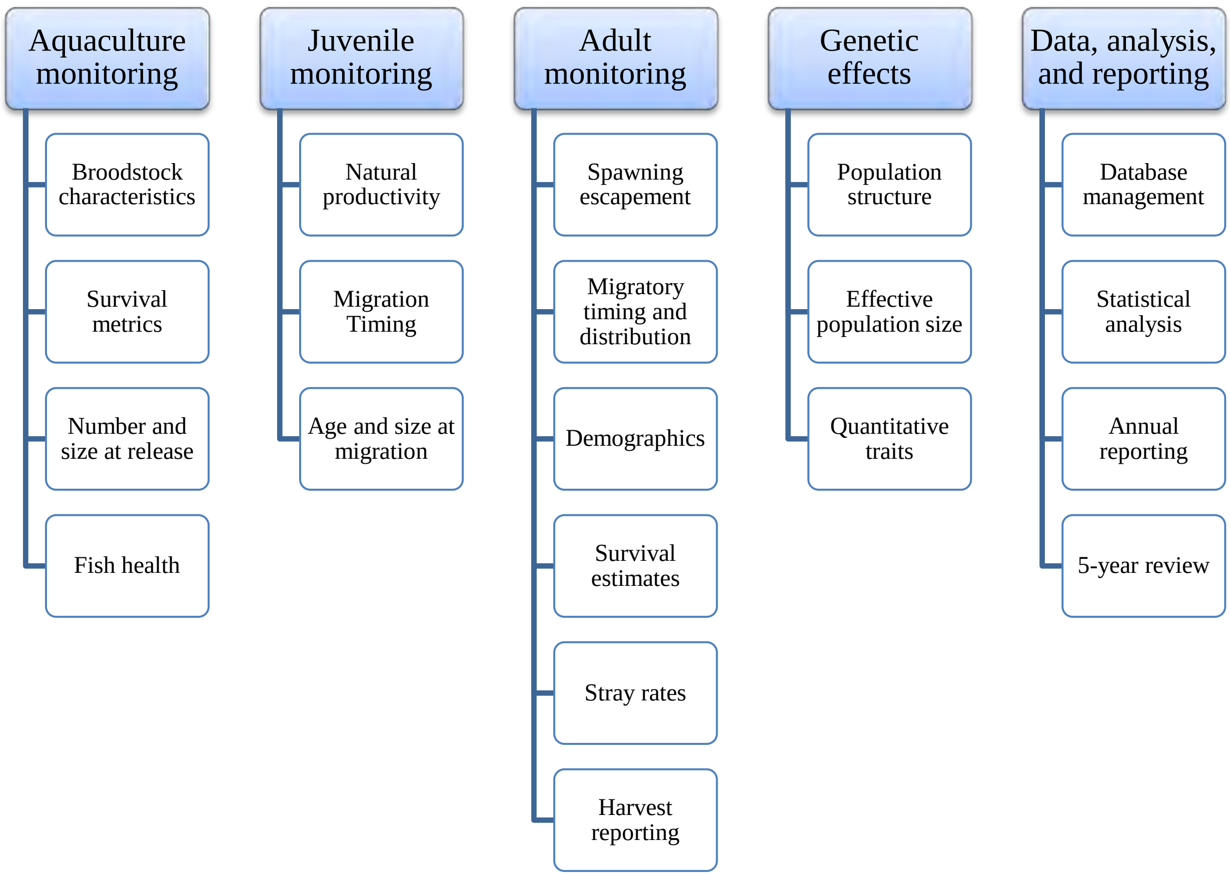

Figure 2. Overview of Monitoring and Evaluation Plan Categories and Components (not including regional objectives).

Table 1. Program objectives, indicators, and goals for conservation hatchery programs including productivity and monitoring indicators (also applies to safety-net programs when used to support a conservation program).

	Objective	Indicator	Target	Program goals: Rebuild natural populations	Program goals: Maintain genetic diversity	Program goals: Opportunity for harvest
Productivity indicators	Determine if the program has increased the number of naturally spawning adults	Abundance of natural spawners	Increase	✓		✓
		Adult productivity (NRR)	No decrease	✓		
	Determine if the proportion of hatchery fish affects freshwater productivity	Residuals vs. pHOS	No relationship	✓		
		Juveniles per redd vs. pHOS	No relationship	✓		
Monitoring indicators	Determine if run timing and distribution meets objectives	Migration timing	No difference	✓	✓	
		Spawn timing	No difference	✓	✓	
		Redd distribution	No difference	✓	✓	
	Determine if program has affected genetic diversity and population structure	Allele frequency (hatchery vs. wild)	No difference		✓	
		Genetic distance between populations	No difference		✓	
		Effective population size	Increase		✓	
		Age and size at maturity	No difference		✓	
	Determine if hatchery survival meets expectations	HRR	HRR > NRR	✓		
		HRR	HRR ≥ Goal	✓		
	Determine if stray rate of hatchery fish is acceptable	Out of basin	≤ 5%	✓	✓	
		Within basin	≤ 10%	✓	✓	
	Determine if hatchery fish were released at program targets	Size and number	= Target	✓		
	Provide harvest opportunities when appropriate	Harvest	Escapement goals			✓

Table 2. Program objectives, indicators, and goals for segregated harvest augmentation hatchery programs including monitoring indicators.

	Objective	Indicator	Target	Program goals: Rebuild natural populations	Program goals: Maintain genetic diversity	Program goals: Opportunity for harvest
Monitoring indicators	Determine if hatchery survival meets expectations	HRR	HRR > NRR			✓
		HRR	HRR ≥ Goal			✓
	Determine if stray rate of hatchery fish is acceptable	Out of basin	≤ 5%		✓	
		Within basin	≤ 10%		✓	
	Determine if hatchery fish were released at program targets	Size and number	= Target			✓
	Provide harvest opportunities when appropriate	Harvest	Escapement goals			✓

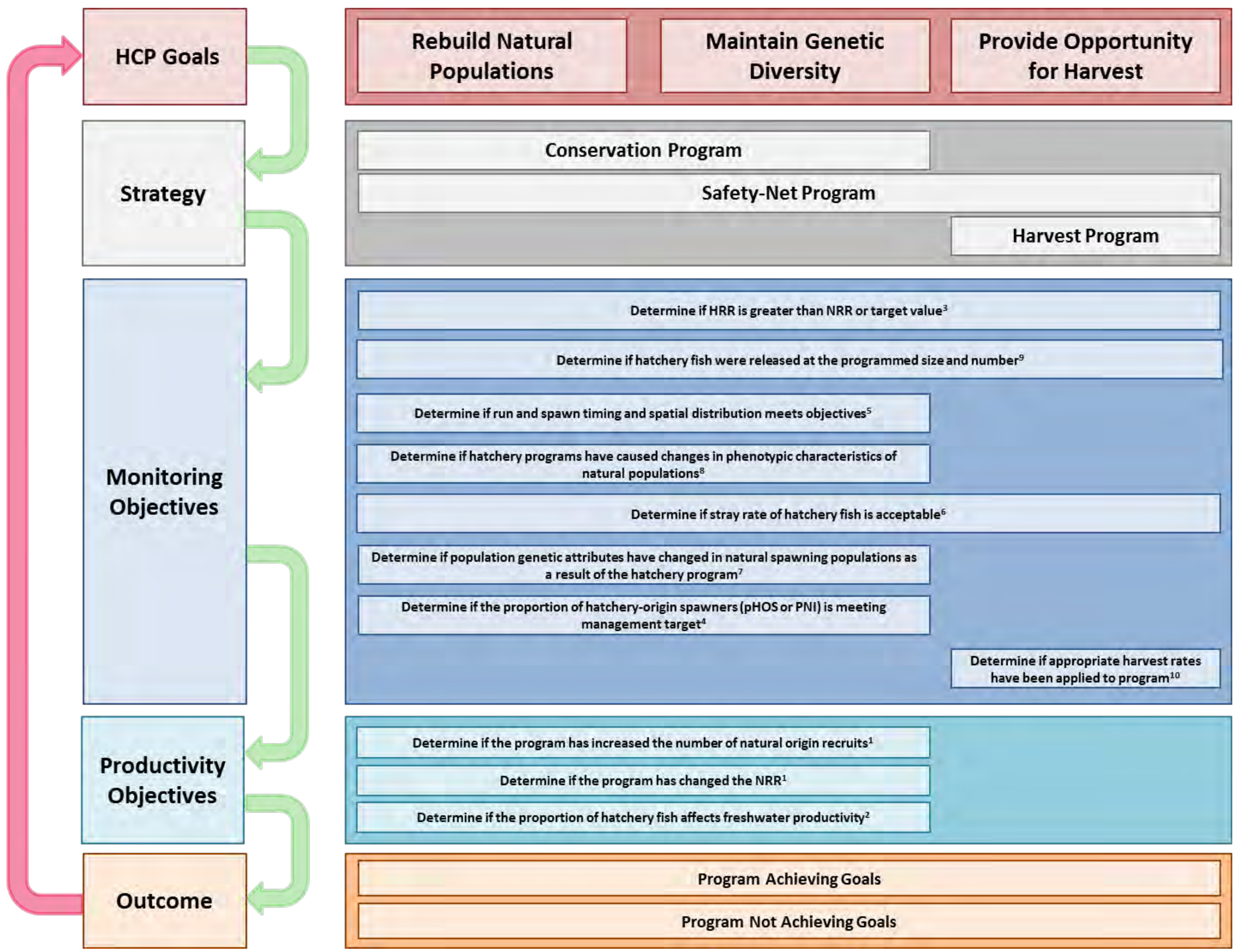

Figure 3. **Adaptive management flow chart depicting HCP goals, associated strategies to meet the goals, the monitoring and evaluation objectives (indicated in superscript), and the adaptive management feedback cycle. The strategies, objectives, and outcomes are aligned vertically under the corresponding goals.**

Table 3. Hatchery programs in the mid-Columbia River Basin, 2012. Funding entities included Douglas PUD (D), Chelan PUD (C), Grant PUD (G), Bonneville Power Administration (B), Bureau of Reclamation (O), and Army Corps of Engineers (A) and are listed in order of contribution. Total artificial production targets in the mid-Columbia River exceeds 20 million juveniles annually.

Program	Species	Basin	Purpose	Funding Entity	Production
Methow[5]	Spring Chinook [1]	Methow	NNI/Conservation	G, C, D	223,765
Chief Joseph[7]	Spring Chinook	Okanogan	Reintroduction/Harvest	B, G, C, D	900,000
Chiwawa[5]	Spring Chinook [1]	Wenatchee	NNI/Conservation	C	144,026
White[5]	Spring Chinook [1]	Wenatchee	NNI/Conservation	G	74,556
Nason[5]	Spring Chinook [1]	Wenatchee	NNI/Conservation	G	149,114
Winthrop[7]	Spring Chinook [2]	Methow	Safety-Net	O	400,000
Leavenworth	Spring Chinook [2]	Wenatchee	Harvest	O	1,200,000
Wells[5]	Steelhead [1]	Columbia	Inundation/Safety-Net	D	160,000
Winthrop[7]	Steelhead [1]	Methow	Conservation	O	100,000-200,000
Wells[5]	Steelhead [1]	Methow	Inundation/Safety-Net	D	100,000
Wells/Omak[5, 6]	Steelhead [1]	Okanogan	NNI/Conservation	G	100,000
Wells[5]	Steelhead [1]	Twisp	Inundation/Conservation	D	40,000
Wells[5]	Steelhead [1]	Twisp	NNI/Conservation	D	8,000
Chiwawa[5]	Steelhead [1]	Wenatchee	NNI/Conservation	C	22,000
Chiwawa[5]	Steelhead [1]	Wenatchee	Inundation/Harvest	C	165,000
Chiwawa[5]	Steelhead [1]	Wenatchee	Species trade	C	60,300
Wells[5]	Summer Chinook [2, 3]	Columbia	Inundation/Harvest	D	484,000
Chief Joseph[7]	Summer Chinook [3]	Okanogan	NNI/Cons./Harvest	B, G, C, D	700,000
Chelan Falls[5]	Summer Chinook [2]	Chelan	Inundation/Harvest	C	400,000
Chelan Falls[5]	Summer Chinook [2]	Chelan	NNI/Conservation	C	176,000
Wells[5]	Summer Chinook [2]	Columbia	Inundation/Harvest	D	320,000
Entiat	Summer Chinook	Entiat	Harvest	O	400,000
Carlton[5]	Summer Chinook	Methow	NNI/Conservation	G	200,000
Chief Joseph[7]	Summer Chinook	Okanogan	NNI/Cons./Harvest	B, G, C, D	1,300,000
Dryden[5]	Summer Chinook	Wenatchee	NNI/Conservation	C, G	500,000
Priest[5]	Fall Chinook[3]	Columbia	Inundation/Harvest	G	5,000,000
Priest[5]	Fall Chinook[3]	Columbia	NNI/Harvest	G	325,543
Priest[5]	Fall Chinook[4]	Columbia	Fry loss/Harvest	G	1,000,000
Priest[5, 7]	Fall Chinook[3]	Columbia	Harvest	A	1,700,000
Ringold[7]	Fall Chinook[3]	Columbia	Harvest	A	3,000,000
Yakama Nation	Coho	Wenatchee	Reintroduction/Harvest	B, G, C, D	1,000,000
Yakama Nation[8]	Coho	Methow	Reintroduction/Harvest	B, G, C, D	500,000
Skaha	Sockeye	Okanogan	Reintroduction/Harvest	C, G	≤ 5 M eggs

[1] Species listed under the Endangered Species Act.
[2] Segregated program.
[3] Sub-yearling production.
[4] Fry production.
[5] Program covered by this M&E Plan.
[6] Program also partially covered by CCT M&E Plan.
[7] Program affects PUD-funded programs covered by this plan.
[8] Planned to increase within the next 5 years.

OBJECTIVES, QUESTIONS, AND HYPOTHESES

Productivity Indicators: Adults

Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.

At the core of a conservation program is the objective of increasing the number of spawning adults (i.e., the combined number of naturally produced and hatchery fish) in order to affect a subsequent increase in the number of returning naturally produced fish or natural origin recruits (NOR). In order for the natural population to remain stable or to increase, the Natural Replacement Rate (NRR), or the ratio of NORs to the parent spawning population, must be at a level where parents are being replaced by their offspring as spawners in the next generation. It is possible to affect an increase in natural origin spawners through supplementation with a stable or decreasing NRR. However, if the NRR is below replacement (NRR<1.0), termination of the supplementation program will result in a declining natural population should that state of NRR persist. The proportion of the hatchery-origin spawners (pHOS) that will increase natural production without creating adverse effects to the genetic diversity or reproductive success rate of the natural population is unknown, and may be dependent on how individual hatchery programs are operated, as well as available spawning and rearing habitat. Some programs may restrict pHOS to reduce the risk to the natural population with the intent of optimizing productivity, concomitantly reducing the overall number of spawners. All other objectives of the M&E Plan either directly support this objective or seek to minimize negative effects of the conservation programs on non-target stocks of concern.

Differences in carrying capacities of supplemented and non-supplemented streams can confound the analysis of the effects of supplementation on total number of spawners returning to the streams. For example, if the supplemented population is at carrying capacity and the non-supplemented population is not, the total number of spawners returning to the non-supplemented population may show an increasing trend over time, while the supplemented population would show no increasing trend. To avoid concluding that the supplementation program has no effect or perhaps a negative effect on total spawners, density corrections should be included in the analyses. Hypotheses that may require density corrections are noted under each monitoring question.

1.1 Natural Replacement Rates of Supplemented[1] Populations (*Productivity Indicator*)

Monitoring Questions:

Q1.1.1 Has the supplementation program changed the adult productivity (NRRs) of the supplemented populations?[2]

Target Species/Populations:

- Q1.1.1 applies to all conservation and safety-net stocks.

Statistical Hypotheses 1.1.1[3]:

- $Ho_{1.1.1.1}$: Slope in NRRs before supplementation ≤ slope in NRRs after supplementation.
- $Ho_{1.1.1.2}$: Differences in slopes in NRRs between supplemented and reference populations before supplementation ≤ differences in slopes in NRRs between supplemented and reference populations after supplementation.
- $Ho_{1.1.1.3}$: Mean NRRs before supplementation ≤ mean NRRs after supplementation.
- $Ho_{1.1.1.4}$: Mean ratio scores in NRRs before supplementation ≤ Mean ratio scores in NRRs during supplementation.
- $Ho_{1.1.1.5}$: Mean ratio scores in NRRs (adjusted for density dependence) before supplementation ≤ Mean ratio scores in NRRs (adjusted for density dependence) during supplementation. [This hypothesis adjusts NRRs for density-dependent effects (see Hillman et al. 2012 for details; Appendix 7).]
- $Ho_{1.1.1.6}$: There is no association between the proportion of hatchery-origin spawners (pHOS) and the residuals from the smooth hockey stick stock-recruitment curve; rho = 0. [If there is a significant negative association between pHOS and the residuals, then hatchery fish may be reducing the productivity of the wild population.]

Measured Variables:

- Number of hatchery and naturally produced fish on spawning grounds
- Number of naturally produced fish harvested

Derived Variables:

- Number of naturally produced recruits by brood year for both naturally produced parents and hatchery parents (≥age-3).
- NRRs (calculated as NORs/spawner).
- Stock-recruit models, parameters, and residuals.
- Includes ratio scores of NRRs (requires reference population[s]).
- Includes calculation of ratios NORs (requires reference population).
- Appendix 1: Spawning escapement and carrying capacity information (as applicable)

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[1] Supplementation programs may include a safety net component.

[2] Because adult productivity is affected by the abundance of the population (i.e., productivity decreases with increasing abundance), the goal of supplementation is to increase or maintain productivity, but not decrease it.

[3] Quality and quantity of data will determine which hypotheses are evaluated. See Hillman et al. 2012 (Appendix 7) for details.

Spatial/Temporal Scale:

- Calculated annually based on brood year.
- Time series.

Possible Statistical Analysis:

- These analyses shall be performed every 5-years. Use graphic analyses, trend analyses, t-tests, Aspin-Welch tests, and randomization tests to evaluate the statistical hypotheses (see Hillman et al. 2012; Appendix 7). The specific analysis used will depend on the availability of reference conditions.
- Correlation analysis will examine associations between hatchery adult composition and NRRs.
- On a five-year period, correlate productivity with extraneous factors such as ocean productivity indices.

Analytical Rules:

- This is a productivity indicator that will be used to assess the success of the supplementation program.
- Type I Error of 0.05.

1.2 Natural Origin Recruits of Supplemented Populations (*Productivity Indicator*)

Monitoring Questions:

Q1.2.1: Has the supplementation program changed the abundance of NORs within the supplemented population?

Target Species/Populations:

- Q1.2.1 applies to all supplemented or safety net stocks.

Statistical Hypotheses 1.2.1[4]:

- $Ho_{1.2.1.1}$: Slope in NORs[5] before supplementation ≥ slope in NORs after supplementation.
- $Ho_{1.2.1.2}$: Differences in slopes in NORs between supplemented and reference populations before supplementation ≥ differences in slopes in NORs between supplemented and reference populations after supplementation.
- $Ho_{1.2.1.3}$: Mean NORs before supplementation ≥ mean NORs after supplementation.
- $Ho_{1.2.1.4}$: Mean ratio scores in NORs before supplementation ≥ Mean ratio scores in NORs during supplementation.
- $Ho_{1.2.1.5}$: Mean ratio scores in NORs/Maximum Recruitment before supplementation ≥ Mean ratio scores in NORs/Maximum Recruitment during supplementation. [This hypothesis adjusts NORs for the capacity of the habitat; it tests the fraction of the habitat saturated with NORs (see Hillman et al. 2012 for details).]

[4] Quality and quantity of data will determine which hypotheses are evaluated. See Hillman et al. 2012 (Appendix 7) for details.
[5] "Slope in NORS" refers to abundance of NORs across time (years).

- $Ho_{1.2.1.6}$: There is no association between the proportion of hatchery-origin spawners (pHOS) and NORs; rho = 0. [If there is a significant negative association between pHOS and NORs, then hatchery fish may be reducing the reproductive success of the wild population.]

Measured Variables:
- Number of hatchery and naturally produced fish on spawning grounds.
- Number of hatchery and naturally produced fish taken for broodstock.
- Number of hatchery and naturally produced fish taken in harvest (if recruitment is to the Columbia).

Derived Variables:
- NORs (number of naturally produced recruits (total recruits) by brood year for both naturally produced parents and hatchery parents [≥age-3]).
- Stock-recruit models, parameters, and residuals.
- Includes ratio scores of NORs (requires reference population[s]).
- Estimates of carrying capacity.

Spatial/Temporal Scale:
- Calculate annually based on brood year.
- Time series.

Possible Statistical Analysis:
- These analyses shall be performed every 5-years. Use graphic analyses, trend analyses, t-tests, Aspin-Welch tests, and randomization tests to evaluate the statistical hypotheses (see Hillman et al. 2012). The specific analysis used will depend on the availability of reference conditions.
- Correlation analysis will examine associations between hatchery adult composition and NORs.
- On a five-year period, correlate NORs with extraneous factors such as ocean productivity indices.

Analytical Rules:
- This is a productivity indicator that will be used to assess the success of the supplementation program.
- Type I Error of 0.05.

Productivity Indicators: Freshwater Environment

Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.

Out-of-basin effects (e.g., smolt passage through the hydro system, harvest, and ocean productivity, etc.) influence the survival of smolts after they migrate from the tributaries. These effects introduce substantial variability into the adult-to-adult survival rates (NRRs and HRRs) and may mask in-basin effects (e.g., habitat quality, density-dependent mortality, and differential reproductive success of hatchery and naturally produced fish). Therefore, an estimate of freshwater productivity may help inform the performance of hatchery and natural origin spawners.

The objective of estimating freshwater productivity in the Upper Columbia ESU/DPS is to estimate the survival from egg to a critical juvenile life stage(s) of target stocks. Smolt or juvenile production models generated from the information obtained through these programs will provide a level of predictability with greater sensitivity to in-basin effects than spawner-recruitment models that take into account all effects.

Differences in the current carrying capacities of supplemented and non-supplemented streams can confound the effects of supplementation on numbers of juveniles per redd. For example, if the supplemented population is at or above carrying capacity and the non-supplemented population is not, numbers of juveniles per redd in the non-supplemented population may be significantly greater than the number of juveniles per redd in the supplemented population. In addition, pHOS may be correlated with overall spawner abundance. In these cases, it is difficult or impossible to separate density-dependent effects from the influence of pHOS on freshwater productivity. To avoid concluding that the supplementation program has no effect or perhaps a negative effect on juveniles per redd, the capacity of the habitats must be included in the analyses. The Supplementary Hypotheses presented below are designed to address the confounding effects of different densities on the analyses.

2.1 Juvenile Productivity (*Productivity Indicator*)

Monitoring Questions:

Q2.1.1: Has the supplementation program changed the number of juveniles (smolts, parr, and/or emigrants) per redd within the supplemented population?

Q2.2.1: Does the number of juveniles per redd decrease as the proportion of hatchery spawners increases?[6]

Target Species/Populations:

- Both Q2.1.1 and Q2.2.1 apply to all conservation stocks.

Statistical Hypotheses for 2.1.1[7]:

[6] Information is needed to estimate the effects of density dependence on these questions. Consider spatial distribution of redds.

- $Ho_{2.1.1.1}$: Slope in juveniles/redd before supplementation ≤ slope in juveniles/redd after supplementation.
- $Ho_{2.1.1.2}$: Differences in slopes in juveniles/redd between supplemented and reference populations before supplementation ≤ differences in slopes in juveniles/redd between supplemented and reference populations after supplementation.
- $Ho_{2.1.1.3}$: Mean juveniles/redd before supplementation ≤ mean juveniles/redd after supplementation.
- $Ho_{2.1.1.4}$: Mean ratio scores in juveniles/redd before supplementation ≤ Mean ratio scores in juveniles/redd during supplementation.
- $Ho_{2.1.1.5}$: Mean ratio scores in juveniles/redd (adjusted for density dependence) before supplementation ≤ Mean ratio scores in juveniles/redd (adjusted for density dependence) during supplementation. [This hypothesis adjusts juveniles/redd for density-dependent effects (see Hillman et al. 2012 for details; Appendix 7).]
- $Ho_{2.1.1.6}$: There is no association between the proportion of hatchery-origin spawners (pHOS) and the residuals from the smooth hockey stick stock-recruitment curve; rho = 0. [If there is a significant negative association between pHOS and the residuals, then hatchery fish may be reducing the productivity of the wild population.]

Statistical Hypotheses for 2.2.1:

- $Ho_{2.2.1.1}$: There is no association between the proportion of hatchery-origin spawners (pHOS) and the residuals from the smooth hockey stick stock-recruitment curve; rho = 0. [If there is a significant negative association between pHOS and the residuals, then hatchery fish may be reducing the productivity of the wild population.]
- $Ho_{2.2.1.2}$: The slope between proportion of hatchery spawners and juveniles/redd is ≥ 0.

Measured Variables:

- Number of hatchery and naturally produced fish on spawning grounds.
- Numbers of redds.
- Number of juveniles (smolts, parr [where appropriate], and emigrants).

Derived Variables:

- Number of juveniles per spawner.
- Number of juveniles per redd.
- Carrying capacity.

Spatial/Temporal Scale:

- Calculate annually based on brood year.
- Time series.

Possible Statistical Analysis:

- These analyses shall be performed every five-years. Use graphic analyses, trend analyses, t-tests, Aspin-Welch tests, and randomization tests to evaluate the statistical

[7] Quality and quantity of data will determine which hypotheses are evaluated. See Hillman et al. 2012 for details.

hypotheses (see Hillman et al. 2012; Appendix 7). The specific analysis used will depend on the availability of reference conditions.

- Correlation analysis will examine associations between hatchery adult composition and juveniles/redd.

Analytical Rules:

- This is a productivity indicator that will be used to assess the success of the supplementation program.
- Type I Error of 0.05.

Monitoring Indicators: Natural Environment

Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.

The survival advantage from the hatchery (i.e., egg-to-smolt) must be sufficient to produce a greater number of returning adults than if broodstock were left to spawn naturally. If a hatchery program cannot produce a greater number of adults than naturally spawning fish, then the program should be modified or discontinued. Production levels were initially developed using historical run sizes and smolt-to-adult survival rates (BAMP 1998). Using the stock specific NRR and agreed upon target values (e.g. values listed in the BAMP or derived from other sources), comparisons to actual survival rates will be made to ensure the expected level of survival has been achieved.

3.1 Hatchery Replacement Rates (HRRs) (*Monitoring Indicator*)

Monitoring Questions:

Q3.2.1: Is the adult-to-adult survival rate of hatchery fish (HRR) greater than or equal to the adult-to-adult survival rate (NRR) of naturally produced fish?

Q3.2.2: Is the adult-to-adult survival rate of hatchery fish (HRR) greater than or equal to the Target Value[8]?

Target Species/Populations:

- Q3.2.1 applies to all conservation stocks.
- Q3.2.2 applies to all stocks.

Statistical Hypothesis 3.2.1:

- $Ho_{3.2.1.1}$: $HRR_{\text{Year x}} \geq NRR_{\text{Year x}}$

Statistical Hypothesis 3.2.2:

- $Ho_{3.2.2.1}$: HRR ≥ Target Value

Measured Variables:

- Number of hatchery and naturally produced fish on spawning grounds.
- Number of hatchery and naturally produced fish harvested.
- Number of hatchery and naturally produced fish collected for broodstock.
- Number of broodstock used by brood year (hatchery and naturally produced fish).

Derived Variables:

- Number of hatchery and naturally produced adults by brood year (≥age-3).
- HRR (number of returning adults per brood year/broodstock)
- NRR (from Objective 1)

[8] Target values may be adjusted by the hatchery committees.

- Appendix 2: HRR targets

Spatial/Temporal Scale:
- Calculate annually based on brood year.
- Time series.

Possible Statistical Analysis:
- For Q3.2.1 use graphic analysis and paired-sample quantile tests to compare HRR to NRR
- For Q3.2.2 use graphic analysis and one-sample quantile tests to compare HRR to the target value.
- On a five-year period, correlate HRRs with extraneous factors such as ocean productivity indices.

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.

4.1 Attainment of proportion of hatchery-origin spawners (pHOS or PNI) target (*Monitoring Indicator*)

Monitoring Questions:

Q4.1.1: Is the estimated proportion of hatchery-origin spawners (pHOS) less than or equal to the management target, and/or, is the estimated Percent Natural Influence (PNI) greater than or equal to the management target?

Target Species/Populations:
- Q4.1.1 applies to all conservation and safety-net stocks that have a defined pHOS or PNI target or sliding scale.

Statistical Hypothesis 4.1.1:
- $Ho_{4.1.1.1}$: pHOS > target value or $PNI_{\text{Supplemented population}}$ < target value

Measured Variables:
- Number of hatchery and naturally produced fish on spawning grounds

Derived Variables:
- pHOS or PNI
- Appendix 3: PNI and pHOS targets and sliding scales (as applicable)

Spatial/Temporal Scale:

- Calculate annually.
- Analyzed as time series.

Possible Statistical Analysis:

- Use graphic analysis and summary statistics to compare pHOS or PNI to the target value.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.

Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.

Strategies for conservation programs typically intend that hatchery and naturally produced fish spawn together and in similar locations. However, in some cases, strategies may differ from this paradigm (e.g., summer Chinook salmon in the Methow River). Run (migration) timing, spawn timing, and spawning distribution may be affected via phenotypic plasticity or selection resulting from the hatchery environment (i.e., domestication). If conservation programs do not adequately represent the genetic diversity of the natural population, and if phenotypic traits in supplementation fish related to fitness deviate from the naturally produced spawning population, the goals of supplementation may not be achieved. Hatchery adults that migrate and/or spawn at different times or are spatially segregated from naturally produced fish may be subject to reduced fitness. Hatchery adults that spawn at different times or locations than naturally produced fish would be reproductively isolated from the natural population. The extent of such isolation, ranging from no isolation to substantial isolation, may be exploited for management purposes in some cases.

5.1 Migration Timing (*Monitoring Indicator*)

Monitoring Questions:

Q5.1.1: Is the migration timing of hatchery and naturally produced fish from the same age class similar?

Target Species/Populations:

- Q5.1.1 applies to all conservation stocks.

Statistical Hypotheses 5.1.1:

- $Ho_{5.1.1.1}$: Migration timing $_{\text{Hatchery Age X}}$ = Migration timing $_{\text{Naturally produced Age X}}$
- $Ho_{5.1.1.2}$: The cumulative frequency of migration timing of hatchery-origin fish = the cumulative frequency of migration timing of natural-origin fish.
- $Ho_{5.1.1.3}$: The 10^{th} percentile, 50^{th} percentile (mode), 90^{th} percentile, and mean migration timing of hatchery-origin fish = the 10^{th} percentile, 50^{th} percentile (median), 90^{th} percentile, and mean migration timing of natural-origin fish.

Measured Variables:

- Ages of hatchery and naturally produced fish sampled via pit tags or stock assessment monitoring.
- Time (Julian date) of arrival at mainstem projects and within tributaries (e.g., traps, PIT arrays) with the intent to identify biologically significant differences.

Derived Variables:

- Mean Julian date for a given age class.

Spatial/Temporal Scale:

- Calculate annually based on return year and age class.
- Time series.

Possible Statistical Analysis:

- Use graphic analyses (cumulative frequency polygons), paired t-tests, Aspin-Welch tests, and randomization tests.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

5.2 Timing of Spawning (*Monitoring Indicator*)

Monitoring Questions:

Q5.2.1: Is the timing of spawning similar for conservation hatchery and naturally produced fish?

Target Species/Populations:

- Q5.2.1: Applies to all semelparous species and populations supplemented by conservation programs. Steelhead can only be assessed for natural spawning in situations where hatchery and natural origin fish can be appropriately marked and detected.

Statistical Hypotheses 5.2.1:

- $Ho_{5.2.1.1}$: The cumulative frequency of spawn timing of hatchery-origin fish = the cumulative frequency of spawn timing of natural-origin fish.
- $Ho_{5.2.1.2}$: The 10^{th} percentile, 50^{th} percentile (mode), 90^{th} percentile, and mean spawn timing of hatchery-origin fish = the 10^{th} percentile, 50^{th} percentile (mode), 90^{th} percentile, and mean spawn timing of natural-origin fish.

Measured Variables:

- Time (Julian date) of hatchery and naturally produced salmon carcasses or marked steelhead detected on spawning grounds within defined reaches.
- Time (Julian date) of ripeness of hatchery and natural origin steelhead captured for broodstock.

Derived Variables:

- Mean Julian date.

Spatial/Temporal Scale:

- Calculate annually based on return year.
- Time series.

Possible Statistical Analysis:

- Use graphic analyses (cumulative frequency polygons), paired t-tests, Aspin-Welch tests, and randomization tests.
- ANCOVA with elevation as a covariate.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

5.3 Spatial Distribution of Redds (*Monitoring Indicator*)

Monitoring Questions:

Q5.3.1: Is the distribution of redds similar for conservation hatchery and naturally produced fish?

Q5.3.2: Is the distribution of redds similar to defined management targets?

Target Species/Populations:

- Q5.3.1 applies to all conservation program stocks.
- Q5.3.2 applies only to conservation program stocks with specific spawning distribution targets (Table 5.3.1).

Statistical Hypothesis 5.3.1:

- $Ho_{5.3.1.1}$: The distribution of hatchery-origin redds (hatchery females) = the distribution of natural-origin redds (natural-origin females).

Statistical Hypothesis 5.3.2:

- $Ho_{5.3.2.1}$: The distribution of hatchery-origin redds (hatchery females) = the target distribution identified in Tables 5.3.1.

Measured Variables:

- Location (GPS coordinate) of female salmon carcasses observed on spawning grounds. The distribution of hatchery and naturally produced steelhead redds may be evaluated if marking or tagging efforts provide reasonable results.

Derived Variables:

- Location of female salmon carcass at the historic reach scale and at the 0.1 km scale.

- Calculate percent overlap in distribution across available spawning habitat or historical reaches.
- Appendix 4: Management targets for spatial distribution of spawners or redds (as applicable).

Spatial/Temporal Scale:
- Calculate annually based on return year.
- Time series.

Possible Statistical Analysis:
- Use graphic analysis and Yates' Chi-square analysis for both Q5.3.1 and Q5.3.2.

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

Objective 6: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.

Maintaining locally adapted traits among independent fish populations requires that returning hatchery fish have a high rate of site fidelity to the target stream. Hatchery practices (e.g., imprinting on water source at key life history stages, release methodology, release location, age at return, and environmental conditions) are the main variables thought to affect stray rates. Regardless of the magnitude or homing of adult returns, if adult hatchery fish do not contribute to the natural population the program will not meet the basic condition of a supplementation program. Independent populations are populations that are genetically differentiated from other populations. In some cases, genetic differentiation may be assumed based on phenotypic traits or geographic isolation when molecular genetics analyses are not available. When populations are not independent, straying among them does not pose a risk of genetic homogenization. In addition, stray rates of hatchery-origin fish cannot be expected to be lower than for natural-origin fish. When estimates of stray rates for natural-origin fish are available and if they exceed the 5% or 10% thresholds identified in this plan, analysis and interpretation of stray rates must take into account the concept that hatchery programs may be held to unattainable standards based on the natural stray rate. Current criteria established by the ICBTRT (2005) and the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (2007) indicate that fish that do stray to other non-target populations should not comprise greater than 5% of the non-target spawning population. Likewise, fish that stray into non-target spawning areas within an independent population should not comprise greater than 10% of the non-target spawning aggregate (see Tables 6.1 and 6.2).

6.1.1 Stray Rates among Populations by Brood Return (*Monitoring Indicator*)

Monitoring Questions:

Q6.1.1: Is the stray rate of hatchery fish less than 5% for the total brood return?

Target Species/Populations:

- Q6.1.1 applies to all hatchery stocks.

Statistical Hypothesis 6.1.1:

- $Ho_{6.1.1.1}$: Stray rate of hatchery fish ≥ 5% of total hatchery brood return

Measured Variables:

- Number of hatchery carcasses found in non-target and target spawning areas or number of returning spawners counted via PIT-tag detection or at weirs in close temporal proximity to spawning areas.
- Number of hatchery fish collected for broodstock.
- Number of hatchery fish taken in fishery.
- Locations of live and dead strays (used to tease out overshoot).

Derived Variables:

- Total number of hatchery carcasses and take in fishery estimated from expansion analysis.
- Percent of the total brood return that strays.
- Appendix 5: Reciprocal stray rates

Spatial/Temporal Scale:

- Calculate annually based on brood year.
- Time series.

Possible Statistical Analysis:

- Use graphical analysis and one-sample quantile tests to compare the estimated stray rate with the target (5%) stray rate.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

6.2 Stray Rates among Populations by Return Year (*Monitoring Indicator*)

Monitoring Questions:

Q6.2.1: Do hatchery strays make up less than 5% of the spawning escapement within other non-target independent populations?

Target Species/Populations:

- Q6.2.1 applies to all hatchery stocks.

Statistical Hypothesis 6.2.1:

- $Ho_{6.2.1.1}$: Stray hatchery fish make up ≥ 5% of the spawning escapement (based on run year) within other independent populations [9]

Measured Variables:

- Number of hatchery carcasses (PIT-tagged steelhead) found in non-target and target spawning areas or number of returning spawners counted via PIT-tag detection or at weirs in close temporal proximity to spawning areas.

Derived Variables:

- Total number of hatchery salmon carcasses (PIT-tagged steelhead, spawners counted at weirs) estimated from expansion analysis.
- Percent of the non-target population that is made up of hatchery strays.
- Appendix 5: Reciprocal stray rates

Spatial/Temporal Scale:

- Calculate annually based on return year.
- Time series.

Possible Statistical Analysis:

- Use graphical analysis and one-sample quantile tests to compare the estimated stray rate with the target (5%) stray rate.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

6.3 Stray Rates among Spawning Areas within the Population (*Monitoring Indicator*)

Monitoring Questions:

Q6.3.1: Do hatchery strays make up less than 10% of the spawning aggregate within non-target spawning areas within the target population?[10]

Target Species/Populations:

- Q6.3.1 applies to all hatchery stocks.

Statistical Hypothesis 6.3.1:

- $Ho_{6.3.1}$: Stray hatchery fish make up ≥ 10% of spawning escapement (based on run year) within non-target spawning areas within the target population

[9] This stray rate is suggested based on a literature review and recommendations by the ICBTRT (2005). It can be re-evaluated as more information on naturally-produced Upper Columbia salmonids becomes available. This will be evaluated on a species and program specific basis and decisions made by the HCP HC. It is important to understand the actual spawner composition of the population to determine the potential effect of straying.

[10] The value of 10% should be reviewed by the Hatchery Committee. See footnote 3 for additional information.

Measured Variables:

- Number of hatchery carcasses (possibly PIT-tagged steelhead) found in non-target and target spawning aggregates or number of returning spawners counted via PIT-tag detection or at weirs in close temporal proximity to spawning areas.

Derived Variables:

- Total number of hatchery salmon carcasses (possibly PIT-tagged steelhead or spawners counted at weirs) estimated from expansion analysis.
- Percent of the non-target spawning aggregate that is made up of hatchery strays.
- Appendix 5: Reciprocal stray rates

Spatial/Temporal Scale:

- Calculate annually based on return year.
- Time series.

Possible Statistical Analysis:

- Use graphical analysis and one-sample quantile tests to compare the estimated stray rate with the target (10%) stray rate.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

Monitoring Indicators: Population Genetics

Objective 7: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program.

The genetic component of the M&E Plan specifically addresses the potential for changes in genetic diversity in natural populations as a result of a hatchery program(s). The long-term fitness of populations is assumed to be related to maintaining the genetic diversity of natural populations. However, hatchery programs select a subset of individuals from the population to pass on genetic material to the next generation. This is often a relatively small number of individuals that produce a large number of offspring, and can result in changes in allele frequencies and reductions of effective population size. Therefore it is important to monitor the genetic status of the natural populations to determine if there are signs of changes in genetic distance among populations, changes in allele frequencies, and to estimate effective population size. Assessing the genetic effects of the hatchery program does not require annual sampling. Meeting stray-rate targets (hypotheses tested under Objective 5) should reduce significant changes in population genetics. Stray rates may inform population genetic analyses. Testing statistical hypotheses associated with genetic components (Hypotheses 3.1, 3.2, and 3.3) should be conducted every ten years or two generations.

7.1 Allele Frequency (*Monitoring Indicator*)

Monitoring Questions:

Q7.1.1: Is the allele frequency of hatchery fish similar to the allele frequency of naturally produced and donor fish?

Target Species/Populations:

- Q7.1.1 applies to all conservation stocks.

Statiscial Hypotheses 7.1.1:

- $Ho_{7.1.1.1}$: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Donor pop.}}$
- $Ha_{7.1.1.1}$: Allele frequency $_{\text{Hatchery}}$ ≠ Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Donor pop.}}$ or
- $Ha_{7.1.1.1}$: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Naturally produced}}$ ≠ Allele frequency $_{\text{Donor pop.}}$ or
- $Ha_{7.1.1.1}$: Allele frequency $_{\text{Hatchery}}$ ≠ Allele frequency $_{\text{Naturally produced}}$ ≠ Allele frequency $_{\text{Donor pop.}}$

Measured Variables:

- Microsatellite genotypes or SNP genotypes, as appropriate

Derived Variables:

- Allele frequency

Spatial/Temporal Scale:

- Analyze as a time series, initially comparing pre- and post-hatchery samples and thereafter every 10 years.
- Compare samples within drainages.

Possible Statistical Analysis:

- Population differentiation tests, analysis of molecular variance (AMOVA), and relative genetic distances.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

7.2 Genetic Distances Between Populations (*Monitoring Indicator*)

Monitoring Questions:

Q7.2.1: Does the genetic distance among subpopulations within a supplemented population remain the same over time?

Target Species/Populations:

- Q7.2.1 applies to all conservation and safety-net stocks.

Statistical Hypothesis 7.2.1:

- $Ho_{7.2.1.1}$: Genetic distance between subpopulations $_{\text{Year x}}$ = Genetic distance between subpopulations $_{\text{Year y}}$

Measured Variables:

- Microsatellite genotypes or SNP genotypes

Derived Variables:

- Allele frequencies

Spatial/Temporal Scale:

- Analyze as a time series, initially comparing pre- and post-hatchery samples and thereafter every 10 years.
- Compare samples among spawning aggregates.

Possible Statistical Analysis:

- Population differentiation tests, AMOVA, and relative genetic distances.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

7.3 Effective Spawning Population (*Monitoring Indicator*)

Monitoring Questions:

Q7.3.1: Is the ratio of effective population size (N_e) to spawning population size (N) constant over time?

Target Species/Populations:

- Q7.3.1 applies to all supplemented stocks.

Statistical Hypothesis 3.3:

- $Ho_{7.3.1.1}$: $(N_e/N)_{t0} = (N_e/N)_{t1}$ for each population

Measured Variables:

- Microsatellite genotypes or SNP genotypes

Derived Variables:

- Allele frequencies

Spatial/Temporal Scale:

- Analyze as a time series, initially comparing pre- and post-hatchery samples and thereafter every 10 years.

Possible Statistical Analysis:

- Population differentiation tests, relative genetic distances, statistics to calculate effective population size (e.g., harmonic means).

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

Monitoring Indicators: Phenotypic Traits

Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

Fitness, or the ability of individuals to survive and pass on their genes to the next generation in a given environment, includes genetic, physiological, and behavioral components.[11] Maintaining the long-term fitness of supplemented populations requires a comprehensive evaluation of genetic and phenotypic characteristics. Evaluation of some phenotypic traits (i.e., run timing, spawn timing, spawning location, and stray rates) is addressed under Objective 5. Objective 8 assess the potential effects of domestication, including size at maturity, age at maturity, sex ratio, and fecundity. Age and size at maturity shall be assessed for both fish arriving in the Columbia system, and those recovered on the spawning grounds. Size (or age) selective mortality during migration through the Columbia system, such as through fisheries, could alter the age and size of fish on the spawning grounds.

8.1 Age at Maturity (*Monitoring Indicator*)

Monitoring Questions:

Q8.1.1: Is the age at maturity of hatchery and naturally produced fish similar at the time they enter the Columbia River and when they spawn?

Target Species/Populations:

- Q8.1.1 applies to all conservation program stocks.

Statistical Hypotheses 8.1.1:

- $Ho_{8.1.1.1}$: Age at Maturity $_{\text{Hatchery produced spawners Gender X}}$ = Age at Maturity $_{\text{Naturally produced spawners Gender X}}$
- $Ho_{8.1.1.2}$: Age at Maturity $_{\text{All hatchery produced adults Gender X}}$ = Age at Maturity $_{\text{All naturally produced adults Gender X}}$

Measured Variables:

- Total and salt (ocean) age of hatchery and naturally produced salmon carcasses collected on spawning grounds.
- Total and salt age of broodstock.
- Total and salt age of fish at stock assessment locations (e.g., Dryden, Tumwater, Wells, Priest Rapids).
- Whenever possible, age at maturity will be measured at weirs or dams near the spawning stream to avoid the size-related carcass recovery bias on spawning grounds (carcass sampling).
- Assess age of fish, including harvested fish.

[11] These metrics are difficult to measure, and phenotypic expression of these traits may be all we can measure and evaluate.

Derived Variables:

- Total age and saltwater age
- Age of fish entering the Columbia River.

Spatial/Temporal Scale:

- Calculate annually based on brood year.
- Time series.

Possible Statistical Analysis:

- Use graphic analysis and Yates' Chi-square.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

8.2 Size at Maturity (*Monitoring Indicator*)

Monitoring Questions:

Q8.2.1: Is the size (length) at maturity of a given age and sex of hatchery fish similar to the size at maturity of a given age and sex of naturally produced fish?

Target Species/Populations:

- Q8.2.1 applies to all conservation and safety-net stocks.

Statistical Hypothesis 8.2.1:

- $Ho_{8.2.1.1}$: Size (length) at Maturity $_{\text{Hatchery Age X and Gender Y}}$ = Size (length) at Maturity $_{\text{Naturally produced Age X and Gender Y}}$
- $Ho_{8.2.1.2}$: Size (length) at Maturity $_{\text{All hatchery adults Gender X}}$ = Size (length) at Maturity $_{\text{All naturally produced adults Gender X}}$

Measured Variables:

- Size (length), age, and gender of hatchery and naturally produced salmon carcasses collected on spawning grounds.
- Size (length), age, and gender of broodstock.
- Size (length), age, and gender of fish at stock assessment locations (e.g., Priest Rapids, Dryden, Tumwater, Wells, Twisp Weir).
- Whenever possible size at maturity will be measured at weirs or dams near the spawning stream to avoid the size-related carcass recovery bias on spawning grounds (carcass sampling).

Derived Variables:

- Total age and saltwater age

Spatial/Temporal Scale:

- Calculate annually based on brood year.
- Time series.

Possible Statistical Analysis:

- Use graphic analysis and three-way ANOVA by origin, gender, and age

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

8.3 Fecundity at Size (*Monitoring Indicator*)[12]

Monitoring Questions:

Q8.3.1: Is the fecundity vs. size relationship of hatchery and naturally produced fish similar?

Q8.3.2: Is the gonadal mass vs. size relationship of hatchery and naturally produced fish similar?

Target Species/Populations:

- Both Q8.3.1 and Q8.3.2 apply to all conservation stocks using both natural- and hatchery-origin broodstock.

Statistical Hypothesis 8.3.1:

- $Ho_{8.3.1.1}$: Slope of Fecundity vs. Size $_{Hatchery}$ = Slope of Fecundity vs. Size $_{Naturally\ produced}$

Statistical Hypothesis 8.3.2:

- $Ho_{8.3.2.1}$: Gonadal Mass vs. Size $_{Hatchery}$ = Gonadal Mass vs. Size $_{Naturally\ produced}$

Measured Variables:

- Length, weight, and age (covariate) of hatchery and natural-origin broodstock after eggs have been removed.
- Number and weight of eggs

Derived Variables:

- Total age and saltwater age.
- Mean weight per egg.

Spatial/Temporal Scale:

- Calculate annually based on brood year.
- Time series.

Possible Statistical Analysis:

[12] May not apply to all programs.

- Use graphic analysis, regression, t-test, and ANCOVA.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

8.4 Sex Ratio (*Monitoring Indicator*)

Monitoring Questions:

Q8.4.1: Is the sex ratio of hatchery and naturally produced fish similar?

Target Species/Populations:

- Q8.4.1 applies to all conservation stocks.

Statistical Hypothesis 8.4.1:

- $Ho_{8.4.1.1}$: Sex Ratio $_{\text{Hatchery}}$ = Sex Ratio $_{\text{Naturally produced}}$

Measured Variables:

- Age and sex of hatchery and naturally produced salmon carcasses collected on spawning grounds or sampled at dams or weirs.
- Whenever possible sex ratio will be measured at weirs or dams near the spawning stream to avoid the size-related carcass recovery bias on spawning grounds (carcass sampling or ultrasound on live fish).

Derived Variables:

- Ratio of sexes based on brood year returns

Spatial/Temporal Scale:

- Calculate annually based on brood year.
- Time series.

Possible Statistical Analysis:

- Use graphic analysis and Yates'Chi-square.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

Monitoring Indicators: Hatchery Environment

Objective 9: Determine if hatchery fish were released at the programmed size and number.

The HCP outlines the number and size of fish that are to be released to meet NNI and inundation compensation levels. The size of the fish at release may be altered according to an adaptive management process in the Hatchery Committee(s), and the number of fish can be altered by survival study results and adjustment of hatchery production for population dynamics. Size of fish at release can affect survival, sex ratios, age at return, stray rate, and fecundity. In addition, the variation in size at release may affect performance of the fish. The coefficient of variation (CV) will be evaluated to ascertain if program performance is related to variation in size at release. Note also that variation in a population is a natural condition and striving to control this variation could result in directional or stabilizing artificial selection that could have unforeseen long-term consequences. Attaining uniform or multi-modal growth in a hatchery environment may not be adaptive for fitness in the wild. Therefore, pursuit of a CV target should be seen as an informative exercise, but is not in itself indicative of success or failure of a hatchery program. Furthermore, growth regimes may prove to be important in affecting adult returns and age structure. Although many factors can influence both the size and number of fish released, past hatchery cultural experience with these stocks should assist in meeting program production levels. Table 9.1 presents the target size at release and CVs for the programs. These targets shall be assessed annually to ensure they are optimized to inform management decisions.

9.1 Size at Release of Hatchery Fish (*Monitoring Indicator*)

Monitoring Questions:

Q9.1.1: Is the size (length and weight) of hatchery fish released equal to the program goal?

Target Species/Populations:

- Q9.1.1 applies to all hatchery stocks.

Statistical Hypothesis 9.1.1:

- $Ho_{9.1.1.1}$: Hatchery fish $_{\text{Size at release}}$ = Programmed $_{\text{Size at release}}$

Measured Variables:

- Fork length and weights of random samples of hatchery juveniles at release.

Derived Variables:

- Mean length (FL) and mean weight
- Appendix 6: Rearing targets

Spatial/Temporal Scale:

- Calculate annually.
- Time series.

Possible Statistical Analysis:

- Use graphic analysis and descriptive statistics to compare the estimated size of hatchery fish at time of release with the program goal.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.

9.2 Coefficient of Variation (CV) of Hatchery Fish Released (*Monitoring Indicator*)

Monitoring Questions:

Q9.2.1: Is the CV of hatchery fish released equal to the program target?

Target Species/Populations:

- Q9.2.1 applies to all hatchery stocks.

Statistical Hypothesis 9.2.1:

- $Ho_{9.2.1.1}$: Hatchery fish $CV_{\text{at release}}$ = Programmed CV

Measured Variables:

- Length and weights of random samples of hatchery smolts.

Derived Variables:

- Coefficient of Variation: $cv = (1 + 1/4n) \times s/x$ (where s = standard deviation, x = estimated mean, n = sample size)
- Appendix 6: Rearing targets

Spatial/Temporal Scale:

- Calculate annually.
- Time series.

Possible Statistical Analysis:

- Use graphic analysis and descriptive statistics to compare the estimated CV of size of hatchery fish released with the program goal.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.

9.3 Condition Factor (K) of Hatchery Fish Released (*Monitoring Indicator*)

Monitoring Questions:

Q9.3.1: Is the K of hatchery fish released equal to the program target?

Target Species/Populations:

- Q9.3.1 applies to all hatchery stocks.

Statistical Hypothesis 9.3.1:

- $Ho_{9.3.1.1}$: Hatchery fish $K_{\text{at release}}$ = Programmed K

Measured Variables:

- Monthly individual lengths and weights of random samples of hatchery juveniles.

Derived Variables:

- Condition Factor: $K = W/L^3 \times 10^5$

Spatial/Temporal Scale:

- Calculate annually.
- Time series.

Possible Statistical Analysis:

- Use graphic analysis and descriptive statistics to compare the estimated K of released hatchery fish with the program goal.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

9.4 Number of Hatchery Fish (*Monitoring Indicator*)

Monitoring Questions:

Q9.4.1: Is the number of hatchery fish released equal to the program goal?

Target Species/Populations:

- Q9.4.1 applies to all hatchery stocks.

Statistical Hypothesis 9.4.1:

- $Ho_{9.4.1.1}$: Hatchery Fish Number = Programmed Number

Measured Variables:

- Numbers of smolts released from the hatchery.

Derived Variables:

- Appendix 6: Rearing targets

Spatial/Temporal Scale:

- Calculate annually.
- Time series.

Possible Statistical Analysis:

- Use graphic analysis and one-sample quantile tests to compare the estimated number of hatchery fish released with the program goal.

Analytical Rules:

- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

Monitoring Indicators: Harvest

Objective 10: Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.

Harvest will be applied to different types of programs in an effort to achieve the management objectives of those programs. Programs designed to augment harvest should routinely contribute to harvest at a rate that greatly reduces the incidence of straying to natural spawning grounds, but also allows the program to be sustained. Safety-net programs may be harvested as part of an adult management strategy to minimize excessive escapement of hatchery-origin fish to spawning grounds. Similarly, conservation programs may undergo harvest to manage returning adults, but the emphasis for these programs should be to achieve escapement goals. In all cases, harvest effort should not have the unintended consequence of removing excessive numbers of conservation or natural-origin fish. In years when the expected returns of hatchery adults are above the level required to meet program goals (i.e., supplementation of spawning populations and/or brood stock requirements), surplus fish may be available for harvest. The M&E Plan specifically addresses harvest and harvest opportunities upstream of Priest Rapids Dam. Harvest or removal of surplus hatchery fish from the spawning grounds may assist in reducing potential adverse ecological and genetic impacts to natural populations (e.g., loss of genetic variation within and between populations, loss of fitness, reduced effective population size, and density-dependent effects).

10.1 Harvest Rates (*Monitoring Indicator*)

Monitoring Questions:

Q10.1.1: Conservation Programs: Is the harvest on conservation hatchery fish at an appropriate level to manage natural spawning of conservation hatchery fish but low enough to sustain the hatchery program?

Q10.1.2: Safety-Net Programs: Is the harvest on conservation hatchery fish at an appropriate level to manage natural spawning of safety-net hatchery fish but low enough to sustain the hatchery program?

Q10.1.3: Is the harvest on hatchery fish produced from harvest-augmentation programs high enough to manage natural spawning but low enough to sustain the hatchery program?

Q10.1.4: Is the escapement of fish from conservation and safety-net programs in excess of broodstock and natural production[13] needs to provide opportunities for terminal harvest?

Target Species/Populations:

- Q10.1.1 applies to conservation programs.
- Q10.1.2 applies to safety-net programs.
- Q10.1.3 applies harvest augmentation programs.

[13] The current best estimates of carrying capacity (maximum recruits) will be used, as available.

- Q10.1.4 applies to conservation and safety-net programs..

Statistical Hypothesis 10.1.1:
- $Ho_{10.1.1.1}$: Harvest rate ≤ Maximum level to meet program goals

Statistical Hypothesis 10.1.2:
- $Ho_{10.1.2.1}$: Harvest rate ≤ Maximum level to meet program goals

Statistical Hypothesis 10.1.3:
- $Ho_{10.1.3.1}$: Escapement ≤ Maximum level to meet supplementation goals

Statistical Hypothesis 10.1.4:
- $Ho_{10.1.4.1}$: Harvest rate ≤ Maximum level to meet program goals

Measured Variables:
- Numbers of hatchery fish taken in harvest.
- Numbers of natural-origin fish taken in harvest.

Derived Variables:
- Total harvest by fishery estimated from expansion analysis.

Spatial/Temporal Scale:
- Calculated annually.
- Time series.

Possible Statistical Analysis:
- Use graphic analysis and one-sample quantile tests to compare the estimated harvest of hatchery fish with the program goal.

Analytical Rules:
- This is a monitoring indicator that will be used to support management decisions.
- Type I Error of 0.05.

Regional Objectives

Hatchery programs have the potential to increase diseases that typically occur at low levels in the natural environment (Objective 9). In addition, hatchery fish can reduce the abundance, size, or distribution of non-target taxa through ecological interactions (Objective 10). These are important objectives that will be monitored at a later time. Analytical rules will be established for these objectives before monitoring activities begin.

Objective 11: Determine if the incidence of disease has increased in the natural and hatchery populations.

The hatchery environment has the potential to amplify diseases that are typically found at low levels in the natural environment. Amplification could occur within the hatchery population (i.e., vertical and horizontal transmission) or indirectly from the hatchery effluent or commingling between infected and non-infected fish (i.e., horizontal transmission). Potential impacts to natural populations have not been extensively studied, but should be considered for programs in which the hatchery fish are expected to commingle with natural fish. This is particularly important for supplementation type programs. Specifically, the causative agent of bacterial kidney disease (BKD), *Renibacterium salmoninarum* (Rs), could be monitored at selected acclimation ponds, both in the water and fish, in which the risk and potential for transmission from the hatchery is highest. Although it is technologically possible to measure the amount of Rs in water or Rs DNA in smolts and adults non-lethally sampled, the biological meaning of these data are uncertain. Currently, the only metric available for M & E purposes is measuring the antigen level from kidney/spleen samples (i.e., ELISA, PCR). When available, non-lethal sampling may replace or be used in concert with lethal sampling.

Implementation of this objective will be conducted in a coordinated approach within the hatchery and natural environment. BKD management within the hatchery population (e.g., broodstock or juveniles) has the potential to reduce the prevalence of disease through various actions (e.g., culling or reduced rearing densities). BKD management must also take into account and support other relevant objectives of the M & E program (e.g., Hatchery Return Rate [HRR], number of smolts released). Hence, the goal of BKD management is to decrease the prevalence of disease and maintain hatchery production objectives (i.e., number and HRR).

As previously discussed, disease transmission from hatchery to naturally produced fish may occur at various life stages and locations. Of these, horizontal transmission from hatchery effluent, vertical transmission on the spawning grounds, and horizontal transmission in the migration corridor have been identified as disease interactions that could be examined under this objective, although others may also be relevant. Experimental designs addressing this objective may require technology not yet available, although in some instances samples may be collected, but not analyzed until a link can be established between bacteria levels in samples and disease prevalence.

Developing a complete set of questions and hypotheses statements for this objective may not be practical at this time, because there is currently no BKD Management Plan. However, while developing experimental designs for this objective, it may be feasible to incorporate both hatchery and natural environment monitoring under a single study design. Integration of the different aspects of the objective would likely result in a more robust approach into understanding the effectiveness of disease management strategies.

Proposed Tasks:

T1: Assemble fish health data for fish used as brood (e.g., ELISA results).

T2: Conduct data exploration exercise to identify potential relationships between pathogen profiles and likely causative variables (e.g., rearing conditions and management actions).

T3: Develop hypotheses for potential testing to meet objective.

Objective 12: Determine if the release of hatchery fish affects non-target taxa of concern (NTTOC) within acceptable limits.

Ecological risks of Pacific salmon (spring, summer, and fall run Chinook, coho, and sockeye salmon) and steelhead trout hatchery programs operated between 2013 and 2023 in the Upper Columbia Watershed will be assessed using Delphi and modeling approaches. Committees composed of resource managers and public utility districts identified non-target taxa of concern (i.e., taxa that are not the target of supplementation), and acceptable hatchery impacts (i.e., change in population status) to those taxa. Biologists assembled information about hatchery programs, non-target taxa, and ecological interactions and this information will be provided to expert panelists in the Delphi process to facilitate assessment of risks and also used to populate the Predation, Competition, and Disease (PCD) Risk 1 model. Delphi panelists will independently estimate the proportion of a non-target taxa population that will be affected by each individual hatchery program. Estimates from each of the two approaches will be independently averaged, a measure of dispersion calculated (e.g., standard deviation), and subsequently compared to the acceptable hatchery impact levels that were determined previously by committees of resource managers and public utility districts. Measures of dispersion will be used to estimate the scientific uncertainty associated with risk estimates. Delphi and model results will be compared to evaluate the qualities of the two approaches. Furthermore, estimates of impacts from each hatchery program will be combined together to generate an estimate of cumulative impact to each non-target taxa.

The Hatchery Evaluation Technical Team (HETT) is currently addressing this objective. Work has been underway for several years. The study is expected to provide risk assessment using both an ecological modeling approach and a panel of expert opinion. These two methods will be compared to establish the potential to use modeling in place of expert panels to conduct such risk assessments in the future.

Adaptively Managing Using Monitoring and Evaluation Results

Because of naturally large variation in productivity indicators, several years of data may be required before statistical inferences can be made regarding the effects of hatchery fish on productivity of naturally produced fish. Furthermore, given the large natural variation of productivity indicators, productivity could increase or decrease as a result of the hatchery programs before a difference is detected statistically. In the interim, risk associated with supplementation programs and the productivity of naturally produced fish can be quantified based on observed natural variation in the indicator of interest (Table 1). If large differences in rates of change between supplemented and reference populations are observed, management actions may be required.

Assuming hatchery programs do not negatively affect the productivity of naturally produced fish, the observed difference in rates of change between the supplemented and reference populations should decrease over time as more of the natural variation within and between populations is incorporated into these data. More simply, as the number of years increases, the acceptable observed difference in the indicator(s) decreases. The value of the difference at any point in time would determine if management actions are warranted.

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Glossary

Term	Definition
Adult-to-Adult survival (Ratio)	The number of parent broodstock relative to the number of returning adults.
Age at maturity	The age of fish at the time of spawning (hatchery or naturally)
Augmentation	A hatchery strategy where fish are released for the sole purpose of providing harvest opportunities.
Broodstock	Adult salmon and steelhead collected for hatchery fish egg harvest and fertilization.
Donor population	The source population for supplementation programs before hatchery fish spawned naturally.
Effective population size (Ne)	The number of reproducing individuals in an ideal population (i.e., Ne = N) that would lose genetic variation due to genetic drift or inbreeding at the same rate as the number of reproducing adults in the real population under consideration (Hallerman 2003).
ESA	Endangered Species Act passed in 1973. The ESA-listed species refers to fish species added to the ESA list of endangered or threatened species and are covered by the ESA.
Expected value	A number of smolts or adults derived from survival rates agreed to in the Biological Assessment and Management Plan (BAMP 1998).
Extraction rate	The proportion of the spawning population collected for broodstock.
Genetic diversity	All the genetic variation within a species of interest, including both within and between population components.
Genetic stock structure	A type of assortative mating, in which the gene pool of a species is composed of a group of subpopulations, or stocks, that mate panmictically within themselves.
Genetic variation	All the variation due to different alleles and genes in an individual, population, or species.
HCP	Habitat Conservation Plan is a plan that enables an individual or organization to obtain a Section 10 Permit which outlines what will be done to “minimize and mitigate” the impact of the permitted take on a listed species.
HCP-HC	Habitat Conservation Plan Hatchery Committee is the committee that directs actions under the hatchery program section of the HCP’s for Chelan and Douglas PUDs.
HRR	Hatchery Replacement Rate is the ratio of the number of returning hatchery adults relative to the number of adults taken as broodstock, both hatchery and naturally produced fish (i.e., adult-to-adult replacement rate).
Long-term fitness	Long-term fitness is the ability of a population to self-perpetuate over successive generation.
Naturally produced	Progeny of fish that spawned in the natural environment, regardless of the origin of the parents.

Mean Ratio	The ratio between a treatment and control population, with the mean taken across a time period, such as years. Used in analysis in Before-After-Control-Impact studies.
Ne	Effective population size
Non-target taxa of concern (NTTOC)	Species, stocks, or components of a stock with high value (e.g., stewardship or utilization) that may suffer negative impacts as a result of a hatchery program.
NRR	Natural replacement rate is the ratio of the number of returning naturally produced adults relative to the number of adults that naturally spawned, both hatchery and naturally produced.
NTTOC	Non-target taxa of concern.
pHOS	Proportion of Hatchery Origin Spawners
PNI	Proportionate Natural Influence
pNOB	Proportion of Natural Origin Broodstock
Productivity	The capacity in which juvenile fish or adults can be produced.
Reference population	A population in which no directed artificial propagation is currently directed, although may have occurred in the past. Reference populations are used to monitor the natural variability in survival rates and out of basin impacts on survival.
SAR	Smolt-to-adult survival rate
SAR Smolt-to-adult survival rate (SAR)	Smolt-to-adult survival rate is a measure of the number of adults that return from a given smolt population.
Segregated	A type of hatchery program in which returning adults are spatially or temporally isolated from other populations.
Size-at-maturity	The length or weight of a fish at a point in time during the year in which spawning will occur.
Smolts per redd	The total number of smolts produced from a stream divided by the total number of redds from which they were produced.
Spawning Escapement	The number of adult fish that survive to spawn.
Stray rate	The rate at which fish spawn outside of natal rivers or the stream in which they were released.
Supplementation	A hatchery strategy where the main purpose is to increase the relative abundance of natural spawning fish without reducing the long-term fitness of the population.
Target population	A specific population in which management actions are directed (e.g., artificial propagation, harvest, or conservation).

Appendices

Appendix 1: Spawning escapement objectives for steelhead, spring- and summer-Chinook in the mid-Columbia River.

Appendix 2: HRR Targets

Appendix 3: PNI and pHOS Management Targets or Sliding Scales.

Appendix 4: Management Targets for the Spatial Distribution of Spawners or Redds.

Appendix 5: Reciprocal stray rate objectives for UCR summer steelhead and spring Chinook.

Appendix 6: Rearing Targets for PUD-Funded Hatchery Programs.

Appendix 7:

Methods for Identifying Reference Populations and Testing Differences in Abundance and Productivity between Reference Populations and Supplemented Populations: Chiwawa Spring Chinook Case Study

T. Hillman
A. Murdoch
T. Pearsons
M. Miller
G. Mackey

September 2011

An important goal of supplementation is to increase spawning abundance and natural-origin recruitment of the supplemented population, and not reduce the productivity of the supplemented population. Indeed, a successful supplementation program must increase spawning abundance and natural-origin recruitment to levels above those that would have occurred without supplementation. There are several methods that can be used to test the effects of supplementation programs on these population metrics. One important method is to compare the performance of population metrics (e.g., spawning abundance, natural-origin recruitment, and productivity) in the supplemented population to those in un-supplemented (reference) populations. By comparing supplemented populations to reference populations, one can determine if the supplementation programs benefit, harm, or have no effect on the supplemented populations. These comparisons, however, are only valid if the performance of the reference populations is similar to the performance of the supplemented population prior to the period of supplementation. If the performance of the two populations differs significantly before any supplementation occurs, then any results from comparing the two populations after supplementation will be suspect. It is therefore important to select reference populations that are as similar as possible to the supplemented populations.

One of the goals of the Conceptual Approach to Monitoring and Evaluating the Chelan County PUD Hatchery Programs (Murdoch and Peven 2005) is to use reference populations to analyze the potential effects of hatchery supplementation programs on natural-origin salmon and steelhead spawner abundance and productivity[14]. Murdoch and Peven (2005) identified specific objectives to evaluate the performance of the program. For example, Objective 1 determines if the supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population (supplemented population) relative to a reference population. Objective 7 determines if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity (e.g., number of juveniles per redd) of supplemented streams when compared to reference streams. The relevant questions tested under each objective are as follows:

[14] Productivity is defined as adult recruits per spawner, where recruits are the number of adults produced from a given brood year (i.e., spawners plus adults harvested).

Objective 1:

- Is the annual change in the number of natural-origin recruits produced from the supplemented populations greater than or equal to the annual change in natural-origin recruits in an un-supplemented population?
- Is the change in natural replacement rates within the supplemented population greater than or equal to the change in natural replacement rates in an un-supplemented population?

Objective 7:

- Is the change in numbers of juveniles (smolts, parr, or emigrants) per redd in the supplemented population greater than or equal to that in an un-supplemented population?[15]

In this paper, we describe methods used to identify suitable reference streams and statistical techniques that can be used to compare reference populations with supplemented populations. Although we apply the methods described in this paper to Chiwawa spring Chinook salmon (hereafter referred to as Chinook), the methods should also apply to steelhead and other supplemented salmon stocks in the Upper Columbia Basin.

Identification of Reference Populations

Reference populations are an important component of an effectiveness monitoring design because they provide the standard by which treatment conditions are compared (ISRP and ISAB 2005; Murdoch and Peven 2005; Galbreath et al. 2008). Selecting appropriate reference areas and maintaining them over long periods of time is needed to establish the effectiveness of supplementation programs.

We developed a three-step process for identifying suitable reference populations (Figure 1). Each step serves as a filter. That is, potential reference populations are evaluated based on specific criteria under each step. Populations that pass through each step are considered suitable reference populations for a specific supplemented population.

[15] In this paper we only address adult recruits, not juvenile recruits. This is because we were unable to find suitable reference populations for analysis of juveniles. However, the methods described in this paper would also apply to juveniles.

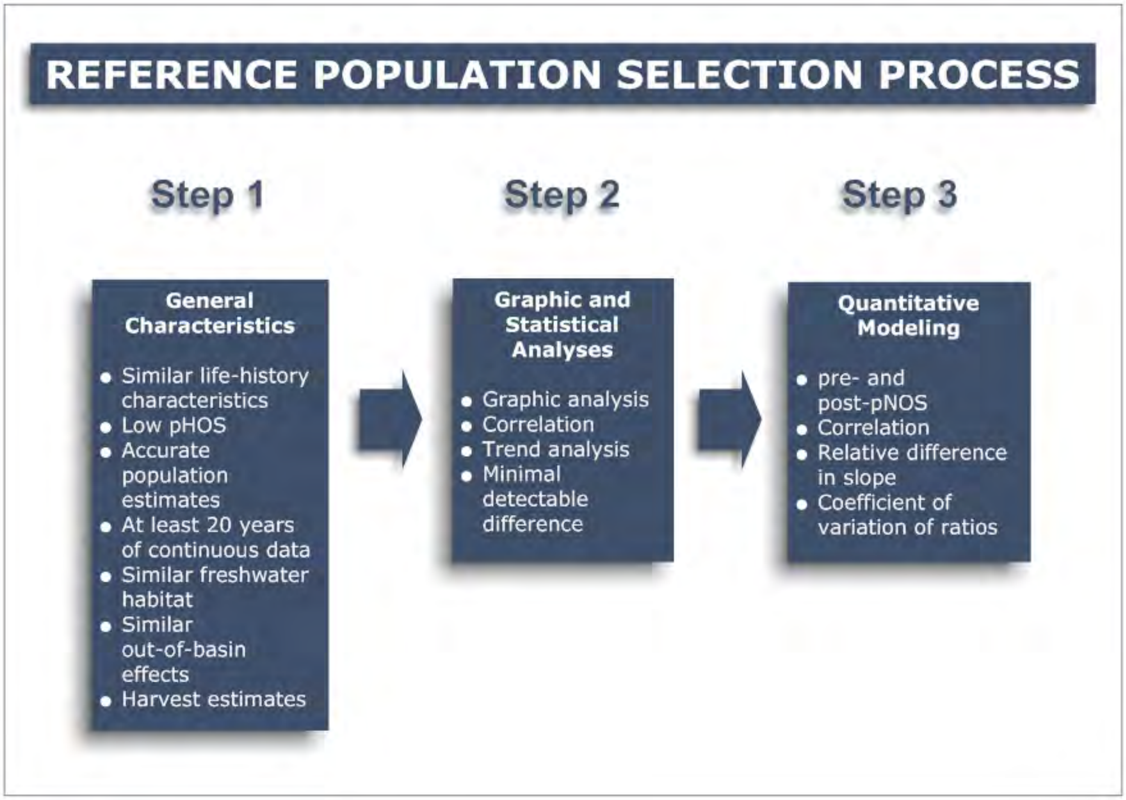

Figure 1. Criteria evaluated during each step in the process of identifying suitable reference populations.

Step 1: General Characteristics

Under step 1, potential reference populations are evaluated based on several general criteria. When compared to the supplemented population, potential reference populations should have:

- Similar life-history characteristics (e.g., run timing, migration characteristics, etc.).
- No or few hatchery fish in the reference area (pHOS < 10%).
- Accurate abundance estimates.
- Long time series of natural-origin abundance and productivity estimates (at least 20 years of continuous data).
- Similar trends in freshwater habitat.
- Similar out-of-basin effects (i.e., similar migration and ocean survivals).
- Harvest estimates for adjusting escapement estimates.

We used these criteria to begin the process of selecting suitable reference populations for the Chiwawa spring Chinook program. We began by identifying stream-type Chinook populations within the Columbia Basin. Galbreath et al. (2008; their Table 1) identified stream-type Chinook populations within the Columbia River Basin that may serve as suitable reference populations for hatchery programs. Supplementing their work with data from the NOAA Fisheries Salmon Population Summary Database, we identified 18 candidate stream-type Chinook populations that may serve as reference populations for the Chiwawa supplementation program (Table 1).

Table 1. Populations of stream-type Chinook salmon and their comparison to Chiwawa spring Chinook.

Population	Similar life-history	No or few hatchery fish	Accurate abundance estimates	Long time series (at least 20 years)	Similar freshwater habitat impairments	Similar out-of-basin effects	Comments
Deschutes River	Yes	Yes	Yes	Yes	No	No	
John Day mainstem	Yes	Yes	Yes	Yes	No	No	
Middle Fk John Day	Yes	Yes	Yes	Yes	No	No	
North Fk John Day	Yes	Yes	Yes	Yes	No	No	
Granite Creek	Yes	Yes	Yes	Yes	No	No	
Wenaha River	Yes	No	Yes	Yes	Yes	No	Hatchery strays (>10%)
Minam River	Yes	No	Yes	Yes	Yes	No	Hatchery strays (>10%)
Slate Creek	Yes	Yes	Yes	No	No	No	
Secesh River	Yes	Yes	Yes	Yes	Yes	No	
Middle Fk Salmon River	Yes	Yes	Yes	No	No	No	Fair productivity est.
Big Creek	Yes	Yes	Yes	Yes	No	No	
Camas Creek	Yes	Yes	Yes	Yes	No	No	Fair productivity est.
Loon Creek	Yes	Yes	Yes	Yes	No	No	Fair productivity est.
Sulphur Creek	Yes	Yes	Yes	Yes	No	No	
Bear Valley Creek	Yes	Yes	Yes	Yes	No	No	
Marsh Creek	Yes	Yes	Yes	Yes	Yes	No	
North Fk Salmon River	Yes	Yes	No	No	Yes	No	
Lemhi River	Yes	Yes	Yes	Yes	No	No	
East Fk Salmon River	Yes	No	Yes	Yes	No	No	Hatchery strays (>10%)
Valley Creek	Yes	No	Yes	Yes	No	No	Hatchery strays (>10%)
Chamberlain Creek	Yes	Yes	Yes	No	Yes	No	
Naches River	Yes	Yes	Yes	Yes	Yes	No	
Little Wenatchee River	Yes	No	Yes	Yes	Yes	Yes	Hatchery strays (>10%)
Entiat River	Yes	No	Yes	Yes	No	No	Hatchery release ending

We then assessed the accuracy and length of the series of abundance estimates. We assumed that abundance estimates generated from expanded redd counts or adjusted weir counts would compare well with estimates in the Chiwawa Basin, which were based on expanded redd counts. In addition, we looked for populations that had an abundance data series that extended from at least 1981 to present. Based on this analysis, we identified 18 populations with abundance estimates that could be compared to those from the Chiwawa Basin (Table 1).

Next, we determined if the potential reference populations came from watersheds with habitat conditions similar to those in the Chiwawa Basin. For this exercise, we searched recovery plans and draft recovery plans to identify tributary factors that limit Chinook abundance, productivity, and survival within the reference populations. We compared these factors with those limiting

Chinook salmon in the Chiwawa Basin. Based on this analysis, we identified eight populations with habitat impairments similar to those in the Chiwawa Basin (Table 1).

Finally, we examined the potential reference populations to see if they experienced out-of-basin effects similar to spring Chinook from the Chiwawa Basin. In this case, we compared the number of mainstem dams that each potential reference population passes during migration. Six of the potential reference populations pass less than six mainstem dams; the other populations pass eight mainstem dams (Table 1). Only the Little Wenatchee population passes seven dams, similar to the Chiwawa population.

In sum, there were no reference populations that matched the Chiwawa spring Chinook population on all the criteria identified above. Differential out-of-basin effects and freshwater habitat conditions prevented most reference populations from matching with Chiwawa spring Chinook. However, some of the potential reference populations were similar to the Chiwawa population on several criteria and warranted further investigation. We selected the following populations for further investigation: Sesech River, Marsh Creek, Naches River, Little Wenatchee, and Entiat River.

We included the Little Wenatchee because it is within the Wenatchee River basin and experiences similar out-of-basin effects and has the same climatic and environmental conditions as the Chiwawa. A confounding effect with the Little Wenatchee is that Chiwawa hatchery fish have strayed into the Little Wenatchee. However, straying of Chiwawa hatchery fish should decrease with the change in source water to the Chiwawa acclimation ponds in 2006. We also included the Entiat River because it is an adjacent basin to the Chiwawa and experiences similar climatic and environmental conditions. The spring Chinook hatchery program that has operated in the Entiat since 1975 has been discontinued. Therefore, this population offers a unique opportunity to compare the Chiwawa population to a population in which the hatchery program has been discontinued.

Step 2: Graphic and Statistical Analysis

Graphic Analysis

Although we were unable to find potential reference populations that matched with the Chiwawa population on all criteria considered under Step 1, spawner abundance, natural-origin recruits (NORs), and productivity of some of the potential reference populations may nevertheless track closely with the Chiwawa population. If the time series of abundance, NORs, and productivity of a potential reference population tracks closely with the abundance, NORs, and productivity of the Chiwawa population, the reference population may provide a reasonable reference condition for testing the effects of supplementation on the Chiwawa population.

Under Step 2, we used graphing techniques to examine the relationship of abundance, NORs, and productivity between the Chiwawa population and the five reference populations (Sesech River, Marsh Creek, Naches River, Little Wenatchee, and Entiat River). We compiled spawner abundance, NORs, and productivity data from local biologists and the NOAA Fisheries Salmon Population Summary Database. We then compared time series plots of spawner abundance, NORs, and productivity data of potential reference populations with the Chiwawa population (Figures 2, 3, and 4; plots on the left side of figures). The time series only included the period 1981 to 1992, which represented the period before supplementation of the Chiwawa population (pre-treatment period). We also plotted the relationship between the abundance, NORs, and productivity of each potential reference population to the Chiwawa population (Figures 2, 3, and 4; plots on right side of figures). These plots show whether the reference populations closely tracked the Chiwawa population. As a point of reference, data points that fall along the dashed line would represent a perfect relationship between the two populations (i.e., both populations have identical abundance, NORs, and productivity estimates). While a perfect relationship between two independent populations is unrealistic, a strong linear relationship between the two populations indicates populations with similar trends.

Based on analysis of spawner abundance, the Naches River time series tracked more closely with the abundance of Chiwawa spring Chinook than did the other potential reference populations. The poor relationship with the other potential reference streams was largely because of the relatively high abundance of Chiwawa spring Chinook during the mid-1980s. As with spawner abundance, analyses of NORs indicated a close relationship between the Naches and Chiwawa populations. The other potential reference populations tracked poorly with the Chiwawa. The analyses of productivity indicated close relationships between potential reference populations and the Chiwawa population. The Naches, Sesech, and Little Wenatchee populations tracked the closest with the Chiwawa population.

When analyzing the potential effects of a supplementation program on fish performance, it is common to transform the data to meet various assumptions of statistical analysis. The most common transformation used to adjust abundance, NORs, and productivity data is the natural logarithm (LN or $\log_e$). We therefore transformed the spawner abundance, NORs, and productivity data using LN and re-plotted the relationships between the potential reference populations and the Chiwawa population (Figures 5, 6, and 7). We added 1 to each observation before taking its logarithm to avoid taking the logarithm of 0, which is undefined (note that the LN of 1 is 0).

By transforming spawner abundance, NORs, and productivity data, most of the potential reference populations tracked more closely with the Chiwawa population. The Naches, Entiat, and Little Wenatchee abundance data tracked the closest with the Chiwawa abundance data (Figure 5). For NORs, Marsh Creek and the Little Wenatchee populations tracked the closest with the Chiwawa (Figure 6). For productivity, the Naches, Sesech, and Little Wenatchee tracked the closest with the Chiwawa (Figure 7).

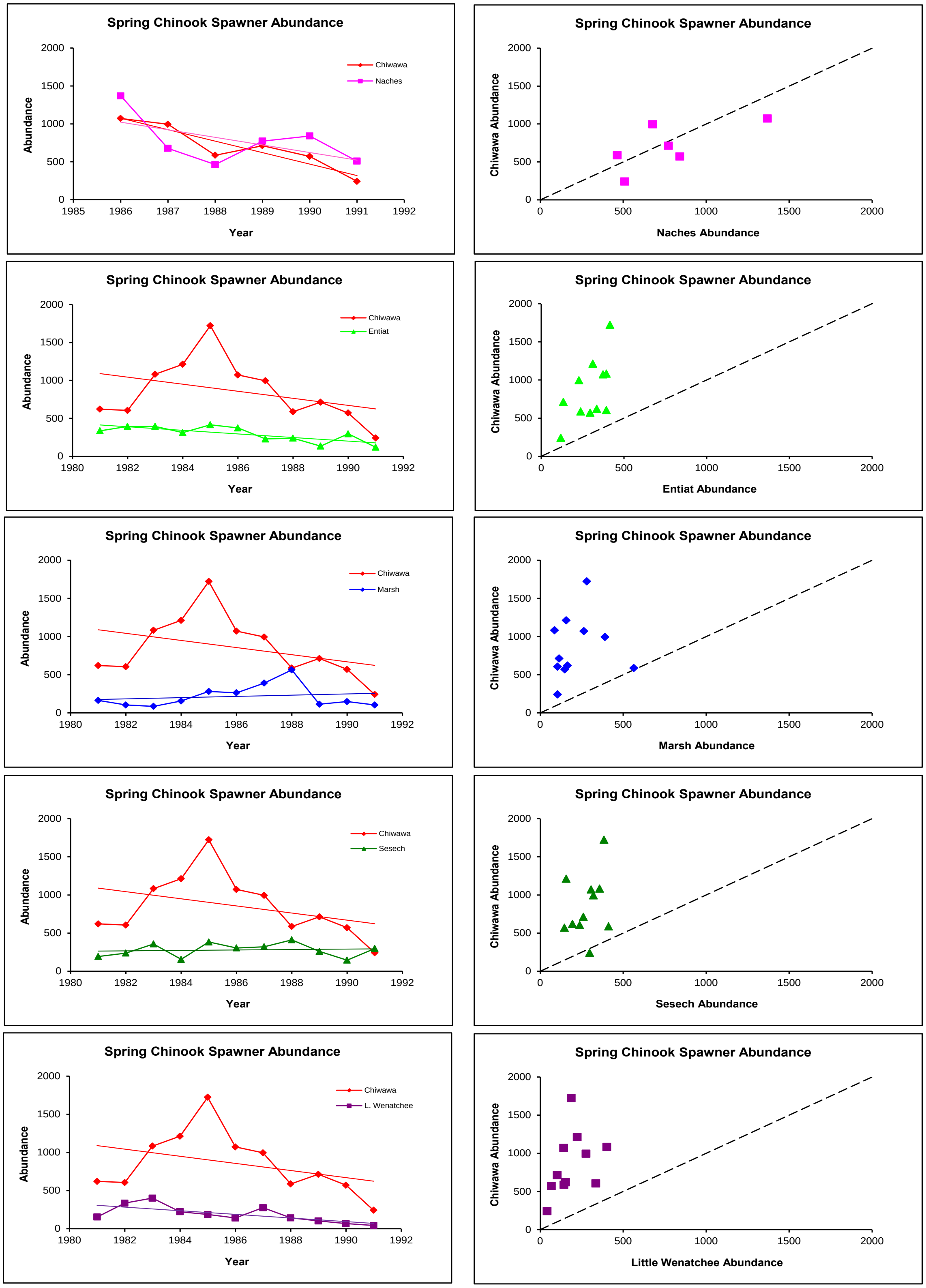

Figure 2. Time series of spawner abundance of potential reference populations and the Chiwawa spring Chinook population before the Chiwawa population was supplemented with hatchery fish.

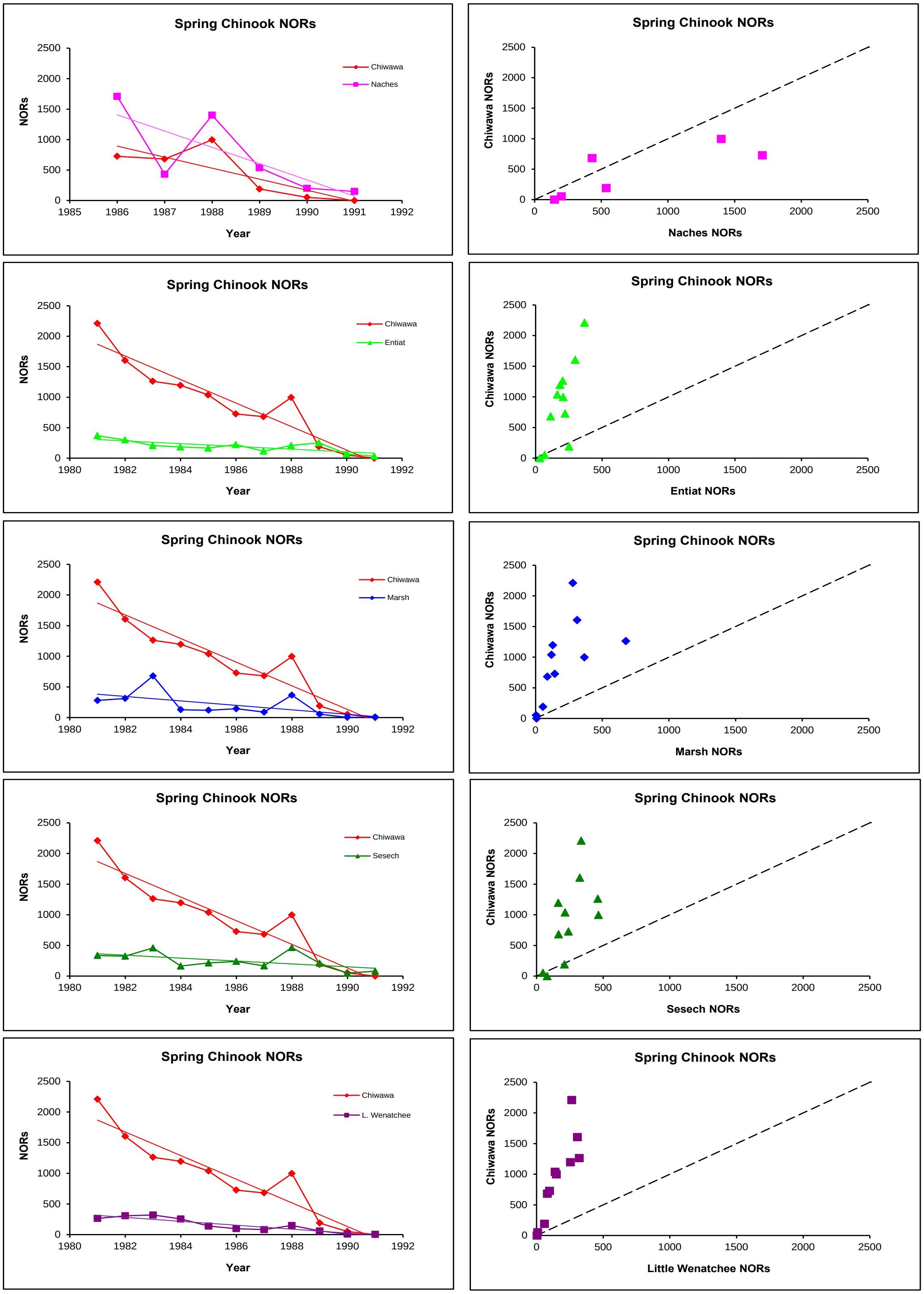

Figure 3. Time series of natural-origin recruits (NORs) of potential reference populations and the Chiwawa spring Chinook population before the Chiwawa population was supplemented with hatchery fish.

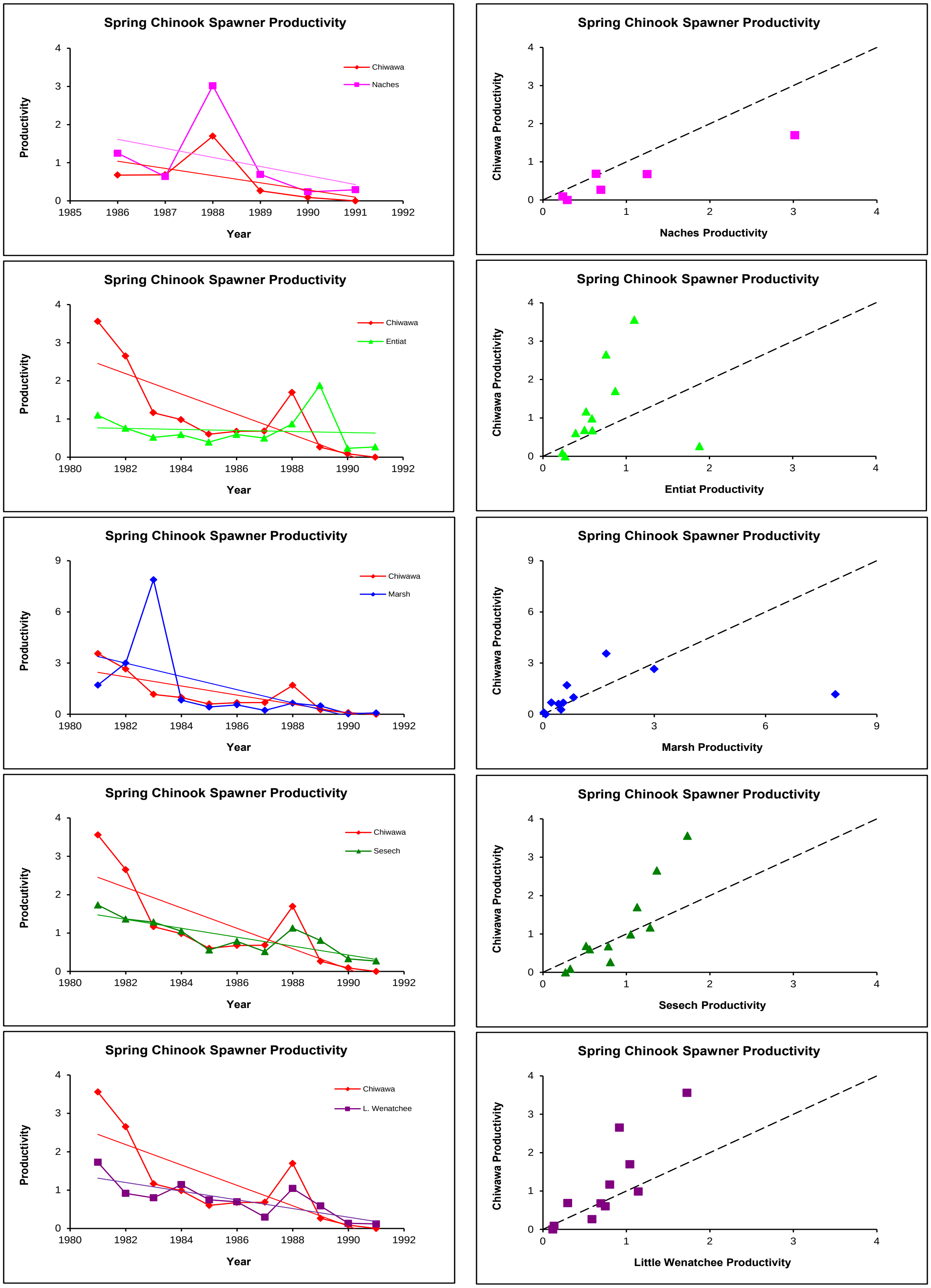

Figure 4. Time series of adult productivity of potential reference populations and the Chiwawa spring Chinook population before the Chiwawa population was supplemented with hatchery fish.

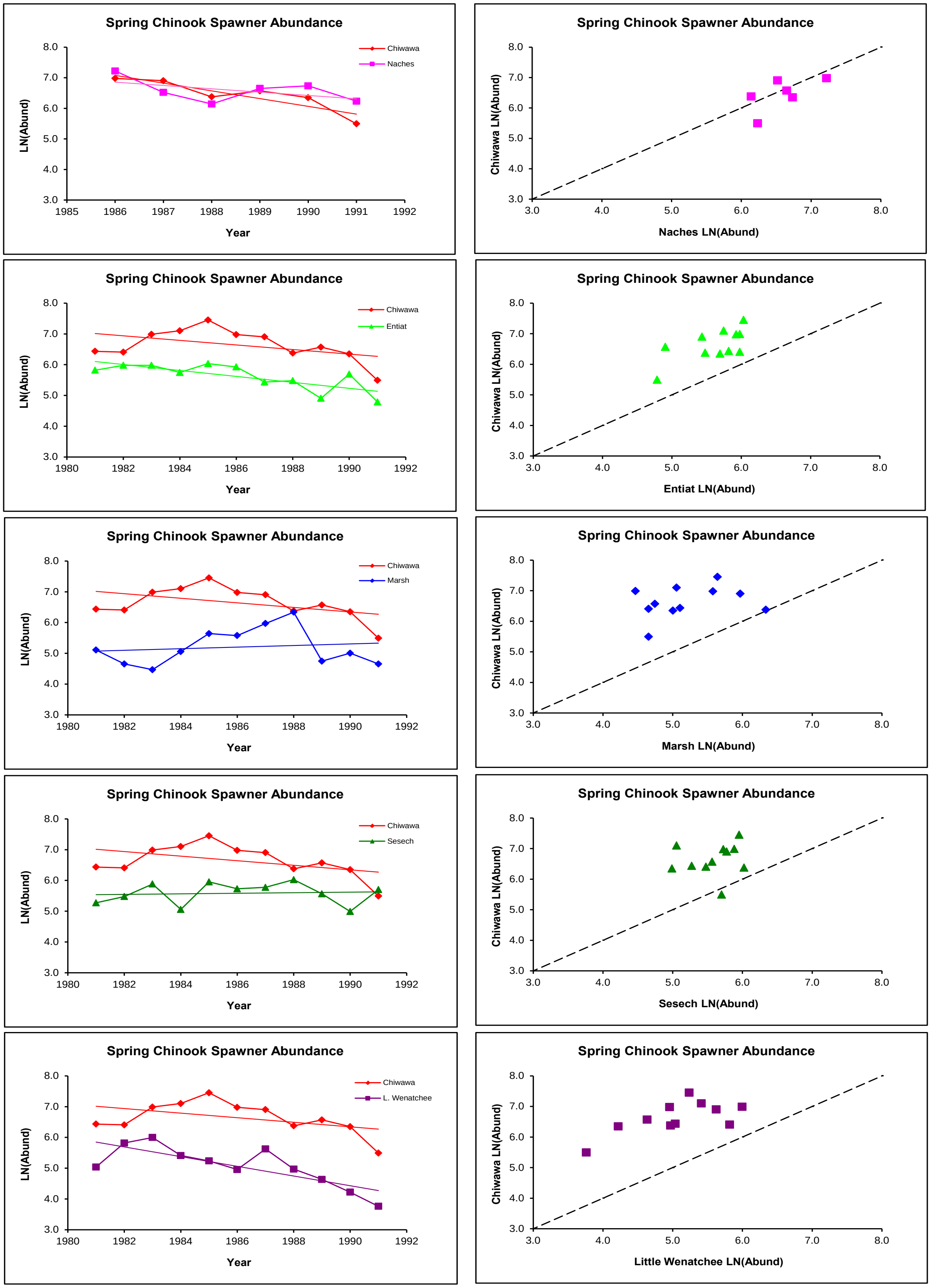

Figure 5. Time series of natural log spawner abundance of potential reference populations and the Chiwawa spring Chinook population before the Chiwawa population was supplemented with hatchery fish.

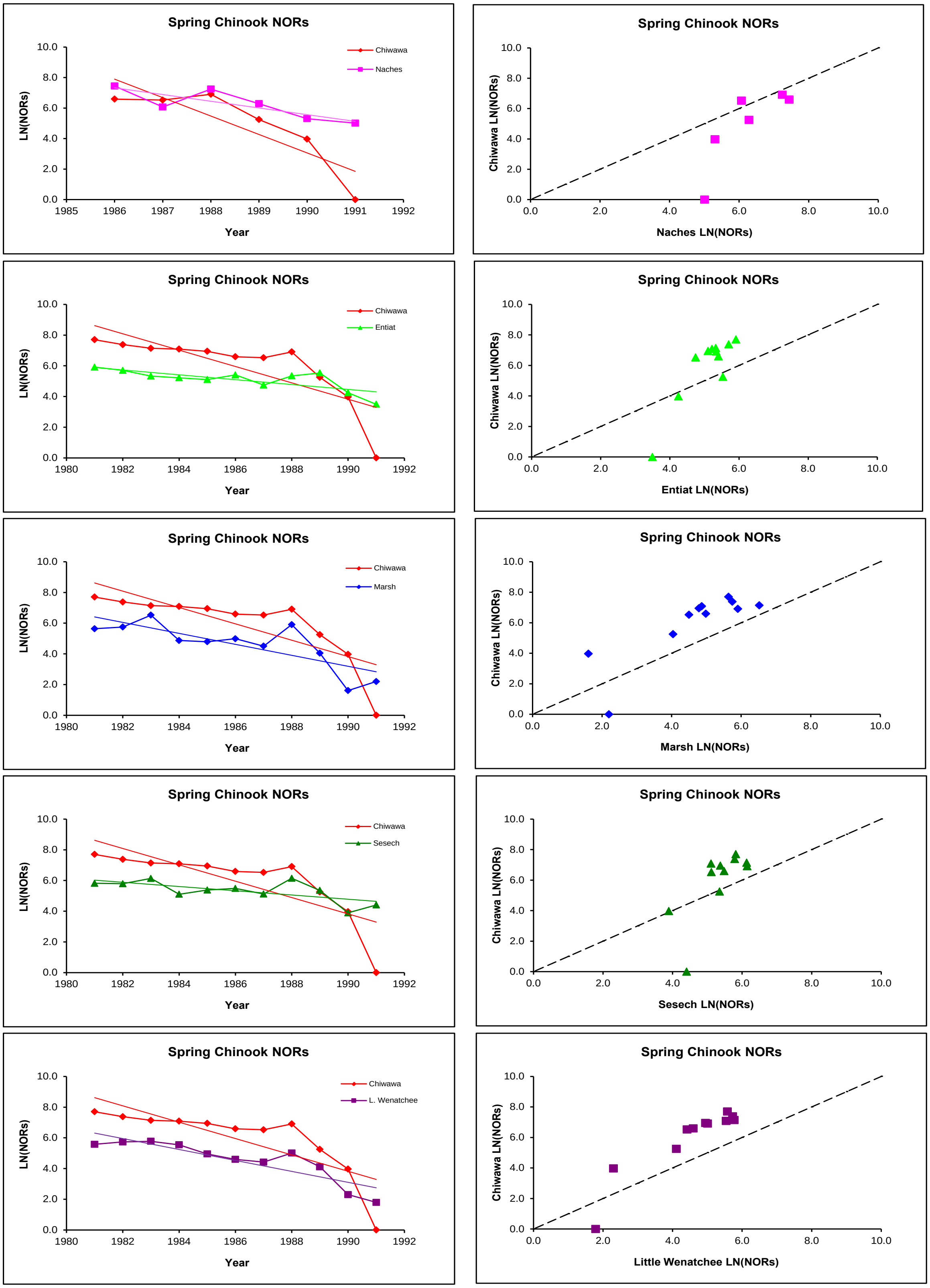

Figure 6. Time series of natural log natural-origin recruits (NORs) of potential reference populations and the Chiwawa spring Chinook population before the Chiwawa population was supplemented with hatchery fish.

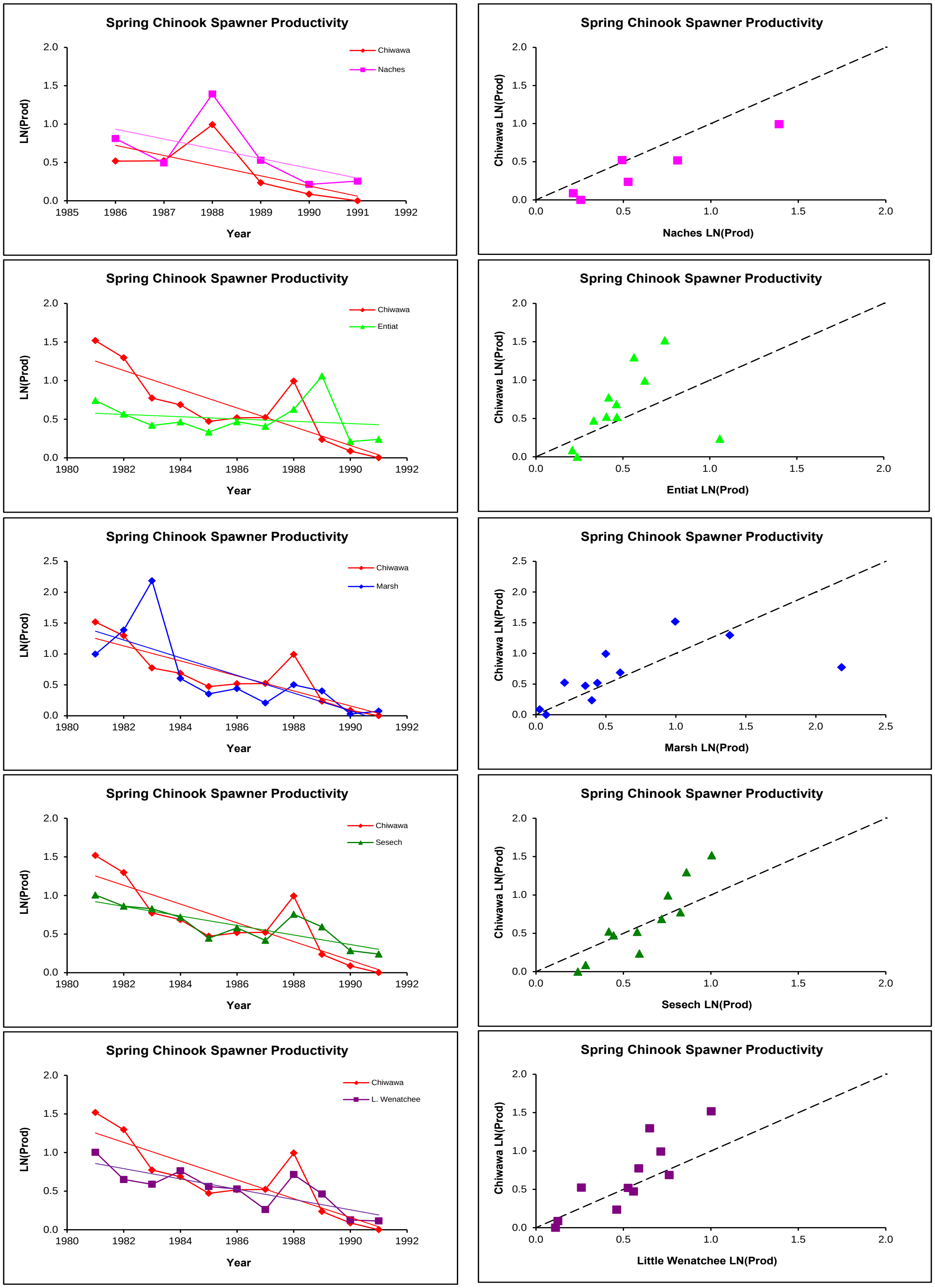

Figure 7. Time series of natural log adult productivity of potential reference populations and the Chiwawa spring Chinook population before the Chiwawa population was supplemented with hatchery fish.

Correlations and Trends

Other methods for evaluating the suitability of potential reference populations under Step 2 include correlation and trend analyses. For correlation analysis, we simply calculated the Pearson correlation coefficient, which is an index of the strength of the association between the potential reference populations and the Chiwawa population. The coefficient ranges from -1 to 1, where a value near 1 or -1 represents that strongest association between the populations. A value of 0 means no association. We used only spawner abundance, NORs, and productivity data during the pre-treatment period (1981-1992). We assumed that populations with coefficients greater than 0.6 represented reasonable reference conditions.

For trend analyses, we used least squares techniques to compute a straight-line trend through the spawner abundance and productivity data for the potential reference populations and the Chiwawa population. Trends were fit to the pre-treatment time series data (1981-1992). We then used t-tests to determine if the slopes of the trends between potential reference populations and the Chiwawa population differed significantly.

It is important to note that time-series trend analyses are susceptible to temporal correlations in the data. Autoregressive integrated moving average (ARIMA) models can be used to describe the correlation structure in temporal data (Gotelli and Ellison 2004). However, these models require a long time series (N > 40) and therefore we could not use them to model the spring Chinook data. As such, we were unable to correct for any temporal correlation that may exist within the time series.

Tests of correlation with spawner abundance data indicated that the Naches River closely correlated with the Chiwawa population (Table 2). There was no difference in abundance trends between the potential reference populations and the Chiwawa population (Table 2; Figure 2). For NORs, all potential reference populations correlated with the Chiwawa population (Table 2). However, trends in NORs of all reference populations, except Naches, differed significantly from the Chiwawa population (Table 2; Figure 3). For productivity, the Naches, Sesech, and Little Wenatchee correlated with the Chiwawa population (Table 2). Only the Entiat productivity trend differed significantly from the Chiwawa population trend (Table 2; Figure 4).

Table 2. Pearson correlation coefficients and t-test results comparing slopes of trends between potential reference populations and the Chiwawa spring Chinook population; d.f. = degrees of freedom and for correlation coefficients, an asterisk (*) indicates significance at $P < 0.05$.

Reference populations	Pearson correlation coefficient	t-test on slopes		
		t-value	d.f.	P-value
Spawner Abundance Data				
Naches	0.684*	-0.659	8	0.528
Entiat	0.598*	-0.596	18	0.559
Marsh	0.147	-1.341	18	0.197
Sesech	0.274	-1.265	18	0.222
Little Wenatchee	0.399	-0.591	18	0.562
Natural-Origin Recruits				
Naches	0.803*	0.666	8	0.524
Entiat	0.795*	-7.495	18	0.000

Reference populations	Pearson correlation coefficient	t-test on slopes		
		t-value	d.f.	P-value
Marsh	0.605*	-5.786	18	0.000
Sesech	0.648*	-6.874	18	0.000
Little Wenatchee	0.880*	-7.206	18	0.000
Productivity Data				
Naches	0.960*	0.169	8	0.870
Entiat	0.272	-3.057	18	0.007
Marsh	0.320	0.605	18	0.553
Sesech	0.903*	-2.059	18	0.054
Little Wenatchee	0.848*	-2.065	18	0.054

We also ran correlation and trend analyses on natural-log transformed spawner abundance, NORs, and productivity data. These analyses indicated that the Naches, Entiat, and Little Wenatchee abundance data correlated with the Chiwawa population data (Table 3). None of the abundance trends of the potential reference populations differed significantly from the Chiwawa population trend (Table 3; Figure 5). For NORs, all potential reference populations correlated with the Chiwawa population (Table 3). Only trends in NORs of the Entiat and Sesech differed significantly from the Chiwawa population (Table 2; Figure 6). For productivity, the Naches, Marsh, Sesech, and Little Wenatchee correlated with the Chiwawa population data (Table 3). Only the Entiat productivity trend differed significantly from the Chiwawa population trend (Table 3; Figure 7).

Table 3. Pearson correlation coefficients and t-test results comparing slopes of trends between potential reference populations and the Chiwawa spring Chinook population; d.f. = degrees of freedom and for correlation coefficients, an asterisk (*) indicates significance at $P < 0.05$. Analyses were conducted on natural-log transformed abundance and productivity data.

Reference populations	Pearson correlation coefficient	t-test on slopes		
		t-value	d.f.	P-value
LN Spawner Abundance Data				
Naches	0.642*	-1.323	8	0.222
Entiat	0.652*	0.412	18	0.685
Marsh	0.294	-1.324	18	0.202
Sesech	0.149	-1.431	18	0.170
Little Wenatchee	0.670*	1.325	18	0.202
LN Natural-Origin Recruits				
Naches	0.824*	-1.985	8	0.082
Entiat	0.886*	-2.563	18	0.019
Marsh	0.830*	-1.038	18	0.313
Sesech	0.730*	-2.664	18	0.016
Little Wenatchee	0.927*	-1.150	18	0.265

Reference populations	Pearson correlation coefficient	t-test on slopes		
		t-value	d.f.	P-value
LN Productivity Data				
Naches	0.944*	-0.042	8	0.968
Entiat	0.373	-3.043	18	0.007
Marsh	0.610*	0.428	18	0.674
Sesech	0.913*	-2.050	18	0.055
Little Wenatchee	0.862*	-1.811	18	0.087

In summary, based on correlation, trend, and graphic analyses, the Naches, Entiat, and Little Wenatchee populations appear to be reasonable reference populations for comparing spawner abundance data with Chiwawa data. For NORs, the Naches, Marsh, and Little Wenatchee appear to be reasonable reference populations. For productivity, the Naches, Marsh, Sesech, and Little Wenatchee populations appear to be reasonable reference populations for the Chiwawa population.

Minimal Detectable Differences (MDD)

Given a suite of potential reference populations, it is important to conduct power analyses to determine the minimum differences that can be detected when comparing the reference populations to the supplemented population. As a final exercise under Step 2, we examined potential reference populations for the smallest minimal detectable differences. Before conducting power analyses, several decisions needed to be made, including what statistical procedures will be used to analyze the data, the desired level of statistical power (probability of rejecting a false null hypothesis), the size of the type-I error (the probability of rejecting a true null hypothesis of no difference), and the number of samples (i.e., years) included in the analysis. In this case, the number of samples represents the number of treatment (supplementation) years. The number of pre-treatment years (1981-1992) was based on the number of years of quality data available for Chiwawa spring Chinook and potential reference populations.

We designed the study as a modified BACI (Before-After, Control-Impact) design, which includes replication before and after supplementation in both the treated (T) population and the reference (R) populations. A common approach used to analyze data from BACI designs includes analysis of difference scores (Stewart-Oaten et al. 1992; Smith et al. 1993). Differences are calculated between paired treatment and reference population scores (i.e., T-R). Another approach is to calculate ratios (treatment/reference; T/R) for paired treatment and reference population scores (Skalski and Robson 1992). Finally, differences in annual changes in paired treatment and reference population scores can be calculated (i.e., ΔT-ΔR) (Murdoch and Peven 2005; Hays et al. 2006).[16] These derived difference and ratio scores are then analyzed for a before-after treatment effect with a two-sample t-test, Aspin-Welch modification of the t-test, or a randomization test. For power analyses, we calculated minimal detectable differences assuming

[16] The difference of annual difference scores was estimated by first subtracting the population parameter (e.g., spawner abundance) in year 2 from year 1. This continues for all years in the data series for both treatment ($T_{t+1} - T_t$) and reference populations ($R_{t+1} - R_t$). We then calculated differences between paired treatment and reference annual difference scores [$(T_{t+1} - T_t) - (R_{t+1} - R_t) = \Delta T - \Delta R$].

the use of an independent two-sample t-test with a type-I error rate of 0.05, power of 0.80 (beta or type-II error rate of 0.20), and sample sizes (treatment years) of 5, 10, 15, 20, 25, and 50 years.

The power analysis calculated the minimal detectable difference between mean difference or ratio scores before and during supplementation. We used existing data to calculate variances for the pre-supplementation and supplementation periods. Thus, variances were known and unequal. For both spawner abundance and NORs, the null hypothesis tested was that the mean difference or ratio before supplementation equaled the mean difference or ratio during supplementation. The alternative hypothesis was that the mean difference or ratio before supplementation was less than the mean difference during supplementation (one-tail test; Difference < 0). For productivity, the null hypothesis tested was that the mean difference or ratio before supplementation equaled the mean difference or ratio during supplementation. The alternative hypothesis was that the mean difference or ratio before supplementation was greater than the mean difference during supplementation (one-tail test; Difference > 0).

Based on spawner abundance data, power analysis indicated that the Sesech-Chiwawa pairing consistently produced the smallest detectable differences (Table 4). However, when the abundance data were transformed using natural logs, the Entiat-Chiwawa pairing produced the smallest detectable difference (Table 5). Minimal detectable differences, based on mean difference scores on untransformed data and a treatment period of 20 years, ranged from 334 to 394 adult spawners; transformed data ranged from 0.479 to 1.010. These analyses indicate that the Naches, Entiat, Sesech, and Little Wenatchee populations appear to be reasonable reference populations for comparing spawner abundance data with Chiwawa data. The Marsh Creek population produced some of the largest detectable differences and based on these analyses may not be a reasonable reference population.

Table 4. Minimal detectable differences between mean difference and ratio scores before and during supplementation. Analyses were conducted on spawner abundance data.

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
T-R	5	638	604	560	396	652
	10	464	448	444	354	481
	15	405	395	406	341	424
	20	376	368	387	334	394
	25	358	352	376	331	376
	50	322	319	354	323	340
T/R	5	0.600	2.084	39.251	1.569	5.498
	10	0.506	1.548	24.729	1.508	3.828
	15	0.478	1.367	19.646	1.490	3.256
	20	0.465	1.275	16.828	1.481	2.954
	25	0.458	1.219	14.974	1.475	2.765
	50	0.447	1.105	10.573	1.465	2.366
ΔT-ΔR	5	1,049	761	717	518	766

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
	10	750	542	539	411	547
	15	650	467	480	376	473
	20	598	429	450	359	434
	25	567	405	431	348	410
	50	506	355	395	329	361

Table 5. Minimal detectable differences between mean difference and ratio scores before and during supplementation. Analyses were conducted on natural-log transformed spawner abundance data.

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
T-R	5	0.975	0.871	2.061	0.828	1.013
	10	0.721	0.613	1.375	0.648	0.722
	15	0.637	0.525	1.138	0.588	0.623
	20	0.595	0.479	1.010	0.559	0.571
	25	0.569	0.450	0.928	0.541	0.539
	50	0.521	0.390	0.749	0.505	0.473
T/R	5	0.157	0.162	2.343	0.160	0.368
	10	0.116	0.115	1.474	0.125	0.247
	15	0.102	0.099	1.170	0.114	0.206
	20	0.095	0.090	1.001	0.108	0.183
	25	0.091	0.085	0.890	0.104	0.169
	50	0.082	0.075	0.625	0.098	0.138
ΔT-ΔR	5	1.261	1.288	3.076	1.160	1.467
	10	0.898	0.900	2.020	0.887	1.001
	15	0.776	0.768	1.653	0.797	0.840
	20	0.713	0.698	1.463	0.751	0.755
	25	0.675	0.655	1.325	0.724	0.701
	50	0.600	0.564	1.038	0.670	0.585

Based on NORs, power analysis indicated that the Entiat-Chiwawa, Marsh-Chiwawa, and Little Wenatchee-Chiwawa pairings produced the smallest detectable differences (Table 6). When NORs were transformed using natural logs, the Little Wenatchee-Chiwawa pairing produced the smallest detectable difference (Table 7). Minimal detectable differences, based on mean difference scores on untransformed data and a treatment period of 20 years, ranged from 483 to 640 NORs; transformed data ranged from 0.958 to 2.262. These analyses indicate that the Entiat, Marsh, and Little Wenatchee populations appear to be reasonable reference populations for comparing NORs with Chiwawa data.

Table 6. Minimal detectable differences between mean difference and ratio scores before and during supplementation. Analyses were conducted on natural-origin recruits.

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
T-R	5	1,139	541	573	630	546
	10	809	511	515	550	503
	15	698	502	498	526	489
	20	640	497	489	514	483
	25	604	494	484	507	479
	50	534	489	474	493	472
T/R	5	0.469	2.538	5.196	1.976	6.973
	10	0.451	2.183	4.183	1.894	5.118
	15	0.446	2.072	3.854	1.869	4.492
	20	0.445	2.017	3.691	1.857	4.170
	25	0.444	1.986	3.594	1.850	3.973
	50	0.443	1.924	3.405	1.836	3.572
ΔT-ΔR	5	1,639	500	519	609	531
	10	1,239	386	409	433	396
	15	1,109	348	374	372	351
	20	1,046	329	356	341	328
	25	1,009	318	346	321	314
	50	943	295	325	281	285

Table 7. Minimal detectable differences between mean difference and ratio scores before and during supplementation. Analyses were conducted on natural-log transformed natural-origin recruits.

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
T-R	5	2.380	1.646	1.967	2.247	1.174
	10	2.291	1.479	1.505	1.835	1.026
	15	2.270	1.428	1.351	1.702	0.980
	20	2.262	1.403	1.273	1.636	0.958
	25	2.258	1.389	1.227	1.597	0.945
	50	2.253	1.361	1.133	1.522	0.920
T/R	5	0.322	0.332	0.739	0.398	0.356
	10	0.301	0.289	0.581	0.334	0.322
	15	0.296	0.275	0.530	0.314	0.312
	20	0.294	0.269	0.504	0.305	0.307
	25	0.293	0.265	0.488	0.299	0.304

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
	50	0.291	0.258	0.458	0.288	0.298
ΔT-ΔR	5	2.858	2.400	2.355	3.283	2.109
	10	2.560	1.714	1.881	2.311	1.552
	15	2.485	1.481	1.728	1.979	1.365
	20	2.456	1.360	1.652	1.805	1.269
	25	2.443	1.285	1.607	1.697	1.210
	50	2.430	1.130	1.519	1.471	1.092

Using untransformed productivity data, power analysis indicated that the Little Wenatchee-Chiwawa pairing consistently produced the smallest detectable differences (Table 8). The Marsh-Chiwawa pairings produced the largest detectable differences. When we analyzed natural-log transformed productivity data, the Naches-Chiwawa and Little Wenatchee-Chiwawa pairings produced the smallest detectable differences (Table 9). Minimal detectable differences, based on mean difference scores on untransformed data and a treatment period of 20 years, ranged from 0.754 to 1.839; transformed data ranged from 0.277 to 0.477. These analyses indicate that the Naches, Entiat, Sesech, and Little Wenatchee populations appear to be reasonable reference populations for comparing productivity data with Chiwawa data. The Marsh Creek population produced some of the largest detectable differences and based on these analyses may not be a reasonable reference population.

Table 8. Minimal detectable differences between mean difference and ratio scores before and during supplementation. Analyses were conducted on productivity data.

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
T-R	5	2.181	1.382	2.033	3.517	1.192
	10	1.442	1.119	1.900	2.265	0.901
	15	1.186	1.033	1.859	1.828	0.804
	20	1.047	0.991	1.839	1.588	0.754
	25	0.959	0.966	1.828	1.432	0.724
	50	0.764	0.917	1.806	1.074	0.664
T/R	5	1.364	1.773	0.863	0.876	2.167
	10	1.095	1.359	0.831	0.687	1.587
	15	1.011	1.221	0.822	0.625	1.391
	20	0.971	1.152	0.817	0.594	1.290
	25	0.949	1.110	0.814	0.575	1.228
	50	0.910	1.027	0.908	0.538	1.102
ΔT-ΔR	5	3.298	1.864	3.211	4.420	1.942
	10	2.263	1.382	2.968	2.811	1.291

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
	15	1.909	1.220	2.894	2.248	1.066
	20	1.723	1.137	2.859	1.938	0.944
	25	1.606	1.087	2.839	1.735	0.866
	50	1.365	0.986	2.800	1.259	0.695

Table 9. Minimal detectable differences between mean difference and ratio scores before and during supplementation. Analyses were conducted on natural-log transformed productivity data.

Response variable	Treatment years	Minimal detectable differences by reference population				
		Naches	Entiat	Marsh	Sesech	Little Wenatchee
T-R	5	0.540	0.551	0.674	0.890	0.585
	10	0.367	0.452	0.542	0.590	0.413
	15	0.308	0.421	0.499	0.486	0.355
	20	0.277	0.405	0.477	0.430	0.324
	25	0.257	0.396	0.465	0.393	0.305
	50	0.215	0.378	0.440	0.314	0.265
T/R	5	0.915	1.286	0.743	0.697	1.685
	10	0.744	0.973	0.704	0.541	1.227
	15	0.691	0.868	0.692	0.489	1.072
	20	0.666	0.815	0.687	0.463	0.993
	25	0.652	0.783	0.683	0.447	0.943
	50	0.628	0.719	0.677	0.416	0.843
ΔT-ΔR	5	0.885	0.810	1.028	1.252	0.971
	10	0.631	0.609	0.822	0.809	0.640
	15	0.546	0.542	0.755	0.655	0.525
	20	0.502	0.508	0.722	0.570	0.463
	25	0.475	0.487	0.702	0.516	0.423
	50	0.423	0.446	0.664	0.391	0.333

Step 3: Quantitative Method for Ranking Selection Criteria

Not surprisingly, different selection criteria produced different results (Table 10). Determining whether a given population is or is not a suitable reference population based on selection criteria such as graphic analysis can be subjective. In addition, treating each selection criterion as equally important may not be appropriate. For example, using the information in Table 10, is it appropriate to select a reference population that has two or three "Yes" entries, or should only populations with four "Yes" entries be selected as suitable reference populations? This approach does not allow certain selection criteria to carry more weight in the overall selection process.

That is, correlation may be more important than graphic analysis in the overall selection process. In order to reduce subjectivity, we developed a method of scoring and weighting each selection criterion. This method allows a more quantitative process for selecting suitable reference populations.

Table 10. Summary of results from graphic analysis, correlations, trend analysis, and power analysis (minimal detectable differences). “Yes” indicates that the population is a suitable reference population for the Chiwawa population; “No” indicates that it may not be a suitable reference population.

Potential reference populations	Graphic analysis	Correlation	Trends	Minimal detectable differences
Spawner Abundance				
Naches	Yes	Yes	Yes	Yes
Entiat	Yes	Yes	Yes	Yes
Marsh	No	No	Yes	No
Sesech	No	No	Yes	Yes
Little Wenatchee	Yes	Yes	Yes	Yes
Natural-Origin Recruits				
Naches	Yes	Yes	Yes	No
Entiat	No	Yes	No	Yes
Marsh	Yes	Yes	Yes	Yes
Sesech	No	Yes	No	No
Little Wenatchee	Yes	Yes	Yes	Yes
Productivity				
Naches	Yes	Yes	Yes	Yes
Entiat	No	No	No	Yes
Marsh	No	Yes	Yes	No
Sesech	Yes	Yes	Yes	Yes
Little Wenatchee	Yes	Yes	Yes	Yes

We developed scoring methods for each of the following five selection criteria:

(1) The proportion of natural-origin spawners (pNOS) in the reference population for the period before supplementation (pre-pNOS);

(2) pNOS in the reference population for the period following supplementation (post-pNOS);

(3) The correlation between the reference and supplemented populations before supplementation;

(4) The relative difference in slopes between the reference and supplemented populations before supplementation; and

(5) The coefficient of variation (CV) of the ratio of supplemented to reference populations before the period of supplementation.

Each selection criteria was scored from 0 to 1, with 0 being the worst possible score and 1 being the best.

The pre- and post-pNOS values were calculated as the average pNOS values before and after supplementation, respectively. Because pNOS values range from 0-1, we did not need to rescale these values. When using reference populations to evaluate the effects of supplementation programs, it is important that the reference populations maintain high values of pNOS throughout the life of the monitoring program. Therefore, we heavily weighted the mean pNOS scores. We assigned weights of 30 and 40 to the mean pre- and post-pNOS scores, respectively. The relatively larger weight for the post-supplementation period is to reduce the likelihood of retaining a reference population that becomes influenced by hatchery fish during the supplementation period.

We assessed the association between the reference and supplemented populations during the pre-supplementation period by calculating the Pearson correlation coefficient, which ranges from -1 to 1. To scale the coefficient between 0 and 1, we took the absolute value of the coefficient. Thus, a coefficient of -0.92 would be reported as 0.92. For our analyses, we were not concerned with the direction of the relationship, only the strength of the relationship. The correlation coefficient was given a weight of 12.5.

As noted earlier, we used least squares to fit a linear trend to each of the reference populations and the supplemented population during the pre-supplementation period. Using the slope estimates for each trend line, we calculated the relative difference in slopes as the slope of the supplemented population minus the slope of the reference population, divided by the slope of the reference population. To scale this value between 0 and 1, we used absolute values, and depending on the direction of the slopes, we subtracted the relative difference from 1. The latter was needed to make sure a larger relative difference value indicated a small difference in slopes between the supplemented and reference populations. The relative difference score was given a weight of 7.5.

Finally, as a means to score effect size, we calculated the CV of the ratio of supplemented to reference population parameters (i.e., T/R). The CV was calculated as the standard deviation of the ratios divided by the absolute value of the mean ratios. The CV was subtracted from 1. This scaled the value from 0 to 1 with larger values representing the best condition. The CV was given a weight of 10, which is greater than the weight for trend, but less than the weight for correlation.

The total score for a reference population was calculated by multiplying the estimated value, which ranged from 0 to 1, by its weight. The sum of the five weighted values provided a total score, which ranged from 0 to 100. Based on several simulations, we set the cut-off score at 81. That is, if the total score for a given reference population equaled or exceeded 81, the population was included as a suitable reference population. If the total score fell below 81, the population was not considered a suitable reference. Based on the distribution of all scores possible, a score of 81 or greater represented only 3% of the total distribution. Thus, a cut-off of 81 is quite conservative.

Under Step 3, we used this method to select the final suite of suitable reference populations. Table 11 shows results from scoring each of the reference populations using the quantitative method. Using the cut-off criterion of 81, only the Naches, Marsh, and Sesech populations would be considered suitable reference populations for the Chiwawa supplementation program. Both the Entiat and Little Wenatchee populations failed to meet the minimum score, largely because of the influence of hatchery fish within those populations (i.e., relatively low pNOS values).

Table 11. Results from scoring potential reference populations using the selection criteria (pNOS, correlation, trend, and effect size). Populations with scores less than 81 were considered unsuitable as reference populations. Populations with scores equal to or greater than 81 were considered suitable references. These results were based on natural-log transformed data.

Potential reference populations	Population metric		
	Abundance	NORs	Productivity
Naches	85	88	91
Entiat	23	21	16
Marsh	79	91	87
Sesech	84	85	88
Little Wenatchee	51	53	49

An important benefit from scoring the different selection criteria is that the total scores can be used to weight the outcome of differing statistical results. For example, analyses may show that when three suitable reference populations are compared to the supplemented population, two of the reference populations may indicate a significant treatment effect, while the third indicates no effect. Under this scenario it is not clear if the supplementation program has or has not affected the abundance or productivity of the supplemented population. If, however, the two reference populations that produced a significant result had higher total scores than the reference population that did not indicate a significant result, one can place more weight on the results from populations with higher total scores.

Conclusions

The purpose of this exercise was to develop a method for selecting suitable reference populations that could be used to assess the effects of supplementation programs on spawner abundance, NORs, and productivity. The selection process included a three-step process (Figure 8). Step 1 identified populations with similar life-history characteristics, few or no hatchery spawners, a long time series of accurate abundance and productivity estimates, and similar freshwater habitat impairments and out-of-basin effects. Populations that met these criteria were then examined for their graphical and statistical relationship with the supplemented population (Step 2). The statistical analysis under Step 2 were converted to a quantitative model (Step 3) that was used to generate a weighted score for pNOS, correlation, trends, and effect sizes for each potential reference population. Reference populations with total scores of 81 or greater were selected as suitable reference populations.

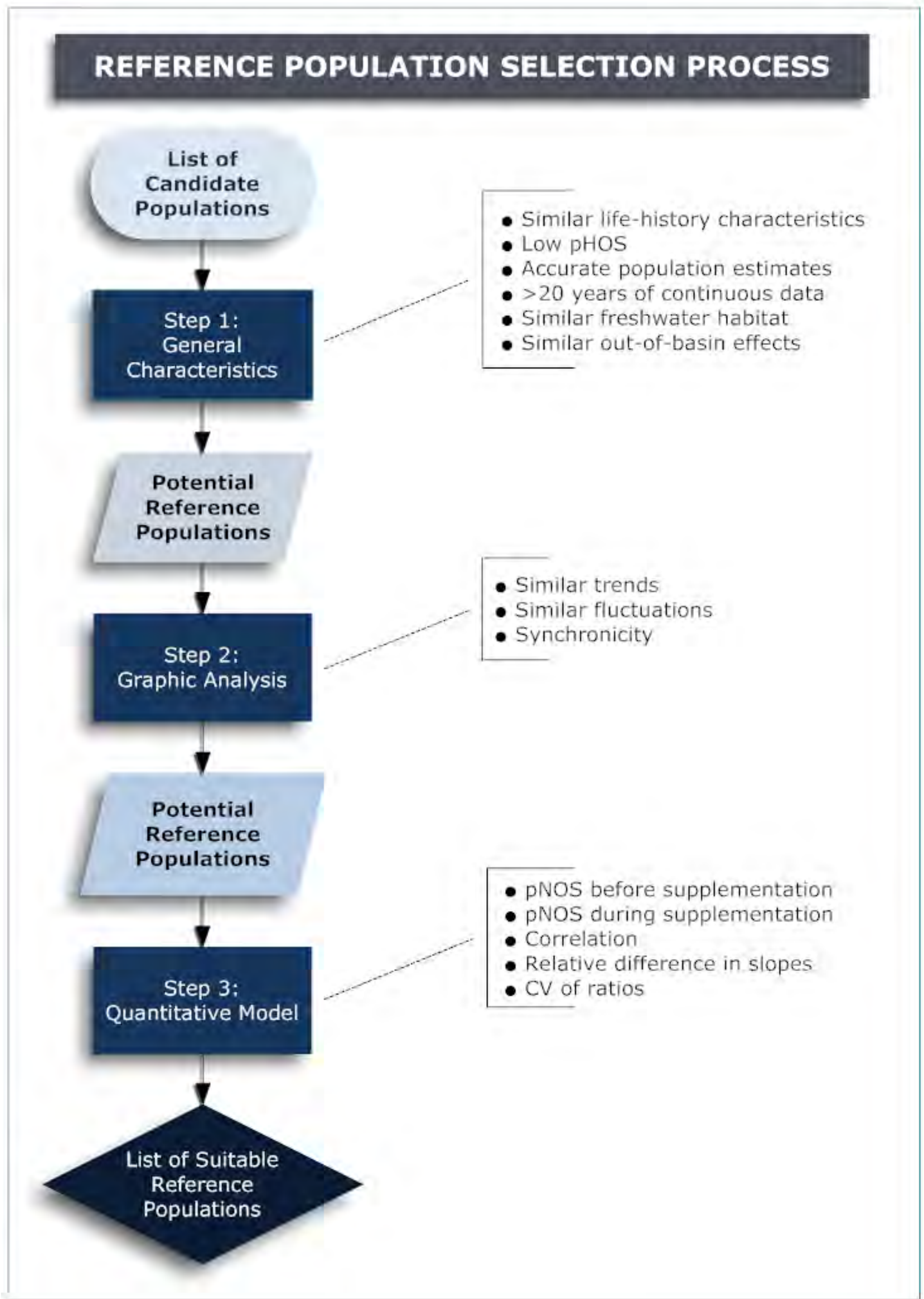

Figure 8. Three-step process for selecting suitable reference populations for supplemented populations.

We used this approach to select suitable reference populations for analyzing the effects of the Chiwawa spring Chinook supplementation program on fish abundance and productivity. The method indicated that the Naches, Marsh, and Sesech populations would serve as suitable reference populations for the Chiwawa spring Chinook supplementation program. Both the Entiat and Little Wenatchee populations failed to meet the minimum score, largely because of the influence of hatchery fish within those populations (i.e., relatively low pNOS values). However, because the presence of hatchery spring Chinook within those populations should decrease, they may serve as unique reference populations in which the comparisons change from all populations receiving hatchery fish to only the Chiwawa population receiving hatchery fish. Therefore, we will continue to include both the Little Wenatchee and Entiat populations in future analyses.

An important assumption in the use of reference populations is that the supplemented and reference populations that tracked each other before supplementation would continue to track each other in the absence of supplementation. Given that the reference populations did not match the Chiwawa population on all criteria examined (Table 1) and some reference populations tracked the Chiwawa population more poorly than others (Figures 2-7; Tables 2-4), there may be some uncertainty as to whether differences observed between the Chiwawa and reference populations during the supplementation period are associated with the hatchery program, "nuisance" factors[17], or a combination of both. In addition, we have no ability to regulate or control activities in reference areas. Any large-scale change (man-made or natural) in reference areas could affect our ability to assess the effectiveness of the supplementation program.

Because we have no ability to maintain reference areas for long periods of time and may not be able to control all activities even within the supplemented populations, we propose the use of a "causal-comparative" approach to strengthen the certainty of our inferences (Pearsons and Temple 2010). The causal-comparative approach relies on correlative data to try and make a case for causal inference.[18] Correlation is used to rule out alternative hypotheses (note that we make our case as much if not more by disproving plausible alternatives as we do by showing that the data are consistent with a hypothesis). For example, large scale land-use activities or natural events can affect stream flows, fine sediment recruitment, and water temperatures. Changes in these factors can affect the freshwater survival and productivity of fish independently of supplementation programs. If changes in habitat, migratory, and ocean conditions do not affect reference and treatment populations similarly, inferences associated with supplementation programs may be confounded. By measuring and tracking these extraneous factors within reference and treatment areas, we can assess the effects of these state variables on population conditions independent of the supplementation programs. This allows us to more effectively assess the influence of supplementation programs on populations.

To that end, we recommend that the following state variables be measured and tracked within the Chiwawa Basin and each of the reference areas: mean annual precipitation, total and riparian forest cover, road density, impervious surface, and alluvium. These variables can be used to describe differences in water temperatures at different life stages (pre-spawning, egg incubation, and summer rearing) and substrate characteristics, including fine sediments and embeddedness (Jorgensen et al. 2009). They can be used to assess possible changes in spawner abundance, NORs, and productivity that are independent of supplementation.

[17] A "nuisance" factor is any factor that is outside the control of the experimenter and can affect the response variable (spawner abundance or productivity). In this case, nuisance factors may include differences in freshwater habitat trends and conditions, out-of-basin effects (e.g., migration and ocean survival), and hatchery strays that affect the Chiwawa and reference populations differently.

[18] It is important to point out that correlation does not demonstrate cause-and-effect. It only suggests a relationship between variables. Thus, inferences based on correlation lack the certainty that is associated with a design-based approach.

Analyses with Reference Populations

Once suitable reference populations are selected, methods for analyzing the supplemented and reference populations need to be identified. What follows is a description of different analyses that can be used to assess the effects of supplementation programs on spawner abundance, NORs, and productivity using reference populations. Later in this report we describe methods for assessing supplementation effects when reference populations are not available.

We used some of the reference populations selected for the Chiwawa program to illustrate the different methods for evaluating the effects of the supplementation program on spawner abundance, NORs, and productivity. For abundance, we selected the Naches, Entiat, Little Wenatchee, and Sesech populations as suitable references for the Chiwawa population. For NORs, we selected the Naches, Entiat, Marsh, and Little Wenatchee populations as suitable references. For productivity, we selected the Naches, Sesech, Little Wenatchee, and Marsh Creek as suitable references for the Chiwawa. As noted earlier, we included the Little Wenatchee and Entiat populations, even though they did not meet all the criteria for suitable reference populations.

Analysis of Trends

As a first step, we used trend analyses to assess the effects of the Chiwawa supplementation program on spring Chinook spawner abundance, NORs, and productivity. Here, we compared the slopes of the trends between each treatment/reference pair before and during supplementation using t-tests. If the hatchery program is successfully supplementing the natural spring Chinook population, trends in spawner abundance and NORs should deviate significantly (i.e., the slope of the supplemented population should be greater than the slopes of the reference populations during the supplementation period). For productivity, the slope of the supplemented population, relative to the reference population, should increase or remain the same.

Trend analysis indicated that the relationship of slopes of spawner abundance between the Chiwawa and reference populations did not change significantly after the initiation of supplementation (Figure 9; Table 12). This was true for both transformed and untransformed abundance data. Before supplementation, spawner abundances trended down in both the Chiwawa and reference populations (Figure 9). During the period of supplementation, abundances in both the Chiwawa and reference populations trended upward. Interestingly, in nearly all treatment/reference comparisons, the Pearson correlation coefficient was greater in the supplementation period than in the pre-supplementation period (Table 12). This was most evident in the transformed abundance data (Figure 9).

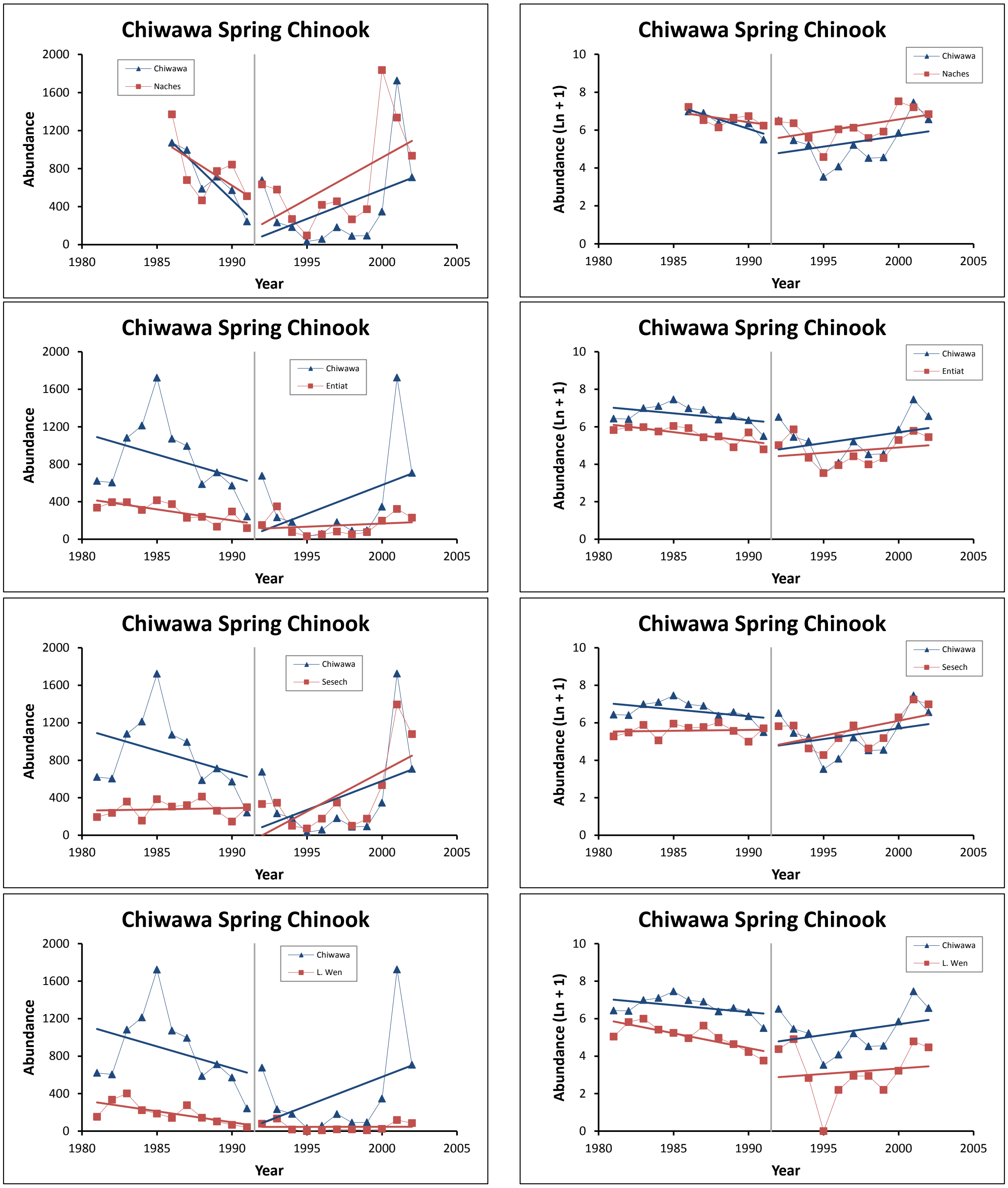

Figure 9. Trends in spring Chinook spawner abundance in the Chiwawa and reference populations. The vertical lines in the figures separate the pre- and post-supplementation periods. Figures on the left include untransformed spawner abundance data; those on the right include natural-log transformed data.

Table 12. Pearson correlation coefficients and t-test results comparing slopes of spawner abundance trends between reference populations and the Chiwawa spring Chinook population before and during the supplementation periods; for correlation coefficients, an asterisk (*) indicates significance at P < 0.05. Analyses include both untransformed and natural-log transformed spawner abundance data.

Reference population	Pearson correlation coefficient		Test on slopes			
			t-value		P-value	
	Before	During	Before	During	Before	During
Spawner Abundance						
Naches	0.684*	0.595	-0.659	-0.414	0.528	0.684
Entiat	0.598*	0.672*	-0.596	1.162	0.559	0.260
Sesech	0.274	0.904*	-1.265	-0.418	0.222	0.681
Little Wenatchee	0.399	0.685*	-0.591	1.330	0.562	0.200
LN Spawner Abundance						
Naches	0.642*	0.813*	-1.323	-0.047	0.222	0.963
Entiat	0.652*	0.860*	0.412	0.422	0.685	0.678
Sesech	0.149	0.878*	-1.431	-0.333	0.170	0.743
Little Wenatchee	0.670*	0.861*	1.325	0.316	0.202	0.756

Trend analysis indicated that the relationship of slopes of NORs between the Chiwawa and reference populations did not change significantly after the initiation of supplementation (Figure 10; Table 13). Before supplementation, Chiwawa NORs trended downward more strongly than the reference populations (Figure 10). However, during the supplementation period, both the Chiwawa and reference population NORs trended upward in parallel. In nearly all treatment/reference comparisons, the Pearson correlation coefficient was greater in the pre-supplementation period than in the supplementation period (Table 13).

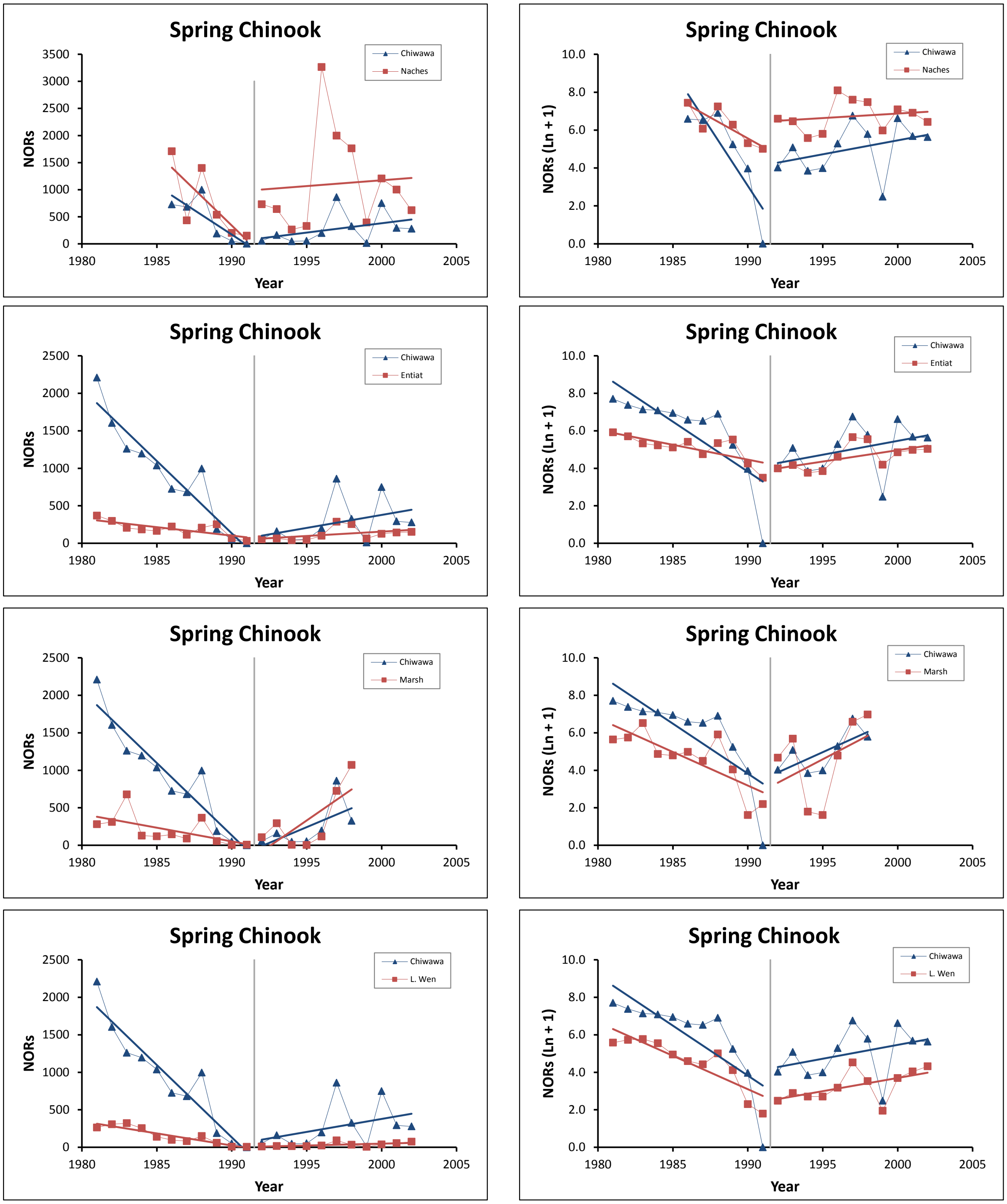

Figure 10. Trends in spring Chinook natural-origin recruits (NORs) in the Chiwawa and reference populations. The vertical lines in the figures separate the pre- and post-supplementation periods. Figures on the left include untransformed NORs; those on the right include natural-log transformed data.

Table 13. Pearson correlation coefficients and t-test results comparing slopes of natural-origin recruits trends between reference populations and the Chiwawa spring Chinook population before and during the supplementation periods; for correlation coefficients, an asterisk (*) indicates significance at $P < 0.05$. Analyses include both untransformed and natural-log transformed natural-origin recruits.

Reference population	Pearson correlation coefficient		Test on slopes			
			t-value		P-value	
	Before	During	Before	During	Before	During
Natural-Origin Recruits						
Naches	0.803*	0.432	0.666	0.140	0.524	0.890
Entiat	0.795*	0.754*	-7.495	0.847	0.000	0.408
Marsh	0.605*	0.677*	-5.786	-0.718	0.000	0.489
Little Wenatchee	0.880*	0.758*	-7.206	1.128	0.000	0.274
LN Natural-Origin Recruits						
Naches	0.824*	0.710*	-1.985	0.693	0.082	0.497
Entiat	0.886*	0.796*	-2.563	0.202	0.019	0.842
Marsh	0.830*	0.835*	-1.038	-0.134	0.313	0.896
Little Wenatchee	0.927*	0.898*	-1.150	0.046	0.265	0.964

As with NORs and spawner abundance data, trend analysis indicated that the relationship of slopes of productivity (recruits/spawner) between the Chiwawa and reference populations did not change significantly after the initiation of supplementation (Figure 11; Table 14). This was true for both transformed and untransformed productivity data. Before supplementation, productivities trended down in both the Chiwawa and reference populations (Figure 11). During the period of supplementation, productivities fluctuated widely in both the Chiwawa and reference populations. Nevertheless, during the supplementation period, productivities generally increased in both the reference and Chiwawa populations. Unlike with spawner abundance, the Pearson correlation coefficients resulting from analysis of productivity data were generally higher in the pre-supplementation period than during the supplementation period (Table 14).

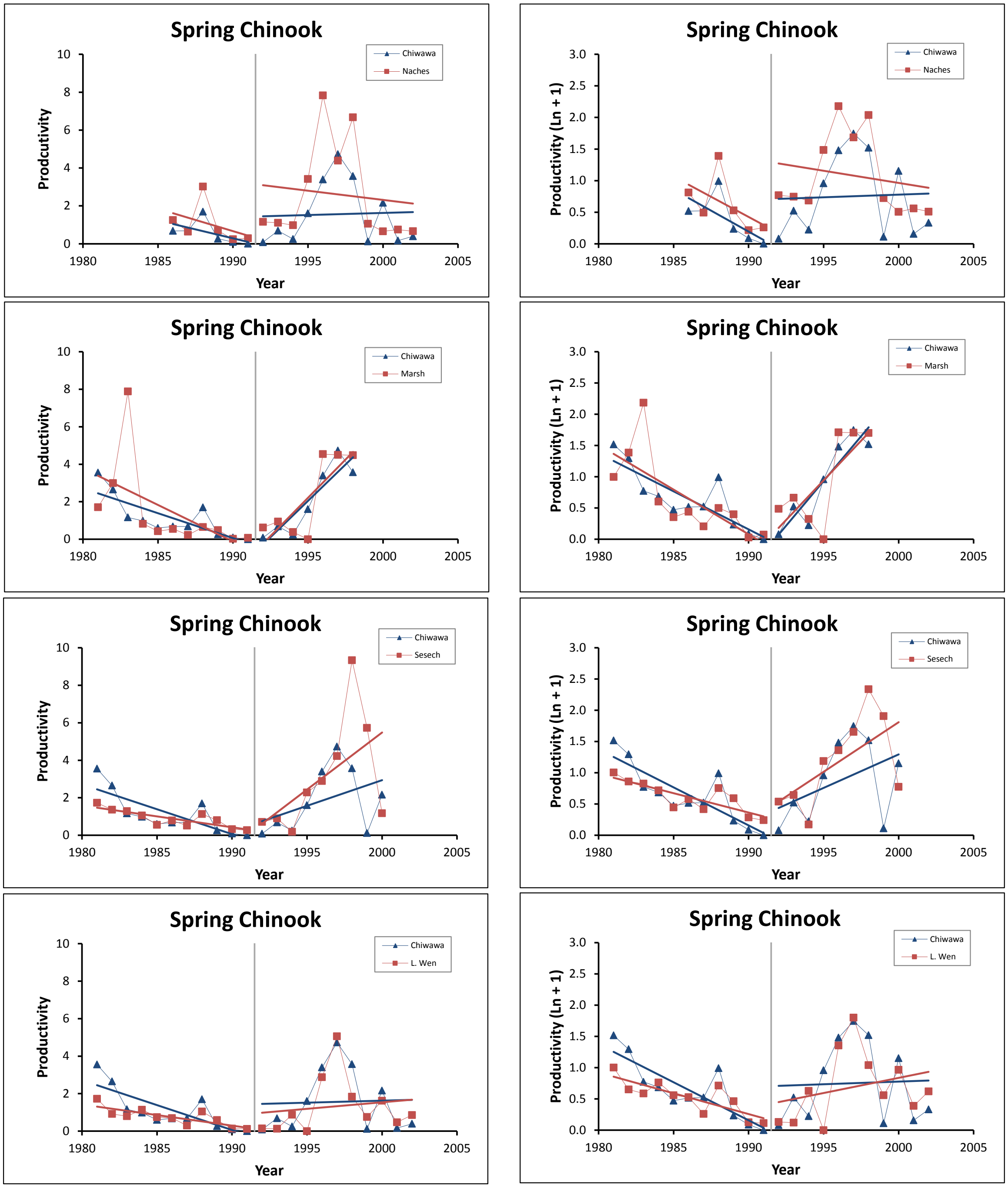

Figure 11. Trends in spring Chinook productivity (recruits/spawner) in the Chiwawa (supplemented) and reference populations. The vertical lines in the figures separate the pre- and post-supplementation periods. Figures on the left include untransformed productivity data; those on the right include natural-log transformed data.

Table 14. Pearson correlation coefficients and t-test results comparing slopes of productivity (recruits/spawner) trends between reference populations and the Chiwawa spring Chinook population before and during the supplementation periods; for correlation coefficients, an asterisk (*) indicates significance at $P < 0.05$. Analyses include both untransformed and natural-log transformed productivity data.

Reference population	Pearson correlation coefficient		Test on slopes			
			t-value		P-value	
	Before	During	Before	During	Before	During
Productivity						
Naches	0.960*	0.802*	0.169	0.387	0.870	0.703
Marsh	0.320	0.910*	0.605	-0.132	0.553	0.898
Sesech	0.903*	0.491	-2.059	-0.837	0.054	0.417
Little Wenatchee	0.848*	0.864*	-2.065	-0.213	0.054	0.834
LN Productivity						
Naches	0.944*	0.805*	-0.042	0.526	0.968	0.605
Marsh	0.610*	0.804*	0.428	0.281	0.674	0.784
Sesech	0.913*	0.531	-2.050	-0.463	0.055	0.651
Little Wenatchee	0.862*	0.751*	-1.811	-0.480	0.087	0.637

Using trend analysis, we found no evidence that the supplementation program has significantly increased the spawner abundance and NORs of spring Chinook in the Chiwawa Basin. Even though we documented an increasing trend in spawner abundance and NORs during the supplementation period, a similar increase in spawner abundance and NORs was observed in the reference populations. In addition, we found no evidence that the supplementation program has increased the productivity of spring Chinook in the Chiwawa Basin. Importantly, the productivity of spring Chinook in the Chiwawa Basin did not trend downward during the supplementation period. Thus, based on trend analysis, it appears that the supplementation program has not increased or decreased the abundance and productivity of spring Chinook in the Chiwawa Basin.

We note that this exercise only tests the slopes of the trend lines. It does not test for differences in elevations of the trend lines. A supplementation program could increase spawner abundance, NORs, and productivity of the target population without changing the slopes of the trend lines. That is, supplementation could cause the elevation of the trend line to be greater during the supplementation period than during the pre-supplementation period. In the next section we evaluate elevation differences by testing mean differences before and after supplementation.

Analysis of Mean Differences, Ratios, and Rates

For assessing mean differences between supplemented and reference populations, we derived three different response variables using transformed and untransformed spawner abundance, NORs, and productivity data. The first included difference scores, which were calculated as the difference between paired treatment and reference data (T-R). The second included ratios, which were calculated as the ratio of paired treatment and reference data (T/R). Finally, we calculated the differences in annual changes in paired treatment and reference population data (ΔT-ΔR; see footnote #2).

If the hatchery program is successfully supplementing the natural spring Chinook population, the mean difference or ratio score of paired spawner abundance data and NORs during the supplementation period should be greater than the pre-supplementation period. For productivity, the mean difference or ratio score during the supplementation period should be equal to or higher than the pre-supplementation period. We tested the following statistical hypotheses.

Spawner Abundance and NORs:

Ho: Mean Difference (or Ratio) before supplementation ≥ Mean Difference (or Ratio) during supplementation.

Ha: Mean Difference (or Ratio) before supplementation < Mean Difference (or Ratio) during supplementation (i.e., $\mu_{pre} - \mu_{post} < 0$).

Productivity (Recruits/Spawner):

Ho: Mean Difference (or Ratio) before supplementation ≤ Mean Difference (or Ratio) during supplementation.

Ha: Mean Difference (or Ratio) before supplementation > Mean Difference (or Ratio) during supplementation (i.e., $\mu_{pre} - \mu_{post} > 0$).[19]

For each set of response variables, we tested before/after supplementation effects using a one-tailed Aspin-Welch unequal-variance test. We used the Aspin-Welch unequal-variance test instead of Student's t-test, because in nearly every case, the variances of response variables in the pre-treatment and supplementation periods were unequal.[20] This was true even for natural-log transformed variables. We used the modified Levene equal-variance test to assess the equality of variance. In some cases, the distributions of response variables were not normal (based on the Omnibus Normality test and examination of histograms, normal probability plots, and box plots). Therefore, we also used a randomization test, based on 10,000 Monte Carlo simulations, to assess differences in response variables before and during supplementation. The randomization procedure only allowed the testing of two-tailed hypotheses. Therefore, we generated 95% confidence intervals on the mean difference ($\mu_{pre} - \mu_{post}$) using bootstrapping methods to determine the direction of the difference. We generated 5,000 bootstrap samples to calculate confidence intervals.

All these statistical methods assume that the samples of derived difference or ratio scores from the pre-supplementation and supplementation periods were independent. However, BACI designs, like time-series trend analysis, are repeated-measures designs and therefore are susceptible to temporal correlations in the data. This means that the two samples of difference or ratio scores may not be independent. Under this scenario, ARIMA models can be used to describe the correlation structure in temporal data (Gotelli and Ellison 2004). ARIMA models can be fit individually to the reference and supplemented time series data, or to a derived data

[19] Because of the logic of null hypothesis testing, the rejection of the null hypothesis of no difference in productivity would mean that the supplementation program has reduced the productivity of the target population (here rejection of the null indicates "harm"). Notice that the rejection of the null hypothesis of no difference in spawner abundance means that the supplementation program has improved the spawner abundance in the target population (here rejection of the null indicates "benefit").

[20] In cases in which the variances were equal, both the Aspin-Welch test and Student's t-test gave the same result.

series created by taking the ratio or difference of the supplemented/reference data at each time step. ARIMA models, however, require a long time series (N > 40) and therefore we could not use them to model the spring Chinook data. Thus, we acknowledge that our analyses may be confounded if the samples are not independent.

Difference Scores (T-R)

Analysis of supplementation effects on spawner abundance using difference scores indicated that supplementation did not significantly increase spawning abundance in the Chiwawa Basin (Table 15; Figure 12). Only the Little Wenatchee-Chiwawa pairing using transformed abundance data indicated a significant increase in spawning abundance following supplementation. The randomization test indicated significant differences in several of the treatment-reference pairs; however, the bootstrap CIs indicated that those differences were in the wrong direction (i.e., CIs > 0). That is, compared to the reference populations, spawner abundance decreased in the Chiwawa Basin during the supplementation period (Figure 12).

Table 15. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed spawner abundance data. Tests determined if the mean difference scores during the supplementation period were greater than mean difference scores during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Spawner Abundance					
Naches	1.066	0.848	184	0.322	-162 – 472
Entiat	1.872	0.962	316	0.078	17 – 633
Sesech	4.502	0.999	607	0.000	349 – 851
Little Wenatchee	1.773	0.954	321	0.093	0 – 690
LN Spawner Abundance					
Naches	2.603	0.990	0.701	0.026	0.210 – 1.214
Entiat	1.701	0.946	0.388	0.108	-0.033 – 0.811
Sesech	5.394	0.999	1.327	0.000	0.891 – 1.805
Little Wenatchee	-2.259	0.018	0.609	0.034	-1.125 – -0.097

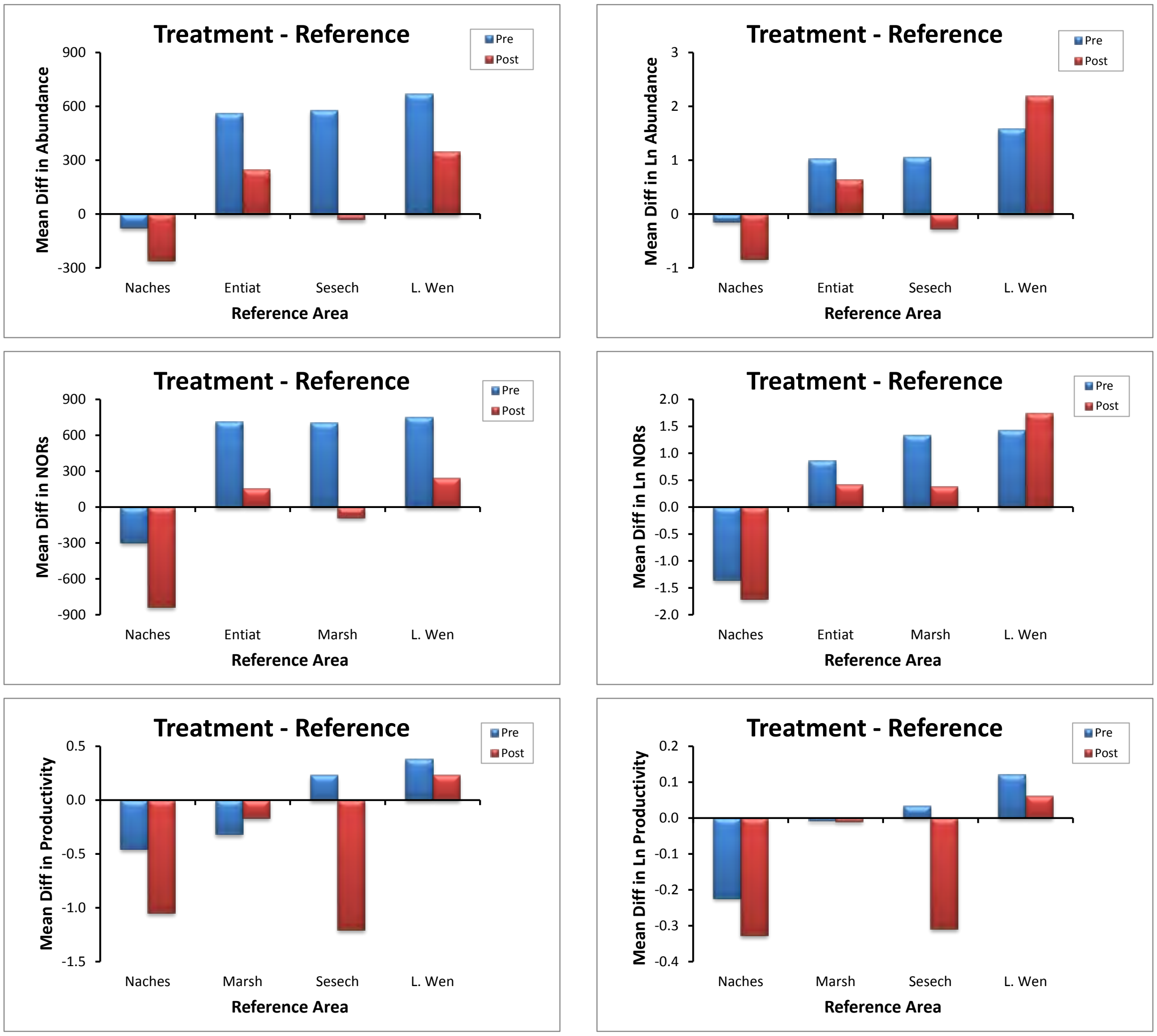

Figure 12. Mean difference (Treatment – Reference) scores of untransformed (figures on the left) and transformed (figures on the right) spawner abundance, natural-origin recruits (NORs), and productivity data before (pre) and after (post) spring Chinook supplementation in the Chiwawa Basin. Positive effects of supplementation on spawner abundance and NORs are indicated when the post-supplementation (red) bars are greater than their corresponding pre-supplementation (blue) bars. Negative effects of supplementation on productivity are indicated when the pre-supplementation (blue) bars are greater than their corresponding post-supplementation (red) bars.

Analysis of supplementation effects on NORs using difference scores indicated that supplementation did not significantly increase NORs in the Chiwawa Basin (Table 16; Figure 12). The randomization test indicated significant differences in several of the treatment-reference pairs; however, the bootstrap CIs indicated that those differences were in the wrong direction. That is, compared to the reference populations, NORs decreased in the Chiwawa Basin during the supplementation period (Figure 12).

Table 16. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed natural-origin recruits. Tests determined if the mean difference scores during the supplementation period were greater than mean difference scores during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Natural-Origin Recruits					
Naches	1.787	0.953	537	0.081	-60 – 1039
Entiat	2.879	0.993	558	0.007	201 – 916
Marsh	3.817	0.999	795	0.001	381 – 1153
Little Wenatchee	2.668	0.991	510	0.013	145 – 863
LN Natural-Origin Recruits					
Naches	0.430	0.659	0.354	0.686	-0.948 – 1.975
Entiat	0.788	0.779	0.445	0.465	-0.504 – 1.583
Marsh	1.45	0.916	0.953	0.168	-0.169 – 2.243
Little Wenatchee	-0.813	0.214	-0.319	0.506	-0.948 – 0.484

Analysis of supplementation effects on productivity (adult recruits/spawner) using difference scores indicated that supplementation did not significantly decrease productivity in the Chiwawa Basin (Table 17; Figure 12). All tests, regardless of treatment-reference pairs, indicated that productivity did not change significantly during the supplementation period. These tests indicate that supplementation has not negatively affected the productivity of spring Chinook salmon in the Chiwawa Basin.

Table 17. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed productivity data. Tests determined if the mean difference scores during the supplementation period were less than mean difference scores during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Productivity					
Naches	1.134	0.139	0.594	0.296	-0.427 – 1.540
Marsh	-0.203	0.579	0.152	0.932	-0.304 – 1.381
Sesech	1.607	0.071	1.435	0.151	-0.403 – 2.917
Little Wenatchee	0.431	0.335	0.147	0.665	-0.498 – 0.762
LN Productivity					
Naches	0.770	0.227	0.104	0.480	-0.125 – 0.378
Marsh	0.012	0.495	0.003	0.992	-0.375 – 0.493
Sesech	1.463	0.087	0.343	0.161	-0.135 – 0.732
Little Wenatchee	0.390	0.351	0.060	0.701	-0.229 – 0.347

Ratio Scores (T/R)

As with difference scores, analysis of supplementation effects on spawner abundance using ratios indicated that supplementation did not significantly increase spawning abundance in the Chiwawa Basin (Table 18; Figure 13). Only the Little Wenatchee-Chiwawa pairing indicated a significant increase in spawning abundance following supplementation. Analysis with both transformed and untransformed Little Wenatchee-Chiwawa data indicated a significant effect. In contrast, only difference scores derived from transformed data indicated a significant effect. The randomization test indicated significant differences in several of the treatment-reference pairs; however, the bootstrap CIs indicated that those differences were in the wrong direction. That is, compared to the reference populations, spawner abundance decreased in the Chiwawa Basin during the supplementation period (Figure 13).

Table 18. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed spawner abundance data. Tests determined if the mean ratios during the supplementation period were greater than mean ratios during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Spawner Abundance					
Naches	2.110	0.970	0.398	0.065	0.056 – 0.737
Entiat	1.254	0.888	0.731	0.223	-0.365 – 1.834
Sesech	4.251	0.999	2.428	0.000	1.278 – 3.435
Little Wenatchee	-2.649	0.009	3.897	0.018	-6.579 – -1.202
LN Spawner Abundance					
Naches	2.783	0.993	0.120	0.021	0.045 – 0.199
Entiat	1.273	0.890	0.055	0.220	-0.026 – 0.135
Sesech	5.143	0.999	0.244	0.000	0.160 – 0.335
Little Wenatchee	-3.462	0.002	0.327	0.003	-0.516 – -0.154

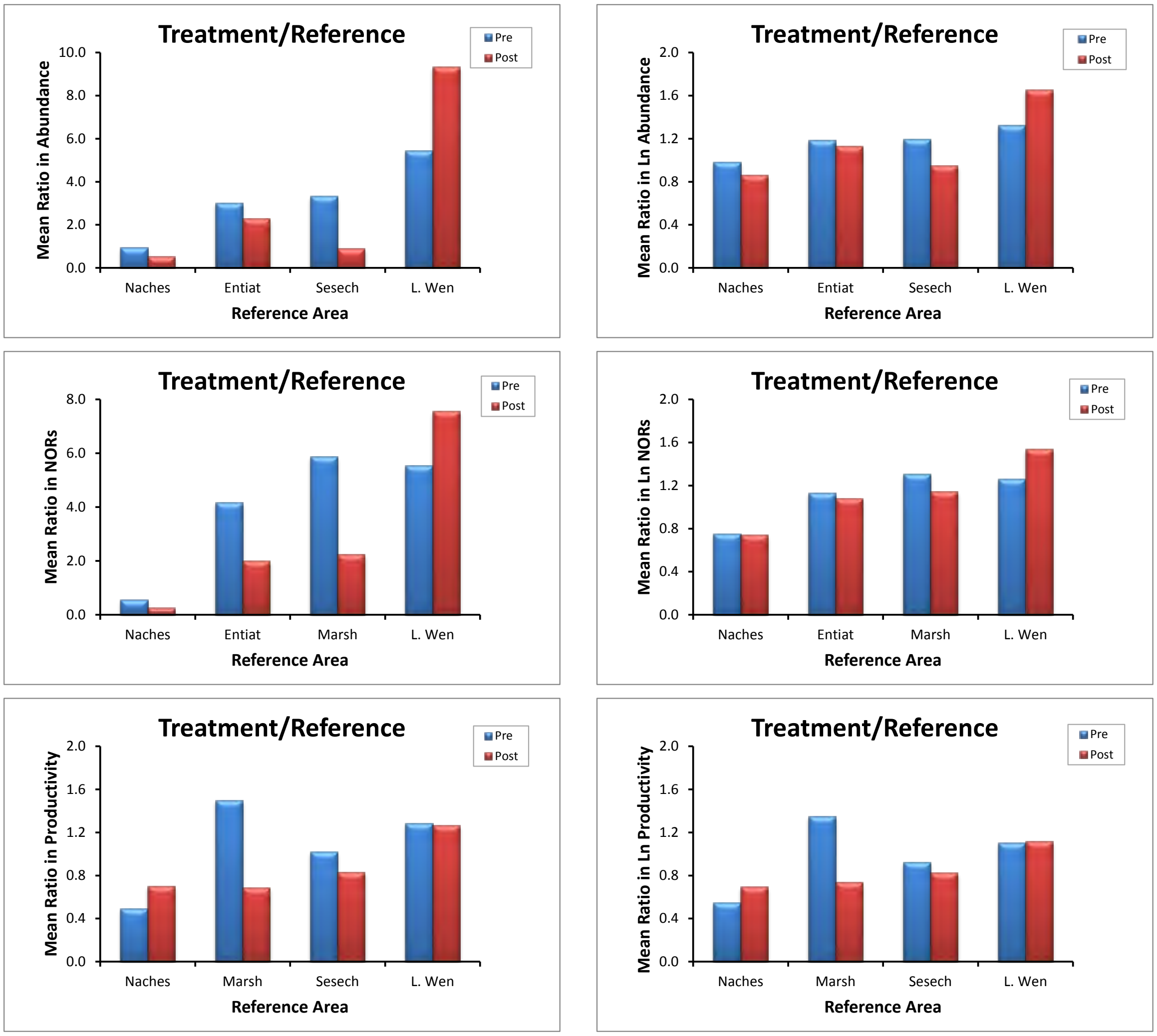

Figure 13. Mean ratios (Treatment/Reference) scores of untransformed (figures on the left) and transformed (figures on the right) spawner abundance, natural-origin recruits (NORs), and productivity data before (pre) and after (post) spring Chinook supplementation in the Chiwawa Basin. Positive effects of supplementation on spawner abundance and NORs are indicated when the post-supplementation (red) bars are greater than their corresponding pre-supplementation (blue) bars. Negative effects of supplementation on productivity are indicated when the pre-supplementation (blue) bars are greater than their corresponding post-supplementation (red) bars.

Analysis of supplementation effects on NORs using ratios indicated that supplementation did not significantly increase NORs in the Chiwawa Basin (Table 19; Figure 13). Only the Little Wenatchee-Chiwawa pairing indicated a significant increase in transformed NORs following supplementation. The randomization test indicated significant differences in several of the treatment-reference pairs; however, the bootstrap CIs indicated that those differences were in the wrong direction. That is, compared to the reference populations, NORs decreased in the Chiwawa Basin during the supplementation period (Figure 13).

Table 19. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed natural-origin recruits. Tests determined if the mean ratios during the supplementation period were greater than mean ratios during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Natural-Origin Recruits					
Naches	1.318	0.881	0.306	0.219	-0.157 – 0.670
Entiat	2.447	0.987	2.172	0.028	0.593 – 3.871
Marsh	2.001	0.965	3.638	0.075	0.532 – 7.201
Little Wenatchee	-1.148	0.136	2.020	0.284	-5.055 – 1.516
LN Natural-Origin Recruits					
Naches	0.057	0.522	0.009	0.967	-0.230 – 0.351
Entiat	0.359	0.638	0.049	0.759	-0.173 – 0.336
Marsh	0.603	0.721	0.161	0.579	-0.272 – 0.681
Little Wenatchee	-1.914	0.038	0.277	0.027	-0.504 – 0.031

Analysis of supplementation effects on productivity (adult recruits/spawner) using ratios indicated that supplementation did not significantly decrease productivity in the Chiwawa Basin (Table 20; Figure 13). Although the Aspin-Welch test indicated a significant effect when comparing the Chiwawa to the Marsh Creek population, both the randomization test and the bootstrap CI did not indicate a significant effect. These tests indicate that supplementation has probably not negatively affected the productivity of spring Chinook salmon in the Chiwawa Basin.

Table 20. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed productivity data. Tests determined if the mean ratios during the supplementation period were less than mean ratios during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Productivity					
Naches	-0.677	0.745	0.209	0.688	-0.700 – 0.425
Marsh	2.236	0.022	0.814	0.054	0.112 – 1.459
Sesech	0.677	0.253	0.191	0.515	-0.356 – 0.718
Little Wenatchee	0.033	0.487	0.018	0.979	-0.879 – 1.162
LN Productivity					
Naches	-0.639	0.734	0.148	0.616	-0.548 – 0.316
Marsh	1.952	0.036	0.613	0.081	-0.003 – 1.170
Sesech	0.447	0.330	0.098	0.663	-0.301 – 0.515
Little Wenatchee	-0.034	0.513	0.015	0.982	-0.692 – 0.861

Difference of Annual Difference Scores (ΔT-ΔR)

Analysis of supplementation effects on spawner abundance using difference scores of annual changes indicated that supplementation did not significantly increase spawning abundance in the Chiwawa Basin (Table 21; Figure 14). None of the statistical analyses detected a significant increase in annual change in the Chiwawa Basin relative to the reference populations.

Table 21. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed spawner abundance data. Tests determined if mean difference scores of annual change during the supplementation period were greater than mean difference scores of annual change during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Spawner Abundance					
Naches	0.009	0.503	2	0.995	-502 – 539
Entiat	-0.239	0.407	48	0.826	-414 – 327
Sesech	-0.126	0.451	20	0.902	-311 – 266
Little Wenatchee	-0.318	0.377	65	0.761	-452 – 311
LN Spawner Abundance					
Naches	-0.425	0.339	0.142	0.698	-0.744 – 0.466
Entiat	-0.084	0.467	0.028	0.933	-0.681 – 0.593
Sesech	-0.349	0.366	0.117	0.740	-0.741 – 0.515
Little Wenatchee	0.001	0.500	0.000	0.999	-0.663 – 0.687

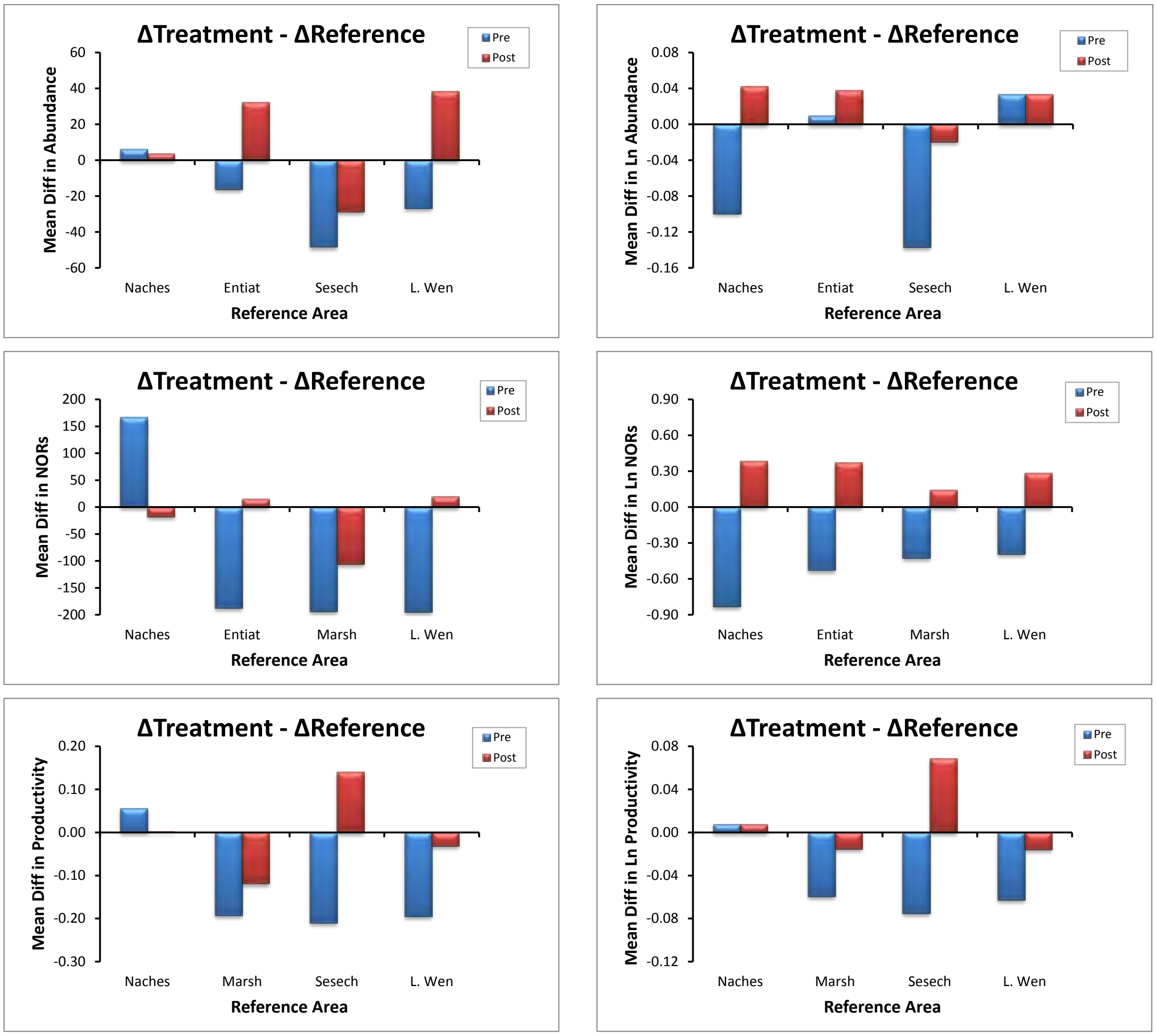

Figure 14. Mean difference scores of annual changes (ΔTreatment – ΔReference) of untransformed (figures on the left) and transformed (figures on the right) spawner abundance and productivity data before (pre) and after (post) spring Chinook supplementation in the Chiwawa Basin.

Analysis of supplementation effects on NORs using difference scores of annual changes indicated that supplementation did not significantly increase NORs in the Chiwawa Basin (Table 22; Figure 14). None of the statistical analyses detected a significant increase in annual change in the Chiwawa Basin relative to the reference populations.

Table 22. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed natural-origin recruits. Tests determined if mean difference scores of annual change during the supplementation period were greater than mean difference scores of annual change during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Natural-Origin Recruits					
Naches	0.399	0.652	184	0.741	-699 – 989
Entiat	-1.381	0.092	202	0.194	-471 – 86
Marsh	-0.505	0.311	88	0.624	-425 – 206
Little Wenatchee	-1.437	0.084	214	0.179	-481 – 64
LN Natural-Origin Recruits					
Naches	-1.301	0.118	1.214	0.224	-2.783 – 0.531
Entiat	-1.408	0.088	0.901	0.188	-1.977 – 0.387
Marsh	-0.712	0.244	0.570	0.517	-1.952 – 0.975
Little Wenatchee	-1.154	0.132	0.674	0.274	-1.706 – 0.497

Analysis of supplementation effects on productivity (adult recruits/spawner) using difference scores of annual changes indicated that supplementation did not significantly decrease productivity in the Chiwawa Basin (Table 23; Figure 14). All tests, regardless of treatment-reference pairs, indicated that productivity did not change significantly during the supplementation period.

Table 23. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed productivity data. Tests determined if the mean difference scores of annual change during the supplementation period were less than mean difference scores of annual change during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Productivity					
Naches	0.002	0.475	0.054	0.952	-1.464 – 1.583
Marsh	-0.063	0.525	0.074	0.948	-2.395 – 2.031
Sesech	-0.317	0.621	0.350	0.628	-2.387 – 1.695
Little Wenatchee	-0.347	0.633	0.163	0.728	-1.023 – 0.725
LN Productivity					
Naches	0.000	0.500	0.000	0.999	-0.408 – 0.445
Marsh	-0.126	0.549	0.044	0.904	-0.715 – 0.595
Sesech	-0.449	0.668	0.144	0.727	-0.685 – 0.509
Little Wenatchee	-0.200	0.578	0.047	0.842	-0.466 – 0.391

We believe results from analysis of mean differences of annual change (ΔT-ΔR) in spawning abundance, NORs, and productivity are difficult to interpret and may be insensitive to treatment effects. A simpler analysis, which is also easier to interpret, is the use of trend analysis. Therefore, we recommend that analyses using differences of annual change be replaced with trend analysis.

Corrections for Density Dependence and Carrying Capacity

The analyses described above assume that the density of spawners or recruits does not affect the survival and productivity of fish. However, it is well known that the density of fish can affect the number of recruits as well as the productivity of the population. This occurs through the relationship between density and mortality. Mortality of fish can be generally classified as density independent and density dependent. In general, when densities are low, the mortality is density independent, but as densities increase, the amount of density-dependent mortality increases. Monitoring programs can make use of this information to derive density-corrected estimates of productivity. In this section, we describe two different methods for deriving density-corrected estimates of productivity.

The first method controlled the effects of density on productivity (adult recruits/spawner; R/S) by partitioning observed productivities into density-independent and density-dependent productivity. When abundance is below the minimum number of spawners (S) needed to produce the maximum number of recruits (K_{sp}), the observed productivity is used in statistical tests. However, when the abundance is equal to or above K_{sp}, the modeled value of productivity (R/K_{sp}) is used in statistical tests.

$$\boldsymbol{Adj\ R/S} = \begin{cases} \boldsymbol{R/S,} & \boldsymbol{if\ S < K_{sp}} \\ \boldsymbol{R/K_{sp},} & \boldsymbol{if\ S \geq K_{sp}} \end{cases}$$

The density-independent and density-dependent productivities were then combined in a single test.

The second method was based on one of the goals of supplementation, which is to fill the capacity of the environment with fish. This method corrects for differences in carrying capacities between the supplemented and reference populations. We did this by calculating the percent saturation of NORs. That is, we calculated the fraction of the habitat (τ) that was filled with NORs by dividing the observed NOR by the modeled maximum number of NORs (K_R) that the habitat could support.

$$\boldsymbol{\tau = \frac{NOR_{obs}}{K_R}}$$

Note that 1-τ represents the unused portion of the carrying capacity and is the term that is multiplied by the exponential growth equation to derive the logistic growth equation. We included τ in the statistical analyses.

These two methods require the estimation of carrying capacity (K_R) and the spawning abundance that produces the maximum number of recruits (K_{sp}). We estimated these parameters for both reference populations and the supplemented population using Ricker, Beverton-Holt, and smooth hockey stick stock-recruitment models. We used only spawner abundance as a predictor of subsequent brood recruitment. We made the following assumptions in proceeding with the analysis:

- *Density-dependent mortality*—For some time period before recruitment, the brood instantaneous mortality rate is proportional to the number of parent spawners (Ricker 1954).
- *Lognormal variation*—At any particular spawning stock size, the variation in recruitment is log-normally distributed about its average, and acts multiplicatively (Quinn and Deriso 1999).
- *Measurement error*—Error in spawning stock size estimates (measurement error) is small relative to the range of spawning stock sizes observed (Hilborn and Walters 1992). Variation in realized recruitment at any particular spawning stock size (process error) dominates recruitment measurement error.
- *Stationarity*—The average stock-recruitment relationship is constant over time (Hilborn and Walters 1992). That is, environmental conditions randomly affect survival independent of stock size or time.

In general, the methods we used to fit the models to the data followed those outlined in Hilborn and Walters (1992) and Froese (2008). The Ricker model, which assumes that the number of recruits increases to a maximum and then declines as the number of spawners increases, takes the form:

$$\boldsymbol{E(R) = \alpha S e^{-\beta S}}$$

where E(R) is the expected recruitment, S is spawner abundance, α is the number of recruits per spawner at low spawning levels, and β describes how quickly the recruits per spawner drop as the number of spawners increases. We estimated K_R as:

$$\boldsymbol{K_R = \left(\frac{\alpha}{\beta}\right) e^{-1}}$$

and K_{sp} as:

$$\boldsymbol{K_{sp} = \frac{1}{\beta}}$$

The Beverton-Holt model assumes that the number of recruits increases constantly toward an asymptote as the number of spawners increases. After the asymptote is reached, the number of recruits neither increases nor decreases. The asymptote represents the maximum number of recruits the system can support (i.e., carrying capacity for the system; K_R). The Beverton-Holt curve takes the form:

$$\boldsymbol{E(R) = \frac{(\alpha S)}{(\beta + S)}}$$

where E(R) and S are as above, α is the maximum number of recruits produced (K_R), and β is the number of spawners needed to produce (on average) recruits equal to one-half the maximum number of recruits. Because $K_{sp} = \infty$ in the Beverton-Holt model, we estimated K_{sp} as the number of spawners needed to produce 0.99(K_R).

Like the Beverton-Holt model, the smooth hockey stick model assumes that the number of recruits increases toward an asymptote (carrying capacity; K_R) as the number of spawners increases. After the carrying capacity is reached, the number of recruits neither increases nor decreases. The carrying capacity represents the maximum number of recruits the system can support. This curve takes the form (Froese 2008):

$$\boldsymbol{E(R) = R_\infty\left(1 - e^{-\left(\frac{\alpha}{R\infty}\right)S}\right)}$$

where E(R) and S are as above, α is the slope at the origin of the spawner-recruitment curve, and R_∞ is the carrying capacity of recruits (note that $R_\infty = K_R$). As with the Beverton-Holt model, we estimated K_{sp} as the number of spawners needed to produce 0.99(K_R).

We used non-linear regression to fit the three models to spawner-recruitment data. Before fitting the models, we transformed recruitment data using natural logs. We estimated bias and uncertainty measures (95% CI) for the model parameters using bootstrap procedures, which assumed that the {R, S} sample represented or approximated the population. The number of bootstrap samples was 3,000. We computed and stored the non-linear regression results for each bootstrap sample. We then calculated the bootstrap 95% CI by arranging the 3,000 bootstrap parameter values in sorted order and selected the 2.5 and 97.5 percentiles from the list.

We used Akaike's Information Criterion for small sample size (AIC_c) to determine which model(s) best explained the relationship between spawners and recruitment in the supplemented and reference populations. AIC_c was estimated as:

$$\boldsymbol{AIC_c = -2log\big(£(\theta|data)\big) + 2K + \left(\frac{2K(K+1)}{n-K-1}\right)}$$

where *log(£(θ|data))* is the maximum likelihood estimate, *K* is the number of estimable parameters (structural parameters plus the residual variance parameter), and *n* is the sample size (Burnham and Anderson 2002). We used least-squares methods to estimate *log(£(θ|data))*, which was calculated as $log(\sigma^2)$, where σ^2 = residual sum of squares divided by the sample size ($\sigma^2 = RSS/n$). AIC_c assessed model fit in relation to model complexity (number of parameters). The model with the smallest AIC_c value represented the "best approximating" model within the model set. Remaining models were ranked relative to the best model using AIC_c difference scores (ΔAIC_c), Akaike weights (w_i), and evidence ratios. Models with ΔAIC_c values less than 2 indicated that there is substantial support for these models as being the best-fitting models within the set (Burnham and Anderson 2002). Models with values greater than 2 had less support. Akaike weights are probabilities estimating the strength of the evidence supporting a particular model as being the best model within the model set. Models with small w_i values are less plausible as competing models (Burnham and Anderson 2002). If no single model could be specified as the best model, a "best subset" of competing models was identified using (1) AIC_c differences to indicate the level of empirical support each model had as being the best model, (2) evidence ratios based on Akaike weights to indicate the relative probability that any model is the best model, and (3) coefficients of determination (R^2) assessing the explanatory power of each model.

Stock-Recruitment Analysis

We successfully fit stock-recruitment models to the Chiwawa and reference population data. The span of spawner data for the Chiwawa and reference populations was greater than 14 times the minimum observed spawners, which should provide sufficient contrast for estimation of model parameters. In addition, the span of recruitment data was greater than 12 times the minimum observed recruitment, again providing sufficient contrast for estimation of parameters. The relationship between natural log R/S and spawners indicated that some of the highest productivities occurred at the lower spawner levels and the lowest productivities generally occurred at the highest spawner levels (Figure 15). This is consistent with the assumption of density-dependent mortality.

Although model fits were generally poor, explaining less than 40% of the residual variation in natural-log recruitment data, we were able to estimate average maximum recruitment levels (K_R) and the spawning levels needed to produce maximum recruitment (K_{sp}) (Table 24; Figure 15). For all populations examined, Akaike information criterion was unable to identify a best approximating model (i.e., ΔAIC_c values were less than 2, indicating support for all three models). However, evaluation of 95% CIs and the asymptotic correlation coefficients indicated that the smooth hockey stick model may be the best approximating model for each population. Therefore, we used estimates of K_R and K_{sp} derived from the smooth hockey stick model to correct for density dependence and different carrying capacities in treatment-reference comparisons.

As part of the regression diagnostics, we examined the dependence of the model residuals on time and found a significant ($P < 0.05$), positive, one-year-lag autocorrelation for the Entiat (0.562), Marsh (0.551), Sesech (0.564), and Little Wenatchee (0.629) populations. For the purposes of our work here, we did not attempt to correct for this one-year-lag correlation in the residuals. Future analyses will explore the use of autoregressive models (e.g., AR1; Noakes et al. 1987) to correct for autocorrelation.

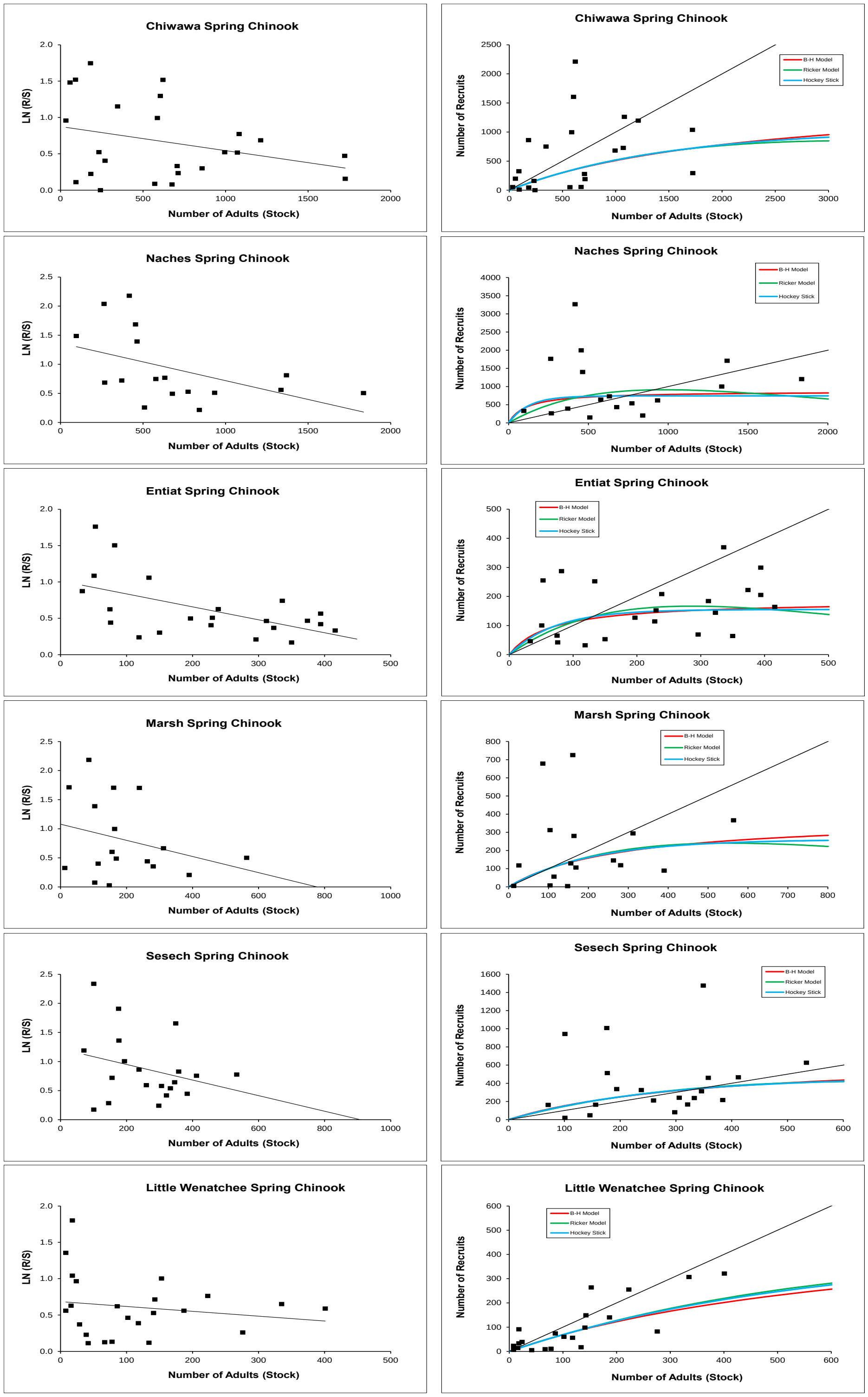

Figure 15. Relationships between natural log recruits/spawner (LN R/S) and spawners (Stock) in the Chiwawa and reference populations (figures on the left) and relationships between numbers of untransformed recruits and spawners in the Chiwawa and reference populations (figures on the right). Figures on the right also show the fit of the Ricker, Beverton-Holt, and the smooth hockey stick models to the data (black straight line represents R=S).

Table 24. Results from fitting Ricker, Beverton-Holt, and smooth hockey stick models to stock-recruitment data from the Chiwawa and reference populations. 95% CI on parameter estimates are based on 3,000 bootstrap trials; Corr coef = asymptotic correlation of the parameter estimates; K_R = maximum natural origin recruits (recruits at carrying capacity); K_{sp} = number of spawners needed to produce K_R; AICc = Akaike's Information Criterion for small sample size; Adj R^2 = coefficient of determination that is adjusted for the number of parameters in the model.

Model	Parameter	Parameter value	Bootstrap 95% CI	Corr coef	K_R	K_{sp}	AICc	Adj R^2
Chiwawa Population								
Ricker	α	0.7048	-0.6197 1.1055	0.791	852	3,285	-47.949	0.125
	β	0.000304	-0.000668 0.000609					
Beverton-Holt	α	1687.4	-65654539 3062.1	0.989	1,687	43,760	-47.962	0.125
	β	2308.5	-99999538 4526.1					
Smooth hockey stick	α	6.956	-41.313 8.2270	-0.708	1,049	6,847	-47.949	0.125
	β	0.7118	-2.397 1.122					
Naches Population								
Ricker	α	2.5223	-2.0003 3.9672	0.844	912	983	-45.063	-0.143
	β	0.001018	-0.000752 0.001717					
Beverton-Holt	α	869.4	97.4 1641.4	0.858	869	11,455	-46.801	-0.097
	β	111.8	-346.2 569.8					
Smooth hockey stick	α	6.612	5.9223 7.006	-0.399	744	565	-46.831	-0.095
	β	6.013	-89.071 12.026					
Entiat Population								
Ricker	α	1.5843	0.1609 2.4178	0.867	167	286	-68.365	-0.049
	β	0.003496	0.001141 0.005906					
Beverton-Holt	α	186.1	67.9 304.3	0.880	186	1,277	-69.895	0.029
	β	65.0	-59.1 189.2					
Smooth hockey stick	α	5.045	4.381 5.378	-0.450	155	344	-69.379	0.003
	β	2.180	-89.369 3.704					
Marsh Creek Population								
Ricker	α	1.1852	-1.8268 1.9269	0.823	241	552	-32.237	0.218
	β	0.001810	-0.003063					

Model	Parameter	Parameter value	Bootstrap 95% CI	Corr coef	K_R	K_{sp}	AICc	Adj R^2
			0.003625					
Beverton-Holt	α	383.3	-85109314 665.4	0.970	383	5,310	-32.291	0.234
	β	282.4	-99999944 564.9					
Smooth hockey stick	α	5.565	-22.631 6.584	-0.694	261	984	-32.264	0.227
	β	1.265	-108.574 2.531					
Sesech Population								
Ricker	α	1.6835	-2.9253 2.5951	0.912	421	680	-54.589	-0.005
	β	0.001470	-0.002951 0.002941					
Beverton-Holt	α	689.9	-986.8 2366.7	0.981	690	6,591	-54.678	0.000
	β	351.7	-1059.0 1762.5					
Smooth hockey stick	α	6.1528	-22.851 6.815	-0.821	470	1,185	-54.633	-0.002
	β	0.8000	-119.370 2.909					
Little Wenatchee Population								
Ricker	α	0.7447	0.0828 1.0280	0.735	356	1,298	-66.978	0.357
	β	0.000770	-0.003052 0.001541					
Beverton-Holt	α	564.7	-74423355 1067.6	0.994	565	13,400	-67.055	0.358
	β	719.7	-99999856 1413.4					
Smooth hockey stick	α	6.0181	-49.5620 8.1122	-0.683	411	2,544	-67.000	0.357
	β	0.7550	-0.9539 1.0452					

Method 1: Productivity Data Adjusted for Density Dependence

Analysis of supplementation effects on productivity (adult recruits/spawner adjusted for density-dependent effects based on the smooth hockey stick model) using difference scores indicated that supplementation did not significantly decrease productivity in the Chiwawa Basin (Table 25; Figure 16). All tests, regardless of treatment-reference pairs, indicated that productivity did not change significantly during the supplementation period, even though productivity did decrease during the supplementation period (Figure 16). These results are consistent with those based on unadjusted productivity data (Table 17). This is because most abundance estimates were below the level of assumed density dependence.

Table 25. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed productivity data corrected for density dependence. Tests determined if the mean difference scores during the supplementation period were greater than mean difference scores during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Productivity					
Naches	0.904	0.190	0.496	0.412	-0.511 – 1.497
Marsh	-0.203	0.579	0.152	0.927	-1.298 – 1.372
Sesech	1.607	0.071	1.435	0.146	-0.359 – 2.911
Little Wenatchee	0.431	0.335	0.147	0.668	-0.487 – 0.781
LN Productivity					
Naches	0.570	0.290	0.083	0.568	-0.168 – 0.362
Marsh	0.012	0.495	0.003	0.991	-0.373 – 0.480
Sesech	1.463	0.087	0.343	0.171	-0.125 – 0.732
Little Wenatchee	0.390	0.351	0.060	0.709	-0.218 – 0.365

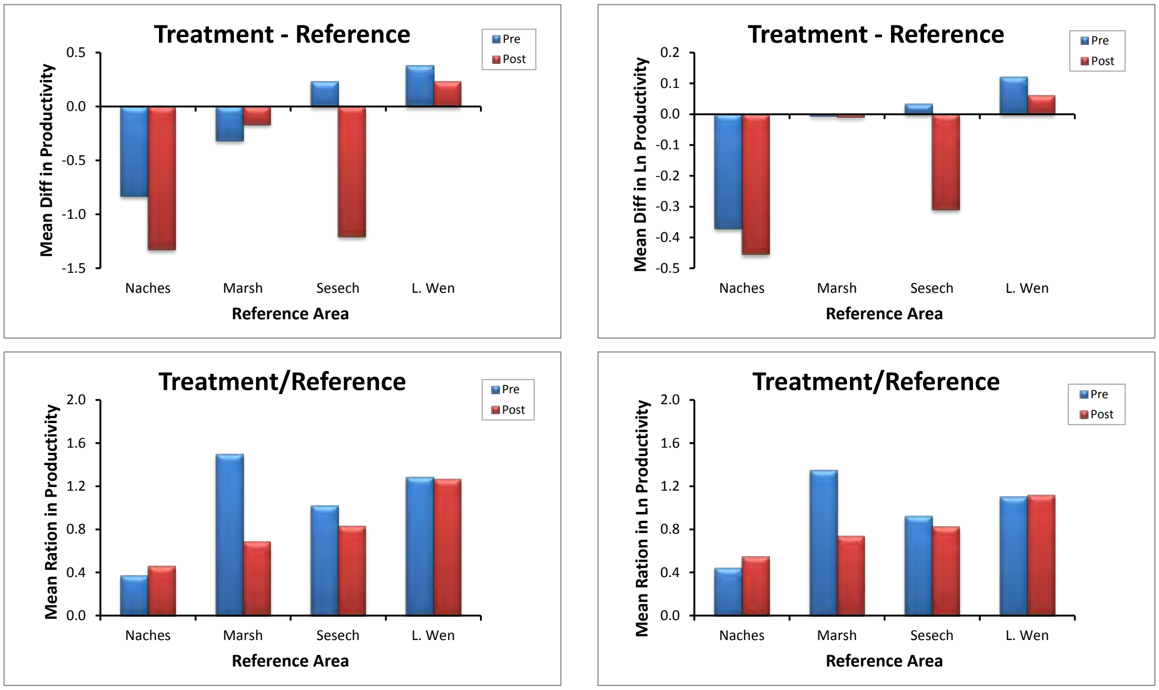

Figure 16. Mean differences (Treatment – Reference; figures on the top) and mean ratios (Treatment/Reference; figures on the bottom) of transformed and untransformed productivity data (adjusted for density dependence) before (pre) and after (post) spring Chinook supplementation in the Chiwawa Basin. Negative effects of supplementation on productivity are indicated when the pre-supplementation (blue) bars are greater than their corresponding post-supplementation (red) bars.

Analysis of supplementation effects on productivity (adult recruits/spawner adjusted for density-dependent effects) using ratios indicated that supplementation did not significantly decrease productivity in the Chiwawa Basin (Table 26; Figure 16). The Aspin-Welch test and the 95% CIs did indicate a significant effect when comparing the Chiwawa to the Marsh Creek population. These results are consistent with those using unadjusted productivity data (Table 20). Again, this is because most abundance estimates were below the level of assumed density dependence.

Table 26. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on transformed and untransformed productivity data corrected for density dependence. Tests determined if the mean ratios during the supplementation period were less than mean ratios during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test	Bootstrap 95% CI
	t-value	P-value	Effect size	P-value	
Productivity					
Naches	-0.529	0.696	0.087	0.597	-0.394 – 0.214
Marsh	2.236	0.022	0.814	0.056	0.140 – 1.470
Sesech	0.677	0.253	0.191	0.496	-0.343 – 0.727
Little Wenatchee	0.033	0.487	0.018	0.978	-0.902 – 1.181
LN Productivity					
Naches	-0.621	0.726	0.104	0.536	-0.406 – 0.191

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Marsh	1.952	0.036	0.613	0.076	0.005 – 1.163
Sesech	0.447	0.330	0.098	0.649	-0.312 – 0.498
Little Wenatchee	-0.034	0.513	0.015	0.980	-0.697 – 0.852

Our analyses assume that there is a spawner abundance (K_{sp}) at which density-independent effects end and density-dependent effects begin. In reality, density-dependent effects occur at low spawning abundance and intensify as spawning abundance increases (evident in the changing slope of the three stock-recruitment curves used in our analyses). We did not account for these increasing density-dependent effects at spawner abundances less than K_{sp}. If we accounted for the increasing effects of density dependence at spawning abundances less than K_{sp}, the analysis with and without productivity adjustments may give different results.

Method 2: Fraction of Carrying Capacity Filled with NORs

We analyzed the effects of supplementation on filling the capacity of the habitat with natural-origin recruits. The smooth hockey stick model derived the carrying capacity (K_R) estimates for the Chiwawa and reference populations. The fraction of the carrying capacity filled with Chinook recruits before and during supplementation for the Chiwawa and reference populations is provided in Table 27. These data indicate that for the Chiwawa population, the mean fraction of the K_R filled with fish decreased significantly from the pre-supplementation period through the supplementation period (Table 27). Likewise, the Entiat and Little Wenatchee populations showed a significant decline in the mean fraction of K_R filled with adult recruits. In contrast, the mean fraction of K_R in the Naches and Marsh Creek populations increased during the same period (Table 27).[21] Interestingly, the fraction of K_R filled with adult recruits for all populations trended downward during the pre-supplementation period (Figure 17). During the supplementation period, however, the fraction of K_R filled with adult recruits trended upward for all populations. These results suggest that agents of mortality outside the Chiwawa and reference populations were reducing recruitment to the populations.

[21] Although we do not show the results here, statistical analysis of the mean fraction of carrying capacity filled by adult recruits using natural-log transformed data produced the same result as using untransformed data. This was true for all populations.

Table 27. Fraction of the carrying capacity that was filled with Chinook salmon adult recruits in the Chiwawa and reference populations before (pre) and during (post) supplementation in Chiwawa Basin. The smooth hockey stick model estimated carrying capacity for each population. Statistical results from comparing the pre and post mean scores using the Aspin-Welch unequal-variance test are provided at the bottom of the table.

Supplementation period	Chiwawa	Reference populations			
		Naches	Entiat	Marsh	L. Wenatchee
Pre-supplementation period (1981-1992)	2.11		2.38	1.07	0.64
	1.53		1.93	1.20	0.75
	1.20		1.32	2.60	0.78
	1.14		1.19	0.49	0.62
	0.99		1.06	0.46	0.34
	0.70	2.30	1.43	0.56	0.24
	0.65	0.58	0.74	0.34	0.20
	0.95	1.88	1.34	1.40	0.36
	0.18	0.72	1.63	0.22	0.15
	0.05	0.27	0.45	0.02	0.02
	0.00	0.20	0.21	0.03	0.01
Pre-Mean:	0.86	0.99	1.24	0.76	0.37
Pre-Range:	0.00 – 2.11	0.20 – 2.30	0.21 – 2.38	0.02 – 2.60	0.01 – 0.78
Post-supplementation period (1992-2002)	0.05	0.98	0.34	0.41	0.03
	0.15	0.86	0.41	1.13	0.04
	0.04	0.35	0.27	0.02	0.03
	0.05	0.44	0.30	0.02	0.03
	0.19	4.39	0.65	0.45	0.06
	0.82	2.68	1.85	2.78	0.22
	0.31	2.37	1.65	4.10	0.08
	0.01	0.53	0.42		0.02
	0.71	1.62	0.82		0.10
	0.28	1.35	0.93		0.14
	0.27	0.83	0.98		0.18
Post-Mean:	0.26	1.49	0.78	1.27	0.08
Post-Range:	0.04 – 0.82	0.35 – 4.39	0.30 – 1.85	0.02 – 4.10	0.02 – 0.22
One-sided Aspin-Welch t-test of pre and post means	t = 2.846; P = 0.007	t = -0.967; P = 0.825	t = 1.833; P = 0.041	t = -0.799; P = 0.776	t = 3.321; P = 0.003

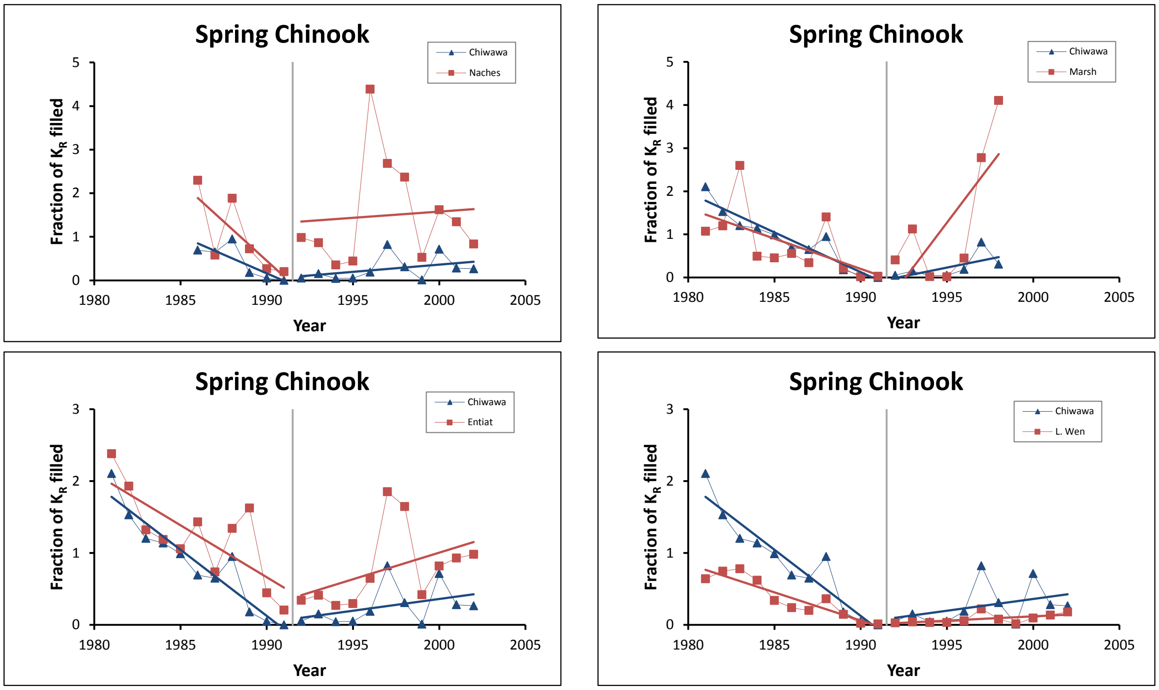

Figure 17. Trends in the fraction of the carrying capacity that was filled with Chinook salmon adult recruits in the Chiwawa and reference populations before (pre) and during (post) supplementation in Chiwawa Basin. The vertical lines in the figures separate the pre- and post-supplementation periods. The smooth hockey stick model estimated carrying capacity for each population.

We then compared the mean difference scores and ratios between the Chiwawa and reference populations before and during supplementation using data representing the fraction of K_R filled with adult recruits. In most of the Chiwawa-reference population comparisons, the absolute value of the mean difference between the fraction of K_R filled with recruits was greater in the supplementation period than during the pre-supplementation period; two of the four pairings were significant (Table 28; Figure 18). Analysis of difference scores using natural-log transformed data indicated that three of the four pairings were significant (Table 28).

Results from analyses using ratios were similar to results using difference scores. Mean ratio scores were generally smaller during the supplementation period than during the pre-supplementation period (Figure 18). This indicated that the mean fraction of K_R filled by adult recruits in most reference populations was greater during the supplementation period than during the pre-supplementation period (i.e., the denominator in the ratio increased between the pre- and post-supplementation periods). In contrast, the fraction of K_R filled by adult recruits in the Chiwawa decreased from the pre- to post-supplementation period (i.e., the numerator in the ratio decreased between the pre- and post-supplementation periods). Thus, unlike the Chiwawa population, the capacity of most reference populations was becoming more saturated during the period when the Chiwawa was being supplemented. Statistical analysis with mean ratios indicated that two of the four pairings were significant (Table 29).

Analyses comparing the Little Wenatchee with the Chiwawa indicate that adult recruits to the Little Wenatchee have been well below its carrying capacity. During the pre-supplementation period, the capacity of the Little Wenatchee was on average 37% saturated with adult recruits. During the supplementation period, the capacity of the Little Wenatchee declined to 8%

saturation with adult recruits (a 22% decline). The Chiwawa, during the pre-supplementation period, was on average 86% saturated. During the supplementation period, percent saturation in the Chiwawa decreased to 26% (a 30% decrease). During the same time periods, the capacity of the Entiat population, which until recently has been supplemented, declined from 124% to 78% saturation (a 63% decline).

Table 28. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on the fraction of the habitat capacity (K_R) that is filled with natural origin recruits. Analyses include both transformed and untransformed data. Tests determined if the mean difference scores during the supplementation period were greater than mean difference scores during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test	Bootstrap 95% CI
	t-value	P-value	Effect size	P-value	
Fraction of Capacity Filled					
Naches	1.550	0.071	0.657	0.145	-0.173 – 1.378
Entiat	0.835	0.207	0.141	0.422	-0.167 – 0.475
Marsh	2.026	0.040	1.141	0.055	0.064 – 2.054
Little Wenatchee	2.166	0.023	0.310	0.031	0.035 – 0.569
LN Fraction of Capacity Filled					
Naches	2.123	0.026	0.311	0.039	0.031 – 0.575
Entiat	1.405	0.087	0.122	0.176	-0.034 – 0.289
Marsh	2.547	0.017	0.519	0.017	0.125 – 0.864
Little Wenatchee	1.744	0.049	0.130	0.100	-0.004 – 0.273

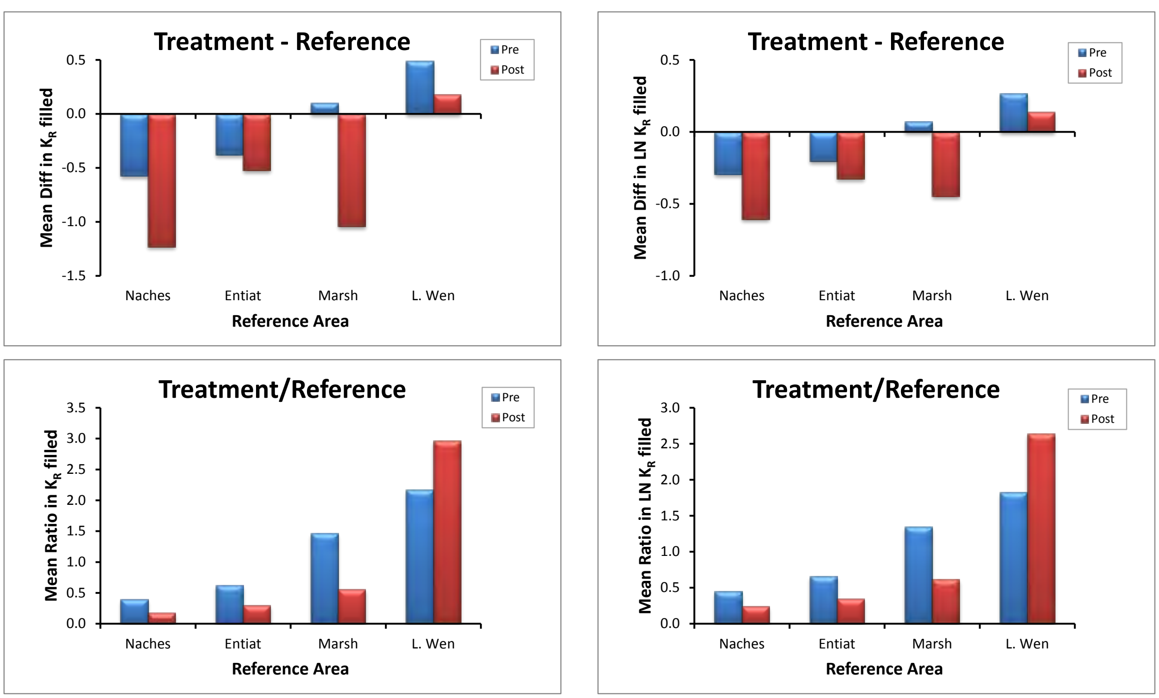

Figure 18. Mean differences (Treatment – Reference; figures on the top) and mean ratios (Treatment/Reference; figures on the bottom) of transformed and untransformed fractions of carrying capacity filled with adult recruits before (pre) and after (post) spring Chinook supplementation in the Chiwawa Basin.

Table 29. Results of the Aspin-Welch unequal-variance test, randomization test (based on 10,000 Monte Carlo samples), and 95% CI (based on 5,000 bootstrap samples) on the fraction of the habitat capacity (K_R) that is filled with natural origin recruits. Analyses include both transformed and untransformed data. Tests determined if the mean ratios during the supplementation period were less than mean ratios during the pre-supplementation period.

Reference population	Aspin-Welch unequal-variance test			Randomization test P-value	Bootstrap 95% CI
	t-value	P-value	Effect size		
Fraction of Capacity Filled					
Naches	1.317	0.119	0.217	0.219	-0.103 – 0.482
Entiat	2.449	0.013	0.321	0.028	0.085 – 0.577
Marsh	2.001	0.035	0.905	0.070	0.138 – 1.788
Little Wenatchee	-1.148	0.864	0.791	0.278	-1.979 – 0.578
LN Fraction of Capacity Filled					
Naches	1.257	0.127	0.207	0.249	-0.099 – 0.484
Entiat	2.346	0.016	0.313	0.031	0.072 – 0.583
Marsh	1.737	0.056	0.729	0.111	0.028 – 1.531
Little Wenatchee	-1.525	0.924	0.815	0.142	-1.751 – 0.195

Comparing Stock-Recruitment Curves

As a final set of treatment and reference population comparisons, we compared the stock-recruitment curves of the Chiwawa population (using {R, S} data only from the supplementation period) to the reference populations (using all available {R, S} data). Specifically, we tested whether the regression parameters were equal between the Chiwawa population and the reference populations, and whether the fitted curves coincided between populations. Earlier in this report we described the data, methods, and results of fitting the Ricker, Beverton-Holt, and smooth hockey stick curves to the data. Because AIC_c was unable to identify a best approximating model, here we included all three models in our analyses. We tested the following hypotheses.

Parameter equivalence:

Ho: Stock-recruitment parameters (α and β) of the Chiwawa population = Stock-recruitment parameters of the reference populations.

Ha: Stock-recruitment parameters (α and β) of the Chiwawa population ≠ Stock-recruitment parameters of the reference populations.

Curve equivalence:

Ho: Modeled stock-recruitment curves of the Chiwawa population = Modeled stock-recruitment curves of the reference populations.

Ha: Modeled stock-recruitment curves of the Chiwawa population ≠ Modeled stock-recruitment curves of the reference populations.

We used two-sided randomization tests to test the null hypotheses of equal model parameters and that fitted curves coincided. Because the total number of permutations was in the millions, we used a Monte Carlo approach to randomly select 10,000 permutations. The test statistic for comparing the model parameters was formed by summing the difference between the population parameter estimates for each pair of populations. The test statistic for comparing the whole curve was formed by summing the difference between the estimated predicted values for each pair of populations at 500 equally spaced points along the curve.

Ricker Relationships

Ricker curves differed significantly between the Chiwawa and reference populations (Figure 19; Table 30). Interestingly, however, the parameters in the Ricker model did not differ significantly among most populations (Table 30). Only the β parameter differed significantly between the Chiwawa and Entiat populations.

In the Ricker model, the α parameter represents intrinsic productivity (i.e., recruits per spawner at low spawner densities). In this analysis, there was not enough evidence in the stock-recruitment data to reject the hypothesis of inequality in intrinsic productivity. Thus, this test was unable to demonstrate that supplementation, based on the Ricker curve, affected productivity in the Chiwawa population.

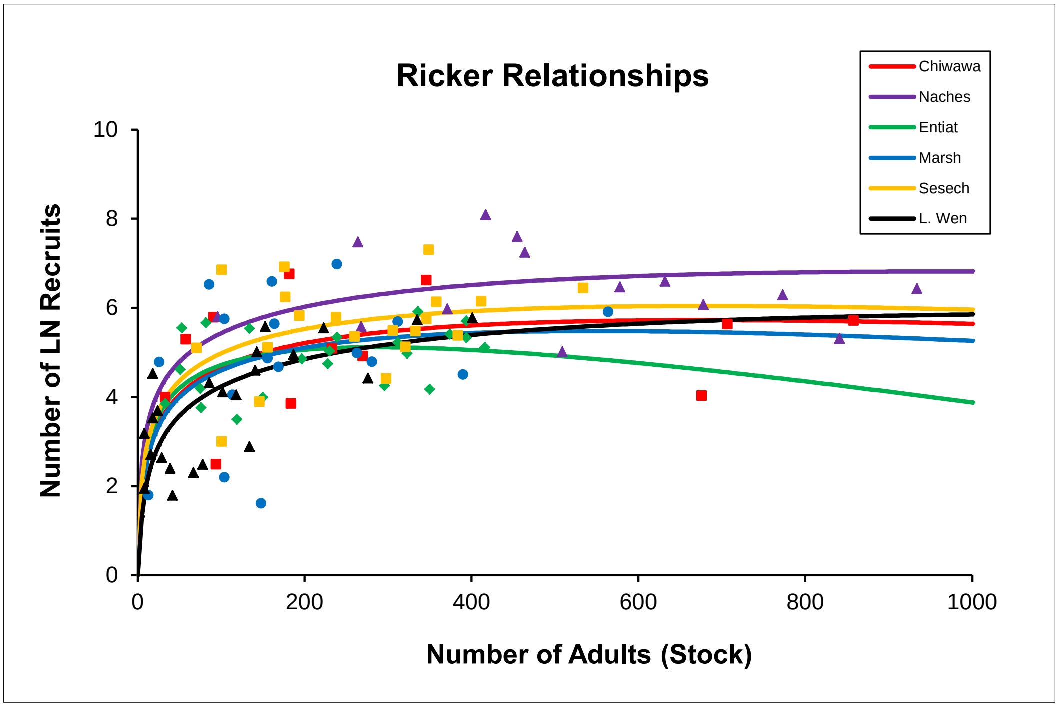

Figure 19. Scatter plot of the number of spawners and natural log adult recruits and fitted Ricker curves to the Chiwawa (supplemented population) and reference (un-supplemented) populations.

Table 30. Randomization test results comparing the equality of Ricker curves and equality of parameter values (α and β). Randomization tests were based on 10,000 Monte Carlo samples. Equality or curves was based on 500 points along the x-axis (spawner abundance axis).

Curves tested	Curve inequality randomization P-value	Parameter inequality		
		Model Parameter		Randomization P-value
		Chiwawa	Reference	
Chiwawa v. Naches	0.008	α = 1.2247	α = 2.5267	0.236
		β = 0.0015	β = 0.0010	0.600
Chiwawa v. Entiat	0.004	α = 1.2247	α = 1.5836	0.978
		β = 0.0015	β = 0.0035	0.025
Chiwawa v. Marsh	0.034	α = 1.2247	α = 1.1855	0.997
		β = 0.0015	β = 0.0018	0.688
Chiwawa v. Sesech	0.036	α = 1.2247	α = 1.6818	0.972
		β = 0.0015	β = 0.0015	0.997
Chiwawa v. L. Wenatchee	0.034	α = 1.2247	α = 0.7439	0.969
		β = 0.0015	β = 0.0008	0.203

Beverton-Holt Relationships

Beverton-Holt curves differed significantly only between the Chiwawa and Naches populations (Figure 20; Table 31). There was no significant difference in curves between the Chiwawa and the other reference populations. The parameters in the Beverton-Holt model did not differ significantly among any of the populations (Table 31). This was true even for the Chiwawa and Naches populations.

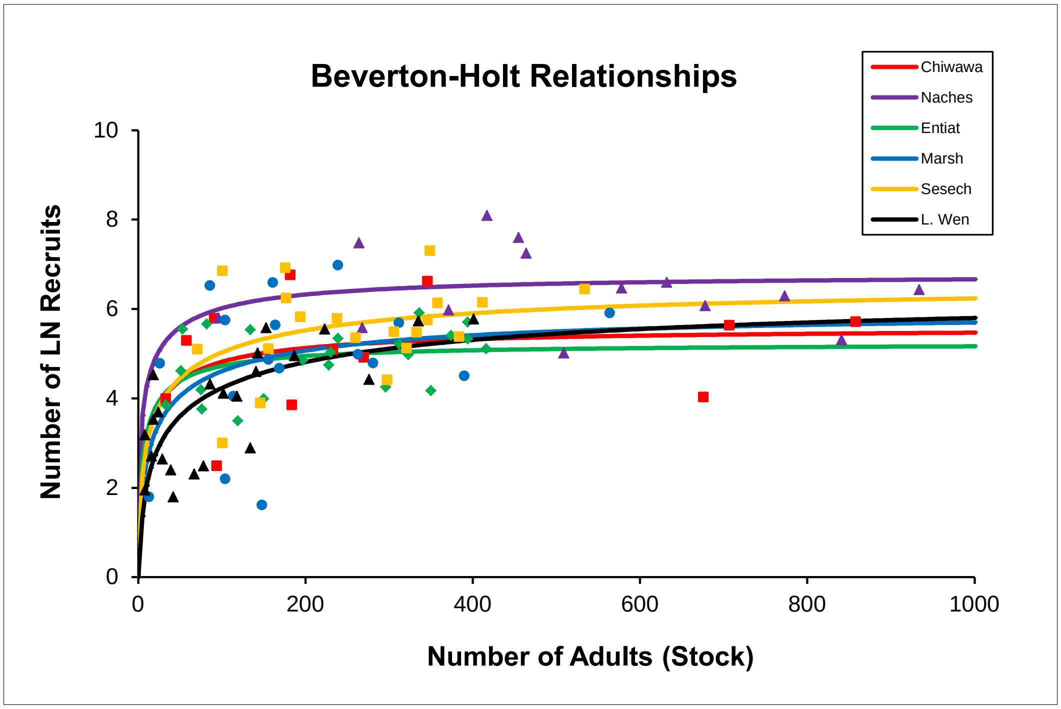

Figure 20. Scatter plot of the number of spawners and natural log adult recruits and fitted Beverton-Holt curves to the Chiwawa (supplemented population) and reference (un-supplemented) populations.

Table 31. Randomization test results comparing the equality of Beverton-Holt curves and equality of parameter values (α and β). Randomization tests were based on 10,000 Monte Carlo samples. Equality or curves was based on 500 points along the x-axis (spawner abundance axis).

<table>
<tr><th rowspan="3">Curves tested</th><th rowspan="3">Curve inequality randomization P-value</th><th colspan="3">Parameter inequality</th></tr>
<tr><th colspan="2">Model Parameter</th><th rowspan="2">Randomization P-value</th></tr>
<tr><th>Chiwawa</th><th>Reference</th></tr>
<tr><td rowspan="2">Chiwawa v. Naches</td><td rowspan="2">0.036</td><td>α = 264.25</td><td>α = 870.62</td><td>0.777</td></tr>
<tr><td>β = 113.79</td><td>β = 112.24</td><td>0.963</td></tr>
<tr><td rowspan="2">Chiwawa v. Entiat</td><td rowspan="2">0.746</td><td>α = 264.25</td><td>α = 186.34</td><td>0.960</td></tr>
<tr><td>β = 113.79</td><td>β = 65.33</td><td>0.954</td></tr>
<tr><td rowspan="2">Chiwawa v. Marsh</td><td rowspan="2">0.850</td><td>α = 264.25</td><td>α = 381.79</td><td>0.944</td></tr>
<tr><td>β = 113.79</td><td>β = 281.04</td><td>0.891</td></tr>
</table>

Curves tested	Curve inequality randomization P-value	Parameter inequality		
		Model Parameter		Randomization P-value
		Chiwawa	Reference	
Chiwawa v. Sesech	0.272	α = 264.25	α = 689.31	0.821
		β = 113.79	β = 351.59	0.869
Chiwawa v. L. Wenatchee	0.654	α = 264.25	α = 568.69	0.864
		β = 113.79	β = 725.87	0.751

Smooth Hockey Stick Relationships

Smooth hockey stick curves differed significantly between the Chiwawa and Naches populations and the Chiwawa and Sesech populations (Figure 21; Table 32). There was no significant difference in curves between the Chiwawa and the other reference populations. Most of the parameters in the smooth hockey stick model did not differ significantly among the populations (Table 32). However, the productivity parameter β did differ significantly between the Chiwawa and the Naches and the Chiwawa and Little Wenatchee populations. The β parameter for the Naches was significantly greater than the Chiwawa, while the β parameter for the Little Wenatchee was significantly less than the Chiwawa.

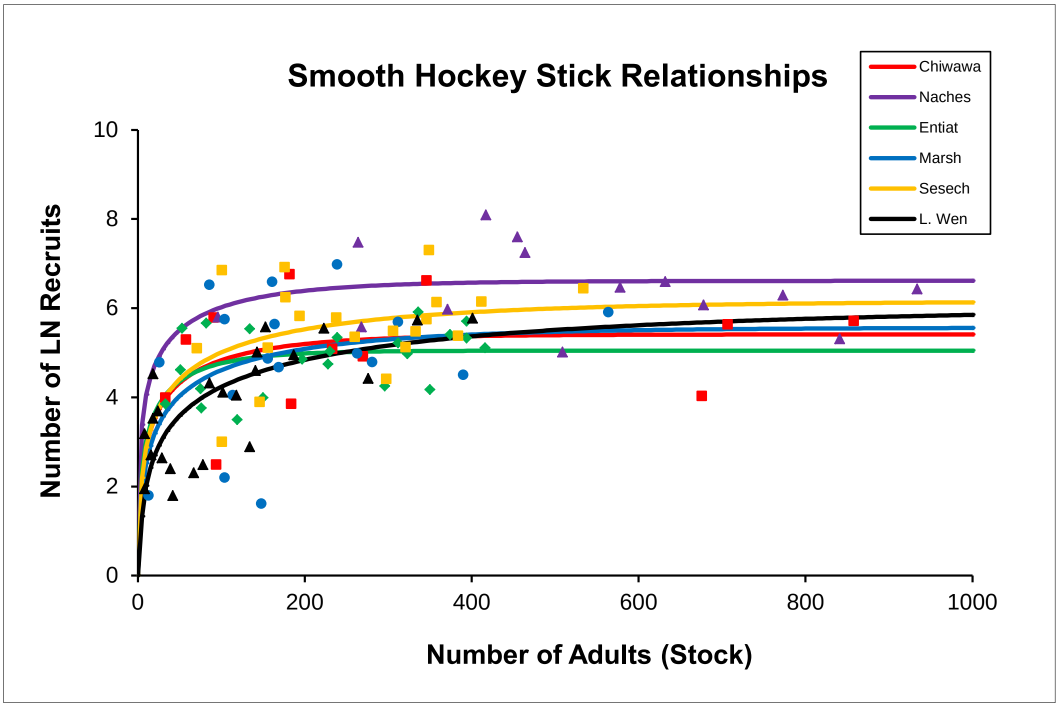

Figure 21. Scatter plot of the number of spawners and natural log adult recruits and fitted smooth hockey stick curves to the Chiwawa (supplemented population) and reference (un-supplemented) populations.

Table 32. Randomization test results comparing the equality of smooth hockey stick curves and equality of parameter values (α and β). Randomization tests were based on 10,000 Monte Carlo samples. Equality or curves was based on 500 points along the x-axis (spawner abundance axis).

Curves tested	Curve inequality randomization P-value	Parameter inequality		
		Model Parameter		Randomization P-value
		Chiwawa	Reference	
Chiwawa v. Naches	0.000	α = 5.41	α = 6.61	0.000
		β = 1.84	β = 5.99	0.000
Chiwawa v. Entiat	0.999	α = 5.41	α = 5.05	0.999
		β = 1.84	β = 2.17	0.999
Chiwawa v. Marsh	0.999	α = 5.41	α = 5.56	0.999
		β = 1.84	β = 1.27	0.999
Chiwawa v. Sesech	0.000	α = 5.41	α = 6.15	0.000
		β = 1.84	β = 1.80	0.999
Chiwawa v. L. Wenatchee	0.990	α = 5.41	α = 6.02	0.999
		β = 1.84	β = 0.75	0.000

Comparing different stock-recruitment curves and their parameters did not provide strong evidence that the supplementation program has negatively affected the productivity of the Chiwawa population.

Analysis without Reference Populations

In some cases, suitable reference populations may not exist to compare with supplemented populations. It is therefore important to have alternative analyses to assess supplementation effects. In this section, we describe methods that can be used to assess supplementation effects when suitable reference populations are not available. We discuss before-after comparisons, correlation analysis, and comparisons to standards as alternatives when reference populations are unavailable.

Before-After Comparisons

Before-after analyses compare population metrics (spawner abundance, NORs, and productivity) before supplementation to those during supplementation. In this case, data collected before supplementation represent the reference condition. The assumption is that population trajectories measured during the pre-supplementation period would continue in the absence of supplementation. We compared trends in abundance and productivity, mean abundance and productivity, and stock-recruitment relationships before and after supplementation.

Trend Analysis

Comparing trends before and after supplementation can be used to assess the effects of supplementation. Here, we compared the slopes of trends of spawner abundance, NORs, and productivity before and during supplementation using t-tests. If the hatchery program is successfully supplementing the natural spring Chinook population, the trend for spawner abundance and NORs during supplementation should be greater than the slope during the pre-supplementation period. For productivity, the slope during the supplementation period should increase or remain the same as that during the pre-supplementation period.

Visual examination of trends of Chiwawa data indicates that spawner abundance, NORs, and productivity decreased during the pre-supplementation period, but increased during the supplementation period (Figure 22). Only the changes in NOR trends were significant (Figure 22). This was true for both transformed and untransformed data.

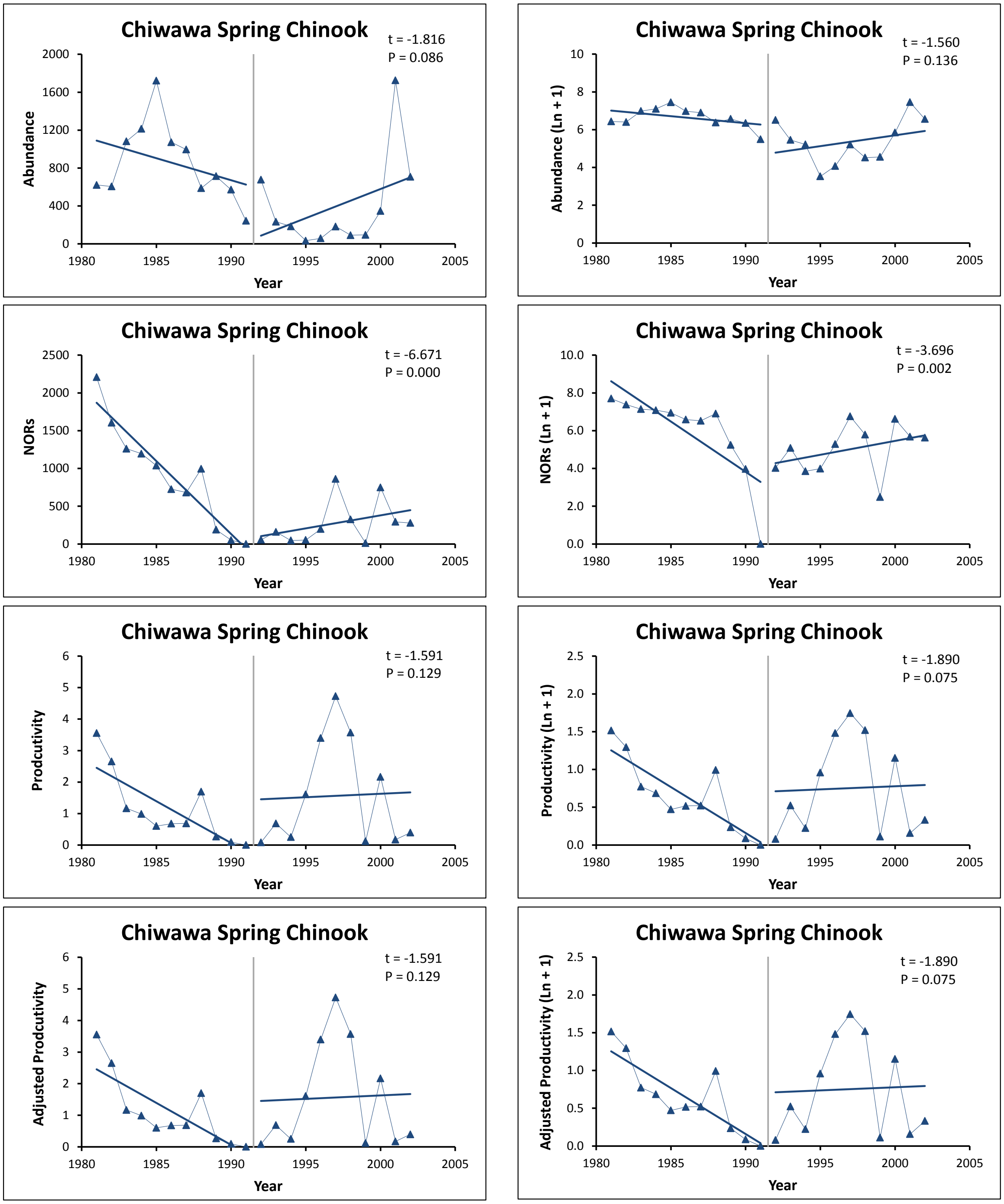

Figure 22. Trends in Chiwawa spring Chinook spawner abundance, natural-origin recruits (NORs), productivity (adults recruits per spawner), and adjusted productivity (adjusted for density dependence) before and during supplementation. The vertical lines in the figures separate the pre- and post-supplementation periods. Figures on the left show untransformed data; figures on the right include natural-log transformed data. Figures include results of t-tests comparing slope of trends before and during supplementation.

Analysis of Mean Scores

We also compared mean spawner abundance, NORs, and productivity data before and after supplementation. If the hatchery program is successfully supplementing the natural spring Chinook population, mean spawner abundance and NORs during the supplementation period should be greater than the pre-supplementation period. For productivity, the mean productivity during the supplementation period should be equal to or higher than the pre-supplementation period. We tested the following statistical hypotheses.

Spawner Abundance and NORs:

Ho: Mean spawner abundance and NORs before supplementation ≥ Mean spawner abundance and NORs during supplementation.

Ha: Mean spawner abundance and NORs before supplementation < Mean spawner abundance and NORs during supplementation.

Productivity (Recruits/Spawner):

Ho: Mean productivity before supplementation ≤ Mean productivity during supplementation.

Ha: Mean productivity before supplementation > Mean productivity during supplementation.

We tested before-after supplementation effects using a one-tailed Aspin-Welch unequal-variance test. We also used a randomization test, based on 10,000 Monte Carlo simulations, to assess differences in spawner abundance and productivity before and during supplementation. The randomization procedure only allowed the testing of two-tailed hypotheses. Therefore, we generated 95% confidence intervals on the mean difference (μ_{pre} - μ_{post}) using bootstrapping methods to determine if the significant result from the randomization test was in the right direction. We generated 5,000 bootstrap samples to calculate confidence intervals.

Mean spawner abundance during the supplementation period was significantly less than the pre-supplementation spawner abundance (Table 33). Mean spawner abundance decreased 46% between the pre- and post-supplementation periods. Likewise, mean NORs decreased significantly between the two periods (Table 33). On the other hand, productivity increased slightly, but not significantly, between the pre- and post-supplementation periods (Table 33). This was true for both adjusted and transformed productivity data.

Table 33. Statistical results comparing mean scores of spawner abundance, natural-origin recruits (NORs), and productivity (using both untransformed and natural-log transformed) before and during supplementation of Chiwawa spring Chinook. Randomization tests were based on 10,000 Monte Carlo samples and 95% CI were based on 5,000 bootstrap samples.

Population metric	Mean scores		Test on means			
			Aspin-Welch test		Random test P-value	Bootstrap 95% CI
	Before	During	t-value	P-value		
Abundance	856	393	2.383	0.986	0.028	112 - 843
LN Abundance	6.6	5.4	3.304	0.997	0.004	0.56 – 1.99
NORs	905	275	2.846	0.993	0.009	214 – 1034
LN NORs	6.0	5.0	1.197	0.876	0.250	-0.40 – 2.54
Productivity	1.13	1.56	-0.721	0.759	0.479	-1.55 – 0.73
LN Productivity	0.64	0.75	-0.450	0.671	0.649	-0.55 – 0.35
Adj Productivity	1.12	1.56	-0.721	0.759	0.477	-1.54 – 0.71
LN Adj Productivity	0.64	0.75	-0.450	0.671	0.652	-0.57 – 0.34

Analysis of Stock-Recruitment Curves

The third method compared stock-recruitment curves of the Chiwawa population during supplementation with those generated before supplementation. Specifically, we tested whether the regression parameters were equal between the pre- and post-supplementation periods, and whether the fitted curves coincided between the two time periods. We used the methods described earlier to fit the Ricker, Beverton-Holt, and smooth hockey stick curves to the two data sets. We tested the following hypotheses.

Parameter equivalence:

Ho: Stock-recruitment parameters (α and β) of the pre-supplementation period = Stock-recruitment parameters of the supplementation period.

Ha: Stock-recruitment parameters (α and β) of the pre-supplementation period ≠ Stock-recruitment parameters of the supplementation period.

Curve equivalence:

Ho: Modeled stock-recruitment curves from the pre-supplementation period = Modeled stock-recruitment curves from the pre-supplementation period.

Ha: Modeled stock-recruitment curves from the pre-supplementation period ≠ Modeled stock-recruitment curves from the pre-supplementation period.

We were only able to fit stock-recruitment curves to the post-supplementation data. Non-linear regression was unable to converge on a solution using only pre-supplementation data. Therefore, we were unable to use this method to test supplementation effects on the Chiwawa spring Chinook population. If we could have fit curves to both the pre- and post-supplementation periods, we would have used two-sided randomization tests to evaluate the null hypotheses of equal model parameters and that fitted curves coincided.

Before describing correlation approaches, it is important to note that comparing before-after data can sometimes be misleading. For example, the spawner abundance, NORs, and productivity data presented in Figure 22 suggest that supplementation is increasing the abundance and productivity of spring Chinook in the Chiwawa Basin. However, when we compared these trends to those from reference populations during the same time periods (Figures 9-11), it becomes clear that supplementation was not responsible for increasing the trends in spawner abundance, NORs, and productivity of the Chiwawa population. Thus, whenever possible, it is wise to compare before-after data with a reference population.

Correlation Analyses

A simple way to see if the supplementation program is increasing or decreasing productivity is to assess the association between the proportion of adult spawners that are made up of hatchery adults (pHOS) and productivity (recruits/spawner). If the supplementation program is working as planned, the increase in hatchery fish spawning naturally should increase the productivity of the population. It should not decrease the productivity of the population.

We tested the association between pHOS and adult productivity[22] using Pearson correlation. During the pre-supplementation period, productivity averaged 1.13 recruits/spawner; during the supplementation period, productivity averaged 1.39 recruits/spawner. This increase in productivity did not appear to be strongly correlated to pHOS (Figure 23). Correlation analysis showed that there was no significant association between pHOS and productivity, even though productivity increased with increasing pHOS.

[22] Note that the analysis could also include juvenile productivity (e.g., smolts/spawner).

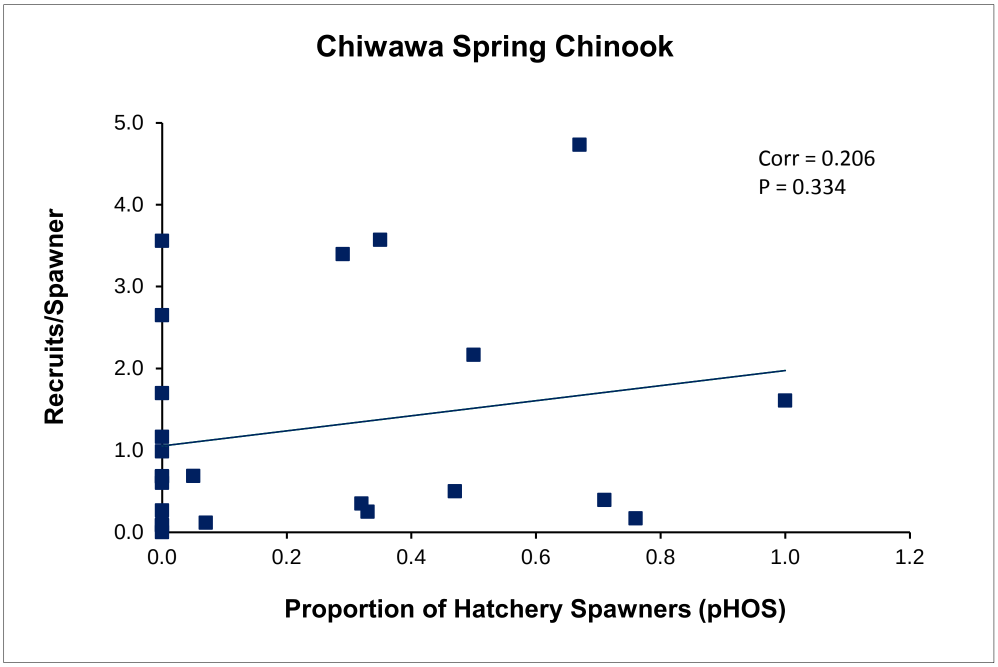

Figure 23. Association between the proportion of spawners that are made up of hatchery adults (pHOS) and the number of natural-origin recruits. The Pearson correlation coefficient (Corr) and its P-value (P) are shown in the figure.

The association between pHOS and productivity can also be assessed by testing the correlation between pHOS and the residuals from stock-recruitment curves fitted to the Chiwawa spawner and natural-origin recruitment data. This approach removes the effects of density dependence on the relationship between pHOS and productivity. A significant negative association provides evidence that hatchery-origin spawners may not be as productive as natural-origin spawners.

The Ricker, Beverton-Holt, and smooth hockey stick models were fit to the Chiwawa stock and recruitment data (including {S, R} data from both the pre- and post-supplementation period, 1981-2004) using methods described earlier. Residuals were calculated by subtracting the predicted recruitment values from the observed (modeled) values. Pearson correlation then tested the association between pHOS and the residuals from each model.

Although there was a negative trend in residuals with increasing pHOS, suggesting that hatchery-origin spawners may not be as productive as natural-origin spawners, the association was not significant (Figure 24). Thus, based on these analyses, there is no strong evidence that the supplementation program has significantly benefited or harmed the natural spring Chinook population.

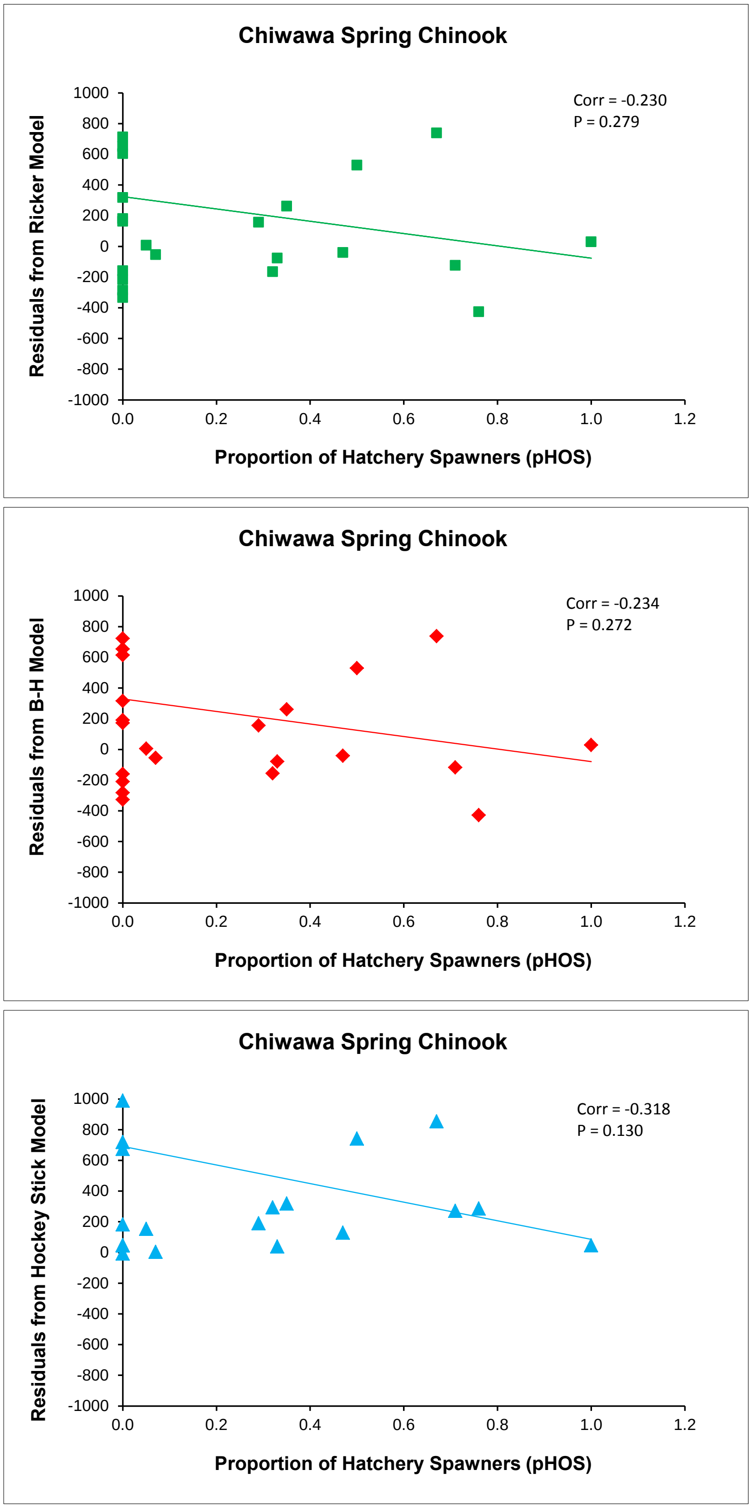

Figure 24. Association between the proportion of spawners that are made up of hatchery adults (pHOS) and the residuals from Ricker, Beverton-Holt (B-H), and smooth hockey stick stock-recruitment models. The Pearson correlation coefficient (Corr) and its P-value (P) are shown in the figures.

Comparison to Standards

In those cases in which suitable reference populations are not available and there are no pre-supplementation data, the investigator is left with comparing population parameters to relevant standards. Standards can include performance of natural-origin fish in similar environments (a type of reference condition), mitigation requirements, quantitative objectives of the program, Biological Assessment and Management Plan (BAMP) values, or other appropriate standards. An example of a statistical hypothesis would be:

Ho: Productivity (Recruits/Spawner) of the supplemented population ≥ standard productivity.

Ha: Productivity (Recruits/Spawner) of the supplemented population < standard productivity.

For these analyses to be useful, the standards must be based on biological reality.

Conclusions and Recommendations

Hatcheries are an important component of fish production within the Upper Columbia Basin. The goal of some of these programs is to supplement natural production in declining populations. The supplementation programs generally use both hatchery and natural (spawned and reared in nature from either wild or hatchery parents) adults for hatchery broodstock. These programs are designed to supplement natural populations by increasing natural reproduction while preventing the establishment of a domesticated hatchery stock. Thus, the programs should increase total spawning escapement and NORs, and not reduce the productivity of the natural population. Measuring the success of these programs is challenging and expensive.

In this paper, we described methods that can be used to determine if supplementation programs are achieving some of their goals. This paper focused on the use of reference populations to determine if the supplementation programs increase total spawning escapement, NORs, and maintain or increase productivities. In some cases, suitable reference populations may not be available (e.g., we found no suitable reference populations for Upper Columbia steelhead and sockeye). In these cases, alternative methods are needed to assess supplementation effects. We also described these alternative methods in this paper.

Identification of Reference Populations

Finding suitable reference populations that match well with supplemented populations is a difficult and time-consuming process. Our three-step selection process included identification of populations with similar life-history characteristics, few or no hatchery spawners, a long time series of accurate abundance and productivity estimates, and similar freshwater habitat impairments and out-of-basin effects. Those populations that met these criteria were then examined for their relationship with the supplemented population (in this case, the Chiwawa spring Chinook population). Several criteria were scored, including pNOS, correlation, trend, and effect size. Reference populations with total weighed scores of 81 or greater were selected as suitable reference populations.

This selection process provided a valuable framework for selecting suitable reference populations for supplemented populations. Interestingly, we found that a given reference population may match well with one parameter of the supplemented population (e.g., spawning escapement), but not for all parameters (e.g., not NORs or productivity). The reason for this may be related to errors in the estimation of population parameters and/or differential factors limiting population parameters of supplemented and reference populations. Therefore, depending on the parameter analyzed, a different suite of reference populations may be needed.

An important assumption in the use of reference populations is that the supplemented and reference populations that tracked each other before supplementation would continue to track each other in the absence of supplementation. Given that the reference populations did not match the Chiwawa population on all criteria examined, and some reference populations tracked the Chiwawa population more poorly than others, there may be some uncertainty as to whether differences observed between the supplemented and reference populations during the supplementation period are associated with the hatchery program, or other unaccounted factors. For example, any large-scale change (man-made or natural) within the reference or supplemented population could affect our ability to assess the effectiveness of the supplementation program.

To account for some of these uncontrollable factors, we recommend the use of a "causal-comparative" approach to strengthen the certainty of our inferences. This approach relies on correlative data to try and make a case for causal inference. We recommend that the following state variables be measured and tracked within the supplemented and reference populations: mean annual precipitation, total and riparian forest cover, road density, impervious surface, and alluvium. These variables can be used to describe differences in water temperatures at different life stages (pre-spawning, egg incubation, and summer rearing) and substrate characteristics, including fine sediments and embeddedness. These state variables can be used to help explain possible changes in spawner abundance, NORs, and productivity that are independent of supplementation. In addition, the use of multiple reference streams reduces the possibility that man-made changes to a single reference stream will influence the interpretation of the results.

Analyses with Reference Populations

Using reference populations, we evaluated the effects of supplementation on natural-log transformed and untransformed total spawning escapement, NORs, and productivity by comparing trends, analyzing mean differences, ratios, and rates, and comparing stock-recruitment curves and their parameters. For trend analysis, we compared the slopes of the trends between each supplemented/reference pair before and during supplementation. If the hatchery program is successfully supplementing the natural population, trends in spawner abundance and NORs should deviate significantly during the supplementation period (i.e., the slope of the supplemented population should be greater than the slopes of the reference populations during the supplementation period), but not during the pre-supplementation period. For productivity, the slope of the supplemented population, relative to the reference population, should increase or remain the same.

Because trend analysis only tests the slopes of the trend lines, it does not test for differences in elevations of the trend lines, additional analyses were needed to determine if supplementation increased spawner abundance, NORs, and productivity of the target population without changing the slopes of the trend lines. To do this, we derived three different response variables using natural-log transformed and untransformed spawner abundance, NORs, and productivity data. The first derived variable included difference scores, which were calculated as the difference between paired treatment and reference data (T-R). The second included ratios, which were calculated as the ratio of paired treatment and reference data (T/R). Finally, we calculated the differences in annual changes in paired treatment and reference population data (ΔT-ΔR). If the hatchery program is successfully supplementing the natural population, the mean difference or ratio score of paired spawner abundance data and NORs during the supplementation period should be greater than the pre-supplementation period. For productivity, the mean difference or ratio score during the supplementation period should be equal to or higher than the pre-supplementation period.

As a final set of analyses, we compared the stock-recruitment curves of the supplemented population (using stock and recruitment data only from the supplementation period) to the reference populations (using all available stock and recruitment data). Specifically, we tested whether the regression parameters were equal between the supplemented population and the reference populations, and whether the fitted curves coincided between populations. Here, we were most interested in comparing the productivity parameters in the models.

Surprisingly, these different analyses yielded similar results when they were applied to the Chiwawa spring Chinook and reference population data. Trend analysis was unable to detect a significant difference in trends between the supplemented and reference populations during the supplementation period. Even though we measured an increasing trend in spawner abundance, NORs, and productivity in the supplemented population during the supplementation period, these same parameters trended upward in the reference populations. Likewise, we were unable to detect a significant supplementation effect using difference scores, ratios, and differences in annual changes. However, we found the results from analysis of mean differences of annual change difficult to interpret and they may be insensitive to treatment effects. A simpler analysis, which is also easier to interpret, is to use trend analysis. Finally, comparing stock-recruitment curves and their parameters did not provide strong evidence that supplementation has affected the productivity of the natural population.

Based on these results, we do not recommend using difference scores of annual change (ΔT-ΔR), nor do we recommend comparing stock-recruitment curves and their parameters. As noted above, difference scores of annual change are difficult to interpret and may be redundant with trend analysis. Testing stock-recruitment curves and their parameters appears redundant with testing differences in productivity using difference scores or ratios. In addition, the analyses are computer intensive and do not appear to be very sensitive to changes.

There was little difference in results using difference scores and ratios. It appears that ratios may be more sensitive to change than difference scores (e.g., we found significant differences in some comparisons using ratios but not with difference scores), but ratios can be more difficult to interpret than difference scores. Nevertheless, we recommend the use of ratios in future analyses.

Correcting for Density Dependence and Carrying Capacity

The analyses described so far assumed that the density of spawners or recruits did not affect the survival and productivity of fish. However, without controlling for density effects, productivity of the population would continue to decline with increasing abundance. This scenario could occur in supplementation programs that increase the number of spawners, and could result in lower productivities relative to reference populations. In addition, lower productivities may be caused by differential environmental carrying capacities rather than the capacity of the supplemented fish to produce offspring. Therefore, we described two different methods for deriving density-corrected estimates of productivity. The first controlled the effects of density on productivity by partitioning observed productivities into density-independent and density-dependent productivity. These productivities were then combined in a single test. The second method corrected for differences in carrying capacities between the supplemented and reference populations. This was accomplished by calculating the percent saturation of NORs, which was estimated as the ratio of observed NORs to the maximum number of NORs that the habitat could support.

We fit Ricker, Beverton-Holt, and smooth hockey stick models to stock and recruitment data to estimate the maximum number of NORs (NORs at carrying capacity) and the maximum number of spawners needed to produce maximum NORs. We fit models to the supplemented and reference populations. Using information-theoretic criterion and evaluating the precision of estimated parameters, we found that the smooth hockey stick model provided the best estimates of maximum NORs and spawners. We used these modeled values to estimate density-independent and density-dependent productivities, and saturation of NORs.

Statistical analyses, using difference scores and ratios of adjusted Chiwawa spring Chinook productivity data, found no significant effects of supplementation on the productivity of the supplemented population. Indeed, the results from correcting for density dependence were similar to those without correcting for density dependence. This is in part because the abundance of the supplemented and reference populations has been below their respective carrying capacities in most years. This was clearly demonstrated in the analyses of NORs corrected for carrying capacity. In the supplemented population, the mean fraction of the carrying capacity filled with NORs decreased significantly during the supplementation period. In other words, the carrying capacity was filled with more NORs during the pre-supplementation period than during the supplementation period, which is contrary to the goal of supplementation. By comparison, two of the reference populations showed a similar decrease in saturation, while the other two reference populations actually increased in saturation. Analyzing the saturation scores using BACI-design analyses indicated that two of the four pairings differed significantly. That is, the percent saturation of the supplemented population decreased significantly relative to two reference populations.

Because productivity can be affected by the abundance of spawners and recruits, we recommend that future analyses comparing supplemented and reference populations adjust for density-dependent effects and differential carrying capacities. Although we detected only slight differences between adjusted and unadjusted results, as supplemented stocks recover, it will become more important to adjust productivities to account for density dependence. Importantly, the analyses using percent saturation placed NORs in the context of the carrying capacity of the environment. This will help managers determine if supplementation programs are filling or over-filling the capacity of the habitat with NORs.

As we noted earlier, analyses using productivities adjusted for density dependence assume that there is a spawner abundance at which density-independent effects end and density-dependent effects begin. In reality, density-dependent effects occur at low spawning abundance and intensify as spawning abundance increases. We did not account for these increasing density-dependent effects at lower spawner abundances. This is an area that needs additional attention.

Analyses without Reference Populations

Because of the rigorous criteria we used to select reference populations, it is likely that reference populations may not exist for making comparisons with supplemented populations. For example, we used the criteria described in this paper to identify reference populations for supplemented steelhead and sockeye populations in the Upper Columbia Basin. We were unsuccessful in identifying any suitable reference populations. Therefore, in the absence of suitable reference populations, it is important to have alternative methods for assessing supplementation effects. We described three different types of analyses one can use to assess supplementation effects in the absence of reference populations. They include before-after comparisons, correlation analysis, and comparisons to standards.

Before-after analyses compare population metrics before supplementation with those during supplementation. In this case, data collected before supplementation represent the reference condition. The assumption is that population trajectories measured during the pre-supplementation period would continue in the absence of supplementation. We compared trends in spawner abundance, NORs, and productivity before and after supplementation. In addition, we compared mean scores in these three parameters before and after supplementation. Finally, we attempted to compare stock-recruitment parameters before and after supplementation. The hypotheses examined were that the spawner abundance and NORs would be greater during the supplementation period, and that productivities would not decline during the supplementation period.

Trend analysis indicated that the all three Chiwawa spring Chinook population parameters trended downward during the pre-supplementation period, but trended upward during supplementation. On the other hand, mean spawner abundance and NORs were lower during the supplementation period than during the pre-supplementation period. Mean productivities increased, but not significantly, during the supplementation period. We were unable to compare pre- and post-supplementation stock-recruitment curves because we were unable to fit stock-recruitment models to the pre-supplementation data.

We used correlation analyses to determine if the proportion of hatchery-origin fish that spawn naturally on the spawning grounds (pHOS) increased productivity. In addition, we used correlation to assess the association between pHOS and the residuals from stock-recruitment relationships. A significant negative association provides evidence that hatchery-origin spawners may not be as productive as natural-origin spawners. The analysis indicated that the productivity of Chiwawa spring Chinook increased with increasing pHOS, but the association was not significant. In contrast, there was a negative association between pHOS and the stock-recruitment residuals, but again the association was not significant. The latter analysis accounts for density-dependent effects.

In concert, the before-after comparisons and correlation analyses do not provide conclusive evidence that the supplementation program has increased spawner abundance and NORs, or that it has significantly reduced the productivity of the supplemented population. Although increasing the number of hatchery fish on the spawning grounds appears to reduce NORs and productivity, mean productivity actually increased during the supplementation period compared to the pre-supplementation period.

It is important to note that relying on only one set of analysis could result in drawing a wrong conclusion. For example, if we had only conducted trend analysis, we may have concluded wrongly that the Chiwawa spring Chinook supplementation program significantly increased spawner abundance, NORs, and productivity in the supplemented population. The analysis of mean scores and correlations indicates that the supplementation program has not increased spawner abundance or NORs in the supplemented population. Therefore, in the absence of suitable reference populations, we recommend that analyses include the evaluation of trends, means scores, and correlations. By conducting more than one set of analyses, one can use weight-of-evidence to assess the effects of supplementation programs.

Under the scenario that there are no reference populations or pre-supplementation data, one is left with comparing population parameters to relevant standards. These standards could come from mitigation requirements, quantitative objectives, or published or unpublished standards. One could also use correlation to evaluate the association between productivity and pHOS, but this requires a wide range in pHOS values to be most effective. A more extreme approach, which probably would not gain much traction with managers, is to shutoff the supplementation program for some time and then evaluate the effects of the program in a before-after design. The Entiat spring Chinook hatchery program provides a unique opportunity to evaluate this type of management decision.

Some Concerns and Limitations

No matter how hard we try to explain different sources of variation in population data, we are limited by the quality of the data. Teasing out the effects of supplementation requires long time series of population data. Because funding levels and methods change over time, the quality (i.e., accuracy and precision) of the data also changes over time. Importantly, the population parameters examined in this paper (spawner abundance, NORs, and productivity) are rarely measured directly in the field. That is, other population metrics, such as numbers of redds, number of fish counted at weirs or dams, scales, tags, etc., are sampled in the field. These metrics are then used to calculate spawner abundance[23], NORs, and productivity, often based on assumptions about fish/redd, pre-spawning loss, marking rates, and sampling rates. This has a tendency to increase the variability in the data independent of supplementation programs. In our studies, we can only control sampling within the supplemented populations, and even that is limited by available funding. We have no control over the sampling within reference populations. Thus, we have to assume that sampling within the reference populations will continue and that sampling effort will remain comparable to that in the supplemented populations.

In our analyses, we included both the Entiat and Little Wenatchee populations as references for the Chiwawa population. In the analyses, we treated them as equivalent to the other reference populations. That is, the statistical procedures used to compare the supplemented population to each reference population were identical. This is appropriate. However, the interpretation of the

[23] The smooth hockey stick model, which we used to estimate density-dependent correction factors for productivity and NORs, is sensitive to errors in spawner escapement estimates. Therefore, it is important to use accurate and precise estimates of spawner escapement.

results must be different when comparing the Entiat and Little Wenatchee to the supplemented population, because they are populations that were influenced by hatchery fish. As noted earlier, the Entiat spring Chinook hatchery program has been discontinued. Therefore, it provides a unique type of reference where the comparison changes from both populations being supplemented to only one population being supplemented. For the Little Wenatchee, nearly all the strays came from the Chiwawa program. Straying should stop or be greatly reduced with the change in water supply to the Chiwawa Rearing Ponds. In sum, one must be careful in how they interpret these test-reference results.

Finally, it is important to point out that for this paper, we conducted 463 statistical tests. Because we set our Type I error rate at 0.05, by random chance alone, we may have incorrectly rejected about 23 null hypotheses. Inasmuch as this work was designed to evaluate different ways to analyze test-reference data, the number of future analyses will be greatly reduced based on the results from this work. However, if the Type I error rate is a concern to managers, researchers can use a lower error rate, such as $\alpha = 0.01$. Another option is to analyze test-reference data graphically. Although this is subjective, there are no statistical analyses and therefore no concerns with violating assumptions of statistical tests, including temporal correlation. We believe researchers should use the statistical procedures recommended in this report to support graphic analysis.

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APPENDIX N
CHELAN PUD 2014 HATCHERY M&E IMPLEMENTATION PLAN

Chelan County PUD Hatchery Monitoring and Evaluation Implementation Plan 2014

Prepared by:

Alene Underwood and Catherine Willard

November 2013

Contents

1. Introduction

The Habitat Conservation Plan (HCP) specifies that a monitoring and evaluation plan will be developed for the hatchery program. The approach to monitoring the hatchery programs was guided by the "*Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update"* (Hillman et al. 2013) and the "*Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Programs*" (Murdoch and Peven 2005).

The purpose of this document is to define the tasks associated with the approved scope of work to implement Chelan PUD's (CPUD's) hatchery monitoring and evaluation (M&E) plan for 2014. Monitoring and evaluation activities for Lake Wenatchee sockeye in 2014 have not yet been determined. Chelan PUD will submit an addendum to this implementation Plan by February 2014 to address these activities. Additionally, specific activities to address Objective 7 of the M&E Plan have not yet been determined. As these become available, this Plan will be amended.

The work described in this plan has Endangered Species Act (ESA) coverage provided by NFMS Section 10(a)(1)(A) permits 18121 and 1395 and Section 10(a)(1)(B) permit 1347. All activities conducted under this Implementation Plan shall adhere to all terms and conditions as specified in the referenced permits. These permits allow for changes to monitoring or research protocols with the caveat that such modifications are approved by NMFS prior to implementing those changes. Terms and conditions relevant to monitoring and evaluating the hatchery programs have been used to inform the various measurements below and associated scopes of work with entities performing the work. A report summarizing compliance with the terms and conditions set forth under the above-references permits is required for submittal to NMFS; a copy of this completed report will be provided to the HCP HC.

The Implementation Plan includes all four components of the M&E Program including: (1) aquaculture monitoring; (2) juvenile monitoring; (3) adult monitoring; and (4) data, analysis and reporting. Under each component are study design elements that will be used to inform the overarching program components. Figure 1 illustrates the relationship of the components and study design elements used to address each component. Table 1 depicts which study design element is being performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

The methods described in this plan differ from previous methodologies in the following ways:

- Emigrant abundance estimates will use newly derived analytical approaches that reduce bias and increase precision to include estimates of emigration during the winter non-trapping periods.
- Spring Chinook spawner abundance estimates will be adjusted for observer efficiency and include estimates of precision.
- Summer Chinook spawner abundance will be based on census counts and be adjusted for observer efficiency and include estimates of precision.
- Steelhead run and spawning escapement estimates will be based on a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates.

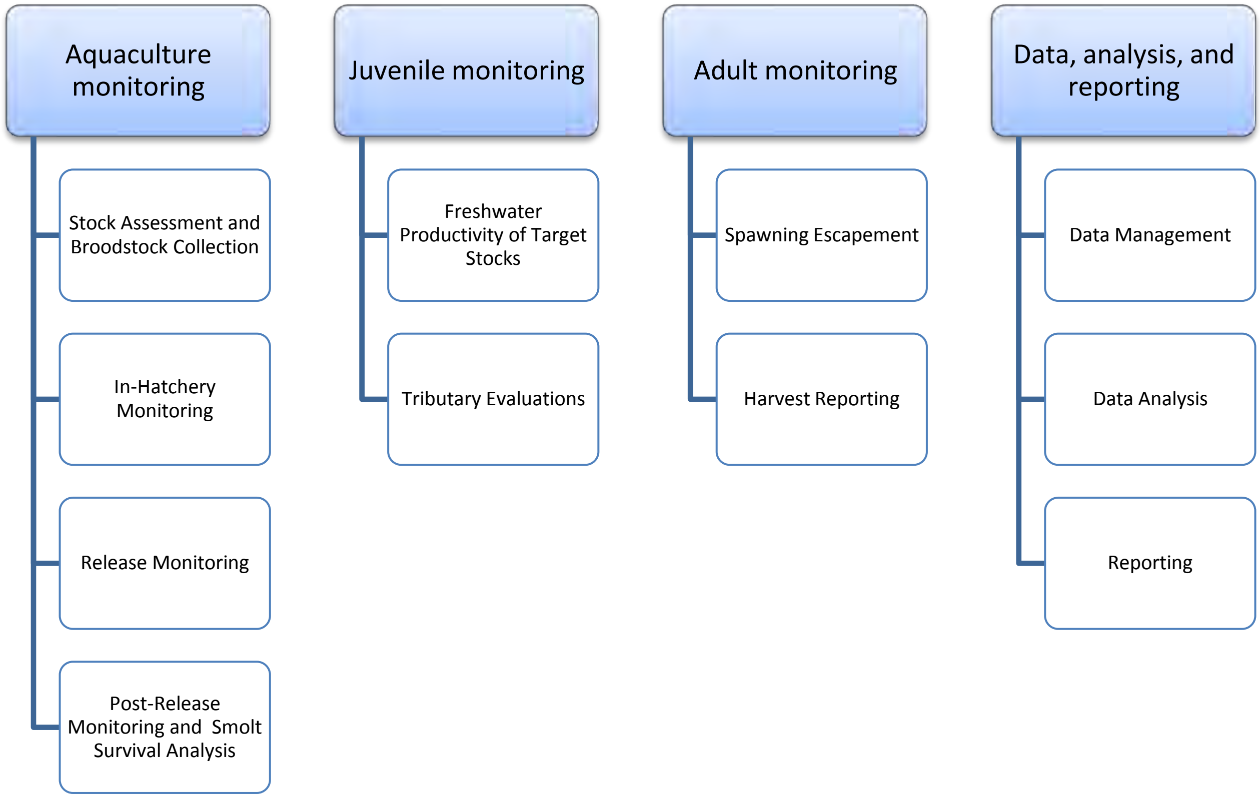

Figure 1. The four components of the hatchery monitoring and evaluation program and the study design elements within each component.

Table 1. Study design elements performed by entity, and the associated objectives for each study design element as referred to in Hillman et al. 2013.

Monitoring and evaluation component	Objectives[1]	Study Design Elements	Chiwawa spring Chinook	Wenatchee summer Chinook	Chelan Falls summer Chinook[3]	Methow summer Chinook[4]	Wenatchee Steelhead	Wenatchee Sockeye
Aquaculture Monitoring	3,5,8	Stock assessment and broodstock collection	WDFW	WDFW	WDFW	WDFW	WDFW	NA
	5, 8	In-hatchery monitoring	WDFW CPUD[2]	WDFW CPUD[2]	WDFW CPUD[2]	WDFW CPUD[2]	WDFW CPUD[2]	NA
	9	Release monitoring	WDFW	WDFW	WDFW	WDFW	WDFW	NA
	9	Post-release monitoring and smolt survival analysis	WDFW	WDFW	WDFW	WDFW	WDFW	NA
Juvenile monitoring	2	Freshwater productivity of stocks	WDFW	WDFW	NA	NA	WDFW	TBD
		Tributary evaluations	WDFW	WDFW	NA	NA	WDFW	TBD
Adult monitoring	1,2,3,4,5,6, 8,10	Spawning escapement	CPUD	WDFW	BioAnalysts	BioAnalysts	WDFW	TBD
	8	Harvest reporting	WDFW	WDFW	WDFW	WDFW	WDFW	TBD
Data, analysis, and reporting	All	Data management	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Data analysis	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD
		Reporting	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	WDFW BioAnalysts	TBD

[1] Specific activities to address Objective 7 have not yet been identified.
[2]CPUD crews will PIT tag in-hatchery fish.
[3]Because the Chelan summer Chinook program is primarily an augmentation program, monitoring and evaluation efforts focus on straying, release characteristics, and harvest.
[4]Monitoring and evaluation in 2014 will be shared by Grant and Chelan PUDs.

2. Aquaculture Monitoring

The Aquaculture monitoring component is comprised of two basic elements: (1) stock assessment and broodstock collection at adult trapping locations and (2) in-hatchery monitoring including spawning, rearing, and release of juveniles. Data collected during these elements primarily support monitoring questions 5.1.1, 5.2.1, 8.1.1, 8.2.1, 8.3.1, 8.3.2, 8.4.1, 9.1.1, 9.2.1, 9.3.1 and 9.4.1, but also contribute data to monitoring questions 3.2.1, and 3.2.2 (Hillman et al. 2013). Table 2 below provides a summary of the variables to be measured in 2014 under the Aquaculture monitoring component and what objective the measure(s) supports. The text that follows in this section further describes the activities.

Table 2. Monitoring and Evaluation Plan (Hillman et al. 2013) objectives and the associated measured variables for the aquaculture monitoring component.

Objectives	**Measured Variables** *(Applicable Study Component(s))*
Objective 3: Determine if the hatchery adult-to adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	• Number of hatchery and naturally produced fish collected for broodstock (*Broodstock Collection and Stock Assessment*) • Number of broodstock used by brood year (hatchery and naturally produced fish) (*Broodstock Collection and Stock Assessment*)
Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	• Ages of hatchery and naturally produced fish sampled via PIT tags or stock assessment monitoring (*Broodstock Collection and Stock Assessment*) • Time (Julian date) of ripeness of hatchery and natural origin steelhead captured for broodstock (*Broodstock Collection and Stock Assessment*)
Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of the natural populations.	• Size (length), gender, and total/salt age of broodstock (*Broodstock Collection and Stock Assessment*) • Assess age of fish (*Broodstock Collection and Stock Assessment*) • Length, weight, and age (covariate) of hatchery and natural-origin broodstock after eggs have been removed (*Broodstock Collection and Stock Assessment*) • Number and weight of eggs (*Broodstock Collection and Stock Assessment*)
Objective 9: Determine if hatchery fish were released at the programmed size and number.	• Fork length and weights of random samples of hatchery juveniles at release (*Release Monitoring*) • Monthly individual lengths and weights of random samples of hatchery juveniles (*In-Hatchery Monitoring*) • Numbers of smolts released from the hatchery (*Release Monitoring*)

2.1 Broodstock Collection and Stock Assessment

Broodstock collection and stock assessment for Wenatchee summer steelhead, Wenatchee summer Chinook, Methow summer Chinook, Chelan Falls summer Chinook, and Chiwawa River spring Chinook, hatchery programs will, in most instances, occur concurrent to and consistent with the Broodstock Collection Protocol approved annually by the Hatchery Committee (e.g., Tonseth 2013) and relevant permits Data collection during broodstock collection will be consistent with Murdoch and Peven (2005). A representative sample of fish trapped throughout the entire run, either collected for broodstock or released back to the river, will be sampled for origin, age, sex, size, and migration timing. Biological sampling of all fish trapped will include presence of internal (CWT or PIT) and external (VIE) tags or marks, scales, length, and sex (determined by ultrasound). PIT tags will be injected into all target species (Chinook and steelhead), whether collected for broodstock or released back to the river to monitor for potential fallbacks. All non-target species will be enumerated daily. Measures of central tendency and spread will be calculated and reported for each metric.

2.2 In-Hatchery Monitoring

The in-hatchery monitoring component will begin when adult fish are collected and retained for broodstock and ends when juvenile fish are released. Life stage specific in-hatchery survival and growth rates, disease monitoring, and an estimate of the number of fish released will be collected and analyzed according to Murdoch and Peven (2005). Additional data to be collected includes individual lengths and weights of juveniles during monthly sampling, and the weight of gonadal mass and body of spawned broodstock. Measures of the central tendency and spread will be calculated and reported for each metric.

Fish Marking

All of Chelan PUD's hatchery fish will be coded-wire tagged (CWT) and externally marked or marked as otherwise agreed to by the HCP HC. A comprehensive marking strategy will be developed by the HCP HC and included as an Addendum to this Plan. The identification of these hatchery-produced fish is needed for a suite of adult metrics and may be used for adult management and/or fisheries as contemplated by the co-managers.

Using methods described in Keller and Murauskas (2012), hatchery fish will be PIT-tagged (Table 3) at Eastbank Hatchery approximately two to four weeks before the fish are transferred to acclimation ponds. Additional PIT-tagging may occur for program specific studies/comparisons as approved by the HC. The data collected from the PIT-tags will assist in release monitoring, migration timing, juvenile survival, and smolt-to-smolt survival. For all fish marking, quality control check will be performed during and immediately following tagging and prior to release.

Table 3. Wenatchee River basin hatchery program release goals and recommended number of fish PIT tagged.

Program	Release goals	Number of fish PIT tagged[1]	PIT tag rate (%)
Chiwawa River spring Chinook	144,026	5,000	3.5
Wenatchee River steelhead	247,300	15,000	6.0
Wenatchee River summer Chinook	318,816 (CPUD Program) 181,184 (GPUD Program)	20,600[2]	4.1

[1] Additional PIT tagging may take place for Chelan PUD approved studies and/or comparisons.

[2] Includes a component of PIT-tagged fish for the NOAA size target study and a component for Grant PUD's program.

2.3 Release Monitoring

Hatchery fish will be released during smoltification in the spring, typically between 15 April and 1 June. Whenever possible, the exact release dates will coincide with environmental conditions that promote a rapid emigration that minimizes both the potential negative ecological interactions of hatchery fish with naturally produced fish and predation on hatchery fish by avian or other predators. The default release method will incorporate a volitional approach, as approved by the HCP HC, unless it can be demonstrated other approaches are better. The monitoring data collected for each stock are described below.

Spring Chinook – Chiwawa River

Pre-release sampling data will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan (Hillman et al. 2013). PIT tag monitoring of spring Chinook released in the Chiwawa River will occur during the release period (April). Juvenile Chinook will pass through two 92-cm diameter PIT-tag antennas connected to Allflex 310 readers and Quantitative Sampling Technologies (QST) QuBE data logger. The release location and type (i.e., volitional, forced, or trucked) are recorded for each observation file created and uploaded to the PTAGIS database maintained by the Pacific States Marine Fisheries Commission after each year of release. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Steelhead–Wenatchee River Basin

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions

9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Monitoring of steelhead released in the Wenatchee River basin will occur during loading of fish into transport trucks, unless fish are released directly into the Chiwawa River. Steelhead will pass through a series of PIT-tag antennas, each connected to a data logger, thereby allowing the creation of a PIT-tag observation file for each truckload of steelhead consisting of unique tag records. The release location (stream and rkm), release type (volitional or forced), and hatchery group (HxH or WxW) will be recorded for each tag file created. PIT-tagged fish in each observation (release) file are assumed to represent untagged fish. However, because PIT-detection efficiency during loading will not be 100%, the number of fish in each truckload will be estimated using volumetric displacement. Observation files contain the PIT tags associated with the original tag files and will be used for analysis (see Post-release Monitoring Section). The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

Summer Chinook – Wenatchee River and Chelan Falls

Pre-release sampling will be conducted consistent with Murdoch and Peven (2005), including individual weights to the nearest 0.1 gram. Data collected will support monitoring questions 9.1, 9.2, 9.3 and 9.4 in the updated monitoring and evaluation plan. Should PIT tagging occur, a monitored release strategy consistent with other Chinook stocks (i.e., Chiwawa Spring Chinook) will be implemented. The total number of fish released will be based on the population size at CWT tagging (100%), subtracting mortality enumerated by hatchery staff that occurred from tagging to release.

2.4 Post-Release Monitoring and Survival Analysis

Data will be collected during rearing, acclimation, release, and the emigration period that may prove valuable in explaining variability in adult survival (Murdoch and Peven 2005). Rearing densities have been reported to influence the survival of hatchery fish (Martin and Wertheimer 1989; Banks 1994) and may also be linked to disease prevalence during rearing (Banks 1994; Ogut and Reno 2004). Acclimation of hatchery fish before release has been found to increase survival and reduce stray rates when the duration of the acclimation period is sufficient (Clarke et al. 2010, 2012; Rosenberger et al. 2013). These metrics (i.e., rearing density and acclimation period) will be collected annually to determine their influence on fish survival.

PIT-tagged groups of hatchery fish will be used to estimate survival during their emigration. Variation in survival during the emigration period may also inform observed adult survival rates. Survival during emigration or smolt-to-smolt survival and travel will be estimated using interrogation or release files and the standard Cormack-Jolly-Seber (CJS) estimator. CJS estimates are termed apparent survival estimates because it is unknown whether fish suffered mortality (e.g., size or time of release) or simply failed to emigrate (i.e., residualized or were precocial males). In the latter case, the proportion of PIT-tagged fish detected in the Wenatchee or Columbia rivers after the emigration period is complete may explain variation in smolt-to-smolt survival rates. The post-release performance of PIT-tag groups will be estimated and monitored annually, consistent with methods in Murdoch and Peven (2005). Additionally, precocity of hatchery releases will be evaluated by examining the proportion of PIT tag releases detected in adult fish ladders and tributaries within the same year as release.

3. Juvenile Monitoring

Data collected during these elements primarily support monitoring questions 2.1.1 and 2.2.1. and the monitoring objectives described in Table 4 (Hillman et al. 2013). Table 4 below provides a summary of the variables to be measured in 2014 under the Juvenile monitoring component and what objective the measure supports. The text that follows in this section further describes the activities.

Table 4. Monitoring and Evaluation Plan (Hillman et al. 2013) objectives and the associated measured variables for the juvenile monitoring component.

Objective	Measured Variables *(Applicable Study Component(s))*
Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	• Number of juveniles (smolts, parr [where appropriate], and emigrants) (*Freshwater Productivity of Supplemented Stocks*)

3.1 Freshwater productivity of Supplemented Stocks

Steelhead, Spring Chinook, and Summer Chinook

The freshwater productivity of supplemented stocks in the Wenatchee Basin will be monitored using smolt traps in the Chiwawa River and the lower Wenatchee River consistent with historical trapping efforts. Additionally, a newly derived analytical method which uses PIT-tag mark-recapture data will be utilized that reduces bias and increases precision by including estimates of emigration during the winter non-trapping periods. Up to 3,000 parr will be PIT tagged in the Chiwawa River in the fall, based on the spatial distribution and abundance estimated during parr snorkel surveys, to generate estimates of migration during the non-trapping periods. A random sample of a minimum of 10 percent of fish per remote site will be held in a live box for 24 hours to evaluate tag loss and delayed mortality. Using PIT tagged parr detections at the lower Chiwawa PIT array during the non-trapping period, the total number of PIT-tagged parr that emigrated will be estimated, and then expanded by the tag rate. Overwinter mortality of PIT-tagged parr is assumed to be the same as non-PIT-tagged parr. Overwinter survival estimates of Chiwawa River parr will be derived by estimating survival to the lower Wenatchee PIT tag array and analyses with the TribPit Survival software program and/or estimating survival of fall parr and spring smolts to McNary. PIT-tag mark-recapture trials conducted during the trapping period in the fall will also be used to estimate detection probabilities of the PIT-tag array at a given discharge level. Abundance and variance will be estimated using the same methods as those used in the smolt trap estimate. The estimated abundance and variance from each method and time period (trapping and non-trapping periods) will be summed to estimate a total production estimate. Under the proposed methodology, unbiased estimates of abundance during the entire migration period will be generated with relatively high precision (PSE < 15%), which is consistent with NOAA Fisheries' recommendations (Crawford and Rumsey 2011). Historical estimates will be revised using the new estimation techniques.

3.2 Tributary Evaluations

Chiwawa River

Snorkel surveys will be utilized to estimate summer parr abundance within the Chiwawa River basin. This approach has been used in the Chiwawa River basin since 1992. In parallel to addressing Objective 2, additional juvenile data can help to assess the habitat carrying capacity in each tributary. This information can add value to the overall M&E plans and help inform management decisions.

Sampling will follow a stratified random sampling design. Landscape classification will be used to stratify streams in the Chiwawa basin that support juvenile Chinook salmon. In the Chiwawa River basin, WDFW found that classification "explained" most of the variability in fish numbers caused by geology, land type, valley bottom type, stream state condition, and habitat type (Hillman 2013). The same classification method was used to identify sections of the Little Wenatchee River (reference area) that corresponded to discrete reaches in the supplemented basins, but that had no release of hatchery Chinook. Consistent with previous efforts, habitat types within each land-class or reach will be identified and quantified annually. At least three units of each habitat type within each reach will be randomly selected for estimating densities of salmon and trout. Thus, overall sampling consists of a stratified-random sampling design, which increases the accuracy and precision of population estimates.

Densities of salmon and trout will be estimated in August and September by direct underwater observation within the randomly-selected habitat units. Underwater methods will follow those described by Thurow (1994), Dolloff et al. (1996), and O'Neal (2007). Habitat surface areas and volumes will be estimated during fish sampling. Numbers of fish counted will be adjusted for detection probabilities using the models published in Hillman et al. (1992). For each habitat type within a state type and reach stratum, the mean density of salmon and trout will be calculated as the ratio of mean numbers to mean area or volume sampled (Cochran 1977). Total numbers of fish will be estimated per habitat type within a state type and reach stratum as the product of mean density of fish in a given habitat type, times total area or volume of that habitat type within the stratum (Cochran 1977). Total numbers of fish within the supplemented basin will be estimated as the sum of all population numbers per habitat type in state type/reach strata. Bootstrapping methods will be utilized to estimate variance and percent errors (based on 95% confidence interval) for total numbers of fish.

4. Adult Monitoring

The Adult monitoring component is comprised of two basic elements: (1) estimating spawning escapement and (2) harvest monitoring. Data collected during these elements primarily support monitoring questions 1.1.1, 1.2.1, 2.1.1, 2.2.1, 3.2.1, 3.2.2, 4.1.1, 5.1.1, 5.2.1, 5.3.1, 5.3.2, 6.3.1, but also contribute data to monitoring questions 6.1.1, 6.2.1, 8.1.1, 8.2.1, 8.4.1, 10.1.1, 10.1.2, 10.1.3 and 10.1.4. Table 5 below provides a summary of the variables to be measured in 2014 under the Adult monitoring component and what objective the measure(s) supports. The text that follows in this section further describes the activities.

Table 5. Monitoring and Evaluation Plan (Hillman et al. 2013) objectives and the associated measured variables for the adult monitoring component.

Objective	Measured Variables *(Applicable Study Component(s))*
Objective 1: Determine if conservation programs have increased the number of naturally spawning and naturally produced adults of the target population and if the program has reduced the natural replacement rate (NRR) of the supplemented population.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)* • Number of hatchery and naturally produced fish taken for broodstock (*Broodstock Collection and Stock Assessment*) • Number of hatchery and naturally produced fish taken in harvest (if recruitment is to the Columbia) *(Harvest Reporting)*
Objective 2: Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity of supplemented stocks.	• Number of hatchery and naturally produced fish on the spawning grounds (*Spawning Escapement Estimates*) • Number of redds *(Spawning Escapement Estimates)*
Objective 3: Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate, HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate, NRR) and the target hatchery survival rate.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)* • Number of hatchery and naturally produced fish harvested *(Harvest Reporting)*
Objective 4: Determine if the proportion of hatchery-origin spawners (pHOS or PNI) is meeting management target.	• Number of hatchery and naturally produced fish on spawning grounds *(Spawning Escapement Estimates)*
Objective 5: Determine if the run timing, spawn timing, and spawning distribution of the hatchery component is similar to the natural component of the target population or is meeting program-specific objectives.	• Time (Julian date) of hatchery and naturally produced salmon carcasses or marked steelhead detected on spawning grounds within defined reaches *(Spawning Escapement Estimates)* • Time (Julian date) of arrival at mainstem projects and within tributaries (e.g., traps, PIT arrays) with the intent to identify biologically significant differences *(Spawning Escapement Estimates)* • Location (GPS coordinates) of female salmon carcasses observed on spawning grounds *(Spawning Escapement Estimates)*

Objective	Measured Variables *(Applicable Study Component(s))*
Objective 6: Determine if stray rate of hatchery fish is below the acceptable levels to maintain genetic variation among stocks.	• Number of hatchery fish collected for broodstock (*Broodstock Collection and Stock Assessment*) • Number of hatchery fish taken in fishery (*Harvest Reporting*) • Locations of live and dead strays (used to tease out overshoot) *(Spawning Escapement Estimates)* • Number of hatchery carcasses (PIT-tagged and/or CWT) found in non-target and target spawning areas or number of returning spawners counted via PIT-tag detection or at weirs in close temporal proximity to spawning areas (stray data into the Entiat subbasin will be obtained from USFWS Fisheries Resource Office-Leavenworth) *(Spawning Escapement Estimates)*
Objective 8: Determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.	• Total and salt (ocean) age and gender of hatchery and naturally produced salmon carcasses collected on spawning grounds *(Spawning Escapement Estimates)* • Whenever possible, age at maturity and sex ratio will be measured at weirs or dams near the spawning stream to avoid the size-related carcass recovery bias on spawning grounds (carcass sampling or ultrasound on live fish) *(Spawning Escapement Estimates)* • Assess age of fish, including harvested fish *(Spawning Escapement Estimates and Harvest Reporting)*
Objective 10: Determine if appropriate harvest rates have been applied to conservation, safety-net, and segregated harvest programs to meet the HCP/SSSA goal of providing harvest opportunities while also contributing to population management and minimizing risk to natural populations.	• Numbers of hatchery fish taken in harvest *(Harvest Reporting)* • Numbers of natural-origin fish taken in harvest *(Harvest Reporting)*

4.1 Spawning Escapement Estimates

Chelan and Methow Summer/Fall Chinook

Chinook spawning ground surveys will be conducted in the Chelan River and Methow subbasin (see Appendix A for survey reaches). Spawning ground surveys will be conducted via foot or raft beginning late September and continuing until spawning has ended (usually mid-November). Frequency of surveys will vary depending on method.

Summer Chinook carcass surveys will be conducted in the Chelan and Methow subbasins beginning in September and ending in November consistent with methods described in Murdoch and Peven (2005). A representative sample (i.e., 20%) of spawners as determined by spawner abundance and distribution (typically 100% of the carcasses encountered in the Chelan and Methow) will be sampled. Biological data will include collection of scale samples for age analysis, length measurements (POH and FKL), gender, egg voidance, and a check for tags or marks. DNA samples (five-hole punches from operculum) will be collected as needed to address different objectives. These data will be used to assess length-at-age, size-at-age, egg voidance, origin (hatchery or naturally produced), stray rates, and genetics. All carcass surveys will be conducted within the historical reaches.

Wenatchee Steelhead

The number of hatchery and naturally produced steelhead returning to the Wenatchee Basin will be estimated using a PIT tag mark recapture model. The estimated spawner abundance for the Wenatchee steelhead population will be a combination of PIT tag-based tributary and redd-based mainstem Wenatchee River estimates. Steelhead redd counts will be conducted weekly in all major spawning areas in the mainstem Wenatchee River (see Appendix A for survey reaches); minor spawning areas in the mainstem Wenatchee River will be surveyed once, based on the spawn timing in adjacent major spawning areas, to estimate redd abundance at peak spawning. The estimated total number of redds in the Wenatchee River mainstem will be expanded by the sex ratio of the population to estimate spawner abundance. Spawner abundance in tributaries of the Wenatchee River will be estimated using a PIT tag mark recapture model.

Chiwawa Spring Chinook

Chiwawa spring Chinook spawning escapement will be estimated based on the total number of redds found in each tributary (Murdoch et al. 2010) using methods described in Murdoch and Peven (2005). Weekly redd and carcass surveys will be conducted simultaneously from the first week of August through September (see Appendix A for survey reaches). Redd-based estimates assume that each female constructs one redd, which WDFW has found to be appropriate for this population (Murdoch et al. 2009). The total number of redds in each reach will be estimated using methods described in Millar et al. (2012) and using the observer efficiency model currently under development by WDFW. Redd counts will be expanded and the number of hatchery and naturally produced fish will be estimated using methods in Murdoch et al. (2010). Carcasses encountered during surveys will be sampled according to methods outlined in Murdoch and Peven (2005). All CWTs (i.e., snout or adipose) from carcasses will be sent to the WDFW lab in Olympia. The CWT lab will extract and read CWTs and submit all required information to RMIS within one year of collection. In addition, all redds and female carcasses will be geo-referenced using hand-held GPS devices. Carcass recovery bias has been detected in the Chiwawa spring Chinook population (Murdoch et al. 2010) and if not corrected will bias estimates of hatchery and naturally produced fish on the spawning grounds. While it may be appropriate to correct for carcass recovery bias for some monitoring questions (e.g., 2.2), when comparisons to reference populations are made in monitoring questions 1.1.and 1.2, carcass bias will not be corrected because other monitoring programs have not corrected for a similar bias.

Wenatchee Summer Chinook

Wenatchee summer Chinook spawning ground counts will begin the last week in September and continue through the end of spawning in November (see Appendix A for survey reaches). Total census redd counts will be conducted by foot or raft depending on stream size, flow, and density of spawners within the stream reach (see Appendix A for survey reaches). All stream reaches will be surveyed once per week. Redd data will be collected using methods described in Murdoch and Peven (2005). Salmon carcass data collected during spawning ground surveys will be consistent with Murdoch and Peven (2005). All CWTs (i.e., snout or adipose) from carcasses will be sent to the WDFW lab in Olympia. The CWT lab will extract and read CWTs and submit all required information to RMIS within one year of collection.

Redd Observer Efficiency and Fish per Redd Value

Estimating redd observer efficiency is a costly and laborious task. Models generated for spring Chinook salmon are not applicable for summer Chinook because of differences in river characteristics of spawning locations. Small unmanned air systems (e.g., four blade helicopter) have been used successfully to document the abundance and distribution of fall Chinook redds in the Snake River (P. Groves, Idaho Power, Pers. comm.). We intend to use this technology to determine the true number of summer Chinook redds in selected reaches of the Wenatchee River. Weekly aerial photos of selected reaches will be digitally overlaid to document existing and newly constructed redds. Weekly ground-based estimates and the true number of redds will be compared in order to determine observer efficiency. Weekly river characteristics (e.g., channel width, water depth, discharge, visibility, and habitat complexity), observer experience, and survey effort will be incorporated into a model to predict observer efficiency in all river reaches. Predicted redd observer efficiency for each river reach will be used to expand ground-based redd counts to estimate the total reach redd count. Aerial photographs and ground-based surveys will also be used to estimate redd life for each river reach. The estimated spawner abundance in the Wenatchee River and an associated level of precision will be calculated using the estimated total redd count for each reach, mean redd life, and the sex ratio of the population similar to methods described in Millar et al. (2012).

4.2 Harvest Reporting

In years when the expected hatchery adult returns are in excess of the levels needed to meet the hatchery program goals (i.e., broodstock and/or escapement), surplus fish may be available for harvest. Harvesting or removal of surplus hatchery fish may have benefits to the natural populations by reducing potential negative ecological and genetic impacts (e.g., density dependent effects, loss of fitness, and loss of genetic variation). The contribution of hatchery fish to fisheries will be monitored using CWT recoveries on a brood-year basis supporting Objective 10.

To obtain the necessary data to determine if the harvest rates are meeting objectives, a statistically valid creel program will be designed and implemented for all sport and/or conservation fisheries in the Upper Columbia River to estimate harvest of hatchery fish from both Chelan and Grant County PUD funded hatchery programs (Murdoch and Peven 2005). Information collected during creel surveys are an integral component to calculating the HRR (Objective 3), particularly given most CWT recoveries for PUD mitigation programs occur in the Upper Columbia River and its tributaries, with the exception of summer Chinook where most CWT recoveries occur in ocean fisheries. Because of considerable time lags in reporting of CWT's to the Regional Marking Information System (RMIS) database, it requires an ongoing query of recovery data until the number of estimated fish does not change.

5. Data Management , Analysis, and Reporting

5.1 Data Management

A Microsoft Access database maintained by WDFW will contain all the monitoring data collected for hatchery evaluations. The database will contain and manage all data associated with aquaculture monitoring, juvenile monitoring, and adult monitoring.

All data entered into the database are evaluated for quality control and quality assurance by WDFW. Quality control checks using analyses such as modified Z-scores, boxplots, and the Generalized Extreme Studentized Deviate Procedure (Iglewicz and Hoaglin 1993) will be conducted for all data entry. In the event outliers are identified, discussion will occur on whether identified outliers are true data points or transcription errors. This process ensures that the data used to test statistical hypotheses are correct and accurate.

5.2 Data Analysis

The analyses proposed are consistent with the Monitoring and Evaluation Plan for PUD Hatchery Programs: 2013 Update (Hillman et al. 2013). Each of the objectives will be addressed using the appropriate statistical tests, as well as graphic analyses that convey relevant information.

5.3 Reporting

An annual M&E report will be generated following the completion of each calendar year and will be available for HCP HC review by June 1 of the following year. Additionally, monthly progress reports will be made available to the HCP HC.

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Appendix A

Designated survey reaches for Methow subbasin summer Chinook spawning ground surveys.

River	Reach	Code	RM
Methow	Mouth to Methow Bridge	M1	0.0-14.78
	Methow Bridge to Carlton Bridge	M2	14.78-27.17
	Carlton Bridge to Twisp Bridge	M3	27.17-39.55
	Twisp Bridge to MVID	M4	39.55-44.85
	MVID to Winthrop Bridge	M5	44.85-49.80
	Winthrop Bridge to Hatchery Dam	M6	49.80-51.55

Designated survey reaches for Wenatchee River basin summer Chinook spawning grounds surveys. Asterisks denotes reaches where redd observer efficiency will be assessed.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Bridge	54.20-53.58
	Bridge to Swamp *	53.58-52.66
	Swamp to Chiwawa River	52.66-48.39
W9	Chiwawa River to Schugart Flats	48.39-47.93
	Schugart Flats to Old Plain Bridge	47.93-46.21
	Old Plain Bridge to RR Bridge	46.21-41.91
	RR Bridge to RR Tunnel	41.91-39.28
	RR Tunnel to Swing Pool *	39.28-36.67
	Swing Pool to Tumwater Br	36.67-35.55
W8	Tumwater Br to Swiftwater Campground *	35.55-33.50
	Swiftwater Campground to Unimproved Campground	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Penstock Br	30.91-28.66
	Penstock Br to Icicle Road Br *	28.66-26.43
W6	Icicle Road Br to Icicle Mouth	26.43-25.61
	Icicle Mouth to Boat Takeout *	25.61-24.49
	Boat Takeout to Leavenworth Br	24.49-23.90
W5	Leavenworth Br to Irrigation Flume *	23.90-22.77
	Irrigation Flume to Peshastin Br	22.77-20.00
W4	Peshastin Br to Dryden Dam *	20.00-17.76
W3	Dryden Dam to Williams Canyon	17.76-15.54
	Williams Canyon to Upper Cashmere Br	15.54-10.22
	Upper Cashmere Br to Lower Cashmere Br	10.22-9.49
W2	Lower Cashmere Br to Old Monitor Br *	9.49-7.12
	Old Monitor Br to Sleepy Hollow Br	7.12-3.27
W1	Sleepy Hollow Br to River Bend *	3.27-1.73
	River Bend to Siphon	1.73-1.29
	Siphon to Mouth	1.29-0.45

Designated survey reaches for Wenatchee Basin spring Chinook spawning grounds surveys.

Reach Code	Reach Section	River Mile
Chiwawa River and Tributaries (Rock and Chikamin)		
C7	Buck Cr to Phelps Cr	36.39-33.46
C6	Phelps Cr (Trinity) to Maple Cr Br	33.46-29.64
C5	Maple Cr Br to Atkinson Flats	29.64-26.59
C4	Atkinson Flats to Schaefer Cr	26.59-24.24
C3	Schaefer Cr to Rock Cr Campground	24.24-22.97
R1 - Rock	Mouth to Chiwawa River Road Bridge	0.00-1.05
C2	Rock Cr Campground to Grouse Cr	22.97-12.27
K1 - Chikamin	Mouth to Chiwawa River Road Bridge	0.00-0.68
C1	Grouse Cr to Mouth	12.27-0.00
Nason Creek		
N4	White Pine Creek to Lower R.R. Bridge	16.09-13.68
N3	Lower R.R. Bridge to Hwy 2 Bridge	13.68-9.13
N2	Hwy 2 Bridge to Kahler Cr	9.13-4.46
N1	Kahler Cr to Mouth	4.46-0.00
White River and Tributaries (Panther and Napeaqua)		
H4	Falls to Grasshopper Meadows	21.16-19.78
T1 - Panther	Boulder field to Mouth	0.43-0.00
H3	Grasshopper Meadows to Napeaqua River	19.78-17.59
Q1 - Napeaqua	Take out to Mouth	0.91-0.00
H2	Napeequa River to Sears Cr Bridge	17.59-11.97
H1	Sears Cr Bridge to Mouth	11.97-0.00
Little Wenatchee River		
L3	Rainy Cr to Lost Cr	10.78-6.74
L2	Lost Cr to Old Fish Weir	6.74-2.13
L1	Old Fish Weir to Mouth	2.13-0.00
Upper Wenatchee River		
W10	Lake Wenatchee to Chiwawa River	54.20-48.39
Chiwaukum Creek		
U1	Metal bridge to Mouth	1.0 – 0.0
Icicle River		
I1	Hatchery to Mouth	3.02-0.00
Peshastin Creek and Tributaries (Ingalls Creek)		
D1 - Ingalls	Trailhead to mouth	0.64-0.00
P2	Ingalls Creek to Camas Cr	9.14-5.63
P1	Camas Cr to Mouth	5.63-0.00

Designated survey reaches for Wenatchee River basin steelhead spawning grounds surveys. Asterisks denote index reaches. Spawning escapements in tributaries will be estimates using PIT-tag arrays.

Reach Code	Reach Section	River Mile
W10	Lake Wenatchee to Chiwawa River*	54.20-48.39
W9	Chiwawa River to Tumwater Bridge*	48.39-35.55
W8	Tumwater Br to Swiftwater Campground	35.55-33.50
	Swiftwater Campground to Unimproved Campground*	33.50-33.08
	Unimproved Campground to Tumwater Dam	33.08-30.91
W7	Tumwater Dam to Icicle Road Bridge	30.91-26.43
W6	Icicle Road Br to Leavenworth boat ramp*	26.43-24.49
	Boat Takeout to Leavenworth Bridge	24.49-23.90
W5	Leavenworth Bridge to Peshastin Bridge	23.90-20.00
W4	Peshastin Bridge to Dryden Dam	20.00-17.76
W3	Dryden Dam to Lower Cashmere Bridge	17.76-9.49
W2	Lower Cashmere Bridge to Sleepy Hollow Bridge *	9.49-3.27
W1	Sleepy Hollow Bridge to Mouth	3.27-0.45

Tributary	River mile of PIT tag array
Mission Creek	0.54
Peshastin Creek	1.91
Chumstick Creek	0.31
Icicle River	0.26
Chiwaukum Creek	0.24
Chiwawa River	0.58
Nason Creek	0.52
Little Wenatchee River	1.74
White River	1.65

APPENDIX O
CHELAN PUD 2012 HATCHERY M&E PLAN REPORT

MONITORING AND EVALUATION OF THE CHELAN COUNTY PUD HATCHERY PROGRAMS

2012 ANNUAL REPORT

June 1, 2013

BioAnalysts, Inc.

CHELAN COUNTY

Prepared by:

T. Hillman
M. Miller
BioAnalysts, Inc.

L. Keller
J. Murauskas
Chelan PUD

T. Miller
M. Tonseth
M. Hughes
A. Murdoch
WA Dept of Fish and Wildlife

Prepared for:
HCP Hatchery Committee
Wenatchee, WA

Citation: Hillman, T., M. Miller, T. Miller, M. Tonseth, M. Hughes, A. Murdoch, L. Keller, and J. Murauskas. 2013. Monitoring and evaluation of the Chelan County PUD hatchery programs: 2012 annual report. Report to the HCP Hatchery Committee, Wenatchee, WA.

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PREFACE

This annual report is the result of coordinated field efforts conducted by Washington Department of Fish and Wildlife (WDFW), the Confederated Tribes and Bands of the Yakama Nation (Yakama Nation), Chelan County Public Utility District (Chelan PUD), and BioAnalysts, Inc. An extensive amount of work was conducted in 2006 through 2012 to collect the data needed to monitor the effects of the Chelan County PUD Hatchery Programs. This work was directed and coordinated by the Habitat Conservation Plan (HCP) Hatchery Committee, consisting of the following members: Bill Gale, U.S. Fish and Wildlife Service (USFWS); Rob Jones and Craig Busack, National Marine Fisheries Service (NMFS); Joe Miller, Josh Murauskas, and Alene Underwood, Chelan County PUD; Tom Scribner and Keely Murdoch, the Yakama Nation; Mike Tonseth, WDFW; Kirk Truscott, Confederated Tribes of the Colville Reservation (Colville Tribes), and Mike Schiewe, Anchor QEA (Chair).

The approach to monitoring the hatchery programs was guided by the "*Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Programs*" (Murdoch and Peven 2005). Technical aspects of the monitoring and evaluation program were developed by the Hatchery Evaluation Technical Team (HETT), which consists of the following scientists: Carmen Andonaegui, Anchor QEA; Matt Cooper, USFWS; Steve Hays, Chelan PUD; Tracy Hillman, BioAnalysts; Tom Kahler, Douglas PUD; Russell Langshaw, Grant PUD; Greg Mackey, Douglas PUD; Joe Miller, Chelan PUD; Josh Murauskas, Chelan PUD, Andrew Murdoch, WDFW; Keely Murdoch, Yakama Nation; and Todd Pearsons, Grant PUD. The HETT developed an "*Analytical Framework for Monitoring and Evaluating PUD Hatchery Programs*" (Hays et al. 2006), which directs the analyses of hypotheses developed under the conceptual approach. Most of the analyses outlined in the Analytical Framework paper will be conducted in the five-year comprehensive reports.

Most of the work reported in this paper was funded by Chelan PUD. Bonneville Power Administration purchased the Passive Integrated Transponder (PIT) tags that were used to mark juvenile Chinook and steelhead captured in tributaries. This is the seventh annual report written under the direction of the HCP.

"I often say that when you can measure something and express it in numbers, you know something about it. When you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind. It may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the stage of science, whatever it may be."

Lord Kelvin

SECTION 1: INTRODUCTION

Chelan PUD implements hatchery programs as part of two Habitat Conservation Plan (HCP) agreements related to the operation of Rocky Reach and Rock Island Hydroelectric Projects. The HCPs define the goal of achieving no net impact to spring Chinook, summer/fall Chinook, sockeye salmon, steelhead, and coho salmon affected by the operation of these projects. The two HCPs identify general program objectives as "*contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest*." The fish resource management agencies initially developed the following general goal statements for each hatchery program, which were adopted by the Hatchery Committee:

(1) *Support the recovery of ESA listed species by increasing the abundance of natural adult population, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity.*

Includes the Wenatchee spring Chinook, Wenatchee summer steelhead, and Methow spring Chinook programs.

(2) *Increase the abundance of the natural adult population of unlisted plan species, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity. In addition, provide harvest opportunities in years when spawning escapement is sufficient to support harvest.*

Includes the Wenatchee sockeye, Wenatchee summer/fall Chinook, Methow summer/fall Chinook, Okanogan summer/fall Chinook, and Okanogan sockeye programs.

(3) *Provide salmon for harvest and increase harvest opportunities, while segregating returning adults from natural tributary spawning populations.*

Includes the Turtle Rock summer/fall Chinook program.

Thus, there are two different types of artificial propagation strategies that address the different goals of the program: supplementation and harvest augmentation. The supplementation programs primarily focus on increasing the natural production of fish in tributaries. A fundamental assumption of this strategy is that hatchery fish returning to the spawning grounds are "reproductively similar" to naturally produced fish. The second program type, harvest augmentation, focuses on increasing harvest opportunities. This is accomplished by releasing hatchery fish directly into the Columbia River with the intent that returning adults remain segregated from the naturally spawning populations in tributaries.

Monitoring is needed to determine if the programs are performing properly. The HCP Hatchery Committee adopted a monitoring and evaluation (M&E) approach that will guide the assessment of the hatchery programs. The approach, developed by Murdoch and Peven (2005), identified the following objectives:

(1) Determine if supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population relative to a non-supplemented population (i.e., reference stream) and the changes in the natural

replacement rate (NRR) of the supplemented population is similar to that of the non-supplemented population.

(2) Determine if the run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.

(3) Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

(4) Determine if the hatchery adult-to-adult survival (i.e., hatchery replacement rate or HRR) is greater than the natural adult-to-adult survival (i.e., natural replacement rate or NRR) and equal to or greater than the program-specific HRR expected value based on estimated survival rates listed in Appendix D in Murdoch and Peven(2005).

(5) Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks.

(6) Determine if hatchery fish were released at the programmed size and number.

(7) Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity (i.e., number of juveniles per redd) of supplemented streams when compared to non-supplemented streams.

(8) Determine if harvest opportunities have been provided using hatchery returning adults where appropriate (e.g., Turtle Rock program).

Two additional objectives that were not explicit in the goals specified above but were included in the M&E approach because they relate to goals and concerns of all artificial production programs include:

(9) Determine whether bacterial kidney disease (BKD) management actions lower the prevalence of disease in hatchery fish and subsequently in the naturally spawning population. In addition, when feasible, assess the transfer of *Renibacterium salmoninarum* (Rs) infection at various life stages from hatchery fish to naturally produced fish.

(10) Determine if the release of hatchery fish impact non-target taxa of concern (NTTOC) within acceptable limits.

Attending each objective is one or more testable hypotheses (see Murdoch and Peven 2005). Each hypothesis will be tested statistically following the routines identified in Hays et al. (2006). Most of these analytical routines will be conducted at the end of five-year monitoring blocks, as outlined in the M&E plan (Murdoch and Peven 2005; Hays et al. 2006).

Throughout each five-year monitoring period, annual reports will be generated that describe the M&E data collected during a specific year. This is the seventh annual report developed under the direction of the M&E guidance approach (Murdoch and Peven 2005). The purpose of this report is to describe monitoring activities conducted in 2012. Activities included broodstock collection, collection of life-history information, within hatchery spawning and rearing activities, juvenile monitoring within streams, and redd and carcass surveys. Data from reference areas are not included in this annual report (reference data are in the five-year reports). To the extent currently possible, we have included information collected before 2012.

This report is divided into several sections, each representing a different species or stock (i.e., steelhead, sockeye salmon, spring Chinook, and summer Chinook). For all species we provide broodstock information; hatchery rearing history, release data, and survival estimates; disease information; juvenile migration and productivity estimates; redd counts, distribution, and spawn timing; spawning escapements; and life-history characteristics. For salmon species, we also provide information on carcasses.

Finally, we end each section by addressing compliance issues with ESA/HCP mandates. For each Chelan PUD Hatchery Program, WDFW and the PUD are authorized annual take of ESA-listed spring Chinook and steelhead through Section 10 of the Endangered Species Act (ESA), including:

1. ESA Section 10(a)(1)(A) Permit No. 1395, which authorizes the annual take of adult and juvenile endangered upper Columbia River (UCR) spring Chinook and endangered UCR steelhead associated with implementing artificial propagation programs for the enhancement of UCR steelhead. The authorization includes takes associated with adult broodstock collection, hatchery operations, juvenile fish releases, monitoring and evaluation activities, and management of adult returns related to UCR steelhead artificial propagation programs in the UCR region (NMFS 2003a).
2. ESA Section 10(a)(1)(A) Permit No. 1196, which authorizes the annual take of adult and juvenile endangered UCR spring Chinook and endangered UCR steelhead associated with implementing artificial propagation programs for the enhancement of UCR spring Chinook. The authorization includes takes associated with adult broodstock collection, hatchery operations, juvenile fish releases, and monitoring and evaluation activities supporting UCR spring Chinook artificial propagation programs in the UCR region (NMFS 2004).
3. ESA Section 10(a)(1)(A) Permit No. 1347, which authorizes the annual incidental take of adult and juvenile endangered UCR spring Chinook and endangered UCR steelhead through actions associated with implementing artificial propagation programs for the enhancement of non-listed anadromous fish populations in the UCR. The authorization includes incidental takes associated with adult broodstock collection, hatchery operations, juvenile fish releases, and monitoring and evaluation activities associated with non-listed summer Chinook, fall Chinook, and sockeye salmon artificial propagation programs in the UCR region (NMFS 2003b).

SECTION 2: SUMMARY OF METHODS

Sampling in 2012 followed the methods and protocols described in Murdoch and Peven (2005). In this section we only briefly review the methods and protocols. More detailed information can be found in Murdoch and Peven (2005).

2.1 Broodstock Collection and Sampling

Methods for collecting broodstock are described in the Annual Broodstock Collection Protocols (Appendix A in WDFW 2011). Methods for sampling broodstock are described in Appendices A and B in Murdoch and Peven (2005). Generally, broodstock were collected over the migration period (to the extent allowed in ESA-permit provisions) in proportion to their temporal occurrence at collection sites, with in-season adjustments dictated by 2012 run timing and trapping success relative to achieving weekly and annual collection objectives. Pre-season weekly collection objectives are shown in Table 2.1 and assumptions associated with broodstock trapping are provided in Table 2.2.

Table 2.1. Weekly collection objectives for steelhead and Chinook in 2012. No sockeye were collected in 2012.

Collection week beginning day	Chiwawa Spring Chinook[a]		Wild Wenatchee Summer Chinook	Wild ME/OK Summer Chinook[b]	Wenatchee Steelhead	
	Hatchery	Wild			Hatchery	Wild
3 June	0	2				
10 June	1	6				
17 June	2	15				
24 June	3	13				
1 Jul	3	11	34	34	1	1
8 Jul	5	10	34	33	1	1
15 Jul	9	11	49	31	2	2
22 Jul	10	7	53	25	2	2
29 Jul	3	3	38	19	3	3
5 Aug			38	17	4	4
12 Aug			18	12	4	4
19 Aug			12	11	4	4
26 Aug				5	4	4
2 Sep				3	4	4
9 Sep					4	4
16 Sep					4	4
23 Sep					7	7
30 Sep					10	9
7 Oct					5	5
14 Oct					5	4
21 Oct					2	2
Total	**36**	**78**	**274**	**190**	**66**	**64**

[a] Collection quota based on 1999-2011 average cumulative Tumwater Dam spring Chinook passage (WDFW unpublished data) and pre-season broodstock collection objectives.

[b] Collection does not include summer Chinook collected by the Colville Tribes using purse seines.

Table 2.2. Biological and trapping assumptions associated with collecting broodstock for the Chelan PUD Hatchery Programs (from Appendix A in Murdoch and Peven 2005).

Assumptions	Wenatchee Steelhead	Chiwawa Spring Chinook	Wenatchee Summer Chinook	ME/OK Summer Chinook
Production level	400,000 yearling smolts	672,000 yearling smolts	864,000 yearling smolts	976,000 yearling smolts
Broodstock required	208 adults (not to exceed 33% of population)	379 adults (not to exceed 33% of population)	492 adults (not to exceed 33% of the population)	556 adults (not to exceed 33% of the population)
Trapping period	7 July – 12 Nov	1 May – 12 Sep	7 Jul – 12 Sep	7 Jul – 15 Sep
# days/week	5	4	5	3
# hours/day	24	24	24	16
Broodstock composition	50% wild; 50% WxW and/or HxW	Sliding scale; minimum 33% wild (depends on the number of wild fish)	100% wild	100% wild
Trapping site	Dryden Dam (Tumwater will be used if weekly quota not achieved at Dryden Dam)	Tumwater Dam (hatchery fish only) and the Chiwawa Weir (both hatchery and wild fish)	Dryden Dam (Tumwater will be used if weekly quota not achieved at Dryden Dam)	Wells Dam east ladder

Several biological parameters were measured during broodstock collection at adult collection sites. Those parameters included the date and start and stop time of trapping; number of each species collected for broodstock; origin, size, and sex of trapped fish; age from scale analysis; and pre-spawn mortality. For each species, trap efficiency, extraction rate, and trap operation effectiveness were estimated following procedures in Appendix B in Murdoch and Peven (2006). In addition, a representative sample of most species trapped but not taken for broodstock were sampled for origin, sex, age, and size (stock assessment). All steelhead trapped were sampled.

2.2 Within Hatchery Monitoring

Methods for monitoring hatchery activities are described in Appendix C in Murdoch and Peven (2005). Biological information collected from all spawned adult fish included age at maturity, length at maturity, spawn timing, and fecundity of females. In addition, all fish were checked for tags and females were sampled for disease.

Throughout the rearing period in the hatchery, fish were sampled for growth, health, and survival. Each month, lengths and weights were collected from a sample of fish and rearing density indices were calculated. In addition, fish were examined monthly for health problems following standard fish health monitoring practices for hatcheries. Various life-stage survivals were estimated for each hatchery stock. These estimates were then compared to the "standard" survival rates identified in Table 2.3 to provide insight as to how well the hatchery operations were performing. Failure to achieve a survival standard could indicate a problem with some part of the hatchery program. However, failure to meet a standard may not be indicative of the overall success of the program to meet the goals identified in Section 1.

Table 2.3. Standard life-stage survival rates for fish reared within the Chelan PUD hatchery programs (from Appendix C in Murdoch and Peven 2005).

Life stage	Standard survival rate (%)
Collection-to-spawning (females)	90
Collection-to-spawning (males)	85
Unfertilized egg-to-eyed	92
Unfertilized egg-to-ponding	98
30 d after ponding	97
100 d after ponding	93
Ponding-to-release	90
Transport-to-release	95
Unfertilized egg-to-release	81

Nearly all hatchery fish from each stock were marked (adipose fin clip) or tagged (coded-wire tag or elastomer tag). Different combinations of marks and tags were used depending on the stock. In addition, Chelan PUD personnel PIT tagged about 10,200 juvenile hatchery spring Chinook (5,100 WxW Chinook and 5,100 HxH Chinook) in June and about 25,400 steelhead (15,244 WxW steelhead and 10,223 HxH steelhead) during September. They tagged 5,100 Similkameen summer Chinook in August and 5,100 Wenatchee summer Chinook in September. They also tagged about 5,100 juvenile sockeye in June. PIT tags will be used to estimate migration timing and survival rates (e.g., smolt-to-adult) outside the hatchery.

Lastly, the size and number of fish released were assessed and compared to programmed production levels. The goal of the program is that numbers released and their sizes should fall within 10% of the programmed targets identified in Table 2.4. However, because of constraints due to run size and proportions of wild and hatchery adults, production levels may not be met every year.

Table 2.4. Targets for fish released from the Chelan PUD hatchery programs; CV = coefficient of variation (from Appendix C in Murdoch and Peven 2005).

Hatchery stock	Release targets	Size targets		
		Fork length (CV)	Weight (g)	Fish/pound
Wenatchee Summer Chinook	864,000	176 (9.0)	45.4	10
Okanogan Summer Chinook	576,000	176 (9.0)	45.4	10
Methow Summer Chinook	400,000	176 (9.0)	45.4	10
Turtle Rock Summer Chinook (yearlings)	200,000	176 (9.0)	45.4	10
Turtle Rock Summer Chinook (subyearlings)	1,620,000	112 (9.0)	11.4	40
Chiwawa Spring Chinook	672,000	176 (9.0)	37.8	12
Wenatchee Sockeye	200,000	133 (9.0)	22.7	20
Wenatchee Steelhead	400,000	198 (9.0)	75.6	6

2.3 Juvenile Sampling

Juvenile sampling within streams included operation of rotary smolt traps, snorkel observations, and PIT tagging. Methods for sampling juvenile fish are described in Appendix E in Murdoch and Peven (2005).

A smolt trap was located on the Wenatchee River about 0.5 km downstream from the mouth of Lake Wenatchee (Upper Wenatchee Trap) and in the Chiwawa River about 1 km upstream from the mouth (Chiwawa Trap). All traps operated throughout the smolt migration period. The Chiwawa Trap operated throughout most of the year (March through November), but not during icing or extreme high flow conditions. The following data were collected at each trap site: water temperature, discharge, number and identification of all species captured, degree of smoltification for anadromous fish, presence of marks and tags, size (fork lengths and weights), and scales from steelhead and sockeye salmon smolts. Trap efficiencies at each trap site were estimated by using mark-recapture trials conducted over a wide range of discharges. Linear regression models relating discharge and trap efficiencies were developed to estimate daily trap efficiencies during periods when no mark-recapture trials were conducted. The total number of fish migrating past the trap each day was estimated as the quotient of the daily number of fish captured and the estimated daily trap efficiency. Summing the daily totals resulted in the total emigration estimate.

Snorkel observations were used to estimate the number of juvenile spring Chinook salmon, juvenile rainbow/steelhead, and bull trout within the Chiwawa River Basin. The focus of the study was on juvenile spring Chinook salmon. Sampling followed a stratified random design with proportional allocation of sites among strata. Strata were identified based on unique combinations of geology, land type, valley bottom type, stream state condition, and habitat types. A total of 149 randomly selected sites were surveyed during August (Table 2.5). Counts of fish within each sampling site were adjusted based on detection efficiencies, which were related to water temperature. That is, non-linear models that described relationships between water temperatures and detection efficiencies (Hillman et al. 1992) were used to estimate total numbers of fish within sampling sites. These numbers were then converted to densities by dividing total fish numbers by the wetted surface area and water volume of sample sites. Total numbers within a stratum were estimated as the product of fish densities times the total wetted surface or water volume for the stratum. The sum of fish numbers across strata resulted in the total number of fish within the basin. The calculation of total numbers, densities, and degrees of certainty are fully explained in Hillman and Miller (2004).

Working in collaboration with the Comparative Survival Study (CSS) funded by Bonneville Power Administration (BPA), crews PIT tagged juvenile wild Chinook, wild and hatchery steelhead, and wild sockeye salmon collected at the Upper Wenatchee and Chiwawa smolt traps. The proposed number of wild spring Chinook and steelhead to be tagged at each location is provided in Table 2.6. The goal of this work was to better understand the life-history characteristics of fish in the Wenatchee River basin and to estimate SARs. This in turn improves the ability to detect potential effects of the hatchery program on wild fish.

Table 2.5. Location of strata and numbers of randomly sampled sites within each stratum that were sampled in the Chiwawa River Basin in 2012.

Reach/stratum	River kilometers (RKm)	Number of randomly selected sites
Chiwawa River		
1	0.0-6.1	11
2	6.1-8.9	5
3	8.9-12.7	8
4	12.7-14.3	6
5	14.3-17.4	5
6	17.4-19.0	5
7	19.0-32.2	28
8	32.2-40.9	22
9	40.9-46.4	10
10	46.4-50.1	10
Phelps Creek		
1	0.0-0.6	1
Chikamin Creek (includes Minnow Creek)		
1	0.0-1.5	10
Rock Creek		
1	0.0-1.2	15
Peven Creek (unnamed stream on USGS map)		
1	0.0-0.1	1
Big Meadow Creek		
1	0.0-1.6	6
Alder Creek		
1	0.0-0.1	2
Brush Creek		
1	0.0-0.1	2
Clear Creek		
1	0.0-0.1	2

Table 2.6. Number of wild spring Chinook and steelhead proposed for tagging at different locations within the Wenatchee River basin, 2012.

Sampling location	Target sample size	
	Wild spring Chinook	Wild steelhead
Chiwawa Trap	2,500-8,000	500-2,000
Upper Wenatchee Trap	500-1,000	50-250
Total	**3,000-9,000**	**550-2,250**

Survival rates for various juvenile life-stages were calculated based on estimates of seeding levels (total egg deposition), numbers of parr, numbers of emigrants, and numbers of smolts. Total egg deposition was estimated as the product of the number of redds counted in the basin times the mean fecundity of female spawners. Fecundity was estimated from females collected for broodstock using an electronic egg counter. Numbers of emigrants and smolts were estimated at trapping sites and numbers of parr were estimated using snorkel observations only in the Chiwawa River basin. Survival estimates could not be calculated for some stocks (e.g., summer Chinook) because specific life-stage abundance estimates were lacking.

2.4 Spawning/Carcass Surveys

Methods for conducting carcass and spawning ground surveys are detailed in Appendix F in Murdoch and Peven (2005). Information collected during spawning surveys included spawn timing, redd distribution, and redd abundance. Data collected during carcass surveys included sex, size (fork length and postorbital-to-hypural length), scales for aging[1], degree of egg voidance, DNA samples, and identification of marks or tags. The sampling goal for carcasses was 20% of the spawning population. Crews also conducted snorkel surveys to assess the incidence of precocial fish spawning naturally in streams.

Both redd and carcass surveys were conducted in reaches that encompassed the spawning distribution of most populations. Steelhead surveys were the exception. These surveys were conducted within major spawning areas in the basin and therefore may not capture the entire spawning distribution of the population. Steelhead surveys were conducted during March through June in reaches and index areas described in Table 2.7. Total redd counts were estimated by expanding counts within non-index areas by expansion factors developed within index areas.

[1] In this report we use two methods of describing age. One is termed the "European Method." This method has two digits, separated by a period. The first digit represents the number of winters the fish spent in freshwater before migrating to the sea. The second digit indicates the number of winters the fish spent in the ocean. For example, a fish designated as 1.2 spent one winter in freshwater and two in the ocean. A fish designated as 0.3 migrated to the ocean in its first year and spent three winters in the ocean. The other method describes the total age of the fish (egg-to-spawning adult, i.e., gravel-to-gravel), so fish demarcated as 0.3 or 1.2 are considered 4-year-olds, from the same brood.

Table 2.7. Description of reaches and index areas surveyed for steelhead redds in the Wenatchee River basin.

Stream	Code	Reach	Index/reference area
Wenatchee River	W2	Sleepy Hollow Br to L. Cashmere Br	Monitor Boat Rmp to Cashmere Boat Rmp
	W6	Leavenworth Br to Icicle Rd Br	Leavenworth Boat Ramp to Icicle Ck
	W8	Tumwater Dam to Tumwater Br	Swift Boat Ramp to Tumwater Br
	W9	Tumwater Br to Chiwawa R	Tumwater Br to Plain
	W10	Chiwawa R to Lk Wenatchee	Chiwawa Pump St. to Lk Wenatchee
Peshastin Creek	P1	Mouth to Camas Cr	Kings Br to Camas Cr
	P2A	Camas Cr to Mouth of Scotty Cr	Ingalls Cr to Ruby Cr
	P2	Camas Cr to Mouth of Scotty Cr	FR7620 to Shaser Cr
Ingalls Creek	D1	Mouth to Trailhead RM 1	Mouth to Trailhead RM 1
	D2	Trailhead to Wilderness Bd RM 1.5	Trailhead to Wilderness Bd RM 1.5
Chiwawa River	C1	Mouth to Grouse Cr	Mouth to Rd 62 Br RM 6.4
	C2	Grouse Cr to Rock Cr	Chikamin Cr to Log Jam
Clear Creek	V1	Mouth to Hwy 22	Mouth to Hwy 22
	V2	Hwy 22 to Lower Culvert RM 2	Hwy 22 to Lower Culvert
Nason Creek	N1	Mouth to Kahler Cr Br	Mouth to Swamp Cr
	N3	Hwy 2 Br to Lower RR Br	Hwy 2 Br to Merrit Br
	N4	Lower RR Br to Whitepine Cr	Rayrock to Church Camp
Icicle River	I1	Mouth to Hatchery	Mouth to Boulder Block
Little Wenatchee	L2	Mouth to Lost Cr	Old Fish Weir to Lost Cr
	L3	Lost Cr to Rainy Cr Br	Lost Cr to Rainy Cr Br
White River	H2	Sears Cr Br to Napeequa R	Riprap Bank to Napeequa R
	H3	Napeequa R to Mouth of Panther Cr	Napeequa R to Grasshopper Meadows
Napeequa River	Q1	Mouth to RM 1	Mouth to RM1

Spring Chinook redd and carcass surveys were conducted during August through September in the Chiwawa River (including Rock and Chikamin creeks), Nason Creek, Icicle Creek, Peshastin Creek (including Ingalls Creek), upper Wenatchee River, Little Wenatchee River, and the White River (including the Napeequa River and Panther Creek). Survey reaches for spring Chinook are described in Table 2.8.

Table 2.8. Description of reaches surveyed for spring Chinook redds and carcasses in the Wenatchee River basin.

Stream	Code	Reach	River mile (RM)
Chiwawa River	C1	Mouth to Grouse Creek	0.0-11.7
	C2	Grouse Creek to Rock Creek	11.7-19.3
	C3	Rock Creek to Schaefer Creek	19.3-22.4
	C4	Schaefer Creek to Atkinson Flats	22.4-25.6
	C5	Atkinson Flats to Maple Creek	25.6-27.0
	C6	Maple Creek to Trinity	27.0-30.3
Rock Creek	R1	Mouth to End	0.0-0.5
Chikamin Creek	K1	Mouth to End	0.0-0.5
Nason Creek	N1	Mouth to Kahler Creek Bridge	0.0-3.9
	N2	Kahler Creek Bridge to Hwy 2 Bridge	3.9-8.3
	N3	Hwy 2 Bridge to Lower RR Bridge	8.3-13.2
	N4	Lower RR Bridge to Whitepine Creek	13.2-15.4
Little Wenatchee River	L2	Old Fish Weir to Lost Creek	2.7-5.2
	L3	Lost Creek to Rainy Creek	5.2-9.2
	L4	Rainy Creek to Falls	9.2-Falls
White River	H2	Sears Creek Bridge to Napeequa River	6.4-11.0
	H3	Napeequa River to Grasshopper Meadows	11.0-12.9
Napeequa River	Q1	Mouth to End	0.0-1.0
Panther Creek	T1	Mouth to End	0.0-0.7
Wenatchee River	W8	Tumwater Dam to Tumwater Bridge	30.9-35.6
	W9	Tumwater Bridge to Chiwawa River	35.6-48.4
	W10	Chiwawa River to Lake Wenatchee	48.4-54.2
Icicle Creek	I1	Mouth to Boulder Block	0.0-4.0
Peshastin Creek	P1	Mouth to Camas Creek	0.0-5.9
	P2	Camas Creek to Mouth of Scotty Creek	5.9-16.3
Ingalls Creek	D1	Mouth to Trailhead	0.0-1.0

Surveys for live sockeye and carcass were conducted during August through October in the Little Wenatchee River. No sockeye redds were counted in 2012. Live fish counts were used to estimate spawning escapements using the area-under-the-curve (AUC) method. Mark-recapture methods were used to estimate the spawning escapement of sockeye in the White River Basin.

Table 2.9. Description of reaches surveyed for sockeye salmon carcasses and live fish in the Wenatchee River basin.

Stream	Code	Reach	River mile (RM)
Little Wenatchee River	L1	Mouth to Old Fish Weir	0.0-2.7
	L2	Old Fish Weir to Lost Creek	2.7-5.2
	L3	Lost Creek to Rainy Creek	5.2-9.2
White River	H1	Mouth to Sears Creek Bridge	0.0-6.4
	H2	Sears Creek Bridge to Napeequa River	6.4-11.0
	H3	Napeequa River to Grasshopper Meadows	11.0-12.9
Napeequa River	Q1	Mouth to End	0.0-1.0

Wenatchee summer Chinook redd and carcass surveys were conducted during September through November within ten reaches on the Wenatchee River (Table 2.10). Peak redd counts and map redd counts were estimated in the Wenatchee River. Map redd counts were conducted only within index areas, not throughout the entire river. The total number of redds within the Wenatchee River was estimated by expanding peak counts based on map counts. This method is described in Appendix F in Murdoch and Peven (2005).

Table 2.10. Description of reaches and index areas surveyed for summer Chinook redds in the Wenatchee River basin.

Code	Reach	River mile	Index/reference area (RM)
W1	Mouth to Sleepy Hollow Br	0.0-3.3	River Bend to Sleepy Hollow Br (1.7-3.3)
W2	Sleepy Hollow Br to L. Cashmere Br	3.3-9.5	L. Cashmere Br to Old Monitor Br (7.1-9.5)
W3	L. Cashmere Br to Dryden Dam	9.5-17.8	Williams Canyon to Dryden Dam (15.5-17.8)
W4	Dryden Dam to Peshastin Br	17.8-20.0	Dryden Dam to Peshastin Br (17.8-20.0)
W5	Peshastin Br to Leavenworth Br	20.0-23.9	Irrigation Flume to Leavenworth Br (22.8-23.9)
W6	Leavenworth Br to Icicle Rd Br	23.9-26.4	Icicle to Boat Takeout (24.5-25.6)
W7	Icicle Rd Br to Tumwater Dam	26.4-30.9	Icicle Br to Penstock Br (26.4-28.7)
W8	Tumwater Dam to Tumwater Br	30.9-35.6	Swiftwater Campgd to Tumwater Br (33.5-35.6)
W9	Tumwater Br to Chiwawa River	35.6-47.9	Swing Pool to Railroad Tunnel (36.7-39.3)
W10	Chiwawa River to Lake Wenatchee	47.9-54.2	Swamp to Bridge (52.7-53.6)

Summer Chinook redd and carcass surveys were also conducted in the Methow, Okanogan, Similkameen, and Chelan rivers during September through November. Total (map) redd counts were conducted in these rivers. Table 2.11 describes the survey reaches in these rivers.

Table 2.11. Description of reaches surveyed for summer Chinook redds and carcasses on the Methow, Okanogan, and Similkameen rivers.

Stream	Code	Reach	River mile (RM)
Methow River	M1	Mouth to Methow Bridge	0.0-14.8
	M2	Methow Bridge to Carlton Bridge	14.8-27.2
	M3	Carlton Bridge to Twisp Bridge	27.2-39.6
	M4	Twisp Bridge to MVID	39.6-44.9
	M5	MVID to Winthrop Bridge	44.9-49.8
	M6	Winthrop Bridge to Hatchery Dam	49.8-51.6
Okanogan River	O1	Mouth to Mallot Bridge	0.0-16.9
	O2	Mallot Bridge to Okanogan Bridge	16.9-26.1
	O3	Okanogan Bridge to Omak Bridge	26.1-30.7
	O4	Omak Bridge to Riverside Bridge	30.7-40.7
	O5	Riverside Bridge to Tonasket Bridge	40.7-56.8
	O6	Tonasket Bridge to Zosel Dam	56.8-77.4
Similkameen River	S1	Driscoll Channel to Oroville Bridge	0.0-1.8
	S2	Oroville Bridge to Enloe Dam	1.8-5.7

Except for sockeye, total spawning escapements for each population were estimated as the product of total number of redds times the ratio of fish per redd for a specific stock. Fish per redd ratios were estimated as the ratio of males to females sampled at broodstock collection sites and monitoring sites. Total spawning escapement for sockeye salmon in the Little Wenatchee River was estimated using the AUC approach (where escapement = [AUC/redd residence time] x observer efficiency). This method relied on weekly counts of live sockeye and assumed a redd residence time of 11 days (from Hyatt et al. 2006) and an observer efficiency of 100%.[2] In addition, sockeye escapement was estimated using mark-recapture methods. Adult sockeye were PIT tagged at Tumwater Dam and Bonneville Dam[3] and detected in the Little Wenatchee and White rivers with stationary PIT-tag interrogators.

Derived metrics calculated from carcass surveys, broodstock sampling, stock assessments, and harvest records included proportion of hatchery spawners, stray rates, age-at-maturity, length-at-age, smolt-to-adult survival (SAR), hatchery replacement rates (HRR), harvest rates, and natural replacement rates (NRR). The expected SARs and HRRs for different stocks raised in the Chelan PUD hatchery programs are provided in Table 2.12. Methods for calculating these variables are described in Appendices D, F, and G in Murdoch and Peven (2005) and in "White Papers" developed by the Hatchery Evaluation Technical Team (HETT) (see Appendices in Hillman et al. 2012).

[2] It is unlikely that observer efficiency is 100%. Thus, spawning escapements based on AUC may be biased.

[3] Adult sockeye that were tagged at Bonneville Dam and detected at Tumwater Dam were included in the mark-recapture analyses.

Table 2.12. Expected smolt-to-adult (SAR) and hatchery replacement rates (HRR) for stocks raised in the Chelan PUD Hatchery Programs (from Table 6 in Appendix D in Murdoch and Peven 2005).

Program	Number of broodstock	Smolts released	SAR	Adult equivalents	Number of smolts/adult	HRR
Chiwawa Spring Chinook	379	672,000	0.003	2,016	333	5.3
Wenatchee Summer Chinook	492	864,000	0.003	2,592	333	5.3
Similkameen Summer Chinook	328	576,000	0.003	1,728	333	5.3
Methow Summer Chinook	228	400,000	0.003	1,200	333	5.3
Wenatchee Sockeye	260	200,000	0.007	1,400	143	5.4
Wenatchee Steelhead	208	400,000	0.010	4,000	100	19.2

Derived data that rely on CWTs (e.g., HRR, SAR, stray rates, etc.) are five or more years behind release information because of the lag time for returning adult fish to enter the fishery and spawning grounds, and the processing of tags. Consequently, complete information on rates and ratios based on CWTs is generally only available for years before 2007.

SECTION 3: WENATCHEE STEELHEAD

3.1 Broodstock Sampling

This section focuses on results from sampling 2011 and 2012 brood years of Wenatchee steelhead, which were collected at Dryden and Tumwater dams. The 2011 brood begins the tracking of the life cycle of steelhead released in 2012. The 2012 brood is included because juveniles from this brood are still maintained within the hatchery.

Origin of Broodstock

A total of 208 Wenatchee steelhead from the 2010 return (2011 brood) were collected at Dryden and Tumwater dams (Table 3.1). About 50% of these were natural-origin (adipose fin present, no CWT, and no elastomer tags) fish and the remaining 50% were hatchery-origin (elastomer tagged and/or adipose fin absent) adults. Origin was determined by analyzing scales and/or otoliths. The total number of steelhead spawned from the 2011 brood was 161 adults (57% natural-origin and 43% hatchery-origin).

A total of 129 steelhead were collected from the 2011 return (2012 brood) at Dryden and Tumwater dams; 63 (49%) natural-origin (adipose fin present, no CWT, and no elastomer tags) and 66 (51%) hatchery-origin (elastomer tagged and/or adipose fin absent) adults. A total of 124 steelhead were spawned; 48% were natural-origin fish and 52% were hatchery fish (Table 3.1). Origin was confirmed by sampling scales and/or otoliths.

Table 3.1. Numbers of wild and hatchery steelhead collected for broodstock, numbers that died before spawning, and numbers of steelhead spawned, 1998-2012. Unknown origin fish (i.e., undetermined by scale analysis, no elastomer, CWT, or fin clips, and no additional hatchery marks) were considered naturally produced. Mortality includes fish that died of natural causes typically near the end of spawning and were not needed for the program or were immature fish killed at spawning.

Brood year	Wild steelhead					Hatchery steelhead					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
1998	35	0	0	35	0	43	4	2	37	0	72
1999	58	5	1	52	0	67	1	2	64	0	116
2000	39	2	1	36	0	101	9	12	60	20	96
2001	64	5	8	51	0	114	5	6	103	0	154
2002	99	0	1	96	2	113	1	0	64	48	160
2003	63	10	4	49	0	92	2	0	90	0	139
2004	85	3	0	75	7	132	1	0	61	70	136
2005	95	8	0	87	0	114	7	1	104	2	191
2006	101	5	0	93	3	98	0	0	69	29	162
2007	79	0	2	76	1	97	0	14	58	25	134
2008	104	0	3	77	22	107	0	28	54	25	131
2009	101	2	0	86	13	107	1	4	73	29	159
2010	106	1	1	96	8	105	2	23	75	5	171
2011	104	8	1	91	4	104	13	2	70	0	161
2012	63	3	0	59	1	66	0	1	65	0	124

Brood year	Wild steelhead					Hatchery steelhead					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
Average	*80*	*3*	*1*	*71*	*4*	*97*	*3*	*6*	*70*	*17*	*140*

Age/Length Data

Broodstock ages were determined from examination of scales and/or otoliths. For the 2011 brood year, both natural-origin and hatchery steelhead consisted primarily of 2-salt adults (Table 3.2). For the 2012 brood year, both hatchery and natural-origin steelhead consisted primarily of 2-salt adults (Table 3.2).

Table 3.2. Percent of hatchery and wild steelhead of different ages (saltwater ages) collected from broodstock, 1998-2012.

Brood year	Origin	Saltwater age		
		1	2	3
1998	Wild	39.4	60.6	0.0
	Hatchery	20.9	79.1	0.0
1999	Wild	50.0	48.3	1.7
	Hatchery	81.8	18.2	0.0
2000	Wild	56.4	43.6	0.0
	Hatchery	67.9	32.1	0.0
2001	Wild	51.7	48.3	0.0
	Hatchery	14.9	85.1	0.0
2002	Wild	55.6	44.4	0.0
	Hatchery	94.6	5.4	0.0
2003	Wild	13.1	85.3	1.6
	Hatchery	29.4	70.6	0.0
2004	Wild	94.8	5.2	0.0
	Hatchery	95.2	4.8	0.0
2005	Wild	22.1	77.9	0.0
	Hatchery	20.5	79.5	0.0
2006	Wild	28.7	71.3	0.0
	Hatchery	60.3	39.7	0.0
2007	Wild	40.3	59.3	0.0
	Hatchery	62.1	37.9	0.0
2008	Wild	65.4	33.7	0.9
	Hatchery	88.8	11.2	0.0
2009	Wild	39.8	57.8	2.4
	Hatchery	23.4	76.6	0.0
2010	Wild	65.2	33.7	1.1
	Hatchery	76.5	23.5	0.0

Brood year	Origin	Saltwater age		
		1	2	3
2011	Wild	27.5	72.5	0.0
	Hatchery	36.0	64.0	0.0
2012	Wild	42.4	52.5	5.1
	Hatchery	40.9	59.1	0.0
Average	***Wild***	***46.2***	***53.0***	***0.9***
	Hatchery	***54.2***	***45.8***	***0.0***

There was little difference between mean lengths of hatchery and natural-origin steelhead for both the 2011 and 2012 brood years (Table 3.3). Natural-origin fish were on average 1 to 4 cm larger than hatchery-origin fish of the same age.

Table 3.3. Mean fork length (cm) at age (saltwater ages) of hatchery and wild steelhead collected from broodstock, 1998-2012; N = sample size and SD = 1 standard deviation.

Brood year	Origin	Steelhead fork length (cm)								
		1-Salt			2-Salt			3-Salt		
		Mean	N	SD	Mean	N	SD	Mean	N	SD
1998	Wild	63	15	4	79	20	5	-	0	-
	Hatchery	61	9	4	73	34	4	-	0	-
1999	Wild	65	29	5	74	28	5	77	1	-
	Hatchery	62	54	4	73	12	4	-	0	-
2000	Wild	64	22	3	74	17	5	-	0	-
	Hatchery	60	57	3	71	27	4	-	0	-
2001	Wild	61	33	6	77	31	5	-	0	-
	Hatchery	62	17	4	72	97	4	-	0	-
2002	Wild	64	55	4	77	44	4	-	0	-
	Hatchery	63	106	4	73	6	4	-	0	-
2003	Wild	69	8	6	77	52	5	91	1	-
	Hatchery	66	27	4	75	65	4	-	0	-
2004	Wild	63	73	6	78	4	2	-	0	-
	Hatchery	61	59	3	73	3	1	-	0	-
2005	Wild	59	21	4	74	74	5	-	0	-
	Hatchery	59	23	4	72	89	4	-	0	-
2006	Wild	63	27	5	75	67	6	-	0	-
	Hatchery	61	41	4	72	27	5	-	0	-
2007	Wild	64	31	6	76	46	5	-	0	-
	Hatchery	60	60	4	71	36	5	-	0	-
2008	Wild	64	68	4	77	35	4	80	1	-
	Hatchery	60	95	4	72	12	2	-	0	-
2009	Wild	65	33	5	76	48	6	81	2	0

Brood year	Origin	Steelhead fork length (cm)								
		1-Salt			2-Salt			3-Salt		
		Mean	N	SD	Mean	N	SD	Mean	N	SD
	Hatchery	63	18	4	75	59	5	-	-	-
2010	Wild	64	60	5	74	31	5	76	1	-
	Hatchery	61	53	5	73	23	5	-	-	-
2011	Wild	62	28	5	76	74	5	-	0	-
	Hatchery	60	36	4	74	64	4	-	0	-
2012	Wild	63	25	3	74	31	5	74	3	2
	Hatchery	59	27	3	74	39	4	-	0	-

Sex Ratios

Male steelhead in the 2011 brood year made up about 45% of the adults collected, resulting in an overall male to female ratio of 0.82:1.00 (Table 3.4). For the 2012 brood year, males made up about 47% of the adults collected, resulting in an overall male to female ratio of 0.90:1.00. On average (1998-2012), the sex ratio is slightly less than the 1:1 ratio assumed in the broodstock protocol (Table 3.4).

Table 3.4. Numbers of male and female wild and hatchery steelhead collected for broodstock, 1998-2012. Ratios of males to females are also provided.

Brood year	Number of wild steelhead			Number of hatchery steelhead			Total M/F ratio
	Males (M)	Females (F)	M/F	Males (M)	Females (F)	M/F	
1998	13	22	0.59:1.00	15	28	0.54:1.00	0.56:1.00
1999	22	36	0.61:1.00	35	32	1.09:1.00	0.84:1.00
2000	18	21	0.86:1.00	60	41	1.46:1.00	1.26:1.00
2001	38	26	1.46:1.00	40	74	0.54:1.00	0.78:1.00
2002	32	67	0.48:1.00	81	32	2.53:1.00	1.14:1.00
2003	19	44	0.43:1.00	44	48	0.92:1.00	0.68:1.0
2004	43	42	1.02:1.00	90	42	2.14:1.00	1.58:1.00
2005	36	59	0.61:1.00	46	68	0.68:1.00	0.65:1.00
2006	38	63	0.60:1.00	47	51	0.92:1.00	0.75:1.00
2007	36	43	0.84:1.00	49	48	1.02:1.00	0.93:1.00
2008	61	43	1.42:1.00	68	39	1.74:1.00	1.57:1.00
2009	44	57	0.77:1.00	54	53	1.02:1.00	0.89:1.00
2010	49	57	0.86:1.00	62	43	1.44:1.00	1.11:1.00
2011	44	60	0.73:1.00	50	54	0.93:1.00	0.82:1.00
2012	30	33	0.91:1.00	31	35	0.89:1.00	0.90:1.00
Total	***523***	***673***	***0.78:1.00***	***772***	***688***	***1.12:1.00***	***0.95:1.00***

Fecundity

Fecundities for Wenatchee steelhead in brood years 2011 and 2012 averaged 6,203 and 5,891 eggs per female, respectively, which were greater than the overall average (Table 3.5). Mean fecundities for the 2011 and 2012 brood years were also greater than the 5,678 eggs per female assumed in the broodstock protocol.

Table 3.5. Mean fecundity of wild, hatchery, and all female steelhead collected for broodstock, 1998-2012.

Brood year	Mean fecundity		
	Wild	Hatchery	Total
1998	6,202	5,558	5,924
1999	5,691	5,186	5,424
2000	5,858	5,729	5,781
2001	5,951	6,359	6,270
2002	5,776	5,262	5,626
2003	6,561	6,666	6,621
2004	5,118	5,353	5,238
2005	5,545	6,061	5,832
2006	5,688	5,251	5,492
2007	5,840	5,485	5,660
2008	5,693	5,153	5,433
2009	6,199	6,586	6,408
2010	5,458	5,423	5,442
2011	6,276	6,100	6,203
2012	5,309	6,388	5,891
Average	***5,811***	***5,771***	***5,816***

3.2 Hatchery Rearing

Rearing History

Number of eggs taken

From 1998-2011, a total of 493,827 eggs were required to meet the program release goal of 400,000 smolts. This was based on the unfertilized egg-to-release survival standard of 81%. In 2012, the egg take target was reduced to 305,309, which is needed to meet the revised release target of 247,300 smolts. Between 1998 and 2011, the egg take goal was reached 57% of the time (Table 3.6). Since 2011, the target has been reached or exceeded 100% of the time (Table 3.6).

Table 3.6. Numbers of eggs taken from steelhead broodstock, 1998-2012.

Brood year	Number of eggs taken
1998	224,315
1999	303,083

2000	280,872
2001	549,464
2002	503,030
2003	532,708
2004	408,538
2005	672,667
2006	546,382
2007	462,662
2008	439,980
2009	633,229
2010	499,499
2011	522,049
2012	371,151
Average	***463,309***

Number of acclimation days

Juvenile steelhead were transferred from the Chelan Fish Hatchery to the Chiwawa Ponds in October and November 2011. Steelhead at the Eastbank Fish Hatchery were transferred to the Chiwawa Ponds in November 2011. In March 2012, about 18,254 steelhead where transferred to Rolfings Pond on Nason Creek. In April 2012, about 24,992 HxH steelhead were transferred to Black Bird Pond near Leavenworth for acclimation on Wenatchee River water. Fish were acclimated for 21 d before a volitional release was initiated on 1 May. The remainder stayed at the Chiwawa Fish Hatchery until they were volitionally released in early May. All HxH steelhead surplused at Ringold Fish Hatchery were released into the Columbia River.

Juvenile Wenatchee steelhead at the Chiwawa Ponds were acclimated and reared on Wenatchee River water. In the past, Wenatchee steelhead were reared on Columbia River water from January through April before being trucked and released into the Wenatchee River basin (Table 3.7).

Table 3.7. Water source and mean acclimation period for Wenatchee steelhead, brood years 1998-2011.

Brood year	Release year	Parental origin	Water source	Number of Days
1998	1999	H x H	Wenatchee/Chiwawa	36
		H x W	Wenatchee/Chiwawa	36
		W x W	Wenatchee/Chiwawa	36
1999	2000	H x H	Wenatchee/Chiwawa	138
		H x W	Wenatchee/Chiwawa	138
		W x W	Wenatchee/Chiwawa	138
		H x W	Eastbank	0
		W x W	Eastbank	0
2000	2001	H x H	Wenatchee/Chiwawa	122

Brood year	Release year	Parental origin	Water source	Number of Days
		H x W	Wenatchee/Chiwawa	122
		H x W	Wenatchee/Chiwawa	122
		W x W	Wenatchee/Chiwawa	122
2001	2002	H x H	Columbia	92
		H x H	Wenatchee/Chiwawa	63
		H x W	Columbia	92
		H x W	Wenatchee/Chiwawa	63
		W x W	Columbia	153
2002	2003	H x H	Columbia	98
		H x W	Columbia	98
		W x W	Columbia	117
2003	2004	H x H	Columbia	88
		H x W	Wenatchee/Chiwawa	84
		W x W	Columbia	148
2004	2005	H x H	Columbia	160
		H x W	Columbia	160
		W x W	Columbia	160
2005	2006	H x H	Columbia	116
		H x W	Columbia	113
		W x W	Columbia	141
2006	2007	Early H x W	Columbia	111
		Late H x W	Columbia	112
		W x W	Columbia	148
2007	2008	Early H x W	Columbia	94-95
		Late H x W	Columbia	91-93
		W x W	Columbia	138
2008	2009	Early H x W	Columbia	120-121
		Early H x W	Columbia/Wenatchee	120-121/28-95
		Late H x W	Columbia	114-115
		W x W	Columbia	152-153
2009	2010	Early H x W	Columbia	93-94
		Early H x W	Columbia/Wenatchee	99-111
		Early H x W	Wenatchee	31-129
		Late H x W	Columbia	84-87
		W x W	Columbia/Nason	118-120/28
2010	2011	H x H	Wenatchee	188-192
		H x H	Wenatchee	37-87

Brood year	Release year	Parental origin	Water source	Number of Days
		H x H	Columbia	181
		W x W	Columbia	148-149
		W x W	Columbia/Nason	113-114/42-101
		W x W	Columbia	148-149
2011	2012	W x W	Wenatchee	160-201
		W x W	Wenatchee	179-188
		W x W	Wenatchee	21-72
		W x W	Nason	56-107

Release Information

Numbers released

In 2011, the HCP Hatchery Committee agreed to reduce the Wenatchee summer steelhead program from 400,000 smolts to 247,300 smolts. Based on this new goal and the number of WxW steelhead present, all HxH steelhead were transferred to the Ringold Fish Hatchery to be included in their production program.

The release of 2011 brood Wenatchee steelhead achieved 83% of the 247,300 target goal with about 206,397 smolts released into the Wenatchee and Chiwawa rivers and Nason Creek (Table 3.8). Distribution of juvenile steelhead released in each of the three subbasins was determined by the mean proportion of steelhead redds in each basin. About 26.1% and 15.0% of the steelhead were released in Nason Creek and the Chiwawa River, respectively. The balance of the program was split between the Wenatchee River downstream from Tumwater Dam (12.1%) and the Wenatchee River upstream from the dam (46.7%).

Table 3.8. Numbers of steelhead smolts released from the hatchery, brood years 1998-2011. Before brood year 2011, the release target for steelhead was 400,000 smolts. Beginning with brood year 2011, the release target is 247,300 smolts.

Brood year	Release year	Number of smolts
1998	1999	172,078
1999	2000	175,701
2000	2001	184,639
2001	2002	335,933
2002	2003	302,060
2003	2004	374,867
2004	2005	294,114
2005	2006	452,184
2006	2007	299,937
2007	2008	306,690
2008	2009	327,143
2009	2010	484,772
2010	2011	354,314

Brood year	Release year	Number of smolts
2011	2012	206,397
Average		***305,059***

Numbers CWT and elastomer tagged

Wenatchee hatchery steelhead from the 2011 brood were marked with coded wire tags (CWT) in the snout. About 28% of the juveniles released were also adipose fin clipped (Table 9). No steelhead in the 2011 brood were marked with elastomer tags.

Table 3.9. Release location and marking scheme for the 1998-2011 brood Wenatchee steelhead.

Brood year	Release location	Parental origin	Proportion Ad-clip	VIE color/side	Tag rate	Number released
1998	Chiwawa River	H x H	0.000	Red Left	0.994	52,765
	Chiwawa River	H x W	0.000	Green Left	0.990	37,013
	Chiwawa River	W x W	0.000	Orange Left	0.827	82,300
1999	Wenatchee River	H x H	0.000	Green Left	0.911	45,347
	Wenatchee River	H x W	0.000	Orange Left	0.927	30,713
	Chiwawa River	H x H	0.000	Red Right	0.936	25,622
	Chiwawa River	H x W	0.000	Green Right	0.936	43,379
	Chiwawa River	W x W	0.000	Orange Right	0.936	30,600
2000	Chiwawa River	H x H	0.000	Red Left	0.963	33,417
	Chiwawa River	H x W	0.000	Green Left	0.963	57,716
	Chiwawa River	H x W	0.000	Green Right	0.949	48,029
	Chiwawa River	W x W	0.000	Orange Right	0.949	45,477
2001	Nason Creek	H x W	0.000	Green Right	0.934	75,276
	Nason Creek	W x W	0.000	Orange Right	0.934	48,115
	Chiwawa River	H x W	0.000	Green Left	0.895	92,487
	Chiwawa River	H x H	0.000	Red Left	0.895	120,055
2002	Chiwawa River	H x H	0.000	Red Left	0.920	156,145
	Chiwawa River	H x W	0.000	Green Left	0.928	33,528
	Nason Creek	W x W	0.000	Orange Right	0.928	112,387
2003	Wenatchee River	H x H	0.000	Red Left	0.968	117,663
	Chiwawa River	H x W	0.000	Green Left	0.927	191,796
	Nason Creek	W x W	0.000	Orange Right	0.962	65,408
2004	Wenatchee River	H x H	0.500	Red Left	0.804	39,636
	Chiwawa River	H x W	0.000	Green Left	0.977	153,959

Brood year	Release location	Parental origin	Proportion Ad-clip	VIE color/side	Tag rate	Number released
	Nason Creek	W x W	0.000	Pink Right	0.940	100,519
2005	Wenatchee River	H x H	1.000	Red Left	0.983	104,552
	Wenatchee River	H x W	0.616	Green Left	0.979	190,319
	Chiwawa River	H x W	0.616	Green Left	0.979	18,634
	Chiwawa River	W x W	0.000	Pink Right	0.969	14,124
	Nason Creek	W x W	0.000	Pink Right	0.969	124,555
2006	Wenatchee River	H x W (early)	1.000	Green Right	0.918	66,022
	Wenatchee River	H x W (late)	0.671	Green Left	0.935	92,176
	Chiwawa River	H x W (late)	0.671	Green Left	0.935	41,240
	Chiwawa River	W x W	0.000	Pink Right	0.945	7,500
	Nason Creek	W x W	0.000	Pink Right	0.945	92,999
2007	Wenatchee River	H x W (early)	0.967	Green Right	0.950	64,310
	Wenatchee River	H x W (late)	0.586	Green Left	0.951	97,549
	Chiwawa River	H x W (late)	0.586	Green Left	0.951	43,011
	Chiwawa River	W x W	0.000	Pink Right	0.952	7,026
	Nason Creek	W x W	0.000	Pink Right	0.952	94,794
2008	Blackbird Pond	HxW (early)	0.917	Green Right	0.910	49,878
	Wenatchee River	H x W (early)	0.917	Green Right	0.910	48,624
	Wenatchee River	H x W (late)	0.595	Green Left	0.908	74,848
	Chiwawa River	H x W (late)	0.595	Green Left	0.908	25,835
	Chiwawa River	W x W	0.000	Pink Right	0.904	25,778
	Nason Creek	W x W	0.000	Pink Right	0.904	102,170
2009	Blackbird Pond	H x W (early)	0.969	Green Right	0.934	50,248
	Wenatchee River	H x W (early)	0.969	Green Right	0.934	105,239
	Wenatchee River	H x W (late)	0.973	Green Left	0.975	27,612
	Wenatchee River	H x W (late)	0.000	Green Left	0.975	45,435
	Chiwawa River	H x W (early)	0.969	Green Right	0.934	23,835
	Chiwawa River	H x W (late)	0.973	Green Left	0.975	33,047
	Chiwawa River	H x W (late)	0.000	Green Left	0.975	54,381
	Nason	W x W	0.000	Pink Right	0.979	145,029
2010	Wenatchee River	H x H	0.994	-	0.984	24,838
	Wenatchee River	H x H	0.994	-	0.984	45,000
	Wenatchee River	H x H	0.994	-	0.984	92,113

Brood year	Release location	Parental origin	Proportion Ad-clip	VIE color/side	Tag rate	Number released
	Chiwawa River	W x W	0.000	Pink Right	0.917	81,174
	Nason River	W x W	0.000	Pink R/Pink L	0.884	20,000
	Nason River	W x W	0.000	Pink Right	0.917	91,189
2011	Wenatchee River	W x W	0.985	CWT	0.953	70,885
	Wenatchee River	W x W	0.985	CWT	0.953	24,992
	Wenatchee River	W x W	0.000	CWT	0.987	25,569
	Chiwawa River	W x W	0.985	CWT	0.953	31,050
	Nason River	W x W	0.000	CWT	0.989	18,254
	Nason River	W x W	0.985	CWT	0.953	36,225

Numbers PIT tagged

Table 3.10 summarizes the number of hatchery steelhead of different parental origins that have been PIT-tagged and released into the Wenatchee River basin.

Table 3.10. Summary of PIT-tagging activities for Wenatchee hatchery steelhead, brood years 2006-2011.

Brood year	Release location	Parental origin	Number of fish tagged	Number of tagged fish that died	Number of tags shed	Number of tagged fish released
2006	Wenatchee River	H x W (early)	10,035	479	24	9,533
	Wenatchee/Chiwawa rivers	H x W (late)	10,031	922	20	9,089
	Chiwawa River/Nason Creek	W x W	10,019	152	352	9,515
2007	Wenatchee River	H x W (early)	10,052	22	10	9,820
	Wenatchee/Chiwawa rivers	H x W (late)	10,063	73	78	9,912
	Chiwawa River/Nason Creek	W x W	10,051	55	1	9,982
2008	Wenatchee River	H x W (early)	10,101	59	15	10,027
	Wenatchee/Chiwawa rivers	H x W (late)	10,104	106	17	9,981
	Chiwawa River/Nason Creek	W x W	10,101	159	80	9,862
2009	Wenatchee/Chiwawa rivers	H x W (early)	10,114	574	11	9,529
	Wenatchee (Blackbird)	H x W (early)	8,100	0	0	8,100
	Wenatchee/Chiwawa rivers	H x W (late)	10,115	271	11	9,833
	Chiwawa pilot	H x W (early)	10,107	532	103	9,472
	Chiwawa River/Nason Creek	W x W	10,101	38	3	10,060
2010	Wenatchee River	HxH	10,100	624	21	9,455

Brood year	Release location	Parental origin	Number of fish tagged	Number of tagged fish that died	Number of tags shed	Number of tagged fish released
	Chiwawa River/Nason Creek	WxW	10,100	206	0	9,894
	Wenatchee (Blackbird)	HxH	10,101	235	8	9,858
	Wenatchee River	HxH	10,100	46	28	10,026
2011	Wenatchee/Chiwawa/Nason	WxW (circular)	10,101	139	30	9,932
	Wenatchee/Chiwawa/Nason	WxW (raceway)	20,220	121	35	20,064

2012 Brood Wenatchee (Chiwawa Raceway) Summer Steelhead—A total of 10,223 Wenatchee summer steelhead were tagged at Chelan Hatchery on 4-7 January 2012. These fish were tagged in raceway #6. Fish were not fed during tagging or for two days before and after tagging. Fish averaged 88 mm in length and 6.5 g at time of tagging.

At the end of January, a total of 115 tagged steelhead have died and 13 others have shed their tags, leaving 10,095 tagged steelhead alive at the end of the month. These fish are in the raceways at the Chiwawa Facility.

2012 Brood Wenatchee (Chiwawa Circular Pond) Summer Steelhead—A total of 15,244 Wenatchee WxW summer steelhead were tagged at Chelan Hatchery on 10-14 January 2012. These fish were tagged in raceway #2. Fish were not fed during tagging or for two days before and after tagging. Fish averaged 89 mm in length and 7.1 g at time of tagging.

At the end of January, a total of 107 tagged steelhead have died and three others have shed their tags, leaving 15,134 tagged steelhead alive at the end of the month. These fish are in the circular ponds at the Chiwawa Facility.

Fish size and condition at release

With the exception of the Blackbird Pond and Rolfhing Pond releases, all 2011 brood steelhead were trucked and released as yearling smolts in May 2012. The Blackbird and Rolfhing groups were released volitionally beginning 1 May. The WxW fish did not meet the length or weight target, but exceeded the target for coefficient of variation (CV) for fork length (Table 3.11). The HxH group was not evaluated since they were transferred to Ringold Fish Hatchery.

Table 3.11. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of steelhead smolts released from the hatchery, brood years 1998-2011. Size targets are provided in the last row of the table.

Brood year	Release year	Parental origin	Fork length (mm)		Mean weight	
			Mean	CV	Grams (g)	Fish/pound
1998	1999	H x H	201	11.1	92.3	5
		H x W	190	12.8	76.9	6
		W x W	173	12.0	55.3	8
1999	2000	H x H	181	8.9	70.6	6
		H x W	187	7.2	75.3	6

Brood year	Release year	Parental origin	Fork length (mm)		Mean weight	
			Mean	CV	Grams (g)	Fish/pound
		W x W	184	11.3	71.5	6
2000	2001	H x H	218	15.2	122.4	4
		H x W	209	10.6	107.5	4
		W x W	205	10.7	100.9	5
2001	2002	H x H	179	17.4	67.0	7
		H x W	192	15.6	82.8	6
		W x W	206	11.6	102.6	4
2002	2003	H x H	194	13.1	83.0	6
		H x W	191	13.0	77.4	6
		W x W	180	19.1	70.3	7
2003	2004	H x H	191	14.4	73.1	6
		H x W	199	12.9	83.9	5
		W x W	200	11.1	90.1	5
2004	2005	H x H	204	11.3	87.2	6
		H x W	202	13.5	71.9	5
		W x W	198	12.4	76.6	6
2005	2006	H x H	215	12.6	116.6	4
		H x W	198	11.8	86.3	5
		W x W	189	15.4	55.3	6
2006	2007	H x H (early)	213	12.1	109.6	4
		H x W (late)	186	11.8	68.3	7
		W x W	178	11.1	58.6	8
2007	2008	H x W (early)	192	17.4	77.1	6
		H x W (late)	179	19.3	63.8	7
		W x W	183	12.3	62.8	7
2008	2009	H x W (early)	184	11.6	68.0	7
		H x W (late)	186	11.6	73.5	6
		W x W	181	13.0	59.7	8
2009	2010	H x W (early)	197	11.3	84.2	5
		H x W (late)	192	11.1	72.7	6
		W x W	190	9.6	70.5	6
2010	2011	H x H	183	14.1	68.9	4
		W x W	188	10.5	68.1	7
2011	2012	H x H	NA	NA	NA	NA
		W x W	156	17.1	45.2	10

Brood year	Release year	Parental origin	Fork length (mm)		Mean weight	
			Mean	CV	Grams (g)	Fish/pound
Targets			***198***	***9.0***	***75.6***	***6***

Survival Estimates

Overall survival of Wenatchee steelhead (WxW) from green (unfertilized) egg to release was below the standard set for the program. This is in part because of poor unfertilized egg to eyed egg survival, 100-day after ponding survival, and ponding to release survival (Table 3.12). There are no survival estimates for the HxH steelhead because they were transferred to Ringold Fish Hatchery.

The Wenatchee steelhead program, from its inception, has experienced highly variable fertilization rates. It is unknown at this time what mechanisms may be influencing stock performance at these stages.

Table 3.12. Hatchery life-stage survival rates (%) for steelhead, brood years 1998-2011. Survival standards or targets are provided in the last row of the table.

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
1998	92.0	100.0	85.5	91.7	99.2	98.8	97.8	99.9	76.7
1999	91.2	100.0	66.9	93.0	95.9	94.9	93.1	99.7	58.0
2000	83.9	96.2	77.6	86.7	99.3	98.9	97.7	99.5	65.7
2001	90.0	100.0	73.0	91.8	99.1	97.8	91.3	99.7	61.1
2002	99.0	100.0	69.2	93.1	95.9	94.4	89.6	89.6	60.0
2003	87.0	96.8	86.3	83.8	97.2	94.8	97.6	85.3	70.4
2004	97.6	98.5	83.4	93.7	97.8	94.1	92.2	99.9	72.0
2005	91.3	95.1	81.3	92.1	95.6	91.8	89.7	99.6	67.2
2006	99.1	95.3	73.2	85.4	95.4	94.6	87.8	98.5	54.9
2007	100.0	100.0	80.3	92.0	95.7	92.7	89.8	99.1	66.3
2008	100.0	100.0	87.1	88.4	99.0	97.4	96.6	99.5	74.4
2009	97.3	100.0	89.0	97.2	96.0	95.2	88.6	96.6	76.6
2010	96.7	100.0	93.8	93.9	91.0	86.2	80.6	96.0	70.9
2011[a]	96.3	94.4	74.2	97.7	96.6	89.5	86.4	98.4	62.7
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

[a] Survival estimates are only for WxW steelhead.

3.3 Disease Monitoring

Rearing of the 2011 brood Wenatchee summer steelhead was typical to previous years with fish being held on Chelan spring water, Eastbank well water, and Chelan well water before being transferred for overwinter acclimation at the Chiwawa Ponds. Volitional and non-migratory released fish were released into Nason Creek, Chiwawa River, and the Wenatchee River. Increased mortality (loss of over 10,000 steelhead) caused by Bacterial Cold Water Disease

(BCWD) and Steatitis occurred in June 2011. At that time a treatment of medicated feed and an effective sunscreen were implemented in an attempt to control BCWD and Steatitis.

3.4 Natural Juvenile Productivity

During 2012, juvenile steelhead were sampled at the Upper Wenatchee and Chiwawa traps and counted during snorkel surveys within the Chiwawa River basin. Because the snorkel surveys targeted juvenile Chinook salmon, the entire distribution of juvenile steelhead in the Chiwawa River basin was not surveyed. Therefore, the parr numbers presented below represent a minimum estimate.

Parr Estimates

A total of 27,134 (±10.0%) age-0 (<100 mm) and 8,576 (±12.0%) age-1+ (100-200 mm)[4] steelhead/rainbow were estimated in the Chiwawa River basin in August 2012 (Table 3.13 and 3.14). During the survey period 1992-2012, numbers of age-0 and 1+ steelhead/rainbow have ranged from 1,410 to 45,727 and 2,533 to 22,128, respectively, in the Chiwawa River basin (Table 3.13 and 3.14; Figure 3.1). Numbers of all fish counted in the Chiwawa River basin are reported in Appendix A.

Juvenile steelhead/rainbow were distributed primarily throughout the lower seven reaches of the Chiwawa River (downstream from Rock Creek). Their densities were highest in the lower portions of the river and in tributaries. Age-0 steelhead/rainbow most often used riffle and multiple channel habitats in the Chiwawa River, although they also associated with woody debris in pool and glide habitat. In tributaries they were generally most abundant in small pools. Those that were observed in riffles selected stations in quiet water behind small and large boulders or occupied stations in quiet water along the stream margin. In pool and multiple-channel habitats, age-0 steelhead/rainbow used the same kinds of habitat as age-0 Chinook.

Age-1+ steelhead/rainbow most often used pool, riffle, and multiple-channel habitats. Those that used pools were usually in deeper water than subyearling steelhead/rainbow and Chinook. Like age-0 steelhead/rainbow, age-1+ steelhead/rainbow selected stations in quiet water behind boulders in riffles, but the two age groups rarely occurred together. Age-1+ steelhead/rainbow used deeper and faster water than did subyearling steelhead/rainbow.

Table 3.13. Total numbers of age-0 steelhead/rainbow trout estimated in different steams in the Chiwawa River basin during snorkel surveys in August 1992-2012; NS = not sampled.

Sample Year	Chiwawa River	Phelps Creek	Chikamin Creek	Rock Creek	Unnamed Creek	Big Meadow Creek	Alder Creek	Brush Creek	Clear Creek	Total
1992	4,927	NS	NS	NS	NS	NS	NS	NS	NS	**4,927**
1993	3,463	0	356	185	NS	NS	NS	NS	NS	**4,004**
1994	953	0	256	24	0	177	0	0	0	**1,410**
1995	6,005	0	744	90	0	371	40	107	0	**7,357**
1996	3,244	0	71	40	0	763	127	0	0	**4,245**
1997	6,959	224	84	324	0	1,124	58	50	0	**8,823**
1998	2,972	22	280	96	113	397	18	22	0	**3,921**
1999	5,060	20	253	189	0	255	34	27	0	**5,838**

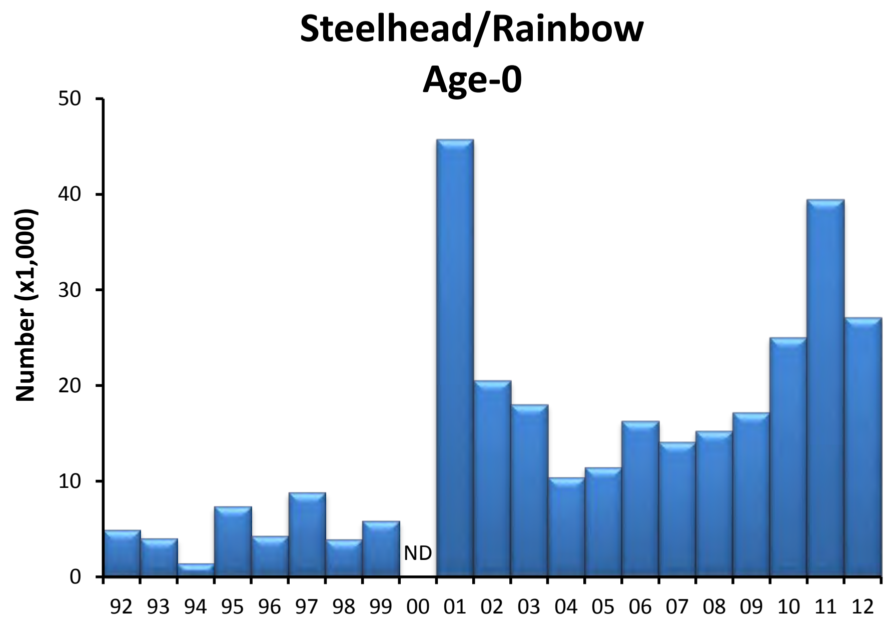
[4] A steelhead/rainbow trout larger than 200 mm (8 in) was considered a resident trout.

Sample Year	Chiwawa River	Phelps Creek	Chikamin Creek	Rock Creek	Unnamed Creek	Big Meadow Creek	Alder Creek	Brush Creek	Clear Creek	Total
2000	NS	NS	NS	NS	NS	NS	NS	NS	NS	**NS**
2001	35,759	192	1,449	1,826	0	6,345	156	0	0	**45,727**
2002	12,137	0	2,252	889	0	4,948	277	18	0	**20,521**
2003	9,911	296	996	1,166	96	5,366	73	116	0	**18,020**
2004	8,464	110	583	113	40	957	35	78	0	**10,380**
2005	4,852	120	2,931	477	45	2,973	65	0	0	**11,463**
2006	10,669	21	858	872	34	3,647	73	71	0	**16,245**
2007	8,442	53	2,137	348	11	2,955	65	28	34	**14,073**
2008	9,863	0	2,260	859	0	1,987	57	168	36	**15,230**
2009	13,231	0	1,183	449	0	2,062	170	67	17	**17,179**
2010	17,572	0	2,870	1,478	5	2,843	182	35	33	**25,018**
2011	35,825	0	1,503	804	0	1,066	56	152	40	**39,446**
2012	21,537	0	1,817	1,501	0	2,164	42	54	19	**27,134**
Average	***11,092***	***56***	***1,204***	***617***	***19***	***2,244***	***85***	***55***	***10***	***15,048***

Table 3.14. Total numbers of age-1+ steelhead/rainbow trout estimated in different steams in the Chiwawa River basin during snorkel surveys in August 1992-2012; NS = not sampled.

Sample Year	Chiwawa River	Phelps Creek	Chikamin Creek	Rock Creek	Unnamed Creek	Big Meadow Creek	Alder Creek	Brush Creek	Clear Creek	Total
1992	2,533	NS	NS	NS	NS	NS	NS	NS	NS	**2,533**
1993	2,530	0	228	102	NS	NS	NS	NS	NS	**2,860**
1994	4,972	0	476	296	5	107	0	0	0	**5,856**
1995	8,769	0	494	71	0	183	0	0	0	**9,517**
1996	11,381	0	6	27	0	435	0	0	0	**11,849**
1997	6,574	160	0	105	0	66	0	0	0	**6,905**
1998	10,403	0	133	49	0	0	0	0	0	**10,585**
1999	21,779	0	68	201	0	82	0	0	0	**22,130**
2000	NS	NS	NS	NS	NS	NS	NS	NS	NS	**NS**
2001	9,368	16	186	407	0	646	0	0	0	**10,623**
2002	7,200	0	199	165	0	1,526	0	0	0	**9,090**
2003	4,745	362	426	599	0	47	0	0	0	**6,179**
2004	7,700	107	209	0	0	174	0	0	0	**8,190**
2005	4,624	63	957	257	0	287	0	0	0	**6,188**
2006	7,538	76	748	1,186	0	985	0	0	0	**10,533**
2007	6,976	0	945	96	0	431	0	0	0	**8,448**
2008	8,317	0	1,168	298	0	793	0	0	0	**10,576**
2009	4,998	16	320	102	0	167	21	0	5	**5,629**
2010	8,324	32	366	393	0	780	21	0	0	**9,616**
2011	13,329	0	415	470	0	689	0	0	0	**14,903**
2012	7,671	0	285	410	0	210	0	0	0	**8,576**

Sample Year	Chiwawa River	Phelps Creek	Chikamin Creek	Rock Creek	Unnamed Creek	Big Meadow Creek	Alder Creek	Brush Creek	Clear Creek	Total
Average	*7,987*	*44*	*402*	*275*	*0*	*423*	*2*	*0*	*0*	*9,039*



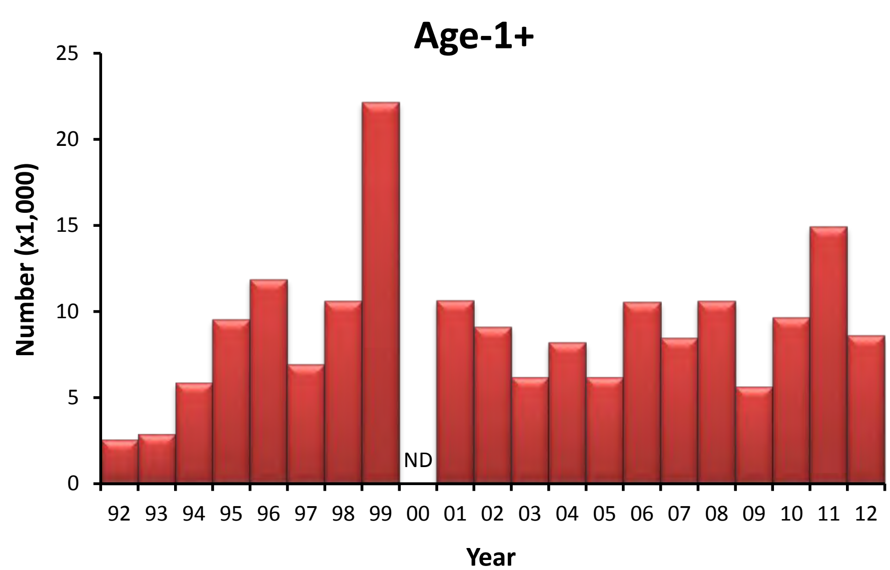


Figure 3.1. Numbers of subyearling and yearling steelhead/rainbow trout within the Chiwawa River Basin in August 1992-2012; ND = no data.

Emigrant and Smolt Estimates

Numbers of steelhead smolts and emigrants were estimated at the Upper Wenatchee and Chiwawa traps in 2012.

Chiwawa Trap

The Chiwawa Trap operated between 25 February and 29 November 2012. During that time period the trap was inoperable for 14 days because of high river flows, debris, snow/ice, or mechanical failure. The trap operated in two different positions depending on stream flow; lower position at flows greater than 12 m^3/s and an upper position at flows less than 12 m^3/s. Monthly captures of all fish collected at the Chiwawa Trap are reported in Appendix B.

A total of 183 wild steelhead/rainbow smolts, 1,664 hatchery smolts, and 1,738 wild parr were captured at the Chiwawa Trap. Nearly all (99%) of the hatchery smolts were collected in May, while most (93%) of the wild steelhead smolts were captured during April and May (Figure 3.2). Although steelhead/rainbow parr emigrated throughout the sampling period, most emigrated during May through June and in September (Figure 3.2). No mark-recapture efficiency trials were conducted with steelhead/rainbow at the Chiwawa Trap to estimate total population sizes.

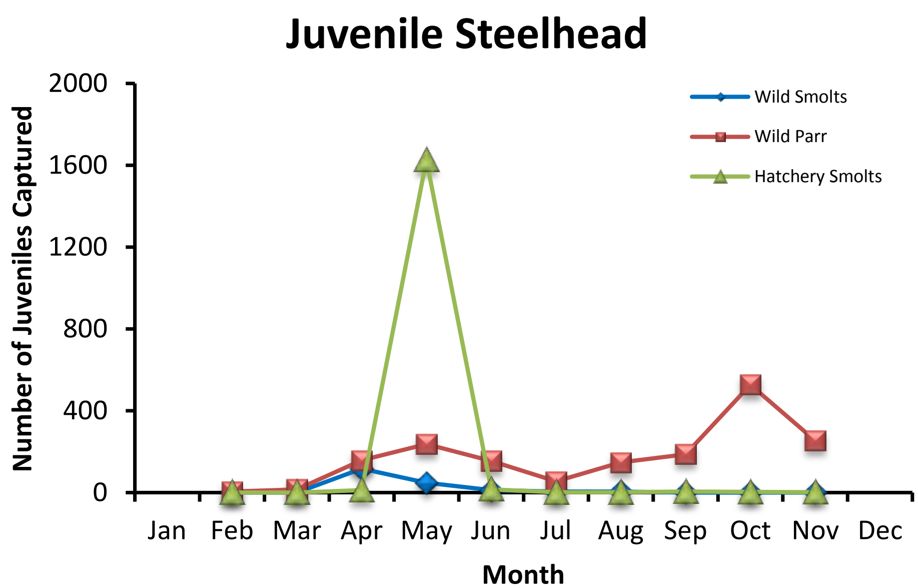


Figure 3.2. Monthly captures of wild smolts, wild parr, and hatchery smolt steelhead/rainbow at the Chiwawa Trap, 2012.

Upper Wenatchee Trap

The Upper Wenatchee Trap operated nightly between 29 March and 5 Sept 2012. During the five-month sampling period, a total of five wild steelhead/rainbow smolts, 65 hatchery smolts, and 152 wild parr were captured at the Upper Wenatchee Trap. Monthly captures of all fish collected at the Upper Wenatchee Trap are reported in Appendix B.

PIT Tagging Activities

As part of the Comparative Survival Study (CSS), a total of 1,083 juvenile steelhead/rainbow trout (1,081 wild and two hatchery) were PIT tagged and released in 2012 at the Chiwawa and Upper Wenatchee traps (Table 3.15a). Most of these were tagged at the Chiwawa Trap. Few were tagged and released at the Upper Wenatchee trap. See Appendix C for a complete list of all fish captured, tagged, lost, and released.

Table 3.15a. Numbers of wild and hatchery steelhead/rainbow trout that were captured, tagged, and released at different trapping locations within the Wenatchee River basin, 2012. Numbers of fish that died or shed tags are also given.

Sampling Location	Species and Life Stage	Number held	Number of recaptures	Number tagged	Number died	Shed Tags	Total released	Percent mortality
Chiwawa Trap	Wild Steelhead/Rainbow	1,050	17	1,011	0	0	1,011	0.00
	Hatchery Steelhead/Rainbow	2	0	2	0	0	2	0.00
	Total	**1,052**	**17**	**1,013**	**0**	**0**	**1,013**	**0.00**
Upper Wenatchee Trap	Wild Steelhead/Rainbow	86	15	70	0	0	70	0.00
	Hatchery Steelhead/Rainbow	0	0	0	0	0	0	--
	Total	**86**	**15**	**70**	**0**	**0**	**70**	**0.00**
Total:	**Wild Steelhead/Rainbow**	**1,136**	**32**	**1,081**	**0**	**0**	**1,081**	**0.00**
	Hatchery Steelhead/Rainbow	**2**	**0**	**2**	**0**	**0**	**2**	**0.00**
Grand Total:		**1,138**	**32**	**1,083**	**0**	**0**	**1,083**	**0.00**

Numbers of steelhead/rainbow PIT-tagged and released as part of CSS during the period 2006-2012 are shown in Table 3.15b.

Table 3.15b. Summary of the numbers of wild and hatchery steelhead/rainbow trout that were tagged and released at different locations within the Wenatchee River basin, 2006-2012.

Sampling Location	Species and Life Stage	Numbers of PIT-tagged steelhead/rainbow released						
		2006	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Chiwawa Trap	Wild Steelhead/Rainbow	1,366	832	1,431	1,127	930	1,012	1,011
	Hatchery Steelhead/Rainbow	0	3	2	1	2	1	2
	Total	**1,366**	**835**	**1,433**	**1,128**	**932**	**1,013**	**1,013**
Chiwawa Remote	Wild Steelhead/Rainbow	33	167	94	35	99	0	0
	Hatchery Steelhead/Rainbow	1	47	35	43	64	0	0
	Total	**34**	**214**	**129**	**78**	**163**	**0**	**0**
Upper Wenatchee Trap	Wild Steelhead/Rainbow	21	37	24	46	69	82	70
	Hatchery Steelhead/Rainbow	0	0	0	0	0	0	0
	Total	**21**	**37**	**24**	**46**	**69**	**82**	**70**
Nason Creek Remote	Wild Steelhead/Rainbow	174	452	255	459	318	0	0
	Hatchery Steelhead/Rainbow	26	75	87	197	32	0	0
	Total	**200**	**527**	**342**	**656**	**350**	**0**	**0**
Upper Wenatchee	Wild Steelhead/Rainbow	413	1,001	21	7	30	0	0

Sampling Location	Species and Life Stage	Numbers of PIT-tagged steelhead/rainbow released						
		2006	2007	2008	2009	2010	2011	2012
Remote	Hatchery Steelhead/Rainbow	2	64	26	23	9	0	0
	Total	**415**	**1,065**	**47**	**30**	**39**	**0**	**0**
Middle Wenatchee Remote	Wild Steelhead/Rainbow	0	0	981	867	1,517	0	0
	Hatchery Steelhead/Rainbow	0	0	11	5	57	0	0
	Total	**0**	**0**	**992**	**872**	**1,574**	**0**	**0**
Lower Wenatchee Remote	Wild Steelhead/Rainbow	0	0	102	69	0	0	0
	Hatchery Steelhead/Rainbow	0	0	10	9	0	0	0
	Total	**0**	**0**	**112**	**78**	**0**	**0**	**0**
Peshastin Creek Remote	Wild Steelhead/Rainbow	0	0	0	92	307	0	0
	Hatchery Steelhead/Rainbow	0	0	0	0	0	0	0
	Total	**0**	**0**	**0**	**92**	**307**	**0**	**0**
Lower Wenatchee Trap	Wild Steelhead/Rainbow	131	461	285	227	465	0	0
	Hatchery Steelhead/Rainbow	0	0	0	1	0	0	0
	Total	**131**	**461**	**285**	**228**	**465**	**0**	**0**
Total:	**Wild Steelhead/Rainbow**	**2,138**	**2,950**	**3,193**	**2,928**	**3,735**	**1,094**	**1,081**
	Hatchery Steelhead/Rainbow	**29**	**189**	**171**	**278**	**164**	**1**	**2**
Grand Total:		**2,167**	**3,139**	**3,364**	**3,206**	**3,899**	**1,095**	**1,083**

3.5 Spawning Surveys

Surveys for steelhead redds were conducted during March through early June, 2012, in the Wenatchee River (including Beaver and Chiwaukum creeks), Chiwawa River (including Meadow, Alder, and Clear creeks), Nason Creek (including White Pine, Roaring, and an un-named stream), Icicle Creek, Peshastin Creek (including Mill, Ingalls, Tronsen, Scotty, Shaser, and Schafer creeks), and the White River (including the Napeequa River and Panther Creek). Surveys were conducted in both index and non-index areas throughout the Wenatchee River basin (see Appendix D for more details).

Redd Counts

A total of 415 steelhead redds were estimated in the Wenatchee River basin in 2012 (Table 3.16). This is about a 45% decrease over the estimate in 2011 (see Appendix D). Most spawning occurred in Nason Creek (38.1%), Wenatchee River (33.0%), and Peshastin Creek (15.7%) (Table 3.16; Figure 3.3). Icicle Creek contained 11.3% of all redds in the Wenatchee River basin. The number of redds estimated in the Chiwawa River basin was below average for that area.

Table 3.16. Numbers of steelhead redds estimated within different streams/watersheds within the Wenatchee River basin, 2001-2012; NS = not sampled. Redd counts beginning in 2004 have been conducted within the same areas and with the same methods. Therefore, comparing redd numbers before 2004 with estimates since may not be valid.

Survey year	Number of steelhead redds							
	Chiwawa	Nason	Little Wenatchee	White	Wenatchee River[a]	Icicle	Peshastin	Total
2001	25	27	NS	NS	116	19	NS	**187**
2002	80	80	1	0	315	27	NS	**503**
2003	64	121	5	3	248	16	15	**472**
2004	62	127	0	0	151	23	34	**397**
2005	162	412	0	2	459	8	97	**1,140**
2006	19	77	NS	0	191	41	67	**395**
2007	11	78	0	1	46	6	17	**159**
2008	11	88	NS	1	100	37	49	**286**
2009	75	126	0	0	327	102	32	**662**
2010	74	270	4	3	380	120	118	**969**
2011	77	235	2	0	323	180	115	**932**
2012	8	158	0	0	137	47	65	**415**
Average[b]	***56***	***150***	***1***	***1***	***233***	***52***	***61***	***543***

[a] Includes redds in Beaver and Chiwaukum creeks.
[b] The average is based on estimates from 2004 to present.

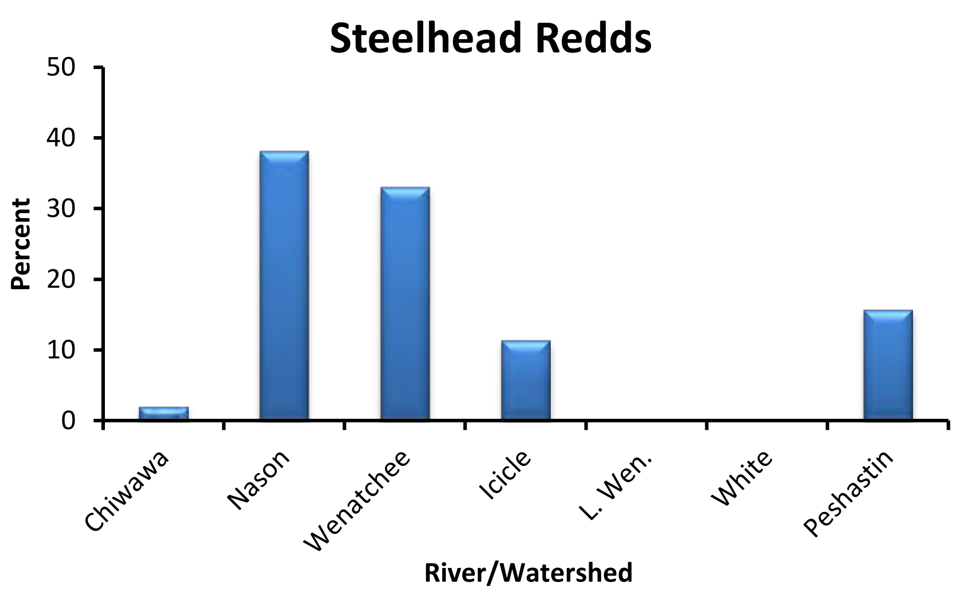


Figure 3.3. Percent of the total number of steelhead redds counted in different streams/watersheds within the Wenatchee River basin during March through early June, 2012.

Redd Distribution

Steelhead redds were not evenly distributed among reaches within survey streams in 2012 (Table 3.17). The three redds found in the Chiwawa River basin occurred in Reach 1. There were five redds observed in Clear Creek and no redds were observed in Alder, Chikamin, Big Meadow, and Rock creeks.

All of the steelhead spawning in the Nason Creek basin occurred in Nason Creek, primarily in Reaches 2 and 3. No spawning was observed in the tributaries. Spawning activity in the Peshastin Creek basin was confined to Peshastin Creek, with no redds observed in Tronsen Creek. About 93% of the spawning in the Wenatchee River occurred upstream from Tumwater Dam (Table 3.17).

Table 3.17. Numbers and percentages of steelhead redds counted within different streams/watersheds within the Wenatchee River basin during March through early June, 2012.

Stream/watershed	Reach	Number of redds	Percent of redds within stream/watershed
Chiwawa	Chiwawa 1 (C1)	3	37.5
	Rock Creek	0	0
	Chikamin Creek	0	0
	Meadow Creek	0	0
	Alder Creek	0	0
	Clear Creek	5	62.5
	Total	**8**	**100.0**
Nason	Nason 1 (N1)	12	7.6
	Nason 2 (N2)	65	41.1
	Nason 3 (N3)	73	46.2
	Nason 4 (N4)	8	5.1
	White Pine Creek	0	0
	Un-named Creek	0	0
	Roaring Creek	0	0
	Total	**158**	**100.0**
White	White 2 (H2)	0	0
	White 3 (H3)	0	0
	Panther Creek	0	0
	Naqeequa River (Q1)	0	0
	Total	**0**	**100.0**
Icicle	Icicle (I1)	47	100.0
	Total	**47**	**100.0**
Peshastin	Peshastin 1 (P1)	35	53.2
	Peshastin 2 (P2)	30	46.8
	Mill Creek	0	0
	Ingalls Creek	0	0
	Tronsen Creek	0	0

Stream/watershed	Reach	Number of redds	Percent of redds within stream/watershed
	Scotty Creek	0	0
	Shaser Creek	0	0
	Schafer Creek	0	0
	Total	**65**	**100.0**
Wenatchee	Wenatchee 1 (W1)	0	0
	Wenatchee 2 (W2)	6	4.4
	Wenatchee 3 (W3)	1	0.7
	Wenatchee 4 (W4)	0	0
	Wenatchee 5 (W5)	0	0
	Wenatchee 6 (W6)	1	0.7
	Wenatchee 7 (W7)	0	0
	Wenatchee 8 (W8)	0	0
	Wenatchee 9 (W9)	35	25.5
	Wenatchee 10 (W10)	92	67.2
	Beaver Creek	2	1.5
	Chiwaukum Creek	0	0
	Total	**137**	**100.0**

Spawn Timing

Steelhead began spawning during the third week of March in Peshastin Creek, fourth week of March in the Wenatchee River and Nason Creek, the first week of April in Icicle Creek, and the second week of April in the Chiwawa River. Spawning activity appeared to begin once the mean daily stream temperature reached about 4.4^{o}C and was observed in water temperatures ranging from 2.6 - 9.0^{o}C. Steelhead spawning peaked during the third week of April in the Icicle River and Peshastin Creek, the first week of May in the Wenatchee River and Chiwawa River, and the second week of May in Nason Creek (Figure 3.4).

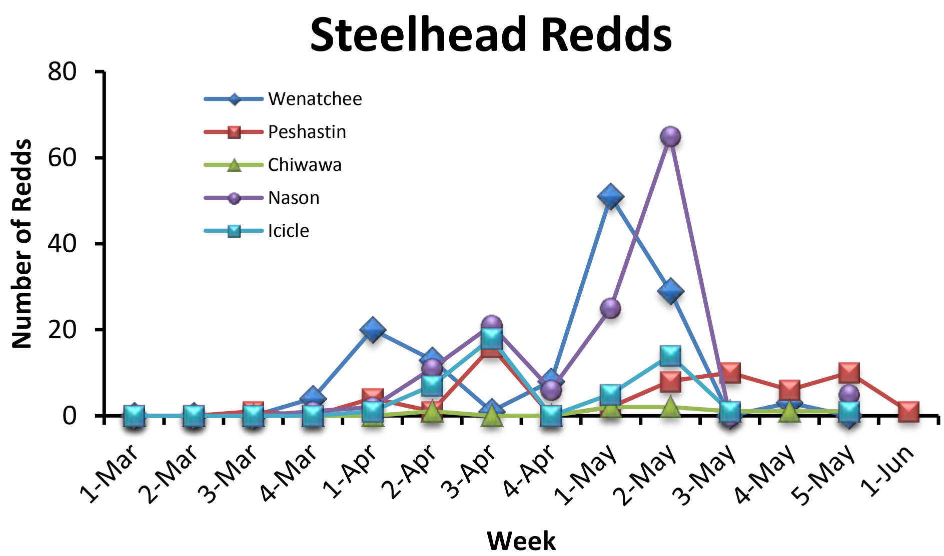


Figure 3.4. Numbers of steelhead redds counted during different weeks in different index areas within the Wenatchee River basin, March through early June 2012.

Spawning Escapement

Spawning escapement for steelhead upstream from Tumwater Dam was calculated as the number of redds (upstream from the dam) times the fish per redd ratio (based on sex ratios estimated at Tumwater Dam using video surveillance). The estimated fish per redd ratio for steelhead in 2012 was 2.00 (Table 3.18). Multiplying this ratio by the total number of redds upstream from the dam resulted in a total spawning escapement of 590 steelhead (Table 3.18). This means that of the 1,055 steelhead counted at Tumwater, about 56% of them were estimated to have spawned upstream from the dam. This estimate was higher than the average of 51%.

The low estimated spawning escapement in 2012 may have resulted from the difficult survey conditions that biologists experienced in that year. That is, poor survey conditions may have obscured redds and high spring flows prevented post-peak surveys to be conducted in some areas. The effect of other factors, such as pre-spawning mortality, fallback, and illegal harvest remain unknown.

Table 3.18. Numbers of steelhead counted at Tumwater Dam, fish/redd estimates (based on male-to-female ratios estimated at Tumwater Dam), numbers of steelhead redds counted upstream from Tumwater Dam, total spawning escapement upstream from Tumwater Dam (estimated as the total number of redds times the fish/redd ratio), and the proportion of the Tumwater Dam count that made up the spawning escapement.

Survey year	Total count at Tumwater Dam	Fish/redd	Number of redds			Spawning escapement	Proportion of Tumwater count that spawned
			Index area	Non-index area	Total redds		
2001	820	2.08	118	19	137	285	0.35
2002	1,720	2.68	296	179	475	1,273	0.74
2003	1,810	1.60	353	88	441	706	0.39

Survey year	Total count at Tumwater Dam	Fish/redd	Number of redds			Spawning escapement	Proportion of Tumwater count that spawned
			Index area	Non-index area	Total redds		
2004	1,869	2.21	277	92	369	815	0.44
2005	2,650	1.61	828	136	964	1,552	0.59
2006	1,053	2.05	192	34	226	463	0.44
2007	657	1.94	105	29	134	260	0.40
2008	1,328	2.81	124	35	159	447	0.34
2009	1,781	1.83	284	107	931	716	0.40
2010	2,270	2.33	546	95	641	1,494	0.66
2011	1,130	1.79	427	33	460	823	0.73
2012	1,055	2.00	273	22	295	590	0.56
***Average*[a]**	***1,533***	***2.06***	***340***	***65***	***464***	***796***	***0.51***

[a] The average is based on estimates from 2004 to present.

3.6 Life History Monitoring

Life history characteristics of steelhead were assessed by examining fish collected at broodstock collection sites, examining videotape at Tumwater Dam, and by reviewing tagging data and fisheries statistics. Some statistics could not be calculated at this time because few fish have been tagged with CWTs. All steelhead released from the hatchery received elastomer tags and about 25,400 were PIT tagged. With the placement of remote PIT tag detectors in spawning streams in 2007 and 2008, statistics such as origin on spawning grounds, stray rates, and SARs can be estimated more accurately in the future.

Migration Timing

Sampling at Tumwater Dam indicates that steelhead migrate throughout the year; however, the migration distribution is bimodal, indicating that steelhead migrate past Tumwater Dam in two pulses: one pulse during summer-autumn the year before spawning and another during winter-spring the year of spawning (Figure 3.5). Most steelhead passed Tumwater Dam during July through October and April. The highest proportion of both wild and hatchery fish migrated during October.

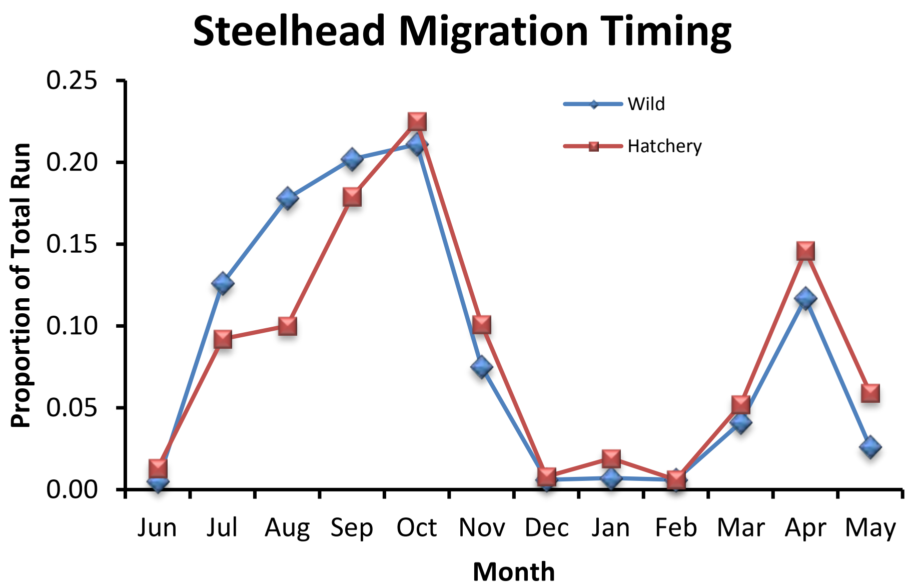


Figure 3.5. Proportion of wild and hatchery steelhead sampled at Tumwater Dam for the combined brood years of 1999-2012.

Because the migration of steelhead is bimodal, we estimated migration statistics separately for each migration pulse (i.e., summer-autumn migration and winter-spring migration). That is, we compared migration statistics for wild and hatchery steelhead passing Tumwater Dam during the summer-autumn period independent of those for the winter-spring migration period. We estimated the week and month that 10%, 50% (median), and 90% of the wild and hatchery steelhead passed Tumwater Dam during the two migration periods. We also estimated the mean weekly and monthly migration timing for wild and hatchery steelhead.

Overall, there was little difference in migration timing of wild and hatchery fish enumerated at Tumwater Dam (Table 3.19a and b; Figure 3.5). For both the summer-autumn and winter-spring migration periods, wild and hatchery steelhead arrived at the dam during the same week and month. The mean and median migration timing for wild and hatchery steelhead were also similar. However, during the summer-autumn migration period, on average, wild steelhead appeared to end their migration about one week earlier than hatchery steelhead.

Table 3.19a. The week that 10%, 50% (median), and 90% of the wild and hatchery steelhead passed Tumwater Dam during their summer-autumn migration (June through December) and during their winter-spring migration (January through May), 1999-2012. The average week is also provided for both migration periods. Migration timing is based on video sampling at Tumwater. The presence of eroded fins and/or missing adipose fins was used to distinguish hatchery fish from wild fish during video monitoring at Tumwater Dam. Estimates also include steelhead collected for broodstock.

Spawn year	Origin	Steelhead Migration Time (week)									
		Summer-Autumn Migration (Jun-Dec)					Winter-Spring Migration (Jan-May)				
		10%	50%	90%	Mean	Sample size	10%	50%	90%	Mean	Sample size
1999	Wild	27	32	47	35	81	12	16	17	15	29
	Hatchery	25	31	47	34	47	12	16	18	15	27
2000	Wild	31	36	41	36	238	11	14	18	14	40
	Hatchery	31	34	41	36	194	12	14	16	14	69
2001	Wild	29	34	41	35	391	13	15	17	15	84
	Hatchery	30	38	41	36	227	12	16	17	15	156
2002	Wild	29	39	46	38	810	13	14	17	14	181
	Hatchery	35	42	46	41	610	12	15	18	15	124
2003	Wild	30	33	40	35	731	3	9	16	9	193
	Hatchery	30	35	51	37	372	3	9	15	9	538
2004	Wild	30	40	45	39	644	13	16	18	16	222
	Hatchery	29	40	44	38	677	11	17	19	16	361
2005	Wild	30	39	43	38	986	10	15	17	15	206
	Hatchery	27	38	42	36	1,112	12	16	18	15	377
2006	Wild	29	40	43	39	428	12	15	17	15	191
	Hatchery	29	41	43	39	334	4	13	16	12	181
2007	Wild	30	36	41	35	277	11	17	17	15	108
	Hatchery	29	38	43	36	90	11	17	18	16	214
2008	Wild	30	38	43	38	397	13	15	18	16	123
	Hatchery	33	41	45	40	554	14	18	19	17	311
2009	Wild	30	37	46	37	338	13	15	19	15	87
	Hatchery	29	35	46	36	1,133	13	16	19	16	229
2010	Wild	31	37	45	38	648	11	15	18	15	171
	Hatchery	31	40	45	40	1,207	12	16	19	16	309
2011	Wild	29	36	44	36	797	13	17	19	17	118
	Hatchery	31	39	45	39	991	15	18	19	18	240
2012	Wild	31	34	41	35	642	15	20	20	17	83
	Hatchery	32	39	43	38	715	15	19	19	17	223
Average	***Wild***	***30***	***37***	***43***	***37***	***529***	***12***	***15***	***18***	***15***	***131***
	Hatchery	***30***	***38***	***44***	***38***	***590***	***11***	***16***	***18***	***15***	***240***

Table 3.19b. The month that 10%, 50% (median), and 90% of the wild and hatchery steelhead passed Tumwater Dam during their summer-autumn migration (June through December) and during their winter-spring migration (January through May), 1999-2012. The average month is also provided for both migration periods. Migration timing is based on video sampling at Tumwater. The presence of eroded fins and/or missing adipose fins was used to distinguish hatchery fish from wild fish during video monitoring at Tumwater Dam. Estimates also include steelhead collected for broodstock.

Spawn year	Origin	Steelhead Migration Time (month)									
		Summer-Autumn Migration (Jun-Dec)					Winter-Spring Migration (Jan-May)				
		10%	50%	90%	Mean	Sample size	10%	50%	90%	Mean	Sample size
1999	Wild	7	8	11	8	81	3	4	4	4	29
	Hatchery	6	8	11	8	47	3	4	4	4	27
2000	Wild	8	9	10	9	238	3	4	5	4	40
	Hatchery	8	8	10	9	194	3	4	4	4	69
2001	Wild	7	8	10	8	391	3	4	4	4	84
	Hatchery	7	9	10	9	227	3	4	4	4	156
2002	Wild	7	9	11	9	810	3	4	4	4	181
	Hatchery	9	10	11	10	610	3	4	5	4	124
2003	Wild	7	8	10	8	731	1	3	4	3	193
	Hatchery	7	8	12	9	372	1	3	4	2	538
2004	Wild	7	10	11	9	644	3	4	4	4	222
	Hatchery	7	10	10	9	677	3	4	5	4	361
2005	Wild	7	9	10	9	986	3	4	4	4	206
	Hatchery	7	9	10	9	1,112	3	4	5	4	377
2006	Wild	7	10	10	10	428	3	4	4	4	191
	Hatchery	7	10	10	9	334	1	3	4	3	181
2007	Wild	7	9	10	9	277	3	4	4	4	108
	Hatchery	7	9	10	9	90	3	4	5	4	214
2008	Wild	7	9	10	9	397	3	4	5	4	123
	Hatchery	8	10	11	10	554	4	4	5	4	311
2009	Wild	7	9	11	9	338	3	4	5	4	87
	Hatchery	7	8	11	9	1,133	3	4	5	4	229
2010	Wild	8	9	11	9	648	3	4	5	4	171
	Hatchery	8	10	11	10	1,207	3	4	5	4	309
2011	Wild	7	9	11	9	797	4	4	5	4	118
	Hatchery	8	9	11	9	991	4	5	5	5	240
2012	Wild	8	8	10	9	642	4	4	5	4	83
	Hatchery	8	9	10	9	715	4	4	5	4	223
Average	***Wild***	***7***	***9***	***10***	***9***	***529***	***3***	***4***	***4***	***4***	***131***
	Hatchery	***7***	***9***	***11***	***9***	***590***	***3***	***4***	***5***	***4***	***240***

Age at Maturity

Nearly all steelhead broodstock collected at Tumwater and Dryden dams lived in saltwater 1 to 2 years (saltwater age) (Table 3.20; Figure 3.6). Very few saltwater age-3 fish returned and those that did were wild fish. On average, there was a difference between the saltwater age at return of wild and hatchery fish. A greater number of wild fish returned as saltwater age-2 fish than did hatchery fish. In contrast, a greater number of hatchery fish returned as saltwater-1 fish than did wild fish.

Table 3.20. Proportions of wild and hatchery steelhead broodstock of different ages collected at Tumwater and Dryden dams, 1998-2012. Age represents the number of years the fish lived in salt water.

Sample year	Origin	Saltwater age			Sample size
		1	2	3	
1998	Wild	0.39	0.61	0.00	35
	Hatchery	0.21	0.79	0.00	43
1999	Wild	0.50	0.48	0.02	58
	Hatchery	0.82	0.18	0.00	67
2000	Wild	0.56	0.44	0.00	39
	Hatchery	0.68	0.32	0.00	101
2001	Wild	0.52	0.48	0.00	64
	Hatchery	0.15	0.85	0.00	114
2002	Wild	0.56	0.44	0.00	99
	Hatchery	0.95	0.05	0.00	113
2003	Wild	0.13	0.85	0.02	63
	Hatchery	0.29	0.71	0.00	92
2004	Wild	0.95	0.05	0.00	85
	Hatchery	0.95	0.05	0.00	132
2005	Wild	0.22	0.78	0.00	95
	Hatchery	0.21	0.79	0.00	114
2006	Wild	0.29	0.71	0.00	101
	Hatchery	0.60	0.40	0.00	98
2007	Wild	0.40	0.59	0.00	79
	Hatchery	0.62	0.38	0.00	97
2008	Wild	0.65	0.34	0.01	104
	Hatchery	0.89	0.11	0.00	107
2009	Wild	0.40	0.58	0.20	83
	Hatchery	0.23	0.77	0.0	77
2010	Wild	0.65	0.34	0.01	92
	Hatchery	0.77	0.23	0.00	98
2011	Wild	0.28	0.73	0.00	102
	Hatchery	0.36	0.64	0.00	100
2012	Wild	0.42	0.53	0.05	59
	Hatchery	0.41	0.59	0.00	66

Sample year	Origin	Saltwater age			Sample size
		1	2	3	
Average	***Wild***	***0.46***	***0.52***	***0.02***	***72***
	Hatchery	***0.57***	***0.43***	***0.00***	***89***

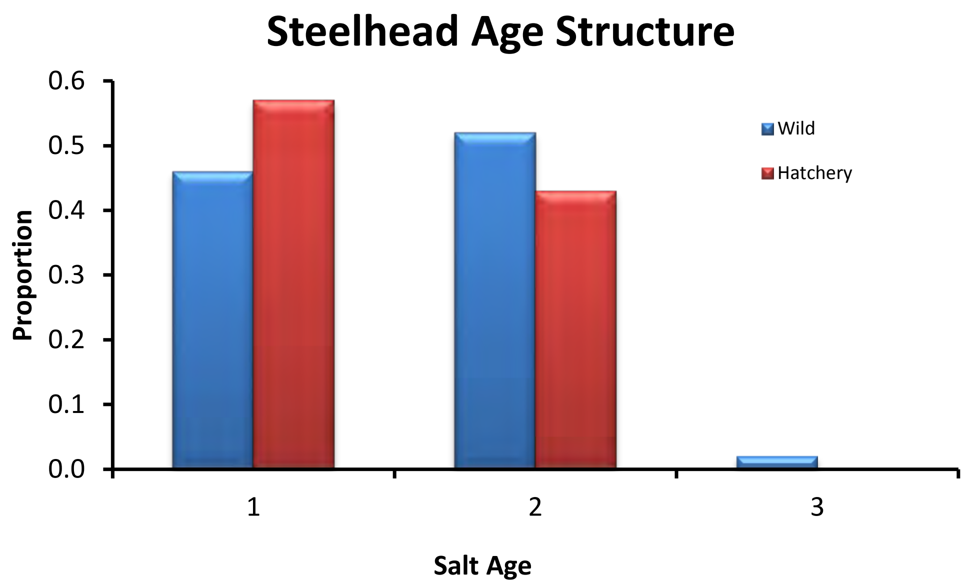


Figure 3.6. Proportions of wild and hatchery steelhead of different saltwater ages sampled at Tumwater Dam for the combined years 1998-2012.

Size at Maturity

On average, hatchery steelhead collected at Tumwater and Dryden dams were about 3 cm smaller than wild steelhead (Table 3.21). This may be related to the fact that more wild steelhead return as saltwater age-2 fish than hatchery steelhead.

Table 3.21. Mean fork length (cm) at age (saltwater ages) of hatchery and wild steelhead collected from broodstock, 1998-2012; N = sample size and SD = 1 standard deviation.

Return year	Origin	Steelhead fork length (cm)								
		1-Salt			2-Salt			3-Salt		
		Mean	N	SD	Mean	N	SD	Mean	N	SD
1998	Wild	63	15	4	79	20	5	-	0	-
	Hatchery	61	9	4	73	34	4	-	0	-
1999	Wild	65	29	5	74	28	5	77	1	-
	Hatchery	62	54	4	73	12	4	-	0	-
2000	Wild	64	22	3	74	17	5	-	0	-
	Hatchery	60	57	3	71	27	4	-	0	-
2001	Wild	61	33	6	77	31	5	-	0	-
	Hatchery	62	17	4	72	97	4	-	0	-

Return year	Origin	Steelhead fork length (cm)								
		1-Salt			2-Salt			3-Salt		
		Mean	N	SD	Mean	N	SD	Mean	N	SD
2002	Wild	64	55	4	77	44	4	-	0	-
	Hatchery	63	106	4	73	6	4	-	0	-
2003	Wild	69	8	6	77	52	5	91	1	-
	Hatchery	66	27	4	75	65	4	-	0	-
2004	Wild	63	73	6	78	4	2	-	0	-
	Hatchery	61	59	3	73	3	1	-	0	-
2005	Wild	59	21	4	74	74	5	-	0	-
	Hatchery	59	23	4	72	89	4	-	0	-
2006	Wild	63	27	5	75	67	6	-	0	-
	Hatchery	61	41	4	72	27	5	-	0	-
2007	Wild	64	31	6	76	46	5	-	0	-
	Hatchery	60	60	4	71	36	5	-	0	-
2008	Wild	64	68	4	77	35	4	80	2	-
	Hatchery	60	95	4	72	12	2	-	0	-
2009	Wild	65	33	5	76	48	6	81	2	0
	Hatchery	63	18	4	75	59	5	-	0	-
2010	Wild	64	60	5	74	31	5	76	1	-
	Hatchery	61	53	5	73	23	5	-	0	-
2011	Wild	62	28	5	76	74	5	-	0	-
	Hatchery	60	36	4	74	64	4	-	0	-
2012	Wild	63	25	3	74	31	5	74	3	2
	Hatchery	59	27	3	74	39	4	-	0	-
Average	Wild	64	35	5	76	40	5	80	1	1
	Hatchery	61	45	4	73	40	4	-	0	-

Contribution to Fisheries

Nearly all harvest on Wenatchee steelhead occurs within the Columbia basin. Harvest rates on steelhead in the Lower Columbia River fisheries (both tribal and non-tribal) are generally less than 5-10% (NMFS 2004). WDFW regulates steelhead harvest in the Upper Columbia. Under certain conditions, WDFW may allow a harvest on hatchery steelhead (adipose fin clipped fish). The intent is to reduce the number of hatchery steelhead that exceed habitat seeding levels in spawning areas and to increase the proportion of wild steelhead in spawning populations.

Origin on Spawning Grounds

At this time, origin of steelhead (wild or hatchery) on spawning grounds cannot be determined precisely. However, based on scales collected during steelhead run composition sampling at Dryden Dam in 2009 (2010 spawners), naturally produced steelhead made up about 23% of the escapement. More precise estimates of wild and hatchery spawners within tributaries can be generated after remote PIT tag detectors are installed within spawning tributaries.

Straying

Stray rates of Wenatchee steelhead can be estimated by examining the locations where PIT-tagged hatchery steelhead were last detected. PIT tagging of steelhead began with brood year 2005, which allows estimation of stray rates by brood return. These data only provide estimates for brood years 2005 through 2008, because later brood years are still rearing in the ocean. The target for brood year stray rates should be less than 5%.

Based on PIT-tag analyses, on average, about 28% of the hatchery steelhead returns were last detected in streams outside the Wenatchee River basin (Table 3.22). The numbers in Table 3.22 should be considered rough estimates because they are not based on confirmed spawning (only last detections) and the numbers have not been adjusted for detection efficiencies, which currently do not exist for most PIT-tag detection arrays in tributaries. What these data do indicate is that large numbers of hatchery steelhead from the Wenatchee program have wandered or strayed into the Entiat and Methow rivers, and also into the Tucannon River. Most (about 70%) of the strays were detected in the Methow River.

Table 3.22. Number and percent of hatchery-origin Wenatchee steelhead that homed to target spawning areas and the target hatchery program, and number and percent that strayed to non-target spawning areas and hatchery programs for brood years 2005 to 2008. Estimates were based on last detections of PIT-tagged hatchery steelhead. Percent strays should be less than 5%.

Brood Year	Homing				Straying			
	Target streams		Target hatchery		Non-target stream		Non-target hatchery	
	Number	%	Number	%	Number	%	Number	%
2005	80	75.5	0	0.0	26	24.5	0	0.0
2006	71	62.3	1	0.9	43	37.7	0	0.0
2007	171	60.6	0	0.0	111	39.4	0	0.0
2008	79	88.8	0	0.0	10	11.2	0	0.0
Average	***100***	***71.8***	***0.3***	***0.2***	***48***	***28.2***	***0.0***	***0.0***

At this time, we cannot estimate among population stray rates by return year, because we have no estimates of detection efficiencies for PIT-tag interrogation sites within different tributaries. These data are needed to estimate the total number of Wenatchee steelhead that stray into areas outside the Wenatchee River basin. Finally, for the same reason, we cannot evaluate within population stray rates.

Genetics

Genetic studies were conducted to determine the potential effects of the Wenatchee Supplementation Program on natural-origin summer steelhead in the Wenatchee River basin (Seamons et al. 2012; the entire report is appended as Appendix E). Temporal collections of tissue samples from Wenatchee hatchery-produced and natural-origin adults sampled at Dryden and Tumwater dams and from natural-origin juveniles from three Wenatchee River tributaries and the Entiat River were surveyed for genetic variation with 132 genetic (single nucleotide polymorphism loci; SNPs) markers. Peshastin Creek and the Entiat River served as no-hatchery-outplant controls. Genetic data were interrogated for the presence or absence of spatial and temporal trends in allele frequencies, genetic distances, and effective population size.

Allele Frequencies—Changes to the summer steelhead hatchery supplementation program had no detectable effect on genetic diversity of wild populations. On average, hatchery-origin adults had higher minor allele frequencies (MAF) than natural-origin adults, which may simply reflect the mixed ancestry of hatchery adults. Both hatchery and natural-origin adults had MAF similar to juveniles collected in spawning tributaries and in the Entiat River. There was no temporal trend in allele frequencies or observed heterozygosity in adult or juvenile collections and allele frequencies in control populations were no different than those still receiving hatchery outplants. This suggests that the hatchery program has had little effect on allele frequencies since broodstock sources changed in 1998 from mixed-ancestry broodstock collected in the Columbia River to using broodstock collected in the Wenatchee River.

Genetic Distances—As intended, interbreeding of Wenatchee River hatchery and natural-origin adults reduced the genetic differences between Wells Hatchery adults and Wenatchee River natural-origin adults observed in the first few years after changing the broodstock collection protocol. Although there were detectable genetic differences between hatchery and natural-origin adults, the magnitude of that difference declined over time. Hatchery adults were genetically different from natural-origin adults and juveniles based on pair-wise F_{ST} and principal components analysis, most likely because of the smaller effective population size (N_b) in the hatchery population (see below). Pair-wise F_{ST} estimates and genetic distances between hatchery and natural-origin adults collected the same year declined over time suggesting that the interbreeding of hatchery and natural-origin adults in the hatchery (and presumably in the wild) is slowly homogenizing Wenatchee River summer steelhead. Analyses using brood year were inconclusive because of limitations in the data.

Effective Population Size—Although the effective population size of the Wenatchee River hatchery steelhead program was consistently small, it does not appear to have caused a reduction in the effective population size of wild populations. On average, estimates of N_b were much lower and varied less for hatchery adults than for natural-origin adults and juveniles. Estimates of N_b for hatchery adults declined from the earliest brood years to a stable new low value after broodstock practices were changed in 1998. There was no indication that this had any effect on N_b in natural-origin adults and juveniles; N_b estimates for natural-origin adults and juveniles were, on average, higher and varied considerably over the 1998-2010 time period and showed no temporal trend.

Proportion of Natural Influence

Another method for assessing the genetic risk of a supplementation program is to determine the influence of the hatchery and natural environments on the adaptation of the composite population. This is estimated by the proportion of natural-origin fish in the hatchery broodstock (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The ratio pNOB/(pHOS+pNOB) is the Proportion of Natural Influence (PNI). The larger the ratio (PNI), the greater the strength of selection in the natural environment relative to that of the hatchery environment. In order for the natural environment to dominate selection, PNI should be greater than 0.67 (HSRG/WDFW/NWIFC 2004).

For brood years 2001-2012, the PNI was equal to or less than 0.59 (Table 3.23). This indicates that the hatchery environment has a greater influence on adaptation of Wenatchee steelhead than does the natural environment.

Table 3.23. Proportionate natural influence (PNI) of the Wenatchee steelhead supplementation program for brood years 2001-2012. PNI was calculated as the proportion of naturally produced steelhead in the hatchery broodstock (pNOB) divided by the proportion of hatchery steelhead on the spawning grounds (pHOS) plus pNOB. NOS = number of natural-origin steelhead on the spawning grounds; HOS = number of hatchery-origin steelhead on the spawning grounds; NOB = number of natural-origin steelhead collected for broodstock; and HOB = number of hatchery-origin steelhead included in hatchery broodstock.

Brood year	Spawners[a]			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
2001	158	127	0.45	51	103	0.33	0.43
2002	731	542	0.43	96	64	0.60	0.59
2003	356	350	0.50	49	90	0.35	0.42
2004	371	444	0.55	75	61	0.55	0.50
2005	690	862	0.56	87	104	0.46	0.45
2006	253	210	0.45	93	69	0.57	0.56
2007	145	115	0.44	76	58	0.57	0.56
2008	168	279	0.62	77	54	0.59	0.48
2009	171	545	0.76	86	73	0.54	0.42
2010	524	970	0.65	96	75	0.56	0.46
2011	351	472	0.57	91	70	0.57	0.50
2012	381	209	0.35	59	65	0.48	0.57
Average	***356***	***427***	***0.53***	***78***	***74***	***0.51***	***0.49***

[a] Proportions of natural-origin and hatchery-origin spawners were determined from video tape at Tumwater Dam. Therefore, these PNI estimates are appropriate for steelhead spawning upstream from Tumwater Dam. They may not represent PNI for steelhead spawning downstream from Tumwater Dam.

Natural and Hatchery Replacement Rates

Natural replacement rates (NRR) were calculated as the ratio of natural-origin recruits (NOR) to the parent spawning population (spawning escapement). For brood years 1998-2004, NRR for summer steelhead in the Wenatchee River basin averaged 0.88 (range, 0.10-3.10) if harvested fish were included in the estimate (Table 3.24).

Hatchery replacement rates (HRR) are the hatchery adult-to-adult returns and were calculated as the ratio of hatchery-origin recruits (HOR) to the parent broodstock collected. These rates should be greater than the NRRs and greater than or equal to 19.2 (the calculated target value in Murdoch and Peven 2005). In nearly all years, HRRs were greater than NRRs (Table 3.24). HRRs exceeded the estimated target value of 19.2 in one of the seven years.

Table 3.24. Broodstock collected, spawning escapements, natural and hatchery-origin recruits (NOR and HOR), and natural and hatchery replacement rates (NRR and HRR with harvest) for summer steelhead in the Wenatchee River basin, brood years 1998-2004.

Brood year	Broodstock Collected	Spawning Escapement	Harvest included			
			HOR	NOR	HRR	NRR
1998	78	602	148	1,867	1.89	3.10
1999	125	343	1,944	334	15.55	0.97
2000	120	1,030	312	878	2.60	0.85
2001	178	1,655	10,335	1,050	58.06	0.66
2002	162	5,000	1,905	515	11.76	0.13
2003	155	2,598	956	504	6.17	0.27
2004	140	2,948	1,127	827	8.05	0.33
Average	***137***	***2,025***	***2,390***	***854***	***14.87***	***0.88***

Smolt-to-Adult Survivals

Smolt-to-adult ratios (SARs) are calculated as the number of returning hatchery adults divided by the number of tagged hatchery smolts released. SARs are generally based on CWT returns. However, Wenatchee steelhead have not been extensively tagged with CWTs. Therefore, elastomer-tagged fish were used to estimate SARs from release to capture at Priest Rapids Dam.

SARs (not adjusted for tag loss) for Wenatchee steelhead ranged from 0.0009 to 0.0308 (mean = 0.0078) for brood years 1996-2006 (Table 3.25).

Table 3.25. Smolt-to-adult ratios (SARs) for Wenatchee hatchery steelhead, 1996-2006. Estimates were based on elastomer tags recaptured at Priest Rapids Dam. SARs were not adjusted for tag loss after release.

Brood year	Number of tagged smolts released	SAR
1996	348,693	0.0034
1997	429,422	0.0041
1998	172,078	0.0009
1999	175,661	0.0111
2000	184,639	0.0017
2001	335,933	0.0308
2002	302,060	0.0063
2003	374,867	0.0025
2004	294,114	0.0038
2005	452,184	0.0107
2006	299,937	0.0100
Average	***306,326***	***0.0078***

3.7 ESA/HCP Compliance

Broodstock Collection

Collection of brood year 2011 broodstock for Wenatchee steelhead at Tumwater and Dryden dams began on 1 July and ended on 20 October 2010 and represented a slightly shortened collection duration from the 1 July to 12 November collection period identified in the 2010 broodstock collection protocol. The broodstock collection protocols specified and achieved a total collection of 208 steelhead, including 104 natural-origin steelhead.

About 1,637 total steelhead were handled and released (or surplused at Tumwater Dam) at Dryden Dam and Tumwater Dam during brood year 2010 Wenatchee steelhead broodstock collection. A majority were hatchery-origin fish handled at Tumwater Dam and ultimately surplused to meet the pHOS objective above Tumwater Dam. Fish released at Dryden Dam were released because the weekly quota for hatchery or wild steelhead had been attained, but not both, or because they were non-target (red/green VIE tagged), or they were unidentifiable hatchery-origin steelhead. All steelhead released were allowed to fully recover from the anesthesia and released immediately upstream from the trap sites.

In addition to steelhead encountered at Dryden Dam during steelhead broodstock collection, an estimated 279 spring Chinook salmon were captured and released unharmed immediately upstream from the trap facility. Consistent with ESA Section 10 Permit 1395 impact minimization measures, all ESA species handled at this site were subject of water-to-water transfers.

Hatchery Rearing and Release

The 2011 brood Wenatchee steelhead reared throughout all life-stages without significant mortality (defined as >10% population mortality associated with a single event). However, the 2011 brood had poor fertilization to eyed-egg and ponding-to-release survival resulting in an unfertilized-to-release survival of 62.7%, which was less than the program target of 81% (see Section 3.2).

Juvenile rearing occurred at three separate facilities including Eastbank Fish Hatchery, Chelan Falls Fish Hatchery, and Chiwawa Ponds. Multiple facilities were used to take advantage of variable water temperatures to manipulate growth of juveniles from different parental crosses. Typically, wild steelhead spawn later than their hatchery cohort and are therefore reared at Chelan Falls Fish Hatchery on warmer water to accelerate their growth so they achieve a size at release similar to HxH parental cross progeny reared on cooler water at Eastbank Fish Hatchery. All parental cross groups received final rearing and over-winter acclimation at Chiwawa Ponds on Wenatchee River and Chiwawa River surface water before direct release (scatter planting) in the Wenatchee River basin.

The 2011 brood steelhead smolt release in the Wenatchee River basin totaled 206,975 smolts, representing about 83% of the program target of 247,300 smolts identified in the Rocky Reach and Rock Island Dam HCPs and in ESA Section 10 Permit 1395. As specified in ESA Section 10 Permit 1395, all steelhead smolts released were externally marked or tagged and a representative number were PIT tagged (see Section 3.2).

Hatchery Effluent Monitoring

Per ESA Permits 1196, 1347, and 1395, permit holders shall monitor and report hatchery effluents in compliance with applicable National Pollution Discharge Elimination Systems (NPDES) (EPA 1999) permit limitations. There was one NPDES violation reported at Chelan PUD Hatchery facilities during the period 1 January 2012 through 31 December 2012. NPDES monitoring and reporting for Chelan PUD Hatchery Programs during 2012 are provided in Appendix F.

Smolt and Emigrant Trapping

Per ESA Section 10 Permit No. 1395, the permit holders are authorized a direct take of 20% of the emigrating steelhead population and a lethal take not to exceed 2% of the fish captured (NMFS 2003). Based on the estimated wild steelhead population (smolt trap expansion) and hatchery juvenile steelhead population estimate (hatchery release data) for the Wenatchee River basin, the reported steelhead encounters during the 2012 emigration complied with take provisions in the Section 10 permit and are detailed in Table 3.26. Additionally, juvenile fish captured at the trap locations were handled consistent with provisions in ESA Section 10 Permit 1395 Section B.

Table 3.26. Estimated take of Upper Columbia River steelhead resulting from juvenile emigration monitoring in the Wenatchee River basin, 2012. NA = not available.

Trap location	Population estimate				Number trapped				Total	Take allowed by Permit
	Wild	Hatchery[b]	Parr	Fry	Wild	Hatchery	Parr	Fry		
Chiwawa Trap										
Population	NA	31,050	NA	NA	183	1,664	1,738	242	3,827	
Encounter rate	NA	NA	NA	NA	NA	0.0536	NA	NA	0.1235	0.20
Mortality [b]	NA	NA	NA	NA	0	1	15	4	20	
Mortality rate	NA	NA	NA	NA	0.0000	0.0006	0.0086	0.0165	0.0052	0.02
Upper Wenatchee Trap										
Population	NA	54,479	NA	NA	5	65	127	1,105	1,302	
Encounter rate	NA	NA	NA	NA	NA	0.0012	NA	NA	0.0239	0.20
Mortality [b]	NA	NA	NA	NA	0	0	2	3	5	
Mortality rate	NA	NA	NA	NA	0.0000	0.0000	0.0157	0.0027	0.0038	0.02
Lower Wenatchee Trap										
Population	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Encounter rate	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.20
Mortality [b]	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Mortality rate	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02
Wenatchee River basin Total										
Population	NA	206,397	NA	NA	188	1,729	1,865	1,347	5,129	
Encounter rate	NA	NA	NA	NA	NA	0.0084	NA	NA	0.0249	0.20
Mortality [b]	NA	NA	NA	NA	0	1	17	7	25	
Mortality rate	NA	NA	NA	NA	0.0000	0.0006	0.0091	0.0052	0.0049	0.02

[a] 2012 smolt release data for the Wenatchee River basin.

[b] Mortality includes trapping and PIT-tag mortalities.

Spawning Surveys

Steelhead spawning ground surveys were conducted in the Wenatchee River basin during 2012, as authorized by ESA Section 10 Permit No. 1395. Because of the difficulty of quantifying the level of take associated with spawning ground surveys, the Permit does not specify a take level associated with these activities, even though it does authorize implementation of spawning ground surveys. Therefore, no take levels are reported. However, to minimize potential effects to established redds, wading was restricted to the extent practical, and extreme caution was used to avoid established redds when wading was required.

Stock Assessment at Priest Rapids Dam

Upper Columbia River steelhead stock assessment sampling at Priest Rapids Dam (PRD) is authorized through ESA Section 10 Permit No. 1395 (NMFS 2003). Permit authorizations include interception and biological sampling of up to 10% of the Upper Columbia River steelhead passing PRD to determine upriver adult population size, estimate hatchery to wild ratios, determine age-class contribution, and evaluate the need for managing hatchery steelhead consistent with ESA recovery objectives, which include fully seeding spawning habitat with naturally produced Upper Columbia River steelhead supplemented with artificially propagated steelhead (NMFS 2003). The 2010-2011 run-cycle report (BY 2011) for stock assessment sampling at Priest Rapids Dam was compiled under provisions of ESA Section 10 Permit 1395. Data and reporting information are included in Appendix G.

SECTION 4: WENATCHEE SOCKEYE SALMON

4.1 Broodstock Sampling

This section focuses on results from sampling 2010 and 2011 Wenatchee sockeye broodstock, which were collected at Tumwater Dam. The 2010 brood begins the tracking of the life cycle of sockeye that were released as parr into Lake Wenatchee in 2011 and some of which began smolt migrations in 2012. The 2011 brood is included because juveniles from this brood were released as parr in the lake in 2012. Complete information is not currently available for the 2012 brood (this information will be provided in the 2013 annual report). Collection of sockeye broodstock targets naturally produced fish and equal numbers of male and female fish. An evaluation of the Wenatchee sockeye program in 2012 determined that the program will be terminated. Thus, the release of juvenile sockeye into Lake Wenatchee in 2012 (2011 brood) will be the last.

Origin of Broodstock

The 2010 broodstock consisted of naturally produced Wenatchee sockeye collected at Tumwater Dam between 15 July and 15 August 2010 (Table 4.1). A total of 198 naturally produced sockeye were spawned. The 2011 broodstock consisted of naturally produced sockeye salmon collected at Tumwater Dam from 7-26 July 2011 (Table 4.1). A total of 196 naturally produced sockeye were spawned.

Table 4.1. Numbers of wild and hatchery sockeye salmon collected for broodstock, numbers that died before spawning, and numbers of sockeye spawned, 1989-2011. Unknown origin fish (i.e., undetermined by scale analysis, no CWT or fin clips, and no additional hatchery marks) were considered naturally produced. Mortality includes sockeye that died of natural causes typically near the end of spawning and were not needed for the program, surplus sockeye killed at spawning, sockeye that died but were not recovered from the net pens, and sockeye that may have jumped out of the net pens.

Brood year	Wild sockeye					Hatchery sockeye					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
1989	299	93	47	115	44	0	0	0	0	0	115
1990	333	7	7	302	17	0	0	0	0	0	302
1991	357	18	16	199	124	0	0	0	0	0	199
1992	362	18	5	320	19	0	0	0	0	0	320
1993	307	79	21	207	0	0	0	0	0	0	207
1994	329	15	9	236	69	5	0	0	5	0	241
1995	218	5	7	194	12	3	0	0	3	0	197
1996	291	2	0	225	64	20	0	0	0	20	225
1997	283	12	3	192	76	19	0	0	19	0	211
1998	225	37	25	122	41	6	0	0	6	0	128
1999	90	7	1	79	3	60	0	0	60	0	139
2000	256	19	1	170	66	5	0	0	5	0	175
2001	252	27	10	200	15	8	1	0	7	0	207
2002	257	0	1	256	0	0	0	0	0	0	256
2003	261	12	9	198	42	0	0	0	0	0	198
2004	211	13	12	177	9	0	0	0	0	0	177

Brood year	Wild sockeye					Hatchery sockeye					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
2005	243	29	12	166	36	0	0	0	0	0	166
2006	260	2	4	214	40	0	0	0	0	0	214
2007	248	15	3	210	20	0	0	0	0	0	210
2008	258	4	11	243	0	2	0	0	2	0	245
2009	258	5	14	239	0	3	0	3	0	0	239
2010	256	3	0	198	55	0	0	0	0	0	256
2011	204	0	8	196	0	0	0	0	0	0	196
Average	***263***	***18***	***10***	***203***	***33***	***6***	***0***	***0***	***5***	***1***	***210***

Age/Length Data

Ages of sockeye were determined from scales and otoliths collected from broodstock. The 2010 return was comprised primarily of age-4 returning adults (67.4%; Table 4.2). Age-5 sockeye made up 32.6% of the 2010 return. The 2011 return consisted primarily of age-4 adults (53.7% (Table 4.2). Age-5 sockeye made up 44.3% of the 2011 return.

Table 4.2. Percent of hatchery and wild sockeye salmon of different ages (total age) collected from broodstock, 1994-2011.

Return year	Origin	Total age		
		4	5	6
1994	Wild	57.3	41.7	1.0
	Hatchery	40.0	60.0	0.0
1995	Wild	77.3	20.7	2.0
	Hatchery	66.7	33.3	0.0
1996	Wild	65.8	34.2	0.0
	Hatchery	0.0	0.0	0.0
1997	Wild	86.5	13.5	0.0
	Hatchery	57.9	42.1	0.0
1998	Wild	9.9	88.6	1.5
	Hatchery	66.7	33.3	0.0
1999	Wild	21.8	74.7	3.5
	Hatchery	90.0	8.3	1.7
2000	Wild	97.7	2.3	0.0
	Hatchery	100.0	0.0	0.0
2001	Wild	69.9	29.6	0.5
	Hatchery	71.4	28.6	0.0
2002	Wild	31.6	67.6	0.8
	Hatchery	0.0	0.0	0.0
2003	Wild	2.6	90.5	6.9
	Hatchery	0.0	0.0	0.0

Return year	Origin	Total age		
		4	5	6
2004	Wild	97.5	2.0	0.5
	Hatchery	0.0	0.0	0.0
2005	Wild	74.2	25.8	0.0
	Hatchery	0.0	0.0	0.0
2006	Wild	34.0	65.5	0.5
	Hatchery	0.0	0.0	0.0
2007	Wild	1.9	88.4	9.7
	Hatchery	0.0	0.0	0.0
2008	Wild	95.0	4.0	1.0
	Hatchery	100.0	0.0	0.0
2009	Wild	78.5	21.5	0.0
	Hatchery	100.0	0.0	0.0
2010	Wild	67.4	32.6	0.0
	Hatchery	0.0	0.0	0.0
2011	Wild	53.7	44.3	2.0
	Hatchery	0.0	0.0	0.0
Average	***Wild***	***56.8***	***41.5***	***1.7***
	Hatchery	***38.5***	***11.4***	***0.1***

Lengths of sockeye for the 2010 and 2011 return years are provided in Table 4.3. Lengths of age-4 and 5 sockeye sampled in 2011 averaged 55 and 59 cm, respectively.

Table 4.3. Mean fork length (cm) at age (total age) of hatchery and wild sockeye salmon collected for broodstock, 1994-2011; SD = 1 standard deviation.

Return year	Origin	Sockeye fork length (cm)								
		Age-4			Age-5			Age-6		
		Mean	N	SD	Mean	N	SD	Mean	N	SD
1994	Wild	56	125	3	55	91	3	54	2	3
	Hatchery	57	2	1	56	3	1	-	0	-
1995	Wild	51	153	2	55	41	4	54	4	5
	Hatchery	53	2	4	59	1	-	-	0	-
1996	Wild	52	146	4	53	76	3	-	0	-
	Hatchery	-	0	-	-	0	-	-	0	-
1997	Wild	50	166	3	53	26	5	-	0	-
	Hatchery	54	11	4	59	8	2	-	0	-
1998	Wild	51	13	4	55	117	3	53	2	3
	Hatchery	52	4	2	55	2	8	-	0	-
1999	Wild	52	19	4	50	65	4	56	3	1
	Hatchery	50	54	3	56	5	4	56	1	-

Return year	Origin	Sockeye fork length (cm)								
		Age-4			Age-5			Age-6		
		Mean	N	SD	Mean	N	SD	Mean	N	SD
2000	Wild	52	167	2	54	4	3	-	0	-
	Hatchery	54	5	1	-	0	-	-	0	-
2001	Wild	54	151	3	56	65	4	58	1	-
	Hatchery	51	5	5	55	2	4	-	0	-
2002	Wild	54	77	2	56	165	4	57	2	0
	Hatchery	-	0	-	-	0	-	-	0	-
2003	Wild	54	5	4	60	172	2	60	13	4
	Hatchery	-	0	-	-	0	-	-	0	-
2004	Wild	53	192	3	56	4	3	63	1	-
	Hatchery	-	0	-	-	0	-	-	0	-
2005	Wild	51	132	3	57	46	4	-	0	-
	Hatchery	-	0	-	-	0	-	-	0	-
2006	Wild	52	70	3	56	135	4	54	2	3
	Hatchery	-	0	-	-	0	-	-	0	-
2007	Wild	57	4	2	58	182	5	58	20	5
	Hatchery	-	0	-	-	0	-	-	0	-
2008	Wild	52	245	3	52	11	3	62	2	6
	Hatchery	53	2	3	-	-	-	-	-	-
2009	Wild	54	197	3	59	54	4	-	-	-
	Hatchery	54	2	1	-	-	-	-	-	-
2010	Wild	56	130	2	57	63	4	-	-	-
	Hatchery	-	-	-	-	-	-	-	-	-
2011	Wild	55	109	2	59	90	3	61	4	3
	Hatchery	-	-	-	-	-	-	-	-	-

Sex Ratios

Male sockeye in the 2010 return made up about 49.6% of the adults collected, resulting in an overall male to female ratio of 0.98:1.00 (Table 4.4). In 2011, males made up about 52.0% of the adults collected, resulting in an overall male to female ratio of 1.08:1.00. Ratios for both years were near the 1:1 ratio target in the broodstock protocol.

Table 4.4. Numbers of male and female wild and hatchery sockeye collected for broodstock, 1989-2011. Ratios of males to females are also provided.

Return year	Number of wild sockeye			Number of hatchery sockeye			Total M/F ratio
	Males (M)	Females (F)	M/F	Males (M)	Females (F)	M/F	
1989	162	137	1.18:1.00	0	0	-	1.18:1.00
1990	177	156	1.13:1.00	0	0	-	1.13:1.00
1991	260	97	2.68:1.00	0	0	-	2.68:1.00

Return year	Number of wild sockeye			Number of hatchery sockeye			Total M/F ratio
	Males (M)	Females (F)	M/F	Males (M)	Females (F)	M/F	
1992	180	182	0.99:1.00	0	0	-	0.99:1.00
1993	130	177	0.73:1.00	0	0	-	0.73:1.00
1994	162	167	0.97:1.00	1	4	0.25:1.00	0.95:1.00
1995	102	116	0.88:1.00	1	2	0.50:1.00	0.87:1.00
1996	150	161	0.93:1.00	0	0	-	0.93:1.00
1997	139	144	0.97:1.00	10	9	1.11:1.00	0.97:1.00
1998	115	110	1.05:1.00	2	4	0.50:1.00	1.03:1.00
1999	22	68	0.32:1.00	37	23	1.61:1.00	0.65:1.00
2000	155	101	1.53:1.00	3	2	1.50:1.00	1.53:1.00
2001	114	138	0.83:1.00	4	4	1.00:1.00	0.83:1.00
2002	128	129	0.99:1.00	0	0	-	0.99:1.00
2003	161	100	1.61:1.00	0	0	-	1.61:1.00
2004	108	103	1.05:1.00	0	0	-	1.05:1.00
2005	130	113	1.15:1.00	0	0	-	1.15:1.00
2006	130	130	1.00:1.00	0	0	-	1.00:1.00
2007	127	121	1.05:1.00	0	0	-	1.05:1.00
2008	127	131	0.97:1.00	1	1	1.00:1.00	0.97:1.00
2009	133	125	1.06:1.00	0	3	0.00:1.00	1.04:1.00
2010	127	129	0.98:1.00	0	0	-	0.98:1.00
2011	106	98	1.08:1.00	0	0	-	1.08:1.00
Total	***2,074***	***2,017***	***1.03:1.00***	***58***	***48***	***1.21***	***1.03:1.00***

Fecundity

Fecundities for the 2010 and 2011 returns of sockeye salmon averaged 2,782 and 2,960 eggs per female, respectively (Table 4.5). Fecundities for this program between 1989 and 2006 are based upon the total (pooled) number of eyed eggs divided by the number of females spawned. For brood years 2007 to present, mean fecundities were derived from individual fecundities.

Table 4.5. Mean fecundity of female sockeye salmon collected for broodstock, 1989-2011. Fecundities were determined from pooled egg lots and were not identified for individual females.

Return year	Mean fecundity
1989	2,344
1990	2,225
1991	2,598
1992	2,341
1993	2,340
1994	2,798
1995	2,295
1996	2,664

Return year	Mean fecundity
1997	2,447
1998	2,813
1999	2,319
2000	2,673
2001	2,960
2002	2,856
2003	3,511
2004	2,505
2005	2,718
2006	2,656
2007	3,115
2008	2,555
2009	2,459
2010	2,782
2011	2,960
Average	***2,649***

4.2 Hatchery Rearing

Rearing History

Number of eggs taken

Based on the unfertilized egg-to-release survival standard of 81%, a total of 246,914 eggs are required to meet the program release goal of 200,000 smolts. From 1989 to 2011, the egg take goal was reached in 65% of the years (Table 4.6). Because the Wenatchee sockeye program ended with the release of juveniles in 2012, there is no collection or rearing history for brood year 2012.

Table 4.6. Numbers of eggs taken from sockeye broodstock, 1989-2011.

Return year	Number of eggs taken
1989	133,600
1990	326,267
1991	231,254
1992	381,561
1993	231,700
1994	338,562
1995	247,900
1996	314,390
1997	254,459
1998	163,278
1999	190,732

Return year	Number of eggs taken
2000	227,234
2001	301,925
2002	356,982
2003	319,470
2004	225,499
2005	211,985
2006	292,136
2007	302,363
2008	316,476
2009	304,963
2010	278,171
2011	290,046
Average	***271,389***

Number of acclimation days

Wenatchee sockeye have only been acclimated on Lake Wenatchee water. For brood years 1989 through 1998, unfed fry were transferred from Eastbank FH to Lake Wenatchee Net Pens until release (Table 4.7). For brood years 1999 to 2011, juvenile sockeye were reared at Eastbank Fish Hatchery until July in an effort to increase growth before release.

Table 4.7. Water source and mean acclimation period for Wenatchee sockeye, brood years 1989-2011.

Brood year	Release year	Transfer date	Release date	Number of Days	Water source
1989	1990	5-Apr	24-Oct	202	Lake Wenatchee
1990	1991	10-Apr	19-Oct	192	Lake Wenatchee
1991	1992	1-Apr	20-Oct	202	Lake Wenatchee
1992	1993	5-Apr	7-Sep	155	Lake Wenatchee
		5-Apr	26-Oct	204	Lake Wenatchee
1993	1994	5-Apr	1-Sep	149	Lake Wenatchee
		5-Apr	17-Oct	195	Lake Wenatchee
1994	1995	4-Apr	15-Sep	164	Lake Wenatchee
		4-Apr	23-Oct	202	Lake Wenatchee
1995	1996	4-Apr	25-Oct	204	Lake Wenatchee
1996	1997	4-Apr	22-Oct	201	Lake Wenatchee
1997	1998	1-Apr	9-Nov	222	Lake Wenatchee
1998	1999	1-Apr	29-Oct	211	Lake Wenatchee
1999	2000	25-Jul	28-Aug	34	Lake Wenatchee
		26-Jul	1-Nov	98	Lake Wenatchee

Brood year	Release year	Transfer date	Release date	Number of Days	Water source
2000	2001	2-Jul	27-Aug	56	Lake Wenatchee
		3-Jul	27-Sep	86	Lake Wenatchee
2001	2002	15-Jul	28-Aug	44	Lake Wenatchee
		16-Jul	22-Sep	68	Lake Wenatchee
2002	2003	30-Jun	25-Aug	56	Lake Wenatchee
		1-Jul	22-Oct	113	Lake Wenatchee
2003	2004	6-Jul	25-Aug	50	Lake Wenatchee
		7-Jul	3-Nov	119	Lake Wenatchee
2004	2005	5-Jul	29-Aug	55	Lake Wenatchee
		6-Jul	2-Nov	120	Lake Wenatchee
2005	2006	11-Jul	30-Oct	111	Lake Wenatchee
2006	2007	9-10 Jul	31-Oct	113-114	Lake Wenatchee
2007	2008	7-8 Jul	29-Oct	113-114	Lake Wenatchee
2008	2009	21-Jul	28-Oct	100	Lake Wenatchee
2009	2010	19-20, 23-Jul	27-Oct	97-101	Lake Wenatchee
2010	2011	6, 11-12-Jul	26-Oct	107-113	Lake Wenatchee
2011	2012	9-10-Jul	29-Oct	112-113	Lake Wenatchee

Release Information

Numbers released

The 2011 Wenatchee sockeye program achieved 121.0% of the 200,000 target goal with about 241,918 fish being released (Table 4.8).

Table 4.8. Total number of sockeye parr released and numbers of released fish with CWTs and PIT tags for brood years 1989-2011. The release target for sockeye is 200,000 fish.

Brood year	Release year	CWT mark rate	Number of released fish with PIT tags	Number released
1989	1990	Not marked	0	108,400
1990	1991	0.9308	0	270,802
1991	1992	0.8940	0	167,523
1992	1993	0.9240	0	340,597
1993	1994	0.7278	0	190,443
1994	1995	0.8869	0	252,859
1995[a]	1996	1.0000	0	150,808
1996[a]	1997	0.9680	0	284,630
1997[a]	1998	0.9642	0	197,195

Brood year	Release year	CWT mark rate	Number of released fish with PIT tags	Number released
1998[a]	1999	0.8713	0	121,344
1999	2000	0.9527	0	167,955
2000	2001	0.9558	0	190,174
2001	2002	0.9911	0	200,938
2002	2003	0.9306	0	315,783
2003	2004	0.9291	0	240,459
2004	2005	0.8995	0	172,923
2005	2006	0.9811	14,791	140,542
2006	2007	0.9735	14,764	225,670
2007	2008	0.9863	14,947	252,133
2008	2009	0.9576	14,858	154,772
2009	2010	0.9847	14,486	227,743
2010	2011	0.9564	5,039	243,260
2011	2012	0.9690	5,074	241,918
Average		***0.9379***	***11,994[b]***	***211,255***

[a] These groups were only adipose fin clipped.
[b] Average is based on brood years 2005 to present.

Numbers tagged

About 96.9% of the hatchery sockeye released in 2012 were CWT and adipose fin clipped (Table 4.8). In addition, a total of 5,100 juvenile sockeye were PIT tagged at the Eastbank Hatchery on 14 June. These fish were transported to the Lake Wenatchee net pens in July and released into the lake on 29 October 2012. At the time of release, a total of 14 fish had died and 12 others had shed their tags. Thus, the total number of PIT-tagged sockeye released into the lake was 5,074 (Table 4.8).

Fish size and condition at release

The 2010 brood sockeye were released as parr in 2011 and emigrated as yearling smolts in spring of 2012. Size at release was 99.2% and 135% of the fork length and weight goals, respectively. The 2010 brood year was over the target CV for length by 58.9% (Table 4.9).

Table 4.9. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of sockeye released, brood years 1989-2011. Size targets are provided in the last row of the table.

Brood year	Release year	Fork length (mm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
1989	1990	128	-	18.2	25
1990	1991	131	-	18.9	24
1991	1992	117	3.0	20.6	22
1992	1993	73	6.8	4.2	44

Brood year	Release year	Fork length (mm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
1993	1994	103	-	13.6	40
1994	1995	75	6.1	4.5	38
1995	1996	137	8.2	14.7	30
1996	1997	107	5.6	15.1	30
1997	1998	122	6.1	21.3	21
1998	1999	112	5.4	17.0	27
1999	2000	94	9.5	9.5	48
		134	11.5	31.3	15
2000	2001	123	6.5	22.3	20
		146	8.4	26.0	12
2001	2002	118	7.4	20.7	22
		135	7.3	30.5	15
2002	2003	73	5.6	4.4	104
		118	7.7	13.7	23
		145	9.4	38.6	13
2003	2004	79	4.6	4.8	96
		118	5.9	17.0	26
		158	8.1	44.3	10
2004	2005	116	4.5	17.2	18
		151	7.0	39.3	12
2005	2006	149	7.5	43.7	10
2006	2007	138	10.6	32.4	14
2007	2008	137	9.3	33.0	14
2008	2009	138	9.6	34.6	13
2009	2010	143	8.9	35.5	13
2010	2011	132	14.3	30.7	15
2011	2012	142	9.6	35.3	13
Targets		***133***	***9.0***	***22.7***	***20***

Survival Estimates

The survival for the 2011 brood from green (unfertilized) egg to release was above the standard set for the program (Table 4.10). Higher than expected survivals in all life stages contributed to the increased program performance.

Table 4.10. Hatchery life-stage survival rates (%) for sockeye salmon, brood years 1989-2011. Survival standards or targets are provided in the last row of the table.

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
1989	41.6	100.0	88.1	63.9	99.2	98.9	98.1	65.2	83.0
1990	96.2	99.4	90.8	96.3	99.9	99.2	98.4	98.4	81.1
1991	91.8	94.1	79.2	94.8	99.8	99.3	96.4	96.4	72.4
1992	91.1	98.8	92.3	98.0	99.9	99.8	98.6	98.8	89.2
1993	57.1	99.2	89.2	98.3	99.6	99.1	93.7	93.8	82.2
1994	89.8	99.2	79.2	96.0	99.5	98.6	98.3	98.2	74.7
1995	97.5	99.1	87.5	95.0	99.0	93.3	73.2	73.2	60.8
1996	99.2	100.0	95.1	98.7	99.7	99.3	96.4	96.5	90.5
1997	92.8	99.3	84.8	97.9	97.9	97.6	95.5	94.9	77.5
1998	75.4	95.5	77.7	98.4	98.6	98.2	97.1	97.2	74.3
1999	92.3	100.0	92.2	97.3	99.6	99.3	98.2	99.7	88.1
2000	84.5	98.1	93.8	97.7	96.7	96.1	91.4	96.8	83.7
2001	75.4	99.2	78.5	97.6	98.0	97.6	86.9	95.1	66.6
2002	100.0	100.0	95.7	97.8	99.6	99.2	94.6	99.8	88.5
2003	91.0	98.1	87.2	96.9	99.0	98.2	94.8	95.5	74.6
2004	88.7	92.6	88.0	93.1	97.9	97.4	93.7	96.1	76.7
2005	98.5	98.5	85.3	94.9	97.8	96.6	95.5	99.2	66.3
2006	95.3	99.1	73.2	85.4	95.4	94.6	87.8	98.5	54.9
2007	88.4	99.2	89.1	98.6	97.0	95.9	94.9	99.0	83.4
2008	97.0	100.0	59.0	88.3	99.1	97.2	93.8	97.4	48.9
2009	95.8	98.3	89.1	94.8	96.9	96.2	88.4	92.3	74.7
2010	99.0	98.0	92.6	98.2	97.5	96.5	95.6	99.6	87.0
2011	100.0	100.0	92.6	100.0	96.8	96.0	95.4	99.7	88.3
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

4.3 Disease Monitoring

Rearing of the 2010 and 2011 brood sockeye was typical to previous years with fish being held on Lake Wenatchee water in net pens for 107-113 and 112-113 days, respectively, before being released directly into the lake. No significant disease-related mortality occurred during the rearing of the 2010 or 2011 brood sockeye.

4.4 Natural Juvenile Productivity

During 2012, juvenile sockeye salmon were sampled at the Upper Wenatchee trap.

Emigrant and Smolt Estimates

Upper Wenatchee Trap

In 2012, the Upper Wenatchee Trap was relocated to RM 50.7, about two miles upstream from the confluence with the Chiwawa River. The trap operated nightly between 31 March and 5 September 2012. During the five-month sampling period, a total of 603 wild sockeye and 45 hatchery sockeye smolts were captured at the Upper Wenatchee Trap. Because of low capture numbers and no successful mark-recapture trials, a total emigrant estimate could not be calculated for the 2012 trapping season (Table 4.11). This was the six brood year since 1999 that all hatchery sockeye parr were released at a similar size and time. Monthly captures of all fish at the Upper Wenatchee Trap are reported in Appendix B.

Table 4.11. Estimated numbers of wild and hatchery sockeye smolts that emigrated from Lake Wenatchee during run years 1997-2012.

Run year	Numbers of sockeye smolts	
	Wild smolts	**Hatchery smolts**
1997	55,359	28,828
1998	1,447,259	55,985
1999	1,944,966	112,524
2000	985,490	24,684
2001	39,353	94,046
2002	729,716	121,511
2003	5,439,032	140,322
2004	5,771,187	216,023
2005	723,413	122,399
2006	1,266,971	159,500
2007	2,797,313	140,542
2008[a]	549,682	121,843
2009[a]	355,549	119,908
2010[a]	3,958,888	126,326
2011	1,500,730	159,089
2012[b]	NA	NA
Average	***1,837,661***	***116,235***

[a] Estimates refined based on PIT tag survival to McNary Dam.
[b] Because of low numbers of sockeye captured and unsuccessful mark-recapture trials, no estimates are available for 2012.

Age classes of wild sockeye smolts were determined from a length frequency analysis based on scales collected randomly each year since 1997 (Table 4.12). For the available run years, most wild sockeye smolts migrated as age 1+ fish. Only in two years (1997 and 2005) did more smolts migrate as age 2+ fish. Relatively few smolts migrated at age 3+.

Table 4.12. Age structure and estimated number of wild sockeye smolts that emigrated from Lake Wenatchee, 1997-2012.

Run year	Proportion of wild smolts			Total wild emigrants
	Age 1+	Age 2+	Age 3+	
1997	0.075	0.906	0.019	55,359
1998	0.955	0.037	0.008	1,447,259
1999	0.619	0.381	0.000	1,944,966
2000	0.599	0.400	0.001	985,490
2001	0.943	0.051	0.006	39,353
2002	0.961	0.039	0.000	729,716
2003	0.740	0.026	0.000	5,439,032
2004	0.929	0.071	0.000	5,771,187
2005	0.230	0.748	0.022	723,413
2006	0.994	0.006	0.000	1,266,971
2007	0.996	0.004	0.000	2,797,313
2008	0.804	0.195	0.001	549,682
2009	0.927	0.073	0.000	355,549
2010	0.963	0.036	0.001	3,958,888
2011	0.786	0.214	0.000	1,500,730
2012*	0.700	0.300	0.000	NA
Average	***0.810***	***0.172***	***0.003***	***1,964,968***

* Ages have not been confirmed with scale analysis and no total emigrant estimate is available.

Freshwater Productivity

Egg-smolt survival estimates for wild sockeye salmon are provided in Table 4.13. Estimates of egg deposition were calculated based on the spawner escapement at Tumwater Dam and the sex ratio and fecundity of the broodstock. Egg-smolt survival rates for brood years 1995-2008 have ranged from 0.012 to 0.212 (mean = 0.091).

Table 4.13. Estimated egg deposition (estimated as mean fecundity times estimated number of females), numbers of smolts, and survival rates for wild Wenatchee sockeye salmon, 1995-2011; NA = not available.

Brood year	Number of females	Mean fecundity	Total eggs	Numbers of wild smolts				Egg-smolt survival
				Age 1+	Age 2+	Age 3+	Total	
1995	2,136	2,295	4,902,120	4,174	53,549	0	57,723	0.012
1996	3,767	2,664	10,035,288	1,382,133	741,032	985	2,124,150	0.212
1997	5,404	2,447	13,223,588	1,203,934	394,196	236	1,598,366	0.121
1998	2,024	2,813	5,693,512	590,309	2,007	0	592,316	0.104
1999	513	2,319	1,189,647	37,110	28,459	0	65,569	0.055
2000	11,413	2,673	30,506,949	701,257	1,414,148	0	2,115,405	0.069
2001	21,685	2,960	64,187,600	4,024,884	409,754	15,915	4,450,553	0.069

Brood year	Number of females	Mean fecundity	Total eggs	Numbers of wild smolts				Egg-smolt survival
				Age 1+	Age 2+	Age 3+	Total	
2002	17,226	2,856	49,197,456	5,361,433	541,113	0	5,902,546	0.120
2003	2,158	3,511	7,576,738	166,385	7,602	0	173,987	0.023
2004	15,469	2,505	38,749,845	1,259,369	11,189	275	1,270,833	0.033
2005	5,867	2,718	15,946,506	2,786,123	107,243	0	2,893,366	0.181
2006	2,747	2,656	7,296,032	442,164	25,919	1,507	469,590	0.064
2007	2,001	3,115	6,232,804	329,629	142,916	594	473,139	0.076
2008	11,775	2,555	30,084,691	3,814,226	320,567	0	4,134,794	0.137
2009	3,939	2,459	9,684,965	1,179,569	NA	NA	NA	NA
2010[a]	11,918	2,785	33,190,467	NA	NA	NA	NA	NA
2011[b]	9,722	2,970	28,873,491	NA	NA	NA	NA	NA
Average	***7,633***	***2,724***	***20,974,806***	***1,552,180***	***299,978***	***1,394***	***1,880,167***	***0.091***

[a] There is no emigrant estimate for trapping during 2012.
[b] The 2011 brood year will be trapped in 2013.

Juvenile survival rates for hatchery sockeye salmon are provided in Table 4.14. Release-smolt survival rates for brood years 1995-2010 have ranged from 0.000 to 1.000 (mean = 0.570). Egg-smolt survival rates for the same brood years ranged from 0.000 to 0.710 (mean = 0.294). On average, egg-smolt survival of hatchery sockeye is about three times greater than egg-smolt survival of wild sockeye.

Table 4.14. Juvenile survival rates for hatchery Wenatchee sockeye, brood years 1995-2010.

Brood year	Number of eggs	Number of parr released	Date of release	Estimated number of smolts	Egg-smolt survival	Release-smolt survival
1995	247,900	150,808	10/25/96	28,828	0.116	0.191
1996	314,390	284,630	10/22/97	55,985	0.178	0.197
1997	254,459	197,195	11/9/98	112,524	0.442	0.571
1998	163,278	121,344	10/27/99	24,684	0.151	0.203
1999	190,732	84,466	8/28/00	30,326	0.159	0.359
		83,489	11/1/00	63,720	0.334	0.763
2000	227,234	92,055	8/27/01	30,918	0.136	0.336
		98,119	9/27/01	90,593	0.399	0.923
2001	301,925	96,486	8/28/02	36,484	0.121	0.378
		104,452	9/23/02	103,838	0.344	0.994
2002	356,982	98,509	6/16/03	5,192	0.015	0.053
		104,855	8/25/03	98,412	0.276	0.939
		112,419	10/22/03	112,419	0.315	1.000
2003	319,470	32,755	6/15/04	0	0.000	0.000
		104,879	8/25/04	19,574	0.061	0.187
		102,825	11/3/04	102,825	0.322	1.000
2004	225,499	81,428	8/29/05	159,500	0.707	0.922

Brood year	Number of eggs	Number of parr released	Date of release	Estimated number of smolts	Egg-smolt survival	Release-smolt survival
		91,495	11/2/05			
2005	211,985	70,386	10/30/06	140,542	0.663	1.000
		70,156	10/30/06			
2006	292,136	225,670	10/31/07	121,843	0.412	0.540
2007	302,363	252,133	10/29/08	119,908	0.397	0.476
2008	316,476	154,772	10/28/09	126,326	0.399	0.813
2009	304,963	227,743	10/27/10	159,089	0.522	0.699
2010[a]	278,171	243,260	10/26/11	NA	NA	NA

[a] There is no emigrant estimate for the 2010 brood year.

PIT Tagging Activities

No wild juvenile sockeye salmon were PIT tagged and released in 2012 at the Upper Wenatchee Trap. Numbers of wild sockeye salmon PIT-tagged and released as part of the Comparative Survival Study during the period 2006-2012 are shown in Table 4.15. See Appendix C for a complete list of all fish captured, tagged, lost, and released.

Table 4.15. Summary of the numbers of wild sockeye salmon that were tagged and released at different locations within the Wenatchee River basin, 2006-2012.

Sampling Location	Numbers of PIT-tagged sockeye salmon released						
	2006	2007	2008	2009	2010	2011	2012
Upper Wenatchee Trap	0	0	3,165	3,683	10,006	0	0

4.5 Spawning Surveys

Spawning surveys were conducted in the Little Wenatchee River from 27 August to 4 October 2012. Spawning surveys in 2012 only included counting numbers of live sockeye spawners. The last redd counts were conducted in 2007 (see Appendix H for more details).

Spawn Timing

Sockeye began spawning during the first week of September and peaked around the third week of September (Figure 4.1). Peak spawning was determined using the total number of spawners observed on the spawning grounds in the Little Wenatchee River.

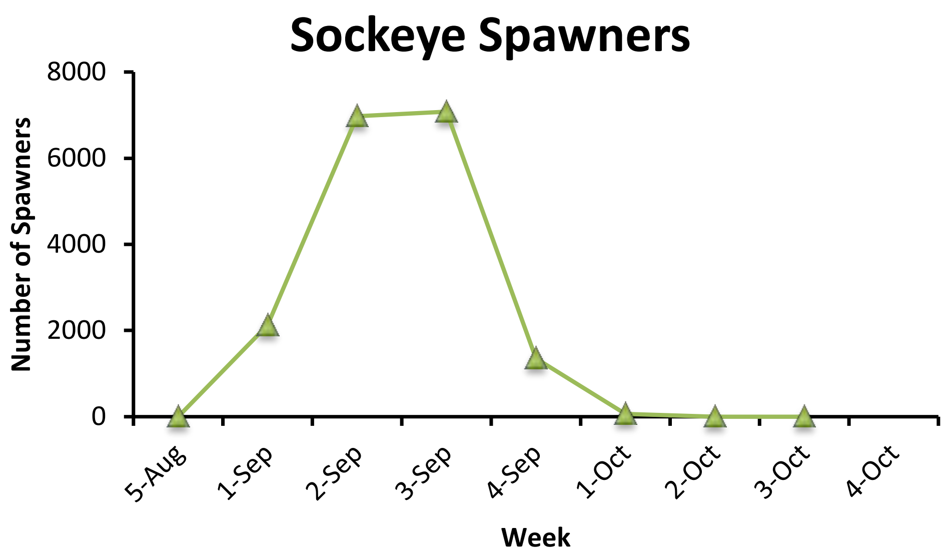


Figure 4.1. Numbers of sockeye spawners counted during different weeks in the Little Wenatchee River, August through October 2012.

Spawning Escapement

Spawning escapement of sockeye salmon in 2012 was estimated using the area-under-the-curve (AUC) method (i.e., escapement = (AUC/redd residence time) x observer efficiency) and mark-recapture methods. AUC relied on weekly counts of live sockeye in the Little Wenatchee River and assumed a redd residence time of 11 days and an observer efficiency of 100%. The mark-recapture method used PIT tags to estimate sockeye spawning escapement (see Appendix H for more details).

Area-under-the-curve

Based on the AUC approach, the estimated total spawning escapement of sockeye in the Little Wenatchee River basin in 2012 was 5,686 (Table 4.16). No AUC counts were conducted in the White River basin in 2012.

Table 4.16. Peak numbers of live spawners and total spawning escapement estimates for sockeye salmon in the Little Wenatchee River basin, August through October 2012; N/A = not available.

Sampling basin	Peak number of live fish	Spawning escapement
Little Wenatchee	3,891	5,686
White River[a]	N/A	NA
Total	***3,891***	***5,686***

[a] No AUC counts were conducted in the White River basin in 2012 (see Appendix H).

Mark-recapture method

Using mark-recapture methods, the estimated total escapement of sockeye in the Upper Wenatchee River basin in 2012 was 28,473 (Table 4.17). About 84% of the escapement entered the White River Basin (including the Napeequa River).

Table 4.17. Estimated escapement of adult sockeye into the Little Wenatchee and White River basins for return years 2009-2012. Escapement was based on recapture of PIT tagged fish.

Return year	Tumwater Dam count	Recreational harvest	Little Wenatchee escapement	White River escapement	Total spawning escapement
2009	16,034	2,229	576	13,876	14,452
2010	35,821	4,129	2,062	19,542	21,604
2011[a]	18,634	0	2,431	14,582	17,013
2012	66,520	12,107	4,607	23,866	28,473
Average	***34,252***	***4,616***	***2,419***	***17,967***	***20,386***

[a] Spawning escapement in 2011 was calculated using AUC counts and a regression model (Keller and Murauskas 2012).

The spawning escapement of 28,473 Wenatchee sockeye was greater than the overall average of 15,800 (Table 4.18).

Table 4.18. Spawning escapements for sockeye salmon in the Wenatchee River basin for return years 1989-2012; NA = not available. Total escapements before 2003 were based on counts at Tumwater Dam.

Return year	Spawning escapement		
	Little Wenatchee	White	Total
1989	NA	NA	**21,802**
1990	NA	NA	**27,325**
1991	NA	NA	**26,689**
1992	NA	NA	**16,461**
1993	NA	NA	**27,726**
1994	NA	NA	**7,330**
1995	NA	NA	**3,448**
1996	NA	NA	**6,573**
1997	NA	NA	**9,693**
1998	NA	NA	**4,014**
1999	NA	NA	**1,025**
2000	NA	NA	**20,735**
2001	NA	NA	**29,103**
2002	NA	NA	**27,565**
2003	NA	NA	**4,855**
2004	NA	NA	**27,556**
2005	NA	NA	**14,011**
2006	574	5,634	**6,208**
2007	150	1,720	**1,870**
2008	3,491	16,757	**20,248**
2009	763	7,004	**7,767**
2010	2,543	19,157	**21,700**
2011	2,431	14,582	**17,013**
2012	4,607	23,866	**28,473**

Return year	Spawning escapement		
	Little Wenatchee	White	Total
Average	***2,080***	***12,674***	***15,800***

4.6 Carcass Surveys

Carcass surveys were conducted in the Little Wenatchee and White (including the Napeequa River) rivers from 10 September to 9 October 2012.

Number sampled

A total of 8,819 sockeye carcasses were sampled during September through October, 2012, in the Wenatchee River basin (Table 4.19). This is higher than the 1993-2012 average of 3,177 carcasses. Most of the carcasses sampled in 2012 were collected in the White River basin (84.8% or 7,479 carcasses) (Figure 4.2). The remaining 15.2% were sampled in the Little Wenatchee River (1,309 carcasses) and Napeequa River (31 carcasses). Because of sampling bias associated with collecting male carcasses, CWTs were only taken from female carcasses.

Table 4.19. Numbers of sockeye carcasses sampled within different streams/watersheds within the Wenatchee River basin, 1989-2012.

Survey year	Numbers of sockeye carcasses			
	Little Wenatchee	White	Napeequa	Total
1993	90	195	0	**285**
1994	121	165	0	**286**
1995	0	56	0	**56**
1996	43	1,387	3	**1,433**
1997	69	1,425	41	**1,535**
1998	61	524	4	**589**
1999	40	186	0	**226**
2000	821	5,494	0	**6,315**
2001	650	3,127	0	**3,777**
2002	506	7,258	55	**7,819**
2003	86	1,002	14	**1,102**
2004	625	6,960	138	**7,723**
2005	1	7	0	**8**
2006	101	2,158	38	**2,297**
2007	17	363	3	**383**
2008	476	5,132	125	**5,733**
2009	84	3,103	103	**3,290**
2010	217	7,832	70	**8,119**
2011	372	3,322	48	**3,742**
2012	1,309	7,479	31	**8,819**
Average	***284***	***2,859***	***34***	***3,177***

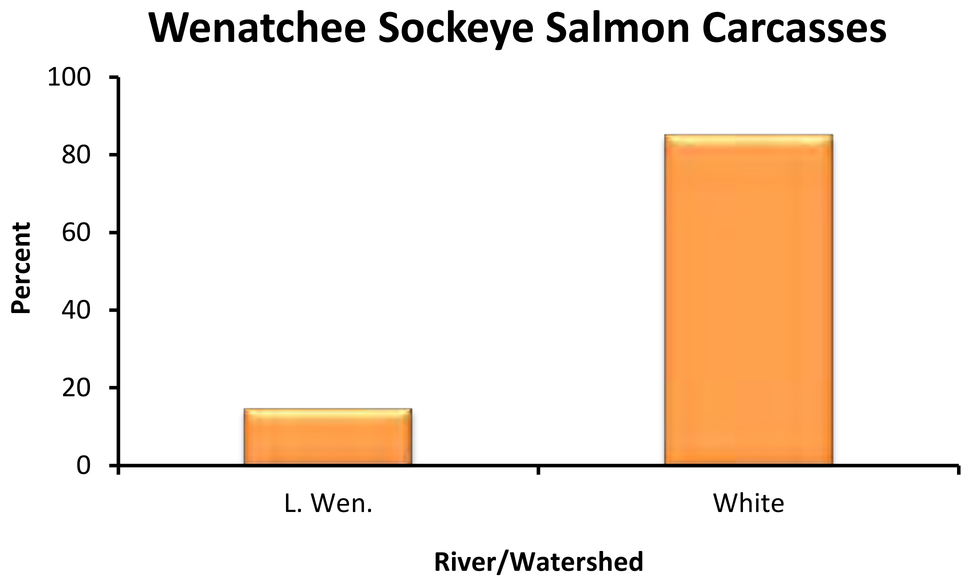


Figure 4.2. Percent of the total number of sockeye carcasses sampled in different streams/watersheds within the Wenatchee River basin during September through October, 2012.

Carcass Distribution and Origin

Sockeye carcasses were not evenly distributed among reaches within survey streams in 2012 (Table 4.20). Carcasses were only found in Reach 2 (Lost Creek to Rainy Creek) on the Little Wenatchee. Most (99%) of the carcasses sampled in the White River basin were in Reach 2 (Sears Creek Bridge to Napeequa River). About 0.4% of the carcasses sampled in the White River basin were in the Napeequa River.

Table 4.20. Numbers of carcasses sampled within different streams/watersheds within the Wenatchee River basin during September through October, 2012.

Stream/watershed	Reach	Total carcasses
Little Wenatchee	Little Wen 1 (L1)	0
	Little Wen 2 (L2)	1,309
	Little Wen 3 (L3)	0
	Total	**1,309**
White	White 1 (H1)	0
	White 2 (H2)	24
	White 3 (H3)	7,455
	Napeequa 1 (Q1)	31
	Total	**7,510**
Grand Total		***8,819***

Based on the available data (1993-2012), the largest percentage of both wild and hatchery sockeye spawned in Reach 2 on the White River (Table 4.21 and Figure 4.3). However, a greater percentage of wild fish was found in Reach 2 than hatchery fish.

Table 4.21. Numbers of wild and hatchery sockeye carcasses sampled within different reaches in the Wenatchee River basin, 1993-2011. Reach codes are described in Table 2.9.

Survey year	Origin	Numbers of sockeye carcasses					
		Little Wenatchee		White River			Total
		L2	L3	H1	H2	Q1	
1993	Wild	86	0	0	183	0	**269**
	Hatchery	4	0	0	12	0	**16**
1994	Wild	112	0	0	155	0	**267**
	Hatchery	9	0	0	9	0	**18**
1995	Wild	0	0	0	55	0	**55**
	Hatchery	0	0	0	1	0	**1**
1996	Wild	41	0	0	1,299	3	**1,343**
	Hatchery	2	0	0	88	0	**90**
1997	Wild	65	0	0	1,411	40	**1,516**
	Hatchery	4	0	0	11	1	**16**
1998	Wild	61	0	0	515	4	**580**
	Hatchery	0	0	0	9	0	**9**
1999	Wild	30	0	0	164	0	**194**
	Hatchery	10	0	0	22	0	**32**
2000	Wild	694	0	3	5,239	0	**5,936**
	Hatchery	127	0	0	252	0	**379**
2001	Wild	625	0	0	3,063	0	**3,688**
	Hatchery	25	0	0	64	0	**89**
2002	Wild	504	0	0	7,207	55	**7,766**
	Hatchery	2	0	0	51	0	**53**
2003	Wild	81	0	0	993	14	**1,088**
	Hatchery	5	0	0	9	0	**14**
2004	Wild	606	0	0	6,755	166	**7,527**
	Hatchery	19	0	0	205	22	**246**
2005	Wild	201	0	5	2,966	21	**3,193**
	Hatchery	1	0	0	8	0	**9**
2006	Wild	80	0	0	2,112	36	**2,228**
	Hatchery	21	0	0	46	2	**69**
2007	Wild	17	0	0	346	3	**366**
	Hatchery	0	0	0	17	0	**17**
2008	Wild	472	0	0	5,118	124	**5,714**
	Hatchery	4	0	0	14	1	**19**
2009	Wild	80	0	0	3,084	103	**3,267**
	Hatchery	4	0	0	19	0	**23**
2010	Wild	210	0	0	7,711	69	**7,990**

Survey year	Origin	Numbers of sockeye carcasses					
		Little Wenatchee		White River			Total
		L2	L3	H1	H2	Q1	
	Hatchery	7	0	0	121	1	**129**
2011	Wild	266	0	0	3,079	43	**3,388**
	Hatchery	106	0	0	243	5	**354**
2012	Wild	1,270	0	21	7,368	30	**8,689**
	Hatchery	39	0	3	87	1	**130**
Average	***Wild***	***275***	***0***	***1***	***2,941***	***36***	***3,253***
	Hatchery	***19***	***0***	***0***	***64***	***2***	***86***

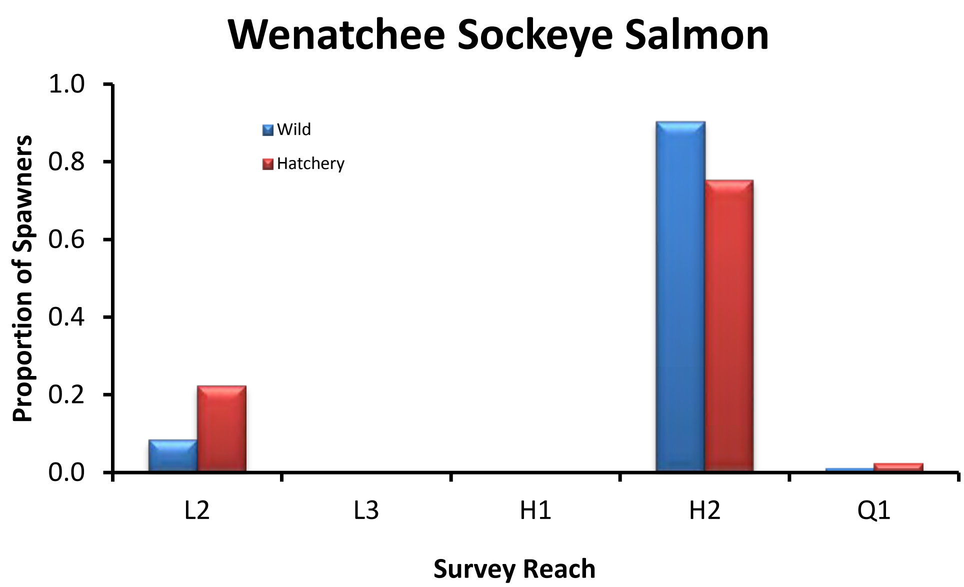


Figure 4.3. Distribution of wild and hatchery produced carcasses in different reaches in the Wenatchee River basin, pooled data from 1993-2012. Reach codes are described in Table 2.9; L = Little Wenatchee, H = White River, and Q = Napeequa River.

Sampling Rate

The sampling rate of sockeye carcasses differed among basins, with a higher sampling rate in the White than in the Little Wenatchee (Table 4.22). Nevertheless, the overall sampling rate for both basins combined exceeded the target of 20%.

Table 4.22. Numbers of carcasses, estimated spawning escapements (based on mark-recapture), and sampling rates for sockeye salmon in the Wenatchee River basin, 2012.

Sampling basin	Total number of carcasses	Total spawning escapement	Sampling rate
Little Wenatchee	1,309	4,607	0.28
White	7,510	23,866	0.32
Total	***8,819***	***28,473***	***0.31***

Length Data

Mean lengths (POH, cm) of male and female hatchery sockeye carcasses sampled during surveys in the Wenatchee River basin in 2012 are provided in Table 4.23. Wild sockeye are sampled at Tumwater Dam, not on the spawning grounds.

Table 4.23. Mean lengths (postorbital-to-hypural length; cm) and standard deviations (in parentheses) of female hatchery sockeye carcasses sampled in different streams/watersheds in the Wenatchee River basin, 2012; N = number of fish sampled, NA = not available. Wild sockeye were sampled at Tumwater Dam.

Stream/watershed	Male		Female	
	N	Length (cm)	N	Length (cm)
Little Wenatchee River	3	40	36	40 (3)
White River	52	41	38	40 (3)
Napeequa River	1	42	0	NA
Wenatchee River	NA	NA	0	NA
Total	***56***	***41***	***74***	***40 (3)***

4.7 Life History Monitoring

Life history characteristics of Wenatchee sockeye were assessed by examining carcasses on spawning grounds and fish sampled at broodstock collection sites, and by reviewing tagging data and fisheries statistics.

Migration Timing

There was little difference in migration timing of hatchery and wild sockeye past Tumwater Dam (Table 4.24a and b; Figure 4.4). On average, early in the run, hatchery and wild sockeye arrived at the dam at about the same time. Toward the end of the migration period, hatchery sockeye tended to arrive at the dam slightly later than did wild sockeye. Most hatchery and wild sockeye migrated upstream past Tumwater Dam during July through early August. The peak migration time for both hatchery and wild sockeye was the last week of July (Figure 4.4).

Table 4.24a. The Julian day and date that 10%, 50% (median), and 90% of the wild and hatchery sockeye salmon passed Tumwater Dam, 1998-2012. The average Julian day and date are also provided. Migration timing is based on video sampling at Tumwater. Data for 1998 through 2003 were based on videotapes and broodstock trapping and may not reflect the actual number of hatchery sockeye salmon. All sockeye were visually examined during trapping from 2004 to present.

Survey year	Origin	Sockeye Migration Time (days)								Sample size
		10 Percentile		50 Percentile		90 Percentile		Mean		
		Julian	Date	Julian	Date	Julian	Date	Julian	Date	
1998	Wild	195	14-Jul	201	20-Jul	208	27-Jul	202	21-Jul	4,173
	Hatchery	196	15-Jul	204	23-Jul	220	8-Aug	206	25-Jul	31
1999	Wild	226	14-Aug	233	21-Aug	241	29-Aug	234	22-Aug	908
	Hatchery	228	16-Aug	234	22-Aug	242	30-Aug	235	23-Aug	264
2000	Wild	200	18-Jul	206	24-Jul	213	31-Jul	207	25-Jul	18,390
	Hatchery	199	17-Jul	206	24-Jul	213	31-Jul	206	24-Jul	2,589

Survey year	Origin	Sockeye Migration Time (days)								Sample size
		10 Percentile		50 Percentile		90 Percentile		Mean		
		Julian	Date	Julian	Date	Julian	Date	Julian	Date	
2001	Wild	189	8-Jul	194	13-Jul	214	2-Aug	198	17-Jul	32,554
	Hatchery	199	18-Jul	212	31-Jul	240	28-Aug	214	2-Aug	79
2002	Wild	204	23-Jul	208	27-Jul	219	7-Aug	210	29-Jul	27,241
	Hatchery	204	23-Jul	209	28-Jul	222	10-Aug	211	30-Jul	580
2003	Wild	194	13-Jul	200	19-Jul	208	27-Jul	201	20-Jul	4,699
	Hatchery	194	13-Jul	201	20-Jul	211	30-Jul	203	22-Jul	375
2004	Wild	191	9-Jul	196	14-Jul	207	25-Jul	198	16-Jul	31,408
	Hatchery	189	7-Jul	194	12-Jul	203	21-Jul	196	14-Jul	1,758
2005	Wild	192	11-Jul	199	18-Jul	227	15-Aug	204	23-Jul	14,176
	Hatchery	187	6-Jul	200	19-Jul	251	8-Sep	212	31-Jul	42
2006	Wild	201	20-Jul	204	23-Jul	214	2-Aug	206	25-Jul	9,151
	Hatchery	202	21-Jul	219	7-Aug	228	16-Aug	215	3-Aug	507
2007	Wild	201	20-Jul	210	29-Jul	227	15-Aug	213	1-Aug	2,542
	Hatchery	205	24-Jul	213	1-Aug	231	19-Aug	216	4-Aug	65
2008	Wild	200	18-Jul	207	25-Jul	219	6-Aug	208	26-Jul	29,229
	Hatchery	201	19-Jul	206	24-Jul	215	2-Aug	208	26-Jul	103
2009	Wild	198	17-Jul	204	23-Jul	213	1-Aug	206	25-Jul	15,552
	Hatchery	199	18-Jul	205	24-Jul	215	3-Aug	207	26-Jul	534
2010	Wild	199	18-Jul	205	24-Jul	220	8-Aug	208	27-Jul	34,519
	Hatchery	200	19-Jul	215	3-Aug	244	1-Sep	218	6-Aug	1,302
2011	Wild	213	1-Aug	216	4-Aug	224	12-Aug	217	5-Aug	17,680
	Hatchery	213	1-Aug	213	1-Aug	231	19-Aug	216	4-Aug	954
2012[a]	Wild	207	25-Jul	212	30-Jul	216	3-Aug	212	30-Jul	21,246
	Hatchery	207	25-Jul	207	25-Jul	228	15-Aug	213	31-Jul	348
Average	Wild	***201***	-	***206***	-	***218***	-	***208***	-	***17,565***
	Hatchery	***202***	-	***209***	-	***226***	-	***212***	-	***635***

[a] The origin of sockeye passing Tumwater Dam during 8 through 11 August 2012 was not assessed. The total number of sockeye passing Tumwater Dam in 2012 was 30,617 adults. Thus, about 9,023 adults of unknown origin passed Tumwater Dam in 2012.

Table 4.24b. The week that 10%, 50% (median), and 90% of the wild and hatchery sockeye salmon passed Tumwater Dam, 1998-2012. The average week is also provided. Migration timing is based on video sampling at Tumwater. Data for 1998 through 2003 were based on videotapes and broodstock trapping and may not reflect the actual number of hatchery sockeye salmon. All sockeye were visually examined during trapping from 2004 to present.

Survey year	Origin	Sockeye Migration Time (week)				Sample size
		10 Percentile	50 Percentile	90 Percentile	Mean	
1998	Wild	28	29	30	29	4,173
	Hatchery	28	30	32	30	31
1999	Wild	33	34	35	34	908
	Hatchery	33	34	35	34	264
2000	Wild	29	30	31	30	18,390
	Hatchery	29	30	31	30	2,589
2001	Wild	27	28	31	29	32,554
	Hatchery	29	31	35	31	79
2002	Wild	30	30	32	30	27,241
	Hatchery	30	30	32	31	580
2003	Wild	28	29	30	29	4,699
	Hatchery	28	29	31	29	375
2004	Wild	28	28	28	29	31,408
	Hatchery	27	28	29	28	1,758
2005	Wild	28	29	33	30	14,176
	Hatchery	27	29	36	31	42
2006	Wild	29	29	31	30	9,151
	Hatchery	29	32	33	31	507
2007	Wild	29	30	33	31	2,542
	Hatchery	30	31	33	31	65
2008	Wild	29	30	32	30	29,229
	Hatchery	29	30	31	30	103
2009	Wild	29	30	31	30	15,552
	Hatchery	29	29	31	30	534
2010	Wild	29	30	32	30	34,519
	Hatchery	29	31	35	32	1,302
2011	Wild	31	31	32	31	17,680
	Hatchery	31	31	33	31	954
2012[a]	Wild	30	31	31	31	21,246
	Hatchery	30	30	33	31	348
Average	Wild	***29***	***30***	***31***	***3***	***17,565***
	Hatchery	***29***	***30***	***33***	***31***	***635***

[a] The origin of sockeye passing Tumwater Dam during 8 through 11 August 2012 was not assessed. The total number of sockeye passing Tumwater Dam in 2012 was 30,617 adults. Thus, about 9,023 adults of unknown origin passed Tumwater Dam in 2012.

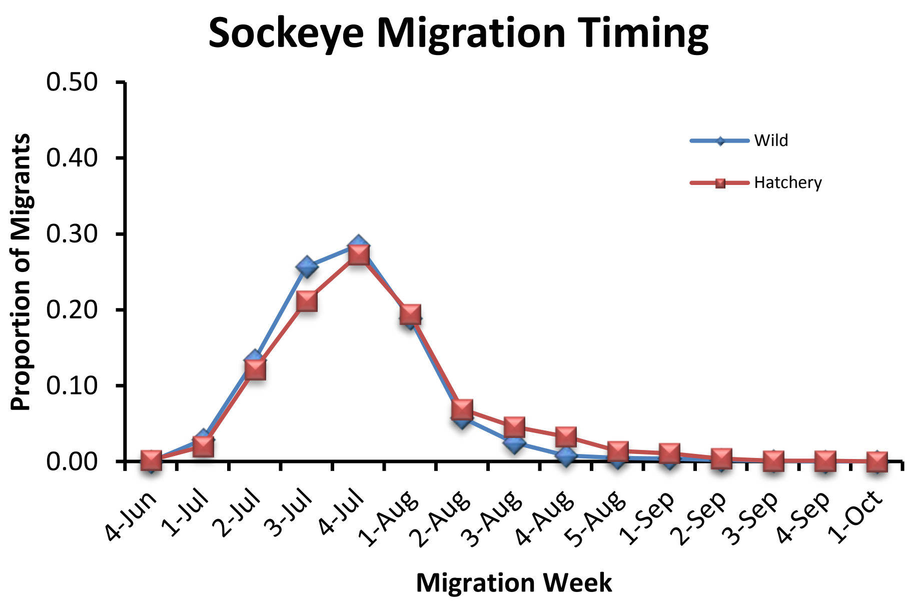


Figure 4.4. Proportion of wild and hatchery sockeye observed (using video) passing Tumwater Dam each week during their migration period late-June through early-October; data were pooled over survey years 1998-2012.

Age at Maturity

Although sample sizes are small, it appears that most hatchery sockeye returned as age-4 fish, while most wild sockeye returned as age-4 and 5 fish (Table 4.25; Figure 4.5). Only wild fish have returned at age-6.

Table 4.25. Proportions of wild and hatchery sockeye of different ages (total age) sampled in broodstock and on spawning grounds, 1994-2012.

Survey year	Origin	Total age						Sample size
		2	3	4	5	6	7	
1994	Wild	-	-	-	-	-	-	0
	Hatchery	0.00	0.00	0.88	0.13	0.00	0.00	16
1995	Wild	-	-	-	-	-	-	0
	Hatchery	0.00	0.00	0.00	1.00	0.00	0.00	1
1996	Wild	-	-	-	-	-	-	0
	Hatchery	0.00	0.00	1.00	0.00	0.00	0.00	82
1997	Wild	-	-	-	-	-	-	0
	Hatchery	0.00	0.00	0.77	0.23	0.00	0.00	13
1998	Wild	0.00	0.08	0.85	0.08	0.00	0.00	26
	Hatchery	0.00	0.00	0.64	0.36	0.00	0.00	11
1999	Wild	0.00	0.00	0.18	0.73	0.10	0.00	113
	Hatchery	0.00	0.00	0.65	0.35	0.00	0.00	31
2000	Wild	0.00	0.00	0.00	1.00	0.00	0.00	1

Survey year	Origin	Total age						Sample size
		2	3	4	5	6	7	
	Hatchery	0.00	0.00	0.98	0.02	0.00	0.00	359
2001	Wild	0.00	0.00	0.76	0.24	0.00	0.00	29
	Hatchery	0.00	0.00	0.75	0.25	0.00	0.00	171
2002	Wild	0.00	0.00	0.20	0.80	0.00	0.00	5
	Hatchery	0.00	0.00	0.29	0.71	0.00	0.00	63
2003	Wild	0.00	0.00	0.00	1.00	0.00	0.00	5
	Hatchery	0.00	0.33	0.67	0.00	0.00	0.00	6
2004	Wild	-	-	-	-	-	-	0
	Hatchery	0.00	0.02	0.93	0.05	0.00	0.00	244
2005	Wild	-	-	-	-	-	-	0
	Hatchery	0.00	0.13	0.75	0.13	0.00	0.00	8
2006	Wild	0.00	0.00	0.34	0.65	0.01	0.00	207
	Hatchery	0.00	0.00	1.00	0.00	0.00	0.00	65
2007	Wild	0.00	0.00	0.02	0.88	0.10	0.00	206
	Hatchery	0.00	0.00	0.35	0.65	0.00	0.00	17
2008	Wild	0.00	0.00	0.95	0.04	0.01	0.00	258
	Hatchery	0.00	0.08	0.92	0.00	0.00	0.00	12
2009	Wild	0.00	0.00	0.79	0.21	0.00	0.00	251
	Hatchery	0.00	0.00	1.00	0.00	0.00	0.00	2
2010	Wild	0.00	0.00	0.67	0.33	0.00	0.00	193
	Hatchery	0.00	0.00	0.98	0.02	0.00	0.00	130
2011	Wild	0.00	0.00	0.63	0.36	0.01	0.00	270
	Hatchery	0.00	0.02	0.96	0.02	0.00	0.00	274
Average	***Wild***	***0.00***	***0.00***	***0.56***	***0.41***	***0.03***	***0.00***	***87***
	Hatchery	***0.00***	***0.01***	***0.89***	***0.10***	***0.00***	***0.00***	***79***

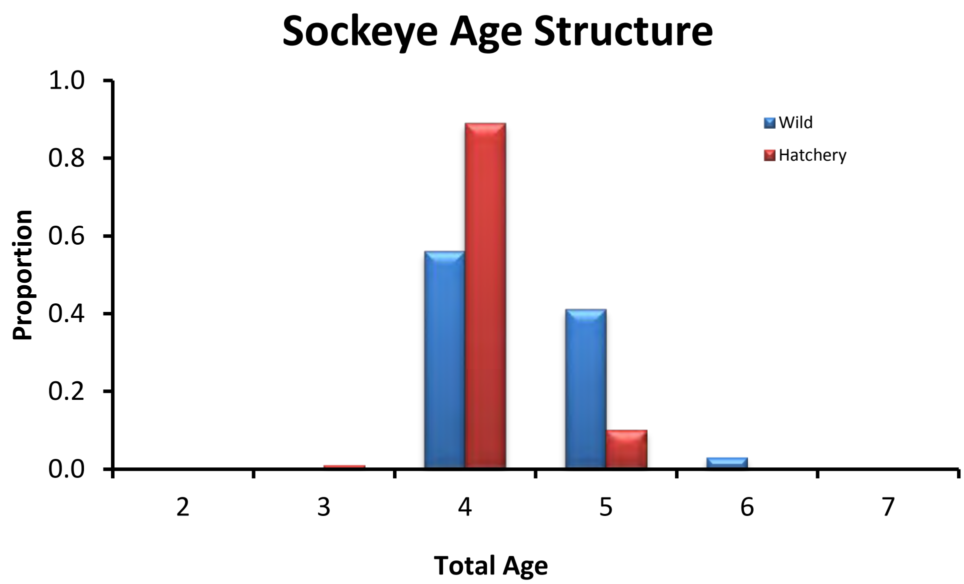


Figure 4.5. Proportions of wild and hatchery sockeye salmon of different total ages sampled at Tumwater Dam and on spawning grounds in the Wenatchee River basin for the combined years 1994-2011.

Size at Maturity

Although sample sizes are small, wild sockeye were larger than hatchery sockeye in 2011 (Table 4.26). This is because more wild sockeye return at age 5, while more hatchery sockeye return at age 4. However, the pooled data indicate that there is little difference in mean sizes of hatchery and wild sockeye salmon sampled in the Wenatchee River basin (Table 4.26). Analyses for the five-year reports will compare sizes of hatchery and wild fish of the same age groups and sex.

Table 4.26. Mean lengths (POH; cm) and variability statistics for wild and hatchery sockeye salmon sampled at Dryden Dam (broodstock) and on spawning grounds in the Wenatchee River basin, 1994-2011; SD = 1 standard deviation.

Survey year	Origin	Sample size	Sockeye length (POH; cm)			
			Mean	SD	Minimum	Maximum
1994	Wild	0	-	-	-	-
	Hatchery	14	42	3	37	47
1995	Wild	0	-	-	-	-
	Hatchery	1	53	-	53	53
1996	Wild	0	-	-	-	-
	Hatchery	5	51	3	49	55
1997	Wild	6	40	3	38	45
	Hatchery	17	41	3	37	50
1998	Wild	585	43	3	34	50
	Hatchery	20	43	3	40	51
1999	Wild	99	42	3	36	50
	Hatchery	31	41	3	36	47

Survey year	Origin	Sample size	Sockeye length (POH; cm)			
			Mean	SD	Minimum	Maximum
2000	Wild	1	48	-	48	48
	Hatchery	377	40	2	30	49
2001	Wild	29	42	2	38	47
	Hatchery	184	43	3	35	51
2002	Wild	5	42	1	40	43
	Hatchery	52	44	3	37	49
2003	Wild	5	44	4	38	47
	Hatchery	13	42	5	30	48
2004	Wild	0	-	-	-	-
	Hatchery	230	40	3	33	49
2005	Wild	0	-	-	-	-
	Hatchery	8	43	9	35	64
2006	Wild	248	45	4	34	52
	Hatchery	17	41	5	31	48
2007	Wild	248	45	3	32	52
	Hatchery	16	41	5	31	48
2008	Wild	261	52	3	44	66
	Hatchery	20	39	3	30	41
2009	Wild	260	43	3	33	53
	Hatchery	22	41	2	36	46
2010	Wild	200	56	3	48	66
	Hatchery	131	41	2	35	45
2011	Wild	277	43	3	35	51
	Hatchery	282	40	3	32	49
Pooled	***Wild***	***2,224***	***45***	***3***	***32***	***66***
	Hatchery	***1,440***	***43***	***4***	***30***	***64***

Contribution to Fisheries

The total number of hatchery and wild sockeye captured in different fisheries is provided in Tables 4.27 and 4.28. Harvest on hatchery-origin sockeye has been less than the harvest on wild sockeye.

Table 4.27. Estimated number and percent (in parentheses) of hatchery-origin Wenatchee sockeye captured in different fisheries, 1989-2006.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational[a] (sport)	
1989	0 (0)	279 (30)	4 (0)	639 (69)	922
1990	0 (0)	23 (100)	0 (0)	0 (0)	23
1991	0 (0)	6 (100)	0 (0)	0 (0)	6
1992	0 (0)	38 (97)	1 (3)	0 (0)	39
1993	0 (0)	4 (100)	0 (0)	0 (0)	4
1994	0 (0)	3 (100)	0 (0)	0 (0)	3
1995	0 (0)	10 (100)	0 (0)	0 (0)	10
1996	0 (0)	62 (82)	9 (12)	5 (7)	76
1997	0 (0)	73 (73)	12 (12)	15 (15)	100
1998	0 (0)	7 (100)	0 (0)	0 (0)	7
1999	0 (0)	3 (20)	0 (0)	12 (80)	15
2000	0 (0)	67 (14)	11 (2)	414 (84)	492
2001	0 (0)	0 (0)	0 (0)	3 (100)	3
2002	0 (0)	16 (100)	0 (0)	0 (0)	16
2003	0 (0)	3 (100)	0 (0)	0 (0)	3
2004	0 (0)	108 (23)	2 (0)	365 (77)	475
2005	0 (0)	63 (32)	8 (4)	126 (64)	197
2006	0 (0)	123 (23)	1 (0)	408 (77)	532

[a] Includes the Lake Wenatchee fishery.

Table 4.28. Estimated number and percent (in parentheses) of wild Wenatchee sockeye captured in different fisheries, 1989-2006.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational[a] (sport)	
1989	0 (0)	2,192 (31)	26 (0)	4,838 (69)	7,056
1990	0 (0)	191 (100)	0 (0)	0 (0)	191
1991	0 (0)	293 (99)	2 (1)	0 (0)	295
1992	0 (0)	345 (99)	5 (1)	0 (0)	350
1993	0 (0)	661 (99)	4 (1)	0 (0)	665
1994	0 (0)	146 (100)	0 (0)	0 (0)	146
1995	0 (0)	63 (86)	3 (4)	7 (10)	73
1996	0 (0)	1,607 (56)	257 (9)	993 (35)	2,857
1997	0 (0)	3,182 (54)	393 (7)	2,266 (39)	5,841
1998	0 (0)	938 (99)	4 (0)	10 (1)	952
1999	0 (0)	25 (21)	3 (3)	90 (76)	118

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational[a] (sport)	
2000	0 (0)	1,349 (21)	187 (3)	4,881 (76)	6,417
2001	0 (0)	827 (100)	0 (0)	0 (0)	827
2002	0 (0)	379 (84)	2 (0)	72 (16)	453
2003	0 (0)	129 (25)	12 (2)	382 (73)	523
2004	0 (0)	1,577 (24)	154 (2)	4,786 (73)	6,517
2005	0 (0)	2,571 (45)	190 (3)	2,899 (51)	5,660
2006	0 (0)	2,800 (52)	104 (2)	2,505 (46)	5,409

[a] Includes the Lake Wenatchee fishery.

Straying

Stray rates were determined by examining CWTs recovered on spawning grounds within and outside the Wenatchee River basin. In addition, PIT tagging of hatchery sockeye, which began with brood year 2005, allows estimation of stray rates by brood return. Targets for strays based on return year (recovery year) outside the Wenatchee River basin should be less than 5%. The target for brood year strays should also be less than 5%.

Based on CWTs and brood year analysis, no hatchery-origin Wenatchee sockeye strayed into non-target spawning areas or hatchery programs before brood year 2006 (Table 4.29). However, several sockeye from brood year 2006 strayed into the Entiat River and a few into the Methow River (non-target streams) and a non-target hatchery (Umpqua Trap) (Table 4.29). Stray rates of Wenatchee sockeye from brood year 2006 exceeded the target of 5%.

Table 4.29. Number and percent of hatchery-origin Wenatchee sockeye that homed to target spawning areas and the target hatchery program, and number and percent that strayed to non-target spawning areas and hatchery programs, by brood years 1990-2006. Hatchery-origin sockeye from brood years 1995-1998 were not tagged because of columnaris disease. Percent stays should be less than 5%.

Brood year	Homing				Straying			
	Target streams		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1990	402	99.5	2	0.5	0	0.0	0	0.0
1991	1	100.0	0	0.0	0	0.0	0	0.0
1992	92	98.9	0	0.0	0	0.0	1	1.1
1993	29	96.7	1	3.3	0	0.0	0	0.0
1994	66	94.3	4	5.7	0	0.0	0	0.0
1995	-	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-
1997	-	-	-	-	-	-	-	-
1998	-	-	-	-	-	-	-	-
1999	65	100.0	0	0.0	0	0.0	0	0.0
2000	571	100.0	0	0.0	0	0.0	0	0.0

Brood year	Homing				Straying			
	Target streams		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
2001	17	100.0	0	0.0	0	0.0	0	0.0
2002	251	100.0	0	0.0	0	0.0	0	0.0
2003	11	100.0	0	0.0	0	0.0	0	0.0
2004	56	100.0	0	0.0	0	0.0	0	0.0
2005	67	97.1	2	2.9	0	0.0	0	0.0
2006	117	41.9	0	0.0	160	57.3	2	0.7
Total	***1,745***	***91.0***	***9***	***0.5***	***160***	***8.3***	***3***	***0.2***

Based on PIT-tag analyses, on average, about 6% of the hatchery sockeye returns were last detected in streams outside the Wenatchee River basin (Table 4.30). The numbers in Table 4.30 should be considered rough estimates because they are not based on confirmed spawning (only last detections) and the numbers have not been adjusted for detection efficiencies, which currently do not exist for PIT-tag detection arrays in tributaries. What these data do indicate is that some hatchery sockeye from the Wenatchee program have wandered or strayed into the Entiat and Methow rivers and possibly into the Okanogan system (based on sockeye detected at Wells Dam but not in the Methow River).

Table 4.30. Number and percent of hatchery-origin Wenatchee sockeye that homed to target spawning areas and the target hatchery program, and number and percent that strayed to non-target spawning areas and hatchery programs for brood years 2005-2007. Estimates were based on last detections of PIT-tagged hatchery sockeye. Percent strays should be less than 5%.

Brood Year	Homing				Straying			
	Target streams		Target hatchery		Non-target stream		Non-target hatchery	
	Number	%	Number	%	Number	%	Number	%
2005	167	92	0	0.0	15	8	0	0.0
2006	421	95	0	0.0	20	5	0	0.0
2007	192	95	0	0.0	10	5	0	0.0
Average	***260***	***94.1***	***0***	***0.0***	***15***	***5.9***	***0***	***0.0***

Genetics

Genetic studies were conducted to determine the potential impacts of the Wenatchee sockeye supplementation program on natural-origin sockeye in the upper Wenatchee River basin (Blankenship et al. 2008; the entire report is appended as Appendix I). Specifically, the objective of the study was to determine if the genetic composition of the Lake Wenatchee sockeye population had been altered by the supplementation program, which was based on the artificial propagation of a small subset of the Wenatchee population. Microsatellite DNA allele frequencies were used to differentiate between temporally replicated collections of natural and hatchery-origin sockeye in the Wenatchee River basin. A total of 13 collections of Wenatchee sockeye were analyzed; eight temporally replicated collections of natural-origin sockeye and five temporally replicated collections of hatchery-origin sockeye. Paired natural-hatchery collections were available from return years 2000, 2001, 2004, 2006, and 2007.

Overall, the study showed that allele frequency distributions were consistent over time, regardless of origin, resulting in small, insignificant measures of genetic differentiation among collections. This indicates that there was no year-to-year differences in allele frequencies between natural and hatchery-origin sockeye. In addition, the analyses found no differences between pre- and post-supplementation collections. Thus, it was concluded that the allele frequencies of the broodstock collections equaled the allele frequency of the natural collections.

Proportion of Natural Influence

Another method for assessing the genetic risk of a supplementation program is to determine the influence of the hatchery and natural environments on the adaptation of the composite population. This is estimated by the proportion of natural-origin fish in the hatchery broodstock (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The ratio pNOB/(pHOS+pNOB) is the Proportion of Natural Influence (PNI). The larger the ratio (PNI), the greater the strength of selection in the natural environment relative to that of the hatchery environment. In order for the natural environment to dominate selection, PNI should be greater than 0.67 (HSRG/WDFW/NWIFC 2004).

For brood years 1989-2011, the PNI has consistently been greater than 0.67 (Table 4.31). This indicates that the natural environment has a greater influence on adaptation of Wenatchee sockeye than does the hatchery environment.

Table 4.31. Proportionate natural influence (PNI) of the Wenatchee sockeye supplementation program for brood years 1989-2011. PNI was calculated as the proportion of naturally produced sockeye in the hatchery broodstock (pNOB) divided by the proportion of hatchery sockeye counted at Tumwater Dam (pHOS) plus pNOB. NOS = number of natural-origin sockeye counted at Tumwater Dam; HOS = number of hatchery-origin sockeye counted at Tumwater Dam; NOB = number of natural-origin sockeye collected for broodstock; and HOB = number of hatchery-origin sockeye included in hatchery broodstock.

Brood year	Spawners[a]			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
1989	21,802	0	0.00	115	0	1.00	1.00
1990	27,325	0	0.00	302	0	1.00	1.00
1991	26,689	0	0.00	199	0	1.00	1.00
1992	16,461	0	0.00	320	0	1.00	1.00
1993	25,064	2,662	0.10	207	0	1.00	0.91
1994	6,929	396	0.05	236	5	0.98	0.95
1995	3,259	186	0.05	194	3	0.98	0.95
1996	6,009	544	0.08	225	0	1.00	0.93
1997	9,597	77	0.01	192	19	0.91	0.99
1998	3,976	32	0.01	122	6	0.95	0.99
1999	905	60	0.06	79	60	0.57	0.90
2000	19,569	1,161	0.06	170	5	0.97	0.94
2001	28,280	815	0.03	200	7	0.97	0.97

Brood year	Spawners[a]			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
2002	27,372	193	0.01	256	0	1.00	0.99
2003	4,797	58	0.01	198	0	1.00	0.99
2004	26,095	1,460	0.05	177	0	1.00	0.95
2005	13,983	28	0.00	166	0	1.00	1.00
2006	9,183	255	0.03	214	0	1.00	0.97
2007	2,320	59	0.02	210	0	1.00	0.98
2008	23,136	93	0.00	243	2	0.99	1.00
2009	13,144	449	0.03	239	0	1.00	0.97
2010	30,357	1,134	0.04	198	0	1.00	0.96
2011	17,490	940	0.05	196	0	1.00	0.95
Average	***15,815***	***461***	***0.03***	***203***	***5***	***0.97***	***0.97***

[a] Proportions of natural-origin and hatchery-origin spawners were determined from video tape at Tumwater Dam.

Natural and Hatchery Replacement Rates

Natural replacement rates (NRR) were calculated as the ratio of natural-origin recruits (NOR) to the parent spawning population. For brood years 1989-2006, NRR in the Wenatchee averaged 1.28 (range, 0.13-4.28) if harvested fish were not included in the estimate and 1.48 (range, 0.14-4.72) if harvested fish were included in the estimate (Table 4.32).

Hatchery replacement rates (HRR) were estimated as hatchery adult-to-adult returns. These rates should be greater than the NRRs and greater than or equal to 5.40 (the calculated target value in Murdoch and Peven 2005). HRRs exceeded NRRs in 12 of the 18 years of data, regardless if harvest was or was not included in the estimates (Table 4.32). Hatchery replacement rates for Wenatchee sockeye have equaled or exceeded the estimated target value of 5.40 in four or five years depending on if harvest was or was not included in the estimate (Table 4.32).

Table 4.32. Broodstock collected, spawning escapements, natural and hatchery-origin recruits (NOR and HOR), and natural and hatchery replacement rates (NRR and HRR; with and without harvest) for sockeye salmon in the Wenatchee River basin, 1989-2006.

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
1989	255	21,802	2757	23,616	10.81	1.08	3680	30,672	14.43	1.41
1990	316	27,325	401	3,509	1.27	0.13	423	3,701	1.34	0.14
1991	233	26,689	95	4,814	0.41	0.18	101	5,110	0.43	0.19
1992	343	16,461	597	5,491	1.74	0.33	636	5,840	1.85	0.35
1993	307	27,726	77	12,224	0.25	0.44	81	12,889	0.26	0.46
1994	270	7,325	46	1,194	0.17	0.16	49	1,340	0.18	0.18
1995	212	3,445	118	839	0.56	0.24	128	914	0.60	0.27
1996	247	6,553	1348	28,049	5.46	4.28	1424	30,904	5.77	4.72
1997	245	9,674	739	36,097	3.02	3.73	839	41,939	3.42	4.34
1998	196	4,008	104	16,166	0.53	4.03	111	17,118	0.57	4.27
1999	207	965	68	566	0.33	0.59	83	685	0.40	0.71

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
2000	200	20,730	1425	29,082	7.13	1.40	1917	35,499	9.59	1.71
2001	253	29,095	24	17,242	0.09	0.59	28	18,069	0.11	0.62
2002	257	27,565	281	5,755	1.09	0.21	297	6,209	1.16	0.23
2003	219	4,855	32	2,070	0.15	0.43	35	2,604	0.16	0.54
2004	202	27,555	1045	23,798	5.17	0.86	1519	30,313	7.52	1.10
2005	207	14,011	463	20,876	2.24	1.49	661	26,536	3.19	1.89
2006	220	9,438	1142	26,966	5.19	2.86	1674	32,375	7.61	3.43
Average	***244***	***15,846***	***598***	***14,353***	***2.53***	***1.28***	***760***	***16,818***	***3.26***	***1.48***

Juvenile-to-Adult Survivals

When possible, both parr-to-adult ratios (PAR) and smolt-to-adult ratios (SAR) were calculated for hatchery sockeye salmon. Ratios were calculated as the number of hatchery adult recaptures divided by the number of tagged hatchery parr released or the estimated number of smolts emigrating from Lake Wenatchee. Survival ratios were based on CWT returns, when available, or on the estimated number of hatchery adults recovered on the spawning grounds, in broodstock, and harvested. For the available brood years, PARs have ranged from 0.0001 to 0.0101 for hatchery sockeye salmon and SARs have ranged from 0.0002 to 0.0254 (Table 4.33).

Table 4.33. Parr-to-adult ratios (PAR) and smolt-to-adult ratios (SAR) for Wenatchee hatchery sockeye salmon, brood years 1990-2005; NA = not available.

Brood year	Number of parr released	Number of smolts	Estimated adult recaptures	PAR	SAR
1989	260,400	NA	3,680	0.0141	NA
1990	372,102	NA	423	0.0011	NA
1991	167,523	NA	101	0.0006	NA
1992	340,557	NA	635	0.0019	NA
1993	190,443	NA	81	0.0004	NA
1994	252,859	NA	49	0.0002	NA
1995	150,808	28,828	128	0.0008	0.0044
1996	284,630	55,985	1,424	0.0050	0.0254
1997	197,195	112,524	839	0.0043	0.0075
1998	121,344	24,684	111	0.0009	0.0045
1999	167,955	94,046	83	0.0005	0.0009
2000	190,174	121,511	1,917	0.0101	0.0158
2001	200,938	140,322	28	0.0001	0.0002
2002	315,783	216,023	297	0.0009	0.0014
2003	240,459	122,399	35	0.0001	0.0003
2004	172,923	159,500	1,519	0.0088	0.0095
2005	140,542	140,542	661	0.0047	0.0047

Brood year	Number of parr released	Number of smolts	Estimated adult recaptures	PAR	SAR
Average	***221,567***	***110,579***	***707***	***0.0032***	***0.0068***

4.8 ESA/HCP Compliance

Broodstock Collection

The 2010 sockeye broodstock collections at Tumwater Dam occurred concurrently with the spring Chinook reproductive success monitoring and evaluation activities (BPA Project No. 2003-039-00) and Wenatchee steelhead broodstock collection activities authorized under ESA permits 1196 and 1395, respectively. No ESA-listed spring Chinook or steelhead take occurred during sockeye broodstock collections at Tumwater Dam that were outside those authorized through ESA Section 10 permits 1196 and 1395.

Hatchery Rearing and Release

The 2010 brood Wenatchee sockeye program released 243,260 juveniles, representing 122% of the production overage allowance in ESA Section 10 Permit 1347.

Hatchery Effluent Monitoring

Per ESA Permits 1196, 1347, and 1395, permit holders shall monitor and report hatchery effluents in compliance with applicable National Pollution Discharge Elimination Systems (NPDES) (EPA 1999) permit limitations. NPDES monitoring and reporting for Chelan PUD Hatchery Programs during 2012 are provided in Appendix F.

Smolt and Emigrant Trapping

ESA-listed spring Chinook and steelhead were encountered during operation of the upper Wenatchee trap. ESA takes are reported in the steelhead (Section 3.8) and spring Chinook (Section 5.8) sections and will not be repeated here.

Spawning Surveys

Sockeye spawning ground surveys conducted in the Wenatchee River basin during 2012 were consistent with ESA Section 10 Permit No. 1347. Because of the difficulty of quantifying the level of take associated with spawning ground surveys, the Permit does not specify a take level associated with these activities, even though it does authorize implementation of spawning ground surveys. Therefore, no take levels are reported. However, to minimize potential effects to established redds, wading was restricted to the extent practical and extreme caution was used to avoid established redds when wading was required.

SECTION 5: WENATCHEE (CHIWAWA) SPRING CHINOOK

Although this section of the report focuses on results from monitoring the Chiwawa spring Chinook program, information on spring Chinook collected throughout the Wenatchee River basin is also provided.

5.1 Broodstock Sampling

This section focuses on results from sampling 2010-2012 Chiwawa spring Chinook broodstock, which were collected at the Chiwawa weir and at Tumwater Dam. Some information for the 2012 return is not available at this time (e.g., age structure and final origin determination). This information will be provided in the 2013 annual report.

Origin of Broodstock

Hatchery-origin adults made up between 35-56% of the Chiwawa spring Chinook broodstock for return years 2010-2012 (Table 5.1). Natural and hatchery-origin adults were collected only at the Chiwawa weir for return year 2012. In previous years, hatchery-origin adults were collected at both Tumwater Dam and the Chiwawa weir. In an effort to partially address straying of Chiwawa spring Chinook to other tributaries in the basin, and secondarily to ensure meeting adult collection quotas, hatchery-origin adults were collected to the greatest extent possible at Tumwater Dam. Natural-origin fish were collected only at the Chiwawa weir. Broodstock were trapped at Tumwater Dam and Chiwawa weir from mid-June through August.

Table 5.1. Numbers of wild and hatchery Chiwawa spring Chinook collected for broodstock, numbers that died before spawning, and numbers of Chinook spawned, 1989-2012. Unknown origin fish (i.e., undetermined by scale analysis, no CWT or fin clips, and no additional hatchery marks) were considered naturally produced. Mortality includes fish that died of natural causes typically near the end of spawning and were not needed for the program or were surplus fish killed at spawning.

Brood year	Wild spring Chinook					Hatchery spring Chinook					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
1989	28	0	0	28	0	0	0	0	0	0	28
1990	19	1	0	18	0	0	0	0	0	0	18
1991	32	0	5	27	0	0	0	0	0	0	27
1992	113	0	0	78	35	0	0	0	0	0	78
1993	100	3	3	94	0	0	0	0	0	0	94
1994	9	0	1	8	0	4	0	0	4	0	12
1995	No Program										
1996	8	0	0	8	0	10	0	0	10	0	18
1997	37	0	5	32	0	83	1	3	79	0	111
1998	13	0	0	13	0	35	1	0	34	0	47
1999	No Program										
2000	10	0	1	9	0	38	1	16	21	0	30
2001	115	2	0	113	0	267	8	0	259	0	372
2002	21	0	1	20	0	63	1	11	51	0	71
2003	44	1	2	41	0	75	2	20	53	0	94
2004	100	1	16	83	0	196	30	34	132	0	215

Brood year	Wild spring Chinook					Hatchery spring Chinook					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
2005	98	1	6	91	0	185	3	1	181	0	279
2006	95	0	4	91	0	303	0	29	224	50	315
2007	45	1	1	43	0	124	2	18	104	0	147
2008	88	2	3	83	0	241	5	16	220	0	303
2009	113	6	11	96	0	151	3	37	111	0	207
2010	83	0	6	77	0	103	0	5	98	0	175
2011	80	0	0	80	0	101	2	6	93	0	173
2012	75	1	1	73	0	41	3	38	0	0	111
Average[a]	*60*	*1*	*3*	*55*	*6*	*92*	*3*	*11*	*76*	*2*	*133*

[a] Origin determinations should be considered preliminary pending scale analyses.

Age/Length Data

Ages were determined from scales and/or coded wire tags (CWT) collected from broodstock. For both the 2010 and 2011 returns, most adults, regardless of origin, were age-4 Chinook (Table 5.2). A larger percentage of the age-5 Chinook were natural-origin fish, whereas a larger percentage of the age-3 fish were hatchery-origin fish.

Table 5.2. Percent of hatchery and wild spring Chinook of different ages (total age) collected from broodstock, 1991-2011.

Return year	Origin	Total age			
		2	3	4	5
1991	Wild	0.0	15.6	59.4	25.0
	Hatchery	0.0	0.0	0.0	0.0
1992	Wild	0.0	0.0	0.0	0.0
	Hatchery	0.0	0.0	0.0	0.0
1993	Wild	0.0	0.0	22.0	78.0
	Hatchery	0.0	0.0	0.0	0.0
1994	Wild	0.0	0.0	28.6	71.4
	Hatchery	0.0	0.0	50.0	50.0
1995	Wild	No program			
	Hatchery				
1996	Wild	0.0	28.6	71.4	0.0
	Hatchery	0.0	50.0	50.0	0.0
1997	Wild	0.0	0.0	87.5	12.5
	Hatchery	0.0	1.2	98.8	0.0
1998	Wild	0.0	0.0	63.6	36.4
	Hatchery	0.0	0.0	62.9	37.1
1999	Wild	No program			
	Hatchery				
2000	Wild	0.0	20.0	70.0	10.0
	Hatchery	0.0	76.3	23.7	0.0

Return year	Origin	Total age			
		2	3	4	5
2001	Wild	0.0	2.8	94.4	2.8
	Hatchery	0.0	1.5	98.5	0.0
2002	Wild	0.0	0.0	66.7	33.3
	Hatchery	0.0	0.0	93.4	6.6
2003	Wild	0.0	27.0	2.7	70.3
	Hatchery	0.0	21.3	5.3	73.3
2004	Wild	1.1	4.3	89.4	5.3
	Hatchery	0.0	36.9	63.1	0.0
2005	Wild	0.0	1.1	84.5	14.4
	Hatchery	0.0	4.3	94.6	1.1
2006	Wild	0.0	1.1	71.1	27.8
	Hatchery	0.0	1.4	81.3	17.3
2007	Wild	2.3	16.3	48.8	32.6
	Hatchery	0.0	27.4	61.5	11.1
2008	Wild	0.0	9.1	75.3	15.6
	Hatchery	0.0	7.9	86.5	5.6
2009	Wild	0.0	8.4	80.0	11.6
	Hatchery	0.0	18.9	77.8	3.3
2010	Wild	0.0	5.4	94.6	0.0
	Hatchery	0.0	1.0	97.0	2.0
2011	Wild	0.0	2.7	52.7	44.6
	Hatchery	0.0	20.6	57.7	21.6
Average	***Wild***	***0.2***	***7.5***	***61.2***	***25.9***
	Hatchery	***0.0***	***14.1***	***58.0***	***12.1***

There was little difference in mean lengths between hatchery and natural-origin broodstock of age-4 and 5 Chinook in 2010 and 2011 (Table 5.3). However, for the 2010 returns, there was a large difference in mean lengths for age-3 hatchery (N = 1) and natural-origin (N = 4) fish.

Table 5.3. Mean fork length (cm) at age (total age) of hatchery and wild spring Chinook collected from broodstock, 1991-2011; N = sample size and SD = 1 standard deviation.

Return year	Origin	Spring Chinook fork length (cm)											
		Age-2			Age-3			Age-4			Age-5		
		Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD
1991	Wild	-	0	-	-	5	-	-	19	-	-	8	-
	Hatchery	-	0	-	-	0	-	-	0	-	-	0	-
1992	Wild	-	0	-	-	0	-	-	0	-	-	0	-
	Hatchery	-	0	-	-	0	-	-	0	-	-	0	-
1993	Wild	-	0	-	-	0	-	79	22	3	92	78	4

Return year	Origin	Spring Chinook fork length (cm)											
		Age-2			Age-3			Age-4			Age-5		
		Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD
	Hatchery	-	0	-	-	0	-	-	0	-	-	0	-
1994	Wild	-	0	-	-	0	-	79	2	3	96	5	6
	Hatchery	-	0	-	-	0	-	82	2	11	91	2	3
1995	Wild	No program											
	Hatchery												
1996	Wild	-	0	-	51	2	1	79	5	7	-	0	-
	Hatchery	-	0	-	56	5	4	74	5	6	-	0	-
1997	Wild	-	0	-	-	0	-	80	28	5	99	4	8
	Hatchery	-	0	-	56	1	-	82	82	4	-	0	-
1998	Wild	-	0	-	-	0	-	78	7	13	83	4	18
	Hatchery	-	0	-	-	0	-	77	22	8	93	13	7
1999	Wild	No program											
	Hatchery												
2000	Wild	-	0	-	51	2	3	82	7	4	98	1	-
	Hatchery	-	0	-	58	29	7	79	9	8	-	0	-
2001	Wild	-	0	-	49	3	6	82	101	6	95	3	3
	Hatchery	-	0	-	56	4	7	83	261	5	-	0	-
2002	Wild	-	0	-	-	0	-	79	12	4	96	6	10
	Hatchery	-	0	-	-	0	-	81	57	6	94	4	9
2003	Wild	-	0	-	55	10	5	83	1	-	99	26	6
	Hatchery	-	0	-	59	16	5	86	4	18	96	55	6
2004	Wild	47	1	-	57	4	4	80	84	5	95	5	9
	Hatchery	-	0	-	49	72	6	79	123	6	-	0	-
2005	Wild	-	0	-	49	1	-	80	82	6	96	14	8
	Hatchery	-	0	-	56	8	5	82	175	6	93	2	2
2006	Wild	-	0	-	48	1	-	80	64	7	96	25	5
	Hatchery	-	0	-	49	4	4	80	240	6	95	51	7
2007	Wild	54	1	-	57	7	10	79	21	6	93	14	7
	Hatchery	-	0	-	59	32	8	81	72	6	93	13	6
2008	Wild	-	0	-	54	7	8	82	58	5	93	12	7
	Hatchery	-	0	-	56	20	10	82	218	6	95	14	6
2009	Wild	-	0	-	53	8	6	81	76	4	95	11	5
	Hatchery	-	0	-	56	29	5	82	119	5	94	5	7
2010	Wild	-	0	-	58	4	9	80	70	6	-	0	-
	Hatchery	-	0	-	84	1	-	82	97	5	98	2	5
2011	Wild	-	0	-	56	2	3	79	39	5	95	33	7
	Hatchery	-	0	-	61	20	6	80	56	4	95	21	6

Sex Ratios

Male spring Chinook in the 2010-2012 return years made up 51%, 50%, and 49.5%, respectively, of the adults collected. This resulted in overall male to female ratios of 1.02:1.00, 1.01:1.00, and 0.90:1.00, respectively (Table 5.4). For the 2012 return year, natural-origin and hatchery-origin fish both consisted of a slightly higher proportion of females than males (Table 5.4).

Table 5.4. Numbers of male and female wild and hatchery spring Chinook collected for broodstock, 1989-2012. Ratios of males to females are also provided.

Return year	Number of wild spring Chinook			Number of hatchery spring Chinook			Total M/F ratio
	Males (M)	Females (F)	M/F	Males (M)	Females (F)	M/F	
1989	11	17	0.65:1.00	-	-	-	0.65:1.00
1990	7	12	0.58:1.00	-	-	-	0.58:1.00
1991	13	19	0.68:1.00	-	-	-	0.68:1.00
1992	39	39	1.00:1.00	-	-	-	1.00:1.00
1993	50	50	1.00:1.00	-	-	-	1.00:1.00
1994	5	4	1.25:1.00	2	2	1.00:1.00	1.17:1.00
1995	No program						
1996	6	2	3.00:1.00	8	2	4.00:1.00	3.50:1.00
1997	14	23	0.61:1.00	34	49	0.69:1.00	0.67:1.00
1998	9	4	2.25:1.00	18	17	1.06:1.00	1.29:1.00
1999	No program						
2000	5	5	1.00:1.00	32	6	5.33:1.00	3.36:1.00
2001	45	70	0.64:1.00	90	177	0.51:1.00	0.55:1.00
2002	9	12	0.75:1.00	30	33	0.91:1.00	0.87:1.00
2003	28	16	1.75:1.00	42	33	1.27:1.00	1.43:1.00
2004	58	42	1.38:1.00	102	94	1.09:1.00	1.18:1.00
2005	58	40	1.45:1.00	89	96	0.93:1.00	1.08:1.00
2006	49	46	1.07:1.00	123	179	0.69:1.00	0.77:1.00
2007	20	25	0.80:1.00	66	58	1.14:1.00	1.04:1.00
2008	41	47	0.87:1.00	109	132	0.83:1.00	0.84:1.00
2009	53	60	0.88:1.00	79	72	1.10:1.00	1.00:1.00
2010	41	42	0.98:1.00	53	50	1.06:1.00	1.02:1.00
2011	38	42	0.90:1.00	53	48	1.10:1.00	1.01:1.00
2012	35	40	0.87:1.00	20	21	0.95:1.00	0.90:1.00
Total	***634***	***657***	***0.96:1.00***	***950***	***1069***	***0.88:1.00***	***0.92:1.00***

Fecundity

Mean fecundities for the 2010-2012 returns of spring Chinook ranged from 4,314-4,385 eggs per female (Table 5.5). These fecundities were less than the overall average of 4,703 eggs per female, but were close to the expected fecundity of 4,400 eggs per female assumed in the broodstock protocol. For the three return years, natural-origin Chinook produced more eggs per female than did hatchery-origin fish (Table 5.5). This could be attributed to differences in size and age of hatchery and natural-origin fish described above.

Table 5.5. Mean fecundity of wild, hatchery, and all female spring Chinook collected for broodstock, 1989-2012; NA = not available.

Return year	Mean fecundity		
	Wild	Hatchery	Total
1989*	NA	NA	2,832
1990*	NA	NA	5,024
1991*	NA	NA	4,600
1992*	NA	NA	5,199[a]
1993*	NA	NA	5,249
1994*	NA	NA	5,923
1995	No program		
1996*	NA	NA	4,645
1997	4,752	4,479	4,570
1998	5,157	5,376	5,325
1999	No program		
2000	5,028	5,019	5,023
2001	4,530	4,663	4,624
2002	5,024	4,506	4,654
2003	6,191	5,651	5,844
2004	4,846	4,775	4,799
2005	4,365	4,312	4,327
2006	4,773	4,151	4,324
2007	4,656	4,351	4,441
2008	4,691	4,560	4,592
2009	4,691	4,487	4,573
2010	4,548	4,114	4,314
2011	4,969	3,884	4,385
2012	4,522	3,682	4,223
Average	***4,850***	***4,534***	***4,704***

* Individual fecundities were not tracked with females until 1997.
[a] Estimated as the mean of fecundities two years before and two years after 1992.

5.2 Hatchery Rearing

Rearing History

Number of eggs taken

Based on the unfertilized egg-to-release survival standard of 81%, a total of 829,630 eggs were required to meet the program release goal of 672,000 smolts for brood years 1989-2010. For the

2011 and 2012 brood years, a total of 367,901 and 252,410 eggs were required to meet the release goals of 298,000 and 204,452 smolts, respectively. Between 1989 and 2012, the egg take goal was reached in one of those years (Table 5.6). The green egg takes for 2010-2012 brood years were 46%, 99.5%, and 99% of program goals, respectively.

ESA Permit 1196 sets limits on the percentage of the total run, natural-origin run, and a minimum contribution of natural-origin fish that must be in the broodstock. Applying these criteria to the low total abundance of spring Chinook salmon to the Chiwawa River basin and the low abundance of natural-origin fish returning to the basin has resulted in the program not meeting production goals.

Table 5.6. Numbers of eggs taken from spring Chinook broodstock, 1989-2012.

Return year	Number of eggs taken
1989	45,311
1990	60,287
1991	73,601
1992	111,624
1993	257,208
1994	35,539
1995	No program
1996	18,579
1997	312,182
1998	90,521
1999	No program
2000	55,256
2001	1,099,630
2002	196,186
2003	247,501
2004	538,176
2005	536,490
2006	744,344
2007	359,739
2008	761,821
2009	564,912
2010	383,944
2011	366,244
2012	250,695
Average	***323,172***

Number of acclimation days

Early rearing of the 2010 brood Chiwawa spring Chinook was similar to previous years with fish being held on well water before being transferred to Chiwawa Ponds for final acclimation. Beginning in 2006 (2005 brood acclimation), modifications were made to the Chiwawa Fish Hatchery intakes so that Wenatchee River water could be applied to the Chiwawa River intakes during severe cold periods to prevent the formation of frazzle ice. During acclimation of the 2010 brood, fish were acclimated for 195 to 212 days on Chiwawa River water, with 88 of those days containing a small percentage of Wenatchee River water to prevent freezing of hatchery intakes (Table 5.7).

Table 5.7. Number of days spring Chinook broods were acclimated and water source, brood years 1989-2010; NA = not available.

Brood year	Release year	Transfer date	Release date	Number of days and water source		
				Total	Chiwawa	Wenatchee
1989	1991	19-Oct	11-May	204	NA	NA
1990	1992	13-Sep	27-Apr	227	NA	NA
1991	1993	24-Sep	24-Apr	212	NA	NA
1992	1994	30-Sep	20-Apr	202	NA	NA
1993	1995	28-Sep	20-Apr	204	NA	NA
1994	1996	1-Oct	25-Apr	207	NA	NA
1995	1997	No Program				
1996	1998	25-Sep	29-Apr	216	NA	NA
1997	1999	28-Sep	22-Apr	206	NA	NA
1998	2000	27-Sep	24-Apr	210	NA	NA
1999	2001	No Program				
2000	2002	26-Sep	25-Apr	211	NA	NA
2001	2003	22-Oct	1-May	191	NA	NA
2002	2004	25-Sep	2-May	220	NA	NA
2003	2005	30-Sep	3-May	215	NA	NA
		30-Sep	18-Apr-18-May	200	NA	NA
2004	2006	3-Sep	1-May	240	88-104	124
		3-Sep	17-Apr-17-May	226	NA	NA
2005	2007	25-Sep	1-May	217	217	98[a]
		26-Sep	16-Apr-15-May	202-232	202-232	98[a]
2006	2008	24-27-Sep	14-Apr-13-May	231	231	95[a]
2007	2009	1-Oct	15-Apr-13-May	223	223	103[a]
2008	2010	14-15-Sep	14-Apr-12-May	212-241	212-241	129
2009	2011	14-15-Sep	26-Apr-19-May	225-249	225-249	88

Brood year	Release year	Transfer date	Release date	Number of days and water source		
				Total	Chiwawa	Wenatchee
2010	2012	3, 5-6-Oct	17-Apr-1-May	195-212	195-212	132

[a] Represents the number of days Wenatchee River water was applied to the Chiwawa River intake screen to prevent the formation of frazzle ice.

Release Information

Numbers released

The 2010 brood Chiwawa spring Chinook program achieved 51.5% of the 672,000 target goal with about 346,248 smolts being released volitionally into the Chiwawa River (Table 5.8).

Table 5.8. Numbers of spring Chinook smolts tagged and released from the hatchery, brood years 1989-2010. The release target for Chiwawa spring Chinook is 672,000 smolts.

Brood year	Release year	Type of release	CWT mark rate	Number released that were PIT tagged	Number of smolts released	Total number of smolts released
1989	1991	Volitional	0.9932	0	43,000	43,000
1990	1992	Volitional	0.9931	0	53,170	53,170
1991	1993	Volitional	0.9831	0	62,138	62,138
1992	1994	Volitional	0.9747	0	85,113	85,113
1993	1995	Volitional	0.9892	0	223,610	223,610
1994	1996	Volitional	0.9967	0	27,226	27,226
1995	1997	No program				
1996	1998	Forced	0.8413	0	15,176	15,176
1997	1999	Volitional	0.9753	0	266,148	266,148
1998	2000	Volitional	0.9429	0	75,906	75,906
1999	2001	No program				
2000	2002	Volitional	0.9920	0	47,104	47,104
2001	2003	Forced	0.9961	0	192,490[a]	377,544
		Volitional	0.9856	0	185,054[a]	
2002	2004	Volitional	0.9693	0	149,668	149,668
2003	2005	Forced	0.9783	0	69,907	222,131
		Volitional	0.9743	0	152,224	
2004	2006	Forced	0.9533	0	243,505	494,517
		Volitional	0.9493	0	251,012	
2005	2007	Forced	0.9882	4,993	245,406	494,012
		Volitional	0.9864	4,988	248,606	
2006	2007	Direct	0.0000	0	12,977[b]	612,482
	2008	Volitional	0.9795	9,894	612,482	
2007	2008	Direct	0.0000	0	9,494	305,542

Brood year	Release year	Type of release	CWT mark rate	Number released that were PIT tagged	Number of smolts released	Total number of smolts released
	2009	Volitional	0.9948	10,035	296,048	
2008	2010	Volitional	0.9835	10,006	609,789	609,789
2009	2011	Forced	0.9874	0	241,181	438,561
		Volitional	0.9874	9,412	197,380	
2010[c]	2012	Volitional	0.9904	5,020	346,248	346,248

[a] This does not include the 226,456 eyed eggs that were planted in the Chiwawa River.
[b] This high ELISA group was only adipose fin clipped and directly planted into Big Meadow Creek in May.
[c] This does not include 18,480 eyed eggs that were culled because of high ELISA.

Numbers tagged

The 2010 brood Chiwawa spring Chinook were 99% CWT and adipose fin clipped (Table 5.8).

In 2012, a total of 10,200 spring Chinook (5,100 HxH and 5,100 WxW Chinook) from the 2011 brood were PIT tagged at the Eastbank Hatchery during 11-12 June. These fish were transferred to the Chiwawa raceway in September. As of the end of January 2013, a total of 251 tagged fish have died and one other shed its tag. This leaves 9,948 (4,969 WxW and 4,979 HxH) tagged spring Chinook alive at the end of January. These fish will be released in the Chiwawa River in spring of 2013. Table 5.9 summarizes the number of hatchery spring Chinook that have been PIT-tagged and released into the Chiwawa River.

Table 5.9. Summary of PIT-tagging activities for Chiwawa hatchery spring Chinook, brood years 2005-2010.

Brood year	Release year	Number of fish tagged	Number of tagged fish that died	Number of tags shed	Number of tagged fish released
2005	2007	10,063	74	8	9,981[a]
2006	2008	10,055	134	27	9,894
2007	2009	10,112	61	16	10,035
2008	2010	10,101	81	14	10,006
2009	2011	10,101	655	34	9,412
2010	2012	5,102	82	0	5,020

[a] This release consisted of 4,988 tagged Chinook that were released volitionally and 4,993 that were forced released.

Fish size and condition at release

Spring Chinook from the 2010 brood were released as yearling smolts between 17 April and 1 May 2012. Size at release was below the target established for the program. The CV for fork length was 10% short of the target (Table 5.10).

Table 5.10. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of spring Chinook smolts released from the hatchery, brood years 1989-2010. Size targets are provided in the last row of the table.

Brood year	Release year	Fork length (mm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
1989	1991	147	4.4	37.8	12
1990	1992	137	5.0	32.4	14
1991	1993	135	4.2	30.3	15
1992	1994	133	5.0	28.4	16
1993	1995	136	4.5	30.2	15
1994	1996	139	7.1	34.4	13
1995	1997	No Program			
1996	1998	157	5.3	52.1	9
1997	1999	146	7.2	38.7	12
1998	2000	143	9.1	39.5	12
1999	2001	No Program			
2000	2002	150	6.8	46.7	10
2001	2003	142	7.1	37.6	12
2002	2004	146	8.5	40.3	11
2003	2005	167[a]	5.9	59.4	8
		151[b]	7.4	44.2	10
2004	2006	146[a]	6.4	39.1	12
		139[b]	5.7	34.3	13
2005	2007	136[a]	4.6	30.8	15
		129[b]	5.8	26.6	17
2006	2008	124	8.8	23.5	19
2007	2008	70[a]	4.0	3.7	122
	2009	140[b]	11.0	33.6	14
2008	2010	141	10.7	36.0	13
2009	2011	167	12.9	56.8	8
2010	2012	129	8.1	25.8	18
Targets		***176***	***9.0***	***37.8***	***12***

[a] Forced release group.
[b] Volitional release group.

Survival Estimates

Overall survival of Chiwawa spring Chinook from green (unfertilized) egg to release was above the standard set for the program (Table 5.11). There was higher than expected survivals in all life stages contributing to increased program performance. Pre-spawn survival of adults was also above the standard set for the program.

Table 5.11. Hatchery life-stage survival rates (%) for spring Chinook, brood years 1989-2010. Survival standards or targets are provided in the last row of the table.

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
1989	100.0	100.0	98.0	99.1	99.1	99.0	96.4	99.3	94.8
1990	100.0	85.7	91.8	98.1	99.5	98.9	97.9	99.2	88.2
1991	100.0	100.0	94.4	96.1	99.6	97.9	93.2	95.0	84.4
1992	100.0	100.0	98.4	96.7	99.9	99.9	80.0	80.6	76.2
1993	96.0	98.0	89.7	98.0	99.7	99.3	98.9	99.7	86.9
1994	100.0	100.0	98.6	100.0	99.8	99.4	77.0	78.9	76.6
1995	No program								
1996	100.0	100.0	88.3	100.0	93.8	93.0	89.9	97.7	81.7
1997	98.6	100.0	93.2	95.7	98.3	99.6	95.6	99.3	85.3
1998	95.2	100.0	94.5	99.0	98.5	98.3	89.6	99.1	83.9
1999	No program								
2000	100.0	100.0	91.0	98.1	97.2	96.6	95.4	99.3	85.2
2001	97.6	97.0	88.9	98.1	99.7	99.6	51.3	51.8	34.3
2002	97.8	100.0	82.1	98.0	97.4	96.7	94.8	99.1	76.3
2003	93.9	100.0	93.2	97.7	99.5	99.3	98.5	98.1	89.7
2004	97.8	82.5	93.3	98.4	98.8	94.3	93.9	97.2	91.9
2005	97.1	100.0	95.9	98.0	99.2	99.0	97.9	99.1	92.1
2006	100.0	100.0	90.1	98.1	99.2	99.0	95.3	97.7	84.2
2007	98.8	97.7	92.9	97.2	99.4	99.0	98.0	99.4	88.5
2008	96.6	99.3	90.8	93.2	97.4	97.1	95.6	97.6	80.0
2009	94.4	97.6	92.5	88.3	97.6	97.4	89.2	92.8	77.6
2010[a]	98.9	100.0	99.2	100.0	97.9	97.5	95.6	98.2	94.8
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

[a] Survival estimates do not include the 18,840 eyed eggs that were culled because of high ELISA levels.

5.3 Disease Monitoring

Results of 2012 adult broodstock bacterial kidney disease (BKD) monitoring indicated that most females (91.7%) had ELISA values less than 0.199. About 93% of females had ELISA values less than 0.120, which would have required about 7% of the progeny to be reared at densities not to exceed 0.06 fish per pound (Table 5.12). As per the HCP Hatchery Committee Agreement, progeny from the four high ELISA females were culled to minimize possible negative effects to the remainder of the program. These progeny represented about 4.9% of the estimated production for the 2012 brood.

For the 2010 brood, mortalities resulting from external fungal infections began increasing shortly after transfer to the Chiwawa Ponds, presumably from bacterial cold water disease (BCWD). Two formalin drip treatments failed to control the infection. A Chloramine-T treatment was initiated, which was successful. No significant health issues were encountered for the remainder of juvenile rearing.

Table 5.12. Proportion of bacterial kidney disease (BKD) titer groups for the Chiwawa spring Chinook broodstock, brood years 1996-2012. Also included are the proportions to be reared at either 0.125 fish per pound or 0.060 fish per pound.

Brood year[a]	Optical density values by titer group				Proportion at rearing densities (fish per pound, fpp)	
	Very Low (≤ 0.099)	Low (0.1-0.199)	Moderate (0.2-0.449)	High (≥ 0.450)	≤ 0.125 fpp (<0.119)	≤ 0.060 fpp (>0.120)
1996	0.0000	0.2500	0.2500	0.5000	0.0000	1.0000
1997	0.1176	0.7353	0.0588	0.0882	0.3529	0.6471
1998	0.1176	0.8235	0.0588	0.0000	0.4706	0.5294
1999	No Program					
2000	0.0000	0.9091	0.0909	0.0000	0.1818	0.8182
2001	0.4066	0.5436	0.0373	0.0124	0.6515	0.3485
2002	0.2195	0.6585	0.0732	0.0488	0.5610	0.4390
2003	0.6957	0.1087	0.0652	0.1304	0.7174	0.2826
2004	0.8182	0.1515	0.0227	0.0076	0.8939	0.1061
2005	0.9084	0.0916	0.0000	0.0000	0.9695	0.0305
2006	0.7222	0.2556	0.0000	0.0222	0.8444	0.1556
2007	0.5854	0.3415	0.0244	0.0488	0.7073	0.2927
2008	0.8304	0.1520	0.0058	0.0117	0.9357	0.0643
2009	0.7600	0.1840	0.0080	0.0480	0.8480	0.1520
2010	0.8791	0.0769	0.0000	0.0439	0.9451	0.0549
2011	0.7640	0.2022	0.0000	0.0337	0.8764	0.1236
2012	0.8333	0.1333	0.0167	0.0167	0.9170	0.0830
Average	*0.5411*	*0.3511*	*0.0445*	*0.0633*	*0.6816*	*0.3184*

[a] Individual ELISA samples were not collected before the 1996 brood.

5.4 Natural Juvenile Productivity

During 2012, juvenile spring Chinook were sampled at the Upper Wenatchee and Chiwawa traps and counted during snorkel surveys within the Chiwawa River basin.

Parr Estimates

A total of 103,940 (±15%) subyearling and 767 (±24%) yearling spring Chinook were estimated in the Chiwawa River Basin in August 2012 (Table 5.13 and 5.14). During the survey period 1992-2012, numbers of subyearling and yearling Chinook have ranged from 5,815 to 141,510 and 5 to 967, respectively, in the Chiwawa River basin (Table 5.13 and 5.14; Figure 5.1). Numbers of all fish counted in the Chiwawa River basin are reported in Appendix A.

Table 5.13. Total numbers of subyearling spring Chinook estimated in different steams in the Chiwawa River basin during snorkel surveys in August 1992-2012; NS = not sampled.

Sample Year	Number of subyearling spring Chinook									
	Chiwawa River	Phelps Creek	Chikamin Creek	Rock Creek	Unnamed Creek	Big Meadow Creek	Alder Creek	Brush Creek	Clear Creek	Total
1992	45,483	NS	NS	NS	NS	NS	NS	NS	NS	**45,483**
1993	77,269	0	1,258	586	NS	NS	NS	NS	NS	**79,113**
1994	53,492	0	398	474	68	624	0	0	0	**55,056**
1995	52,775	0	1,346	210	0	683	67	160	0	**55,241**
1996	5,500	0	29	10	0	248	28	0	0	**5,815**
1997	15,438	0	56	92	0	480	0	0	0	**16,066**
1998	65,875	0	1,468	496	57	506	0	13	0	**68,415**
1999	40,051	0	366	592	0	598	22	0	0	**41,629**
2000	NS	NS	NS	NS	NS	NS	NS	NS	NS	**NS**
2001	106,753	168	2,077	2,855	354	2,332	78	0	0	**114,617**
2002	117,230	75	8,233	2,953	636	5,021	429	0	297	**134,874**
2003	80,250	4,508	1,570	3,255	118	1,510	22	45	0	**91,278**
2004	43,360	102	717	215	54	637	21	71	0	**45,177**
2005	45,999	71	2,092	660	17	792	0	0	0	**49,631**
2006	73,478	113	2,500	1,681	51	1,890	62	127	0	**79,902**
2007	53,863	125	5,235	870	51	538	20	28	22	**60,752**
2008	72,431	214	3,287	4,730	163	1,221	28	255	22	**82,351**
2009	101,085	125	2,486	1,849	14	1,082	29	18	17	**106,705**
2010	117,499	526	4,571	4,052	0	1,449	56	42	25	**128,220**
2011	136,424	64	2,762	1,330	53	581	42	214	40	**141,510**
2012	96,036	78	4,125	2,227	49	1,322	35	31	37	**103,940**
Average	***70,015***	***325***	***2,346***	***1,534***	***94***	***1,195***	***52***	***56***	***26***	***75,289***

Table 5.14. Total numbers of yearling spring Chinook estimated in different steams in the Chiwawa River basin during snorkel surveys in August 1992-2012; NS = not sampled.

Sample Year	Number of yearling spring Chinook									
	Chiwawa River	Phelps Creek	Chikamin Creek	Rock Creek	Unnamed Creek	Big Meadow Creek	Alder Creek	Brush Creek	Y Creek	Total
1992	563	NS	NS	NS	NS	NS	NS	NS	NS	**563**
1993	174	0	0	0	NS	NS	NS	NS	NS	**174**
1994	14	0	0	4	0	0	0	0	0	**18**
1995	13	0	0	0	0	0	0	0	0	**13**
1996	22	0	0	0	0	0	0	0	0	**22**
1997	5	0	0	0	0	0	0	0	0	**5**
1998	63	0	0	0	0	0	0	0	0	**63**
1999	41	0	0	0	0	0	0	0	0	**41**
2000	NS	NS	NS	NS	NS	NS	NS	NS	NS	**NS**
2001	66	0	3	0	0	0	0	0	0	**69**

Sample Year	Number of yearling spring Chinook									
	Chiwawa River	Phelps Creek	Chikamin Creek	Rock Creek	Unnamed Creek	Big Meadow Creek	Alder Creek	Brush Creek	Y Creek	Total
2002	32	0	0	0	0	0	0	0	0	**32**
2003	134	0	0	0	0	0	0	0	0	**134**
2004	14	0	0	0	0	7	0	0	0	**21**
2005	62	0	17	0	0	0	0	0	0	**79**
2006	345	0	0	43	0	0	0	0	0	**388**
2007	41	0	0	0	0	0	0	0	0	**41**
2008	144	0	45	0	0	0	0	0	0	**189**
2009	49	0	0	5	0	0	0	0	0	**54**
2010	207	27	19	38	0	0	0	0	0	**291**
2011	645	0	71	194	0	57	0	0	0	**967**
2012	748	0	0	19	0	0	0	0	0	**767**
Average	***169***	***1***	***8***	***16***	***0***	***4***	***0***	***0***	***0***	***197***

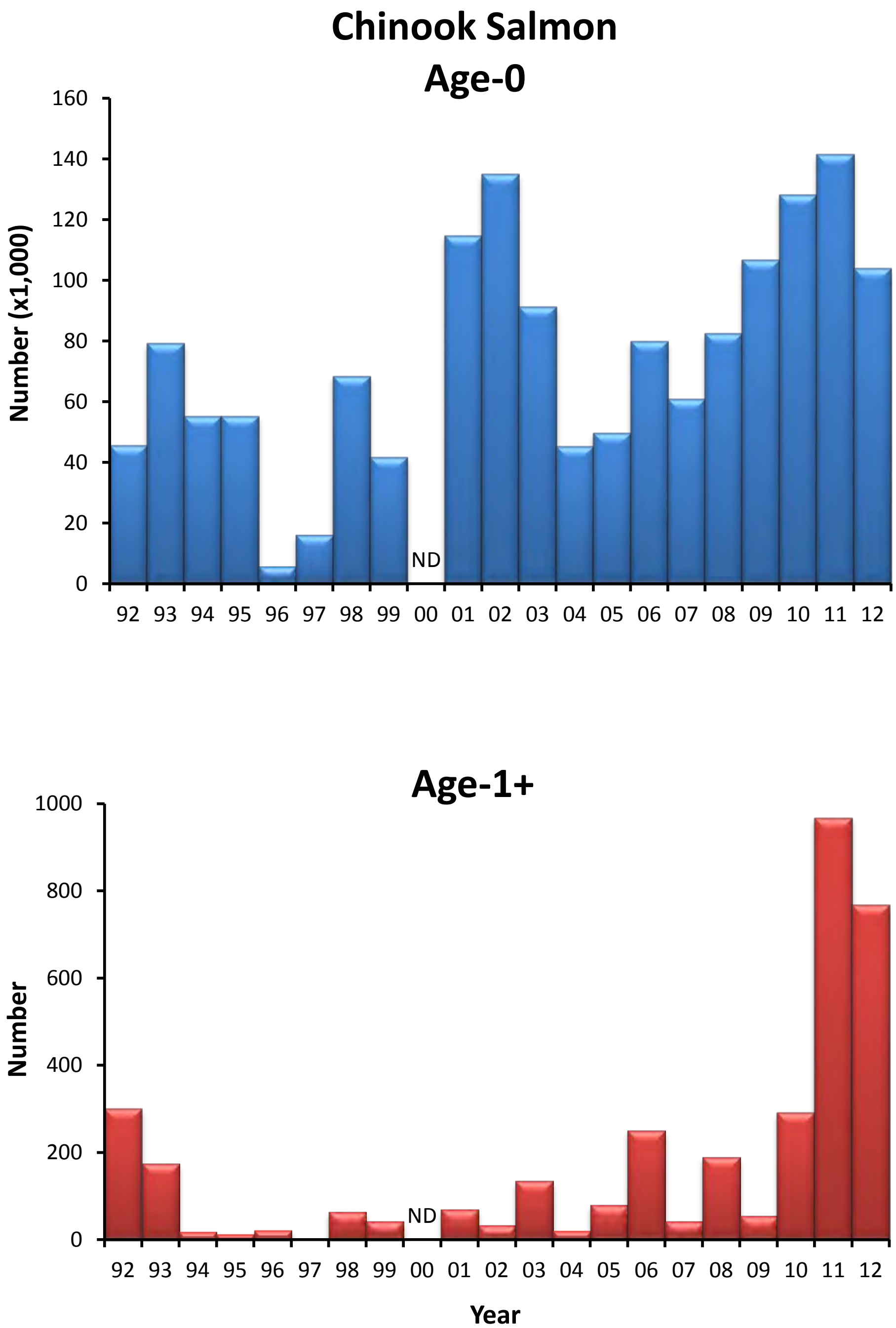


Figure 5.1. Numbers of subyearling and yearling Chinook salmon within the Chiwawa River Basin in August 1992-2012; ND = no data.

Juvenile Chinook were distributed contagiously among reaches in the Chiwawa River. Their densities were highest in the upper portions of the basin, with the highest densities within tributaries. Juvenile Chinook were most abundant in multiple channels and least abundant in glides and riffles. Most Chinook associated closely with woody debris in multiple channels. These sites (multiple channels) made up 17% of the total area of the Chiwawa River basin, but they provided habitat for 43% of all subyearling Chinook in the basin in 2012. In contrast, riffles made up 53% of the total area, but provided habitat for only 15% of all juvenile Chinook in the Chiwawa River basin. Pools made up 23% of the total area and provided habitat for 41% of all juvenile Chinook in the basin. Virtually no Chinook used glides that lacked woody debris.

Mean densities of juvenile Chinook in two reaches of the Chiwawa River were generally less than those in corresponding reference areas (Nason Creek and the Little Wenatchee River) (Figure 5.2). Within both the Chiwawa River and its reference areas, pools and multiple channels consistently had the highest densities of juvenile Chinook.

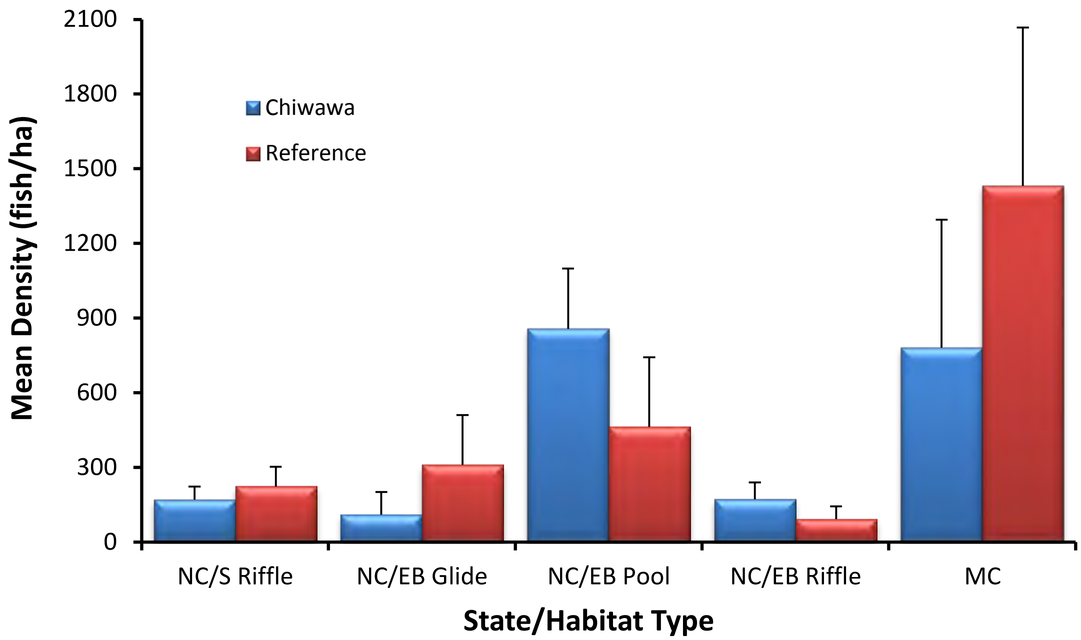


Figure 5.2. Comparison of the 19-year means of subyearling spring Chinook densities within state/habitat types in reaches 3 and 8 of the Chiwawa River and their matched reference areas on Nason Creek and the Little Wenatchee River. NC = natural channel; S = straight channel; EB = eroded banks; MC = multiple channel. There was no sampling in 2000 and no sampling within reference areas in 1992.

Smolt and Emigrant Estimates

Numbers of spring Chinook smolts and emigrants were estimated at the Upper Wenatchee and Chiwawa traps in 2012.

Chiwawa Trap

The Chiwawa Trap operated between 25 February and 29 November 2012. During that time period the trap was inoperable for 14 days because of high river flows, debris, snow/ice, or mechanical failure. The trap operated in two different positions depending on stream flow; lower position at flows greater than 12 m^3/s and an upper position at flows less than 12 m^3/s. Daily trap efficiencies were estimated from two regression models depending on trap position and age class of fish (e.g., subyearling and yearling). The daily number of fish captured was expanded by the estimated trap efficiency to estimate daily total emigration. Monthly captures of all fish and results of mark-recapture efficiency tests at the Chiwawa Trap are reported in Appendix B.

Wild yearling spring Chinook (2010 brood year) were primarily captured from March through June 2012 (Figure 5.3). Based on capture efficiencies estimated from the flow model, the total number of wild yearling Chinook emigrating from the Chiwawa River was 47,511 (±7,765). Combining the total number of subyearling spring Chinook (53,619) that emigrated during the fall of 2011 with the total number of yearling Chinook (47,511) that emigrated during 2012 resulted in a total emigrant estimate of 101,130 spring Chinook for the 2010 brood year (Table 5.15).

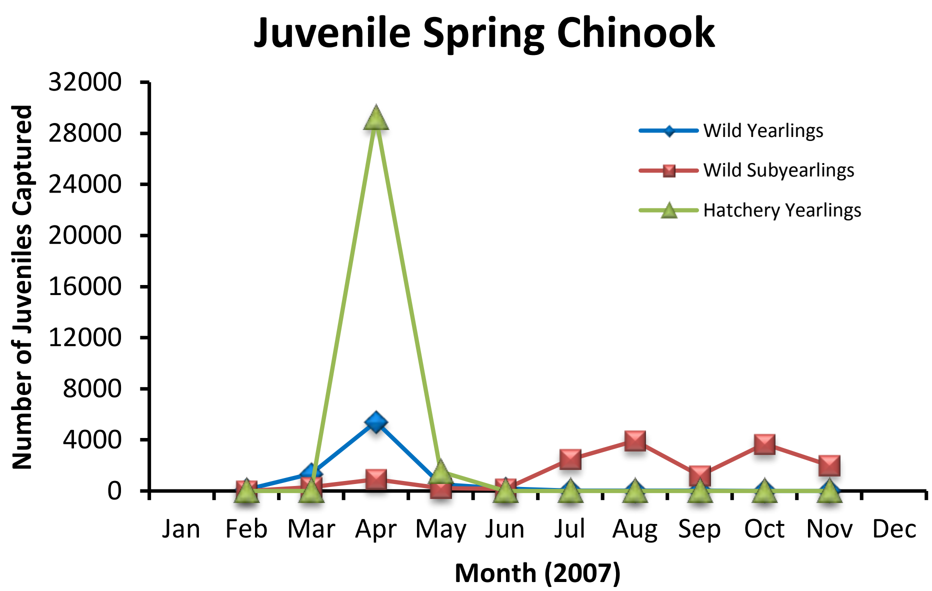


Figure 5.3. Monthly captures of wild subyearling, wild yearling, and hatchery yearling spring Chinook at the Chiwawa Trap, 2012.

Table 5.15. Numbers of redds and juvenile spring Chinook at different life stages in the Chiwawa River basin for brood years 1991-2012; NS = not sampled.

Brood year	Number of redds	Egg deposition	Number of parr	Number of smolts produced within Chiwawa River basin[a]	Total number of smolts[b]	Number of emigrants
1991	104	478,400	45,483[c]	42,525	42,525	NS
1992	302	1,570,098	79,113	39,723	56,763	65,541
1993	106	556,394	55,056	8,662	17,926	22,698
1994	82	485,686	55,240	16,472	22,145	25,067
1995	13	66,248	5,815	3,830	5,230	5,951
1996	23	106,835	16,066	15,475	17,922	19,183
1997	82	374,740	68,415	28,334	39,044	44,562

Brood year	Number of redds	Egg deposition	Number of parr	Number of smolts produced within Chiwawa River basin[a]	Total number of smolts[b]	Number of emigrants
1998	41	218,325	41,629	23,068	24,953	25,923
1999	34	166,090	NS	10,661	13,953	15,649
2000	128	642,944	114,617	40,831	50,634	55,685
2001	1,078	4,984,672	134,874	86,482	389,940	546,266
2002	345	1,605,630	91,278	90,948	152,547	184,279
2003	111	648,684	45,177	16,755	27,897	33,637
2004	241	1,156,559	49,631	72,080	101,172	116,158
2005	332	1,436,564	79,902	69,064	140,737	177,659
2006	297	1,284,228	60,752	45,050	86,579	107,972
2007	283	1,256,803	82,351	25,809	65,539	86,006
2008	689	3,163,888	106,705	35,023	91,229	120,184
2009	421	1,925,233	128,220	30,959	51,417	61,955
2010	502	2,165,628	141,510	47,511	82,911	101,130
2011	492	2,157,420	103,940	-	-	-
Average	***272***	***1,259,575***	***73,781***	***37,463***	***74,053***	***95,553***

[a] The estimated number of smolts (yearlings) that are produced entirely within the Chiwawa River basin. Smolt estimates for brood years 1992-1996 were calculated with a mark-recapture model; brood years 1997-present were calculated with a flow model.
[b] These numbers represent Chiwawa smolts produced within the entire Wenatchee River basin. This assumes that 66% of the subyearling migrants from the Chiwawa River basin survive to smolt in the Wenatchee River basin, regardless of the number of subyearling migrants (i.e., no density dependence). Smolt estimates for brood years 1992-1996 were calculated with a mark-recapture model; brood years 1997-present were calculated with a flow model.
[c] Estimate only includes numbers of Chinook in the Chiwawa River. Tributaries were not sampled at that time.

Wild subyearling spring Chinook (2011 brood year) were captured between 25 March and 29 November 2012. Based on capture efficiencies estimated from the flow model for both the upper trap position and lower position, the total number of wild subyearling (fry and parr) Chinook from the Chiwawa River basin was 100,867 (±19,071). Removing fry from the estimate, a total of 67,982 (±11,382) parr emigrated from the Chiwawa River basin in 2012. Although subyearlings migrated during most months of sampling, the majority (88%) migrated during July through November (Figure 5.3).

Yearling spring Chinook sampled in 2012 averaged 90 mm in length, 8.0 g in weight, and had a mean condition of 1.06 (Table 5.16). These size estimates were less than the overall mean of yearling spring Chinook sampled in previous years (overall means: 94 mm, 9.0 g, and condition of 1.08). Subyearling spring Chinook sampled in 2012 at the Chiwawa Trap averaged 75 mm in length, averaged 4.8 g, and had a mean condition of 1.13 (Table 5.16). These sizes were less than the overall mean of subyearling spring Chinook sampled in previous years (overall means, 77 mm, 5.7 g, and condition of 1.10).

Table 5.16. Mean fork length (mm), weight (g), and condition factor of subyearling and yearling spring Chinook collected in the Chiwawa Trap, 1996-2012. Numbers in parentheses indicate 1 standard deviation.

Sample year	Life stage	Sample size[a]	Mean size		
			Length (mm)	Weight (g)	Condition (K)
1996	Subyearling	514	78 (25)	6.9 (4.2)	1.11 (0.11)
	Yearling	1,589	94 (9)	9.5 (3.0)	1.11 (0.08)
1997	Subyearling	840	86 (8)	7.5 (2.1)	1.16 (0.08)
	Yearling	1,114	100 (7)	10.2 (2.6)	1.02 (0.10)
1998	Subyearling	3,743	82 (11)	6.2 (2.2)	1.08 (0.09)
	Yearling	2,663	97 (7)	10.3 (2.8)	1.12 (0.23)
1999	Subyearling	569	89 (9)	8.5 (2.4)	1.15 (0.07)
	Yearling	3,664	95 (8)	9.6 (3.4)	1.09 (0.19)
2000	Subyearling	1,810	85 (10)	7.4 (2.4)	1.15 (0.10)
	Yearling	1,891	97 (8)	10.5 (5.2)	1.13 (0.07)
2001	Subyearling	4,657	82 (11)	6.6 (3.4)	1.14 (0.09)
	Yearling	2,935	97 (7)	10.5 (2.4)	1.15 (0.08)
2002	Subyearling	6,130	64 (12)	3.0 (1.6)	1.06 (0.10)
	Yearling	1,735	94 (8)	9.0 (2.3)	1.09 (0.08)
2003	Subyearling	3,679	64 (12)	3.2 (1.7)	1.08 (0.10)
	Yearling	2,657	87 (9)	7.2 (3.5)	1.07 (0.10)
2004	Subyearling	2,278	75 (16)	4.3 (2.1)	0.92 (0.16)
	Yearling	1,032	91 (9)	8.5 (2.7)	1.09 (0.10)
2005	Subyearling	2,702	73 (12)	4.6 (2.2)	1.08 (0.09)
	Yearling	803	96 (9)	9.9 (2.8)	1.08 (0.08)
2006	Subyearling	3,462	76 (11)	5.1 (2.0)	1.12 (0.21)
	Yearling	4,645	95 (7)	9.4 (2.3)	1.10 (0.13)
2007	Subyearling	1,718	72 (12)	4.5 (2.1)	1.13 (0.16)
	Yearling	2,245	91 (8)	8.6 (2.5)	1.10 (0.09)
2008	Subyearling	10,443	79 (12)	5.9 (2.3)	1.15 (0.15)
	Yearling	8,792	93 (7)	8.8 (2.1)	1.08 (0.10)
2009	Subyearling	10,536	75 (10)	5.0 (2.2)	0.91 (0.11)
	Yearling	3,630	92 (7)	8.8 (2.1)	0.89 (0.07)
2010	Subyearling	3,888	77 (12)	5.4 (2.3)	1.11 (0.16)
	Yearling	5,799	91 (8)	8.9 (2.2)	1.15 (0.14)
2011	Subyearling	6,870	73 (11)	4.8 (2.2)	1.15 (0.16)
	Yearling	4,734	94 (8)	8.7 (2.2)	1.04 (0.10)
2012	Subyearling	8,756	75 (10)	4.8 (2.2)	1.13 (0.28)
	Yearling	7,290	90 (7)	8.0 (2.6)	1.06 (0.24)
Average	***Subyearling***	***4,270***	***77 (7)***	***5.7 (1.7)***	***1.10 (0.07)***

Sample year	Life stage	Sample size[a]	Mean size		
			Length (mm)	Weight (g)	Condition (K)
	Yearling	***3,366***	***94 (3)***	***9.0 (1)***	***1.08 (0.06)***

[a] Sample size represents the number of fish that were measured for both length and weight.

Upper Wenatchee Trap

The Upper Wenatchee Trap operated nightly between 31 March and 5 September 2012. During the five-month sampling period, a total of 88 wild yearling Chinook, 4,978 wild subyearling Chinook, and seven hatchery yearling Chinook were captured at the Upper Wenatchee Trap. Monthly captures of all fish collected at the Upper Wenatchee Trap are reported in Appendix B.

PIT Tagging Activities

As part of the Comparative Survival Study (CSS), a total of 15,700 wild juvenile Chinook (7,645 subyearling and 8,055 yearlings) were PIT tagged and released in 2012 in the Wenatchee River basin (Table 5.17a). Most of these (99.5%) were tagged at the Chiwawa trap. See Appendix C for a complete list of all fish captured, tagged, lost, and released.

Table 5.17a. Numbers of wild Chinook that were captured, tagged, and released at different locations within the Wenatchee River basin, 2012. Numbers of fish that died or shed tags are also given.

Sampling Location	Species and Life Stage	Number held	Number of recaptures	Number tagged	Number died	Shed Tags	Total released	Percent mortality
Chiwawa Trap	Wild Subyearling Chinook	8,370	467	7,659	15	0	7,644	0.18
	Wild Yearling Chinook	8,353	314	7,990	10	0	7,980	0.12
	Total	**16,723**	**781**	**15,649**	**25**	**0**	**15,624**	**0.15**
Upper Wenatchee Trap	Wild Subyearling Chinook	1	0	1	0	0	1	0.00
	Wild Yearling Chinook	76	1	75	0	0	75	0.00
	Total	**77**	**1**	**76**	**0**	**0**	**76**	**0.00**
Total:	**Wild Subyearling Chinook**	**8,371**	**467**	**7,660**	**15**	**0**	**7,645**	**0.18**
	Wild Yearling Chinook	**8,429**	**315**	**8,065**	**10**	**0**	**8,055**	**0.12**
Grand Total:		**16,800**	**782**	**15,725**	**25**	**0**	**15,700**	**0.15**

Numbers of wild Chinook salmon PIT-tagged and released as part of CSS during the period 2006-2012 are shown in Table 5.17b.

Table 5.17b. Summary of the numbers of wild Chinook that were tagged and released at different locations within the Wenatchee River basin, 2006-2012.

Sampling Location	Species and Life Stage	Numbers of PIT-tagged Chinook salmon released						
		2006	2007	2008	2009	2010	2011	2012
Chiwawa Trap	Wild Subyearling Chinook	5,130	6,137	8,755	8,765	3,324	6,030	7,644
	Wild Yearling Chinook	2,793	4,659	8,397	3,694	6,281	4,318	7,980
	Total	**7,923**	**10,796**	**17,152**	**12,459**	**9,605**	**10,348**	**15,624**
Chiwawa Remote	Wild Subyearling Chinook	111	20	43	128	531	0	0
	Wild Yearling Chinook	0	0	0	3	4	0	0

Sampling Location	Species and Life Stage	Numbers of PIT-tagged Chinook salmon released						
		2006	2007	2008	2009	2010	2011	2012
	Total	**111**	**20**	**43**	**131**	**535**	**0**	**0**
Upper Wenatchee Trap	Wild Subyearling Chinook	0	15	0	37	3	1	1
	Wild Yearling Chinook	81	1,434	159	296	486	714	75
	Total	**81**	**1,449**	**159**	**333**	**489**	**715**	**76**
Nason Creek Remote[a]	Wild Subyearling Chinook	68	6	4	701	595	0	0
	Wild Yearling Chinook	1	7	0	13	3	0	0
	Total	**69**	**13**	**4**	**714**	**598**	**0**	**0**
Upper Wenatchee Remote	Wild Subyearling Chinook	0	61	1	0	2	0	0
	Wild Yearling Chinook	27	0	0	0	0	0	0
	Total	**27**	**61**	**1**	**0**	**2**	**0**	**0**
Middle Wenatchee Remote	Wild Subyearling Chinook	0	0	65	284	233	0	0
	Wild Yearling Chinook	0	0	0	0	0	0	0
	Total	**0**	**0**	**65**	**284**	**233**	**0**	**0**
Lower Wenatchee Remote	Wild Subyearling Chinook	0	0	0	0	0	0	0
	Wild Yearling Chinook	0	0	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Peshastin Creek Remote	Wild Subyearling Chinook	0	0	0	0	1	0	0
	Wild Yearling Chinook	0	0	0	0	0	0	0
	Total	**0**	**0**	**0**	**0**	**1**	**0**	**0**
Lower Wenatchee Trap	Wild Subyearling Chinook	0	0	2	0	0	0	0
	Wild Yearling Chinook	522	1,641	506	468	917	0	0
	Total	**522**	**1,641**	**508**	**468**	**917**	**0**	**0**
Total:	**Wild Subyearling Chinook**	**5,309**	**6,239**	**8,870**	**9,915**	**4,689**	**6,031**	**7,645**
	Wild Yearling Chinook	**3,424**	**7,741**	**9,062**	**4,474**	**7,691**	**5,032**	**8,055**
Grand Total:		**8,733**	**13,980**	**17,932**	**14,389**	**12,380**	**11,063**	**15,700**

Freshwater Productivity

Both productivity and survival estimates for different life stages of spring Chinook in the Chiwawa River basin are provided in Table 5.18. Estimates for brood year 2010 fall within the ranges estimated over the period of brood years 1991-2009. During that period, freshwater productivities ranged from 125-1,015 parr/redd, 122-779 smolts/redd, and 147-834 emigrants/redd. Survivals during the same period ranged from 2.7-19.1% for egg-parr, 2.9-16.8% for egg-smolt, and 3.2-18.0% for egg-emigrants. Overwinter survival rates for juvenile spring Chinook within the Chiwawa River basin have ranged from 15.7-100.0%.

Table 5.18. Productivity (fish/redd) and survival (%) estimates for different juvenile life stages of spring Chinook in the Chiwawa River basin for brood years 1991-2011; ND = no data. These estimates were derived from data in Table 5.14.

Brood year	Parr/Redd	Smolts/Redd[a]	Emigrants/ Redd	Egg-Parr (%)	Parr-Smolt[b] (%)	Egg-Smolt[a] (%)	Egg-Emigrant (%)
1991	437	409	ND	9.5	93.5	8.9	ND
1992	262	188	217	5.0	50.2	3.6	4.2
1993	519	169	214	9.9	15.7	3.2	4.1
1994	674	270	306	11.4	29.8	4.6	5.2
1995	447	402	458	8.8	65.9	7.9	9.0
1996	699	779	834	15.0	96.3	16.8	18.0
1997	834	476	543	18.3	41.4	10.4	11.9
1998	1,015	609	632	19.1	55.4	11.4	11.9
1999	ND	410	460	ND	ND	8.4	9.4
2000	895	396	435	17.8	35.6	7.9	8.7
2001	125	362	507	2.7	64.1	7.8	11.0
2002	265	442	534	5.7	99.6	9.5	11.5
2003	407	251	303	7.0	37.1	4.3	5.2
2004	206	420	482	4.3	100.0	8.7	10.0
2005	241	424	535	5.6	86.4	9.8	12.4
2006	205	292	364	4.7	74.2	6.7	8.4
2007	291	232	304	6.6	31.3	5.2	6.8
2008	155	132	174	3.4	32.8	2.9	3.8
2009	305	122	147	6.7	24.1	2.7	3.2
2010	282	165	201	6.5	33.6	3.8	4.7
2011	211	-	-	4.8	-	-	-
Average	***424***	***348***	***403***	***8.6***	***56.2***	***7.2***	***8.4***

[a] These estimates include Chiwawa smolts produced within the Wenatchee River basin. This assumes that 66% of the subyearling migrants survive to smolt, regardless of the number of subyearling migrants (i.e., no density dependence). Smolt estimates for brood years 1992-1996 were calculated with a mark-recapture model; brood years 1997-present were calculated with a flow model.

[b] These estimates represent overwinter survival within the Chiwawa River basin. It does not include Chiwawa smolts produced outside the Chiwawa River basin. As noted in footnote *a*, smolts/redd and egg-smolt survival include Chiwawa smolts produced in the Wenatchee River basin.

Seeding level (egg deposition) explained most of the variability in productivity and survival of juvenile spring Chinook in the Chiwawa River basin. That is, for estimates based on "within-Chiwawa-Basin" life stages (e.g., parr and within-Chiwawa-Basin smolts), survival and productivity decreased as seeding levels increased (Figure 5.4). This suggests that density dependence regulates juvenile productivity and survival within the Chiwawa River basin. This form of population regulation is less apparent with total smolts (i.e., Chiwawa smolts produced within the Wenatchee River basin) and total emigrants. However, one would expect the number of emigrants to increases as seeding levels exceed the capacity of the Chiwawa River basin.

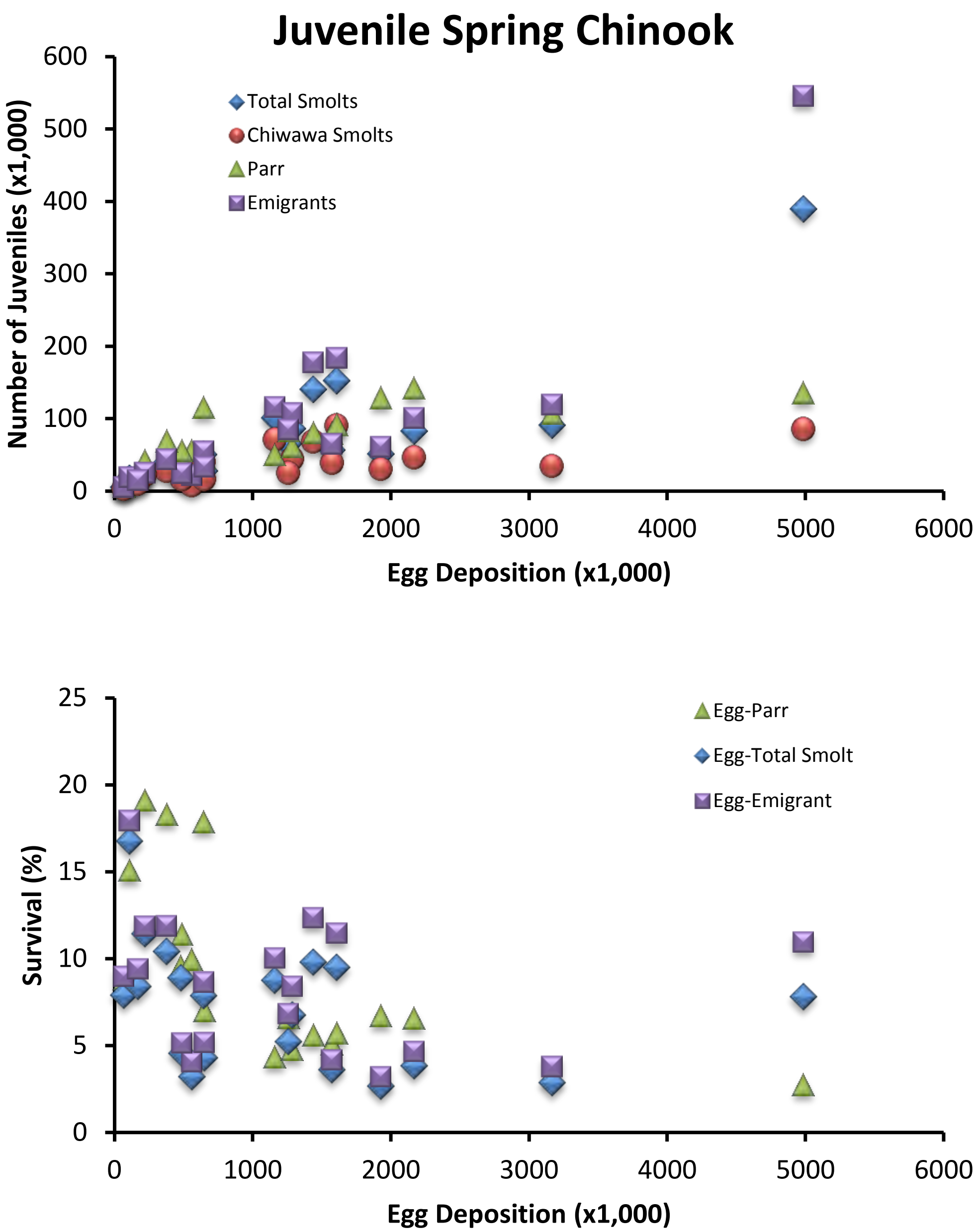


Figure 5.4. Relationships between seeding levels (egg deposition) and juvenile life-stage survivals and productivities for Chiwawa spring Chinook, brood years 1991-2010. Total smolts are Chiwawa smolts produced within and outside the Chiwawa River basin (assumes a 66% survival on subyearling emigrants). Chiwawa smolts are smolts produced only in the Chiwawa River basin.

5.5 Spawning Surveys

Surveys for spring Chinook redds were conducted during August through September, 2012, in the Chiwawa River (including Rock, Phelps, Big Meadow, and Chikamin creeks), Nason Creek, Icicle Creek, Peshastin Creek (including Ingalls Creek), Upper Wenatchee River (including

Chiwaukum Creek), Little Wenatchee River, and White River (including the Napeequa River and Panther Creek).

Redd Counts

A total of 1,704 spring Chinook redds were counted in the Wenatchee River basin in 2012 (Table 5.19). This is higher than the average of 589 redds counted during the period 1989-2011 in the Wenatchee River basin. Most spawning occurred in the Chiwawa River (51.6% or 880 redds) (Table 5.19; Figure 5.5). Nason Creek contained 24.3% (413 redds), Icicle contained 11.7% (199 redds), White River contained 5.0% (86 redds), the Upper Wenatchee River 4.3% (73 redds), Little Wenatchee contained 2.5% (43 redds), and Peshastin Creek contained 0.6% (10 redds).

Table 5.19. Numbers of spring Chinook redds counted within different streams/watersheds within the Wenatchee River basin, 1989-2012. Redd counts in Peshastin Creek in 2001 and 2002 (*) were elevated because the U.S. Fish and Wildlife Service planted 487 and 350 spring Chinook adults, respectively, into the stream. These counts were not included in the total or average calculations.

Sample year	Number of spring Chinook redds							
	Chiwawa	Nason	Little Wenatchee	White	Wenatchee River	Icicle	Peshastin	Total
1989	314	98	45	64	94	24	NS	**639**
1990	255	103	30	22	36	50	4	**500**
1991	104	67	18	21	41	40	1	**292**
1992	302	81	35	35	38	37	0	**528**
1993	106	223	61	66	86	53	5	**600**
1994	82	27	7	3	6	15	0	**140**
1995	13	7	0	2	1	9	0	**32**
1996	23	33	3	12	1	12	1	**85**
1997	82	55	8	15	15	33	1	**209**
1998	41	29	8	5	0	11	0	**94**
1999	34	8	3	1	2	6	0	**54**
2000	128	100	9	8	37	68	0	**350**
2001	1,078	374	74	104	218	88	173*	**2,109**
2002	345	294	42	42	64	245	107*	**1,139**
2003	111	83	12	15	24	18	60	**323**
2004	241	169	13	22	46	30	55	**576**
2005	332	193	64	86	143	8	3	**829**
2006	297	152	21	31	27	50	10	**588**
2007	283	101	22	20	12	17	11	**466**
2008	689	336	38	31	180	116	21	**1,411**
2009	421	167	39	54	5	32	15	**733**
2010	502	188	38	33	47	155	5	**968**
2011	492	170	30	20	12	122	26	**872**
2012	880	413	43	86	73	199	10	**1,704**
Average	***298***	***145***	***28***	***33***	***50***	***60***	***11***	***635***

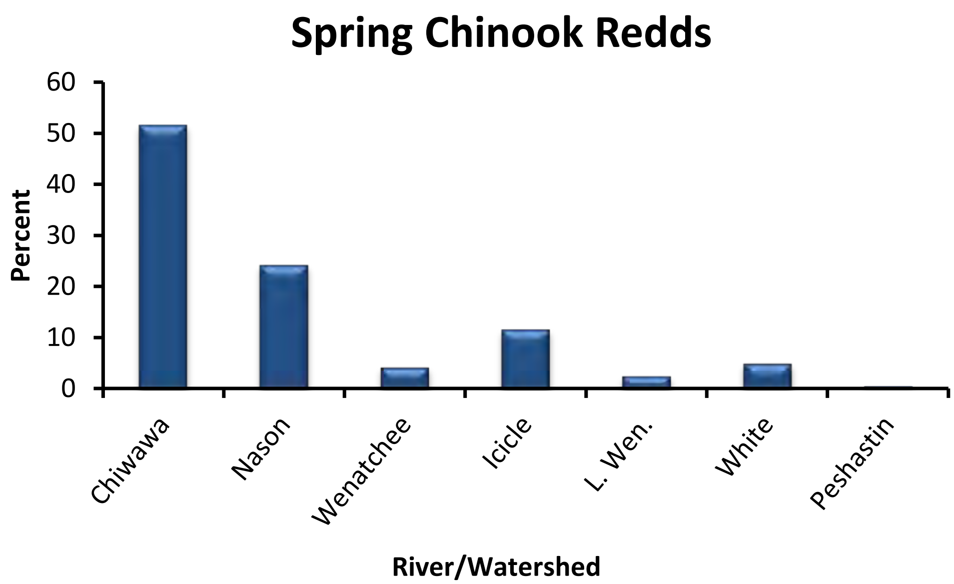


Figure 5.5. Percent of the total number of spring Chinook redds counted in different streams/watersheds within the Wenatchee River basin during August through September, 2012.

Redd Distribution

Spring Chinook redds were not evenly distributed among reaches within survey streams in 2012 (Table 5.20). Most of the spawning in the Chiwawa River basin occurred in Reaches 1 through 6. Over half of all the spawning in the Chiwawa River basin occurred in the lower two reaches (RM 0.0-19.3; from the mouth to Rock Creek). Relatively few fish spawned in Rock and Chikamin creeks. The spatial distribution of redds in Nason Creek was weighted towards Reach 3, having 38% of the Nason Creek redds. In the Little Wenatchee River, 58% of all spawning occurred in Reach 3 (RM 5.2-9.2; Lost Creek to Rainy Creek). On the White River, 86% of the spawning occurred in Reach 3 (RM 11.0-12.9; Napeequa River to Grasshopper Meadows). About 66% of all the spawning in the Wenatchee River occurred upstream from the mouth of the Chiwawa River.

Table 5.20. Numbers and proportions of spring Chinook redds counted within different streams/watersheds within the Wenatchee River basin during August through September, 2012.

Stream/watershed	Reach	Number of redds	Proportion of redds within stream/watershed
Chiwawa	Chiwawa 1 (C1)	200	0.23
	Chiwawa 2 (C2)	367	0.42
	Chiwawa 3 (C3)	25	0.03
	Chiwawa 4 (C4)	74	0.08
	Chiwawa 5 (C5)	74	0.08
	Chiwawa 6 (C6)	101	0.11
	Phelps 1	0	0.00
	Rock 1 (R1)	23	0.03

Stream/watershed	Reach	Number of redds	Proportion of redds within stream/watershed
	Chikamin 1 (K1)	16	0.02
	Big Meadow 1	0	0.00
	Total	**880**	**1.00**
Nason	Nason 1 (N1)	96	0.23
	Nason 2 (N2)	96	0.23
	Nason 3 (N3)	158	0.38
	Nason 4 (N4)	63	0.15
	Total	**413**	**1.00**
Little Wenatchee	Little Wen 2 (L2)	18	0.42
	Little Wen 3 (L3)	25	0.58
	Total	**43**	**1.00**
White	White 2 (H2)	5	0.06
	White 3 (H3)	74	0.86
	White 4 (H4)	3	0.03
	Napeequa 1 (Q1)	1	0.01
	Panther 1 (T1)	3	0.03
	Total	**86**	**1.00**
Wenatchee River	Wen 8 (W8)	0	0.00
	Wen 9 (W9)	11	0.15
	Wen 10 (W10)	48	0.66
	Chiwaukum 1	14	0.19
	Total	**73**	**1.00**
Icicle	Icicle 1 (I1)	199	1.00
	Total	**199**	**1.00**
Peshastin	Peshastin 1 (P1)	7	0.70
	Peshastin 2 (P2)	0	0.00
	Ingalls (D1)	3	0.30
	Total	**10**	**1.00**
Grand Total		***1,704***	***1.00***

Spawn Timing

Spring Chinook began spawning during the second week of August in Nason Creek, Chiwawa River, Little Wenatchee River and the White River, and the fourth week in the Wenatchee River (Figure 5.6). Spawning peaked the fourth week of August in the White and Chiwawa rivers, and the fifth week of August in Nason Creek, Little Wenatchee River, and the Wenatchee River. All spawning was completed by the end of September.

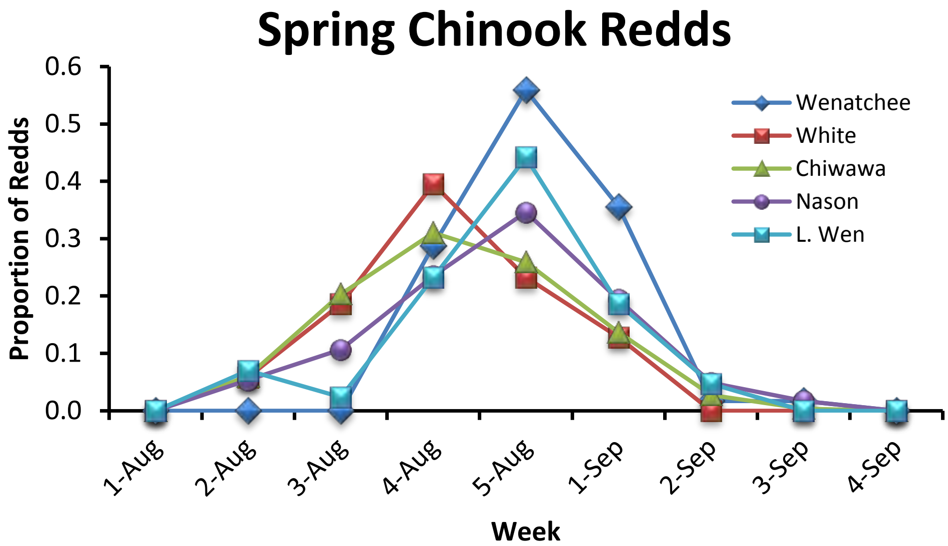


Figure 5.6. Proportion of spring Chinook redds counted during different weeks in different sampling streams within the Wenatchee River basin, August through September 2012.

The temporal distribution of spawning activity in the Chiwawa River in 2012 occurred earlier than the mean 1991-2011 spawning distribution for the Chiwawa (Figure 5.7). The greatest difference in distributions was noted in August.

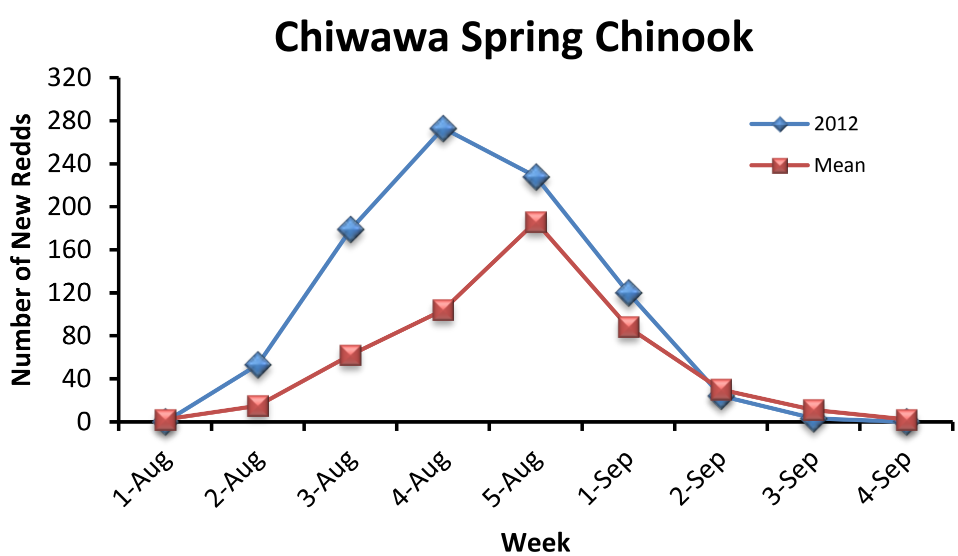


Figure 5.7. Comparison of the number of new spring Chinook redds counted during different weeks in the Chiwawa River basin, August through September, 2012, to the overall average.

Spawning Escapement

Spawning escapement for spring Chinook was calculated as the number of redds times the male-to-female ratio (i.e., fish per redd expansion factor) estimated from broodstock and fish sampled at adult trapping sites. The estimated fish per redd ratio for spring Chinook upstream from Tumwater in 2012 was 1.63 (based on sex ratios estimated at Tumwater Dam). The estimated fish per redd ratio for spring Chinook downstream from Tumwater (Icicle and Peshastin creeks) was 1.90 (derived from broodstock collected at the Leavenworth National Fish Hatchery). Multiplying these ratios by the number of redds counted in the Wenatchee River basin resulted in a total spawning escapement of 2,833 spring Chinook (Table 5.21). The Chiwawa River basin had the highest spawning escapement (1,434 Chinook), while Peshastin Creek had the lowest.

Table 5.21. Number of redds, fish per redd ratios, and total spawning escapement for spring Chinook in the Wenatchee River basin, 2012. Spawning escapement was estimated as the product of redds times fish per redd.

Sampling area	Total number of redds	Fish/redd	Total spawning escapement*
Chiwawa	880	1.63	1,434
Nason	413	1.63	673
Upper Wenatchee River	73	1.63	119
Icicle	199	1.90	378
Little Wenatchee	43	1.63	70
White	86	1.63	140
Peshastin	10	1.90	19
Total	***1,704***	**-**	***2,833***

* Spawning escapement estimate is based on total number of redds by stream. If escapement is calculated at the reach scale, then the total escapement may vary from what is shown here because of rounding errors.

The estimated total spawning escapement of 2,833 spring Chinook in 2012 was greater than the overall average of 1,442 spring Chinook (Table 5.22). The escapement in the Chiwawa River basin in 2012 was over twice the escapement in Nason Creek, the second most abundant stream in the Wenatchee River basin (Table 5.22).

Table 5.22. Spawning escapements for spring Chinook in the Wenatchee River basin for return years 1989-2012; NA = not available.

Return year	Upper basin spawning escapement						Lower basin spawning escapement			Total
	Fish/redd	Chiwawa	Nason	Little Wenatchee	White	Wenatchee River	Fish/redd	Icicle	Peshastin	
1989	2.27	713	222	102	145	213	2.27	54	NA	**1,449**
1990	2.24	571	231	67	49	81	2.24	112	9	**1,120**
1991	2.33	242	156	42	49	96	2.33	93	2	**680**
1992	2.24	676	181	78	78	85	2.24	83	0	**1,181**
1993	2.20	233	491	134	145	189	2.20	117	11	**1,320**
1994	2.24	184	60	16	7	13	2.24	34	0	**314**
1995	2.51	33	18	0	5	3	2.51	23	0	**82**
1996	2.53	58	83	8	30	3	2.53	30	3	**215**
1997	2.22	182	122	18	33	33	2.22	73	2	**463**
1998	2.21	91	64	18	11	0	2.21	24	0	**208**

Return year	Upper basin spawning escapement						Lower basin spawning escapement			Total
	Fish/redd	Chiwawa	Nason	Little Wenatchee	White	Wenatchee River	Fish/redd	Icicle	Peshastin	
1999	2.77	94	22	8	3	6	2.77	17	0	**150**
2000	2.70	346	270	24	22	100	2.70	184	0	**946**
2001	1.60	1,725	598	118	166	349	1.60	141	277	**3,874**
2002	2.05	707	603	86	86	131	2.05	502	219	**2,334**
2003	2.43	270	202	29	36	58	2.43	44	146	**785**
2004[a]	3.56/3.00	858	507	39	66	138	1.79	54	98	**1,759**
2005	1.80	598	347	115	155	257	1.75	14	5	**1,491**
2006	1.78	529	271	37	55	48	1.80	90	18	**1,048**
2007	4.58	1,296	463	101	92	55	1.86	32	20	**2,059**
2008	1.68	1,158	565	64	52	302	1.77	205	37	**2,383**
2009	3.20	1,347	534	125	173	16	2.72	87	41	**2,323**
2010	2.18	1,094	410	83	72	102	2.72	422	14	**2,197**
2011	4.13	2,032	702	124	83	50	2.66	325	69	**3,384**
2012	1.63	1,434	673	70	140	119	1.90	378	19	**2,833**
Average	***2.48***	***686***	***325***	***63***	***73***	***102***	***2.23***	***131***	***43***	***1,442***

[a] In 2004 the fish/redd expansion estimate of 3.56 was applied to the Chiwawa River only and 3.00 fish/redd for the rest of the upper basin.

5.6 Carcass Surveys

Surveys for spring Chinook carcasses were conducted during August through September, 2012, in the Chiwawa River (including Rock, Phelps, Big Meadow, and Chikamin creeks), Nason Creek, Icicle Creek, Peshastin Creek (including Ingalls Creek), Upper Wenatchee River (including Chiwaukum Creek), Little Wenatchee River, and White River (including the Napeequa River and Panther Creek).

Number sampled

A total of 857 spring Chinook carcasses were sampled during August through September in the Wenatchee River basin (Table 5.23). Most were sampled in the Chiwawa River basin (45.5% or 390 carcasses) and Nason Creek (38.7% or 332 carcasses) (Figure 5.8). A total of 62 carcasses were sampled in Icicle Creek, 25 in the upper Wenatchee River, 24 in the Little Wenatchee, 21 in the White River, and three in Peshastin Creek.

Table 5.23. Numbers of spring Chinook carcasses sampled within different streams/watersheds within the Wenatchee River basin, 1996-2012.

Survey year	Number of spring Chinook carcasses							
	Chiwawa	Nason	Little Wenatchee	White	Wenatchee River	Icicle	Peshastin	Total
1996	22	3	0	2	0	1	0	**28**
1997	13	42	3	8	1	28	1	**96**
1998	24	25	3	2	1	6	0	**61**
1999	15	5	0	0	2	1	0	**23**
2000	122	110	8	1	37	52	0	**330**

Survey year	Number of spring Chinook carcasses							
	Chiwawa	Nason	Little Wenatchee	White	Wenatchee River	Icicle	Peshastin	Total
2001	751	388	68	74	213	163	63	**1,720**
2002	190	292	30	24	34	91	49	**710**
2003	70	100	8	8	12	37	42	**277**
2004	178	186	1	13	29	16	40	**463**
2005	391	217	48	52	120	2	0	**830**
2006	241	190	13	25	15	7	0	**491**
2007	250	201	16	13	25	15	6	**526**
2008	386	243	15	13	108	68	5	**838**
2009	240	128	20	19	2	67	2	**478**
2010	193	141	7	11	30	39	2	**423**
2011	177	98	7	4	4	40	3	**333**
2012	390	332	24	21	25	62	3	**857**
Average	***215***	***159***	***16***	***17***	***39***	***41***	***13***	***499***

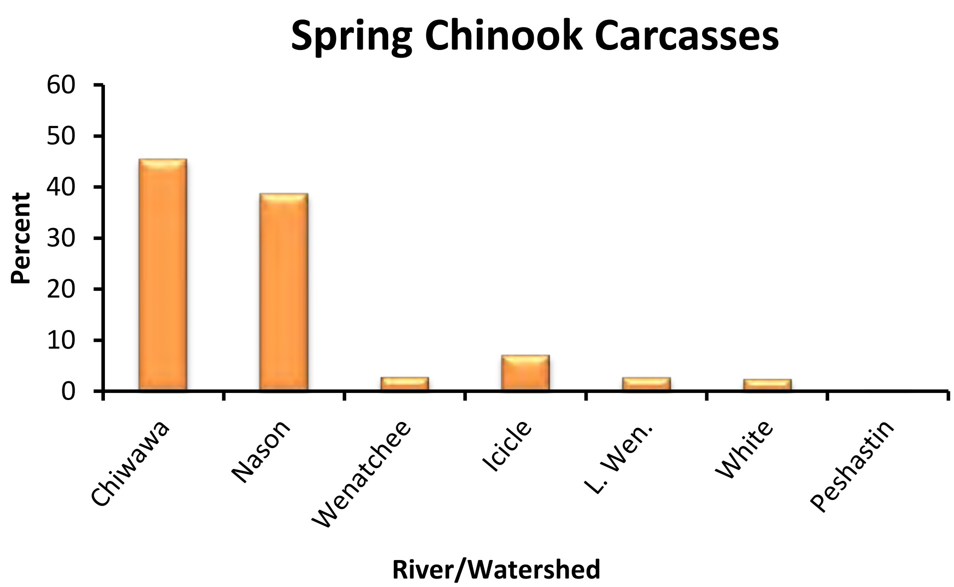


Figure 5.8. Percent of the total number of spring Chinook carcasses sampled in different streams/watersheds within the Wenatchee River basin during August through September, 2012.

Carcass Distribution and Origin

Spring Chinook carcasses were not evenly distributed among reaches within survey streams in 2012 (Table 5.24). Most of the carcasses in the Chiwawa River basin occurred in Reaches 1 and 2 (downstream from Rock Creek). In Nason Creek, most carcasses (36%) were collected in Reach 1 and the fewest (9%) in Reach 4. Most of the carcasses in the Little Wenatchee River were sampled in Reach 3 (Lost Creek to Rainy Creek). On the White River, all occurred in Reach 3 (Napeequa River to Grasshopper Meadows). On the Wenatchee River, 84% of the carcasses were found upstream from the confluence of the Chiwawa River and 8% were found below the confluence.

Table 5.24. Numbers and proportions of carcasses sampled within different streams/watersheds within the Wenatchee River basin during August through September, 2012.

Stream/watershed	Reach	Number of carcasses	Proportion of redds within stream/watershed
Chiwawa	Chiwawa 1 (C1)	104	0.27
	Chiwawa 2 (C2)	165	0.42
	Chiwawa 3 (C3)	15	0.04
	Chiwawa 4 (C4)	34	0.09
	Chiwawa 5 (C5)	29	0.07
	Chiwawa 6 (C6)	34	0.09
	Phelps 1	0	0.00
	Rock 1 (R1)	9	0.02
	Chikamin 1 (K1)	0	0.00
	Big Meadow 1	0	0.00
	Total	**390**	**1.00**
Nason	Nason 1 (N1)	119	0.36
	Nason 2 (N2)	48	0.14
	Nason 3 (N3)	135	0.41
	Nason 4 (N4)	30	0.09
	Total	**332**	**1.00**
Little Wenatchee	Little Wen 2 (L2)	9	0.38
	Little Wen 3 (L3)	15	0.62
	Total	**24**	**1.00**
White	White 2 (H2)	0	0.00
	White 3 (H3)	21	1.00
	White 4 (H4)	0	0.00
	Napeequa 1 (Q1)	0	0.00
	Panther 1 (T1)	0	0.00
	Total	**21**	**1.00**
Wenatchee River	Wen 8 (W8)	0	0.00
	Wen 9 (W9)	2	0.08
	Wen 10 (W10)	21	0.84
	Chiwaukum 1	2	0.08
	Total	**25**	**1.00**
Icicle	Icicle 1 (I1)	62	1.00
	Total	**62**	**1.00**
Peshastin	Peshastin 1 (P1)	2	0.67
	Peshastin 2 (P2)	0	0.00
	Ingalls (D1)	1	0.33

Stream/watershed	Reach	Number of carcasses	Proportion of redds within stream/watershed
Grand Total		**857**	**1.00**

Of the 390 carcasses sampled in 2012, 63% were hatchery fish (Table 5.25; these numbers may change after analysis of CWTs). In the Chiwawa River basin, the spatial distribution of hatchery and wild fish was not equal (Table 5.25). A larger percentage of hatchery fish were found in the lower reaches (C1 and C2; Mouth to Rock Creek) than were wild fish. This general trend was also apparent in the pooled data (Figure 5.9).

Table 5.25. Numbers of wild and hatchery spring Chinook carcasses sampled within different reaches in the Chiwawa River basin, 1993-2012. See Table 2.8 for description of survey reaches.

Survey year	Origin	Survey Reach								Total
		C-1	C-2	C-3	C-4	C-5	C-6	Chikamin	Rock	
1993	Wild	0	0	0	0	0	0	0	0	**0**
	Hatchery	1	0	0	0	0	0	0	0	**1**
1994	Wild	0	6	0	2	0	1	0	0	**9**
	Hatchery	1	1	0	2	0	0	0	0	**4**
1995	Wild	0	0	0	0	0	0	0	0	**0**
	Hatchery	2	3	0	1	0	0	0	0	**6**
1996	Wild	11	1	1	1	0	0	0	0	**14**
	Hatchery	6	0	0	0	0	0	0	0	**6**
1997	Wild	5	2	0	1	0	0	0	0	**8**
	Hatchery	3	1	0	0	0	1	1	3	**9**
1998	Wild	0	3	5	1	2	4	0	0	**15**
	Hatchery	1	3	2	0	1	1	0	0	**8**
1999	Wild	1	8	0	5	0	0	0	0	**14**
	Hatchery	0	0	0	0	1	0	0	0	**1**
2000	Wild	25	27	1	1	1	1	0	0	**56**
	Hatchery	42	12	0	0	0	2	0	0	**56**
2001	Wild	24	57	15	40	16	20	1	3	**176**
	Hatchery	164	284	19	58	14	21	8	0	**568**
2002	Wild	15	11	9	6	7	5	2	0	**55**
	Hatchery	46	40	12	5	1	15	14	4	**137**
2003	Wild	7	13	0	11	3	2	0	0	**36**
	Hatchery	14	14	0	3	1	0	0	0	**32**
2004	Wild	23	48	2	11	7	3	0	1	**95**
	Hatchery	46	21	1	1	1	3	0	2	**75**
2005	Wild	16	36	3	4	3	2	0	0	**64**
	Hatchery	170	132	7	7	4	3	0	1	**324**
2006	Wild	10	17	2	8	4	3	1	0	**45**
	Hatchery	84	75	5	7	6	13	3	3	**196**
2007	Wild	3	20	3	4	4	2	0	0	**36**
	Hatchery	42	113	15	14	16	12	2	0	**214**

Survey year	Origin	Survey Reach								Total
		C-1	C-2	C-3	C-4	C-5	C-6	Chikamin	Rock	
2008	Wild	4	24	0	5	4	8	0	0	**45**
	Hatchery	174	121	2	8	15	15	4	1	**340**
2009	Wild	4	22	4	8	4	1	0	3	**46**
	Hatchery	88	69	6	14	7	5	0	5	**194**
2010	Wild	6	32	7	9	10	3	0	0	**67**
	Hatchery	63	35	2	9	7	5	0	5	**126**
2011	Wild	9	28	10	7	8	6	0	1	**69**
	Hatchery	42	32	4	4	5	10	1	4	**108**
2012	Wild	13	72	6	22	11	17	0	3	**144**
	Hatchery	91	93	9	12	18	17	0	6	**246**
Average	***Wild***	***9***	***21***	***3***	***7***	***4***	***4***	***0***	***1***	***50***
	Hatchery	***54***	***52***	***4***	***7***	***5***	***6***	***2***	***2***	***133***

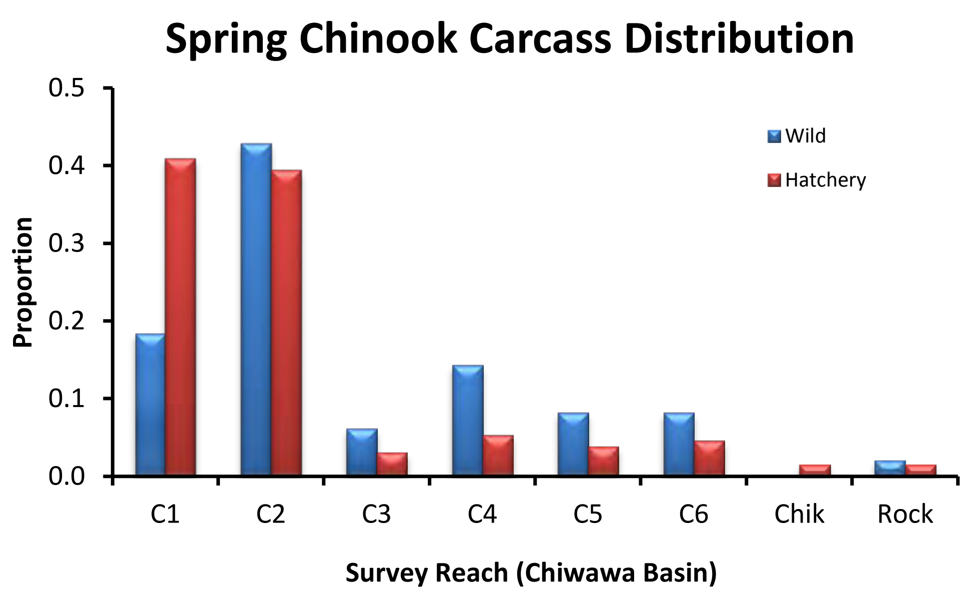


Figure 5.9. Distribution of wild and hatchery produced carcasses in different reaches in the Chiwawa River basin, 1993-2012; Chik = Chikamin Creek and Rock = Rock Creek. Reach codes are described in Table 2.8.

Sampling Rate

Overall, 30% of the estimated total spawning escapement of spring Chinook in the Wenatchee River basin was sampled in 2012 (Table 5.26). Sampling rates among streams/watershed varied from 15 to 49%.

Table 5.26. Number of redds and carcasses, total spawning escapement, and sampling rates for spring Chinook salmon in the Wenatchee River basin, 2012.

Sampling area	Total number of redds	Total number of carcasses	Total spawning escapement	Sampling rate
Chiwawa	880	390	1,434	0.27
Nason	413	332	673	0.49
Upper Wenatchee	73	25	119	0.21
Icicle	199	62	378	0.16
Little Wenatchee	43	24	70	0.34
White	86	21	140	0.15
Peshastin	10	3	19	0.16
Total	***1,704***	***857***	***2,833***	***0.30***

Length Data

Mean lengths (POH, cm) of male and female spring Chinook carcasses sampled during surveys in the Wenatchee River basin in 2012 are provided in Table 5.27. The average sizes of males and females sampled in the Wenatchee River basin were 60 and 62 cm, respectively.

Table 5.27. Mean lengths (postorbital-to-hypural length; cm) and standard deviations (in parentheses) of male and female spring Chinook carcasses sampled in different streams/watersheds in the Wenatchee River basin, 2012.

Stream/watershed	Mean lengths (cm)	
	Male	Female
Chiwawa	62 (9.8)	62 (5.0)
Nason	57 (10.3)	61 (4.2)
Upper Wenatchee	60 (6.7)	62 (3.3)
Icicle	66 (5.4)	61 (4.8)
Little Wenatchee	63 (13.5)	62 (5.0)
White	47 (0.0)	61 (3.7)
Peshastin	0 (0.0)	69 (7.1)
Total	***60 (10.2)***	***62 (4.7)***

5.7 Life History Monitoring

Life history characteristics of spring Chinook were assessed by examining carcasses on spawning grounds and fish collected at broodstock collection sites, and by reviewing tagging data and fisheries statistics.

Migration Timing

There was little difference in migration timing of hatchery and wild spring Chinook past Tumwater Dam (Table 5.28a and b; Figure 5.10). On average, early in the migration, wild Chinook arrived at Tumwater Dam slightly earlier than hatchery fish, but by the end of the migration, both were arriving at about the same time. Most hatchery and wild spring Chinook migrated upstream past Tumwater Dam during June and July (Figure 5.10).

Table 5.28a. The Julian day and date that 10%, 50% (median), and 90% of the wild and hatchery spring Chinook salmon passed Tumwater Dam, 1998-2012. The average Julian day and date are also provided. Migration timing is based on video sampling at Tumwater. Data for 1998 through 2003 were based on videotapes and broodstock trapping and may not reflect the actual number of hatchery spring Chinook. All spring Chinook were visually examined during trapping from 2004 to present.

Survey year	Origin	Spring Chinook Migration Time (days)								Sample size
		10 Percentile		50 Percentile		90 Percentile		Mean		
		Julian	Date	Julian	Date	Julian	Date	Julian	Date	
1998	Wild	156	5-Jun	156	5-Jun	156	5-Jun	156	5-Jun	49
	Hatchery	156	5-Jun	156	5-Jun	156	5-Jun	156	5-Jun	25
1999	Wild	192	11-Jul	207	26-Jul	224	12-Aug	207	26-Jul	173
	Hatchery	200	19-Jul	211	30-Jul	229	18-Aug	213	1-Aug	25
2000	Wild	171	19-Jun	186	4-Jul	194	12-Jul	184	2-Jul	651
	Hatchery	179	27-Jun	189	7-Jul	201	19-Jul	190	8-Jul	357
2001	Wild	154	3-Jun	166	15-Jun	185	4-Jul	167	16-Jun	2,073
	Hatchery	157	6-Jun	169	18-Jun	185	4-Jul	170	19-Jun	4,244
2002	Wild	174	23-Jun	189	8-Jul	204	23-Jul	189	8-Jul	1,033
	Hatchery	178	27-Jun	189	8-Jul	199	18-Jul	189	8-Jul	1,363
2003	Wild	162	11-Jun	181	30-Jun	200	19-Jul	181	30-Jun	919
	Hatchery	157	6-Jun	179	28-Jun	192	11-Jul	178	27-Jun	423
2004	Wild	156	4-Jun	172	20-Jun	189	7-Jul	172	20-Jun	969
	Hatchery	161	9-Jun	177	25-Jun	189	7-Jul	177	25-Jun	1,295
2005	Wild	153	2-Jun	172	21-Jun	193	12-Jul	173	22-Jun	1,038
	Hatchery	153	2-Jun	173	22-Jun	187	6-Jul	172	21-Jun	2,808
2006	Wild	177	26-Jun	184	3-Jul	193	12-Jul	185	7-Jul	577
	Hatchery	178	27-Jun	185	4-Jul	194	13-Jul	186	5-Jul	1,601
2007	Wild	169	18-Jun	185	4-Jul	203	22-Jul	185	4-Jul	351
	Hatchery	174	23-Jun	192	11-Jul	209	28-Jul	192	11-Jul	3,232
2008	Wild	173	21-Jun	188	6-Jul	209	27-Jul	189	7-Jul	634
	Hatchery	177	25-Jun	193	11-Jul	210	28-Jul	193	11-Jul	5,368
2009	Wild	174	23-Jun	186	5-Jul	201	20-Jul	187	6-Jul	1,008
	Hatchery	175	24-Jun	187	6-Jul	202	21-Jul	188	7-Jul	4,106
2010	Wild	173	22-Jun	190	9-Jul	214	2-Aug	191	10-Jul	977
	Hatchery	180	29-Jun	194	13-Jul	213	1-Aug	195	14-Jul	4,450
2011	Wild	183	2-Jul	198	17-Jul	213	1-Aug	198	17-Jul	1,433
	Hatchery	187	6-Jul	200	19-Jul	210	29-Jul	199	18-Jul	4,707
2012	Wild	180	28-Jun	191	9-Jul	205	23-Jul	192	10-Jul	1,482
	Hatchery	182	30-Jun	194	12-Jul	206	24-Jul	194	12-Jul	4,449
Average	Wild	***170***	**-**	***183***	**-**	***199***	**-**	***184***	**-**	***891***

Survey year	Origin	Spring Chinook Migration Time (days)								Sample size
		10 Percentile		50 Percentile		90 Percentile		Mean		
		Julian	Date	Julian	Date	Julian	Date	Julian	Date	
	Hatchery	***173***	**-**	***186***	**-**	***199***	**-**	***186***	**-**	***2,564***

Table 5.28b. The week that 10%, 50% (median), and 90% of the wild and hatchery spring Chinook salmon passed Tumwater Dam, 1998-2012. The average week is also provided. Migration timing is based on video sampling at Tumwater. Data for 1998 through 2003 were based on videotapes and broodstock trapping and may not reflect the actual number of hatchery spring Chinook. All spring Chinook were visually examined during trapping from 2004 to present.

Survey year	Origin	Spring Chinook Migration Time (week)				Sample size
		10 Percentile	50 Percentile	90 Percentile	Mean	
1998	Wild	23	23	23	23	49
	Hatchery	23	23	23	23	25
1999	Wild	28	30	32	30	173
	Hatchery	29	31	34	31	25
2000	Wild	24	27	27	27	651
	Hatchery	26	27	29	28	357
2001	Wild	22	24	27	24	2,073
	Hatchery	23	25	27	25	4,244
2002	Wild	25	27	30	27	1,033
	Hatchery	26	27	29	27	1,363
2003	Wild	24	26	29	26	919
	Hatchery	23	26	28	26	423
2004	Wild	23	25	27	25	969
	Hatchery	23	26	27	26	1,295
2005	Wild	22	25	28	25	1,038
	Hatchery	22	25	27	25	2,808
2006	Wild	26	27	28	27	577
	Hatchery	26	27	28	27	1,601
2007	Wild	25	27	29	27	351
	Hatchery	25	28	30	28	3,232
2008	Wild	25	27	30	27	634
	Hatchery	26	28	30	28	5,368
2009	Wild	25	27	29	27	1,008
	Hatchery	25	27	29	27	4,106
2010	Wild	25	28	31	28	977
	Hatchery	26	28	31	28	4,450
2011	Wild	27	29	31	29	1,433
	Hatchery	27	29	30	29	4,707

Survey year	Origin	Spring Chinook Migration Time (week)				Sample size
		10 Percentile	50 Percentile	90 Percentile	Mean	
2012	Wild	26	28	30	28	1,482
	Hatchery	26	28	30	28	4,449
Average	Wild	***25***	***27***	***29***	***27***	***891***
	Hatchery	***25***	***27***	***29***	***27***	***2,564***

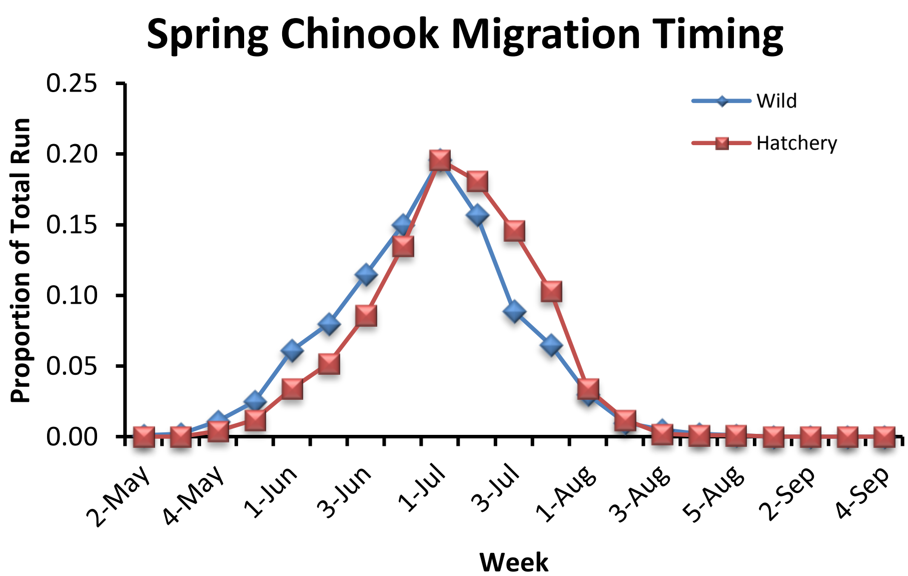


Figure 5.10. Proportion of wild and hatchery spring Chinook observed (using video) passing Tumwater Dam each week during their migration period May through September; data were pooled over survey years 1998-2012.

Age at Maturity

Most of the wild and hatchery spring Chinook sampled during the period 1994-2012 in the Chiwawa River basin were age-4 fish (total age) (Table 5.29; Figure 5.11). On average, hatchery fish made up a higher percentage of age-3 Chinook than did wild fish. In contrast, a higher proportion of age-5 wild fish returned than did age-5 hatchery fish. Thus, wild fish tended to return at an older age than hatchery fish.

Table 5.29. Proportions of wild and hatchery spring Chinook of different ages (total age) sampled on spawning grounds in the Chiwawa River basin, 1994-2012.

Sample year	Origin	Total age					Sample size
		2	3	4	5	6	
1994	Wild	0.00	0.00	0.33	0.67	0.00	9
	Hatchery	0.00	0.20	0.00	0.80	0.00	5
1995	Wild	0.00	0.00	0.00	0.00	0.00	0
	Hatchery	0.00	0.00	1.00	0.00	0.00	2

Sample year	Origin	Total age					Sample size
		2	3	4	5	6	
1996	Wild	0.00	0.36	0.64	0.00	0.00	14
	Hatchery	0.00	0.83	0.17	0.00	0.00	6
1997	Wild	0.00	0.00	0.75	0.25	0.00	8
	Hatchery	0.00	0.00	1.00	0.00	0.00	9
1998	Wild	0.00	0.00	0.00	1.00	0.00	15
	Hatchery	0.00	0.00	0.13	0.88	0.00	8
1999	Wild	0.00	0.07	0.50	0.43	0.00	14
	Hatchery	0.00	0.00	0.00	1.00	0.00	1
2000	Wild	0.00	0.02	0.95	0.03	0.00	56
	Hatchery	0.00	0.50	0.50	0.00	0.00	52
2001	Wild	0.00	0.01	0.95	0.04	0.00	176
	Hatchery	0.00	0.02	0.98	0.00	0.00	571
2002	Wild	0.00	0.00	0.56	0.44	0.00	55
	Hatchery	0.00	0.00	0.91	0.09	0.00	128
2003	Wild	0.00	0.09	0.00	0.91	0.00	36
	Hatchery	0.00	0.19	0.03	0.78	0.00	32
2004	Wild	0.00	0.05	0.94	0.01	0.00	99
	Hatchery	0.00	0.42	0.58	0.00	0.00	78
2005	Wild	0.00	0.01	0.78	0.21	0.00	67
	Hatchery	0.00	0.04	0.96	0.00	0.00	324
2006	Wild	0.02	0.02	0.51	0.45	0.00	45
	Hatchery	0.01	0.03	0.78	0.18	0.00	196
2007	Wild	0.00	0.10	0.24	0.66	0.00	29
	Hatchery	0.00	0.35	0.59	0.06	0.00	221
2008	Wild	0.02	0.02	0.81	0.14	0.00	43
	Hatchery	0.00	0.06	0.89	0.05	0.00	325
2009	Wild	0.00	0.9	0.87	0.04	0.00	44
	Hatchery	0.00	0.24	0.75	0.02	0.00	196
2010	Wild	0.00	0.00	0.90	0.10	0.00	62
	Hatchery	0.00	0.07	0.92	0.01	0.00	127
2011	Wild	0.00	0.08	0.38	0.54	0.00	65
	Hatchery	0.00	0.26	0.45	0.29	0.00	112
2012	Wild	0.00	0.01	0.80	0.19	0.00	141
	Hatchery	0.00	0.01	0.95	0.02	0.00	246
Average	***Wild***	***0.00***	***0.07***	***0.71***	***0.22***	***0.00***	***49***
	Hatchery	***0.00***	***0.11***	***0.83***	***0.06***	***0.00***	***132***

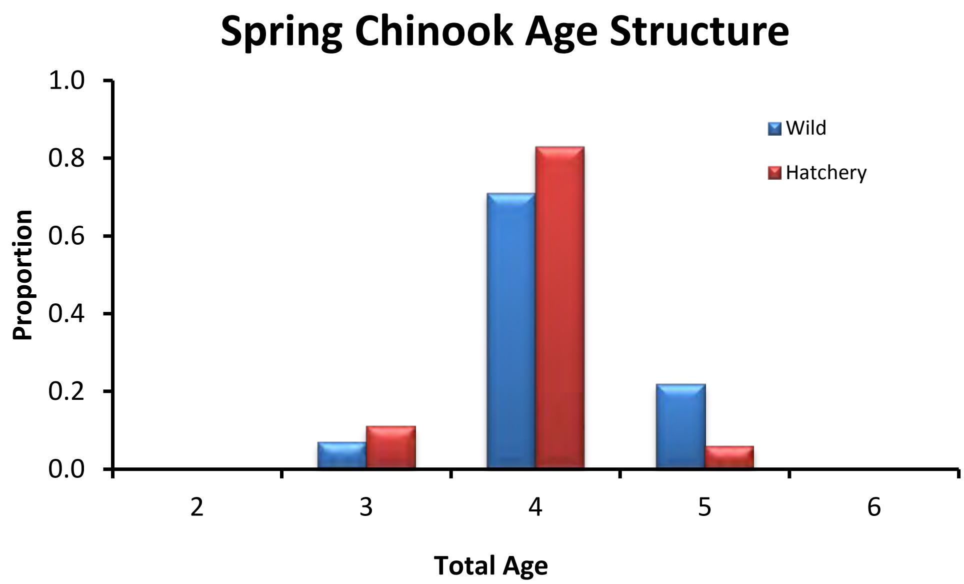


Figure 5.11. Proportions of wild and hatchery spring Chinook of different total ages sampled at the Chiwawa Weir and on spawning grounds in the Chiwawa River basin for the combined years 1994-2012.

Size at Maturity

On average, hatchery and wild spring Chinook of a given age differed slightly in length (Table 5.30). For example, wild age-5 fish were larger on average than the age-5 hatchery fish. In contrast, hatchery age-3 and 4 Chinook were generally larger than age-3 and 4 wild fish.

Table 5.30. Mean lengths (POH in cm; ±1SD) and sample sizes (in parentheses) of different ages (total age) of male and female spring Chinook of wild and hatchery-origin sampled in the Chiwawa River basin, 1994-2012. Brood years 2004-2012 include carcasses and live fish PIT-tag detections. In addition, 2005 and 2006 include fish released at the weir.

Brood year	Total age	Mean length (cm)			
		Male		Female	
		Wild	Hatchery	Wild	Hatchery
1994	3				43 ±0 (1)
	4			62 ±3 (3)	
	5	76 ±0 (1)		73 ±2 (5)	
	6				
1995	3				
	4		61 ±5 (5)		
	5				
	6				
1996	3	45 ±3 (5)	49 ±7 (10)		
	4	69 ±4 (6)	69 ±0 (1)	67 ±8 (2)	
	5				
	6				
1997	3				

Brood year	Total age	Mean length (cm)			
		Male		Female	
		Wild	Hatchery	Wild	Hatchery
	4	61 ±1 (2)	68 ±0 (1)	67 ±5 (3)	63 ±3 (8)
	5	67 ±5 (2)			
	6				
1998	3				
	4				54 ±0 (1)
	5	77 ±7 (8)	75 ±4 (4)	74 ±4 (7)	76 ±4 (3)
	6				
1999	3	44 ±0 (1)			
	4	61 ±0 (1)		64 ±3 (6)	
	5	76 ±5 (3)		72 ±5 (3)	66 ±0 (1)
	6				
2000	3		46 ±3 (17)		50 ±7 (3)
	4	60 ±8 (23)	62 ±5 (5)	61 ±5 (26)	62 ±3 (20)
	5	77 ±1 (2)			
	6				
2001	3	37 ±0 (1)	42 ±4 (11)	41 ±0 (1)	60 ±0 (1)
	4	63 ±5 (57)	65 ±5 (151)	62 ±4 (110)	63 ±4 (407)
	5	75 ±5 (2)	83 ±0 (1)	76 ±1 (5)	
	6				
2002	3				
	4	64 ±4 (14)	66 ±5 (46)	60 ±4 (15)	63 ±4 (71)
	5	80 ±6 (13)	75 ±5 (4)	72 ±3 (12)	73 ±6 (6)
	6				
2003	3	45 ±2 (3)	45 ±1 (6)		
	4		63 ±0 (1)		
	5	78 ±5 (12)	74 ±8 (11)	75 ±3 (19)	72 ±5 (14)
	6				
2004	3	42 ±3 (3)	44 ±5 (33)		
	4	63 ±7 (60)	66 ±5 (9)	63 ±4 (59)	63 ±6 (36)
	5			74 ±0 (1)	
	6				
2005	3		43 ±5 (48)		
	4	61 ±5 (32)	65 ±5 (224)	62 ±4 (61)	62 ±4 (382)
	5	74 ±5 (6)	54±0 (1)	71 ±3 (11)	
	6				
2006	3	45 ±3 (3)	43 ±3 (73)		
	4	64 ±3 (7)	62 ±6 (91)	63 ±5 (41)	60 ±4 (227)
	5	74 ±6 (8)	75 ±6 (17)	71 ±4 (26)	71± 4 (37)
	6				
2007	3	39 ±3 (5)	45 ±6 (90)		50 ±3 (7)
	4	60 ±4 (4)	66 ±5 (45)	61 ±4 (10)	63 ±3 (142)

Brood year	Total age	Mean length (cm)			
		Male		Female	
		Wild	Hatchery	Wild	Hatchery
	5	78 ±6 (15)	76 ±5 (8)	74 ±3 (20)	73 ±5 (12)
	6				
2008	3	43 ±0 (1)	44 ±5 (22)		
	4	65 ±4 (9)	64 ±6 (73)	62 ±4 (26)	64 ±4 (229)
	5	65 ±5 (3)	79 ±5 (10)	73 ±3 (4)	72 ±3 (5)
	6				
2009	3	45 ±3 (8)	46 ±6 (68)		65 ±0 (1)
	4	64 ±4 (38)	65 ±5 (136)	63 ±3 (67)	64 ±4 (202)
	5	79 ±0 (1)		72 ±2 (4)	71 ±4 (10)
	6				
2010	3		46 ±4 (11)		65 ±3 (3)
	4	64 ±5 (31)	66 ±5 (74)	64 ±4 (82)	65 ±3 (196)
	5	77 ±4 (6)		73 ±5 (9)	73 ±6 (4)
	6				
2011	3	43 ±4 (133)	44 ±4 (1374)		53 ±4 (17)
	4	62 ±5 (137)	64 ±5 (169)	64 ±3 (94)	64 ±3 (258)
	5	80 ±5 (78)	79 ±4 (85)	75 ±3 (116)	75 ±3 (63)
	6				
2012	3	56 ±0 (1)	52 ±7 (7)		
	4	79 ± 6(37)	80 ±6 (49)	79 ± (76)	78 ±4 (180)
	5	97 ±7 (11)	96 ±3 (4)	93 ± (16)	87 ±0 (1)
	6				

Contribution to Fisheries

Nearly all the harvest on hatchery-origin Chiwawa spring Chinook occurs within the Columbia Basin. Ocean catch records (Pacific Fishery Management Council) indicate that virtually no Upper Columbia spring Chinook are taken in ocean fisheries. Most of the harvest on hatchery-origin Chiwawa spring Chinook occurs in the Lower Columbia River fisheries, which are managed by the states and tribes pursuant to management plans developed in *U.S. v Oregon*. The Lower Columbia River fisheries occur during what is referred to in *U.S. v Oregon* as the winter, spring, and summer seasons, which begin in February and ends July 31 of each year. The Tribal fishery occurs upstream from Bonneville Dam, but primarily in Zone 6, the area between Bonneville and McNary dams; the non-treaty commercial fisheries occur in Zones 1-5, which are downstream from Bonneville Dam. The non-treaty recreational (sport) fishery occurs in the lower mainstem.

The total number of hatchery-origin spring Chinook captured in different fisheries has been relatively low (Table 5.31). The largest harvests occurred on the 1997, 1998, 2004, 2005, and 2006 brood years.

Table 5.31. Estimated number and percent (in parentheses) of hatchery-origin Chiwawa spring Chinook captured in different fisheries, brood years 1989-2006; NP = no hatchery program.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational[a] (sport)	
1989	3 (13)	5 (21)	0 (0)	16 (67)	24
1990	0 (0)	0 (0)	0 (0)	18 (100)	18
1991	0 (0)	3 (100)	0 (0)	0 (0)	3
1992	0 (0)	1 (100)	0 (0)	0 (0)	1
1993	3 (75)	1 (25)	0 (0)	0 (0)	4
1994	0 (0)	0 (0)	0 (0)	0 (0)	0
1995	NP	NP	NP	NP	NP
1996	0 (0)	2 (100)	0 (0)	0 (0)	2
1997	1 (0)	193 (51)	68 (18)	115 (31)	377
1998	9 (5)	47 (24)	12 (6)	126 (65)	194
1999	NP	NP	NP	NP	NP
2000	0 (0)	17 (74)	0 (0)	6 (26)	23
2001	17 (46)	8 (22)	1 (3)	11 (30)	37
2002	12 (17)	11 (15)	22 (31)	26 (37)	71
2003	18 (21)	29 (35)	11 (13)	26 (31)	84
2004	3 (1)	188 (40)	31 (7)	253 (53)	475
2005	6 (5)	31 (24)	18 (14)	74 (57)	129
2006	25 (3)	485 (61)	84 (11)	201 (25)	795

[a] Includes the Wanapum fishery.

Straying

Stray rates were determined by examining CWTs recovered on spawning grounds within and outside the Wenatchee River basin. Targets for strays based on return year (recovery year) within the Wenatchee River basin should be less than 10% and targets for strays outside the Wenatchee River basin should be less than 5%. The target for brood year stray rates should be less than 5%.

The percentage of the spawning escapement made up of hatchery-origin Chiwawa spring Chinook in non-target spawning areas has been high in some years and exceeded the target of 10% (Table 5.32). Chiwawa spring Chinook have strayed into spawning areas on Nason Creek, the White River, the Little Wenatchee River, and the Upper Wenatchee River. On average, Chiwawa spring Chinook made up the highest percentage of the spawning escapement within Nason Creek and the Upper Wenatchee River. Stray rates of hatchery-origin Chiwawa spring Chinook do not appear to have declined with the change in source water that was implemented in 2006 for the Chiwawa rearing ponds.

Table 5.32. Number (No.) and percent (%) of the spawning escapement in other non-target spawning streams within the Wenatchee River basin that consisted of hatchery-origin Chiwawa spring Chinook, return years 1992-2011. For example, for return year 2001, 35.3% of the spring Chinook spawning escapement in Nason Creek consisted of hatchery-origin Chiwawa spring Chinook. Percent strays should be less than 10%.

Return year	Nason Creek		Icicle Creek		Peshastin Creek		Upper Wenatchee		White River		Little Wenatchee	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1992	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1993	61	12.4	0	0.0	0	0.0	34	18.0	7	4.8	0	0.0
1994	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1995	0	0.0	0	0.0	0	0.0	2	66.7	0	0.0	0	0.0
1996	25	30.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1997	55	45.1	8	11.0	0	0.0	0	0.0	0	0.0	0	0.0
1998	3	4.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1999	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2000	45	16.7	0	0.0	0	0.0	31	31.0	0	0.0	6	27.3
2001	211	35.3	0	0.0	0	0.0	271	77.7	46	39.0	52	31.3
2002	188	31.2	10	2.0	0	0.0	60	45.8	14	16.3	21	24.4
2003	14	6.9	0	0.0	0	0.0	30	51.7	0	0.0	0	0.0
2004	139	27.4	0	0.0	0	0.0	54	39.1	6	9.1	0	0.0
2005	252	72.6	7	50.0	0	0.0	256	99.6	106	68.4	65	56.5
2006	131	48.3	13	14.4	0	0.0	28	58.3	9	16.4	12	32.4
2007	303	65.4	0	0.0	0	0.0	37	67.3	7	7.6	6	5.9
2008	381	67.4	48	23.4	29	78.4	259	85.8	30	57.7	52	81.3
2009	289	54.1	8	9.2	0	0.0	16	100.0	73	42.2	56	44.8
2010	272	66.3	58	13.7	11	78.6	85	83.3	23	31.9	59	71.1
2011	397	56.6	61	18.8	0	0.0	41	82.0	0	0.0	53	42.7
Total	***2,766***	***42.5***	***213***	***8.5***	***40***	***4.2***	***1,204***	***62.1***	***321***	***24.2***	***382***	***30.1***

Hatchery-origin Chiwawa spring Chinook have strayed into the Methow and Entiat basins (Table 5.33). Based on return year analyses, rates of hatchery-origin Chiwawa spring Chinook straying into these populations have been low in most years. Chiwawa spring Chinook made up more than 5% of the spawning escapement in the Entiat River basin during return years 2002, 2006, 2008, 2009, and 2010.

Table 5.33. Number and percent of spawning escapements within other non-target basins that consisted of hatchery-origin Chiwawa spring Chinook, return years 1992-2011. For example, for return year 2002, 9.2% of the spring Chinook spawning escapement in the Entiat River basin consisted of hatchery-origin Chiwawa spring Chinook. Percent strays should be less than 5%. NS = not sampled.

Return year	Methow River basin		Entiat River basin	
	Number	%	Number	%
1992	0	0.0	0	0.0
1993	0	0.0	0	0.0
1994	0	0.0	0	0.0

Return year	Methow River basin		Entiat River basin	
	Number	%	Number	%
1995	0	0.0	0	0.0
1996	NS	NS	0	0.0
1997	0	0.0	0	0.0
1998	NS	NS	0	0.0
1999	0	0.0	0	0.0
2000	0	0.0	1	0.6
2001	0	0.0	1	0.2
2002	0	0.0	34	9.2
2003	0	0.0	6	2.3
2004	0	0.0	0	0.0
2005	10	0.7	15	4.2
2006	8	0.5	27	10.5
2007	9	0.8	4	1.6
2008	12	1.2	61	21.9
2009	9	0.3	15	5.4
2010	7	0.3	18	3.7
2011	0	0.0	49	8.2
Total	***55***	***0.2***	***231***	***5.1***

Based on brood year analyses, on average, about 36% of the hatchery returns have strayed into non-target spawning areas, exceeding the target of 5% (Table 5.34). Depending on brood year, percent strays into non-target spawning areas have ranged from 0-81%. Few (<1%) have strayed into non-target hatchery programs. The change in source water that was implemented in 2006 for the Chiwawa rearing ponds does not appear to have decreased stray rates.

Table 5.34. Number and percent of hatchery-origin Chiwawa spring Chinook that homed to target spawning areas and the target hatchery program, and number and percent that strayed to non-target spawning areas and non-target hatchery programs, by brood years 1989-2006. Percent stays should be less than 5%.

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1989	74	41.1	1	0.6	102	56.7	3	1.7
1990	0	0.0	1	100.0	0	0.0	0	0.0
1991	29	87.9	0	0.0	2	6.1	2	6.1
1992	2	6.5	4	12.9	25	80.6	0	0.0
1993	134	47.5	82	29.1	63	22.3	3	1.1
1994	4	19.0	14	66.7	3	14.3	0	0.0
1995	No program							

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1996	58	75.3	7	9.1	12	15.6	0	0.0
1997	1,242	55.6	298	13.4	687	30.8	5	0.2
1998	553	55.8	109	11.0	329	33.2	0	0.0
1999	No program							
2000	149	42.1	115	32.5	90	25.4	0	0.0
2001	647	35.8	276	15.3	878	48.6	4	0.2
2002	314	44.3	238	33.6	156	22.0	1	0.1
2003	556	80.0	11	1.6	123	17.7	5	0.7
2004	1,198	47.7	203	8.1	1,091	43.4	19	0.8
2005	822	59.3	139	10.0	415	29.9	10	0.7
2006	777	51.4	128	8.5	596	39.4	12	0.8
Total	***6,559***	***51.2***	***1,626***	***12.7***	***4,572***	***35.7***	***64***	***0.5***

Genetics

Genetic studies were conducted to determine the potential impacts of the Chiwawa Supplementation Program on natural-origin spring Chinook in the upper Wenatchee River basin (Blankenship et al. 2007; the entire report is appended as Appendix J). Microsatellite DNA allele frequencies collected from temporally replicated natural and hatchery-origin spring Chinook were used to statistically assign individual fish to specific demes (locations) within the Wenatchee population. In addition, genetic effects of the hatchery program were assessed by examining relationships between census and effective population sizes (N_e) from samples collected before and after supplementation.

Overall, this work showed that although allele frequencies within and between natural and hatchery-origin spring Chinook were significantly different, there was no evidence (i.e., robust signal) that the difference was the result of the hatchery program. Rather, the differences were more likely the result of life history characteristics. However, there was an increasing trend toward homogenization of the allele frequencies of the natural and hatchery-origin fish that comprised the broodstock, even though there was consistent year-to-year variation in allele frequencies among hatchery and natural-origin fish. In addition, there were no robust signals indicating that hatchery-origin hatchery broodstock, hatchery-origin natural spawners, natural-origin hatchery broodstock, and natural-origin natural spawners were substantially different from each other. Finally, the N_e estimate of 387 was only slightly larger than the pre-hatchery N_e (based on demographic data from 1989-1992), which means that the Chiwawa hatchery program has not reduced the N_e of the Wenatchee spring Chinook population.

Significant differences in allele frequencies were observed within and among major spawning areas in the Upper Wenatchee River basin. However, these differences made up only a very small portion of the overall variation, indicating genetic similarity among the major spawning areas. There was no evidence that the Chiwawa program has changed the genetic structure (allele frequency) of spring Chinook in Nason Creek and the White River, despite the presence of hatchery-origin spawners in both systems.

Proportion of Natural Influence

Another method for assessing the genetic risk of a supplementation program is to determine the influence of the hatchery and natural environments on the adaptation of the composite population. This is estimated by the proportion of natural-origin fish in the hatchery broodstock (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The ratio pNOB/(pHOS+pNOB) is the Proportion of Natural Influence (PNI). The larger the ratio (PNI), the greater the strength of selection in the natural environment relative to that of the hatchery environment. In order for the natural environment to dominate selection, PNI should be greater than 0.67 (HSRG/WDFW/NWIFC 2004).

For brood years 1989-1994, the PNI was greater than or equal to 0.67, indicating that the natural environment had a greater influence on adaptation of Chiwawa spring Chinook than did the hatchery environment (Table 5.35). Since brood year 1994, however, the PNI has been less than 0.67, indicating that the hatchery environment has a greater influence on adaptation than does the natural environment.

Table 5.35. Proportionate natural influence (PNI) of the Chiwawa spring Chinook supplementation program for brood years 1989-2011. PNI was calculated as the proportion of naturally produced Chinook in the hatchery broodstock (pNOB) divided by the proportion of hatchery Chinook on the spawning grounds (pHOS) plus pNOB. NOS = number of natural-origin Chinook on the spawning grounds; HOS = number of hatchery-origin Chinook on the spawning grounds; NOB = number of natural-origin Chinook collected for broodstock; and HOB = number of hatchery-origin Chinook included in hatchery broodstock.

Brood year	Spawners			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
1989	713	0	0.00	28	0	1.00	1.00
1990	571	0	0.00	18	0	1.00	1.00
1991	242	0	0.00	27	0	1.00	1.00
1992	676	0	0.00	78	0	1.00	1.00
1993	231	2	0.01	94	0	1.00	0.99
1994	123	61	0.33	8	4	0.67	0.67
1995	0	33	1.00	No Program			
1996	41	17	0.29	8	10	0.44	0.60
1997	60	122	0.67	32	79	0.29	0.30
1998	59	32	0.35	13	34	0.28	0.44
1999	87	7	0.07	No Program			
2000	173	173	0.50	9	21	0.30	0.38
2001	414	1,311	0.76	113	259	0.30	0.28
2002	205	502	0.71	20	51	0.28	0.28
2003	143	127	0.47	41	53	0.44	0.48
2004	582	276	0.32	83	132	0.39	0.55
2005	134	464	0.78	91	181	0.33	0.30

Brood year	Spawners			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
2006	116	413	0.78	91	224	0.29	0.27
2007	192	1,104	0.85	43	104	0.29	0.25
2008	205	953	0.82	83	220	0.27	0.25
2009	303	1,044	0.78	96	111	0.46	0.37
2010	418	676	0.62	77	98	0.44	0.42
2011	874	1,158	0.57	80	93	0.46	0.45
Average	***285***	***368***	***0.46***	***49***	***73***	***0.48***	***0.49***

Natural and Hatchery Replacement Rates

Natural replacement rates (NRR) were calculated as the ratio of natural-origin recruits (NOR) to the parent spawning population (spawning escapement). For brood years 1989-2006, NRR for spring Chinook in the Chiwawa averaged 1.19 (range, 0.01-4.40) if harvested fish were not include in the estimate and 1.30 (range, 0.01-4.81) if harvested fish were included in the estimate (Table 5.36). NRRs for more recent brood years will be calculated as soon as all tag recoveries and sampling rates have been loaded into the database.

Hatchery replacement rates (HRR) are the hatchery adult-to-adult returns and were calculated as the ratio of hatchery-origin recruits (HOR) to the parent broodstock collected. These rates should be greater than the NRRs and greater than or equal to 5.30 (the calculated target value in Murdoch and Peven 2005). In nearly all years, HRRs were greater than NRRs, regardless if harvest was or was not included (Table 5.36). HRRs exceeded the estimated target value of 5.3 in seven or nine of the 16 years, depending on if harvested fish were or were not included in the estimates.

Table 5.36. Broodstock collected, spawning escapements, natural and hatchery-origin recruits (NOR and HOR), and natural and hatchery replacement rates (NRR and HRR; with and without harvest) for spring Chinook in the Chiwawa River basin, brood years 1989-2006; NP = no hatchery program.

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
1989	28	713	180	194	6.43	0.27	204	282	7.29	0.40
1990	19	571	1	34	0.05	0.06	19	40	1.00	0.07
1991	32	242	33	2	1.03	0.01	36	2	1.13	0.01
1992	113	676	31	46	0.27	0.07	32	48	0.28	0.07
1993	100	233	282	159	2.82	0.68	286	163	2.86	0.70
1994	13	184	21	37	1.62	0.20	21	38	1.62	0.21
1995	NP	33	NP	66	NP	2.00	NP	69	NP	2.09
1996	18	58	77	255	4.28	4.40	79	279	4.39	4.81
1997	120	182	2,233	716	18.61	3.93	2,609	794	21.74	4.36
1998	48	91	994	350	20.71	3.85	1,185	373	24.69	4.10
1999	NP	94	NP	10	NP	0.11	NP	11	NP	0.12

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
2000	48	346	354	699	7.38	2.02	377	733	7.85	2.12
2001	382	1,725	1,805	310	4.73	0.18	1,842	314	4.82	0.18
2002	84	707	711	245	8.46	0.35	780	255	9.29	0.36
2003	119	270	697	113	5.84	0.42	781	121	6.56	0.45
2004	296	858	2,515	276	8.50	0.32	2,990	298	10.10	0.35
2005	283	598	1,386	405	4.90	0.68	1,515	418	5.35	0.70
2006	398	529	1,848	995	4.64	1.88	2,631	1,259	6.61	2.38
Average	***131***	***451***	***823***	***273***	***6.27***	***1.19***	***962***	***305***	***7.22***	***1.30***

Smolt-to-Adult Survivals

Smolt-to-adult survival ratios (SARs) were calculated as the number of hatchery adult recaptures divided by the number of tagged hatchery smolts released. SARs were based on CWT returns. For the available brood years, SARs have ranged from 0.00036 to 0.01562 for hatchery spring Chinook (Table 5.37).

Table 5.37. Smolt-to-adult ratios (SARs) for Chiwawa hatchery spring Chinook, brood years 1989-2006.

Brood year	Number of tagged smolts released[a]	Estimated adult captures[b]	SAR
1989	42,707	204	0.00478
1990	52,798	19	0.00036
1991	61,088	36	0.00059
1992	82,976	31	0.00037
1993	221,316	284	0.00128
1994	27,135	21	0.00077
1995	No hatchery program		
1996	12,767	67	0.00525
1997	259,585	2,549	0.00982
1998	71,571	1,118	0.01562
1999	No hatchery program		
2000	46,726	375	0.00803
2001	374,129	1,827	0.00488
2002	145,074	760	0.00524
2003	216,702	763	0.00352
2004	491,987	2,975	0.00605
2005	489,664	1,506	0.00308
2006	548,777	2,298	0.00419
Average	***196,563***	***927***	***0.00461***

[a] Includes all tag codes and CWT released fish (CWT + Ad Clip fish and CWT-only fish).

[b] Includes estimated recoveries (spawning ground, hatcheries, harvest, etc.) and observed recoveries if estimated recoveries were unavailable.

5.8 ESA/HCP Compliance

Broodstock Collection

The collection of 2010 Brood Chiwawa River spring Chinook broodstock was consistent with the 2010 Upper Columbia River salmon and steelhead broodstock objectives and site-based broodstock collection protocols. Specifically, broodstock collection targeted hatchery-origin fish at Tumwater Dam and the Chiwawa Weir, while only natural-origin spring Chinook were collected at the Chiwawa Weir. In-season adjustments were made to the number of hatchery and natural-origin spring Chinook collected for broodstock as needed and were based on in-season escapement monitoring at Tumwater Dam and estimated Chiwawa run-escapement.

Broodstock collection at Tumwater Dam began 1 May 2010, concluded on 26 July 2010, and targeted hatchery-origin, coded-wire tagged spring Chinook. Collection was implemented concurrent with trapping, sampling, and tagging associated with the spring Chinook reproductive success study (BPA project No. 2003-039-00). Trapping at the Chiwawa Weir began on 6 July 2010 and concluded on 4 August 2010. Broodstock collection targeted natural-origin spring Chinook and hatchery-origin spring Chinook as needed to attain a minimum 33% natural-origin broodstock and a maximum 33% extraction of the estimated natural-origin return to the Chiwawa River.

The BY 2010 brood collection retained a total of 186 spring Chinook, including 83 natural-origin fish, representing a 45% natural-origin broodstock. The brood successfully met the minimum targeted 33% natural-origin composition.

Both passive (low abundance periods) and active (high abundance periods) trapping were used to collect spring Chinook at Tumwater Dam. During passive trapping, the trap was checked and fish were processed several times per day. At the Chiwawa Weir, the trap was operated passively, checked several times per day, and fish were processed once daily. Trapping at the Chiwawa Weir generally followed a four-up and three-down schedule, and operated only as needed to meet weekly collection objectives consistent with the 2010 collection protocol or as adjusted based on in-season run escapement monitoring and ESA Section 10 Permit 1196 requirements. All spring Chinook, steelhead, and bull trout that were captured were anesthetized with tricaine methanesulfonate (MS-222) and subject to water-to-water transfers during handling. All fish were allowed to fully recover before release.

The estimated escapement of 2010 spring Chinook past Tumwater Dam totaled 5,492 adult and jack spring Chinook (Murdoch et al. 2010). Based on 2010 spawning ground data (redd and carcass surveys), an estimated 380 natural-origin spring Chinook spawned in the Chiwawa River basin. Assuming the pre-spawn survival of Chiwawa River natural-origin spring Chinook was similar to the at-large population upstream from Tumwater Dam (73%), combined with the 83 natural-origin Chinook extracted for broodstock, the natural-origin escapement to the Chiwawa River basin totaled 604 spring Chinook (i.e., (380/0.73) + 83 = 604). The 2010 broodstock retention of 186 spring Chinook (83 natural-origin and 103 hatchery-origin) represents 12.4% of the total estimated 2010 Chiwawa spring Chinook escapement (13.7% of the wild Chiwawa escapement) to Tumwater. The estimated broodstock extraction rate of natural-origin Chiwawa spring Chinook and overall extraction of spring Chinook upstream from Tumwater Dam comply with provisions of ESA Permit 1196.

No additional spring Chinook were handled and released as a function of maintaining, at minimum, 33% natural-origin spring Chinook in the broodstock. About 194 bull trout were captured and released. To minimize fallback or impingement on the weir, all spring Chinook and bull trout were released unharmed about 10 km upstream from the weir.

Hatchery Rearing and Release

The rearing and release of 2010 brood Chiwawa spring Chinook was completed without incident. No mortality events occurred that exceeded 10% of the population. Fish were acclimated on Chiwawa River water with regulated amounts of Wenatchee river water to prevent frazzle ice formation during the winter months (see Section 5.2).

The release of 2010 brood Chiwawa spring Chinook smolts totaled 346,248 spring Chinook, representing 116.2% of program objectives and complied with the ESA Section 10 Permit 1196 program level of 298,000 smolts.

Hatchery Effluent Monitoring

Per ESA Permits 1196, 1347, and 1395, permit holders shall monitor and report hatchery effluents in compliance with applicable National Pollution Discharge Elimination Systems (NPDES) (EPA 1999) permit limitations. There was one NPDES violation reported at the Chelan PUD Hatchery facilities during the period 1 January through 31 December 2012. NPDES monitoring and reporting for Chelan PUD Hatchery Programs during 2012 are provided in Appendix F.

Smolt and Emigrant Trapping

Per ESA Section 10 Permit No. 1196, the permit holders are authorized a direct take of 20% of the emigrating spring Chinook population during juvenile emigration monitoring and a lethal take not to exceed 2% of the fish captured (NMFS 2003). Based on the estimated wild spring Chinook population (smolt trap expansion) and hatchery juvenile spring Chinook population estimate (hatchery release data) for the Wenatchee River basin, the reported spring Chinook encounters during 2012 emigration monitoring complied with take provisions in the Section 10 permit. Spring Chinook encounter and mortality rates for each trap site (including PIT tag mortalities) are detailed in Table 5.38. Additionally, juvenile fish captured at the trap locations were handled consistent with provisions in ESA Section 10 Permit 1196, Section B.

Table 5.38. Estimated take of Upper Columbia River spring Chinook resulting from juvenile emigration monitoring in the Wenatchee River basin, 2012.

Trap location	Population estimate			Number trapped			Total	Take allowed under Permit
	Wild[a]	Hatchery[b]	Sub-yearling[c]	Wild	Hatchery	Sub-yearling		
Chiwawa Trap								
Population	47,511	346,248	67,982	7,626	30,751	14,831	53,208	
Encounter rate	NA	NA	NA	0.1605	0.0888	0.2182	0.1152	0.20
Mortality[e]	NA	NA	NA	78	7	69	219	
Mortality rate	NA	NA	NA	0.0016	0.0002	0.0047	0.0041	0.02
Upper Wenatchee Trap								
Population	NA[d]	13,963	NA[d]	88	7	165[f]	260	
Encounter rate	NA	NA	NA	NA	0.0005	NA	0.0186	0.20
Mortality[e]	NA	NA	NA	2	0	2	4	
Mortality rate	NA	NA	NA	0.0227	0.0000	0.0121	0.0154	0.02
Lower Wenatchee Trap								
Population	NA	NA	NA	NA	NA	NA	NA	
Encounter rate	NA	NA	NA	NA	NA	NA	NA	0.20
Mortality[e]	NA	NA	NA	NA	NA	NA	NA	
Mortality rate	NA	NA	NA	NA	NA	NA	NA	0.02
Wenatchee River basin Total								
Population	47,511	360,211	67,982	7,714	30,758	14,996	53,468	
Encounter rate	NA	NA	NA	0.1624	0.0854	0.2206	0.1124	0.20
Mortality[e]	NA	NA	NA	80	7	71	158	
Mortality rate	NA	NA	NA	0.0104	0.0002	0.0047	0.0030	0.02

[a] Smolt population estimate derived from juvenile emigration trap data.

[b] 2012 smolt release data for the Wenatchee River basin.

[c] Based on size, date of capture, and location of capture, subyearling Chinook encountered at the Lower Wenatchee Trap are categorized as summer Chinook.

[d] Insufficient numbers of natural-origin spring Chinook were encountered to derive a population estimate.

[e] Combined trapping and PIT tagging mortality.

[f] Subyearling Chinook fry captured prior to July 1 were considered summer Chinook fry, above number represents capture after July 1.

Spawning Surveys

Spring Chinook spawning ground surveys were conducted in the Wenatchee River basin during 2012, as authorized by ESA Section 10 Permit 1196. Because of the difficulty of quantifying the level of take associated with spawning ground surveys, the Permit does not specify a take level associated with these activities, even though it does authorize implementation of spawning ground surveys. Therefore, no take levels are reported. However, to minimize potential effects to established redds, wading was restricted to the extent practical, and extreme caution was used to avoid established redds when wading was required.

Spring Chinook Reproductive Success Study

ESA Section 10 Permit 1196 specifically provides authorization to capture, anesthetize, biologically sample, PIT tag, and release adult spring Chinook at Tumwater Dam for reproductive success studies and general program monitoring. During 2010 through 2012, all spring Chinook passing Tumwater Dam were enumerated, anesthetize, biologically sampled, PIT tagged, and released (not including hatchery-origin Chinook retained for broodstock) as a component of the reproductive success study (BPA Project No. 2003-039-00). Please refer to Ford et al. (2010, 2011, and 2012) for complete details on the methods and results of the spring Chinook reproductive success study for 2010, 2011 and 2012.

SECTION 6: WENATCHEE SUMMER CHINOOK

6.1 Broodstock Sampling

This section focuses on results from sampling 2010-2011 Wenatchee summer Chinook broodstock, which were collected at Dryden and Tumwater dams. Complete information is not currently available for the 2012 brood (this information will be provided in the 2013 annual report).

Origin of Broodstock

Both the 2010 and 2011 broodstock consisted primarily of natural-origin (adipose fin present) summer Chinook (Table 6.1). In order to meet production goals, hatchery-origin adults were collected in concert with natural-origin fish. About 2% of the 2011 broodstock was comprised of hatchery-origin fish (hatchery-origin was determined by examination of scales and/or CWTs).

Table 6.1. Numbers of wild and hatchery summer Chinook collected for broodstock, numbers that died before spawning, and numbers of Chinook spawned in the Wenatchee River basin, 1989-2011. Unknown origin fish (i.e., undetermined by scale analysis, no CWT or fin clips, and no additional hatchery marks) were considered naturally produced. Mortality includes fish that died of natural causes typically near the end of spawning and were not needed for the program and surplus fish killed at spawning.

Brood year	Wild summer Chinook					Hatchery summer Chinook					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
1989	346	29	27	290	0	0	0	0	0	0	290
1990	87	6	24	57	0	0	0	0	0	0	57
1991	128	9	14	105	0	0	0	0	0	0	105
1992	341	48	19	274	0	0	0	0	0	0	274
1993	480	28	46	406	0	44	0	0	44	0	450
1994	363	29	1	333	0	55	1	0	54	0	387
1995	382	15	4	363	0	16	0	0	16	0	378
1996	331	34	34	263	0	3	0	0	3	0	266
1997	225	14	6	205	0	15	1	1	13	0	218
1998	378	40	39	299	0	94	4	12	78	0	377
1999	250	7	1	242	0	238	1	1	236	0	478
2000	298	18	5	275	0	194	7	7	180	0	455
2001	311	41	60	210	0	182	8	38	136	0	346
2002	469	28	32	409	0	13	1	2	10	0	419
2003	488	90	61	337	0	8	1	0	7	0	344
2004	494	24	46	424	0	2	0	0	2	0	426
2005	491	29	19	397	46	3	0	0	3	0	400
2006	483	29	21	433	0	5	1	0	4	0	437
2007	415	53	99	263	0	4	0	1	3	0	266
2008	400	11	11	378	0	72	2	1	69	0	447
2009	482	22	8	452	0	9	1	0	8	0	460
2010	427	14	25	388	0	7	2	0	5	0	393
2011	398	11	11	376	0	7	0	0	7	0	405

Brood year	Wild summer Chinook					Hatchery summer Chinook					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
Average	*368*	*27*	*27*	*312*	*2*	*42*	*1*	*3*	*38*	*0*	*351*

Age/Length Data

Ages of summer Chinook broodstock were determined from analysis of scales and/or CWTs. Broodstock collected from the 2010 return consisted primarily of age-4 and age-5 natural-origin Chinook (93%). Age-2 and age-3 natural-origin fish collectively made up 6% of the broodstock. No age-6 fish were included in the broodstock (Table 6.2). Of the hatchery Chinook included in the broodstock, age-4 and age-5 fish comprised 57% and 43%, respectively, of the hatchery-origin broodstock collected.

Broodstock collected from the 2011 return consisted primarily of age-4 and age-5 natural-origin Chinook (91%). Age-2, 3 and 6 natural-origin fish collectively made up 9% of the broodstock (Table 6.2). Of the hatchery Chinook included in the broodstock, age-3 and age-5 fish comprised 33% and 67% of the hatchery-origin broodstock collected.

Table 6.2. Percent of hatchery and wild Wenatchee summer Chinook of different ages (total age) collected from broodstock in the Wenatchee River basin, 1991-2011.

Return Year	Origin	Total age				
		2	3	4	5	6
1991	Wild	0.0	4.6	36.8	57.5	1.1
	Hatchery	0.0	0.0	0.0	0.0	0.0
1992	Wild	0.0	2.6	40.4	50.9	6.1
	Hatchery	0.0	0.0	0.0	0.0	0.0
1993	Wild	0.0	1.5	36.0	60.3	2.2
	Hatchery	0.0	0.0	93.0	7.0	0.0
1994	Wild	0.0	1.0	33.7	64.3	1.0
	Hatchery	0.0	0.0	1.9	98.1	0.0
1995	Wild	0.0	3.3	18.9	76.6	1.2
	Hatchery	0.0	0.0	0.0	0.0	100.0
1996	Wild	0.0	4.6	40.1	53.3	2.0
	Hatchery	0.0	0.0	33.3	66.7	0.0
1997	Wild	0.0	2.3	42.6	53.2	1.9
	Hatchery	0.0	26.7	66.7	6.6	0.0
1998	Wild	0.0	5.5	34.8	58.6	1.1
	Hatchery	0.0	5.4	68.5	19.6	6.5
1999	Wild	0.5	1.9	39.0	56.3	2.4
	Hatchery	0.0	1.3	23.2	72.1	2.4
2000	Wild	2.6	6.3	24.6	66.5	0.0
	Hatchery	0.0	23.6	15.2	42.9	18.3
2001	Wild	0.3	16.4	53.9	27.7	1.7

Return Year	Origin	Total age				
		2	3	4	5	6
	Hatchery	0.0	6.3	80.6	10.0	3.1
2002	Wild	1.6	8.4	61.1	28.3	0.6
	Hatchery	0.0	0.0	41.7	58.3	0.0
2003	Wild	0.9	2.8	31.4	64.9	0.0
	Hatchery	0.0	12.5	25.0	62.5	0.0
2004	Wild	0.2	3.6	10.1	84.0	2.1
	Hatchery	0.0	0.0	50.0	50.0	0.0
2005	Wild	0.0	4.3	53.5	35.1	7.1
	Hatchery	0.0	0.0	0.0	100.0	0.0
2006	Wild	1.4	0.9	14.9	81.8	1.0
	Hatchery	0.0	0.0	0.0	80.0	20.0
2007	Wild	3.6	14.9	18.6	46.4	16.5
	Hatchery	0.0	0.0	0.0	100.0	0.0
2008	Wild	0.5	6.3	65.4	26.2	1.6
	Hatchery	0.0	3.0	13.2	69.1	14.7
2009	Wild	1.1	6.3	46.3	46.3	0.0
	Hatchery	0.0	12.5	34.4	53.1	0.0
2010	Wild	0.1	6.3	66.3	26.5	0.0
	Hatchery	0.0	0.0	57.1	42.9	0.0
2011	Wild	0.8	8.2	50.6	40.4	0.3
	Hatchery	0.0	33.3	0.0	66.7	0.0
Average	***Wild***	***0.6***	***5.3***	***39.0***	***52.6***	***2.4***
	Hatchery	***0.0***	***5.9***	***28.8***	***47.9***	***7.9***

Mean lengths of natural-origin summer Chinook of a given age differed little between return years 2010 and 2011 (Table 6.3). Mean lengths of age-2 and 5 Chinook differed between years by about 4 cm. The few hatchery fish that were included in broodstock were about 9-15 cm smaller than their natural counterparts in the 2011 brood (Table 6.3).

Table 6.3. Mean fork length (cm) at age (total age) of hatchery and wild Wenatchee summer Chinook collected from broodstock in the Wenatchee River basin, 1991-2011; N = sample size and SD = 1 standard deviation.

Return year	Origin	Summer Chinook fork length (cm)														
		Age-2			Age-3			Age-4			Age-5			Age-6		
		Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD
1991	Wild	-	0	-	-	4	-	-	32	-	-	50	-	-	1	-
	Hatchery	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
1992	Wild	-	0	-	66	3	10	69	46	5	81	58	3	87	7	1
	Hatchery	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
1993	Wild	-	0	-	68	6	10	84	142	9	98	238	6	100	9	6

Return year	Origin	Summer Chinook fork length (cm)														
		Age-2			Age-3			Age-4			Age-5			Age-6		
		Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD
	Hatchery	-	0	-	-	0	-	79	41	8	101	3	8	-	0	-
1994	Wild	-	0	-	74	3	5	86	101	8	96	193	7	106	3	7
	Hatchery	-	0	-	-	0	-	75	1	-	90	53	8	-	0	-
1995	Wild	-	0	-	66	11	8	85	64	7	97	255	6	106	4	7
	Hatchery	-	0	-	-	0	-	-	0	-	-	0	-	91	16	8
1996	Wild	-	0	-	69	14	5	86	121	6	97	161	6	104	6	5
	Hatchery	-	0	-	-	0	-	63	1	-	96	2	4	-	0	-
1997	Wild	-	0	-	54	5	10	85	92	7	98	115	7	97	4	9
	Hatchery	-	0	-	46	4	2	74	10	4	98	1	-	-	0	-
1998	Wild	-	0	-	66	19	9	85	120	7	99	201	7	106	4	7
	Hatchery	-	0	-	53	5	2	77	63	8	95	19	8	98	6	8
1999	Wild	42	1	-	65	4	6	86	83	6	97	120	7	103	5	8
	Hatchery	-	0	-	52	3	6	79	55	7	90	171	6	100	8	6
2000	Wild	43	7	4	60	17	7	84	67	5	98	181	6	-	0	-
	Hatchery	-	0	-	53	47	7	76	29	8	94	83	7	102	35	9
2001	Wild	48	1	-	66	48	7	88	155	7	97	80	6	102	5	3
	Hatchery	-	0	-	51	10	3	75	132	8	91	17	8	100	5	8
2002	Wild	48	7	4	64	37	8	89	270	7	100	125	7	99	3	13
	Hatchery	-	0	-	-	0	-	78	5	8	95	7	5	-	0	-
2003	Wild	41	4	2	58	13	4	87	144	8	100	297	7	-	0	-
	Hatchery	-	0	-	40	1	-	78	2	4	101	5	8	-	0	-
2004	Wild	51	1	-	69	17	5	84	47	8	99	392	6	109	10	7
	Hatchery	-	0	-	-	0	-	84	1	-	108	1	-	-	0	-
2005	Wild	-	0	-	68	20	7	86	247	8	95	162	6	101	33	6
	Hatchery	-	0	-	-	0	-	-	0	-	90	3	9	-	0	-
2006	Wild	44	6	6	63	4	11	88	66	7	99	363	6	96	5	7
	Hatchery	-	0	-	-	0	-	-	0	-	99	4	7	100	1	-
2007	Wild	44	14	5	65	58	7	89	72	8	99	180	7	102	64	6
	Hatchery	-	0	-	-	0	-	-	0	-	90	4	5	-	0	-
2008	Wild	46	2	3	69	24	7	90	247	6	98	99	7	105	6	9
	Hatchery	-	0	-	63	2	14	81	9	7	93	47	6	99	10	5
2009	Wild	48	7	6	70	25	6	89	199	7	101	199	6	-	0	-
	Hatchery	-	0	-	61	4	7	80	11	9	98	17	10	-	0	-
2010	Wild	45	4	4	70	26	9	89	275	7	99	110	6	-	0	-
	Hatchery	-	0	-	-	0	-	74	4	8	88	3	7	-	0	-
2011	Wild	49	3	3	66	30	7	88	183	7	98	147	7	114	1	-
	Hatchery	-	0	-	57	2	1	-	0	-	83	4	6	-	0	-

Sex Ratios

Male summer Chinook in the 2010 broodstock made up about 53% of the adults collected, resulting in an overall male to female ratio of 1.12:1.00 (Table 6.4.). In 2011, males made up about 50% of the adults collected, resulting in an overall male to female ratio of 0.99:1.00 (Table 6.4). The ratios in 2011 were nearly equal to the 1:1 ratio goal in the broodstock protocol.

Table 6.4. Numbers of male and female wild and hatchery summer Chinook collected for broodstock in the Wenatchee River basin, 1989-2011. Ratios of males to females are also provided.

Return year	Number of wild summer Chinook			Number of hatchery summer Chinook			Total M/F ratio
	Males (M)	Females (F)	M/F	Males (M)	Females (F)	M/F	
1989	166	180	0.92:1.00	0	0	-	0.92:1.00
1990	45	39	1.15:1.00	0	0	-	1.15:1.00
1991	60	68	0.88:1.00	0	0	-	0.88:1.00
1992	154	187	0.82:1.00	0	0	-	0.82:1.00
1993	208	228	0.91:1.00	35	9	3.89:1.00	1.03:1.00
1994	158	179	0.88:1.00	24	31	0.77:1.00	0.87:1.00
1995	169	213	0.79:1.00	1	15	0.07:1.00	0.75:1.00
1996	150	181	0.83:1.00	2	1	2.00:1.00	0.84:1.00
1997	104	121	0.86:1.00	15	0	-	0.98:1.00
1998	211	167	1.26:1.00	64	30	2.13:1.00	1.40:1.00
1999	130	120	1.08:1.00	108	130	0.83:1.00	0.95:1.00
2000	153	145	1.06:1.00	112	82	1.37:1.00	1.17:1.00
2001	187	124	1.51:1.00	132	50	2.64:1.00	1.83:1.00
2002	266	203	1.31:1.00	5	8	0.63:1.00	1.28:1.00
2003	270	218	1.24:1.00	5	3	1.67:1.00	1.24:1.00
2004	230	264	0.87:1.00	1	1	1.00:1.00	0.87:1.00
2005	291	200	1.46:1.00	2	1	2.00:1.00	1.46:1.00
2006	237	246	0.96:1.00	1	4	0.25:1.00	0.95:1.00
2007	239	176	1.36:1.00	2	2	1.00:1.00	1.35:1.00
2008	208	192	1.08:1.00	29	43	0.67:1.00	1.01:1.00
2009	223	236	0.94:1.00	25	7	3.57:1.00	1.02:1.00
2010	217	198	1.10:1.00	5	2	2.50:1.00	1.12:1.00
2011	198	200	0.99:1.00	4	3	1.33:1.00	0.99:1.00
Total	***4,274***	***4,085***	***1.05:1.00***	***572***	***422***	***1.36:1.00***	***1.08:1.00***

Fecundity

Fecundities for the 2010 and 2011 returns of summer Chinook averaged 4,963 and 4,913 eggs per female, respectively (Table 6.5). These values are close to the overall average of 5,165 eggs per female. Mean observed fecundities for the 2010 and 2011 returns were near the expected fecundity of 5,000 eggs per female assumed in the broodstock protocol.

Table 6.5. Mean fecundity of wild, hatchery, and all female summer Chinook collected for broodstock in the Wenatchee River basin, 1989-2011; NA = not available.

Return year	Mean fecundity		
	Wild	Hatchery	Total
1989*	NA	NA	5,280
1990*	NA	NA	5,436
1991*	NA	NA	4,333
1992*	NA	NA	5,307
1993*	NA	NA	5,177
1994*	NA	NA	5,899
1995*	NA	NA	4,402
1996*	NA	NA	4,941
1997	5,385	5,272	5,390
1998	5,393	4,825	5,297
1999	5,036	4,942	4,987
2000	5,464	5,403	5,441
2001	5,280	4,647	5,097
2002	5,502	5,027	5,484
2003	5,357	5,696	5,361
2004	5,372	6,681	5,377
2005	5,045	6,391	5,053
2006	5,126	5,633	5,133
2007	5,124	4,510	5,115
2008	5,147	4,919	5,108
2009	5,308	4,765	5,291
2010	4,971	3,323	4,963
2011	4,943	2,983	4,913
Average	***5,230***	***5,001***	***5,165***

* Individual fecundities were not tracked with females until 1997.

6.2 Hatchery Rearing

Rearing History

Number of eggs taken

Based on the unfertilized egg-to-release survival standard of 81%, a total of 1,066,667 eggs were required to meet the program release goal of 864,000 smolts for brood years 1989-2011. An evaluation of the program in 2012 determined that 617,285 eggs are needed to meet the revised release goal of 500,001 smolts. This revised goal will begin with brood year 2012. From 1989 to 2011, the egg take goal was reached in seven of those years (Table 6.6).

Table 6.6. Numbers of eggs taken from Wenatchee summer Chinook broodstock, 1989-2011.

Return year	Number of eggs taken
1989	829,012
1990	163,109
1991	247,000
1992	827,911
1993	1,133,852
1994	999,364
1995	949,531
1996	756,000
1997	554,617
1998	854,997
1999	1,182,130
2000	1,113,159
2001	733,882
2002	1,049,255
2003	901,095
2004	1,311,051
2005	883,669
2006	1,190,757
2007	655,201
2008	1,145,330
2009	1,217,028
2010	947,875
2011	959,202
Average	***895,871***

Number of acclimation days

The 2010 brood Wenatchee summer Chinook were transferred to Dryden Pond between 26-30 March 2012. These fish received 26-30 days of acclimation on Wenatchee River water before being released on 25 April 2012 (Table 6.7). In recent years, a small proportion of the brood (high ELISA fish) has been reared separately and received no acclimation (i.e., these fish were released directly into the Wenatchee River). These data are not shown in Table 6.7. No such release occurred in 2012.

Table 6.7. Number of days Wenatchee summer Chinook were acclimated at Dryden Pond, brood years 1989-2010. Numbers in parenthesis represents the number of days fish reared at Chiwawa Ponds.

Brood year	Release year	Transfer date	Release date	Number of days
1989	1991	2-Mar	7-May	66
1990	1992	19-Feb	2-May	73

Brood year	Release year	Transfer date	Release date	Number of days
1991	1993	10-Mar	8-May	59
1992	1994	1-Mar	6-May	66
1993	1995	3-Mar	1-May	59
1994	1996	2-Oct	6-May	217 (154)
		5-Mar	6-May	62
1995	1997	16-Oct	8-May	205 (139)
		27-Feb	8-May	70
1996	1998	6-Oct	28-Apr	204 (142)
		25-Feb	28-Apr	62
1997	1999	23-Feb	27-Apr	63
1998	2000	5-Mar	1-May	57
1999	2001	8-Mar	23-Apr	46
2000	2002	1-Mar	6-May	66
2001	2003	19-Feb	23-Apr	63
2002	2004	5-Mar	23-Apr	49
2003	2005	15-Mar	25-Apr	41
2004	2006	25-Mar	27-Apr	33
2005	2007	15-Mar	30-Apr	46
2006	2008	11-14-Mar	28-Apr	45-48
2007	2009	30-31-Mar	29-Apr	29-30
2008	2010	9-12, 15, 22-Mar	28-Apr	38-51
2009	2011	15-18, 21-Mar, 22-Apr	26-Apr	5-43
2010	2012	26-30-Mar	25-Apr	26-30

Release Information

Numbers released

The 2010 Wenatchee summer Chinook program achieved 92% of the 864,000 target goal with about 792,746 fish being released (Table 6.8).

Table 6.8. Numbers of Wenatchee summer Chinook smolts released from the hatchery, 1989-2010. The release target for Wenatchee summer Chinook is 864,000 smolts.

Brood year	Release year	CWT mark rate	Number released with PIT tags	Number of smolts released
1989	1991	0.2013	0	720,000
1990	1992	0.9597	0	124,440
1991	1993	0.9957	0	191,179
1992	1994	0.9645	0	627,331
1993	1995	0.9881	0	900,429
1994	1996	0.9697	0	797,350
1995	1997	0.9725	0	687,439
1996	1998	0.9758	0	600,127
1997	1999	0.9913	0	438,223
1998	2000	0.9869	0	649,612
1999	2001	0.9728	0	1,005,554
2000	2002	0.9723	0	929,496
2001	2003	0.9868	0	604,668
2002	2004	0.9644	0	835,645
2003	2005	0.9778	0	653,764
2004	2006	0.9698	0	892,926
2005	2007	0.9596	0	644,182
2006	2008	0.9676	0	51,550[a]
		0.9676	0	899,107
2007	2009	0.9768	0	456,805
2008	2010	0.9664	10,035	888,811
2009	2011	0.9767	29,930	843,866
2010	2012	0.9964	0	792,746
Average		***0.9751***	***1,738***	***691,168***

[a] Represents high Elisa group planted directly in the Wenatchee River at Leavenworth Boat Launch.

Numbers tagged

The 2010 brood Wenatchee summer Chinook were 99.6% CWT and adipose fin-clipped (Table 6.8).

In 2012, a total of about 5,100 summer Chinook (brood year 2011) were PIT tagged at Eastbank Fish Hatchery during 18-19 September 2012. Fish were not fed during tagging or for two days before and after tagging. Fish averaged 82 mm in length and 5.6 g at time of tagging. As of the end of January 2013, a total of 20 tagged Chinook had died. No Chinook had shed their tags.

Table 6.9 summarizes the number of hatchery summer Chinook that have been PIT-tagged and released into the Wenatchee River.

Table 6.9. Summary of PIT-tagging activities for Wenatchee hatchery summer Chinook, brood years 2008-2010.

Brood year	Release year	Number of fish tagged	Number of tagged fish that died	Number of tags shed	Number of tagged fish released
2008	2010	10,100	64	1	10,035
2009	2011	10,108 (Control)	140	3	9,965
		10,100 (R1)	129	0	9,971
		10,099 (R2)	105	0	9,994
2010	2012	0	0	0	0

Fish size and condition at release

About 792,746 summer Chinook from the 2010 brood were released from Dryden Pond using an unmonitored volitional method (i.e., volitional without PIT-tag detection equipment in place) on 25 April 2012. Size at release was 87.5% and 94.9% of the target fork length and weight goals, respectively. This brood year exceeded the target CV for length (Table 6.10). Since the program began, Wenatchee summer Chinook have not met the target length and CV values. The target weight (fish/pound or FPP) of juvenile fish has been met occasionally.

Table 6.10. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of Wenatchee summer Chinook smolts released from the hatchery, brood years 1989-2010; NA = not available. Size targets are provided in the last row of the table.

Brood year	Release year	Fork length (cm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
1989	1991	158	13.7	45.4	10
1990	1992	155	14.2	45.4	10
1991	1993	156	15.5	42.3	11
1992	1994	152	13.1	40.1	10
1993	1995	149	NA	34.9	13
1994	1996	138	NA	21.7	21
1995	1997	149	12.2	42.5	11
1996	1998	151	16.6	43.2	10
1997	1999	154	10.1	42.8	11
1998	2000	166	9.7	53.1	9
1999	2001	137	16.1	29.0	16
2000	2002	148	14.6	37.1	12
2001	2003	148	NA	38.9	12
2002	2004	146	15.1	37.3	14
2003	2005	147	13.2	36.5	12
2004	2006	147	10.7	35.4	13
2005	2007	153	16.3	40.6	11

Brood year	Release year	Fork length (cm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
2006	2008	136	21.5	29.2	16
2007	2009	163	21.6	49.7	9
2008	2010	166	15.0	52.0	9
2009	2011	152	15.9	39.0	12
2010	2012	154	17.2	43.1	11
Targets		***176***	***9.0***	***45.4***	***10***

Survival Estimates

Overall survival of the 2010 brood Wenatchee summer Chinook from green (unfertilized) egg to release was slightly higher than the standard set for the program. This was in part because of a high 100-d after ponding survival (Table 6.11).

Table 6.11. Hatchery life-stage survival rates (%) for Wenatchee summer Chinook, brood years 1989-2010. Survival standards or targets are provided in the last row of the table.

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
1989	90.0	93.4	90.9	97.0	99.7	99.3	98.5	99.4	86.9
1990	89.7	95.6	80.9	96.6	99.6	99.2	97.7	98.8	76.3
1991	88.2	98.3	86.9	96.1	99.3	98.5	94.9	98.1	77.4
1992	84.3	92.2	79.8	97.8	99.9	99.9	97.1	98.1	75.8
1993	92.4	95.9	84.2	97.5	99.6	99.3	96.7	98.8	79.4
1994	90.7	95.3	83.7	100	99.2	97.0	95.3	98.4	79.8
1995	94.7	98.2	86.0	100	96.7	96.4	74.9	90.8	72.4
1996	84.6	96.1	84.1	100	97.9	97.7	94.4	97.7	79.4
1997	89.3	98.3	82.6	97.3	97.1	96.9	98.3	98.2	79.0
1998	85.3	94.6	80.9	98.3	99.4	98.6	95.6	99.8	76.0
1999	98.4	98.3	90.4	97.9	98.1	97.9	96.2	99.4	85.1
2000	93.0	96.6	88.3	98.0	99.6	99.3	96.5	98.9	83.5
2001	87.4	91.5	90.6	97.7	99.8	99.6	93.1	93.3	82.4
2002	93.8	94.1	85.1	99.8	98.1	97.6	93.7	96.5	79.6
2003	77.4	85.1	80.5	98.1	99.6	99.1	91.9	93.5	72.6
2004	92.8	97.8	85.7	87.8	99.9	99.6	86.6	92.1	65.1
2005	97.3	89.6	83.5	98.0	99.7	99.4	89.1	99.5	72.9
2006	92.4	95.2	85.6	98.4	99.3	98.4	94.8	97.2	79.8
2007	73.6	97.5	73.7	97.9	99.5	98.7	96.6	99.1	69.7
2008	96.6	97.9	90.4	97.3	99.4	98.7	88.2	89.6	77.6
2009	95.1	95.6	92.0	99.6	97.3	97.3	84.8	98.2	78.1
2010	94.7	97.8	96.1	99.3	97.6	97.1	87.2	90.3	83.2

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

6.3 Disease Monitoring

Rearing of the 2010 brood Wenatchee summer Chinook was similar to previous years with fish being held on well water before being transferred to Dryden Pond for final acclimation in March 2012. Fish were transferred to Dryden pond from 26 to 30 March. Increased mortality caused by external fungus began to occur during the acclimation period at Dryden pond at which time a formalin treatment was initiated in an attempt to prevent the fungus from proliferating.

Results of the 2012 adult broodstock bacterial kidney disease (BKD) monitoring indicated that all females (100%) had ELISA values less than 0.199. All females had ELISA values less than 0.120, which means that none of the progeny needed to be reared at densities less than 0.06 fish per pound (Table 6.12).

Table 6.12. Proportion of bacterial kidney disease (BKD) titer groups for the Wenatchee summer Chinook broodstock, brood years 1997-2012. Also included are the proportions to be reared at either 0.125 fish per pound or 0.060 fish per pound.

Brood year[a]	Optical density values by titer group				Proportion at rearing densities (fish per pound, fpp)	
	Very Low (≤ 0.099)	Low (0.1-0.199)	Moderate (0.2-0.449)	High (≥ 0.450)	≤ 0.125 fpp (<0.119)	≤ 0.060 fpp (>0.120)
1997	0.7714	0.0857	0.0381	0.1048	0.8095	0.1905
1998	0.3067	0.2393	0.1656	0.2883	0.4479	0.5521
1999	0.9590	0.0123	0.0123	0.0164	0.9713	0.0287
2000	0.6268	0.1053	0.1627	0.1053	0.7321	0.2679
2001	0.6513	0.0263	0.0987	0.2237	0.6776	0.3224
2002	0.7868	0.0457	0.0711	0.0964	0.8325	0.1675
2003	0.9825	0.0000	0.0058	0.0117	0.9825	0.0175
2004	0.9593	0.0081	0.0163	0.0163	0.9675	0.0325
2005	0.9833	0.0056	0.0000	0.0111	0.9833	0.0167
2006	0.9134	0.0563	0.0000	0.0303	0.9351	0.0649
2007	0.9535	0.0078	0.0078	0.0310	0.9535	0.0465
2008	0.9868	0.0088	0.0044	0.0000	0.9868	0.0132
2009	0.9957	0.0000	0.0000	0.0043	0.9957	0.0043
2010	0.9897	0.0025	0.0000	0.0025	0.9949	0.0051
2011	0.9585	0.0363	0.0000	0.0052	0.9896	0.0104
2012	0.9697	0.0303	0.0000	0.0000	1.0000	0.0000
Average	*0.8622*	*0.0419*	*0.0364*	*0.0592*	*0.8912*	*0.1088*

[a] Individual ELISA samples were not collected before the 1997 brood.

6.4 Natural Juvenile Productivity

The Lower Wenatchee Trap did not operate in 2012. Therefore, there are no estimates of juvenile summer Chinook emigrants in 2012.

6.5 Spawning Surveys

Surveys for Wenatchee summer Chinook redds were conducted from late 17 September to 30 October 2012 in the Wenatchee River and Icicle Creek. Both peak counts and total counts (based on expansion factors; Murdoch and Peven 2005) were conducted in the river (see Appendix H for more details).

Redd Counts

A peak count of 2,303 summer Chinook redds was estimated in 2012 based on ground surveys conducted in the Wenatchee River and Icicle Creek (Table 6.13). A total count of 2,504 redds was estimated in 2012 based on expanded peak counts in the Wenatchee River basin (Table 6.13).

Table 6.13. Peak and total numbers of redds counted in the Wenatchee River basin, 1989-2012; NA = not available. Total counts are based on expanded peak counts (see Appendix H for more information).

Survey year	Peak redd count	Total count (peak expansion)
1989	3,331	4,215
1990	2,479	3,103
1991	2,180	2,748
1992	2,328	2,913
1993	2,334	2,953
1994	2,426	3,077
1995	1,872	2,350
1996	1,435	1,814
1997	1,388	1,739
1998	1,660	2,230
1999	2,188	2,738
2000	2,022	2,540
2001	2,857	3,550
2002	5,419	6,836
2003	4,281	5,268
2004	4,003	4,874
2005	2,895	3,538
2006*	7,233	8,896
2007*	1,870	1,970
2008*	2,361	2,800
2009*	2,688	3,441
2010*	2,564	3,261

Survey year	Peak redd count	Total count (peak expansion)
2011*	2,592	3,078
2012*	2,303	2,504
Average	***2,780***	***3,435***

* Peak and total counts include 68, 13, 23, 21, 11, 9, and two redds counted in Icicle Creek in 2006-2012, respectively.

Redd Distribution

Summer Chinook redds were not evenly distributed among reaches within the Wenatchee River basin in 2012 (Table 6.14; Figure 6.1). Most of the spawning occurred upstream from the Leavenworth Bridge in Reaches 6, 9, and 10. The highest density of redds occurred in Reach 6 near the confluence of the Icicle River.

Table 6.14. Peak and total numbers of summer Chinook redds counted in different reaches in the Wenatchee River basin during September through mid-November, 2012. Reach codes are described in Table 2.10.

Survey reach	Peak redd count	Total count (peak expansion)
Wenatchee 1 (W1)	7	9
Wenatchee 2 (W2)	162	166
Wenatchee 3 (W3)	160	227
Wenatchee 4 (W4)	67	70
Wenatchee 5 (W5)	49	62
Wenatchee 6 (W6)	831	865
Wenatchee 7 (W7)	149	153
Wenatchee 8 (W8)	127	173
Wenatchee 9 (W9)	437	400
Wenatchee 10 (W10)	312	377
Icicle Creek (I1)	2	2
Totals	***2,303***	***2,504***

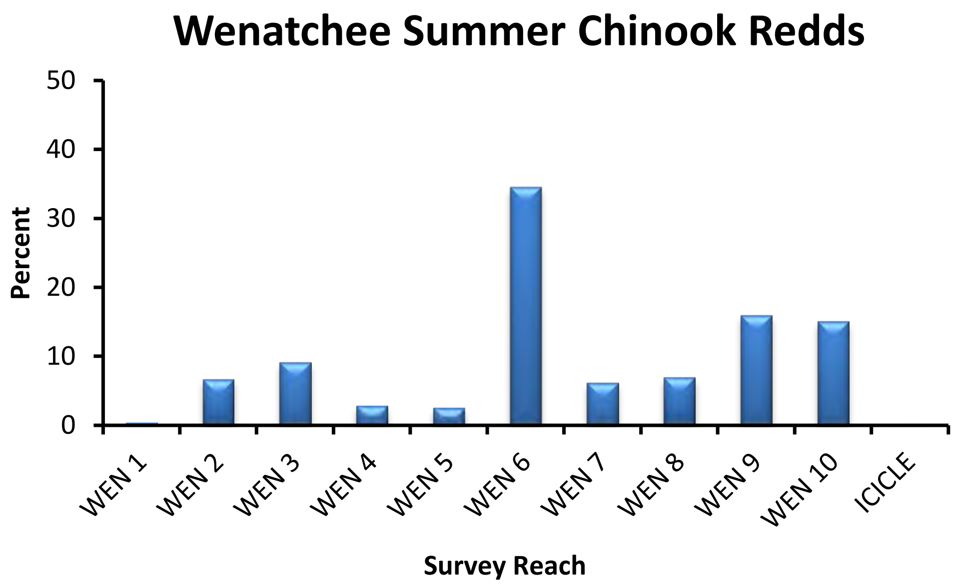


Figure 6.1. Percent of the total number (based on peak expansion) of summer Chinook redds counted in different reaches in the Wenatchee River basin during September through early-November, 2012. Reach codes are described in Table 2.10.

Spawn Timing

In 2012, spawning in the Wenatchee River began during the last week of September, peaked the second week of October, and ended in late October (Figure 6.2).

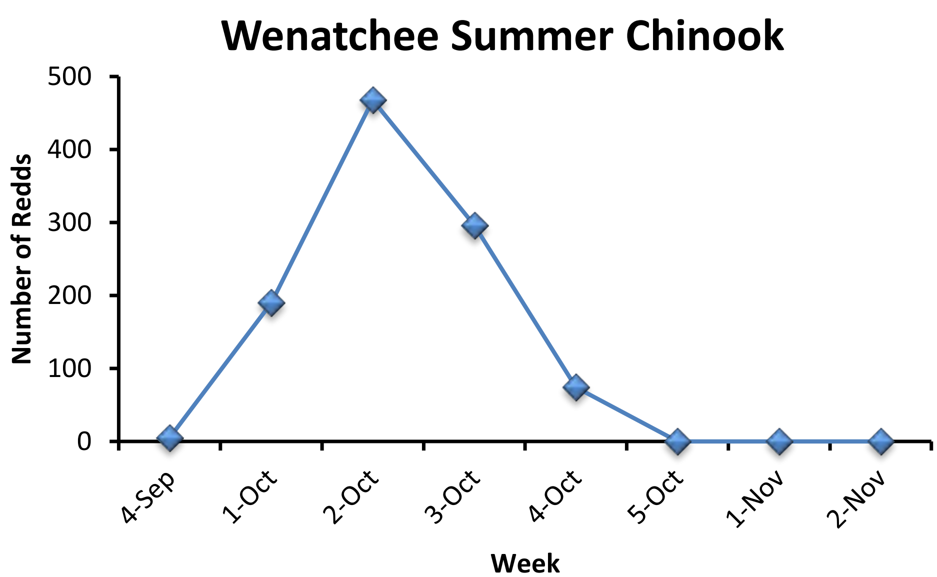


Figure 6.2. Number of new summer Chinook redds counted during different weeks in the Wenatchee River, September through mid-November 2012 (based on mapping counts).

Spawning Escapement

Spawning escapement for Wenatchee summer Chinook was calculated as the total number of redds (expanded peak counts) times the fish per redd ratio estimated from broodstock and fish sampled at adult trapping sites. The estimated fish per redd ratio for summer Chinook in 2012 was 3.41. Multiplying this ratio by the number of redds counted in the Wenatchee River basin resulted in a total spawning escapement of 8,539 summer Chinook (Table 6.15).

Table 6.15. Spawning escapements for summer Chinook in the Wenatchee River basin, return years 1989-2012. Number of redds is based on expanded peak redd counts.

Return year	Fish/Redd	Redds	Total spawning escapement
1989	3.40	4,215	14,331
1990	3.50	3,103	10,861
1991	3.70	2,748	10,168
1992	4.00	2,913	11,652
1993	3.20	2,953	9,450
1994	3.30	3,077	10,154
1995	3.30	2,350	7,755
1996	3.40	1,814	6,168
1997	3.40	1,739	5,913
1998	2.40	2,230	5,352
1999	2.00	2,738	5,476
2000	2.17	2,540	5,512
2001	3.20	3,550	11,360
2002	2.30	6,836	15,723
2003	2.24	5,268	11,800
2004	2.15	4,874	10,479
2005	2.46	3,538	8,703
2006	2.00	8,896	17,792
2007	2.33	1,970	4,590
2008	2.32	2,800	6,496
2009	2.42	3,441	8,327
2010	2.29	3,261	7,468
2011	3.20	3,078	9,850
2012	3.41	2,504	8,539
Average	***2.84***	***3,435***	***9,330***

6.6 Carcass Surveys

Surveys for Wenatchee summer Chinook carcasses were conducted during late September to early November 2011 in the Wenatchee River and Icicle Creek.

Number sampled

A total of 1,319 summer Chinook carcasses were sampled during October through early November in the Wenatchee River basin in 2012 (Table 6.16).

Table 6.16. Numbers of summer Chinook carcasses sampled within each survey reach in the Wenatchee River basin, 1993-2012. Reach codes are described in Table 2.10.

Survey year	Number of summer Chinook carcasses											
	W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9	W-10	Icicle	Total
1993	61	138	627	12	77	141	202	38	0	0	0	**1,296**
1994	0	6	22	1	17	48	18	47	125	1	0	**285**
1995	0	10	14	0	0	111	49	36	19	0	0	**239**
1996	0	5	67	39	9	190	26	30	41	0	0	**407**
1997	1	44	118	4	28	288	7	71	67	13	0	**641**
1998	6	74	141	3	0	248	28	346	324	59	0	**1,229**
1999	0	160	97	15	31	857	61	133	171	72	0	**1,597**
2000	7	109	165	7	79	651	75	111	159	193	0	**1,556**
2001	0	45	127	26	0	323	33	110	87	81	0	**832**
2002	0	238	170	0	196	809	0	306	520	155	6	**2,400**
2003	6	323	164	61	132	673	56	237	482	47	36	**2,217**
2004	8	141	181	157	158	975	87	312	428	366	5	**2,818**
2005	8	85	106	39	46	707	70	140	353	257	7	**1,818**
2006	22	140	160	64	112	953	435	343	703	658	18	**3,608**
2007	3	15	49	9	26	475	38	38	96	91	8	**848**
2008	10	34	63	36	36	678	47	42	103	143	8	**1,200**
2009	11	29	43	32	27	389	16	58	240	175	6	**1,026**
2010	3	31	98	57	122	681	136	49	124	193	15	**1,509**
2011	5	88	126	19	38	1,335	78	45	211	289	9	**2,243**
2012	8	82	95	23	40	600	53	62	173	183	0	**1,319**
Average	***8***	***90***	***132***	***30***	***59***	***557***	***76***	***128***	***221***	***149***	***6***	***1,454***

Carcass Distribution and Origin

Summer Chinook carcasses were not evenly distributed among reaches within the Wenatchee River basin in 2012 (Table 6.15; Figure 6.3). Most of the carcasses in the Wenatchee River basin were found upstream from the Leavenworth Bridge. The highest percentage of carcasses (46%) was sampled in Reach 6 near the confluence of the Icicle River.

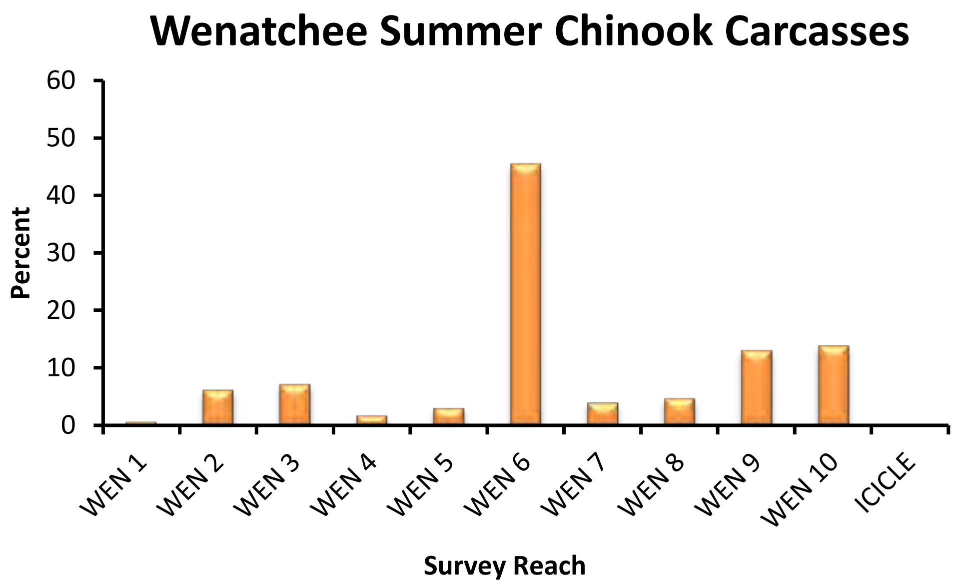


Figure 6.3. Percent of summer Chinook carcasses sampled within different reaches in the Wenatchee River basin during September through mid-November, 2012. Reach codes are described in Table 2.10.

Numbers of wild and hatchery-origin summer Chinook carcasses sampled in 2012 will be available after analysis of CWTs and scales. Based on the available data (1993-2011), most fish, regardless of origin, were found in Reach 6 (Leavenworth Bridge to Icicle Road Bridge) (Table 6.17). However, a larger percentage of hatchery fish were found in that reach than were wild fish (Figure 6.4). In contrast, a larger percentage of wild fish were found in reaches upstream from the Icicle Road Bridge.

Table 6.17. Numbers of wild and hatchery summer Chinook carcasses sampled within different reaches in the Wenatchee River basin, 1993-2011.

Survey year	Origin	Survey reach											Total
		W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9	W-10	Icicle	
1993	Wild	52	133	591	11	77	124	200	37	0	0	0	**1,225**
	Hatchery	9	5	36	1	0	17	2	1	0	0	0	**71**
1994	Wild	0	2	15	1	15	34	18	47	124	1	0	**257**
	Hatchery	0	4	7	0	2	14	0	0	1	0	0	**28**
1995	Wild	0	4	11	0	0	99	49	34	19	0	0	**216**
	Hatchery	0	6	3	0	0	12	0	2	0	0	0	**23**
1996	Wild	0	5	65	37	8	181	26	30	41	0	0	**393**
	Hatchery	0	0	2	2	1	9	0	0	0	0	0	**14**
1997	Wild	1	35	104	4	21	242	7	71	66	13	0	**564**
	Hatchery	0	9	14	0	7	46	0	0	1	0	0	**77**
1998	Wild	6	55	106	2	0	169	25	325	297	56	0	**1,041**
	Hatchery	0	19	35	1	0	79	3	21	27	3	0	**188**
1999	Wild	0	79	55	7	14	525	51	124	155	68	0	**1,078**

Survey year	Origin	Survey reach											Total
		W-1	W-2	W-3	W-4	W-5	W-6	W-7	W-8	W-9	W-10	Icicle	
	Hatchery	0	81	42	8	17	332	10	9	16	4	0	**519**
2000	Wild	4	68	102	6	51	443	68	100	154	186	0	**1,182**
	Hatchery	3	41	63	1	28	208	7	11	5	7	0	**374**
2001	Wild	0	33	88	4	0	230	29	108	83	78	0	**653**
	Hatchery	0	12	39	22	0	93	4	2	4	3	0	**179**
2002	Wild	0	140	110	0	94	440	0	295	514	150	4	**1,747**
	Hatchery	0	98	60	0	102	369	0	11	6	5	2	**653**
2003	Wild	5	218	118	21	94	425	52	223	445	46	11	**1,658**
	Hatchery	1	105	46	40	38	248	4	14	37	1	25	**559**
2004	Wild	7	108	151	102	97	640	74	282	416	357	0	**2,234**
	Hatchery	1	33	30	55	61	335	13	30	12	9	5	**584**
2005	Wild	4	49	78	24	26	397	66	125	336	243	0	**1,348**
	Hatchery	4	36	28	15	20	310	4	15	17	14	7	**470**
2006	Wild	16	108	133	46	80	753	426	336	700	654	5	**3,257**
	Hatchery	6	32	27	18	32	200	9	7	3	4	13	**351**
2007	Wild	1	9	29	2	16	241	36	37	96	91	3	**561**
	Hatchery	2	6	20	7	10	234	2	1	0	0	5	**287**
2008	Wild	7	17	39	25	21	404	43	35	102	142	2	**869**
	Hatchery	3	17	24	11	15	272	4	7	2	1	6	**130**
2009	Wild	6	22	32	23	20	288	13	55	236	173	5	**873**
	Hatchery	5	7	11	9	7	101	3	3	4	2	1	**153**
2010	Wild	2	22	62	44	64	477	125	47	121	192	0	**1,156**
	Hatchery	1	9	36	14	58	204	11	2	3	1	15	**354**
2011	Wild	4	46	75	12	25	916	74	45	211	287	3	**1,698**
	Hatchery	1	42	51	7	13	416	3	0	0	2	6	**541**
Average	***Wild***	***6***	***61***	***103***	***20***	***38***	***370***	***73***	***124***	***217***	***144***	***2***	***1,158***
	Hatchery	***2***	***30***	***30***	***11***	***22***	***184***	***4***	***7***	***7***	***3***	***4***	***292***

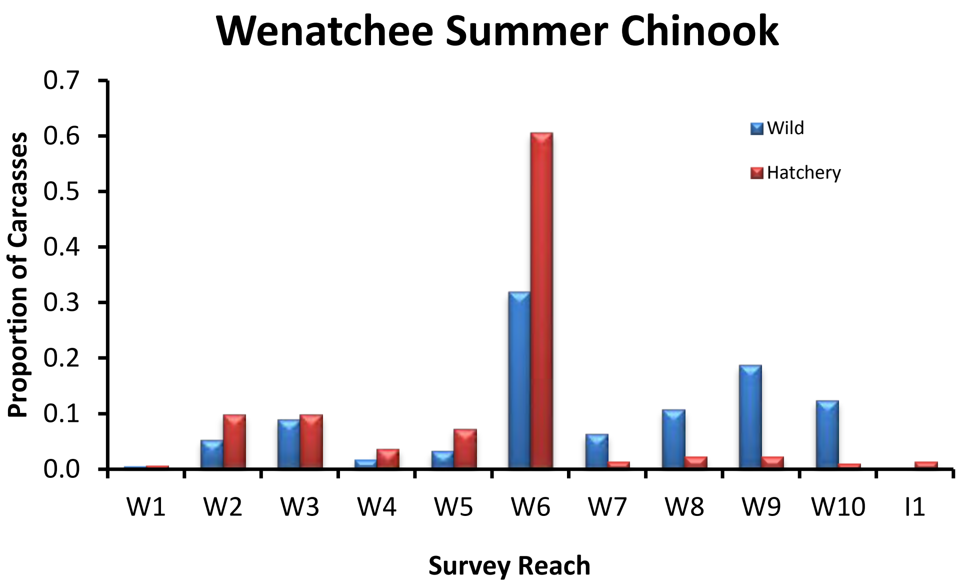


Figure 6.4. Distribution of wild and hatchery produced carcasses in different reaches in the Wenatchee River basin, 1993-2011. Reach codes are described in Table 2.10.

Sampling Rate

If escapement is based on total numbers of redds (based on peak expansion), then about 15% of the total spawning escapement of summer Chinook in the Wenatchee River basin was sampled in 2012 (Table 6.18). Sampling rates among survey reaches varied from 0 to 26%.

Table 6.18. Number of redds and carcasses, total spawning escapement, and sampling rates for summer Chinook in the Wenatchee River basin, 2012.

Sampling reach	Total number of redds	Total number of carcasses	Total spawning escapement	Sampling rate
Wenatchee 1 (W1)	9	8	31	0.26
Wenatchee 2 (W2)	166	82	566	0.14
Wenatchee 3 (W3)	227	95	774	0.12
Wenatchee 4 (W4)	70	23	239	0.10
Wenatchee 5 (W5)	62	40	211	0.19
Wenatchee 6 (W6)	865	600	2,950	0.20
Wenatchee 7 (W7)	153	53	522	0.10
Wenatchee 8 (W8)	173	62	590	0.11
Wenatchee 9 (W9)	400	173	1,364	0.13
Wenatchee 10 (W10)	377	183	1,286	0.14
Icicle Creek (I1)	2	0	7	0.00
Total	***2,504***	***1,319***	***8,539***	***0.15***

Length Data

Mean lengths (POH, cm) of male and female summer Chinook carcasses sampled during surveys in the Wenatchee River basin in 2012 are provided in Table 6.19. The average size of males and females sampled in the Wenatchee River basin were 65 cm and 70 cm, respectively.

Table 6.19. Mean lengths (postorbital-to-hypural length; cm) and standard deviations (in parentheses) of male and female summer Chinook carcasses sampled in different streams/watersheds in the Wenatchee River basin, 2012.

Stream/watershed	Mean length (cm)	
	Male	Female
Wenatchee 1 (W1)	73.0 (10.5)	61.3 (3.2)
Wenatchee 2 (W2)	63.0 (10.6)	71.3 (6.1)
Wenatchee 3 (W3)	66.8 (10.3)	68.9 (6.5)
Wenatchee 4 (W4)	62.1 (11.7)	65.0 (9.8)
Wenatchee 5 (W5)	61.7 (9.6)	69.5 (4.2)
Wenatchee 6 (W6)	64.3 (9.7)	70.2 (5.5)
Wenatchee 7 (W7)	64.8 (8.2)	69.0 (5.1)
Wenatchee 8 (W8)	66.0 (6.1)	71.5 (4.5)
Wenatchee 9 (W9)	70.0 (9.3)	72.6 (5.3)
Wenatchee 10 (W10)	64.1 (10.1)	70.0 (4.7)
Icicle Creek (I1)	--	--
Total	***64.9 (10.0)***	***70.4 (5.5)***

6.7 Life History Monitoring

Life history characteristics of Wenatchee summer Chinook were assessed by examining carcasses on spawning grounds and fish collected or examined at broodstock collection sites, and by reviewing tagging data and fisheries statistics.

Migration Timing

Migration timing of hatchery and wild Wenatchee summer Chinook was determined from broodstock data and stock assessment data collected at Dryden Dam. Sampling at Dryden Dam occurs from early July through mid-October. During the early part of the migration, hatchery summer Chinook arrived about one week later than wild Chinook (Table 6.20). This pattern carries through the migration distribution of summer Chinook at Dryden Dam. By the end of the migration, hatchery fish continue to pass Dryden about five to six weeks after 90% of the wild fish have passed the dam.

Table 6.20. The week that 10%, 50% (median), and 90% of the wild and hatchery summer Chinook salmon passed Dryden Dam, 2007-2012. The average week is also provided. Migration timing is based on collection of summer Chinook broodstock at Dryden Dam.

Survey year	Origin	Wenatchee Summer Chinook Migration Time (week)				Sample size
		10 Percentile	50 Percentile	90 Percentile	Mean	
2007	Wild	28	31	37	31	274
	Hatchery	30	33	41	35	305
2008	Wild	29	31	40	32	219
	Hatchery	32	37	41	37	576
2009	Wild	27	29	41	31	469
	Hatchery	28	34	42	35	382
2010	Wild	30	33	35	32	403
	Hatchery	29	30	33	30	268
2011	Wild	30	31	34	32	293
	Hatchery	32	34	39	35	304
2012	Wild	30	32	39	33	247
	Hatchery	31	37	41	36	366
Average	Wild	***28***	***31***	***36***	***32***	***1,905***
	Hatchery	***29***	***35***	***41***	***35***	***2,201***

Age at Maturity

Because hatchery summer Chinook are released after one year of rearing and natural-origin summer Chinook migrate primarily as age-0 fish, total ages will differ between hatchery and natural-origin Chinook (see Hillman et al. 2011). Therefore, in this section, we evaluated age at maturity by comparing differences in salt (ocean) ages between the two groups.

Most of the wild and hatchery summer Chinook sampled during the period 1993-2011 in the Wenatchee River basin were salt age-3 fish (Table 6.21; Figure 6.5). A higher percentage of salt age-4 wild Chinook returned to the basin than did salt age-4 hatchery Chinook. In contrast, a higher proportion of salt age-1 and 2 hatchery fish returned than did salt age-1 and 2 wild fish. Thus, a higher percentage of wild fish returned at an older age than did hatchery fish.

Table 6.21. Proportions of wild and hatchery summer Chinook of different salt (ocean) ages sampled on spawning grounds in the Wenatchee River basin, 1993-2011.

Sample year	Origin	Salt age					Sample size
		1	2	3	4	5	
1993	Wild	0.02	0.24	0.62	0.12	0.00	1,224
	Hatchery	0.03	0.91	0.03	0.03	0.00	64
1994	Wild	0.02	0.21	0.45	0.32	0.00	257
	Hatchery	0.00	0.14	0.86	0.00	0.00	21
1995	Wild	0.02	0.15	0.65	0.18	0.00	216
	Hatchery	0.00	0.00	0.05	0.95	0.00	21

Sample year	Origin	Salt age					Sample size
		1	2	3	4	5	
1996	Wild	0.01	0.25	0.66	0.08	0.00	512
	Hatchery	0.00	0.33	0.33	0.29	0.05	21
1997	Wild	0.01	0.24	0.57	0.18	0.00	561
	Hatchery	0.05	0.20	0.67	0.08	0.00	75
1998	Wild	0.02	0.23	0.66	0.09	0.00	1,041
	Hatchery	0.03	0.49	0.38	0.10	0.00	187
1999	Wild	0.01	0.34	0.55	0.10	0.00	1,087
	Hatchery	0.01	0.15	0.79	0.05	0.00	510
2000	Wild	0.02	0.20	0.64	0.15	0.00	1,181
	Hatchery	0.07	0.12	0.66	0.15	0.00	343
2001	Wild	0.01	0.16	0.74	0.08	0.00	653
	Hatchery	0.05	0.76	0.14	0.04	0.00	182
2002	Wild	0.00	0.14	0.62	0.24	0.00	1,744
	Hatchery	0.01	0.16	0.80	0.03	0.00	646
2003	Wild	0.01	0.07	0.51	0.41	0.00	1,653
	Hatchery	0.05	0.07	0.75	0.12	0.00	530
2004	Wild	0.00	0.13	0.32	0.54	0.01	2,232
	Hatchery	0.08	0.57	0.25	0.10	0.00	566
2005	Wild	0.00	0.12	0.75	0.13	0.00	1,190
	Hatchery	0.02	0.09	0.86	0.03	0.00	450
2006	Wild	0.00	0.02	0.27	0.71	0.00	2,972
	Hatchery	0.02	0.16	0.24	0.57	0.00	299
2007	Wild	0.01	0.09	0.31	0.53	0.07	480
	Hatchery	0.00	0.15	0.75	0.07	0.03	275
2008	Wild	0.01	0.06	0.76	0.17	0.00	769
	Hatchery	0.02	0.12	0.75	0.11	0.00	332
2009	Wild	0.01	0.07	0.51	0.41	0.00	797
	Hatchery	0.10	0.36	0.49	0.05	0.00	132
2010	Wild	0.01	0.18	0.65	0.16	0.00	1,069
	Hatchery	0.00	0.49	0.46	0.03	0.00	299
2011	Wild	0.01	0.10	0.60	0.29	0.00	1,534
	Hatchery	0.06	0.04	0.90	0.01	0.00	471
Average	***Wild***	***0.01***	***0.14***	***0.53***	***0.32***	***0.00***	***1,159***
	Hatchery	***0.03***	***0.25***	***0.60***	***0.11***	***0.00***	***271***

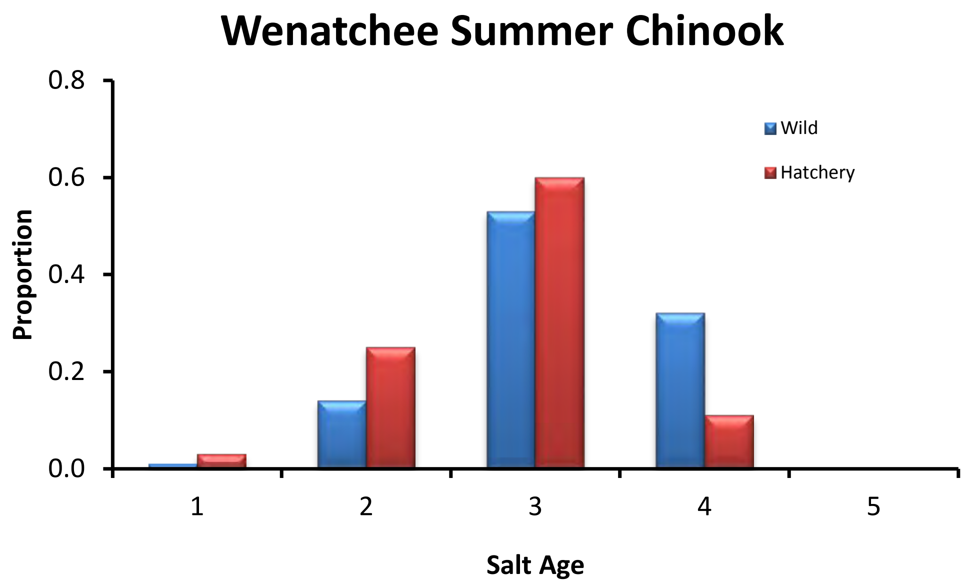


Figure 6.5. Proportions of wild and hatchery summer Chinook of different salt (ocean) ages sampled at broodstock collection sites and on spawning grounds in the Wenatchee River basin for the combined years 1993-2011.

Size at Maturity

On average, hatchery summer Chinook were about 4 cm smaller than wild summer Chinook sampled in the Wenatchee River basin (Table 6.22). This is likely because a higher percentage of wild fish returned as salt age-3 and 4 fish than did hatchery fish. Analyses for the five-year reports will compare sizes of hatchery and wild fish of the same age groups and sex.

Table 6.22. Mean lengths (POH; cm) and variability statistics for wild and hatchery summer Chinook sampled in the Wenatchee River basin, 1993-2011; SD = 1 standard deviation.

Sample year	Origin	Sample size	Summer Chinook length (POH; cm)			
			Mean	SD	Minimum	Maximum
1993	Wild	1,344	73	8	33	94
	Hatchery	68	61	9	37	83
1994	Wild	276	73	8	31	89
	Hatchery	25	70	8	54	85
1995	Wild	225	75	7	48	87
	Hatchery	23	74	7	57	85
1996	Wild	210	74	7	43	92
	Hatchery	9	66	12	52	84
1997	Wild	615	74	8	29	99
	Hatchery	78	69	10	29	83
1998	Wild	1,179	73	8	28	97
	Hatchery	188	67	10	37	87
1999	Wild	1,218	72	8	29	95

Sample year	Origin	Sample size	Summer Chinook length (POH; cm)			
			Mean	SD	Minimum	Maximum
	Hatchery	518	71	8	26	94
2000	Wild	1,302	71	10	24	94
	Hatchery	369	69	11	33	91
2001	Wild	730	70	9	30	93
	Hatchery	179	63	10	28	86
2002	Wild	1,914	72	8	39	94
	Hatchery	653	71	8	34	95
2003	Wild	1,950	74	9	24	105
	Hatchery	546	69	10	26	97
2004	Wild	2,571	72	9	32	98
	Hatchery	580	59	11	25	91
2005	Wild	1,352	69	7	41	92
	Hatchery	469	69	8	39	91
2006	Wild	3,249	74	6	29	99
	Hatchery	350	71	9	35	90
2007	Wild	566	73	9	29	92
	Hatchery	269	70	7	45	87
2008	Wild	836	69	8	29	89
	Hatchery	363	70	9	24	94
2009	Wild	872	71	8	30	94
	Hatchery	153	64	11	32	84
2010	Wild	1,147	68	8	32	92
	Hatchery	351	65	10	25	87
2011	Wild	1,698	68	8	33	101
	Hatchery	541	66	9	34	85
Pooled	***Wild***	***23,254***	***72***	***8***	***24***	***105***
	Hatchery	***5,732***	***68***	***9***	***24***	***97***

Contribution to Fisheries

Most of the harvest on hatchery-origin Wenatchee summer Chinook occurred in the ocean (Table 6.23). Ocean harvest has made up 47% to 100% of all hatchery Wenatchee summer Chinook harvested. Total harvest on early brood years (1990-1996) was lower than for later brood years (1997-2006).

Table 6.23. Estimated number and percent (in parentheses) of hatchery-origin Wenatchee summer Chinook captured in different fisheries, brood years 1989-2006.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational (sport)	
1989	1,510 (51)	1,432 (48)	0 (0)	20 (1)	2,962
1990	30 (100)	0 (0)	0 (0)	0 (0)	30
1991	30 (63)	0 (0)	0 (0)	18 (38)	48
1992	147 (79)	39 (21)	0 (0)	0 (0)	186
1993	35 (58)	25 (42)	0 (0)	0 (0)	60
1994	644 (91)	63 (9)	2 (0)	0 (0)	709
1995	558 (98)	9 (2)	5 (1)	0 (0)	572
1996	195 (96)	3 (1)	0 (0)	6 (3)	204
1997	2,995 (95)	49 (2)	4 (0)	106 (3)	3,154
1998	4,950 (92)	128 (2)	16 (0)	287 (5)	5,381
1999	1,550 (84)	168 (9)	21 (1)	105 (6)	1,844
2000	7,958 (73)	1,248 (11)	447 (4)	1,225 (11)	10,878
2001	1,059 (60)	238 (13)	106 (6)	366 (21)	1,769
2002	1,488 (56)	557 (21)	189 (7)	431 (16)	2,665
2003	819 (50)	484 (29)	89 (5)	257 (16)	1,649
2004	409 (47)	218 (25)	70 (8)	167 (19)	864
2005	1,339 (58)	481 (21)	186 (8)	287 (13)	2,293
2006	3,811 (52)	1,965 (27)	406 (6)	1,092 (15)	7,274

Straying

Stray rates were determined by examining CWTs recovered on spawning grounds within and outside the Wenatchee River basin. Targets for strays based on return year (recovery year) and brood year should be less than 5%.

Hatchery-origin Wenatchee summer Chinook have strayed into the Entiat, Chelan, Methow, and Okanogan River basins and into the Hanford Reach (Table 6.24). In four different years, Wenatchee summer Chinook strays have made up more than 5% of the spawning escapement in the Chelan Tailrace. They have made up more than 5% of the spawning escapement in the Entiat River basin in five different years and in the Methow River basin in six different years. Few have strayed into the Okanogan River basin or into the Hanford Reach.

Table 6.24. Number and percent of spawning escapements within other non-target basins that consisted of hatchery-origin Wenatchee summer Chinook, return years 1994-2009. For example, for return year 2000, 3% of the summer Chinook escapement in the Methow River basin consisted of hatchery-origin Wenatchee summer Chinook. Percent strays should be less than 5%.

Return year	Methow		Okanogan		Chelan		Entiat		Hanford Reach	
	Number	%	Number	%	Number	%	Number	%	Number	%
1994	0	0.0	75	1.9	-	-	-	-	-	-
1995	0	0.0	0	0.0	-	-	-	-	-	-
1996	0	0.0	0	0.0	-	-	-	-	-	-
1997	0	0.0	0	0.0	-	-	-	-	-	-
1998	25	3.7	0	0.0	0	0.0	0	0.0	0	0.0
1999	20	2.0	3	0.1	0	0.0	0	0.0	13	0.1
2000	36	3.0	13	0.4	0	0.0	0	0.0	0	0.0
2001	163	5.9	57	0.5	30	3.0	0	0.0	0	0.0
2002	153	3.3	53	0.4	40	6.9	74	14.8	0	0.0
2003	80	2.0	24	0.7	44	10.5	132	19.1	26	0.0
2004	113	5.2	42	0.6	30	7.1	0	0.0	0	0.0
2005	245	9.6	67	0.8	51	9.7	49	13.4	0	0.0
2006	170	6.2	12	0.1	12	2.9	18	3.1	0	0.0
2007	127	9.3	5	0.1	9	4.8	18	7.3	20	0.1
2008	87	4.5	24	0.3	10	2.0	31	9.7	0	0.0
2009	101	5.7	13	0.2	2	0.3	12	4.8	0	0.0
Total	***1,320***	***4.3***	***388***	***0.4***	***228***	***4.1***	***334***	***8.2***	***59***	***0.0***

Based on brood year analyses, on average, about 12% of the hatchery-origin Wenatchee summer Chinook returns have strayed into non-target spawning areas, exceeding the target of 5% (Table 6.25). Depending on brood year, percent strays into non-target spawning areas have ranged from 0-19%. In addition, on average, about 4.5% have strayed into non-target hatchery programs, but straying into non-target programs has declined over time.

Table 6.25. Number and percent of hatchery-origin Wenatchee summer Chinook that homed to target spawning areas and the target hatchery program, and number and percent that strayed to non-target spawning areas and non-target hatchery programs, by brood years 1989-2006. Percent stays should be less than 5%.

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1989	1,352	62.9	60	2.8	75	3.5	662	30.8
1990	74	84.1	1	1.1	0	0.0	13	14.8
1991	14	60.9	1	4.3	0	0.0	8	34.8
1992	375	84.8	7	1.6	0	0.0	60	13.6
1993	67	72.8	9	9.8	4	4.3	12	13.0

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1994	892	71.8	208	16.7	61	4.9	81	6.5
1995	748	74.8	139	13.9	48	4.8	65	6.5
1996	261	70.4	42	11.3	53	14.3	15	4.0
1997	3,609	85.6	171	4.1	397	9.4	37	0.9
1998	1,790	78.5	11	0.5	416	18.2	64	2.8
1999	507	79.7	0	0.0	121	19.0	8	1.3
2000	2,745	83.0	0	0.0	526	15.9	37	1.1
2001	521	82.0	0	0.0	105	16.5	9	1.4
2002	1,521	85.3	10	0.6	244	13.7	8	0.4
2003	1,268	88.6	42	2.9	112	7.8	9	0.6
2004	497	84.2	3	0.5	72	12.2	18	3.1
2005	1,126	84.0	1	0.1	193	14.2	21	1.6
2006	2,646	80.5	0	0.0	577	17.6	64	1.9
Total	***20,013***	***80.3***	***705***	***2.8***	***3,004***	***12.1***	***1,127***	***4.5***

Genetics

Genetic studies were conducted to investigate relationships among temporally replicated collections of summer Chinook from the Wenatchee River, Methow River, and Okanogan River in the upper Columbia River basin (Kassler et al. 2100; the entire report is appended as Appendix K). Samples from the Eastbank Hatchery – Wenatchee stock, Eastbank Hatchery – Methow/Okanogan (MEOK) stock, and Wells Hatchery were also included in the analysis. Samples of natural and hatchery-origin summer Chinook were analyzed and compared to determine if the supplementation program has affected the genetic structure of these populations. The study also calculated the effective number of breeders for collection locations of natural and hatchery-origin summer Chinook from 1993 and 2008.

In general, population differentiation was not observed among the temporally replicated collection locations. A single collection from the Okanogan River (1993) was the only collection showing statistically significant differences. The effective number of breeders was not statistically different from the early collection in 1993 in comparison to the late collection in 2008. Overall, these analyses revealed a lack of differentiation among the temporal replicates from the same locations and among the collection from different locations, suggesting the populations have been homogenized or that there has been substantial gene flow among populations. Additional comparisons among summer-run and fall-run Chinook populations in the upper Columbia River were conducted to determine if there was any differentiation between Chinook with different run timing. These analyses revealed pairwise F_{ST} values that were less than 0.01 for the collections of summer Chinook to collections of fall Chinook from Hanford Reach, lower Yakima River, Priest Rapids, and Umatilla. Collections of fall Chinook from Crab Creek, Lyons Ferry Hatchery, Marion Drain, and Snake River had pairwise F_{ST} values that were higher in comparison to the collections of summer Chinook. The consensus clustering analysis did not provide good statistical support to the groupings, but did show relationships among collections based on geographic proximity. Overall the summer and fall run Chinook that have historically been spawned together were not differentiated while fall Chinook from greater geographic distances were differentiated.

Proportion of Natural Influence

Another method for assessing the genetic risk of a supplementation program is to determine the influence of the hatchery and natural environments on the adaptation of the composite population. This is estimated by the proportion of natural-origin fish in the hatchery broodstock (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The ratio pNOB/(pHOS+pNOB) is the Proportion of Natural Influence (PNI). The larger the ratio (PNI), the greater the strength of selection in the natural environment relative to that of the hatchery environment. In order for the natural environment to dominate selection, PNI should be greater than 0.67 (HSRG/WDFW/NWIFC 2004).

Except for brood year 1999, the PNI has been greater than 0.67 (Table 6.26). This indicates that the natural environment has a greater influence on adaptation of Wenatchee summer Chinook than does the hatchery environment.

Table 6.26. Proportionate natural influence (PNI) of the Wenatchee summer Chinook supplementation program for brood years 1989-2011. PNI was calculated as the proportion of naturally produced Chinook in the hatchery broodstock (pNOB) divided by the proportion of hatchery Chinook on the spawning grounds (pHOS) plus pNOB. NOS = number of natural-origin Chinook on the spawning grounds; HOS = number of hatchery-origin Chinook on the spawning grounds; NOB = number of natural-origin Chinook collected for broodstock; and HOB = number of hatchery-origin Chinook included in hatchery broodstock.

Brood year	Spawners			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
1989	14,331	0	0.00	290	0	1.00	1.00
1990	10,861	0	0.00	57	0	1.00	1.00
1991	10,168	0	0.00	105	0	1.00	1.00
1992	11,652	0	0.00	274	0	1.00	1.00
1993	8,810	640	0.07	406	44	0.90	0.93
1994	8,378	1,776	0.17	333	54	0.86	0.83
1995	6,813	942	0.12	363	16	0.96	0.89
1996	5,991	177	0.03	263	3	0.99	0.97
1997	5,381	532	0.09	205	13	0.94	0.91
1998	4,003	1,349	0.25	299	78	0.79	0.76
1999	3,971	1,505	0.27	242	236	0.51	0.65
2000	4,381	1,131	0.21	275	180	0.60	0.74
2001	9,264	2,096	0.18	210	136	0.61	0.77
2002	11,691	4,032	0.26	409	10	0.98	0.79
2003	9,760	2,040	0.17	337	7	0.98	0.85
2004	9,085	1,394	0.13	424	2	1.00	0.88

Brood year	Spawners			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
2005	6,862	1,841	0.21	397	3	0.99	0.83
2006	16,060	1,732	0.10	433	4	0.99	0.91
2007	3,173	1,417	0.31	263	3	0.99	0.76
2008	4,794	1,702	0.26	378	69	0.85	0.77
2009	7,113	1,214	0.15	452	8	0.98	0.87
2010	5,879	1,589	0.21	388	5	0.99	0.83
2011	8,155	1,695	0.17	376	7	0.98	0.85
Average	***8,112***	***1,252***	***0.15***	***312***	***38***	***0.91***	***0.86***

Natural and Hatchery Replacement Rates

Natural replacement rates (NRR) were calculated as the ratio of natural-origin recruits (NOR) to the parent spawning population (spawning escapement). For brood years 1989-2005, NRR for summer Chinook in the Wenatchee averaged 0.92 (range, 0.16-2.90) if harvested fish were not include in the estimate and 2.58 (range, 0.36-9.76) if harvested fish were included in the estimate (Table 6.27). NRRs for more recent brood years will be calculated as soon as all tag recoveries and sampling rates have been loaded into the database.

Hatchery replacement rates (HRR) are the hatchery adult-to-adult returns and were calculated as the ratio of hatchery-origin recruits (HOR) to the parent broodstock collected. These rates should be greater than the NRRs and greater than or equal to 5.30 (the calculated target value in Murdoch and Peven 2005). HRRs exceeded NRRs in 13 of the 17 years of data, regardless if harvest was or was not included in the estimate (Table 6.27). Hatchery replacement rates for Wenatchee summer Chinook have exceeded the estimated target value of 5.30 in three or six of the 17 years of data depending on if harvest was or was not included in the estimate.

Table 6.27. Broodstock collected, spawning escapements, natural and hatchery-origin recruits (NOR and HOR), and natural and hatchery replacement rates (NRR and HRR; with and without harvest) for summer Chinook in the Wenatchee River basin, brood years 1989-2005.

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
1989	346	14,331	2,149	9,141	6.21	0.64	5,111	21,791	14.77	1.52
1990	87	10,861	88	9,463	1.01	0.87	118	12,805	1.36	1.18
1991	128	10,168	23	5,556	0.18	0.55	71	17,151	0.55	1.69
1992	341	11,652	442	5,875	1.30	0.50	630	8,417	1.85	0.72
1993	524	9,450	92	5,025	0.18	0.53	157	8,306	0.30	0.88
1994	418	10,154	1,239	3,877	2.96	0.38	1,945	6,106	4.65	0.60
1995	398	7,755	1,000	5,220	2.51	0.67	1,574	8,273	3.95	1.07
1996	334	6,168	371	4,354	1.11	0.71	575	6,803	1.72	1.10
1997	240	5,913	4,214	9,585	17.56	1.62	7,389	16,786	30.79	2.84
1998	472	5,352	2,281	15,514	4.83	2.90	7,686	52,236	16.28	9.76

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
1999	488	5,476	636	11,854	1.30	2.16	2,478	46,486	5.08	8.49
2000	492	5,512	3,308	3,981	6.72	0.72	14,169	17,086	28.80	3.10
2001	493	11,360	635	19,058	1.29	1.68	2,401	72,740	4.87	6.40
2002	482	15,723	1,783	4,911	3.70	0.31	4,448	12,308	9.23	0.78
2003	496	11,800	1,431	1,940	2.89	0.16	3,080	4,199	6.21	0.36
2004	496	10,479	586	7,441	1.18	0.71	1,447	18,464	2.92	1.76
2005	494	8,703	1,271	5,172	2.57	0.59	3,564	14,093	7.21	1.62
Average	***396***	***9,462***	***1,268***	***7,529***	***3.38***	***0.92***	***3,344***	***20,238***	***8.27***	***2.58***

Smolt-to-Adult Survivals

Smolt-to-adult survival ratios (SARs) were calculated as the number of hatchery adult recaptures divided by the number of tagged hatchery smolts released. SARs were based on CWT returns. For the available brood years, SARs have ranged from 0.00037 to 0.01526 for hatchery summer Chinook in the Wenatchee River basin (Table 6.28).

Table 6.28. Smolt-to-adult ratios (SARs) for Wenatchee hatchery summer Chinook, brood years 1989-2006.

Brood year	Number of tagged smolts released[a]	Estimated adult captures[b]	SAR
1989	144,905	1,027	0.00709
1990	119,214	115	0.00096
1991	190,371	71	0.00037
1992	605,055	613	0.00101
1993	210,626	152	0.00072
1994	452,340	1,920	0.00424
1995	668,409	1,538	0.00230
1996	585,590	567	0.00097
1997	480,418	7,330	0.01526
1998	641,109	7,589	0.01184
1999	988,328	2,458	0.00249
2000	903,368	13,832	0.01531
2001	596,618	2,389	0.00400
2002	805,919	4,318	0.00536
2003	639,381	3,032	0.00474
2004	603,942	1,439	0.00238
2005	631,492	3,586	0.00568
2006	931,880	10,384	0.01114
Average	***566,609***	***3,464***	***0.00533***

[a] Includes all tag codes and CWT released fish (CWT + Ad Clip fish and CWT-only fish).

[b] Includes estimated recoveries (spawning ground, hatcheries, harvest, etc.) and observed recoveries if estimated recoveries were unavailable.

6.8 ESA/HCP Compliance

Broodstock Collection

Per the 2010 broodstock collection protocol, 492 natural-origin (adipose fin present) summer Chinook adults were targeted for collection at Dryden and Tumwater dams. The actual 2010 collection totaled 422 summer Chinook (415 natural-origin and seven hatchery-origin; the hatchery-origin fish were not direct collections but rather adipose present non-wired fish with a hatchery scale pattern) in combination from Dryden Dam and Tumwater Dam. Trapping began 7 July and ended 24 August 2010.

Summer Chinook and steelhead broodstock collections occurred concurrently at Dryden Dam; therefore, steelhead and spring Chinook encounters at Dryden Dam during Wenatchee summer Chinook broodstock collection were attributable to steelhead broodstock collections authorized under ESA Permit 1395 take authorizations. No steelhead or spring Chinook takes were associated with the Wenatchee summer Chinook collection.

Consistent with impact minimization measures in ESA Permit 1347, all ESA-listed species handled during summer Chinook broodstock collection were subject to water-to-water transfers or anesthetized if removed from water during handling.

Hatchery Rearing and Release

The 2010 Wenatchee summer Chinook program released an estimated 792,746 smolts, representing 91.8% of the 864,000 programmed production and was within the 10% overage allowance identified in ESA permit 1347.

Hatchery Effluent Monitoring

Per ESA Permits 1196, 1347, and 1395, permit holders shall monitor and report hatchery effluents in compliance with applicable National Pollution Discharge Elimination Systems (NPDES) (EPA 1999) permit limitations. There was one NPDES violation reported at the Chelan PUD Hatchery facilities during the period 1 January through 31 December 2012. NPDES monitoring and reporting for Chelan PUD Hatchery Programs during 2012 are provided in Appendix F.

Smolt and Emigrant Trapping

ESA-listed spring Chinook and steelhead were encountered during operation of the Lower Wenatchee Trap. ESA takes are reported in the steelhead (Section 3.8) and spring Chinook (Section 5.8) sections and are not repeated here.

Spawning Surveys

Summer Chinook spawning ground surveys conducted in the Wenatchee River basin during 2012 were consistent with ESA Section 10 Permit No. 1347. Because of the difficulty of quantifying the level of take associated with spawning ground surveys, the Permit does not specify a take level associated with these activities, even though it does authorize implementation of spawning ground surveys. Therefore, no take levels are reported. However, to minimize potential effects to established redds, wading was restricted to the extent practical, and extreme caution was used to avoid established redds when wading was required.

SECTION 7: METHOW SUMMER CHINOOK

7.1 Broodstock Sampling

This section focuses on results from sampling 2010-2011 Methow summer Chinook broodstock, which were collected in the East and West Ladder of Wells Dam in 2010, and the West Ladder in 2011. Summer Chinook adults collected at Wells Dam are also used in the Okanogan/Similkameen supplementation program. Complete information is not currently available for the 2012 return (this information will be provided in the 2013 annual report).

Origin of Broodstock

Both 2010 and 2011 broodstock consisted almost entirely of natural-origin (adipose fin present) summer Chinook (Table 7.1). These fish were used for both the Methow and Okanogan supplementation programs. In 2011, to meet production goals, hatchery-origin adults were collected in concert with natural-origin fish. About 5.7% of the 2011 broodstock were comprised of hatchery-origin fish (hatchery-origin was determined by examination of scales and CWTs).

Table 7.1. Numbers of wild and hatchery summer Chinook collected for broodstock, numbers that died before spawning, and numbers of Chinook spawned for the Methow/Okanogan programs, 1989-2011. Unknown origin fish (i.e., undetermined by scale analysis, no CWT or fin clips, and no additional hatchery marks) were considered naturally produced. Mortality includes fish that died of natural causes typically near the end of spawning and were not needed for the program and surplus fish killed at spawning.

Brood year	Wild summer Chinook					Hatchery summer Chinook					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
1989[a]	1,419	72	-	1,297	-	341	17	-	312	-	1,609
1990[a]	864	34	-	828	-	214	8	-	206	-	1,034
1991[a]	1,003	59	-	924	-	341	20	-	314	-	1,238
1992[a]	312	6	-	297	-	428	9	-	406	-	703
1993[a]	813	48	-	681	-	464	28	-	388	-	1,069
1994	385	33	11	341	12	266	15	7	244	1	585
1995	254	13	10	173	58	351	28	9	240	74	413
1996	316	15	11	290	0	234	2	9	223	0	513
1997	214	11	5	198	0	308	24	20	264	0	462
1998	239	28	58	153	0	348	18	119	211	0	364
1999	248	5	19	224	0	307	2	16	289	0	513
2000	184	15	5	164	0	373	17	17	339	0	503
2001	135	8	36	91	0	423	29	128	266	0	357
2002	270	2	21	247	0	285	11	33	241	0	488
2003	449	14	53	381	0	112	2	9	101	0	482
2004	541	23	12	506	0	17	0	1	16	0	522
2005	551	29	76	391	55	12	2	0	9	1	400
2006	579	50	10	500	19	12	2	0	10	0	510
2007	504	22	26	456	0	19	0	2	17	0	473
2008	418	5	9	404	0	41	0	0	41	0	445

Brood year	Wild summer Chinook					Hatchery summer Chinook					Total number spawned
	Number collected	Prespawn loss	Mortality	Number spawned	Number released	Number collected	Prespawn loss	Mortality	Number spawned	Number released	
2009	553	31	15	507	0	5	5	0	0	0	507
2010	503	13	6	484	0	8	0	0	8	0	492
2011	498	18	13	467	0	30	4	0	26	0	493
Average[b]	*380*	*19*	*22*	*332*	*8*	*175*	*9*	*21*	*141*	*4*	*473*

[a] Number of fish spawned and collected during these years included fish retained from the right- and left-bank ladder traps at Wells Dam and fish collected from the volunteer channel. There was no distinction made between fish collected at trap locations and program (i.e., aggregated population used for Wells, Methow, and Okanogan summer Chinook programs).
[b] Because of bias from aggregating the spawning population from 1989-1993, averages are based on adult numbers collected from 1994-2011.

Age/Length Data

Ages of summer Chinook broodstock were determined from analysis of scales and/or CWTs. Broodstock collected from the 2010 return consisted primarily of age-4 and 5 natural-origin Chinook (83%) and age-4 and 5 hatchery-origin Chinook (75%). Age-2 and 3 natural-origin fish collectively made up 17% of the broodstock (Table 7.2). Age-3 and 6 hatchery-origin Chinook collectively made up 25% of the broodstock (Table 7.2).

Broodstock collected from the 2011 return consisted primarily of age-4 and 5 natural-origin Chinook (92.4%) and age-4 and 5 hatchery-origin Chinook (73.1%). Age-2 and 3 natural-origin fish collectively made up 7.6% of the broodstock (Table 7.2). Age-3 hatchery-origin Chinook made up 26.9% of the broodstock (Table 7.2).

Table 7.2. Percent of hatchery and wild summer Chinook of different ages (total age) collected from broodstock for the Methow/Okanogan programs, 1991-2011.

Return Year	Origin	Total age				
		2	3	4	5	6
1991	Wild	0.5	6.8	35.1	55.4	2.2
	Hatchery	0.5	5.1	36.2	49.0	9.2
1992	Wild	0.0	13.1	36.2	50.7	0.0
	Hatchery	0.0	0.0	0.0	0.0	0.0
1993	Wild	0.0	3.9	75.3	20.8	0.0
	Hatchery	0.0	1.0	85.9	13.1	0.0
1994	Wild	3.1	9.7	26.3	60.3	0.6
	Hatchery	0.0	14.7	11.3	74.0	0.0
1995	Wild	0.0	4.6	15.2	75.6	4.6
	Hatchery	0.0	0.4	13.0	25.6	61.0
1996	Wild	0.0	8.4	56.6	30.4	4.6
	Hatchery	0.0	3.0	31.0	47.0	19.0
1997	Wild	1.0	9.3	52.9	34.8	2.0
	Hatchery	0.0	20.7	10.8	62.0	6.5
1998	Wild	2.0	14.1	54.8	29.1	0.0
	Hatchery	2.3	18.5	56.6	15.9	6.7
1999	Wild	4.7	5.1	53.7	36.0	0.5

Return Year	Origin	Total age				
		2	3	4	5	6
	Hatchery	0.3	3.6	28.0	66.1	2.0
2000	Wild	0.6	14.0	28.7	56.1	0.6
	Hatchery	0.0	27.0	14.3	54.3	4.3
2001	Wild	7.1	26.0	52.0	11.8	3.1
	Hatchery	0.3	19.8	68.1	9.5	2.3
2002	Wild	0.4	17.4	66.0	16.2	0.0
	Hatchery	0.0	2.4	39.4	58.2	0.0
2003	Wild	0.7	3.9	65.9	29.5	0.0
	Hatchery	0.9	5.6	18.5	69.4	5.6
2004	Wild	0.8	15.3	11.6	72.1	0.2
	Hatchery	0.0	6.7	53.3	33.3	6.7
2005	Wild	0.0	17.2	69.9	11.0	1.9
	Hatchery	0.0	1.0	40.0	50.0	0.0
2006	Wild	1.6	3.0	41.0	52.9	1.5
	Hatchery	0.0	16.7	25.0	50.0	8.3
2007	Wild	1.8	15.3	8.2	70.2	4.5
	Hatchery	0.0	0.0	21.1	57.9	21.0
2008	Wild	0.3	17.1	67.8	13.6	1.2
	Hatchery	0.0	2.6	52.7	42.1	2.6
2009	Wild	1.3	10.0	68.3	20.4	0.0
	Hatchery	0.0	0.0	0.0	100.0	0.0
2010	Wild	0.21	16.4	50.8	32.6	0.0
	Hatchery	0.0	12.5	50.0	25.0	12.5
2011	Wild	0.05	7.1	75.4	17.0	0.0
	Hatchery	0.0	26.9	26.9	46.2	0.0
Average	***Wild***	***1.3***	***11.3***	***48.2***	***37.9***	***1.3***
	Hatchery	***0.20***	***9.0***	***32.5***	***45.2***	***8.0***

Mean lengths of natural-origin summer Chinook of a given age differed little between 2010 and 2011 (Table 7.3). Average fork lengths for age-4 natural-origin adults were 12 cm longer than that of age-4 hatchery fish (Table 7.3). Differences in hatchery-origin and natural-origin fish were hard to discern given the small sample size of hatchery-origin fish (i.e., few hatchery fish were included in the broodstock).

Table 7.3. Mean fork length (cm) at age (total age) of hatchery and wild Methow/Okanogan summer Chinook collected from broodstock for the Methow/Okanogan programs, 1991-2011; N = sample size and SD = 1 standard deviation.

Return year	Origin	Summer Chinook fork length (cm)														
		Age-2			Age-3			Age-4			Age-5			Age-6		
		Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD
1991	Wild	47	1	-	68	15	6	82	78	10	94	123	8	97	5	5
	Hatchery	47	1	-	49	10	6	78	71	5	91	96	8	96	18	6
1992	Wild	-	0	-	55	9	5	69	25	6	78	35	6	-	0	-
	Hatchery	-	0	-	-	0	-	-	0	-	-	0	-	-	0	-
1993	Wild	-	0	-	72	3	4	86	58	7	98	16	5	-	0	-
	Hatchery	-	0	-	42	1	-	76	85	8	88	13	6	-	0	-
1994	Wild	42	10	6	51	31	7	80	84	9	93	193	8	104	2	13
	Hatchery	-	0	-	49	38	5	76	29	7	88	191	7	-	0	-
1995	Wild	-	0	-	67	6	8	79	20	9	96	99	5	94	6	5
	Hatchery	-	0	-	52	1	-	73	32	9	89	63	9	95	150	8
1996	Wild	-	0	-	68	22	9	83	149	8	95	80	7	101	12	5
	Hatchery	-	0	-	52	7	10	77	72	7	90	109	8	100	44	7
1997	Wild	36	2	6	60	19	7	85	108	8	96	71	7	98	4	11
	Hatchery	-	0	-	45	63	5	71	33	9	92	189	7	97	20	7
1998	Wild	43	4	6	59	23	6	83	107	7	96	58	7	-	0	-
	Hatchery	42	8	7	50	64	6	74	190	8	92	54	8	98	23	5
1999	Wild	38	10	3	64	11	8	82	115	8	96	77	6	104	1	-
	Hatchery	37	1	-	53	11	9	75	92	7	91	204	6	98	6	5
2000	Wild	39	1	-	66	23	7	83	47	6	96	92	5	95	1	-
	Hatchery	-	0	-	54	100	7	78	53	8	93	201	6	99	16	6
2001	Wild	40	9	3	65	33	8	87	66	8	93	15	5	97	4	16
	Hatchery	44	1	-	51	79	7	78	271	8	93	38	7	102	9	5
2002	Wild	56	1	-	65	44	7	88	167	6	100	41	7	-	0	-
	Hatchery	-	0	-	45	6	5	76	100	7	95	148	5	-	0	-
2003	Wild	43	3	6	61	16	6	87	268	7	99	120	6	-	0	-
	Hatchery	49	1	-	55	6	9	73	20	8	91	75	7	102	6	9
2004	Wild	51	4	4	67	78	6	81	59	6	97	368	7	99	1	-
	Hatchery	-	0	-	52	1	-	70	8	5	97	5	8	109	1	-
2005	Wild	-	0	-	68	89	6	83	363	8	94	57	6	101	10	7
	Hatchery	-	0	-	55	1	-	70	4	4	89	5	4	-	0	-
2006	Wild	48	9	3	69	16	4	88	222	7	97	286	6	97	8	6
	Hatchery	-	0	-	52	2	0	80	3	3	88	6	7	94	1	-
2007	Wild	50	8	6	69	69	9	85	37	8	98	317	6	96	20	8
	Hatchery	-	0	-	-	0	-	70	4	2	94	11	7	91	4	18
2008	Wild	52	1	-	70	67	6	87	265	6	95	53	7	103	5	7
	Hatchery	-	0	-	55	1	-	79	20	5	89	16	7	104	1	-
2009	Wild	49	7	6	69	54	7	91	368	6	99	110	6	-	0	-

Return year	Origin	Summer Chinook fork length (cm)														
		Age-2			Age-3			Age-4			Age-5			Age-6		
		Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD	Mean	N	SD
	Hatchery	-	0	-	-	0	-	-	0	-	79	1	-	-	0	-
2010	Wild	56	1	-	70	79	6	90	245	6	98	157	6	-	0	-
	Hatchery	-	0	-	74	1	-	86	4	6	99	2	1	117	1	-
2011	Wild	43	2	3	66	32	8	87	338	7	97	76	5	-	0	-
	Hatchery	-	0	-	61	7	8	78	7	7	90	12	9	-	0	-

Sex Ratios

Male summer Chinook in the 2010 broodstock made up about 49.5% of the adults collected, resulting in an overall male to female ratio of 0.98:1.00 (Table 7.4.). In 2011, males made up about 49.1% of the adults collected, resulting in an overall male to female ratio of 0.96:1.00 (Table 7.4). The ratio for both 2010 and 2011 broodstock was below the assumed 1:1 ratio goal in the broodstock protocol.

Table 7.4. Numbers of male and female wild and hatchery summer Chinook collected for broodstock at Wells Dam for the Methow/Okanogan programs, 1991-2011. Ratios of males to females are also provided.

Return year	Number of wild summer Chinook			Number of hatchery summer Chinook			Total M/F ratio
	Males (M)	Females (F)	M/F	Males (M)	Females (F)	M/F	
1989[a]	752	667	1.13:1.00	181	160	1.13:1.00	1.13:1.00
1990[a]	381	482	0.79:1.00	95	120	0.79:1.00	0.79:1.00
1991[a]	443	559	0.79:1.00	151	191	0.79:1.00	0.79:1.00
1992[a]	349	318	1.10:1.00	38	35	1.09:1.00	1.10:1.00
1993[a]	513	300	1.71:1.00	293	171	1.71:1.00	1.71:1.00
1994	205	180	1.14:1.00	165	101	1.63:1.00	1.32:1.00
1995	103	149	0.69:1.00	158	197	0.80:1.00	0.75:1.00
1996	178	138	1.29:1.00	132	102	1.29:1.00	1.29:1.00
1997	102	112	0.91:1.00	174	134	1.30:1.00	1.12:1.00
1998	130	109	1.19:1.00	263	85	3.09:1.00	2.03:1.00
1999	138	110	1.25:1.00	161	146	1.10:1.00	1.17:1.00
2000	82	102	0.80:1.00	243	130	1.87:1.00	1.40:1.00
2001	89	46	1.93:1.00	311	112	2.78:1.00	2.53:1.00
2002	166	104	1.60:1.00	149	136	1.10:1.00	1.31:1.00
2003	255	194	1.31:1.00	61	51	1.20:1.00	1.29:1.00
2004	263	278	0.95:1.00	12	5	2.40:1.00	0.97:1.00
2005	365	186	1.96:1.00	6	6	1.00:1.00	1.93:1.00
2006	287	292	0.98:1.00	9	3	3.00:1.00	1.00:1.00
2007	228	276	0.83:1.00	11	8	1.38:1.00	0.84:1.00
2008	210	208	1.01:1.00	13	28	0.46:1.00	0.94:1.00
2009	261	292	0.89:1.00	2	3	0.67:1.00	0.89:1.00

Return year	Number of wild summer Chinook			Number of hatchery summer Chinook			Total M/F ratio
	Males (M)	Females (F)	M/F	Males (M)	Females (F)	M/F	
2010	248	255	0.97:1.00	5	3	1.67:1.00	0.98:1.00
2011	236	262	0.90:1.00	23	7	3.29:1.00	0.96:1.00
Total[b]	***5,984***	***5,619***	***1.06:1.00***	***2,656***	***1,934***	***1.37:1.00***	***1.14:1.00***

[a] Numbers and male to female ratios were derived from the aggregate population collected at Wells Fish Hatchery volunteer channel and left- and right-ladder traps at Wells Dam.
[b] Total values were derived from 1994-present data to exclude aggregate population bias from 1989-1993 returns.

Fecundity

Fecundities for the 2010 and 2011 summer Chinook broodstock averaged 5,116 and 4,578eggs per female, respectively (Table 7.5). These values are close to the overall average of 4,973 eggs per female. Mean observed fecundities for the 2010 returns were slightly above the expected fecundity of 5,000 eggs per female assumed in the broodstock protocol; whereas the 2011 returns were slightly below the assumed value.

Table 7.5. Mean fecundity of wild, hatchery, and all female summer Chinook collected for broodstock at Wells Dam for the Methow/Okanogan programs, 1989-2011; NA = not available.

Return year	Mean fecundity		
	Wild	Hatchery	Total
1989*	NA	NA	4,750
1990*	NA	NA	4,838
1991*	NA	NA	4,819
1992*	NA	NA	4,804
1993*	NA	NA	4,849
1994*	NA	NA	5,907
1995*	NA	NA	4,930
1996*	NA	NA	4,870
1997	5,166	5,296	5,237
1998	5,043	4,595	4,833
1999	4,897	4,923	4,912
2000	5,122	5,206	5,170
2001	5,040	4,608	4,735
2002	5,306	5,258	5,279
2003	5,090	4,941	5,059
2004	5,130	5,118	5,130
2005	4,545	4,889	4,553
2006	4,854	4,824	4,854
2007	5,265	5,093	5,260
2008	4,814	4,588	4,787
2009	5,115	-	5,115
2010	5,124	4,717	5,116
2011	4,594	3,915	4,578

Return year	Mean fecundity		
	Wild	Hatchery	Total
Average	***5,007***	***4,855***	***4,973***

* Individual fecundities were not assigned to females until 1997 brood.

7.2 Hatchery Rearing

Rearing History

Number of eggs taken

Based on the unfertilized egg-to-release survival standard of 81%, a total of 493,827 eggs were needed to meet the program release goal of 400,000 smolts for brood years 1989-2011. An evaluation of the program in 2012 determined that 246,913 eggs are needed to meet the revised release goal of 200,000 smolts. This revised goal will begin with brood year 2012. From 1989 through 2012, the egg take goal was reached in eight of those years (Table 7.6).

Table 7.6. Numbers of eggs taken from summer Chinook broodstock collected at Wells Dam for the Methow/Okanogan programs, 1989-2012.

Return year	Number of eggs taken
1989	482,800
1990	464,097
1991	586,594
1992	486,260
1993	531,490
1994	595,390
1995	491,000
1996	448,000
1997	401,162
1998	389,346
1999	483,726
2000	403,268
2001	279,272
2002	466,530
2003	473,681
2004	537,210
2005	305,826
2006	509,334
2007	549,802
2008	441,778
2009	560,602
2010	505,188
2011	488,747
2012	245,245

Return year	Number of eggs taken
Average	***473,091***

Number of acclimation days

Rearing of the 2010 brood Methow summer Chinook was similar to previous years with fish being held on well water before being transferred to Carlton Pond for final acclimation on Methow River water in March 2012 (Table 7.7). Groups of the 1994 and 1995 broods were reared for longer durations at the Methow Fish Hatchery on Methow River water.

Table 7.7. Number of days Methow summer Chinook were acclimated at Carlton Pond, brood years 1989-2010.

Brood year	Release year	Transfer date	Release date	Number of days
1989	1991	15-Mar	6-May	52
1990	1992	26-Feb	28-Apr	61
1991	1993	10-Mar	23-Apr	44
1992	1994	4-Mar	21-Apr	48
1993	1995	18-Mar	2-May	45
1994	1996	25-Sep	28-Apr	215
		19-Mar	28-Apr	40
1995	1997	22-Oct	8-Apr	168
		19-Mar	22-Apr	34
1996	1998	9-Mar	14-Apr	36
1997	1999	10-Mar	20-Apr	41
1998	2000	19-Mar	2-May	44
1999	2001	18-Mar	18-Apr	31
2000	2002	28-Mar	1-May	34
2001	2003	27-Mar	24-Apr	28
2002	2004	16-Mar	24-Apr	39
2003	2005	18-Mar	21-Apr	34
2004	2006	12-Mar	22-Apr	41
2005	2007	12-Mar	15-Apr – 8-May	34-57
2006	2008	4-7-Mar	16-Apr – 2 May	40-59
2007	2009	18-24-Mar	21-Apr	28-34
2008	2010	4-5, 8-9-Mar	4-21-Apr	33-50
2009	2011	25, 29, 31-Mar & 4-Apr	11-25-Apr	8-31
2010	2012	19-21, 24-Mar	23-24-Apr	31-37

Release Information

Numbers released

The 2010 brood Methow summer Chinook program achieved 110% of the 400,000 target goal with about 439,000 fish being forced released from the ponds on 23-24 April 2012 (Table 7.8).

Table 7.8. Numbers of Methow summer Chinook smolts released from the hatchery, brood years 1989-2010. The release target for Methow summer Chinook is 400,000 smolts.

Brood year	Release year	CWT mark rate	Number of smolts released
1989	1991	0.8529	420,000
1990	1992	0.9485	391,650
1991	1993	0.6972	540,900
1992	1994	0.9752	402,641
1993	1995	0.4623	433,375
1994	1996	0.9851	406,560
1995	1997	0.9768	353,182
1996	1998	0.9221	298,844
1997	1999	0.9884	384,909
1998	2000	0.9429	205,269
1999	2001	0.9955	424,363
2000	2002	0.9928	336,762
2001	2003	0.9902	248,595
2002	2004	0.9913	399,975
2003	2005	0.9872	354,699
2004	2006	0.9848	400,579
2005	2007	0.9897	263,723
2006	2008	0.9783	419,734
2007	2009	0.9837	433,256
2008	2010	0.9394	397,554
2009	2011	0.9862	404,956
2010	2012	0.9962	439,000
Average		***0.9349***	***380,024***

Numbers tagged

The 2010 brood Methow summer Chinook were 99.6% CWT and adipose fin-clipped (Table 7.8).

No juvenile hatchery summer Chinook were PIT tagged in 2012. Table 7.9 summarizes the number of hatchery summer Chinook that have been PIT-tagged and released into the Methow River.

Table 7.9. Summary of PIT-tagging activities for Methow hatchery summer Chinook, brood years 2008-2011; NA = data not available.

Brood year	Release year	Number of fish tagged	Number of tagged fish that died	Number of tags shed	Number of tagged fish released
2008	2010	10,100	4	0	10,096
2009	2011	5,050	17	9	5,024
2010	2012	0	0	0	0
2011	2013	0	0	0	0

Fish size and condition at release

A forced release of yearling smolts took place on 23-24 April 2012. Size at release from the acclimated population was 82.4% and 76% of the respective target fork length and weight goals (Table 7.10). This brood year exceeded the target CV for length by 85.6%.

Table 7.10. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of Methow summer Chinook smolts released from the hatchery, brood years 1991-2010. Size targets are provided in the last row of the table.

Brood year	Release year	Fork length (mm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
1991	1993	152	13.6	40.3	11
1992	1994	145	16.0	37.2	12
1993	1995	154	8.6	37.1	12
1994	1996	163	8.2	48.2	9
1995	1997	141	9.6	37.0	12
1996	1998	199	13.1	105.1	4
1997	1999	153	7.6	39.5	12
1998	2000	164	8.7	51.7	9
1999	2001	153	9.3	41.5	11
2000	2002	170	10.2	54.2	8
2001	2003	167	7.4	52.7	9
2002	2004	148	13.1	35.7	13
2003	2005	148	10.1	35.5	13
2004	2006	142	9.8	31.1	15
2005	2007	158	15.0	42.2	11
2006	2008	156	18.0	42.8	11
2007	2009	138	21.0	32.1	14
2008	2010	155	14.2	42.0	11
2009	2011	170	15.8	56.9	8
2010	2012	145	16.7	34.5	13
Targets		***176***	***9.0***	***45.4***	***10***

Survival Estimates

Overall survival of the Methow summer Chinook from green (unfertilized) egg-to-release was above the standard set for the program (Table 7.11). High survival can be attributed to exceeding the survival standards set for the program and just missing the unfertilized egg-eyed egg and the 30-day after ponding survival rates. Currently, it is unknown if gamete viability is sex biased or is uniform between sexes and more influenced by between-year environmental variations.

It is important to note that the Methow summer Chinook program typically receives progeny from the highest ELISA females, while the lowest titer progeny are reserved for the Okanogan program. The inability to effectively manage bacterial kidney disease at Similkameen Pond during the winter months precludes an even mix of progeny for a given brood year between the two programs. As a result, in some years poor survival performance at any level may be more directly related to this procedure than a function of the overall program.

Table 7.11. Hatchery life-stage survival rates (%) for Methow summer Chinook, brood years 1989-2010. Survival standards or targets are provided in the last row of the table.

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
1989[a]	89.8	99.5	89.9	96.7	99.7	99.4	73.3	98.5	87.0
1990[a]	93.9	99.0	84.9	97.1	81.2	80.6	97.7	99.5	84.4
1991[a]	93.1	95.5	88.2	98.0	99.4	99.1	97.5	99.6	92.2
1992[a]	96.9	99.0	87.8	98.0	99.9	99.9	90.9	98.3	82.8
1993[a]	82.2	99.4	85.4	97.6	99.8	99.5	92.0	99.4	81.5
1994	96.1	90.0	86.6	100.0	98.1	97.4	73.1	99.1	68.3
1995	91.9	96.2	98.2	84.1	96.5	96.2	92.7	89.6	71.9
1996	95.4	98.1	83.2	100.0	97.7	96.9	86.5	89.0	66.7
1997	91.9	94.6	86.1	98.4	98.7	98.3	98.8	99.7	95.9
1998	84.0	96.2	54.1	98.0	99.4	98.9	96.6	99.9	52.7
1999	98.8	98.7	92.9	96.9	98.0	97.6	96.9	99.9	87.7
2000	90.5	96.9	89.2	98.1	98.5	98.3	94.6	94.4	83.5
2001	96.2	92.3	89.1	97.6	97.2	97.1	97.5	99.8	89.0
2002	97.1	98.1	88.3	99.9	97.7	97.5	96.7	99.9	85.7
2003	96.7	97.5	82.8	98.2	99.7	99.2	93.7	99.9	74.9
2004	93.6	98.2	84.0	97.8	99.6	99.2	98.3	98.5	74.6
2005	97.0	89.6	88.0	95.5	99.6	98.9	96.6	99.9	86.2
2006	92.9	89.5	86.3	98.3	99.6	98.7	97.2	99.5	82.4
2007	92.6	99.6	84.1	98.5	99.7	99.5	98.9	99.8	81.9
2008	99.6	97.9	91.9	99.5	99.3	98.9	98.5	99.9	90.0

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
2009[b]	93.6	93.5	91.0	97.7	99.7	99.2	98.8	100.0	87.9
2010[c]	96.5	100.0	91.1	100.0	96.4	96.1	95.4	99.5	86.9
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

[a] Survival rates were calculated from aggregate population collected at Wells Fish Hatchery volunteer channel and left- and right-ladder traps at Wells Dam.
[b] Survival rates were calculated from aggregate collections at Wells east fish ladder for the Methow and Okanogan/Similkameen programs. About 41% of the total fish collected were used to estimate survival rates.
[c] Survival rates were calculated from aggregate collections at Wells West Ladder for the Methow and Similkameen programs. About 71% of the total fish collected were used to estimate survival rates.

7.3 Disease Monitoring

Results of adult broodstock bacterial kidney disease (BKD) monitoring indicated that most females (97.8%) had ELISA values less than 0.199. Just over 2% of females had ELISA values less than 0.120, which means that only a small percentage of the progeny (2.2%) needed to be reared at densities not to exceed 0.06 fish per pound (Table 7.12).

Table 7.12. Proportion of bacterial kidney disease (BKD) titer groups for the Methow/Okanogan summer Chinook broodstock, brood years 1997-2012. Also included are the proportions to be reared at either 0.125 fish per pound or 0.060 fish per pound.

Brood year[a]	Optical density values by titer group				Proportion at rearing densities (fish per pound, fpp)	
	Very Low (≤ 0.099)	Low (0.1-0.199)	Moderate (0.2-0.449)	High (≥ 0.450)	≤ 0.125 fpp (<0.119)	≤ 0.060 fpp (>0.120)
1997	0.6267	0.1333	0.0622	0.1778	0.6844	0.3156
1998	0.9632	0.0184	0.0123	0.0061	0.9816	0.0184
1999	0.9444	0.0198	0.0238	0.0119	0.9643	0.0357
2000	0.7476	0.0952	0.0238	0.1333	0.8000	0.2000
2001	0.9801	0.0199	0.0000	0.0000	1.0000	0.0000
2002	0.9567	0.0130	0.0130	0.0173	0.9740	0.0260
2003	0.9620	0.0127	0.0169	0.0084	0.9747	0.0253
2004	0.9585	0.0151	0.0075	0.0189	0.9736	0.0264
2005	0.9884	0.0000	0.0000	0.0116	0.9884	0.0116
2006	0.9962	0.0038	0.0000	0.0000	0.9962	0.0038
2007	0.9202	0.0266	0.0152	0.0380	0.9354	0.0646
2008	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000
2009	0.9891	0.0073	0.0037	0.0000	0.9927	0.0073
2010	0.9960	0.0040	0.0000	0.0000	1.0000	0.0000
2011	0.9766	0.0140	0.0000	0.0093	0.9860	0.0140
2012	0.9341	0.0440	0.0110	0.0110	0.9780	0.0220
Average	*0.09337*	*0.0267*	*0.0118*	*0.0277*	*0.9518*	*0.0482*

[a] Individual ELISA samples were not collected before the 1997 brood.

7.4 Spawning Surveys

Surveys for Methow summer Chinook redds were conducted from mid-September to mid-November 2012 in the Methow River. Total redd counts (not peak counts) were conducted in the river (see Appendix L for more details).

Redd Counts

A total of 960 summer Chinook redds were counted in the Methow River in 2012 (Table 7.13). This was higher than the overall average of 642 redds.

Table 7.13. Total number of redds counted in the Methow River, 1989-2012.

Survey year	Total redd count
1989	149*
1990	418*
1991	153
1992	107
1993	154
1994	310
1995	357
1996	181
1997	205
1998	225
1999	448
2000	500
2001	675
2002	2,013
2003	1,624
2004	973
2005	874
2006	1,353
2007	620
2008	599
2009	692
2010	887
2011	941
2012	960
Average	***642***

* Total counts based on expanded aerial counts.

Redd Distribution

Summer Chinook redds were not evenly distributed among the seven reaches in the Methow River. Most redds (79%) were located in reaches downstream from the town of Twisp (Reaches 1-3) (Table 7.14; Figure 7.1). Few summer Chinook spawned upstream from the Winthrop Bridge in Reaches 6 and 7.

Table 7.14. Total number of summer Chinook redds counted in different reaches on the Methow River during September through early November, 2012. Reach codes are described in Table 2.11.

Survey reach	Total redd count	Percent
Methow 1 (M1)	239	25
Methow 2 (M2)	221	23
Methow 3 (M3)	296	31
Methow 4 (M4)	92	10
Methow 5 (M5)	99	10
Methow 6 (M6)	3	0
Methow 7 (M7)	10	1
Totals	***960***	***100***

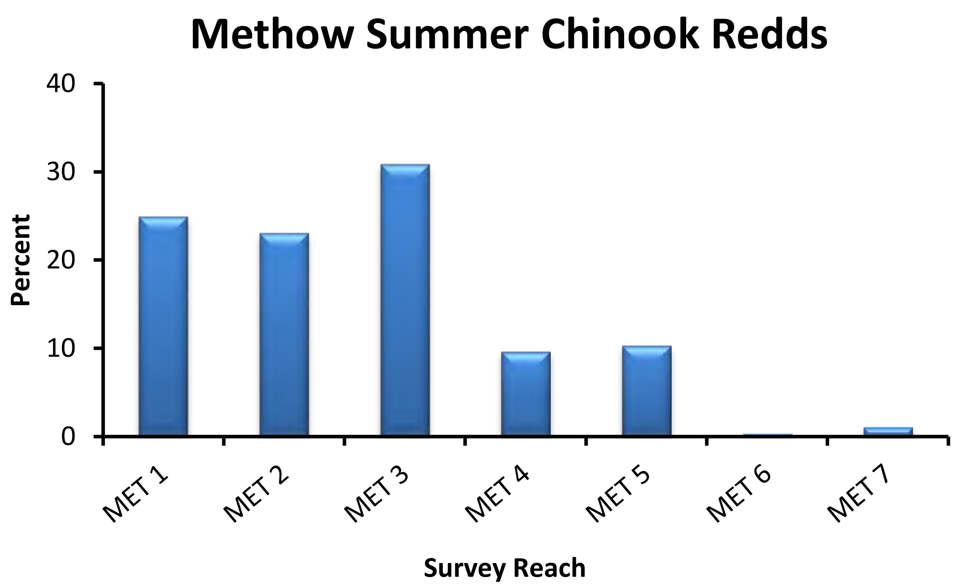


Figure 7.1. Percent of the total number of summer Chinook redds counted in different reaches on the Methow River during September through mid-November, 2012. Reach codes are described in Table 2.11.

Spawn Timing

Spawning in 2012 began the last week of September, peaked the third week of October, and ended after the first week of November (Figure 7.2). Stream temperatures in the Methow River, when spawning began, varied from 8.0-10.5°C. Peak spawning occurred in the upper reaches of the Methow River during the second week of October and in the lower reaches the following week.

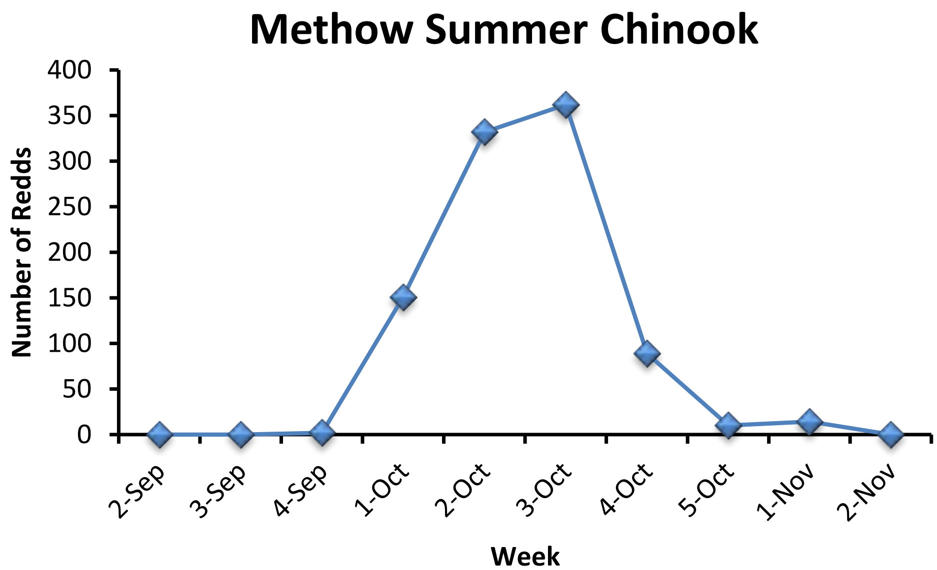


Figure 7.2. Number of new summer Chinook redds counted during different weeks in the Methow River, September through mid-November 2012.

Spawning Escapement

Spawning escapement for Methow summer Chinook was calculated as the total number of redds times the fish per redd ratio estimated from fish sampled at Wells Dam. The estimated fish per redd ratio for Methow summer Chinook in 2012 was 3.07. Multiplying this ratio by the number of redds counted in the Methow River resulted in a total spawning escapement of 2,947 summer Chinook (Table 7.15).

Table 7.15. Spawning escapements for summer Chinook in the Methow River for return years 1989-2012.

Return year	Fish/Redd	Redds	Total spawning escapement
1989*	3.30	149	492
1990*	3.40	418	1,421
1991*	3.70	153	566
1992*	4.30	107	460
1993*	3.30	154	508
1994*	3.50	310	1,085
1995*	3.40	357	1,214
1996*	3.40	181	615
1997*	3.40	205	697
1998	3.00	225	675
1999	2.20	448	986

Return year	Fish/Redd	Redds	Total spawning escapement
2000	2.40	500	1,200
2001	4.10	675	2,768
2002	2.30	2,013	4,630
2003	2.42	1,624	3,930
2004	2.25	973	2,189
2005	2.93	874	2,561
2006	2.02	1,353	2,733
2007	2.20	620	1,364
2008	3.25	599	1,947
2009	2.54	692	1,758
2010	2.81	887	2,492
2011	3.10	941	2,917
2012	3.07	960	2,947
Average	***3.01***	***642***	***1,756***

* Spawning escapement was calculated using the "Modified Meekin Method" (i.e., 3.1 x jack multiplier).

7.5 Carcass Surveys

Surveys for Methow summer Chinook carcasses were conducted during late September to mid-November 2012 in the Methow River (see Appendix L for more details).

Number sampled

A total of 629 summer Chinook carcasses were sampled during September through mid-November in the Methow River (Table 7.15).

Table 7.15. Numbers of summer Chinook carcasses sampled within each survey reach on the Methow River, 1991-2012. Reach codes are described in Table 2.11.

Survey year	Number of summer Chinook carcasses							
	M-1	**M-2**	**M-3**	**M-4**	**M-5**	**M-6**	**M-7**	**Total**
1991	0	12	8	4	2	0	0	**26**
1992	8	8	19	0	17	1	0	**53**
1993	19	25	14	2	5	0	0	**65**
1994[a]	43	33	20	5	13	0	0	**114**
1995	14	33	58	7	7	0	0	**119**
1996	6	30	46	5	2	0	0	**89**
1997	6	12	38	2	19	1	0	**78**
1998	90	84	99	17	30	0	0	**320**
1999	47	144	232	32	37	12	2	**506**
2000	62	118	105	9	99	5	0	**398**
2001	392	275	88	14	76	11	1	**857**
2002	551	318	518	164	219	34	10	**1,814**
2003	115	383	317	115	128	5	0	**1,063**

Survey year	Number of summer Chinook carcasses							
	M-1	M-2	M-3	M-4	M-5	M-6	M-7	Total
2004	40	173	187	82	92	2	1	**577**
2005	154	173	182	42	112	3	0	**666**
2006	121	149	111	56	146	3	1	**587**
2007	135	131	108	27	55	0	0	**456**
2008	64	128	197	33	57	3	0	**482**
2009	144	158	159	36	94	0	0	**591**
2010	105	180	185	38	63	5	1	**577**
2011	56	134	202	78	83	5	1	**559**
2012	127	154	170	75	82	14	7	**629**
Average	***105***	***130***	***139***	***38***	***65***	***5***	***1***	***483***

[a] An additional 113 carcasses were sampled, but reach was not identified.

Carcass Distribution and Origin

Summer Chinook carcasses were not evenly distributed among reaches within the Methow River in 2012 (Table 7.15; Figure 7.3). Most of the carcasses in the Methow River were found downstream from Twisp (Reaches 1-3).

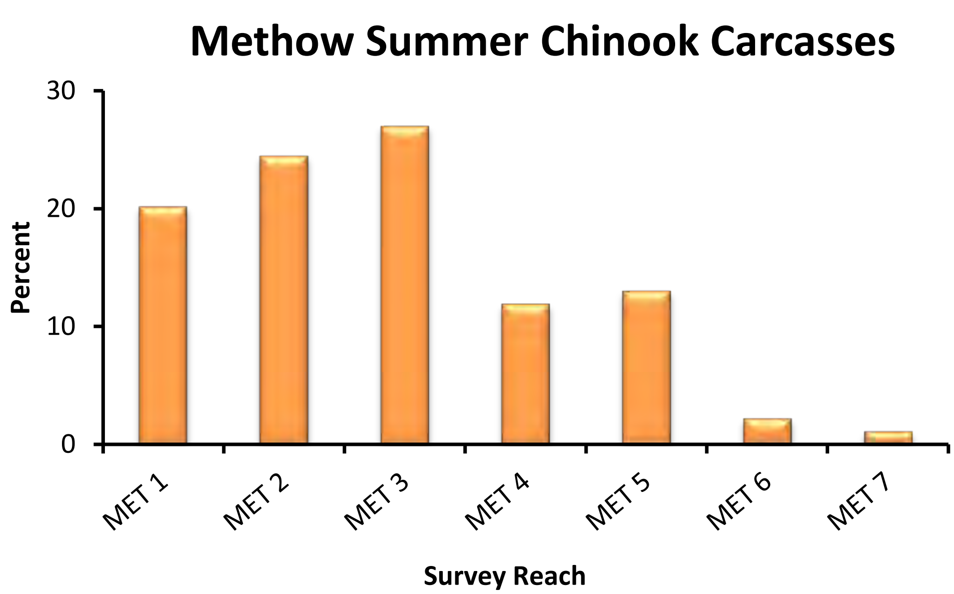


Figure 7.3. Percent of summer Chinook carcasses sampled within different reaches on the Methow River during September through mid-November, 2012. Reach codes are described in Table 2.11.

Numbers of wild and hatchery-origin summer Chinook carcasses sampled in 2012 will be available after analysis of CWTs and scales. Based on the available data (1991-2011), hatchery and wild summer Chinook carcasses were not distributed equally among the reaches in the Methow River (Table 7.16). A larger percentage of hatchery carcasses occurred in the lower reaches, while a larger percentage of wild summer Chinook carcasses occurred in upstream reaches (Figure 7.4).

Table 7.16. Numbers of wild and hatchery summer Chinook carcasses sampled within different reaches on the Methow River, 1991-2011.

Survey year	Origin	Survey reach							Total
		M-1	M-2	M-3	M-4	M-5	M-6	M-7	
1991	Wild	0	12	8	4	2	0	0	**26**
	Hatchery	0	0	0	0	0	0	0	**0**
1992	Wild	8	8	19	0	17	1	0	**53**
	Hatchery	0	0	0	0	0	0	0	**0**
1993	Wild	11	15	9	0	3	0	0	**38**
	Hatchery	8	7	5	2	2	0	0	**24**
1994	Wild	21	17	8	4	9	0	0	**59**
	Hatchery	20	15	11	0	3	0	0	**49**
1995	Wild	6	9	27	7	5	0	0	**54**
	Hatchery	7	24	25	0	1	0	0	**57**
1996	Wild	1	20	29	4	2	0	0	**56**
	Hatchery	5	7	11	1	0	0	0	**24**
1997	Wild	5	5	28	1	17	0	0	**56**
	Hatchery	1	4	7	1	2	1	0	**16**
1998	Wild	41	46	70	9	23	0	0	**189**
	Hatchery	48	36	28	6	5	0	0	**123**
1999	Wild	27	79	110	14	17	4	2	**253**
	Hatchery	15	57	102	17	13	7	0	**211**
2000	Wild	23	78	74	7	72	3	0	**257**
	Hatchery	37	33	20	1	16	2	0	**109**
2001	Wild	49	102	54	9	66	11	1	**292**
	Hatchery	330	157	32	4	6	0	0	**529**
2002	Wild	124	163	362	129	183	34	9	**1,004**
	Hatchery	412	141	138	24	22	0	1	**738**
2003	Wild	33	123	176	63	85	3	0	**483**
	Hatchery	80	122	127	38	36	2	0	**405**
2004	Wild	14	108	144	61	73	1	0	**401**
	Hatchery	24	52	28	17	12	1	1	**135**
2005	Wild	62	99	133	33	107	3	0	**437**
	Hatchery	92	74	49	9	5	0	0	**229**
2006	Wild	68	103	83	49	131	3	1	**438**
	Hatchery	53	46	28	7	15	0	0	**149**
2007	Wild	52	71	62	19	45	0	0	**249**
	Hatchery	93	60	47	9	10	0	0	**219**
2008	Wild	15	69	158	29	54	2	0	**327**

Survey year	Origin	Survey reach							Total
		M-1	M-2	M-3	M-4	M-5	M-6	M-7	
	Hatchery	49	59	39	4	3	1	0	**155**
2009	Wild	54	91	104	28	86	0	0	**363**
	Hatchery	90	67	55	8	8	0	0	**228**
2010	Wild	33	79	102	24	53	5	1	**297**
	Hatchery	72	101	83	14	10	0	0	**280**
2011	Wild	21	56	87	54	56	5	1	**280**
	Hatchery	35	78	114	24	27	0	0	**278**
Average	***Wild***	***32***	***64***	***88***	***26***	***53***	***4***	***1***	***267***
	Hatchery	***70***	***54***	***45***	***9***	***9***	***1***	***0***	***188***

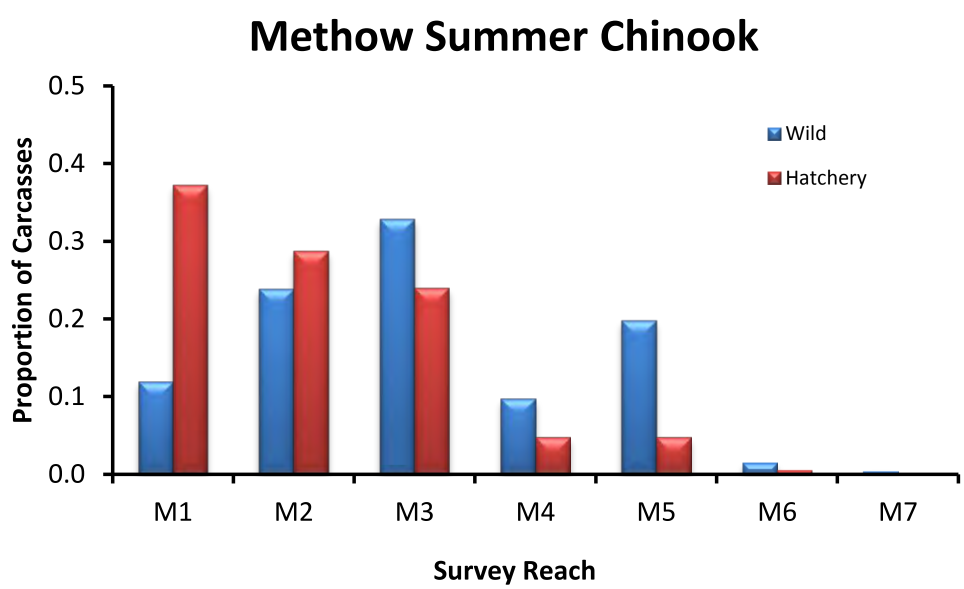


Figure 7.4. Distribution of wild and hatchery produced carcasses in different reaches on the Methow River, 1993-2011. Reach codes are described in Table 2.11.

Sampling Rate

Overall, 21% of the total spawning escapement of summer Chinook in the Methow River basin was sampled in 2012 (Table 7.17). Sampling rates among survey reaches varied from 17 to 152%.

Table 7.17. Number of redds and carcasses, total spawning escapement, and sampling rates for summer Chinook in the Methow River basin, 2012. Reach codes are described in Table 2.11.

Survey reach	Total number of redds	Total number of carcasses	Total spawning escapement	Sampling rate
Methow 1 (M1)	239	127	734	0.17
Methow 2 (M2)	221	154	678	0.23

Survey reach	Total number of redds	Total number of carcasses	Total spawning escapement	Sampling rate
Methow 3 (M3)	296	170	909	0.19
Methow 4 (M4)	92	75	282	0.27
Methow 5 (M5)	99	82	304	0.27
Methow 6 (M6)	3	14	9	1.52
Methow 7 (M7)	10	7	31	0.23
Total	***960***	***629***	***2,947***	***0.21***

Length Data

Mean lengths (POH, cm) of male and female summer Chinook carcasses sampled during surveys on the Methow River in 2012 are provided in Table 7.18. The average size of males and females sampled in the Methow River were 61 cm and 68 cm, respectively.

Table 7.18. Mean lengths (postorbital-to-hypural length; cm) and standard deviations (in parentheses) of male and female summer Chinook carcasses sampled in different reaches on the Methow River, 2012. Reach codes are described in Table 2.11.

Stream/watershed	Mean length (cm)	
	Male	Female
Methow 1 (M1)	59.1 (10.3)	67.9 (5.7)
Methow 2 (M2)	56.6 (10.3)	65.5 (5.8)
Methow 3 (M3)	63.3 (10.2)	67.4 (6.0)
Methow 4 (M4)	67.1 (9.6)	70.1 (7.2)
Methow 5 (M5)	61.9 (8.9)	70.6 (5.4)
Methow 6 (M6)	69.6 (11.5)	69.1 (4.2)
Methow 7 (M7)	-	72.0 (5.0)
Total	***60.8 (10.7)***	***67.9 (6.2)***

7.6 Life History Monitoring

Life history characteristics of Methow summer Chinook were assessed by examining carcasses on spawning grounds and fish collected or examined at broodstock collection sites, and by reviewing tagging data and fisheries statistics.

Migration Timing

Migration timing of hatchery and wild Methow/Okanogan summer Chinook was determined from broodstock data collected at Wells Dam. Counting of summer/fall Chinook at Wells Dam occurs from 29 June to 15 November. Broodstock collection at the Dam occurs from early July (week 27) to mid-September (week 37) (Table 2.1). Based on broodstock sampling in 2012, both wild and hatchery summer Chinook arrived at Wells Dam about the same time (Table 7.19). This was true throughout most of the migration period. This pattern was also observed when data were pooled for the 2007-2012 survey period.

Table 7.19. The week that 10%, 50% (median), and 90% of the wild and hatchery summer Chinook salmon passed Wells Dam, 2007-2012. The average week is also provided. Migration timing is based on collection of summer Chinook broodstock at Wells Dam.

Survey year	Origin	Methow/Okanogan Summer Chinook Migration Time (week)				Sample size
		10 Percentile	50 Percentile	90 Percentile	Mean	
2007	Wild	27	30	34	30	485
	Hatchery	27	30	33	30	433
2008	Wild	28	30	34	30	542
	Hatchery	28	30	36	31	884
2009	Wild	27	29	34	30	585
	Hatchery	27	29	33	29	708
2010	Wild	27	29	33	29	377
	Hatchery	27	29	32	29	801
2011	Wild	30	32	36	32	516
	Hatchery	30	32	35	33	1,223
2012	Wild	28	30	34	31	192
	Hatchery	28	31	34	31	591
Average	Wild	***27***	***30***	***34***	***31***	***2,697***
	Hatchery	***28***	***31***	***35***	***31***	***4,640***

Age at Maturity

Because hatchery summer Chinook are released after one year of rearing and natural-origin summer Chinook migrate primarily as age-0 fish, total ages will differ between hatchery and natural-origin Chinook (see Hillman et al. 2011). Therefore, in this section, we evaluated age at maturity by comparing differences in salt (ocean) ages between the two groups.

Most of the wild and hatchery summer Chinook sampled during the period 1993-2011 in the Methow River were salt age-3 fish (Table 7.20; Figure 7.5). A higher percentage of salt age-4 wild Chinook returned to the basin than did salt age-4 hatchery Chinook. In contrast, a higher proportion of salt age-1, 2, and 3 hatchery fish returned than did salt age-1, 2, and 3 wild fish. Thus, a higher percentage of wild fish returned at an older age than did hatchery fish.

Table 7.20. Proportions of wild and hatchery summer Chinook of different salt (ocean) ages sampled on spawning grounds in the Methow River, 1993-2011.

Sample year	Origin	Salt age						Sample size
		1	2	3	4	5	6	
1993	Wild	0.05	0.08	0.76	0.11	0.00	0.00	38
	Hatchery	0.00	1.00	0.00	0.00	0.00	0.00	20
1994	Wild	0.03	0.26	0.51	0.20	0.00	0.00	101
	Hatchery	0.00	0.07	0.93	0.00	0.00	0.00	110
1995	Wild	0.00	0.09	0.70	0.20	0.00	0.00	54
	Hatchery	0.02	0.04	0.44	0.51	0.00	0.00	55

Sample year	Origin	Salt age						Sample size
		1	2	3	4	5	6	
1996	Wild	0.04	0.30	0.54	0.13	0.00	0.00	56
	Hatchery	0.00	0.05	0.50	0.41	0.05	0.00	22
1997	Wild	0.00	0.22	0.51	0.27	0.00	0.00	55
	Hatchery	0.13	0.06	0.56	0.25	0.00	0.00	16
1998	Wild	0.09	0.38	0.45	0.09	0.00	0.00	188
	Hatchery	0.02	0.52	0.41	0.04	0.00	0.00	123
1999	Wild	0.01	0.51	0.43	0.05	0.00	0.00	252
	Hatchery	0.00	0.07	0.90	0.03	0.00	0.00	210
2000	Wild	0.01	0.09	0.75	0.16	0.00	0.00	257
	Hatchery	0.10	0.16	0.62	0.11	0.00	0.00	97
2001	Wild	0.02	0.20	0.72	0.07	0.00	0.00	292
	Hatchery	0.10	0.60	0.26	0.04	0.00	0.00	526
2002	Wild	0.01	0.17	0.61	0.21	0.00	0.00	1,003
	Hatchery	0.01	0.41	0.57	0.01	0.00	0.00	734
2003	Wild	0.01	0.11	0.50	0.37	0.00	0.00	478
	Hatchery	0.02	0.03	0.90	0.04	0.00	0.00	399
2004	Wild	0.00	0.09	0.35	0.56	0.00	0.00	394
	Hatchery	0.07	0.28	0.30	0.35	0.00	0.00	141
2005	Wild	0.00	0.11	0.74	0.14	0.01	0.00	410
	Hatchery	0.06	0.26	0.65	0.02	0.00	0.00	220
2006	Wild	0.00	0.02	0.33	0.64	0.00	0.00	356
	Hatchery	0.01	0.19	0.49	0.30	0.00	0.00	164
2007	Wild	0.03	0.09	0.24	0.59	0.05	0.00	208
	Hatchery	0.07	0.09	0.74	0.09	0.01	0.00	214
2008	Wild	0.01	0.14	0.70	0.13	0.01	0.00	301
	Hatchery	0.09	0.41	0.27	0.14	0.00	0.00	151
2009	Wild	0.00	0.11	0.41	0.48	0.00	0.00	317
	Hatchery	0.17	0.26	0.52	0.04	0.00	0.00	242
2010	Wild	0.01	0.16	0.58	0.24	0.00	0.00	271
	Hatchery	0.01	0.69	0.29	0.02	0.00	0.00	247
2011	Wild	0.00	0.01	0.04	0.49	0.46	0.00	255
	Hatchery	0.00	0.00	0.16	0.12	0.71	0.01	262
Average	***Wild***	***0.01***	***0.15***	***0.52***	***0.29***	***0.03***	***0.00***	***278***
	Hatchery	***0.05***	***0.30***	***0.53***	***0.08***	***0.05***	***0.00***	***208***

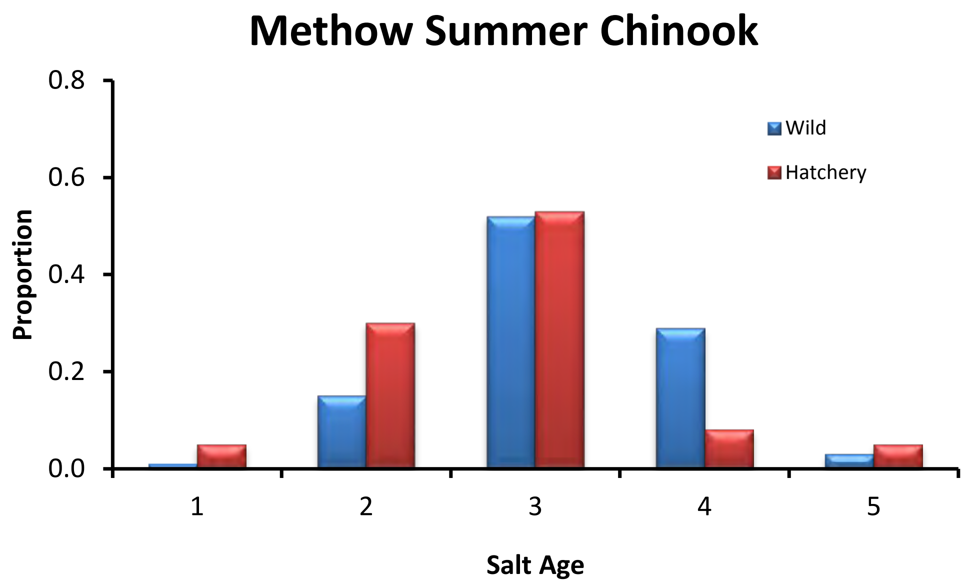


Figure 7.5. Proportions of wild and hatchery summer Chinook of different salt (ocean) ages sampled at broodstock collection sites and on spawning grounds in the Methow River for the combined years 1993-2011.

Size at Maturity

On average, hatchery summer Chinook were about 4 cm smaller than wild summer Chinook sampled in the Methow River basin (Table 7.21). This is likely because a higher percentage of wild fish returned as salt age-4 fish than did hatchery fish. Future analyses will compare sizes of hatchery and wild fish of the same age groups and sex.

Table 7.21. Mean lengths (POH; cm) and variability statistics for wild and hatchery summer Chinook sampled in the Methow River basin, 1993-2011; SD = 1 standard deviation.

Survey year	Origin	Sample size	Summer Chinook length (POH; cm)			
			Mean	SD	Minimum	Maximum
1993	Wild	41	74	9	51	89
	Hatchery	24	62	8	36	80
1994	Wild	112	69	8	35	87
	Hatchery	114	67	5	43	77
1995	Wild	62	74	6	52	88
	Hatchery	57	73	7	46	85
1996	Wild	64	70	11	34	91
	Hatchery	23	72	7	58	85
1997	Wild	62	76	9	35	90
	Hatchery	16	68	15	33	87
1998	Wild	196	67	10	38	97
	Hatchery	123	63	10	37	87
1999	Wild	293	66	8	43	99

Survey year	Origin	Sample size	Summer Chinook length (POH; cm)			
			Mean	SD	Minimum	Maximum
	Hatchery	211	66	7	26	89
2000	Wild	288	74	8	37	89
	Hatchery	109	68	12	24	87
2001	Wild	328	67	10	29	86
	Hatchery	529	63	10	31	87
2002	Wild	1,076	70	8	37	94
	Hatchery	738	67	9	33	87
2003	Wild	543	71	8	35	88
	Hatchery	405	69	8	35	89
2004	Wild	442	73	7	38	89
	Hatchery	135	65	12	34	85
2005	Wild	437	69	8	45	86
	Hatchery	229	64	9	36	79
2006	Wild	438	73	7	35	92
	Hatchery	149	69	8	38	91
2007	Wild	249	72	11	33	89
	Hatchery	219	69	9	22	84
2008	Wild	384	69	8	30	90
	Hatchery	210	63	15	23	86
2009	Wild	363	71	9	32	88
	Hatchery	228	63	12	30	83
2010	Wild	296	69	8	33	90
	Hatchery	280	62	9	39	81
2011	Wild	280	70	9	31	89
	Hatchery	278	64	11	26	82
Pooled	***Wild***	***5,954***	***67***	***8***	***29***	***99***
	Hatchery	***4,077***	***63***	***9***	***22***	***91***

Contribution to Fisheries

Most of the harvest on hatchery-origin Methow summer Chinook occurred in the Ocean (Table 7.22). Ocean harvest has made up 13% to 99% of all hatchery-origin Methow summer Chinook harvested. Brood years 1989, 1998, and 2006 provided the largest harvests, while brood years 1996 and 1999 provided the lowest.

Table 7.22. Estimated number and percent (in parentheses) of hatchery-origin Methow summer Chinook captured in different fisheries, brood years 1989-2006.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational (sport)	
1989	1,045 (52)	884 (44)	0 (0)	66 (3)	1,995
1990	55 (57)	41 (43)	0 (0)	0 (0)	96
1991	12 (20)	49 (80)	0 (0)	0 (0)	61
1992	17 (55)	14 (45)	0 (0)	0 (0)	31
1993	14 (58)	8 (33)	2 (8)	0 (0)	24
1994	153 (81)	34 (18)	1 (1)	1 (1)	189
1995	77 (99)	0 (0)	1 (1)	0 (0)	78
1996	12 (92)	1 (8)	0 (0)	0 (0)	13
1997	215 (88)	7 (3)	0 (0)	21 (9)	243
1998	1,747 (83)	101 (5)	14 (1)	234 (11)	2,096
1999	2 (13)	13 (87)	0 (0)	0 (0)	15
2000	366 (71)	88 (17)	27 (5)	33 (6)	514
2001	320 (52)	97 (16)	43 (7)	160 (26)	620
2002	272 (48)	96 (17)	61 (11)	137 (24)	566
2003	58 (58)	17 (17)	7 (7)	18 (18)	100
2004	133 (49)	55 (20)	16 (6)	68 (25)	272
2005	296 (54)	137 (25)	50 (9)	66 (12)	549
2006	1,122 (48)	805 (35)	100 (4)	294 (13)	2,321

Straying

Stray rates were determined by examining CWTs recovered on spawning grounds within and outside the Methow River basin. Targets for strays based on return year (recovery year) and brood year should be less than 5%.

Few hatchery-origin Methow summer Chinook have strayed into basins outside the Methow (Table 7.23). Although hatchery-origin Methow summer Chinook have strayed into the Okanogan River basin, Entiat River basin, Chelan tailrace, and Hanford Reach, they have made up less than 1% of the spawning escapement within those areas.

Table 7.23. Number and percent of spawning escapements within other non-target basins that consisted of hatchery-origin Methow summer Chinook, return years 1994-2009. For example, for return year 2002, 0.4% of the summer Chinook escapement in the Okanogan River basin consisted of hatchery-origin Methow summer Chinook. Percent strays should be less than 5%.

Return year	Wenatchee		Okanogan		Chelan		Entiat		Hanford Reach	
	Number	%	Number	%	Number	%	Number	%	Number	%
1994	0	0.0	72	1.8	-	-	-	-	-	-
1995	0	0.0	9	0.3	-	-	-	-	-	-
1996	0	0.0	0	0.0	-	-	-	-	-	-

Return year	Wenatchee		Okanogan		Chelan		Entiat		Hanford Reach	
	Number	%	Number	%	Number	%	Number	%	Number	%
1997	0	0.0	0	0.0	-	-	-	-	-	-
1998	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1999	0	0.0	6	0.2	0	0.0	0	0.0	7	0.0
2000	0	0.0	3	0.1	0	0.0	0	0.0	0	0.0
2001	0	0.0	0	0.0	0	0.0	0	0.0	7	0.0
2002	0	0.0	54	0.4	0	0.0	0	0.0	0	0.0
2003	0	0.0	1	0.0	6	1.4	0	0.0	0	0.0
2004	0	0.0	7	0.1	3	0.7	0	0.0	0	0.0
2005	0	0.0	24	0.3	0	0.0	0	0.0	0	0.0
2006	0	0.0	12	0.1	0	0.0	0	0.0	0	0.0
2007	0	0.0	17	0.4	2	1.1	1	0.4	0	0.0
2008	0	0.0	12	0.2	0	0.0	0	0.0	0	0.0
2009	0	0.0	14	0.2	0	0.0	0	0.0	0	0.0
Total	***0***	***0.0***	***231***	***0.3***	***11***	***0.2***	***1***	***0.0***	***14***	***0.0***

Based on brood year analyses, on average, about 4.9% of the returns have strayed into non-target spawning areas, falling below the target of 5% (Table 7.24). Depending on brood year, percent strays into non-target spawning areas have ranged from 0-11.9%. Few (<2% on average) have strayed into non-target hatchery programs.

Table 7.24. Number and percent of hatchery-origin Methow summer Chinook that homed to target spawning areas and the target hatchery program, and number and percent that strayed to non-target spawning areas and non-target hatchery programs, by brood years 1989-2006. Percent stays should be less than 5%.

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1989	773	55.7	459	33.0	81	5.8	76	5.5
1990	199	70.6	81	28.7	0	0.0	2	0.7
1991	82	65.6	43	34.4	0	0.0	0	0.0
1992	68	63.0	40	37.0	0	0.0	0	0.0
1993	25	65.8	10	26.3	3	7.9	0	0.0
1994	419	79.7	94	17.9	13	2.5	0	0.0
1995	126	81.8	28	18.2	0	0.0	0	0.0
1996	57	93.4	4	6.6	0	0.0	0	0.0
1997	379	93.8	7	1.7	18	4.5	0	0.0
1998	1,653	94.7	32	1.8	60	3.4	0	0.0
1999	18	100.0	0	0.0	0	0.0	0	0.0
2000	239	93.0	4	1.6	14	5.4	0	0.0

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
2001	272	88.3	6	1.9	29	9.4	1	0.3
2002	315	95.2	4	1.2	12	3.6	0	0.0
2003	131	99.2	1	0.8	0	0.0	0	0.0
2004	194	85.5	6	2.6	27	11.9	0	0.0
2005	373	90.5	13	3.2	23	5.6	3	0.7
2006	1,239	91.4	14	1.0	103	7.6	0	0.0
Total	***6,562***	***83.3***	***846***	***10.7***	***383***	***4.9***	***82***	***1.0***

Genetics

Genetic studies were conducted to investigate relationships among temporally replicated collections of summer Chinook from the Wenatchee River, Methow River, and Okanogan River in the upper Columbia River basin (Kassler et al. 2100; the entire report is appended as Appendix K). Samples from the Eastbank Hatchery – Wenatchee stock, Eastbank Hatchery – Methow/Okanogan (MEOK) stock, and Wells Hatchery were also included in the analysis. Samples of natural and hatchery-origin summer Chinook were analyzed and compared to determine if the supplementation program has affected the genetic structure of these populations. The study also calculated the effective number of breeders for collection locations of natural and hatchery-origin summer Chinook from 1993 and 2008.

In general, population differentiation was not observed among the temporally replicated collection locations. A single collection from the Okanogan River (1993) was the only collection showing statistically significant differences. The effective number of breeders was not statistically different from the early collection in 1993 in comparison to the late collection in 2008. Overall, these analyses revealed a lack of differentiation among the temporal replicates from the same locations and among the collection from different locations, suggesting the populations have been homogenized or that there has been substantial gene flow among populations. Additional comparisons among summer-run and fall-run Chinook populations in the upper Columbia River were conducted to determine if there was any differentiation between Chinook with different run timing. These analyses revealed pairwise F_{ST} values that were less than 0.01 for the collections of summer Chinook to collections of fall Chinook from Hanford Reach, lower Yakima River, Priest Rapids, and Umatilla. Collections of fall Chinook from Crab Creek, Lyons Ferry Hatchery, Marion Drain, and Snake River had pairwise F_{ST} values that were higher in comparison to the collections of summer Chinook. The consensus clustering analysis did not provide good statistical support to the groupings, but did show relationships among collections based on geographic proximity. Overall the summer and fall run Chinook that have historically been spawned together were not differentiated while fall Chinook from greater geographic distances were differentiated.

Proportion of Natural Influence

Another method for assessing the genetic risk of a supplementation program is to determine the influence of the hatchery and natural environments on the adaptation of the composite population. This is estimated by the proportion of natural-origin fish in the hatchery broodstock (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The ratio pNOB/(pHOS+pNOB) is the Proportion of Natural Influence (PNI). The larger the ratio (PNI), the greater the strength of selection in the natural environment relative to that of the hatchery environment. In order for the natural environment to dominate selection, PNI should be greater than 0.67 (HSRG/WDFW/NWIFC 2004).

For most brood years 1993-2003, the PNI was less than 0.67, indicating that the hatchery environment had a greater influence on adaptation of Methow summer Chinook than did the natural environment (Table 7.25). However, since brood year 2003, the PNI has generally been greater than 0.67, indicating that the natural environment has a greater influence on adaptation of Methow summer Chinook than does the hatchery environment.

Table 7.25. Proportionate natural influence (PNI) of the Methow summer Chinook supplementation program for brood years 1989-2011. PNI was calculated as the proportion of naturally produced Chinook in the hatchery broodstock (pNOB) divided by the proportion of hatchery Chinook on the spawning grounds (pHOS) plus pNOB. NOS = number of natural-origin Chinook on the spawning grounds; HOS = number of hatchery-origin Chinook on the spawning grounds; NOB = number of natural-origin Chinook collected for broodstock; and HOB = number of hatchery-origin Chinook included in hatchery broodstock.

Brood year	Spawners			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
1989	492	0	0.00	1,297	312	0.81	1.00
1990	1,421	0	0.00	828	206	0.80	1.00
1991	566	0	0.00	924	314	0.75	1.00
1992	460	0	0.00	297	406	0.42	1.00
1993	309	199	0.39	681	388	0.64	0.62
1994	573	512	0.47	341	244	0.58	0.55
1995	563	651	0.54	173	240	0.42	0.44
1996	424	191	0.31	287	155	0.65	0.68
1997	512	185	0.27	197	265	0.43	0.61
1998	432	243	0.36	153	211	0.42	0.54
1999	537	449	0.46	224	289	0.44	0.49
2000	838	362	0.30	164	337	0.33	0.52
2001	1,052	1,716	0.62	12	345	0.03	0.05
2002	2,505	2,125	0.46	247	241	0.51	0.53
2003	2,224	1,706	0.43	381	101	0.79	0.65
2004	1,609	580	0.26	506	16	0.97	0.79
2005	1,672	889	0.35	391	9	0.98	0.74
2006	2,039	694	0.25	500	10	0.98	0.80
2007	764	600	0.44	456	17	0.96	0.69

Brood year	Spawners			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
2008	1,293	654	0.34	359	86	0.81	0.70
2009	1,093	665	0.38	503	4	0.99	0.72
2010	1,326	1,166	0.47	484	8	0.98	0.68
2011	1,503	1,414	0.48	467	26	0.95	0.66
Average	***1,052***	***652***	***0.33***	***429***	***184***	***0.68***	***0.67***

Natural and Hatchery Replacement Rates

Natural replacement rates (NRR) were calculated as the ratio of natural-origin recruits (NOR) to the parent spawning population (spawning escapement). For brood years 1989-2005, NRR for summer Chinook in the Methow averaged 1.15 (range, 0.10-4.74) if harvested fish were not include in the estimate and 2.25 (range, 0.18-10.45) if harvested fish were included in the estimate (Table 7.26). NRRs for more recent brood years will be calculated as soon as all tag recoveries and sampling rates have been loaded into the database.

Hatchery replacement rates (HRR) are the hatchery adult-to-adult returns and were calculated as the ratio of hatchery-origin recruits (HOR) to the parent broodstock collected. These rates should be greater than the NRRs and greater than or equal to 5.30 (the calculated target value in Murdoch and Peven 2005). HRRs exceeded NRRs in ten out of the 17 years of data, regardless if harvest was or was not included in the estimate (Table 7.26). Hatchery replacement rates for Methow summer Chinook have exceeded the estimated target value of 5.30 in two of the 17 years of data, regardless if harvest was or was not included in the estimate.

Table 7.26. Broodstock collected, spawning escapements, natural and hatchery-origin recruits (NOR and HOR), and natural and hatchery replacement rates (NRR and HRR; with and without harvest) for wild summer Chinook in the Methow River basin, brood years 1989-2005.

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
1989	202	492	1,389	621	6.88	1.26	3,384	1,507	16.75	3.06
1990	202	1,421	282	933	1.40	0.66	378	1,257	1.87	0.88
1991	266	566	125	276	0.47	0.49	186	413	0.70	0.73
1992	214	460	108	599	0.50	1.30	139	773	0.65	1.68
1993	234	508	38	420	0.16	0.83	62	685	0.26	1.35
1994	260	1,085	526	521	2.02	0.48	715	710	2.75	0.65
1995	242	1,214	154	1,149	0.64	0.95	232	1,730	0.96	1.43
1996	220	615	61	417	0.28	0.68	74	507	0.34	0.82
1997	209	697	404	1,436	1.93	2.06	647	2,309	3.10	3.31
1998	235	675	1,745	3,197	7.43	4.74	3,841	7,057	16.34	10.45
1999	222	986	18	2,826	0.08	2.87	33	5,185	0.15	5.26
2000	222	1,200	257	813	1.16	0.68	771	2,449	3.47	2.04
2001	223	2,768	308	2,857	1.38	1.03	928	8,658	4.16	3.13

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
2002	222	4,630	331	1,072	1.49	0.23	897	2,921	4.04	0.63
2003	224	3,930	132	395	0.59	0.10	232	694	1.04	0.18
2004	223	2,189	227	1,644	1.02	0.75	499	3,621	2.24	1.65
2005	225	2,561	412	1,162	1.83	0.45	961	2,715	4.27	1.06
Average	***226***	***1,529***	***383***	***1,196***	***1.72***	***1.15***	***822***	***2,541***	***3.71***	***2.25***

Smolt-to-Adult Survivals

Smolt-to-adult survival ratios (SARs) were calculated as the number of hatchery adult recaptures divided by the number of tagged hatchery smolts released. SARs were based on CWT returns. For the available brood years, SARs have ranged from 0.00008 to 0.01879 for hatchery summer Chinook in the Methow River basin (Table 7.27).

Table 7.27. Smolt-to-adult ratios (SARs) for Methow summer Chinook, brood years 1989-2006.

Brood year	Number of tagged smolts released[a]	Estimated adult captures[b]	SAR
1989	358,237	2,872	0.00802
1990	371,483	361	0.00097
1991	377,097	130	0.00034
1992	392,636	138	0.00035
1993	200,345	62	0.00031
1994	400,488	710	0.00177
1995	344,974	229	0.00066
1996	289,880	73	0.00025
1997	380,430	643	0.00169
1998	202,559	3,807	0.01879
1999	422,473	33	0.00008
2000	334,337	770	0.00230
2001	246,159	923	0.00375
2002	310,846	894	0.00288
2003	353,495	232	0.00066
2004	394,490	496	0.00126
2005	262,496	959	0.00365
2006	417,795	3,669	0.00878
Average	***336,679***	***945***	***0.00314***

[a] Includes all tag codes and CWT released fish (CWT + Ad Clip fish and CWT-only fish).

[b] Includes estimated recoveries (spawning ground, hatcheries, harvest, etc.) and observed recoveries if estimated recoveries were unavailable.

7.7 ESA/HCP Compliance

Broodstock Collection

Summer Chinook adults collected at Wells Dam are used for both the Methow and Okanogan supplementation programs. Per the 2010 broodstock collection protocol, 389 natural-origin (adipose fin present) adults were targeted for collection between 1 July and 18 September at the West Ladder of Wells Dam (and additional 167 NOR's were targeted by the CCT purse seine as an evaluation of collection methodology for a combined Methow/Okanogan broodstock total of 556 adults). Actual collections occurred between 1 July and 14 September and totaled 332 summer Chinook (plus an additional 167 from CCT purse seine efforts). ESA Permit 1347 provides authorization to collect Methow and Okanogan summer Chinook at Wells Dam three days per week and up to 16 hours per day from July through November. During 2010, broodstock collection activities were accomplished within the allowable trapping days authorized under ESA Permit 1347.

Collection of Methow and Okanogan summer Chinook broodstock at Wells Dam occurred concurrently with collection of summer steelhead for the Wells steelhead program authorized under ESA Section 10 Permit 1395. Encounters with steelhead and spring Chinook during Methow and Okanogan summer Chinook broodstock collections did not result in takes that were outside those authorized in Permit 1347 and in Permit 1395 for the Wells Steelhead program. Steelhead encountered during summer Chinook collections that were not required for steelhead broodstock were passed at the trap site and were not physically handled. Any spring Chinook encountered during summer Chinook broodstock activities were also passed without handling.

Hatchery Rearing and Release

The 2010 brood Methow/Okanogan summer Chinook reared throughout their juvenile life-stages at Eastbank Fish Hatchery and the Carlton Acclimation pond without incident (see Section 7.2). The 2010 brood smolt release totaled 439,000 summer Chinook, representing 109.8% of the production objective and was compliant with the 10% overage allowable in ESA Section 10 Permit 1347.

Hatchery Effluent Monitoring

Per ESA Permits 1196, 1347, and 1395, permit holders shall monitor and report hatchery effluents in compliance with applicable National Pollution Discharge Elimination Systems (NPDES) (EPA 1999) permit limitations. There was one NPDES violation reported at the Chelan PUD Hatchery facilities during the period 1 January 2011 through 31 December 2012. NPDES monitoring and reporting for Chelan PUD Hatchery Programs during 2012 are provided in Appendix F.

Spawning Surveys

Summer Chinook spawning ground surveys conducted in the Methow River basin during 2012 were consistent with ESA Section 10 Permit No. 1347. Because of the difficulty of quantifying the level of take associated with spawning ground surveys, the Permit does not specify a take level associated with these activities, even though it does authorize implementation of spawning ground surveys. Therefore, no take levels are reported. However, to minimize potential effects to established redds, wading was restricted to the extent practical, and extreme caution was used to avoid established redds when wading was required.

SECTION 8: OKANOGAN/SIMILKAMEEN SUMMER CHINOOK

8.1 Broodstock Sampling

Summer Chinook broodstock for the Okanogan/Similkameen and Methow programs is collected at the mouth of the Okanogan River via purse seine and at the East and West Ladder of Wells Dam. Refer to Section 7.1 for information on the origin, age and length, sex ratios, and fecundity of summer Chinook broodstock collected at Wells Dam.

8.2 Hatchery Rearing

Rearing History

Number of eggs taken

Based on the unfertilized egg-to-release survival standard of 81%, a total of 711,111 eggs were required to meet the program release goal of 576,000 smolts. An evaluation of the program in 2012 determined that 265,023 eggs are needed to meet the revised release goal of 214,669 smolts. This revised goal will begin with brood year 2012. From 1989 through 2012, the egg take goal was reached in 13 of those years (Table 8.1).

Table 8.1. Numbers of eggs taken from summer Chinook broodstock collected at Wells Dam for the Okanogan program, 1989-2011.

Return year	Number of eggs taken
1989	724,200
1990	696,144
1991	879,892
1992	729,389
1993	797,234
1994	893,086
1995	736,500
1996	672,000
1997	601,744
1998	584,018
1999	725,589
2000	645,403
2001	418,907
2002	718,599
2003	710,521
2004	805,814
2005	452,928
2006	757,350
2007	824,703
2008	662,668

Return year	Number of eggs taken
2009	840,902
2010	726,979
2011	683,419
2012	201,295
Average	***708,173***

Number of acclimation days

Summer Chinook were released volitionally from Similkameen Pond as yearling smolts beginning 166 April and ending 7 May 2012. Fish acclimated at Similkameen were held for 173 to 196 days (Table 8.2). There was no Bonaparte Pond program for the 2010 brood (2012 release) year.

Table 8.2. Number of days Okanogan summer Chinook broods were acclimated at Similkameen and Bonaparte ponds, brood years 1989-2010.

Brood year	Release year	Rearing facility	Transfer date	Release date	Number of days
1989	1991	Similkameen	29-Oct	7-May	190
1990	1992	Similkameen	5-Nov	25-Apr	171
1991	1993	Similkameen	1-Nov	9-Apr	159
1992	1994	Similkameen	2-Nov	1-Apr	150
			26-Feb	1-Apr	34
1993	1995	Similkameen	24-Oct	1-Apr	159
			24-Feb	1-Apr	36
1994	1996	Similkameen	30-Oct	6-Apr	158
			14-Mar	6-Apr	23
1995	1997	Similkameen	1-Oct	1-Apr	182
1996	1998	Similkameen	10-Oct	15-Mar	156
1997	1999	Similkameen	7-Oct	19-Apr	194
1998	2000	Similkameen	5-Oct	19-Apr	196
1999	2001	Similkameen	5-Oct	18-Apr	195
2000	2002	Similkameen	10-Oct	8-Apr	180
2001	2003	Similkameen	1-Oct	29-Apr	210
2002	2004	Similkameen	9-Nov	23-Apr	165
2003	2005	Similkameen	19-Oct	28-Apr	191
2004	2006	Similkameen	26-Oct	23-Apr	179
2005	2007	Bonaparte	6-Nov	11-Apr	156
		Similkameen	25-Oct	18-Apr – 9-May	179-200

Brood year	Release year	Rearing facility	Transfer date	Release date	Number of days
2006	2008	Similkameen	15-17-Oct	16-Apr – 7-May	182-205
2007	2009	Bonaparte	3-4-Nov	10-22-Apr	157-170
		Similkameen	20-24-Oct	14-Apr – 9-May	172-201
2008	2010	Bonaparte	2-4-Nov	19-Apr – 5-May	167-185
		Similkameen	26-28-Oct	19-Apr – 14-May	176-201
2009	2011	Bonaparte	8-9-Nov	12-Apr	155-156
		Similkameen	25-27-Oct	13-Apr – 5-May	169-193
2010	2012	Bonaparte	No program	No program	No program
		Similkameen	25-27 Oct	16-Apr – 7-May	173-196

Release Information

Numbers released

The 2010 Okanogan summer Chinook program achieved 107.3% of the 576,000 target goal with about 617,950 fish being released volitionally into the Similkameen River (Table 8.3).

Table 8.3. Numbers of Okanogan summer Chinook smolts released from the Similkameen and Bonaparte ponds, brood years 1989-2010; NA = not available. The release target for Okanogan summer Chinook is 576,000 smolts.

Brood year	Release year	Rearing facility	CWT mark rate	Number of smolts released
1989	1991	Similkameen	0.5732	352,600
1990	1992	Similkameen	0.6800	540,000
1991	1993	Similkameen	0.5335	675,500
1992	1994	Similkameen	0.9819	548,182
1993	1995	Similkameen	0.6470	586,000
1994	1996	Similkameen	0.4176	536,299
1995	1997	Similkameen	0.9785	587,000
1996	1998	Similkameen	0.9769	507,913
1997	1999	Similkameen	0.9711	589,591
1998	2000	Similkameen	0.9825	293,191
1999	2001	Similkameen	0.9689	630,463
2000	2002	Similkameen	0.9928	532,453
2001	2003	Similkameen	0.9877	26,642
2002	2004	Similkameen	0.9204	388,589
2003	2005	Similkameen	0.9929	579,019
2004	2006	Similkameen	0.9425	703,359
2005	2007	Bonaparte	0	0 (assumed)
		Similkameen	0.9862	275,919

Brood year	Release year	Rearing facility	CWT mark rate	Number of smolts released
2006	2008	Bonaparte	NA	NA
		Similkameen	0.9878	604,035
2007	2009	Bonaparte	0.9920	102,099
		Similkameen	0.9914	513,039
2008	2010	Bonaparte	0.9947	175,729
		Similkameen	0.9947	343,628
2009	2011	Bonaparte	0.9981	151,382
		Similkameen	0.9953	524,521
2010	2012	Bonaparte	No program	No program
		Similkameen	0.9886	617,950
Average		Bonaparte	***0.9949***	***143,070***
		Similkameen	***0.8860***	***497,995***

Numbers tagged

The 2010 brood Okanogan summer Chinook from the Similkameen and Bonaparte facilities were respectively 98.9% CWT and adipose fin-clipped (Table 8.3).

In 2012, a total of about 5,100 summer Chinook (brood year 2011) were PIT tagged at Eastbank Fish Hatchery during 29-30 August 2012. Fish were not fed during tagging or for two days before and after tagging. Fish averaged 82 mm in length and 5.9 g at time of tagging. As of the end of January 2013, a total of 58 tagged Chinook have died. No Chinook have shed their tags.

Table 8.4 summarizes the number of hatchery summer Chinook that have been PIT-tagged and released into the Okanogan River basin.

Table 8.4. Summary of PIT-tagging activities for Okanogan hatchery summer Chinook, brood years 2008-2010.

Brood year	Release year	Number of fish tagged	Number of tagged fish that died	Number of tags shed	Number of tagged fish released
2008	2010	5,700 (high density)	1,169	0	4,531
		5,700 (low density)	1,407	0	4,293
2009	2011	5,100	11	0	5,089
2010	2012	0	0	0	0

Fish size and condition at release

Size at release of the Similkameen population was 71% and 51% of the target fork length and weight, respectively. The target CV for fork length was exceeded by 12% (Table 8.5). There was no Bonaparte program for the 2012 release year.

Table 8.5. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of Okanogan summer Chinook smolts released from the hatchery, brood years 1989-2010. Size targets are provided in the last row of the table.

Brood year	Release year	Fork length (mm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
1989	1991	-	-	41.3	11
1990	1992	143	9.5	37.8	12
1991	1993	125	15.5	22.4	20
1992	1994	120	15.4	20.7	22
1993	1995	132	-	23.2	20
1994	1996	136	16.0	29.6	15
1995	1997	137	8.2	32.8	14
1996	1998	127	12.8	26.2	17
1997	1999	144	9.9	36.0	13
1998	2000	148	5.9	41.0	11
1999	2001	141	15.7	35.4	13
2000	2002	121	13.4	20.4	22
2001	2003	132	8.2	25.7	18
2002	2004	119	13.4	20.8	22
2003	2005	133	10.6	28.9	16
2004	2006	132	9.9	29.8	15
2005	2007	132	9.6	25.9	18
2006	2008	120	12.3	20.9	22
2007	2009	124	12.6	21.9	21
2008	2010	140	12.3	35.1	13
2009	2011	132	11.6	24.7	18
2010	2012	125	10.1	23.2	20
Targets		***176***	***9.0***	***45.4***	***10***

Survival Estimates

Overall survival of Okanogan summer Chinook from green (unfertilized) egg to release was above the standard set for the program (Table 8.6). High survival can be attributed to exceeding the survival standards set for the program at all stages, with the exception of unfertilized egg-eyed egg falling just short of its target survival. Currently, it is unknown if gamete viability is sex biased or is uniform between sexes and more influenced by between-year environmental variations.

Table 8.6. Hatchery life-stage survival rates (%) for Okanogan summer Chinook, brood years 1989-2010. Survival standards or targets are provided in the last row of the table.

Brood year	Rearing facility	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
		Female	Male							
1989[a]	Similkameen	89.8	99.5	89.9	96.7	99.7	99.4	73.3	57.4	48.7
1990[a]	Similkameen	93.9	99.0	84.9	97.1	81.2	80.6	97.7	98.6	77.6
1991[a]	Similkameen	93.1	95.5	88.2	97.1	99.4	99.1	98.4	97.1	76.8
1992[a]	Similkameen	96.9	99.0	87.0	98.0	99.9	99.9	91.7	92.6	75.2
1993[a]	Similkameen	82.2	99.4	85.4	97.6	99.8	99.5	92.0	90.2	73.5
1994	Similkameen	96.1	90.0	86.6	100.0	98.1	97.4	73.1	89.8	60.1
1995	Similkameen	91.9	96.2	98.2	84.1	96.5	96.2	92.7	98.2	79.7
1996	Similkameen	95.4	98.1	83.2	100.0	97.7	96.9	86.5	92.5	75.6
1997	Similkameen	91.9	94.6	86.1	98.4	98.7	98.3	98.8	99.4	98.0
1998	Similkameen	84.0	96.2	54.1	98.0	99.4	98.9	96.6	99.6	50.2
1999	Similkameen	98.8	98.7	92.9	96.9	98.0	97.6	96.9	99.0	86.9
2000	Similkameen	90.5	96.9	89.2	98.5	98.2	98.0	93.6	97.2	82.5
2001	Similkameen	96.2	92.3	89.1	97.6	99.7	99.5	7.4	11.9	6.4
2002	Similkameen	97.1	98.1	89.8	98.0	99.7	99.5	51.6	52.2	54.1
2003	Similkameen	96.7	97.5	86.8	97.6	99.3	98.5	98.0	98.8	81.5
2004	Similkameen	93.6	98.2	84.0	97.6	99.6	99.3	97.8	98.8	80.2
	Bonaparte	93.6	98.2	84.0	97.6	99.6	99.3	97.9	98.9	80.3
2005	Similkameen	97.0	89.6	88.0	99.5	99.5	99.0	93.5	94.6	81.8
	Bonaparte	97.0	89.6	88.0	99.5	99.5	99.0	0.0	0.0	0.0
2006	Similkameen	92.9	89.5	86.3	98.3	99.6	99.3	94.1	95.5	79.8
2007	Similkameen	92.6	99.6	80.8	99.1	99.5	99.1	97.0	98.1	77.7
	Bonaparte	92.6	99.6	80.8	99.1	99.5	99.1	95.6	96.7	76.6
2008	Similkameen	97.9	99.6	91.2	96.8	99.7	99.3	89.8	90.5	79.3
	Bonaparte	97.9	99.6	91.2	96.8	99.7	99.3	86.9	87.8	76.7
2009[b]	Similkameen	93.6	93.5	91.0	98.2	99.7	99.5	97.8	98.6	87.4
	Bonaparte	93.6	93.5	91.0	98.2	99.7	99.5	74.8	75.3	66.8
2010	Similkameen	96.5	100.0	91.2	99.9	97.4	97.1	93.3	96.3	85.0
	Bonaparte	NA	NA	NA	NA	NA	NA	NA	NA	NA
Standard		***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

[a] Survival rates were calculated from the aggregate population collected at Wells Fish Hatchery volunteer channel and left- and right-ladder traps at Wells Dam.

[b] Survival rates were calculated from aggregate collections at Wells east fish ladder for the Methow and Okanogan/Similkameen programs. About 59% of the total fish collected were used to estimate survival rates.

8.3 Disease Monitoring

Rearing of the 2010 brood Okanogan summer Chinook was similar to previous years with fish being held on well water before being transferred for final acclimation on the Similkameen. The Similkameen group was transferred in late October. Fish acclimating at the Similkameen facility were diagnosed with bacterial cold water disease and external fungus in November and were treated. No additional disease-related problems were noted before the fish were released.

Results of adult broodstock bacterial kidney disease (BKD) monitoring for Methow/Okanogan summer Chinook are shown in Table 7.11 in Section 7.3.

8.4 Spawning Surveys

Surveys for Okanogan/Similkameen summer Chinook redds were conducted from late September to mid-November 2012 in the Okanogan and Similkameen rivers. Total redd counts (not peak counts) were conducted in the rivers (see Appendix L for more details).

Redd Counts

A total of 2,679 summer Chinook redds were counted in the Okanogan River basin in 2012 (Table 8.7). This was greater than the overall average of 1,819 redds.

Table 8.7. Total number of redds counted in the Okanogan River basin, 1989-2012.

Survey year	Number of summer Chinook redds		
	Okanogan River	Similkameen River	Total count
1989	151	370	521
1990	99	147	246
1991	64	91	155
1992	53	57	110
1993	162	288	450
1994	375*	777	1,152
1995	267*	616	883
1996	116	419	535
1997	158	486	644
1998	88	276	364
1999	369	1,275	1,644
2000	549	993	1,542
2001	1,108	1,540	2,648
2002	2,667	3,358	6,025
2003	1,035	378	1,413
2004	1,327	1,660	2,987
2005	1,611	1,423	3,034
2006	2,592	1,666	4,258
2007	1,301	707	2,008
2008	1,146	1,000	2,146
2009	1,672	1,298	2,970
2010	1,011	1,107	2,118
2011	1,714	1,409	3,123
2012	1,613	1,066	2,679
Average	***937***	***934***	***1,819***

* Reach-expanded aerial counts.

Redd Distribution

Summer Chinook redds were not evenly distributed among the survey reaches in the Okanogan River basin. Most redds (84%) were located in the upper Okanogan and lower Similkameen reaches (reaches upstream of the Riverside Bridge) (Table 8.8; Figure 8.1). Relatively few summer Chinook spawned downstream of the Riverside Bridge on the Okanogan River (Reaches 1-4).

Table 8.8. Total number of summer Chinook redds counted in different reaches in the Okanogan River basin during September through mid-November, 2012. Reach codes are described in Table 2.11.

Survey reach	Total redd count	Percent
Okanogan 1 (O1)	12	0
Okanogan 2 (O2)	54	2
Okanogan 3 (O3)	159	6
Okanogan 4 (O4)	68	3
Okanogan 5 (O5)	555	21
Okanogan 6 (O6)	765	29
Similkameen 1 (S1)	914	34
Similkameen 2 (S2)	152	6
Totals	***2,679***	***100***

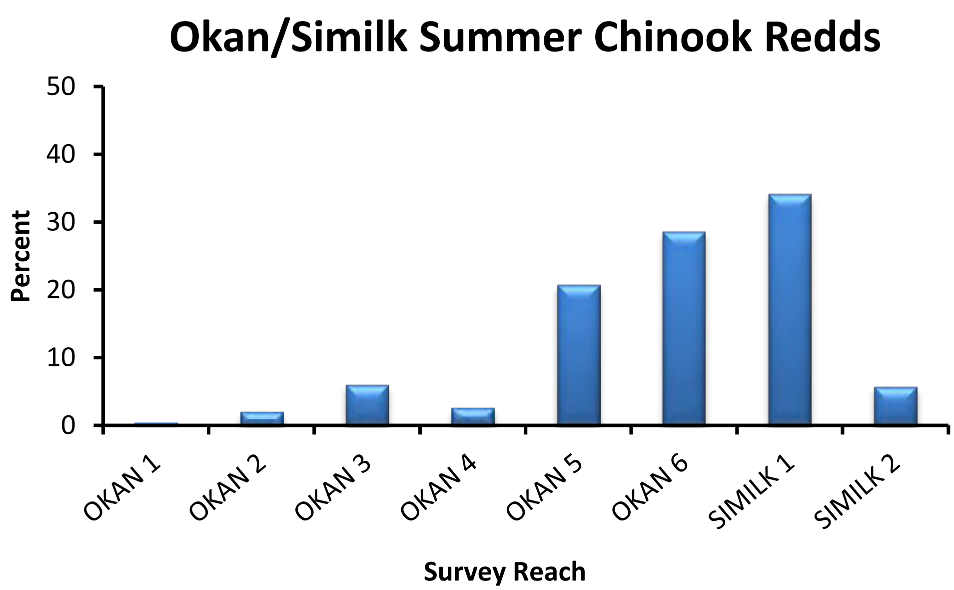


Figure 8.1. Percent of the total number of summer Chinook redds counted in different reaches in the Okanogan River basin during September through mid-November, 2012. Reach codes are described in Table 2.11.

Spawn Timing

Spawning in 2012 began the last week of September in the Okanogan River basin, and peaked during the third week of October (Figure 8.2). Spawning began when stream temperature varied from 11.0-16.0°C.

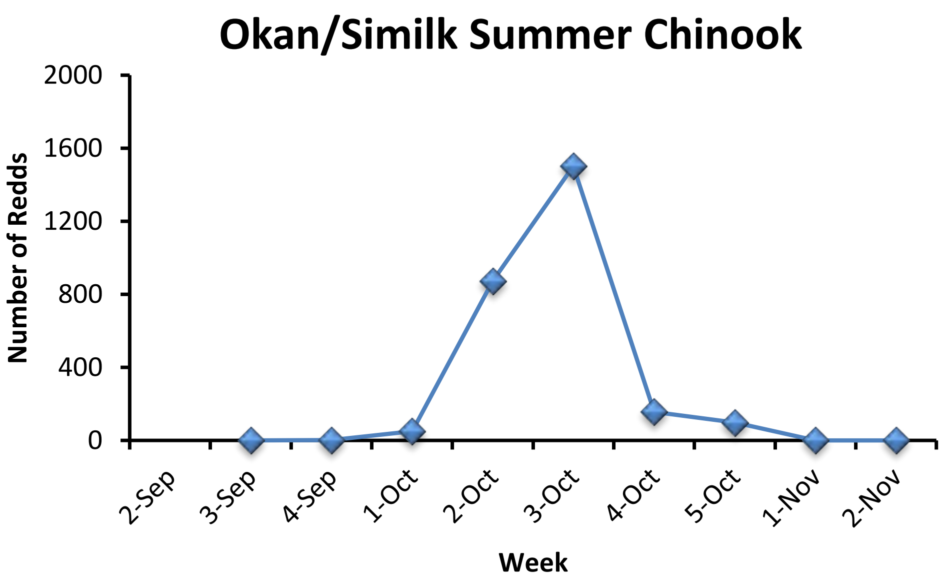


Figure 8.2. Number of new summer Chinook redds counted during different weeks in the Okanogan River basin, September through mid-November, 2012.

Spawning Escapement

Spawning escapement for Okanogan/Similkameen summer Chinook was calculated as the total number of redds times the fish per redd ratio estimated from fish sampled at Wells Dam. The estimated fish per redd ratio for Okanogan/Similkameen summer Chinook in 2012 was 3.07. Multiplying this ratio by the number of redds counted in the Okanogan and Similkameen rivers resulted in a total spawning escapement of 8,225 summer Chinook (Table 8.9).

Table 8.9. Spawning escapements for summer Chinook in the Okanogan and Similkameen rivers for return years 1989-2012.

Return year	Fish/Redd	Spawning escapement		
		Okanogan	Similkameen	Total
1989*	3.30	498	1,221	1,719
1990*	3.40	337	500	837
1991*	3.70	237	337	574
1992*	4.30	228	245	473
1993*	3.30	535	950	1,485
1994*	3.50	1,313	2,720	4,033
1995*	3.40	908	2,094	3,002
1996*	3.40	394	1,425	1,819

Return year	Fish/Redd	Spawning escapement		
		Okanogan	Similkameen	Total
1997*	3.40	537	1,652	2,189
1998	3.00	264	828	1,092
1999	2.20	812	2,805	3,617
2000	2.40	1,318	2,383	3,701
2001	4.10	4,543	6,314	10,857
2002	2.30	6,134	7,723	13,857
2003	2.42	2,505	915	3,420
2004	2.25	2,986	3,735	6,721
2005	2.93	4,720	4,169	8,889
2006	2.02	5,236	3,365	8,601
2007	2.20	2,862	1,555	4,417
2008	3.25	3,725	3,250	6,975
2009	2.54	4,247	3,297	7,544
2010	2.81	2,841	3,111	5,952
2011	3.10	5,313	4,368	9,681
2012	3.07	4,952	3,273	8,225
Average	***3.01***	***2,394***	***2,593***	***4,987***

* Spawning escapement was calculated using the "Modified Meekin Method" (i.e., 3.1 x jack multiplier).

8.5 Carcass Surveys

Surveys for summer Chinook carcasses were conducted during late September to mid-November 2012 in the Okanogan and Similkameen rivers (see Appendix L for more details).

Number sampled

A total of 1,414 summer Chinook carcasses were sampled during September through mid-November in the Okanogan River basin (Table 8.10). A total of 865 were sampled in the Okanogan River and 549 in the Similkameen River.

Table 8.10. Numbers of summer Chinook carcasses sampled within each survey reach in the Okanogan River basin, 1993-2012. Reach codes are described in Table 2.11.

Survey year	Number of summer Chinook carcasses								
	Okanogan						Similkameen		Total
	O-1	O-2	O-3	O-4	O-5	O-6	S-1	S-2	
1993[a]	0	2	3	0	23	13	73	1	**115**
1994[b]	0	4	4	0	27	5	318	60	**418**
1995	0	0	2	0	30	0	239	15	**286**
1996	0	0	0	2	5	2	226	0	**235**
1997	0	0	2	0	9	3	225	1	**240**
1998	0	1	8	1	7	7	340	4	**368**

Survey year	Number of summer Chinook carcasses								
	Okanogan						Similkameen		Total
	O-1	O-2	O-3	O-4	O-5	O-6	S-1	S-2	
1999	0	0	3	2	23	53	766	48	**895**
2000	0	2	20	15	47	16	727	41	**868**
2001	0	26	75	10	127	112	1,141	105	**1,596**
2002	10	32	83	35	204	573	1,265	259	**2,461**
2003[c]	0	0	26	0	15	208	180	8	**437**
2004	0	4	31	24	146	283	1,392	298	**2,178**
2005	0	8	93	37	371	431	731	276	**1,947**
2006	4	3	31	16	120	291	513	100	**1,078**
2007	2	1	48	1	459	519	657	29	**1,716**
2008	4	10	40	36	248	665	859	157	**2,019**
2009	2	7	31	32	348	500	702	150	**1,772**
2010	3	10	30	42	241	352	627	148	**1,453**
2011	0	0	55	14	361	479	752	114	**1,775**
2012	1	0	56	15	256	537	495	54	**1,414**
Average	***1***	***6***	***32***	***14***	***153***	***252***	***611***	***93***	***1,164***

[a] 25 additional carcasses were sampled on the Similkameen and 46 on the Okanogan without any reach designation.
[b] One additional carcasses was sampled on the Similkameen without any reach designation.
[c] 793 carcasses were sampled on the Similkameen before initiation of spawning (pre-spawn mortality) and an additional 40 carcasses were sampled on the Okanogan. The cause of the high mortality (*Ichthyophthirius multifilis* and *Flavobacterium columnarae*) was exacerbated by high river temperatures.

Carcass Distribution and Origin

Summer Chinook carcasses were not evenly distributed among reaches within the Okanogan River basin in 2012 (Table 8.9; Figure 8.3). Most of the carcasses in the basin were found in the upper Okanogan River and lower Similkameen River. The highest percentage of carcasses was sampled in Reach 6 on the Okanogan River (38%) and Reach 1 on the Similkameen River between the Driscoll Channel and Oroville Bridge (35%).

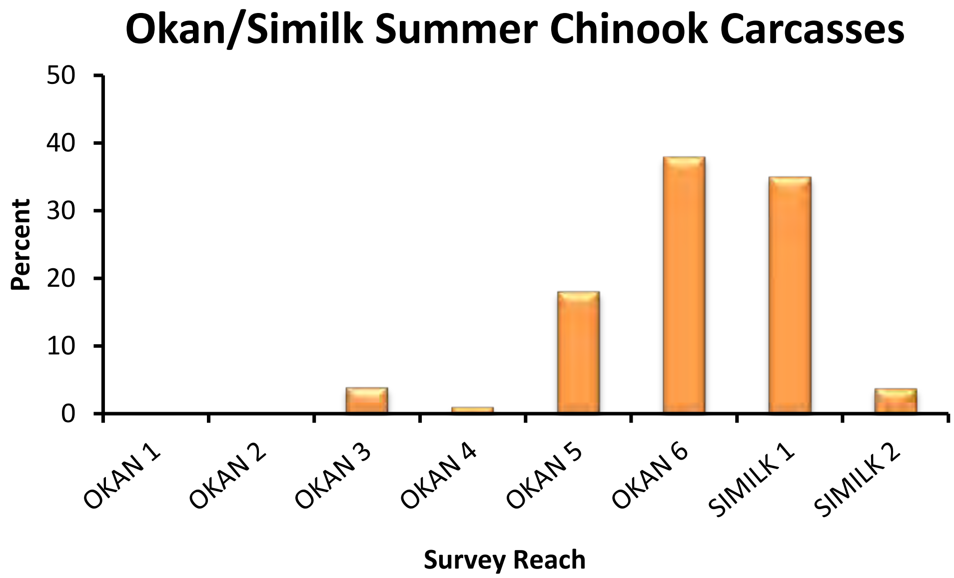


Figure 8.3. Percent of summer Chinook carcasses sampled within different reaches in the Okanogan River basin during September through mid-November, 2012. Reach codes are described in Table 2.11.

Numbers of wild and hatchery-origin summer Chinook carcasses sampled in 2012 will be available after analysis of CWTs and scales. Based on the available data (1991-2011), most fish, regardless of origin, were found in Reach 1 on the Similkameen River (Driscoll Channel to Oroville Bridge) (Table 8.11). However, a slightly larger percentage of hatchery fish were found in reaches on the Similkameen River than were wild fish (Figure 8.4). In contrast, a larger percentage of wild fish were found in reaches on the Okanogan River.

Table 8.11. Numbers of wild and hatchery summer Chinook carcasses sampled within different reaches in the Okanogan River basin, 1993-2011.

Survey year	Origin	Survey reach								Total
		O-1	O-2	O-3	O-4	O-5	O-6	S-1	S-2	
1993	Wild	0	0	3	0	13	4	48	1	**69**
	Hatchery	0	2	0	0	10	9	25	0	**46**
1994	Wild	0	0	1	0	8	1	113	22	**145**
	Hatchery	0	4	3	0	19	4	205	38	**273**
1995	Wild	0	0	1	0	10	0	66	4	**81**
	Hatchery	0	0	1	0	20	0	173	11	**205**
1996	Wild	0	0	0	1	3	1	53	0	**58**
	Hatchery	0	0	0	1	2	1	173	0	**177**
1997	Wild	0	0	1	0	0	2	83	0	**86**
	Hatchery	0	0	1	0	9	0	142	1	**153**
1998	Wild	0	1	3	1	6	5	162	4	**182**
	Hatchery	0	0	5	0	1	2	178	0	**186**
1999	Wild	0	0	0	0	9	24	298	10	**341**
	Hatchery	0	0	3	2	14	29	468	38	**554**
2000	Wild	0	0	8	8	24	11	189	4	**244**

Survey year	Origin	Survey reach								Total
		O-1	O-2	O-3	O-4	O-5	O-6	S-1	S-2	
	Hatchery	0	2	12	7	23	5	538	37	**624**
2001	Wild	0	10	23	5	67	42	390	54	**591**
	Hatchery	0	16	52	5	60	70	751	51	**1,005**
2002	Wild	6	14	20	10	81	212	340	72	**755**
	Hatchery	4	18	63	25	123	360	925	187	**1,705**
2003	Wild	0	0	13	0	12	149	221	116	**511**
	Hatchery	0	0	15	0	5	91	364	257	**732**
2004	Wild	0	2	19	19	108	225	1,126	260	**1,759**
	Hatchery	0	2	12	5	38	58	266	38	**419**
2005	Wild	0	5	51	21	256	364	532	176	**1,405**
	Hatchery	0	3	42	16	115	67	199	100	**542**
2006	Wild	2	2	23	11	110	271	70	78	**567**
	Hatchery	2	1	8	5	10	20	443	22	**511**
2007	Wild	1	0	33	1	303	347	441	21	**1,147**
	Hatchery	1	0	22	0	150	172	217	8	**570**
2008	Wild	2	1	16	11	121	341	361	44	**897**
	Hatchery	2	9	24	25	127	324	498	113	**1,122**
2009	Wild	2	3	14	15	192	352	341	76	**995**
	Hatchery	0	4	17	17	156	148	362	74	**778**
2010	Wild	1	5	19	18	154	180	332	69	**778**
	Hatchery	2	5	11	24	87	172	295	79	**675**
2011	Wild	0	0	21	4	201	362	216	19	**1,144**
	Hatchery	0	0	34	10	160	117	537	95	**632**
Average	***Wild***	***1***	***2***	***14***	***7***	***88***	***152***	***283***	***54***	***619***
	Hatchery	***1***	***3***	***17***	***7***	***59***	***87***	***356***	***60***	***574***

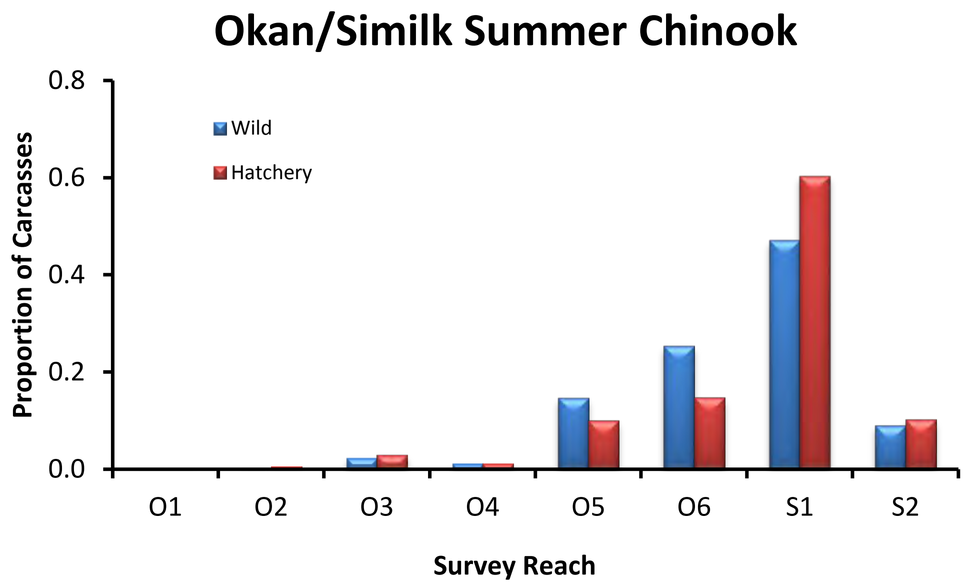


Figure 8.4. Distribution of wild and hatchery produced carcasses in different reaches in the Okanogan River basin, 1993-2011. Reach codes are described in Table 2.11.

Sampling Rate

Overall, 17% of the total spawning escapement of summer Chinook in the Okanogan River basin was sampled in 2012 (Table 8.12). Sampling rates among survey reaches varied from 0 to 23%.

Table 8.12. Number of redds and carcasses, total spawning escapement, and sampling rates for summer Chinook in the Okanogan River basin, 2012.

Sampling reach	Total number of redds	Total number of carcasses	Total spawning escapement	Sampling rate
Okanogan 1 (O1)	12	1	37	0.03
Okanogan 2 (O2)	54	0	166	0.00
Okanogan 3 (O3)	159	56	488	0.11
Okanogan 4 (O4)	68	15	209	0.07
Okanogan 5 (O5)	555	256	1,704	0.15
Okanogan 6 (O6)	765	537	2,349	0.23
Similkameen 1 (S1)	914	495	2,806	0.18
Similkameen 2 (S2)	152	54	467	0.12
Total	***2,679***	***1,414***	***8,225***	***0.17***

Length Data

Mean lengths (POH, cm) of male and female summer Chinook carcasses sampled during surveys on the Okanogan and Similkameen rives in 2012 are provided in Table 8.13. The average size of males and females sampled in the Okanogan River basin were 61 cm and 70 cm, respectively.

Table 8.13. Mean lengths (postorbital-to-hypural length; cm) and standard deviations (in parentheses) of male and female summer Chinook carcasses sampled in different reaches in the Okanogan River basin, 2012.

Stream/watershed	Mean length (cm)	
	Male	Female
Okanogan 1 (O1)	58.0 (-)	-
Okanogan 2 (O2)	-	-
Okanogan 3 (O3)	56.7 (9.9)	69.6 (6.1)
Okanogan 4 (O4)	65.0 (11.5)	71.2 (4.9)
Okanogan 5 (O5)	60.1 (11.2)	69.4 (5.6)
Okanogan 6 (O6)	59.1 (11.2)	70.7 (6.1)
Similkameen 1 (S1)	62.8 (11.4)	69.9 (5.7)
Similkameen 2 (S2)	63.5 (13.1)	69.8 (4.9)
Total	***60.5 (11.3)***	***70.1 (5.8)***

8.6 Life History Monitoring

Life history characteristics of Okanogan/Similkameen summer Chinook were assessed by examining carcasses on spawning grounds and fish collected or examined at broodstock collection sites, and by reviewing tagging data and fisheries statistics.

Migration Timing

Migration timing for Okanogan/Similkameen summer Chinook is described in Section 7.6.

Age at Maturity

Because hatchery summer Chinook are released after one year of rearing and natural-origin summer Chinook migrate primarily as age-0 fish, total ages will differ between hatchery and natural-origin Chinook (see Hillman et al. 2011). Therefore, in this section, we evaluated age at maturity by comparing differences in salt (ocean) ages between the two groups.

Most of the wild and hatchery summer Chinook sampled during the period 1993-2011 in the Okanogan River basin were salt age-3 fish (Table 8.14; Figure 8.5). A higher percentage of salt age-4 wild Chinook returned to the basin than did salt age-4 hatchery Chinook. In contrast, a higher proportion of salt age-1, 2, and 3 hatchery fish returned than did salt age-1, 2, and 3 wild fish. Thus, a higher percentage of wild fish returned at an older age than did hatchery fish.

Table 8.14. Proportions of wild and hatchery summer Chinook of different salt (ocean) ages sampled on spawning grounds in the Okanogan River basin, 1993-2011.

Sample year	Origin	Salt age					Sample size
		1	2	3	4	5	
1993	Wild	0.00	0.21	0.70	0.10	0.00	63
	Hatchery	0.00	0.98	0.02	0.00	0.00	44
1994	Wild	0.02	0.13	0.54	0.31	0.00	134
	Hatchery	0.02	0.09	0.89	0.00	0.00	290

Sample year	Origin	Salt age					Sample size
		1	2	3	4	5	
1995	Wild	0.00	0.19	0.59	0.22	0.00	68
	Hatchery	0.01	0.15	0.36	0.49	0.00	200
1996	Wild	0.03	0.28	0.61	0.08	0.00	36
	Hatchery	0.02	0.22	0.56	0.20	0.01	174
1997	Wild	0.04	0.27	0.53	0.15	0.00	73
	Hatchery	0.00	0.02	0.87	0.11	0.00	148
1998	Wild	0.02	0.35	0.52	0.11	0.00	151
	Hatchery	0.05	0.50	0.23	0.22	0.00	185
1999	Wild	0.00	0.20	0.64	0.16	0.00	268
	Hatchery	0.00	0.12	0.85	0.02	0.00	552
2000	Wild	0.03	0.15	0.62	0.20	0.00	216
	Hatchery	0.12	0.02	0.76	0.10	0.00	545
2001	Wild	0.02	0.18	0.76	0.04	0.00	531
	Hatchery	0.05	0.88	0.02	0.05	0.00	1,005
2002	Wild	0.02	0.15	0.62	0.21	0.00	692
	Hatchery	0.01	0.19	0.80	0.01	0.00	1,681
2003	Wild	0.03	0.18	0.63	0.17	0.00	478
	Hatchery	0.03	0.06	0.79	0.12	0.00	653
2004	Wild	0.01	0.17	0.26	0.55	0.00	1,528
	Hatchery	0.01	0.32	0.45	0.23	0.00	382
2005	Wild	0.00	0.12	0.79	0.08	0.01	1,281
	Hatchery	0.02	0.06	0.77	0.15	0.00	530
2006	Wild	0.00	0.02	0.53	0.45	0.00	830
	Hatchery	0.05	0.18	0.24	0.53	0.00	139
2007	Wild	0.02	0.07	0.12	0.78	0.02	1,061
	Hatchery	0.22	0.30	0.42	0.05	0.01	559
2008	Wild	0.01	0.32	0.63	0.04	0.01	847
	Hatchery	0.02	0.60	0.36	0.02	0.00	1,108
2009	Wild	0.01	0.03	0.81	0.15	0.00	926
	Hatchery	0.05	0.05	0.86	0.03	0.00	783
2010	Wild	0.00	0.16	0.45	0.39	0.00	711
	Hatchery	0.02	0.64	0.27	0.06	0.00	622
2011	Wild	0.00	0.01	0.05	0.82	0.12	787
	Hatchery[a]	0.01	0.00	0.16	0.09	0.74	876
Average	***Wild***	***0.01***	***0.13***	***0.50***	***0.34***	***0.01***	***534***
	Hatchery	***0.04***	***0.29***	***0.53***	***0.08***	***0.06***	***524***

[a] There was one salt age-6 hatchery fish that was not included in this table.

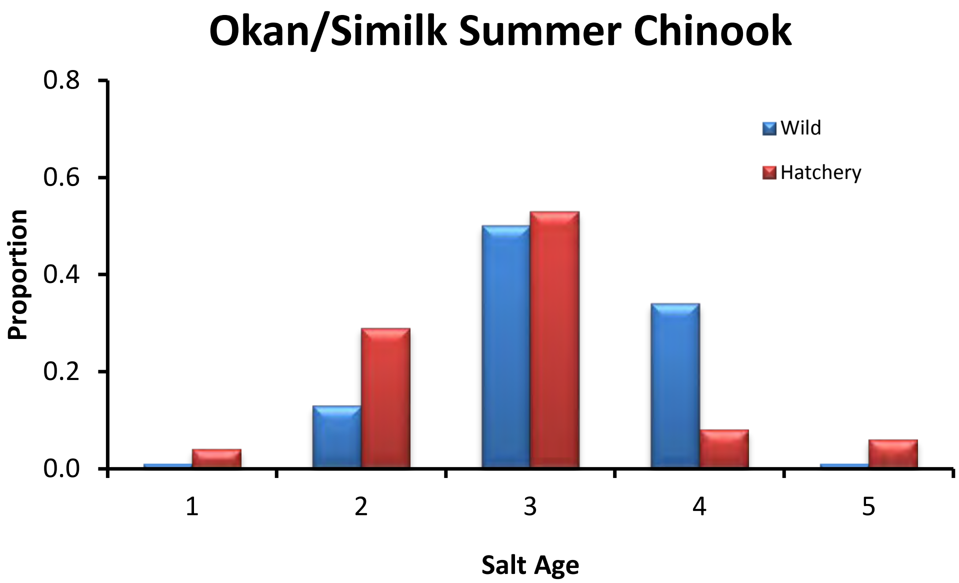


Figure 8.5. Proportions of wild and hatchery summer Chinook of different salt (ocean) ages sampled at broodstock collection sites and on spawning grounds in the Okanogan River basin for the combined years 1993-2011.

Size at Maturity

On average, hatchery summer Chinook were about 2 cm smaller than wild summer Chinook sampled in the Okanogan River basin (Table 8.15). This is likely because a higher percentage of wild fish returned as salt age-4 fish than did hatchery fish. Future analyses will compare sizes of hatchery and wild fish of the same age groups and sex.

Table 8.15. Mean lengths (POH; cm) and variability statistics for wild and hatchery summer Chinook sampled in the Okanogan River basin, 1993-2011; SD = 1 standard deviation.

Sample year	Origin	Sample size	Summer Chinook length (POH; cm)			
			Mean	SD	Minimum	Maximum
1993	Wild	69	73	7	52	90
	Hatchery	59	62	6	47	75
1994	Wild	164	71	7	40	86
	Hatchery	300	69	8	30	84
1995	Wild	81	75	6	54	87
	Hatchery	201	73	8	39	87
1996	Wild	22	68	14	22	85
	Hatchery	26	75	8	60	88
1997	Wild	87	71	7	44	85
	Hatchery	148	74	6	48	88
1998	Wild	182	70	8	45	94
	Hatchery	186	65	12	30	87
1999	Wild	340	73	7	56	91

Sample year	Origin	Sample size	Summer Chinook length (POH; cm)			
			Mean	SD	Minimum	Maximum
	Hatchery	554	71	7	23	84
2000	Wild	241	70	10	32	86
	Hatchery	624	69	12	24	92
2001	Wild	579	67	9	26	90
	Hatchery	997	61	8	32	90
2002	Wild	755	69	9	28	91
	Hatchery	1,705	70	8	33	87
2003	Wild	533	68	9	30	93
	Hatchery	732	69	10	26	90
2004	Wild	1,757	71	10	33	94
	Hatchery	416	66	9	41	92
2005	Wild	1,407	66	7	41	99
	Hatchery	542	68	8	31	85
2006	Wild	940	72	6	31	91
	Hatchery	138	70	10	33	86
2007	Wild	1,147	75	9	27	99
	Hatchery	570	63	13	30	85
2008	Wild	897	65	9	29	86
	Hatchery	1,122	65	8	32	89
2009	Wild	995	70	7	28	89
	Hatchery	777	70	9	35	86
2010	Wild	778	71	9	43	90
	Hatchery	675	64	10	22	87
2011	Wild	823	68	7	29	89
	Hatchery	953	66	11	26	86
Pooled	***Wild***	***11,797***	***70***	***8***	***22***	***99***
	Hatchery	***10,725***	***68***	***9***	***22***	***92***

Contribution to Fisheries

Most of the harvest on hatchery-origin Okanogan/Similkameen summer Chinook occurred in the Ocean (Table 8.16). Ocean harvest has made up 37-100% of all hatchery-origin Okanogan/Similkameen summer Chinook harvested. Brood years 1997, 1998, 2000, 2004, and 2006 provided the largest harvests, while brood year 1996 provided the lowest.

Table 8.16. Estimated number and percent (in parentheses) of hatchery-origin Okanogan/Similkameen summer Chinook captured in different fisheries, brood years 1989-2006.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational (sport)	
1989	2,370 (80)	553 (19)	0 (0)	42 (1)	2,965
1990	355 (89)	34 (8)	0 (0)	12 (3)	401
1991	220 (86)	37 (14)	0 (0)	0 (0)	257
1992	420 (91)	28 (6)	2 (0)	10 (2)	460
1993	24 (80)	6 (20)	0 (0)	0 (0)	30
1994	373 (92)	23 (6)	2 (0)	7 (2)	405
1995	654 (93)	9 (1)	12 (2)	25 (4)	700
1996	5 (100)	0 (0)	0 (0)	0 (0)	5
1997	6,526 (92)	136 (2)	36 (1)	416 (6)	7,114
1998	4,353 (89)	251 (5)	45 (1)	219 (4)	4,868
1999	1,353 (68)	224 (11)	31 (2)	383 (19)	1,991
2000	3,136 (69)	533 (12)	222 (5)	664 (15)	4,555
2001	183 (57)	81 (25)	31 (10)	24 (8)	319
2002	702 (56)	200 (16)	90 (7)	258 (21)	1,250
2003	696 (37)	568 (31)	130 (7)	466 (25)	1,860
2004	3,095 (38)	2,161 (27)	694 (9)	2,166 (27)	8,116
2005	467 (46)	306 (30)	79 (8)	167 (16)	1,019
2006	3,144 (38)	3,330 (40)	469 (6)	1,373 (17)	8,316

Straying

Stray rates were determined by examining CWTs recovered on spawning grounds within and outside the Okanogan River basin. Targets for strays based on return year (recovery year) and brood year should be less than 5%.

Few hatchery-origin Okanogan summer Chinook have strayed into basins outside the Okanogan (Table 8.17). Although hatchery-origin Okanogan summer Chinook have strayed into other spawning areas, they usually made up less than 5% of the spawning escapement within those areas. The Chelan tailrace has received the largest number of Okanogan strays.

Table 8.17. Number and percent of spawning escapements within other non-target basins that consisted of hatchery-origin Okanogan summer Chinook, return years 1994-2009. For example, for return year 2002, 1% of the summer Chinook spawning escapement in the Entiat Basin consisted of hatchery-origin Okanogan summer Chinook. Percent strays should be less than 5%.

Return year	Wenatchee		Methow		Chelan		Entiat		Hanford Reach	
	Number	%	Number	%	Number	%	Number	%	Number	%
1994	0	0.0	0	0.0	-	-	-	-	-	-
1995	0	0.0	0	0.0	-	-	-	-	-	-
1996	0	0.0	0	0.0	-	-	-	-	-	-

Return year	Wenatchee		Methow		Chelan		Entiat		Hanford Reach	
	Number	%	Number	%	Number	%	Number	%	Number	%
1997	0	0.0	0	0.0	-	-	-	-	-	-
1998	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1999	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2000	0	0.0	6	0.5	30	4.5	0	0.0	3	0.0
2001	12	0.1	0	0.0	10	1.0	0	0.0	0	0.0
2002	0	0.0	3	0.1	4	0.7	5	1.0	0	0.0
2003	0	0.0	8	0.2	22	5.3	14	2.0	0	0.0
2004	0	0.0	0	0.0	5	1.2	0	0.0	0	0.0
2005	5	0.1	27	1.1	36	8.1	7	1.9	8	0.0
2006	0	0.0	5	0.2	4	1.0	2	0.3	0	0.0
2007	0	0.0	3	0.2	4	2.1	0	0.0	0	0.0
2008	0	0.0	9	0.5	46	9.3	4	1.3	0	0.0
2009	15	0.2	3	0.2	11	1.8	18	7.2	0	0.0
Total	***32***	***0.0***	***64***	***0.2***	***172***	***3.1***	***50***	***1.2***	***11***	***0.0***

On average, about 1% of the returns have strayed into non-target spawning areas, falling below the target of 5% (Table 8.18). Depending on brood year, percent strays into non-target spawning areas have ranged from 0-4.2%. Few (<1% on average) have strayed into non-target hatchery programs.

Table 8.18. Number and percent of hatchery-origin Okanogan summer Chinook that homed to target spawning areas and the target hatchery, and number and percent that strayed to non-target spawning areas and non-target hatchery programs, by brood years 1989-2006. Percent stays should be less than 5%.

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1989	3,132	69.7	1,328	29.6	2	0.0	31	0.7
1990	729	71.4	291	28.5	0	0.0	1	0.1
1991	1,125	71.3	453	28.7	0	0.0	0	0.0
1992	1,264	68.5	572	31.0	8	0.4	1	0.1
1993	54	62.1	32	36.8	0	0.0	1	1.1
1994	924	80.8	203	17.7	16	1.4	1	0.1
1995	1,883	85.4	271	12.3	50	2.3	0	0.0
1996	27	100.0	0	0.0	0	0.0	0	0.0
1997	11,659	97.1	309	2.6	35	0.3	2	0.0
1998	2,784	95.4	102	3.5	31	1.1	2	0.1
1999	828	96.7	18	2.1	10	1.2	0	0.0
2000	2,091	93.8	29	1.3	94	4.2	15	0.7

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
2001	105	98.1	2	1.9	0	0.0	0	0.0
2002	702	96.2	17	2.3	11	1.5	0	0.0
2003	1,580	96.2	47	2.9	16	1.0	0	0.0
2004	4,947	94.4	206	3.9	85	1.6	2	0.0
2005	606	93.2	22	3.4	22	3.4	0	0.0
2006	5,090	97.6	59	1.1	68	1.3	0	0.0
Total	***39,530***	***89.9***	***3,961***	***9.0***	***448***	***1.0***	***56***	***0.1***

Genetics

Genetic studies were conducted to investigate relationships among temporally replicated collections of summer Chinook from the Wenatchee River, Methow River, and Okanogan River in the upper Columbia River basin (Kassler et al. 2100; the entire report is appended as Appendix K). Samples from the Eastbank Hatchery – Wenatchee stock, Eastbank Hatchery – Methow/Okanogan (MEOK) stock, and Wells Hatchery were also included in the analysis. Samples of natural and hatchery-origin summer Chinook were analyzed and compared to determine if the supplementation program has affected the genetic structure of these populations. The study also calculated the effective number of breeders for collection locations of natural and hatchery-origin summer Chinook from 1993 and 2008.

In general, population differentiation was not observed among the temporally replicated collection locations. A single collection from the Okanogan River (1993) was the only collection showing statistically significant differences. The effective number of breeders was not statistically different from the early collection in 1993 in comparison to the late collection in 2008. Overall, these analyses revealed a lack of differentiation among the temporal replicates from the same locations and among the collection from different locations, suggesting the populations have been homogenized or that there has been substantial gene flow among populations. Additional comparisons among summer-run and fall-run Chinook populations in the upper Columbia River were conducted to determine if there was any differentiation between Chinook with different run timing. These analyses revealed pairwise F_{ST} values that were less than 0.01 for the collections of summer Chinook to collections of fall Chinook from Hanford Reach, lower Yakima River, Priest Rapids, and Umatilla. Collections of fall Chinook from Crab Creek, Lyons Ferry Hatchery, Marion Drain, and Snake River had pairwise F_{ST} values that were higher in comparison to the collections of summer Chinook. The consensus clustering analysis did not provide good statistical support to the groupings, but did show relationships among collections based on geographic proximity. Overall the summer and fall run Chinook that have historically been spawned together were not differentiated while fall Chinook from greater geographic distances were differentiated.

Proportion of Natural Influence

Another method for assessing the genetic risk of a supplementation program is to determine the influence of the hatchery and natural environments on the adaptation of the composite population. This is estimated by the proportion of natural-origin fish in the hatchery broodstock (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The ratio pNOB/(pHOS+pNOB) is the Proportion of Natural Influence (PNI). The larger the ratio (PNI), the greater the strength of selection in the natural environment relative to that of the hatchery environment. In order for the natural environment to dominate selection, PNI should be greater than 0.67 (HSRG/WDFW/NWIFC 2004).

For brood years 1993-2003, the PNI was less than 0.67, indicating that the hatchery environment had a greater influence on adaptation of Okanogan summer Chinook than did the natural environment (Table 8.19). However, since brood year 2003, the PNI has generally been greater than 0.67, indicating that the natural environment has a greater influence on adaptation of Okanogan summer Chinook than does the hatchery environment.

Table 8.19. Proportionate natural influence (PNI) of the Okanogan/Similkameen summer Chinook supplementation program for brood years 1989-2011. PNI was calculated as the proportion of naturally produced Chinook in the hatchery broodstock (pNOB) divided by the proportion of hatchery Chinook on the spawning grounds (pHOS) plus pNOB. NOS = number of natural-origin Chinook on the spawning grounds; HOS = number of hatchery-origin Chinook on the spawning grounds; NOB = number of natural-origin Chinook collected for broodstock; and HOB = number of hatchery-origin Chinook included in hatchery broodstock.

Brood year	Spawners			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
1989	1,719	0	0.00	1,297	312	0.81	1.00
1990	837	0	0.00	828	206	0.80	1.00
1991	574	0	0.00	924	314	0.75	1.00
1992	473	0	0.00	297	406	0.42	1.00
1993	915	570	0.38	681	388	0.64	0.63
1994	1,322	2,709	0.67	341	244	0.58	0.46
1995	979	2,023	0.67	173	240	0.42	0.39
1996	568	1,251	0.69	287	155	0.65	0.49
1997	862	1,327	0.61	197	265	0.43	0.41
1998	600	492	0.45	153	211	0.42	0.48
1999	1,274	2,343	0.65	224	289	0.44	0.40
2000	1,174	2,527	0.68	164	337	0.33	0.33
2001	4,306	6,551	0.60	12	345	0.03	0.05
2002	4,346	9,511	0.69	247	241	0.51	0.43
2003	1,933	1,487	0.43	381	101	0.79	0.65
2004	5,309	1,412	0.21	506	16	0.97	0.82
2005	6,441	2,448	0.28	391	9	0.98	0.78
2006	5,507	3,094	0.36	500	10	0.98	0.73
2007	2,983	1,434	0.32	456	17	0.96	0.75

Brood year	Spawners			Broodstock			PNI
	NOS	HOS	pHOS	NOB	HOB	pNOB	
2008	2,998	3,977	0.57	359	86	0.81	0.59
2009	4,204	3,340	0.44	503	4	0.99	0.69
2010	3,189	2,763	0.46	484	8	0.98	0.68
2011	4,642	5,039	0.52	467	26	0.95	0.65
Average	***2,485***	***2,361***	***0.42***	***429***	***184***	***0.68***	***0.63***

Natural and Hatchery Replacement Rates

Natural replacement rates (NRR) were calculated as the ratio of natural-origin recruits (NOR) to the parent spawning population (spawning escapement). For brood years 1989-2005, NRR for summer Chinook in the Okanogan averaged 1.12 (range, 0.16-3.77) if harvested fish were not include in the estimate and 2.34 (range, 0.35-10.09) if harvested fish were included in the estimate (Table 8.20). NRRs for more recent brood years will be calculated as soon as all tag recoveries and sampling rates have been loaded into the database.

Hatchery replacement rates (HRR) are the hatchery adult-to-adult returns and were calculated as the ratio of hatchery-origin recruits (HOR) to the parent broodstock collected. These rates should be greater than the NRRs and greater than or equal to 5.30 (the calculated target value in Murdoch and Peven 2005). HRRs exceeded NRRs in 14 of the 17 years of data, regardless if harvest was or was not included in the estimate (Table 8.20). Hatchery replacement rates for Okanogan summer Chinook have exceeded the estimated target value of 5.30 in seven or ten of the 17 years of data depending on if harvest was or was not included in the estimate.

Table 8.20. Broodstock collected, spawning escapements, natural and hatchery-origin recruits (NOR and HOR), and natural and hatchery replacement rates (NRR and HRR; with and without harvest) for wild summer Chinook in the Okanogan River basin, brood years 1989-2005.

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
1989	304	1,719	4,493	2,139	14.78	1.24	7,458	3,565	24.53	2.07
1990	288	837	1,021	1,477	3.55	1.76	1,422	2,063	4.94	2.46
1991	364	574	1,578	884	4.34	1.54	1,835	1,023	5.04	1.78
1992	304	473	1,845	1,068	6.07	2.26	2,305	1,338	7.58	2.83
1993	328	1,485	87	474	0.27	0.32	117	637	0.36	0.43
1994	302	4,033	1,144	1,397	3.79	0.35	1,549	1,896	5.13	0.47
1995	385	3,002	2,204	1,354	5.72	0.45	2,904	1,789	7.54	0.60
1996	330	1,819	27	717	0.08	0.39	32	855	0.10	0.47
1997	313	2,189	12,005	4,370	38.35	2.00	19,119	6,970	61.08	3.18
1998	352	1,092	2,919	4,121	8.29	3.77	7,787	11,019	22.12	10.09
1999	333	3,617	856	6,673	2.57	1.84	2,847	22,318	8.55	6.17
2000	334	3,701	2,229	1,729	6.67	0.47	6,784	5,271	20.31	1.42
2001	335	10,857	107	8,993	0.32	0.83	426	35,972	1.27	3.31

Brood year	Broodstock Collected	Spawning Escapement	Harvest not included				Harvest included			
			HOR	NOR	HRR	NRR	HOR	NOR	HRR	NRR
2002	333	13,857	730	6,043	2.19	0.44	1,980	16,421	5.95	1.19
2003	337	3,420	1,643	553	4.88	0.16	3,503	1,182	10.39	0.35
2004	335	6,721	5,240	3,105	15.64	0.46	13,356	7,941	39.87	1.18
2005	338	8,889	650	6,167	1.92	0.69	1,669	15,894	4.94	1.79
Average	***330***	***4,017***	***2,281***	***3,016***	***7.03***	***1.12***	***4,417***	***8,009***	***13.51***	***2.34***

Smolt-to-Adult Survivals

Smolt-to-adult survival ratios (SARs) were calculated as the number of hatchery adult recaptures divided by the number of tagged hatchery smolts released. SARs were based on CWT returns. For the available brood years, SARs have ranged from 0.00006 to 0.03249 for hatchery summer Chinook in the Okanogan River basin (Table 8.21).

Table 8.21. Smolt-to-adult ratios (SARs) for Okanogan/Similkameen summer Chinook, brood years 1989-2006.

Brood year	Number of tagged smolts released[a]	Estimated adult captures[b]	SAR
1989	202,125	4,292	0.02123
1990	367,207	972	0.00265
1991	360,380	975	0.00271
1992	537,190	2,280	0.00424
1993	379,139	117	0.00031
1994	217,818	1,527	0.00701
1995	574,197	2,853	0.00497
1996	487,776	31	0.00006
1997	572,531	18,603	0.03249
1998	287,948	7,676	0.02666
1999	610,868	2,776	0.00454
2000	528,639	6,757	0.01278
2001	26,315	424	0.01611
2002	245,997	1,975	0.00803
2003	574,908	3,488	0.00607
2004	676,222	12,898	0.01907
2005	273,512	1,659	0.00607
2006	597,276	13,415	0.02246
Average	***417,780***	***4,595***	***0.01097***

[a] Includes all tag codes and CWT released fish (CWT + Ad Clip fish and CWT-only fish).

[b] Includes estimated recoveries (spawning ground, hatcheries, harvest, etc.) and observed recoveries if estimated recoveries were unavailable.

8.7 ESA/HCP Compliance

Broodstock Collection

Because summer Chinook adults collected at Wells Dam are used for both the Methow and Okanogan supplementation programs, please refer to Section 7.7 for information on ESA compliance during broodstock collection.

Hatchery Rearing and Release

The 2010 brood Okanogan/Similkameen summer Chinook reared throughout their juvenile life-stages at Eastbank Fish Hatchery and Similkameen pond. Elevated mortality associated with bacterial cold water disease and external fungus (see Section 8.3) at Similkameen pond occurred in November and was controlled using formalin and Chloramine T treatments. The 2010 brood smolt release from the Similkameen pond totaled 617,950 summer Chinook, representing 107% of the production objective for the Okanogan/Similkameen program and was incompliance with the 10% overage in production allowable in ESA Section 10 Permit 1347.

Hatchery Effluent Monitoring

Per ESA Permits 1196, 1347, and 1395, permit holders shall monitor and report hatchery effluents in compliance with applicable National Pollution Discharge Elimination Systems (NPDES) (EPA 1999) permit limitations. There was one NPDES violation reported at the Chelan PUD Hatchery facilities during the period 1 January 2010 through 31 December 2012. NPDES monitoring and reporting for Chelan PUD Hatchery Programs during 2012 are provided in Appendix F.

Spawning Surveys

Summer Chinook spawning ground surveys conducted in the Okanogan River basin during 2012 were consistent with ESA Section 10 Permit No. 1347. Because of the difficulty of quantifying the level of take associated with spawning ground surveys, the Permit does not specify a take level associated with these activities, even though it does authorize implementation of spawning ground surveys. Therefore, no take levels are reported. However, to minimize potential effects to established redds, wading was restricted to the extent practical, and extreme caution was used to avoid established redds when wading was required.

SECTION 9: CHELAN FALLS SUMMER CHINOOK

9.1 Broodstock Sampling

Broodstock for the Chelan Falls program (formerly the Turtle Rock program) are collected as part of the Wells summer Chinook volunteer program. Refer to Snow et al. (2007) for information related to adults collected for these programs.

9.2 Hatchery Rearing

Rearing History

Number of eggs taken

Broodstock for the Chelan Falls summer Chinook program are collected at Wells Dam and consist of volunteers to the hatchery. In recent years some naturally produced fish have been incorporated into the brood. Eyed eggs are transferred from Wells FH to Eastbank FH for rearing. As such, the number of green (unfertilized) eggs collected for this program is reported as egg inventory and distribution reports provided by Wells FH personnel.

Disease

No significant health concerns were encountered during rearing and no treatments were recommended for Chelan Falls summer Chinook in 2012. External fungus was diagnosed after transfer from Eastbank FH to the Chelan Falls acclimation facility in December. External fungus developed again in March. No additional disease-related problems were noted before the fish were released.

Number of acclimation days

Rearing of the 2010-brood Chelan Falls summer Chinook was similar to previous years with fish being held on well water. However, this was the first year that the whole program was transferred to the Chelan Falls acclimation ponds for final overwinter acclimation. Transfer occurred on 7-9 November 2011. Fish were force released on 18 April after 163 days of acclimation on Chelan River water.

Release Information

Numbers released

The subyearling Turtle Rock summer Chinook program was discontinued in 2010; however, releases of subyearling Chinook in past years are shown in Tables 9.1 and 9.2. Production from the subyearling programs was converted to the yearling program.

The 2010 yearling summer Chinook program achieved 94% of the 600,000 target goal with about 563,824 fish being released from the Chelan River Acclimation Ponds (Table 9.3). Releases of 2011 yearling Chinook will be reported in the 2013 report.

Table 9.1. Numbers of Turtle Rock summer Chinook subyearlings released from the hatchery, brood years 1995-2009. The release target for Turtle Rock summer Chinook subyearlings was 810,000 fish.

Brood year	Release year	CWT mark rate	Number of subyearlings released
1995	1996	0.1873	1,074,600
1996	1997	0.9653	385,215
1997	1998	0.9780	508,060
1998	1999	0.6453	301,777
1999	2000	0.9748	369,026
2000	2001	0.3678	604,892
2001	2002	0.9871	214,059
2002	2003	0.3070	656,399
2003	2004	0.4138	491,480
2004	2005	0.4591	411,707
2005	2006	0.4337	490,074
2006	2007	0.3388	538,392
2007	2008	0.4385	439,806
2008	2009	0.6355	309,003
2009	2010	NA	713,130
Average		***0.6111***	***500,508***

Table 9.2. Numbers of Turtle Rock summer Chinook accelerated subyearlings released from the hatchery, brood years 1995-2008. The release target for Turtle Rock summer Chinook accelerated subyearlings was 810,000 fish.

Brood year	Release year	CWT mark rate	Number of subyearlings released
1995	1996	0.9834	169,000
1996	1997	0.4163	477,300
1997	1998	0.3767	521,480
1998	1999	0.6033	307,571
1999	2000	0.9556	347,946
2000	2001	0.4331	449,329
2001	2002	0.4086	480,584
2002	2003	0.5492	364,461
2003	2004	0.6414	289,696
2004	2005	0.5471	364,453
2005	2006	0.9783	457,340
2006	2007	0.5510	342,273
2007	2008	0.4745	392,024
2008	2009	0.5295	372,320
Average		***0.6034***	***381,127***

Table 9.3. Numbers of Turtle Rock summer Chinook yearling smolts released from the hatchery, brood years 1995-2010. The release target for Turtle Rock summer Chinook was 200,000 smolts for the period before brood year 2010. The current release target is 600,000 smolts.

Brood year	Release year	Acclimation facility	CWT mark rate	Number of smolts released
1995	1997	Turtle Rock	0.9688	150,000
1996	1998	Turtle Rock	0.9582	202,727
1997	1999	Turtle Rock	0.9800	202,989
1998	2000	Turtle Rock	0.9337	217,797
1999	2001	Turtle Rock	0.9824	285,707
2000	2002	Turtle Rock	0.9948	165,935
2001	2003	Turtle Rock	0.9824	203,279
2002	2004	Turtle Rock	0.9799	195,851
2003	2005	Turtle Rock	0.9258	215,366
2004	2006	Turtle Rock	0.9578	206,734
2005	2007	Turtle Rock	0.9810	204,644
2006	2008	Chelan	0.9752	99,271
		Turtle Rock	0.9752	43,943
2007	2009	Chelan	0.9426	112,604
		Turtle Rock	0.9426	61,003
2008	2010	Chelan	0.9818	200,999
		Turtle Rock	0.9818	252,762
2009	2011	Chelan[a]	-	190,449
		Turtle Rock	0.9721	250,667
2010	2012	Chelan	0.9702	563,824
Average		***Chelan***	***0.9678***	***190,627***
		Turtle Rock	***0.9745***	***233,429***

[a] No CWT mark rate was provided because of the early release of this group.

Numbers tagged

The 2010 yearling Chinook were 95.0% CWT and adipose fin-clipped.

In 2012, a total of 4,200 summer Chinook from the 2010 brood were PIT tagged at the Chelan River Hatchery during 21-23 and 27 March. Fish were tagged in four groups of 1,050 per group. Fish were not fed during tagging or for 1-2 days before and after tagging. Chinook averaged 143 mm in length and 34.0 g at time of tagging. At the time of release, ten fish had died. No fish shed their tags.

Table 9.4 summarizes the number of yearling summer Chinook that have been PIT-tagged and released from the Turtle Rock Program.

Table 9.4. Summary of PIT-tagging activities for Turtle Rock yearling summer Chinook, brood years 2007-2010.

Brood year	Release year	Raceway/Program	Number of fish tagged	Number of tagged fish that died	Number of tags shed	Number of tagged fish released
2007	2009	Circular Reuse	10,104	128	1	9,975
		Standard	10,102	162	3	9,937
2008	2010	Circular Reuse	11,102	15	0	11,087
		Standard	11,100	18	2	11,080
2009	2011	Turtle Rock	5,051	106	0	4,945
		Chelan Net Pens	5,050	2	0	5,048
2010	2012	Turtle Rock	0	0	0	0
		Chelan Net Pens	4,200	10	0	4,190

Fish size and condition at release

Although the subyearling summer Chinook program was discontinued, sizes of subyearlings released from Turtle Rock Hatchery before 2010 are shown in Tables 9.5 and 9.6.

Table 9.5. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of Turtle Rock summer Chinook subyearlings released from the hatchery, brood years 1995-2009. Size targets are provided in the last row of the table.

Brood year	Release year	Fork length (mm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
1995	1996	102	6.3	12.6	36
1996	1997	87	8.0	7.4	62
1997	1998	98	6.2	10.2	45
1998	1999	96	6.3	10.7	43
1999	2000	90	9.0	9.8	46
2000	2001	100	7.1	11.3	40
2001	2002	104	7.2	13.4	34
2002	2003	97	7.3	11.8	39
2003	2004	101	8.0	12.0	43
2004	2005	100	7.8	11.4	40
2005	2006	100	6.5	12.5	36
2006	2007	95	7.2	9.5	48
2007	2008	79	7.4	5.6	81
2008	2009	86	7.9	7.9	57
2009[a]	2010	89	7.1	7.0	65
Targets		***112***	***9.0***	***11.4***	***40***

[a] Pre-release growth sample was conducted using pond mortalities.

Table 9.6. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of Turtle Rock summer Chinook accelerated subyearlings released from the hatchery, brood years 1995-2008. Size targets are provided in the last row of the table.

Brood year	Release year	Fork length (mm)		Mean weight	
		Mean	CV	Grams (g)	Fish/pound
1995	1996	129	7.1	27.3	17
1996	1997	107	6.5	15.6	29
1997	1998	117	6.0	18.9	24
1998	1999	119	8.0	18.9	24
1999	2000	114	6.7	19.0	24
2000	2001	111	7.0	16.8	27
2001	2002	117	8.4	19.5	23
2002	2003	116	11.3	21.2	21
2003	2004	113	14.9	17.0	30
2004	2005	117	11.3	20.1	23
2005	2006	119	9.1	22.2	21
2006	2007	118	8.3	19.1	24
2007	2008	95	7.7	10.0	45
2008[a]	2009	97	8.6	10.6	43
Targets		***112***	***9.0***	***11.4***	***40***

[a] The 2008 brood year was the last year of the accelerated subyearling program.

Size at release of the 2010 yearling summer Chinook was 75% and 73.1% of the target fork length and weight, respectively, for the Chelan Falls group. This group also exceeded the target CV for length. (Table 9.7).

Table 9.7. Mean lengths (FL, mm), weight (g and fish/pound), and coefficient of variation (CV) of Turtle Rock summer Chinook yearlings released from the hatchery, brood years 1995-2010. Size targets are provided in the last row of the table.

Brood year	Release year	Acclimation facility	Fork length (mm)		Mean weight	
			Mean	CV	Grams (g)	Fish/pound
1995	1997	Turtle Rock	-	-	-	-
1996	1998	Turtle Rock	166	14.2	60.9	7
1997	1999	Turtle Rock	198	4.6	91.3	5
1998	2000	Turtle Rock	161	11.9	53.9	8
1999	2001	Turtle Rock	164	18.6	59.0	8
2000	2002	Turtle Rock	170	15.3	59.0	8
2001	2003	Turtle Rock	154	22.3	48.6	9
2002	2004	Turtle Rock	157	16.7	44.0	12
2003	2005	Turtle Rock	173	13.8	54.7	8
2004	2006	Turtle Rock	176	20.6	45.3	7
2005	2007	Turtle Rock	158	11.0	43.5	10

Brood year	Release year	Acclimation facility	Fork length (mm)		Mean weight	
			Mean	CV	Grams (g)	Fish/pound
2006	2008	Chelan	172	14.5	58.4	8
		Turtle Rock	157	25.8	54.1	8
2007	2009	Chelan	153	18.8	45.7	10
		Turtle Rock	167	14.6	49.3	9
2008	2010	Chelan	146	22.9	40.6	11
		Turtle Rock	172	15.9	58.5	8
2009	2011	Chelan	158	15.1	46.6	10
		Turtle Rock	174	17.5	59.3	8
2010	2012	Chelan	132	27.4	33.2	14
Targets			***176***	***9.0***	***45.4***	***10***

Survival Estimates

Normal subyearling releases

Overall survival of the normal subyearling Turtle Rock summer Chinook program from green egg to release was below the standard set for the program (Table 9.8). Lower than expected survival at ponding and post-ponding reduced the overall program performance. This program was discontinued in 2010.

Table 9.8. Hatchery life-stage survival rates (%) for Turtle Rock subyearling (zero program) summer Chinook, brood years 2004-2009. Survival standards or targets are provided in the last row of the table.

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
2004	NA	NA	93.5	74.4	93.9	91.4	90.8	99.7	63.1
2005	NA	NA	94.4	87.9	85	84.8	84.2	99.4	69.8
2006	NA	NA	97.8	87.9	85.0	84.8	84.2	99.4	72.4
2007	NA	NA	92.7	84.9	88.5	86.7	84.8	99.6	66.7
2008	NA	NA	78.8	95.0	80.7	79.3	79.9	99.8	59.8
2009	NA	NA	95.0	89.4	89.5	89.2	79.7	89.5	67.7
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

Accelerated subyearling releases

Overall survival of the accelerated subyearling Turtle Rock summer Chinook program from green egg to release was below the standard set for the program (Table 9.9). Lower than expected survival in post-ponding reduced the overall program performance. This program was discontinued in 2010.

Table 9.9. Hatchery life-stage survival rates (%) for Turtle Rock subyearling (accelerated program) summer Chinook, brood years 2004-2009. Survival standards or targets are provided in the last row of the table.

Brood year	Collection to spawning		Unfertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Unfertilized egg-release
	Female	Male							
2004	NA	NA	92.5	98.3	93.4	92.4	90.0	97.8	81.8
2005	NA	NA	93.8	94.6	83.7	83.4	81.7	98.8	72.5
2006	NA	NA	86.1	94.6	83.7	83.4	81.7	98.8	66.5
2007	NA	NA	93.4	95.4	78.4	77.5	76.3	98.9	67.9
2008[a]	NA	NA	93.4	95.0	79.8	78.8	78.2	99.3	67.1
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

[a] The 2008 brood year was the last year of the accelerated subyearling program.

Yearling releases

Overall survival of the yearling Chelan Falls summer Chinook program from green egg to release was above the standard set for the program (Table 9.10). Higher than expected survivals in all life stages contributed to the increased program performance.

Table 9.10. Hatchery life-stage survival rates (%) for Turtle Rock yearling summer Chinook, brood years 2004-2010. Survival standards or targets are provided in the last row of the table.

Brood year	Collection to spawning		Un-fertilized egg-eyed	Eyed egg-ponding	30 d after ponding	100 d after ponding	Ponding to release	Transport to release	Un-fertilized egg-release
	Female	Male							
2004	NA	NA	92.9	97.7	96.8	96.4	95.5	99.6	86.7
2005	NA	NA	89.1	97.5	98.1	97.8	96.6	99.1	83.9
2006	NA	NA	86.2	78.8	97.6	97.1	95.2	98.7	64.8
2007 (Turtle Rock)	NA	NA	80.3	97.6	98.8	98.2	95.4	99.1	74.8
2007 (Chelan Falls)	NA	NA	80.3	97.6	98.8	98.2	94.9	97.1	74.4
2008 (Turtle Rock)	NA	NA	93.5	98.0	99.4	97.2	95.9	98.8	87.8
2008 (Chelan Falls)	NA	NA	93.5	98.0	97.6	98.7	96.4	99.3	88.2
2009 (Turtle Rock)	NA	NA	90.8	96.8	99.7	99.0	97.2	98.1	85.5
2009 (Chelan Falls)	NA	NA	90.9	96.9	99.8	99.0	96.7	97.7	85.2
2010 (Chelan Falls)	NA	NA	94.8	97.7	99.4	95.2	92.4	97.6	85.5
Standard	***90.0***	***85.0***	***92.0***	***98.0***	***97.0***	***93.0***	***90.0***	***95.0***	***81.0***

9.3 Life History Monitoring

Life history characteristics of Chelan Falls and Turtle Rock summer Chinook were assessed by examining carcasses on spawning grounds and by reviewing tagging data and fisheries statistics.

Contribution to Fisheries

Normal subyearling releases

Most of the harvest on Turtle Rock summer Chinook (normal subyearling releases) occurred in the Ocean (10-100% of the fish harvested; Table 9.11). Brood year 1995, 1999, 2001, 2005, and 2006 provided the largest total harvests, while brood year 1997 and 1998 provided the lowest. This program was discontinued in 2010.

Table 9.11. Estimated number and percent (in parentheses) of Turtle Rock summer Chinook (normal subyearling releases) captured in different fisheries, brood years 1995-2006.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational (sport)	
1995	682 (84)	106 (13)	11 (1)	16 (2)	815
1996	72 (80)	0 (0)	5 (6)	13 (14)	90
1997	10 (100)	0 (0)	0 (0)	0 (0)	10
1998	21 (100)	0 (0)	0 (0)	0 (0)	21
1999	182 (63)	26 (9)	4 (1)	75 (26)	287
2000	36 (55)	8 (12)	8 (12)	14 (21)	66
2001	164 (64)	30 (12)	20 (8)	44 (17)	258
2002	23 (20)	33 (29)	3 (3)	56 (49)	115
2003	9 (10)	55 (61)	2 (2)	24 (27)	90
2004	42 (37)	29 (25)	2 (2)	42 (37)	115
2005	100 (38)	95 (36)	24 (9)	44 (17)	263
2006	296 (40)	288 (39)	53 (7)	104 (14)	741

Accelerated subyearling releases

Most of the harvest on Turtle Rock summer Chinook (accelerated subyearling releases) occurred in ocean fisheries (Table 9.12). Ocean harvest has made up 27% to 100% of all Turtle Rock summer Chinook harvested (no fish from the 2003 brood year were harvested). Brood year 1999 provided the largest total harvest, while brood years 1995, 1997, 2002, and 2003 provided the lowest. This program was discontinued in 2010.

Table 9.12. Estimated number and percent (in parentheses) of Turtle Rock summer Chinook (accelerated subyearling releases) captured in different fisheries, brood years 1995-2006.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational (sport)	
1995	3 (100)	0 (0)	0 (0)	0 (0)	3
1996	77 (89)	5 (6)	5 (6)	0 (0)	87
1997	3 (100)	0 (0)	0 (0)	0 (0)	3
1998	97 (95)	2 (2)	3 (3)	0 (0)	102
1999	1,015 (75)	142 (11)	12 (1)	178 (13)	1,347
2000	117 (100)	0 (0)	0 (0)	0 (0)	117

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational (sport)	
2001	205 (59)	49 (14)	13 (4)	80 (23)	347
2002	9 (100)	0 (0)	0 (0)	0 (0)	9
2003	0 (0)	0 (0)	0 (0)	0 (0)	0
2004	45 (27)	79 (48)	6 (4)	34 (21)	164
2005	62 (58)	12 (11)	26 (24)	7 (7)	107
2006	130 (43)	113 (37)	16 (5)	43 (14)	302

Yearling releases

Most of the harvest on Turtle Rock summer Chinook (yearling releases) occurred in ocean fisheries (Table 9.13). Ocean harvest has made up 39% to 95% of all Turtle Rock summer Chinook harvested. Brood year 1998 provided the largest harvest, while brood year 1995 provided the lowest.

Table 9.13. Estimated number and percent (in parentheses) of Turtle Rock summer Chinook (yearling releases) captured in different fisheries, brood years 1995-2006.

Brood year	Ocean fisheries	Columbia River Fisheries			Total
		Tribal	Commercial (Zones 1-5)	Recreational (sport)	
1995	452 (75)	51 (8)	32 (5)	70 (12)	605
1996	757 (95)	14 (2)	2 (0)	21 (3)	794
1997	2,789 (91)	61 (2)	27 (1)	176 (6)	3,053
1998	4,251 (90)	224 (5)	16 (0)	230 (5)	4,721
1999	1,646 (73)	233 (10)	7 (0)	382 (17)	2,268
2000	1,122 (73)	129 (8)	48 (3)	244 (16)	1,543
2001	1,902 (58)	453 (14)	178 (5)	728 (22)	3,261
2002	1,000 (49)	384 (19)	102 (5)	537 (27)	2,023
2003	746 (45)	449 (27)	70 (4)	378 (23)	1,643
2004	832 (39)	560 (26)	127 (6)	605 (28)	2,124
2005	499 (44)	303 (27)	123 (11)	206 (18)	1,131
2006	1,162 (40)	880 (30)	231 (8)	668 (23)	2,941

Straying

Normal subyearling releases

Rates of Turtle Rock summer Chinook (normal subyearling releases) straying into spawning areas in the upper basin have been low. Although Turtle Rock summer Chinook have strayed into other spawning areas, they made up less than 5% of the spawning escapement within those areas (Table 9.14). The Chelan tailrace has received the largest number of Turtle Rock strays. This program was discontinued in 2010.

Table 9.14. Number (No.) and percent of spawning escapements within other non-target basins that consisted of Turtle Rock summer Chinook (normal subyearling releases), return years 1998-2009. For example, for return year 2003, 0.6% of the summer Chinook spawning escapement in the Okanogan River basin consisted of Turtle Rock summer Chinook. Percent strays should be less than 5%.

Return year	Wenatchee		Methow		Okanogan		Chelan		Entiat		Hanford Reach	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1998	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1999	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2000	8	0.1	3	0.3	13	0.4	63	9.5	0	0.0	0	0.0
2001	0	0.0	5	0.2	13	0.1	0	0.0	0	0.0	0	0.0
2002	0	0.0	0	0.0	13	0.1	0	0.0	0	0.0	0	0.0
2003	7	0.1	7	0.2	19	0.6	6	1.4	0	0.0	0	0.0
2004	5	0.0	4	0.2	13	0.2	6	1.4	0	0.0	0	0.0
2005	5	0.1	0	0.0	5	0.1	0	0.0	2	0.5	0	0.0
2006	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2007	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2008	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2009	0	0.0	16	0.9	0	0.0	2	0.3	9	3.6	0	0.0
Total	***25***	***0.02***	***35***	***0.13***	***76***	***0.10***	***77***	***1.41***	***11***	***0.27***	***0***	***0.00***

On average, about 28% of the brood year returns have strayed into spawning areas in the upper basin (Table 9.15). Depending on brood year, percent strays into spawning areas have ranged from 0-100%. Few (0.9% on average) have strayed into non-target hatchery programs.

Table 9.15. Number and percent of Turtle Rock summer Chinook (normal subyearling releases) that homed to the target hatchery and strayed to non-target spawning areas and non-target hatchery programs, by brood years 1995-2006.

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1995	-	-	197	74.1	64	24.1	5	1.9
1996	-	-	54	54.5	44	44.4	1	1.0
1997	-	-	2	28.6	5	71.4	0	0.0
1998	-	-	0	0.0	24	100.0	0	0.0
1999	-	-	40	43.5	52	56.5	0	0.0
2000	-	-	5	50.0	5	50.0	0	0.0
2001	-	-	56	77.8	16	22.2	0	0.0
2002	-	-	10	100.0	0	0.0	0	0.0
2003	-	-	27	100.0	0	0.0	0	0.0
2004	-	-	71	97.3	2	2.7	0	0.0
2005	-	-	80	92.0	7	8.0	0	0.0

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
2006	-	-	194	72.1	72	26.8	3	1.1
Total	***-***	***-***	***736***	***71.0***	***291***	***28.1***	***9***	***0.9***

Accelerated subyearling releases

Rates of Turtle Rock summer Chinook (accelerated subyearling releases) straying into spawning areas in the upper basin have been low. Although Turtle Rock summer Chinook have strayed into other spawning areas, they made up less than 5% of the spawning escapement within those areas (Table 9.16). The Chelan tailrace, Entiat Basin, and Methow River basin have received the largest number of Turtle Rock strays. This program was discontinued in 2010.

Table 9.16. Number (No.) and percent of spawning escapements within other non-target basins that consisted of Turtle Rock summer Chinook (accelerated subyearling releases), return years 1998-2009. For example, for return year 2001, 0.2% of the summer Chinook spawning escapement in the Methow River basin consisted of Turtle Rock summer Chinook. Percent strays should be less than 5%.

Return year	Wenatchee		Methow		Okanogan		Chelan		Entiat		Hanford Reach	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1998	3	0.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
1999	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2000	7	0.1	0	0.0	0	0.0	24	3.6	0	0.0	0	0.0
2001	0	0.0	12	0.4	31	0.3	0	0.0	0	0.0	0	0.0
2002	0	0.0	5	0.1	0	0.0	0	0.0	0	0.0	0	0.0
2003	0	0.0	45	1.1	0	0.0	22	5.3	13	1.9	16	0.0
2004	0	0.0	7	0.3	0	0.0	14	3.3	0	0.0	18	0.0
2005	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2006	0	0.0	0	0.0	0	0.0	0	0.0	2	0.3	0	0.0
2007	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
2008	0	0.0	7	0.4	0	0.0	27	5.4	0	0.0	0	0.0
2009	19	0.2	0	0.0	0	0.0	2	0.3	0	0.0	0	0.0
Total	***29***	***0.03***	***76***	***0.28***	***31***	***0.04***	***89***	***1.63***	***15***	***0.37***	***34***	***0.01***

On average, about 35% of the brood year returns have strayed into spawning areas in the upper basin (Table 9.17). Depending on brood year, percent strays into spawning areas have ranged from 0-83%. Few (<1% on average) have strayed into non-target hatchery programs.

Table 9.17. Number and percent of Turtle Rock summer Chinook (accelerated subyearling releases) that homed to the target hatchery and strayed to non-target spawning areas and non-target hatchery programs, by brood years 1995-2006.

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1995	-	-	7	70.0	3	30.0	0	0.0
1996	-	-	33	32.4	69	67.6	0	0.0
1997	-	-	6	100.0	0	0.0	0	0.0
1998	-	-	2	16.7	10	83.3	0	0.0
1999	-	-	138	54.1	117	45.9	0	0.0
2000	-	-	12	40.0	18	60.0	0	0.0
2001	-	-	57	96.6	2	3.4	0	0.0
2002	-	-	0	0.0	0	0.0	0	0.0
2003	-	-	3	100.0	0	0.0	0	0.0
2004	-	-	90	75.6	29	24.4	0	0.0
2005	-	-	64	75.3	19	22.4	2	2.4
2006	-	-	88	88.9	7	7.1	4	4.0
Total	**-**	**-**	***500***	***64.1***	***274***	***35.1***	***6***	***0.8***

Yearling releases

Rates of Turtle Rock summer Chinook (yearling releases) straying into spawning areas in the upper basin have varied widely depending on spawning area. Most of these fish strayed to spawning areas within the Chelan tailrace, Entiat Basin, and Methow River basin. Turtle Rock summer Chinook have made up 6-21% of the spawning escapement within those basins (Table 9.18). Relatively few, on average, have strayed to spawning areas in the Okanogan River basin, Wenatchee River basin, and the Hanford Reach (i.e., they made up less than 5% of the spawning escapement in these areas).

Table 9.18. Number (No.) and percent of spawning escapements within other non-target basins that consisted of Turtle Rock summer Chinook (yearling releases), return years 1998-2009. For example, for return year 2003, 4.3% of the summer Chinook spawning escapement in the Methow River basin consisted of Turtle Rock summer Chinook. Percent strays should be less than 5%.

Return year	Wenatchee		Methow		Okanogan		Chelan		Entiat		Hanford Reach	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
1998	0	0.0	2	0.3	0	0.0	0	0.0	0	0.0	0	0.0
1999	3	0.1	2	0.2	0	0.0	0	0.0	0	0.0	0	0.0
2000	18	0.3	57	4.8	167	4.5	73	11.0	0	0.0	10	0.0
2001	109	1.0	523	18.9	334	3.1	316	32.1	0	0.0	7	0.0
2002	92	0.6	437	9.4	194	1.4	191	32.8	136	27.1	0	0.0
2003	64	0.5	170	4.3	14	0.4	165	39.4	180	26.0	9	0.0

Return year	Wenatchee		Methow		Okanogan		Chelan		Entiat		Hanford Reach	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
2004	10	0.1	51	2.3	116	1.7	75	17.9	0	0.0	0	0.0
2005	5	0.1	73	2.9	73	0.8	88	19.8	42	11.4	0	0.0
2006	0	0.0	100	3.7	25	0.3	64	15.2	9	1.6	0	0.0
2007	0	0.0	65	4.8	31	0.7	40	21.2	20	8.2	19	0.1
2008	18	0.3	72	3.7	60	0.9	115	23.1	46	14.4	0	0.0
2009	8	0.1	95	5.4	32	0.4	7	1.1	18	7.2	0	0.0
Total	***327***	***0.29***	***1,647***	***6.16***	***1,046***	***1.31***	***1,134***	***20.71***	***451***	***11.05***	***45***	***0.01***

On average, about 65% of the brood year returns have strayed into spawning areas in the upper basin (Table 9.19). Depending on brood year, percent strays into spawning areas have ranged from 37-86%. Few (<1% on average) have strayed into non-target hatchery programs.

Table 9.19. Number and percent of Turtle Rock summer Chinook (yearling releases) that homed to the target hatchery and strayed to non-target spawning areas and non-target hatchery programs, by brood years 1995-2006.

Brood year	Homing				Straying			
	Target stream		Target hatchery		Non-target streams		Non-target hatcheries	
	Number	%	Number	%	Number	%	Number	%
1995	-	-	180	39.0	278	60.2	4	0.9
1996	-	-	218	27.0	583	72.2	6	0.7
1997	-	-	254	14.2	1,531	85.8	0	0.0
1998	-	-	166	16.1	864	83.9	0	0.0
1999	-	-	181	42.4	243	56.9	3	0.7
2000	-	-	89	27.3	236	72.4	1	0.3
2001	-	-	389	59.8	261	40.2	0	0.0
2002	-	-	303	57.8	220	42.1	0	0.0
2003	-	-	373	63.0	219	37.0	0	0.0
2004	-	-	287	56.6	219	43.2	1	0.2
2005	-	-	202	40.7	293	59.1	1	0.2
2006	-	-	367	36.5	638	63.4	1	0.1
Total	**-**	**-**	***3,009***	***34.9***	***5,585***	***64.9***	***17***	***0.2***

Smolt-to-Adult Survivals

Subyearling-to-adult and smolt-to-adult survival ratios (SARs) were calculated as the number of hatchery adult recaptures divided by the number of tagged hatchery subyearling or yearling Chinook released. SARs were based on CWT returns.

Normal subyearling releases

For the available brood years, SARs for normal subyearling-released Chinook have ranged from 0.000034 to 0.001870 (Table 9.20). This program was discontinued in 2010.

Table 9.20. Subyearling-to-adult ratios (SARs) for Turtle Rock normal subyearling-released summer Chinook, brood years 1995-2006.

Brood year	Number released[a]	Estimated adult captures[b]	SAR
1995	201,230	203	0.001009
1996	371,848	188	0.000506
1997	496,904	17	0.000034
1998	194,723	28	0.000144
1999	197,793	202	0.001021
2000	222,460	28	0.000126
2001	211,306	330	0.001562
2002	200,163	38	0.000190
2003	203,410	49	0.000241
2004	198,019	91	0.000460
2005	197,135	143	0.000725
2006	188,250	352	0.001870
Average	***240,270***	***139***	***0.000657***

[a] Includes all tag codes and CWT released fish (CWT + Ad Clip fish and CWT-only fish).

[b] Includes estimated recoveries (spawning ground, hatcheries, harvest, etc.) and observed recoveries if estimated recoveries were unavailable.

Accelerated subyearling releases

For the available brood years, SARs for accelerated subyearling-released Chinook have ranged from 0.000011 to 0.004578 (Table 9.21). This program was discontinued in 2010.

Table 9.21. Subyearling-to-adult ratios (SARs) for Turtle Rock accelerated subyearling-released summer Chinook, brood years 1995-2006.

Brood year	Number released[a]	Estimated adult captures[b]	SAR
1995	166,203	13	0.000078
1996	198,720	79	0.000398
1997	196,459	3	0.000015
1998	185,551	69	0.000372
1999	192,665	882	0.004578
2000	194,603	63	0.000324
2001	196,355	167	0.000851
2002	200,165	5	0.000025
2003	185,834	2	0.000011
2004	203,255	156	0.000768

Brood year	Number released[a]	Estimated adult captures[b]	SAR
2005	192,045	81	0.000422
2006	186,324	217	0.001165
Average	***191,515***	***145***	***0.000750***

[a] Includes all tag codes and CWT released fish (CWT + Ad Clip fish and CWT-only fish).

[b] Includes estimated recoveries (spawning ground, hatcheries, harvest, etc.) and observed recoveries if estimated recoveries were unavailable.

Yearling releases

For the available brood years, SARs for yearling-released Chinook have ranged from 0.007184 to 0.027842 (Table 9.22).

Table 9.22. Smolt-to-adult ratios (SARs) for Turtle Rock yearling-released summer Chinook, brood years 1995-2006.

Brood year	Number released[a]	Estimated adult captures[b]	SAR
1995	145,318	1,044	0.007184
1996	194,251	1,544	0.007948
1997	198,924	4,767	0.023964
1998	215,646	5,731	0.026576
1999	280,683	2,659	0.009473
2000	165,072	1,867	0.011310
2001	199,694	3,868	0.019370
2002	192,234	2,518	0.013099
2003	199,386	2,085	0.010457
2004	202,682	2,599	0.012823
2005	202,329	1,629	0.008051
2006	142,699	3,973	0.027842
Average	***194,910***	***2,857***	***0.014841***

[a] Includes all tag codes and CWT released fish (CWT + Ad Clip fish and CWT-only fish).

[b] Includes estimated recoveries (spawning ground, hatcheries, harvest, etc.) and observed recoveries if estimated recoveries were unavailable.

9.4 ESA/HCP Compliance

Broodstock Collection

The 2010 brood Turtle Rock summer Chinook program is supported through adult collections at the volunteer trap at Wells Fish Hatchery and in conjunction with the Wells summer Chinook collections. During 2010, broodstock collections at the volunteer trap were consistent with the 2010 Upper Columbia River Salmon and Steelhead Broodstock Objectives and site-based broodstock collection protocols as required in ESA permit 1347. The 2010 collection totaled 1,211 summer Chinook (combined Wells Fish Hatchery and Chelan Falls programs), representing 100% of the targeted broodstock collection objective.

Hatchery Rearing and Release

Brood year 2010 releases totaled 563,824 yearling fish. These releases represented 94.0% of the Rocky Reach HCP and ESA Section 10 Permit 1347 production for the Chelan Falls yearling summer Chinook production.

Hatchery Effluent Monitoring

Per ESA Permits 1196, 1347, and 1395, permit holders shall monitor and report hatchery effluents in compliance with applicable National Pollution Discharge Elimination Systems (NPDES) (EPA 1999) permit limitations. There was one NPDES violation reported at the Chelan PUD Hatchery facilities during the period 1 January through 31 December 2012. NPDES monitoring and reporting for Chelan PUD Hatchery Programs during 2012 are provided in Appendix F.

SECTION 10: REFERENCES

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SECTION 11: APPENDICES

Appendix A: **Abundance and Total Numbers of Chinook Salmon and Trout in the Chiwawa River Basin, Washington, 2012.**

Appendix B: **Fish Trapping at the Chiwawa and Upper Wenatchee Smolt Traps during 2012.**

Appendix C: **Summary of ISEMP PIT-Tagging Activities in the Wenatchee River Basin, 2012.**

Appendix D: **Wenatchee Steelhead Spawning Ground Surveys, 2012.**

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Appendix H: **Wenatchee Sockeye and Summer Chinook Spawning Ground Surveys, 2012.**

Appendix I: **Genetic Diversity of Wenatchee Sockeye Salmon.**

Appendix J: **Genetic Diversity of Natural Chiwawa River Spring Chinook Salmon.**

Appendix K: **Genetic Diversity of Upper Columbia Summer Chinook Salmon.**

Appendix L: **Summer Chinook Spawning Ground Surveys in the Methow and Okanogan River Basins, 2012.**

Appendix A

Abundance and Total Numbers of Chinook Salmon and Trout in the Chiwawa River basin, Washington, 2012

BioAnalysts, Inc.℠
4725 North Cloverdale Road, Ste 102
Boise Idaho 83713

January 25, 2013

TO: HCP Hatchery Committee

FROM: Tracy Hillman

Subject: Abundance and Total Numbers of Chinook Salmon and Trout in the Chiwawa River basin, Washington, 2012

The Chelan County Public Utility District (PUD) hatchery program is operated through a habitat conservation program (HCP) that was incorporated into the PUD's license in 2004. The HCP directed the signatories to develop a monitoring and evaluation plan within one year of the effective date. This resulted in the development of the Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Hatchery Programs (Murdoch and Peven 2005). This study will help the HCP Hatchery Committee determine if it is meeting Objective 7 in the monitoring and evaluation plan (Murdoch and Peven 2005).

Objective 7: *Determine if the proportion of hatchery fish on the spawning grounds affects the freshwater productivity (i.e., number of juveniles per redd) of supplemented streams when compared to non-supplemented streams.*

We estimated densities and total numbers of age-0 spring Chinook salmon *Oncorhynchus tshawytscha,* trout *Oncorhynchus* sp., and char *Salvelinus* sp. in the Chiwawa River basin, Washington, in August 2012. This was the 20th year of an ongoing study to assess the freshwater productivity (juveniles/redd) of Chinook salmon in the Chiwawa River basin. We used landscape classification to stratify streams in the basin that supported juvenile Chinook salmon (Hillman and Miller 2004). Classification "explained" most of the variability in fish numbers caused by geology, land type, valley bottom type, stream state condition, and habitat type. We identified ten reaches on the lower 31 miles (50 km) of the Chiwawa River and one reach in each of Phelps, Rock, Chikamin, Big Meadow, Alder, Brush, Clear, Y, and Unnamed[1] creeks (Figure 1). Each reach consisted of several combinations of state-type and habitat-type strata. We used classification to find reference areas for reaches in the Chiwawa River. We matched Reach 3 and Reach 8 of the Chiwawa River with a moderately-confined section of Nason Creek (RM 0.62-1.70) and an unconfined area of the Little Wenatchee River (RM 4.39-8.55), respectively

[1]Unnamed tributary that drains the eastside of Chiwawa Ridge. Its confluence with the Chiwawa River is about 1 mile (1.6 km) downstream from the mouth of Phelps Creek.

(Hillman and Miller 2004). Following methods described in Hillman and Miller (2004), we used underwater observations to estimate numbers of fish in 167 randomly selected sites.

During sampling in August 2012, discharge in the Chiwawa River averaged 345 cubic feet per second (cfs) and ranged from 179 to 554 cfs (Figure 2). Stream temperatures for the study period ranged from 9.0 to 15.5°C. Fish species observed in the Chiwawa River basin and reference areas during the 1992-2012 survey period[2] included: spring Chinook salmon, coho salmon *O. kisutch*, sockeye salmon *O. nerka* (in the Little Wenatchee River reference area), steelhead/rainbow trout *O. mykiss* (hatchery rainbow were present only in 1992 and 1993), cutthroat trout *O. clarki lewisi*, bull trout *S. confluentus*, brook trout *S. fontinalis*, mountain whitefish *Prosopium williamsoni*, dace *Rhinichthys* sp., suckers *Catostomus* sp., and sculpin *Cottus* sp. The age-0 spring Chinook that we observed in the Chiwawa River basin during the 2012 survey were produced from 492 redds counted in the fall of 2011 (Hillman et al. 2012). Assuming a mean fecundity of 4,385 eggs per female Chinook (from females collected for broodstock), and that no female produced more than one redd (Murdoch et al. 2009), we estimated that the Chiwawa River basin was seeded with 2,157,420 eggs in 2011 (Appendix A).

In 2012, riffles made up the largest fraction of habitat types in reaches of the Chiwawa River basin (53% of the total stream surface area) (Table 1). Pools (23%), glides (7%), and multiple channels (17%) constituted the remaining 47% of the stream surface area. We consistently found woody debris associated with multiple-channel habitat.

Chinook Salmon Abundance

Chinook salmon were the most abundant salmonid in the Chiwawa River basin. We estimated, based on surface area, that age-0 Chinook salmon numbered 103,940 (±15% of the estimated total) in the Chiwawa River basin in August 2012 (Table 2). Extrapolating based on volume of habitat types, age-0 Chinook numbered 105,613 (±14%) in the Chiwawa River basin. About 8% of the juvenile Chinook were in tributaries to the Chiwawa River. During the 1992-2012 surveys, numbers of age-0 Chinook ranged from 5,815 to 141,510 in the Chiwawa River basin (Figure 3; Appendix B). Most of the difference in juvenile numbers among years resulted from different seeding (stock) levels (Figure 4). Numbers of Chinook redds in the Chiwawa River basin during 1992-2012 ranged from 13 to 1,046, resulting in seeding levels of 66,248 to 4,836,704 eggs (Appendix A).

As in most years, age-0 Chinook in 2012 were distributed contagiously among reaches in the Chiwawa River (Table 2). In the Chiwawa River, densities of age-0 Chinook were highest in the upper reaches (Reaches 7-10). The highest densities in the Chiwawa River basin were in tributaries to the Chiwawa River (Table 2). Age-0 Chinook were most abundant in multiple channels and least abundant in glides and riffles. We found the majority of the Chinook associated with woody debris in multiple channels (multiple channel use index = 2.76)[3]. These

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[2] The study period 1992-2012 includes only 20 years of sampling because there was no sampling in 2000.

[3] The habitat use index was calculated as follows: Multiple channel use = ($parr_{mc}$/$parr_t$) / ($area_{mc}$/$area_t$), where $parr_{mc}$ = the number of parr counted in multiple channel habitat, $parr_t$ = the total number of parr counted within all habitat types, $area_{mc}$ = the area of multiple channel habitat within the sampling frame, and $area_t$ = the total area of the sampling frame. A multiple channel use index value of 1 would indicate that parr were uniformly distributed among

sites (multiple channels) made up 17% of the total area of the Chiwawa River basin, but they provided habitat for 43% of all the age-0 Chinook in the basin in 2012 (Appendix C). In contrast, riffles made up 53% of the total area, but provided habitat for only 15% of all age-0 Chinook in the Chiwawa River basin (riffle use index = 0.26). Pools made up 23% of the total area and provided habitat for 41% of all age-0 Chinook in the basin (pool use index = 1.56). Few Chinook used glides that lacked woody debris (glide use index = 0.28).

As noted earlier, we assumed that the Chiwawa River was seeded with 2,157,420 Chinook eggs (492 redds times 4,385 eggs/female) in fall, 2011, and that at least 103,940 of those survived to August 2012. This means that the egg-to-parr survival was at least 4.8% (95% confidence bound 4.1-5.6%). During 1992-2012, egg-to-parr survival averaged 5.7% (range 2.7-19.1%) in the Chiwawa River basin (Appendix A). This survival rate comports with those from other streams. For example, Mullan et al. (1992) estimated an egg-to-parr survival rate of 9.8% for spring Chinook salmon in Icicle Creek, a tributary of the Wenatchee River. Using a Beverton and Holt model, Hubble (1993) estimated that egg-to-parr survival of Chinook in the Chewuck River, a tributary to the Methow River, ranged between 13% and 32%, depending on percent seeding level in the basin. Kiefer and Forster (1991) estimated a mean egg-to-parr survival rate of 5.5% (range 5.1-6.7%) for naturally-spawning spring Chinook salmon in the entire upper Salmon River. They also noted that egg-to-parr survival of natural spawners and adult outplants in the headwater streams of the upper Salmon River averaged 24.4% (range 16.1-32.0%). Petrosky (1990) reported an egg-to-parr survival range of 1.2-29.0% for Chinook in the upper Salmon River, Idaho. Konopacky et al. (1986) estimated egg-to-parr survival of Chinook in Bear Valley Creek, Idaho, as 8.1-9.4%. Work by Richards and Cernera (1987) in Bear Valley Creek indicated an egg-to-parr survival of 2.1%.

Mean densities of age-0 Chinook salmon in two reaches of the Chiwawa River were generally less than those in corresponding reference areas (Figure 5). Within both the Chiwawa River and its reference areas, pools and multiple channels consistently had the highest densities of age-0 Chinook.

We estimated a total of 767 (±24% of the estimated total) age-1+ Chinook salmon in the Chiwawa River basin in August 2012 (Table 3). This was the second highest estimate since the initiation of the study. In August 1992-2012, numbers of age-1+ Chinook ranged from 5 to 967 in the Chiwawa River basin (Figure 3; Appendix B). These fish occurred throughout the Chiwawa River. We found relatively few age-1+ Chinook in tributaries. Age-1+ Chinook were most abundant in multiple channels and pools.

Juvenile Chinook Salmon Productivity (Fish/Redd)

Freshwater productivity of juvenile Chinook salmon was estimated as the number of parr (age-0 Chinook) per redd in the Chiwawa River basin. Theoretically, the relationship between number of parr and redds can be explained mathematically provided the relationship between the two parameters goes through the origin, increases monotonically at low spawning levels, and shows

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habitat types and exhibited no preference for multiple habitat types. Values of the use index greater than 1 indicate use of multiple channels to a greater extent than the average, while scores between 0 and 1 indicate below-average use of multiple channel habitat.

some level of density dependence at high spawning levels. We identified four alternative hypotheses that may explain the relationship between spawning level (redds) and numbers of age-0 Chinook:

1. The first hypothesis assumed that the number of juveniles increases constantly toward an asymptote as the number of redds increases. After the asymptote is reached, the number of juveniles neither increases nor decreases. The asymptote represents the maximum number of juveniles the system can support (i.e., carrying capacity for the system). This hypothesis was modeled with a Beverton-Holt curve that took the form:

$$\boldsymbol{J} = \frac{(\boldsymbol{\alpha R})}{(\boldsymbol{\beta} + \boldsymbol{R})}$$

   where $\boldsymbol{J}$ is the number of juvenile (age-0) Chinook, $\boldsymbol{R}$ is the number or redds, $\boldsymbol{\alpha}$ is the maximum number of juveniles produced, and $\boldsymbol{\beta}$ is the number of redds needed to produce (on average) juveniles equal to one-half the maximum number of juveniles.

2. The second hypothesis, like the first, assumed that the number of juveniles increases toward an asymptote (carrying capacity) as the number of redds increases. After the carrying capacity is reached, the number of juveniles neither increases nor decreases. The carrying capacity represents the maximum number of juveniles the system can support. This hypothesis was modeled with a smooth hockey stick function that took the form:

$$\boldsymbol{J} = \boldsymbol{J}_{\infty}\left(\boldsymbol{1} - \boldsymbol{e}^{-\left(\frac{\boldsymbol{\alpha}}{\boldsymbol{J}_{\infty}}\right)\boldsymbol{R}}\right)$$

   where $\boldsymbol{J}$ and $\boldsymbol{R}$ are as above, $\boldsymbol{\alpha}$ is the slope at the origin of the spawner-recruitment curve, and $\boldsymbol{J}_{\infty}$ is the carrying capacity of juveniles.

3. The third hypothesis assumed that the number of juveniles increases to a maximum and then declines as the number or redds increases. In this case, mortality rate of juveniles (or eggs) is proportional to the initial number of redds. Higher mortality rate is associated with density-dependent growth coupled with size-dependent predation. This hypothesis was modeled with a Ricker curve that took the form:

$$\boldsymbol{J} = \boldsymbol{\alpha R e^{-\beta R}}$$

   where $\boldsymbol{J}$ and $\boldsymbol{R}$ are as above, $\boldsymbol{\alpha}$ is the number of juveniles per redd at low spawning levels, and $\boldsymbol{\beta}$ describes how quickly the juveniles per redd drop as the number of redds increases.

4. The fourth hypothesis, like the first, assumed that the number of juveniles increases constantly, but unlike the first, the number of juveniles does not reach an asymptote. Rather, the number of juveniles increases indefinitely, but at a slowing rate of increase. This hypothesis was modeled with both a Cushing curve and a Gamma function. The Cushing curve took the form:

$$\boldsymbol{J} = \boldsymbol{\alpha R^{\gamma}}$$

   where $\boldsymbol{J}$ and $\boldsymbol{R}$ are as above, $\boldsymbol{\alpha}$ is the number of juveniles per redd at low spawning levels, and $\boldsymbol{\gamma}$ describes the level of density dependence at high spawning levels. The Gamma function is a three-parameter model that has the form:

$$J = \alpha R^{\gamma} e^{-\beta R}.$$

This is an un-normalized gamma function that is similar to the Cushing curve when $\beta = 0$. We used Akaike's Information Criterion for small sample size (AIC_c) to determine which model(s) best explained the productivity of juvenile Chinook in the Chiwawa River basin. AIC_c was estimated as:

$$AIC_c = -2log\left(£(\theta|data)\right) + 2K + \left(\frac{2K(K+1)}{n-K-1}\right)$$

where ***log(£(θ|data))*** is the maximum likelihood estimate, ***K*** is the number of estimable parameters (structural parameters plus the residual variance parameter), and ***n*** is the sample size (Burnham and Anderson 2002). We used least-squares methods to estimate ***log(£(θ|data))***, which was calculated as $\boldsymbol{log(\sigma^2)}$, where $\boldsymbol{\sigma^2}$ = residual sum of squares divided by the sample size ($\boldsymbol{\sigma^2 = RSS/n}$). AIC_c assesses model fit in relation to model complexity (number of parameters). The model with the smallest AIC_c value represents the "best approximating" model within the model set. Remaining models were ranked relative to the best model using AIC_c difference scores (**ΔAIC_c**), Akaike weights ($\boldsymbol{w_i}$), and evidence ratios. Models with **ΔAIC_c** values less than 2 indicate that there is substantial support for these models as being the best-fitting models within the set (Burnham and Anderson 2002). Models with values greater than 2 have less support. Akaike weights are probabilities estimating the strength of the evidence supporting a particular model as being the best model within the model set. Models with small $\boldsymbol{w_i}$ values are less plausible as competing models (Burnham and Anderson 2002). If no single model could be specified as the best model, a "best subset" of competing models was identified using (1) AIC_c differences to indicate the level of empirical support each model had as being the best model, (2) evidence ratios based on Akaike weights to indicate the relative probability that any model is the best model, and (3) coefficients of determination (R^2) assessing the explanatory power of each model.

The use of AIC_c indicated that the Beverton-Holt model best approximated the information in the juveniles/redd data (Table 4; Figure 6). The estimated structural parameters for this model were:

$$Juveniles = \frac{(141{,}089 \times Redds)}{(170 + Redds)}$$

where the bootstrap estimated standard errors for the two parameters were 19,656 and 55, respectively. The adjusted $R^2 = 0.82$. The second-best model was the smooth hockey stick model, which was 0.89 AIC_c units from the best model (Table 4; Figure 6). The estimated parameters for this model were:

$$LN(Juveniles) = 11.5 + LN\left(1 - e^{-\left(\frac{752.2}{105{,}836}\right)Redds}\right)$$

where the bootstrap estimated standard errors of the two parameters were 0.1 and 156, respectively, and the $R^2 = 0.81$. The AIC_c difference scores, Akaike weights, and evidence ratios indicated that there was substantial support for both the Beverton-Holt and smooth hockey stick models (Table 4). There was less support for the remaining models (Ricker, Gamma[4], and Cushing), which were > 2 AIC_c units from the best models. This was further supported by the fact that, relative to the best models, the remaining models had evidence ratios greater than 6.

Although the Beverton-Holt, smooth hockey stick, and Ricker models have different biological assumptions, they all indicated a density-dependent relationship between spawning levels (redds) and juvenile Chinook production. This was not only evident in the best approximating models, but there was also a significant negative relationship between juveniles per redd and numbers of redds in the Chiwawa River basin (Figure 7). Although data at high seeding levels are lacking, the Beverton-Holt model would limit the production of juvenile Chinook to less than about 178,000 parr in the basin (bootstrap upper 95% CI of $\boldsymbol{\alpha}$ in the Beverton-Holt model). In contrast, the smooth hockey stick model, which fit the data as well as the Beverton-Holt model, would limit the carrying capacity for juvenile Chinook to about 134,000 parr (bootstrap upper 95% CI of $\boldsymbol{J_\infty}$ in the smooth hockey stick model). Additional information at high spawning escapements would improve the precision of the maximum juvenile productivity in the Chiwawa River basin.

Steelhead/Rainbow Abundance

Based on stream surface area, we estimated a total of 27,134 (±10% of the estimated total) age-0 steelhead/rainbow (<4 in) in reaches of the Chiwawa River basin in August 2012 (Table 5). During the 1992-2012 survey period, numbers of age-0 steelhead/rainbow ranged from 1,410 to 45,727 in the Chiwawa River basin (Figure 8; Appendix B). In 1992-2012, numbers of age-0 steelhead/rainbow varied among reaches, but were typically highest in the lower reaches of the Chiwawa River. In all years they most often used riffle and multiple channel habitats in the Chiwawa River, although we also found them associated with woody debris in pool and glide habitat. In tributaries they were generally most abundant in small pools. Those that we observed in riffles selected stations in quiet water behind small and large boulders or occupied stations in quiet water along the stream margin. In pool and multiple-channel habitats, we found age-0 steelhead/rainbow using the same kinds of habitat as age-0 Chinook salmon.

We estimated that 8,576 (±12% of the estimated total) age-1+ steelhead/rainbow (4-8 in) lived in reaches of the Chiwawa River basin in August 2012 (Table 6). During the survey period 1992-2012, numbers of age-1+ steelhead/rainbow ranged from 2,533 to 22,130 (Figure 8; Appendix B). In most years we found these fish in nearly all reaches, but they were typically most numerous in lower reaches of the Chiwawa River. We observed age-1+ steelhead/rainbow mostly in pool, riffle, and multiple-channel habitats. Those that we observed in pools were usually in deeper water than age-0 steelhead/rainbow and Chinook. Like age-0 steelhead/rainbow, age-1+ steelhead/rainbow selected stations in quiet water behind boulders in riffles, but we generally did not find the two age groups together. Age-1+ steelhead/rainbow appeared to use deeper and faster water than did age-0 steelhead/rainbow.

We estimated that steelhead/rainbow larger than 8 inches numbered 65 (±20% of the estimated total) in the Chiwawa River basin in August 2012 (Table 7). During the period 1992-2012,

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[4] The γ parameter in the Gamma model was greater than 0, which means that this model is nearly identical to the Ricker model. The reason it did not rank higher is because it contains an extra parameter, which means that it has less bias and greater variance than the Ricker model.

steelhead/rainbow numbers ranged from 8 to 1,869 (Appendix B). Steelhead/rainbow larger than 8 inches were most abundant in the lower Chiwawa River; however, in 1992 and 1993, they were most abundant near campgrounds in Reaches 8, 9, and 10 (these were mostly hatchery fish planted near the campgrounds). We found very few in tributaries. Most of the steelhead/rainbow larger than 8 inches used deep pools (>5 feet), and occupied stations near the bottom at the upstream end of pools.

Bull Trout Abundance

We estimated, based on surface area that at least 159 (±23% of the estimated total) juvenile (2-8 in) bull trout lived in reaches of the Chiwawa River basin in August 2012 (Table 8). We found most of these fish in the upper-most reaches and in tributaries of the Chiwawa River. During 1992-2012, numbers of juvenile bull trout ranged from 79 to 505 (Figure 9; Appendix B). These estimates and those for adult bull trout are incomplete because we did not sample the entire range of bull trout in all tributaries. We did not extend our surveys into the headwaters of the Chiwawa River because there were no juvenile Chinook there. Areas beyond the distribution of juvenile Chinook salmon are known to support bull trout, steelhead/rainbow, and cutthroat trout (USFS 1993). In addition, our estimates of bull trout abundance were based on daytime snorkel surveys, which may underestimate the actual abundance of bull trout.[5] Several studies (e.g., Goetz 1994; Thurow and Schill 1996; Hillman and Chapman 1996; Bonar et al. 1997) have found bull trout population estimates based on nighttime snorkeling to be in some cases more accurate than daytime snorkeling, especially for juvenile bull trout. Our estimates of adult bull trout numbers may be more accurate than those for juveniles.

In all years we found most juvenile bull trout in the upstream reaches of the Chiwawa River. Of the reaches we surveyed, they were most numerous in Reaches 7-10 on the Chiwawa River. We found the majority of these fish in multiple channels, pools, and riffles, and few in glides. They consistently occupied stations close to the stream bottom over rubble and small boulder substrate or near woody debris. This is similar to the observation of Pratt (1984) in the upper Flathead River Basin in Montana. She found that juvenile bull trout lay close to instream cover and that they tended to conceal themselves. As a result, she found it difficult to accurately estimate their numbers. Although this implies that we underestimated numbers of juvenile bull trout in the Chiwawa River, the relative distribution of juvenile bull trout is valid if we assume that we saw the same fraction of juveniles in all reaches (i.e., detection probability was the same across survey sites).

We estimated a total of 768 (±13% of the estimated total) adult (>8 in) bull trout in reaches of the Chiwawa River basin in August 2012 (Table 9). In previous years, numbers ranged from 76 to 900 (Figure 9; Appendix B). As with juvenile bull trout, we found most of the adult bull trout upstream from Reach 6; although they were found in all reaches on the Chiwawa River. We found few adult bull trout in tributaries of the Chiwawa River. Adult bull trout primarily used pools and multiple channel habitat, although most of the smaller adults (<10 in) used riffles. In

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[5] Because there are no estimates for probability of detecting bull trout with daytime underwater observation methods in the Chiwawa River basin, we could not adjust bull trout numbers based on detectability. Therefore, the numbers reported in this report likely underestimate the "true" number of bull trout in the survey area.

all years we found few adult bull trout near campgrounds.

Abundance of Other Salmonids

In August 2012, we estimated that at least 74 brook trout, an exotic species closely related to the bull trout, occurred in the Chiwawa River, Chikamin Creek, Big Meadow Creek, Minnow Creek, and in the Little Wenatchee River survey areas. Brook trout occurred in the lower seven reaches on the Chiwawa River. In both the Chiwawa and Little Wenatchee rivers, brook trout usually used multiple channels. Few appeared to be bull trout/brook trout hybrids. In Chikamin, Minnow, and Big Meadow creeks, brook trout were most abundant in pools. Brook trout lengths ranged from 2-10 inches.

At least 190 westslope cutthroat trout occurred in the Chiwawa River, Rock Creek, Phelps Creek, and Little Wenatchee River survey areas in August 2012. These fish most often occurred in pools and multiple channel habitats. They ranged in size from 2-18 inches. Juvenile coho salmon were observed in Nason Creek and Chikamin Creek.

We observed both juvenile and adult mountain whitefish in the Chiwawa River, Rock Creek, Nason Creek, and the Little Wenatchee River survey areas. In sum, at least 5,544 adult and 2,014 juvenile whitefish lived in these streams in August 2012. We found few whitefish in most tributaries to the Chiwawa River.

Conclusion

This was the 20th year of a study to monitor trends in juvenile spring Chinook production in the Chiwawa River basin. As shown in Figure 3, numbers of juvenile Chinook salmon in the Chiwawa River basin have fluctuated widely over the 20-year period. Numbers of juveniles in 2001 and 2002 were some of the highest recorded, while numbers in the mid-1990s were some of the lowest. Interestingly, the highest spawning escapements (highest redd numbers) resulted in the lowest egg-parr survival rates (Appendix A). This is supported by the fact that the best approximating models clearly demonstrated a density-dependent relationship between seeding levels and juvenile production. Indeed, there was a significant negative relationship between parr per redd and numbers of redds in the Chiwawa River basin. This is an important observation because Objectives 1, 3, 4, and 7 and their associated hypotheses in the monitoring and evaluation plan (Murdoch and Peven 2005) are only valid when the supplemented population is below its carrying capacity.

The presence of density dependence in the early life stages of spring Chinook is not surprising. Rarely does density dependence appear in numbers of adult spring Chinook or on their spawning grounds. The Chiwawa River basin appears to have plenty of spawning habitat, as indicated by the large numbers of spawners and redds widely distributed throughout the basin during 2001 and 2002. However, those large spawning escapements did not translate into large numbers of juveniles or smolts. Thus, density-dependent regulation appears to occur sometime during the early life stages of the fish, likely at the fry stage. It is possible that physical habitat (space) during higher flows when fry are emerging may limit juvenile Chinook production in the basin. Low nutrient levels and its effects on food (macroinvertebrates) production may also be a limiting factor in the basin. If spawning escapements remain relatively high, marine-derived nutrients should increase in the basin, resulting in more food for juvenile Chinook salmon.

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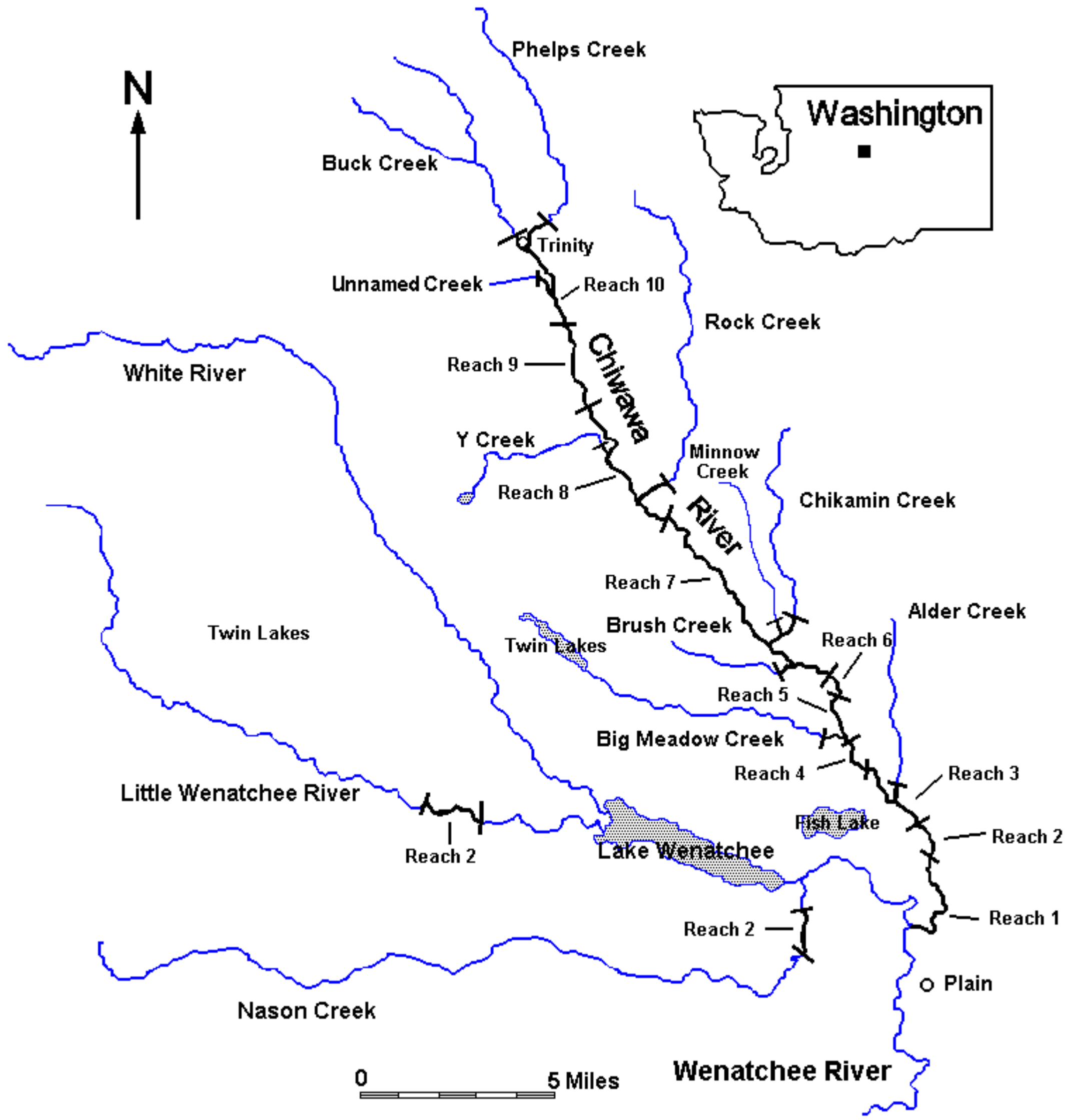


Figure 1. Location of study reaches on the Chiwawa River, and Chikamin, Rock, Big Meadow, Unnamed, Alder, Brush and Phelps creeks, Chelan County, Washington. Reach 2 on Nason Creek and Reach 2 on the Little Wenatchee River were matched with Reaches 3 and 8 on the Chiwawa River, respectively.

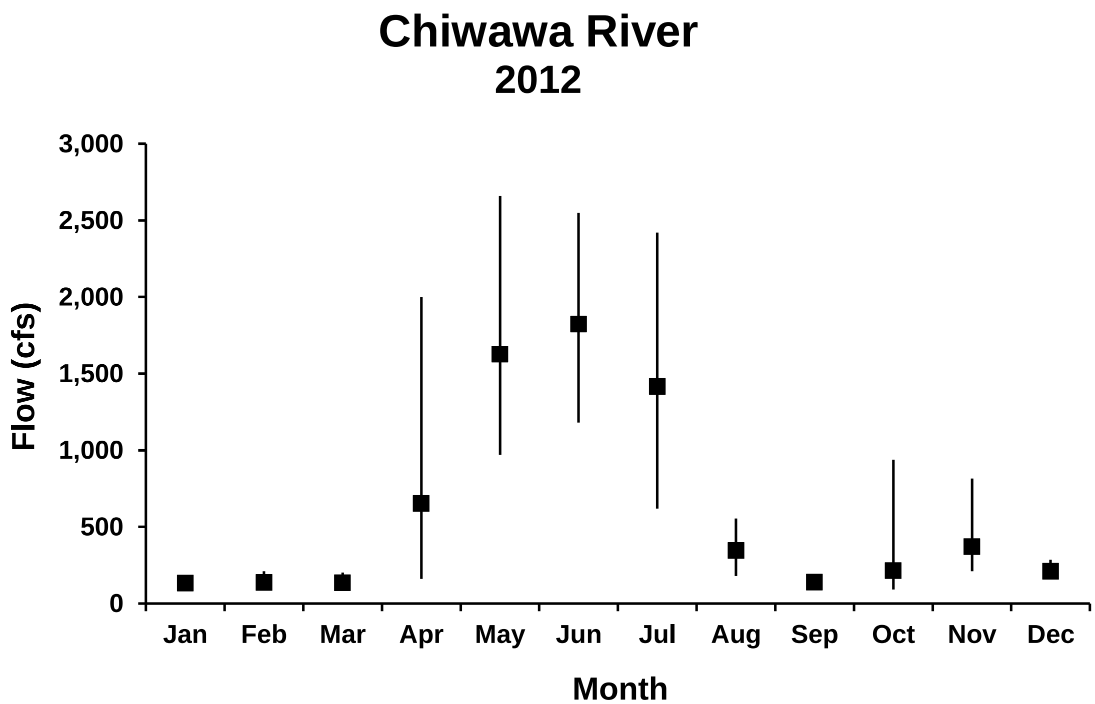


Figure 2. Mean, minimum, and maximum monthly flows in the Chiwawa River for 2012.

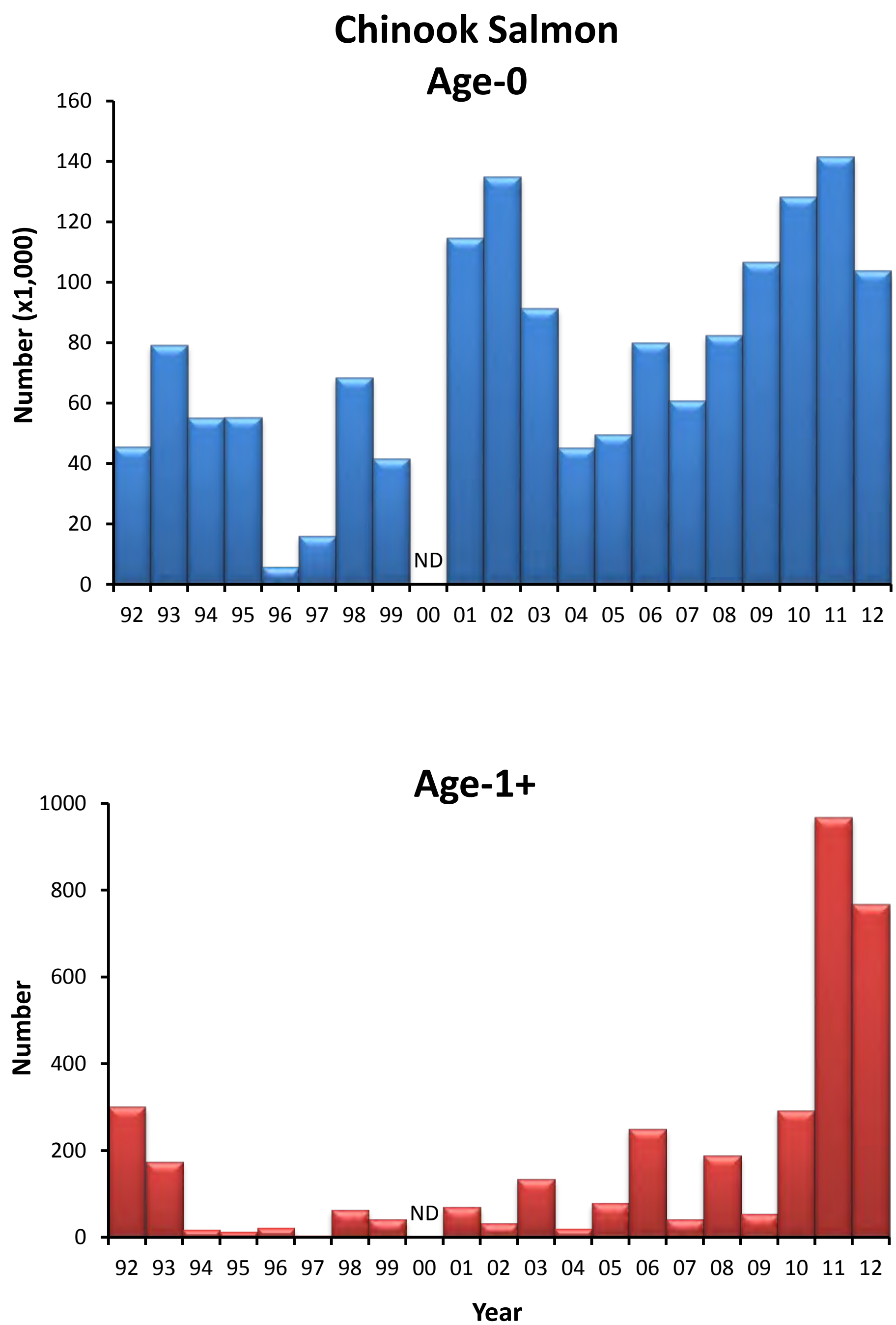


Figure 3. Numbers of age-0 and age-1+ Chinook salmon within the Chiwawa River basin in August 1992-2012; ND = no data.

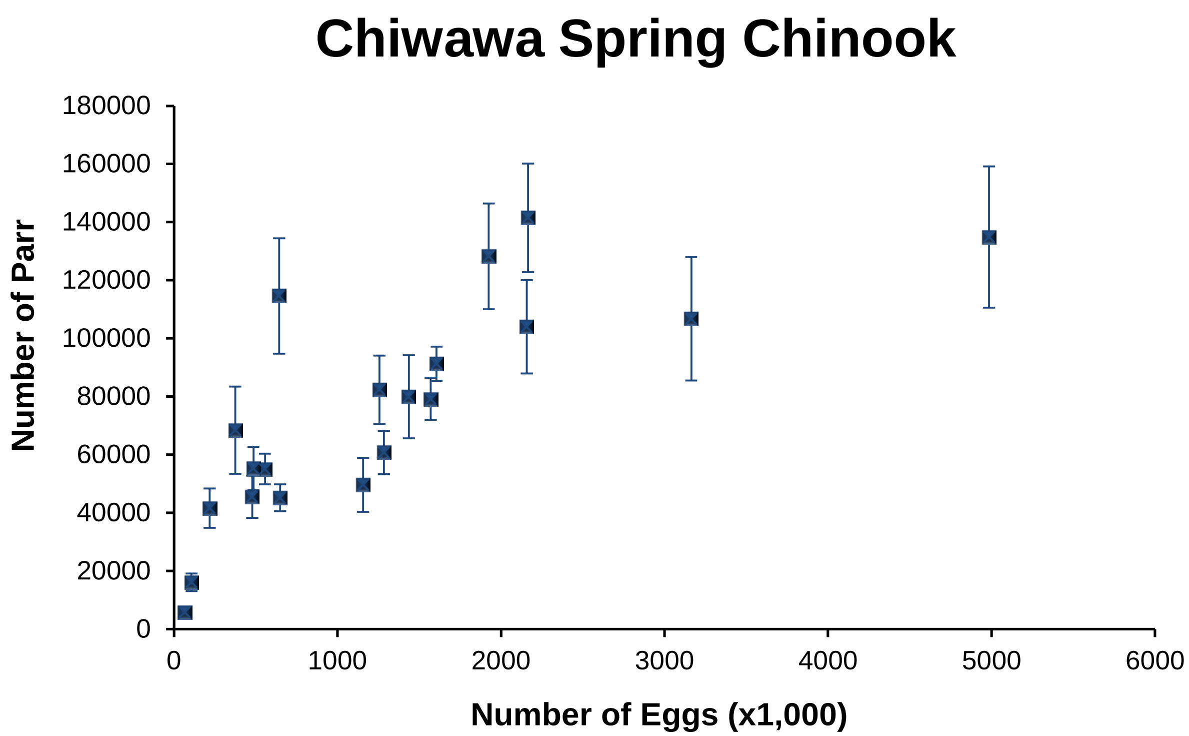


Figure 4. Relationship between total numbers of age-0 Chinook salmon (based on fish/ha) and numbers of eggs in the Chiwawa River basin. Vertical bars indicate 95% confidence bounds.

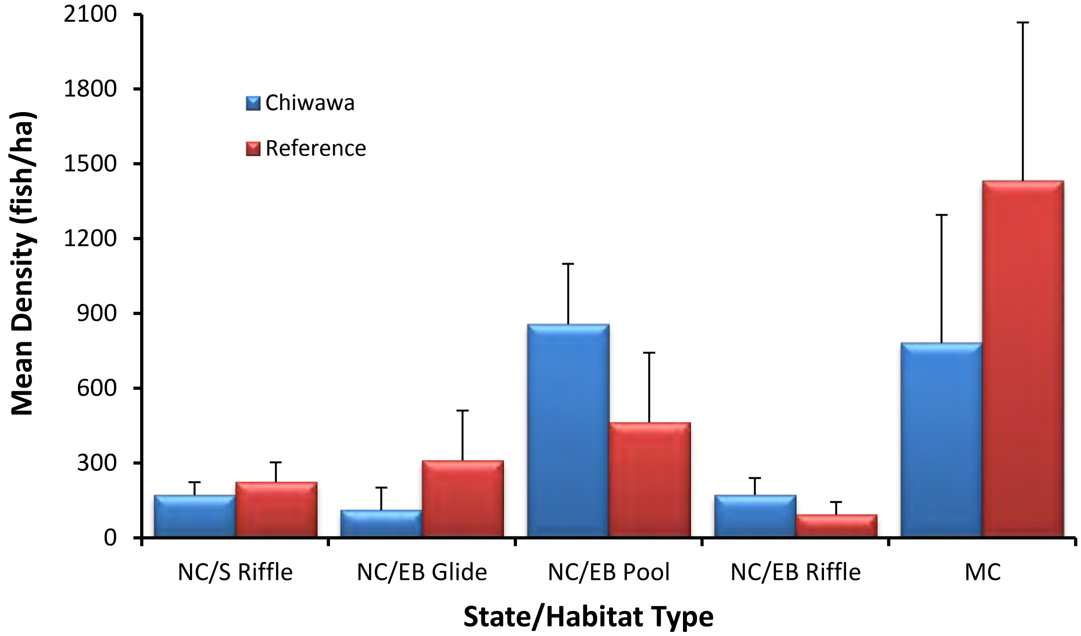


Figure 5. Comparison of the 19-year means (95% CI) of age-0 Chinook salmon densities (fish/ha) within state/habitat types in Reaches 3 and 8 of the Chiwawa River and their matched reference areas on Nason Creek and the Little Wenatchee River. There was no sampling in 2000 and no sampling in reference areas in 1992.

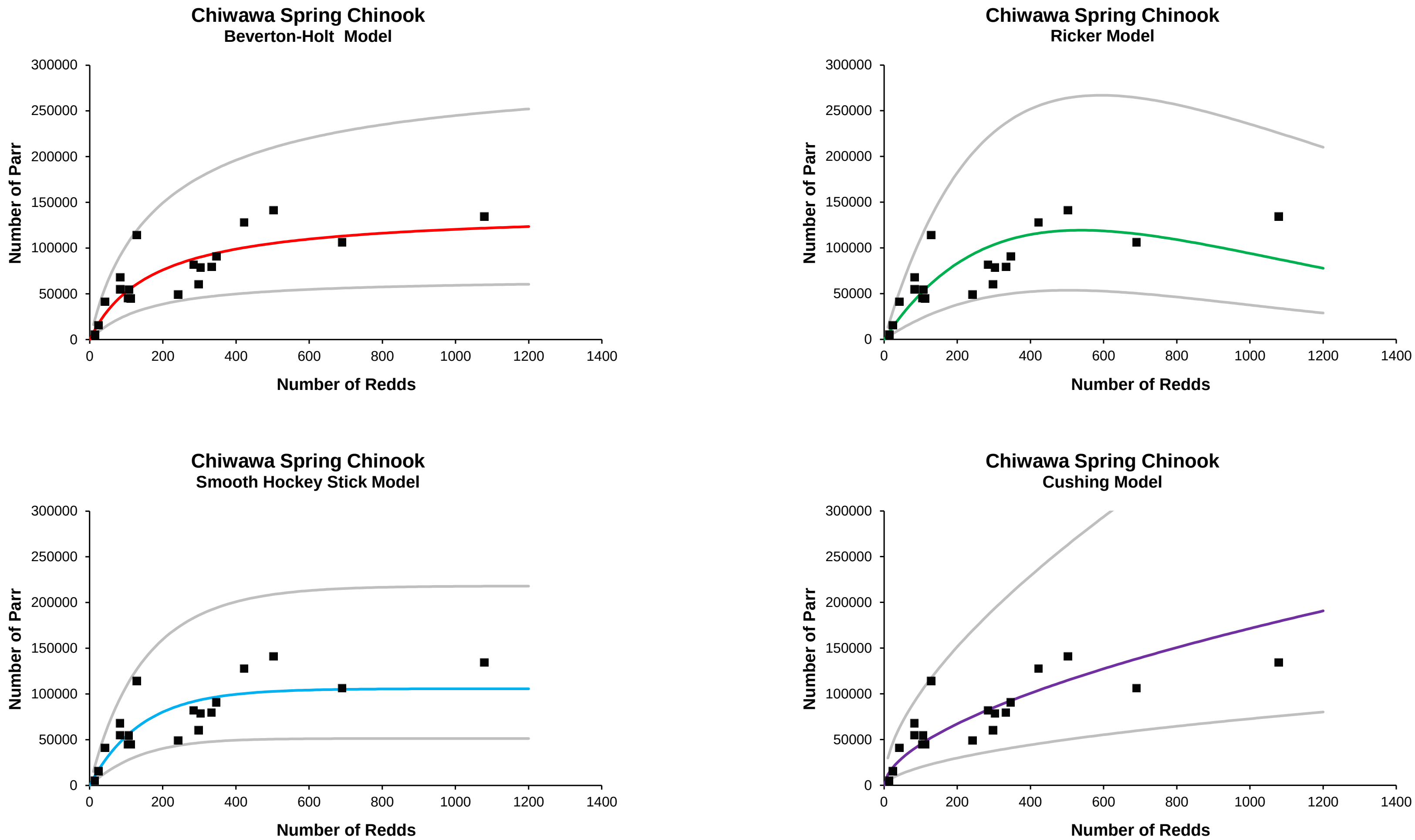


Figure 6. Relationship between numbers of juvenile (age-0) Chinook and redds in the Chiwawa River basin, 1992-2012 (no sampling occurred in 2000). Figures show the fit of the Beverton-Holt model, smooth hockey stick, Ricker model, and the Cushing model to the data. Gray lines indicate the upper and lower 95% C.B.

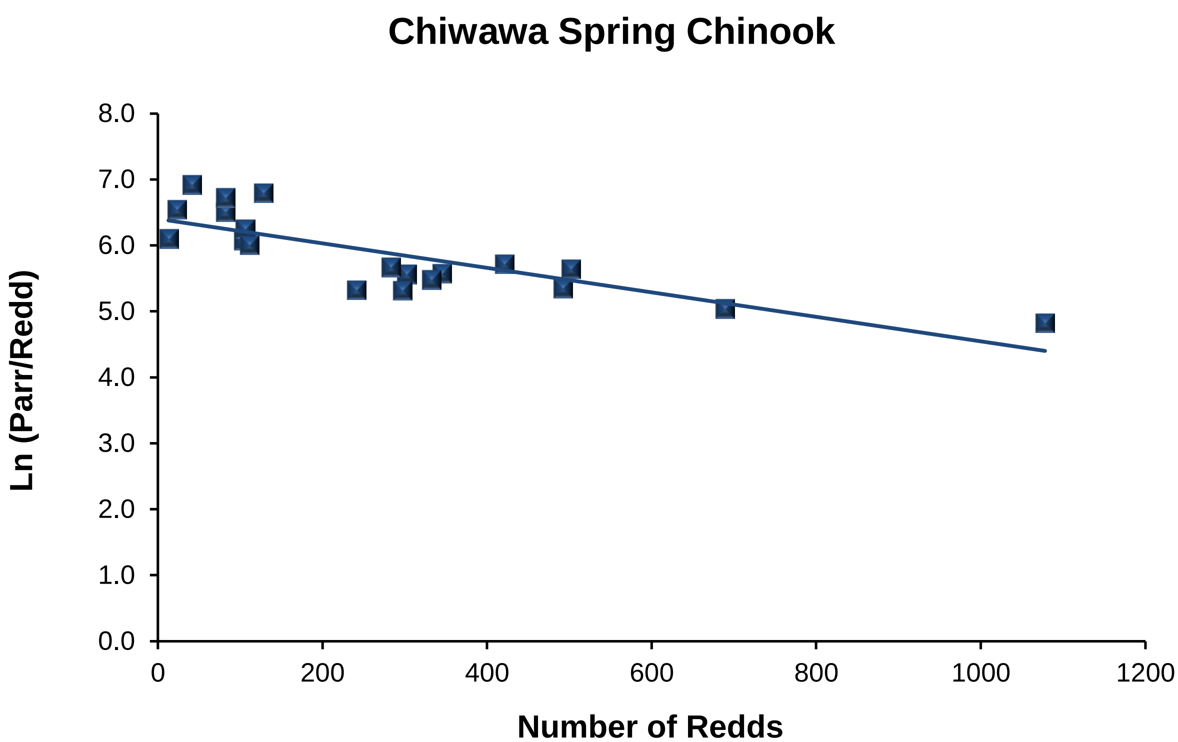
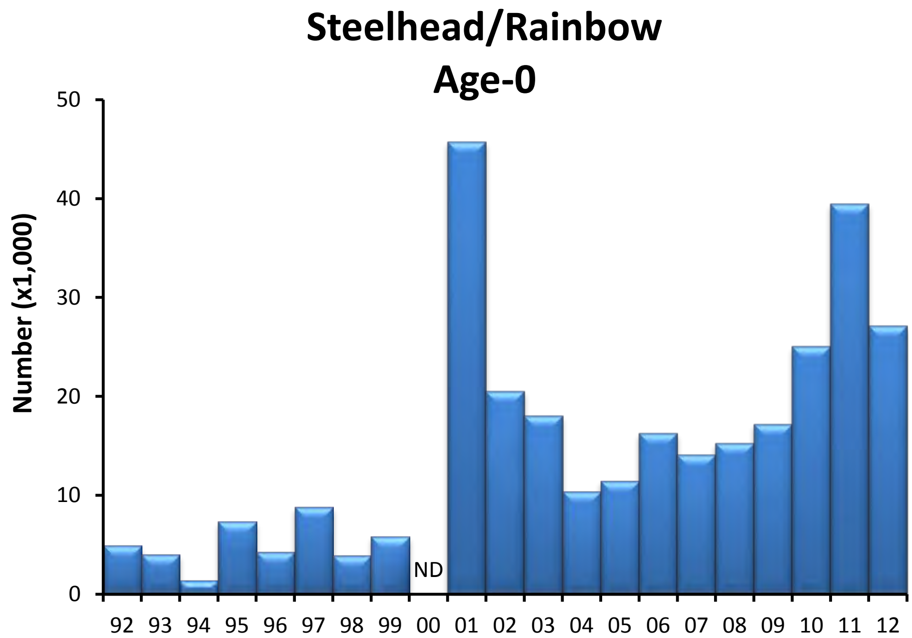


Figure 7. Relationship between natural log parr/redd and numbers of redds in the Chiwawa River basin, 1992-2012. No sampling was conducted in 2000. Estimates for 1992-2012 included the Chiwawa River and its tributaries; the 1992 estimate included only the Chiwawa River. The linear relationship LN(P/R) = 6.40 – 0.002(Redds) was significant with P = 0.0000; R^2 = 0.656.



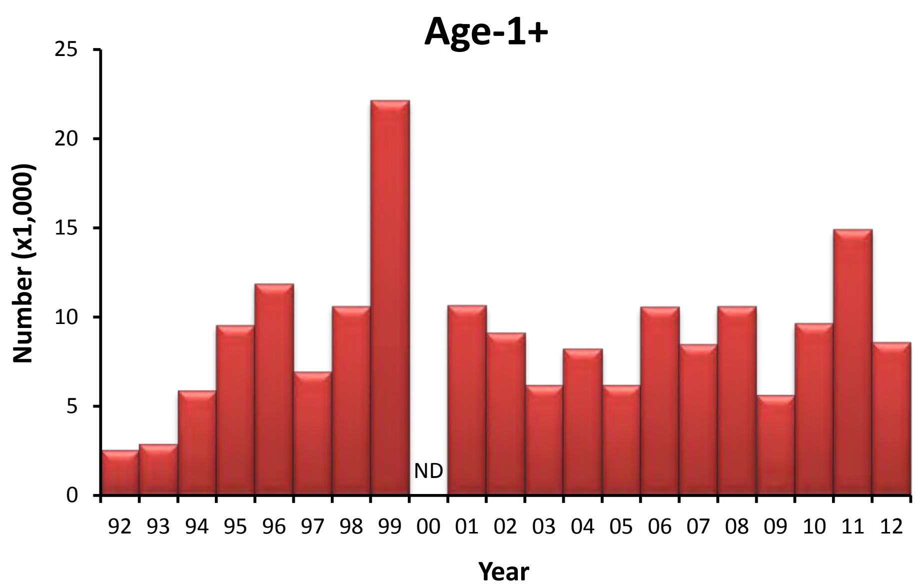
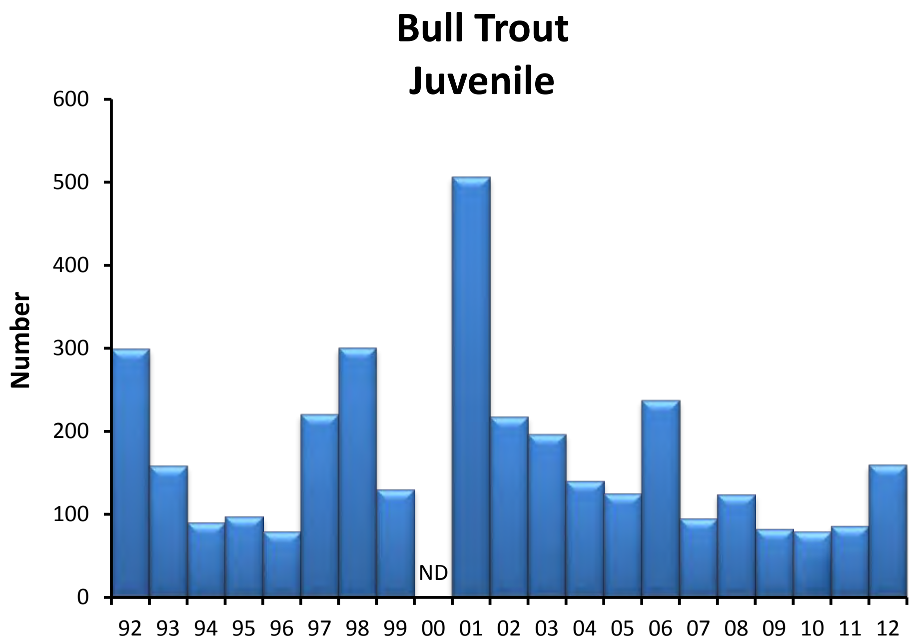


Figure 8. Numbers of age-0 (<4 in) and age-1+ (4-8 in) steelhead/rainbow within the Chiwawa River basin in August 1992-2012; ND = no data.



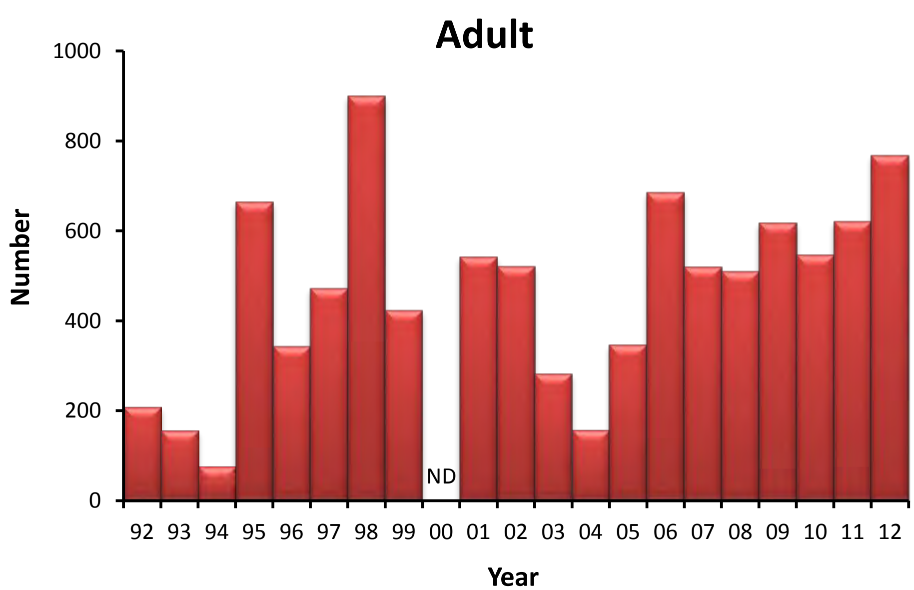


Figure 9. Numbers of juvenile (2-8 inches) and adult (>8 inches) bull trout within the Chiwawa River basin in August 1992-2012; ND = no data.

Table 1. Description, location (river mile), and area (hectares) of land-class strata (reaches) used by age-0 Chinook salmon in the Chiwawa River basin, 2012. Reaches were classified according to geologic district, landtype association, valley-bottom type, stream state-type, and habitat type within the Cascade Ecoregion; MCV = moderately confined valley, CC = confined canyon, UCV = unconfined valley, NC = natural channel, EB = eroded banks, S = straight, G = glide, P = pool, R = riffle, and MC = multiple channel. See Hillman and Miller (2004) for definitions of stream state codes.

Reach	RM	Gradient	Geologic district	Landtype association	Valley bottom type	Stream state type	Habitat type	Area (ha)	
								Total	Sample
Chiwawa River									
1	0.00-3.77	0.007	Glacial Drift over Chumstick Formation	Glacial Valley	MCV Alluvial	NC/EB	G	0.64	0.64
						NC/EB	P	1.47	1.05
						NC/EB	R	16.79	1.70
2	3.77-5.51	0.010	Glacial Drift over Chumstick Formation	Glacial Canyon	CC Fluvial	NC/EB	G	0.28	0.28
						NC/EB	P	0.76	0.29
						NC/EB	R	6.90	0.69
3	5.51-7.88	0.009	Glacial Drift over Chumstick Formation	Glacial Valley	MCV Alluvial	NC/S	R	5.87	0.77
						NC/EB	G	0.14	0.14
						NC/EB	R	4.67	0.59
						MC	MC	0.49	0.49
4	7.88-8.90	0.007	Glacial Drift over Chumstick Formation	Glacial Canyon	CC Fluvial	NC/EB	P	0.40	0.28
						NC/EB	R	2.96	0.42
						MC	MC	0.42	0.42
5	8.90-10.83	0.011	Glacial Drift over Chumstick Formation	Glacial Valley	MCV Alluvial	NC/EB	P	0.15	0.15
						NC/EB	R	9.03	0.99
6	10.83-11.80	0.008	Glacial Drift over Chumstick Formation	Glacial Canyon	CC Fluvial	NC/EB	P	0.24	0.24
						NC/EB	R	3.79	0.87
						MC	MC	0.34	0.34
7	11.80-20.03	0.001	Glacial Drift over Chumstick Formation	Glacial Valley	UCV Alluvial	NC	G	2.29	0.73
						NC	P	6.47	0.51
						NC	R	1.73	0.29
						NC/EB	G	2.62	1.53
						NC/EB	P	7.05	1.61
						NC/EB	R	4.59	0.54
						MC	MC	5.87	2.62
8	20.03-25.42	0.003	Glacial Drift over Swakane Gneiss	Glacial Valley	UCV Alluvial	NC/EB	G	2.84	1.18
						NC/EB	P	7.48	1.71
						NC/EB	R	6.20	0.97
						EB	P	0.23	0.23
						EB	R	0.37	0.37
						MC	MC	7.96	2.36
9	25.42-28.81	0.007	Glacial Drift over Swakane Gneiss	Glacial Valley	MCV Alluvial	NC	G	0.07	0.07
						NC	P	5.29	0.77
						NC	R	2.50	0.64
						MC	MC	2.52	0.30
10	28.81-31.11	0.011	Pre-upper Jurassic Gneiss	Glacial Valley	MCV Alluvial	NC	P	0.91	0.50
						NC	R	3.54	0.42
						MC	MC	3.75	0.58

Table 1. Concluded.

Reach	RM	Gradient	Geologic district	Landtype association	Valley bottom type	Stream state type	Habitat type	Area (ha)	
								Total	Sampled
Phelps Creek									
1	0.00-0.35	0.043	Pre-upper Jurassic Gneiss	Glacial Valley	MCV	NC	MC	0.07	0.07
Chikamin Creek[1]									
1	0.00-0.94	0.013	Glacial Drift over Chumstick Formation	Glacial Valley	UCV Alluvial	NC	P	0.21	0.06
						NC	R	0.36	0.10
						MC	MC	0.08	0.08
Rock Creek									
1	0.00-0.73	0.020	Glacial Drift over Swakane Gneiss	Glacial Valley	UCV Alluvial	NC	G	0.01	0.01
						NC	P	0.14	0.03
						NC	R	0.50	0.12
						MC	MC	0.20	0.20
Unnamed Creek									
1	0.00-0.05		Pre-upper Jurassic Gneiss	Glacial Valley	MCV Alluvial	NC	P	0.01	0.01
						NC	R	0.01	0.01
Big Meadow Creek									
1	0.00-0.35	0.025	Glacial Drift over Chumstick Formation	Glacial Valley	MCV Alluvial	NC	G	0.00	0.00
						NC	P	0.21	0.03
						NC	R	0.06	0.02
						NC	MC	0.03	0.03
Alder Creek									
1	0.00-0.01		Glacial Drift over Chumstick Formation	Glacial Valley	MCV Alluvial	NC	P	0.002	0.002
						NC	R	0.007	0.007
Brush Creek									
1	0.00-0.01		Glacial Drift over Chumstick Formation	Glacial Valley	UCV Alluvial	NC	P	0.001	0.001
						NC	R	0.004	0.004
Clear Creek									
1	0.00-0.05		Glacial Drift over Chumstick Formation	Glacial Valley	UCV Alluvial	NC	P	0.002	0.002
						NC	R	0.002	0.002
Y Creek									
1	0.00-0.05		Glacial Drift over Swakane Gneiss	Glacial Valley	UCV Alluvial	NC	P	0.000	0.000
						NC	R	0.000	0.000

[1] Includes the lower 0.2 miles of Minnow Creek.

Table 2. Estimated mean densities (fish/hectare and fish/m^3), total numbers, 95% confidence bounds on total numbers, and error of the estimated total number of age-0 Chinook salmon in reaches in the Chiwawa River basin, Washington, August 2012.

Reach	Mean density		Surface area (ha)			Volume (m^3)		
	Fish/ha	Fish/m^3	Total No.	95% C.B.	± Error	Total No.	95% C.B.	± Error
Chiwawa River								
1	288.0	0.067	5,444	±1,510	0.28	5,490	±1,490	0.27
2	241.1	0.048	1,914	±238	0.12	1,986	±244	0.13
3	325.3	0.077	3,634	±74	0.02	3,681	±72	0.02
4	756.6	0.144	2,860	±229	0.08	2,829	±242	0.09
5	167.9	0.033	1,542	±30	0.02	1,592	±27	0.02
6	317.2	0.070	1,386	±69	0.05	1,218	±31	0.03
7	984.7	0.144	30,150	±2,943	0.10	30,905	±2,874	0.09
8	1,166.7	0.187	29,261	±15,574	0.53	29,422	±14,732	0.50
9	852.8	0.156	8,852	±1,139	0.13	10,009	±986	0.10
10	1,340.6	0.298	10,993	±1,025	0.09	9,897	±758	0.08
Phelps Creek								
1	1,114.3	0.415	78	±0	0.00	78	±0	0.00
Chikamin Creek[1]								
1	6,346.2	2.955	4,125	±888	0.22	4,378	±1,077	0.25
Rock Creek								
1	2,620.0	1.003	2,227	±615	0.28	2,192	±542	0.25
Unnamed Creek								
1	4,900.0	0.750	49	±0	0.00	49	±0	0.00
Big Meadow Creek								
1	4,348.7	2.593	1,322	±494	0.37	1,784	±614	0.34
Alder Creek								
1	3,888.9	3.646	35	±0	0.00	35	±0	0.00
Brush Creek								
1	5,166.7	10.000	31	±0	0.00	31	±0	0.00
Clear Creek								
1	7,400.0	7.255	37	±0	0.00	37	±0	0.00
Y Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Grand Total	**790.3**	**0.145**	**103,940**	**±16,043**	**0.15**	**105,613**	**±15,200**	**0.14**

[1] Includes lower 0.2 miles of Minnow Creek.

Table 3. Estimated mean densities (fish/hectare and fish/m^3), total numbers, 95% confidence bounds on total numbers, and error of the estimated total number of age-1+ Chinook salmon in reaches in the Chiwawa River basin, Washington, August 2012.

Reach	Mean density		Surface area (ha)			Volume (m^3)		
	Fish/ha	Fish/m^3	Total No.	95% C.B.	± Error	Total No.	95% C.B.	± Error
Chiwawa River								
1	1.5	0.000	29	±19	0.66	33	±47	1.42
2	4.3	0.001	34	±5	0.15	37	±39	1.05
3	0.0	0.179	2	±0	0.00	2	±0	0.00
4	7.7	0.002	29	±5	0.17	29	±7	0.24
5	0.7	0.000	6	±0	0.00	5	±0	0.00
6	2.5	0.001	11	±0	0.00	11	±0	0.00
7	10.4	0.002	318	±139	0.44	343	±146	0.43
8	7.8	0.001	196	±113	0.58	204	±216	1.06
9	0.0	0.000	0	±0	0.00	0	±0	0.00
10	15.0	0.003	123	±41	0.33	106	±37	0.35
Phelps Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Chikamin Creek[1]								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Rock Creek								
1	22.4	0.009	19	±0	0.00	19	±0	0.00
Unnamed Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Big Meadow Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Alder Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Brush Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Clear Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Y Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Grand Total	**5.8**	**0.001**	**767**	**±185**	**0.24**	**789**	**±270**	**0.34**

[1] Includes lower 0.2 miles of Minnow Creek.

Table 4. Summary of the six productivity models of juvenile (age-0) Chinook salmon in the Chiwawa River basin. Models are shown, including the number of parameters (K), AIC_c values, AIC_c difference scores (Δ_i), the likelihood of the model given the data ($£(g_i|x)$), Akaike weights (w_i), and adjusted R^2 values. The sample size (n) for all models was 20. Models describe the relationship between juvenile Chinook numbers (dependent variable) and redd numbers (independent variable).

Model	K^a	AIC_c	Δ_i	$£(g_i\|x)$	w_i	Adj R^2
Beverton-Holt	3	-101.02	0.00	1.00	0.57	0.82
Smooth Hockey Stick	3	-100.13	0.89	0.64	0.37	0.81
Ricker	3	-94.99	6.04	0.05	0.03	0.76
Gamma[b]	4	-94.32	6.70	0.04	0.02	0.77
Cushing	3	-93.53	7.49	0.02	0.01	0.74

[a] ***K*** is the number of structural parameters in the model plus 1 for σ^2.
[b] The γ parameter in the Gamma model was greater than 0, which means that this model is nearly identical to the Ricker model. The reason it did not rank higher than the Ricker model is because the Gamma model contains an extra parameter, which means that it has less bias and greater variance than the Ricker model (less parsimonious).

Table 5. Estimated mean densities (fish/hectare and fish/m^3), total numbers, 95% confidence bounds on total numbers, and error of the estimated total number of age-0 (<4 in) steelhead/rainbow in reaches in the Chiwawa River basin, Washington, August 2012.

Reach	Mean density		Surface area (ha)			Volume (m^3)		
	Fish/ha	Fish/m^3	Total No.	95% C.B.	± Error	Total No.	95% C.B.	± Error
Chiwawa River								
1	202.6	0.048	3,830	±216	0.06	3,902	±131	0.03
2	177.5	0.036	1,409	±172	0.12	1,464	±208	0.14
3	393.3	0.096	4,393	±139	0.03	4,542	±157	0.03
4	458.5	0.087	1,733	±55	0.03	1,701	±40	0.02
5	252.1	0.049	2,314	±132	0.06	2,403	±186	0.08
6	124.7	0.026	545	±54	0.10	460	±67	0.15
7	234.1	0.034	7,167	±2,631	0.37	7,254	±2,540	0.35
8	5.8	0.001	146	±210	1.44	157	±216	1.38
9	0.0	0.000	0	±0	0.00	0	±0	0.00
10	0.0	0.000	0	±0	0.00	0	±0	0.00
Phelps Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Chikamin Creek[1]								
1	2,795.4	1.204	1,817	±810	0.45	1,784	±767	0.43
Rock Creek								
1	1,765.9	0.731	1,501	±479	0.32	1,598	±429	0.27
Unnamed Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Big Meadow Creek								
1	7,118.4	4.022	2,164	±200	0.09	2,767	±207	0.07
Alder Creek								
1	4,666.7	4.375	42	±0	0.00	42	±0	0.00
Brush Creek								
1	9,000.0	17.419	54	±0	0.00	54	±0	0.00
Clear Creek								
1	3,800.0	3.726	19	±0	0.00	19	±0	0.00
Y Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Grand Total	**206.3**	**0.039**	**27,134**	**±2,830**	**0.10**	**28,147**	**±2,727**	**0.10**

[1] Includes lower 0.2 miles of Minnow Creek.

Table 6. Estimated mean densities (fish/hectare and fish/m^3), total numbers, 95% confidence bounds on total numbers, and error of the estimated total number of age-1+ (4-8 in) steelhead/rainbow in reaches in the Chiwawa River basin, Washington, August 2012.

Reach	Mean density		Surface area (ha)			Volume (m^3)		
	Fish/ha	Fish/m^3	Total No.	95% C.B.	± Error	Total No.	95% C.B.	± Error
Chiwawa River								
1	108.7	0.026	2,054	±130	0.06	2,093	±215	0.10
2	78.3	0.016	622	±41	0.07	646	±41	0.06
3	140.6	0.034	1,570	±87	0.06	1,622	±84	0.05
4	156.3	0.029	591	±69	0.12	578	±79	0.14
5	67.8	0.013	622	±29	0.05	645	±41	0.06
6	69.6	0.014	304	±38	0.13	243	±58	0.24
7	40.4	0.006	1,237	±656	0.53	1,180	±681	0.58
8	26.8	0.004	671	±686	1.02	675	±775	1.15
9	0.0	0.000	0	±0	0.00	0	±0	0.00
10	0.0	0.000	0	±0	0.00	0	±0	0.00
Phelps Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Chikamin Creek[1]								
1	438.5	0.215	285	±275	0.96	318	±160	0.50
Rock Creek								
1	482.4	0.204	410	±122	0.30	446	±124	0.28
Unnamed Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Big Meadow Creek								
1	690.8	0.441	210	±73	0.35	303	±68	0.22
Alder Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Brush Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Clear Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Y Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Grand Total	**65.2**	**0.012**	**8,576**	**±1,015**	**0.12**	**8,749**	**±1,085**	**0.12**

[1] Includes lower 0.2 miles of Minnow Creek.

Table 7. Estimated mean densities (fish/hectare and fish/m^3), total numbers, 95% confidence bounds on total numbers, and error of the estimated total number of steelhead/rainbow larger than 8 inches in reaches in the Chiwawa River basin, Washington, August 2012.

Reach	Mean density		Surface area (ha)			Volume (m^3)		
	Fish/ha	Fish/m^3	Total No.	95% C.B.	± Error	Total No.	95% C.B.	± Error
Chiwawa River								
1	1.1	0.000	21	±5	0.24	16	±13	0.81
2	1.9	0.000	15	±7	0.47	16	±13	0.81
3	0.9	0.000	10	±3	0.30	10	±4	0.40
4	1.1	0.000	4	±0	0.00	4	±3	0.75
5	0.1	0.000	1	±0	0.00	1	±0	0.00
6	1.1	0.000	5	±3	0.60	4	±3	0.75
7	0.1	0.000	2	±8	4.00	2	±7	3.50
8	0.0	0.000	0	±0	0.00	0	±0	0.00
9	0.7	0.000	7	±3	0.43	6	±5	0.83
10	0.0	0.000	0	±0	0.00	0	±0	0.00
Phelps Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Chikamin Creek[1]								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Rock Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Unnamed Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Big Meadow Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Alder Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Brush Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Clear Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Y Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Grand Total	**0.5**	**0.000**	**65**	**±13**	**0.20**	**59**	**±21**	**0.36**

[1] Includes lower 0.2 miles of Minnow Creek.

Table 8. Estimated mean densities (fish/hectare and fish/m^3), total numbers, 95% confidence bounds on total numbers, and error of the estimated total number of juvenile bull trout (2-8 in) in reaches in the Chiwawa River basin, Washington, August 2012.

Reach	Mean density		Surface area (ha)			Volume (m^3)		
	Fish/ha	Fish/m^3	Total No.	95% C.B.	± Error	Total No.	95% C.B.	± Error
Chiwawa River								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
2	0.4	0.000	3	±3	1.00	4	±4	1.00
3	0.0	0.000	0	±0	0.00	0	±0	0.00
4	0.3	0.000	1	±0	0.00	2	±0	0.00
5	0.0	0.000	0	±0	0.00	0	±0	0.00
6	0.0	0.000	0	±0	0.00	0	±0	0.00
7	0.6	0.000	17	±19	1.12	21	±18	0.86
8	0.6	0.000	16	±16	1.00	16	±16	1.00
9	1.6	0.000	17	±0	0.00	19	±0	0.00
10	4.1	0.001	34	±9	0.26	30	±11	0.37
Phelps Creek								
1	200.0	0.075	14	±0	0.00	14	±0	0.00
Chikamin Creek[1]								
1	21.5	0.010	14	±24	1.71	15	±18	1.20
Rock Creek								
1	50.6	0.018	43	±11	0.26	40	±11	0.28
Unnamed Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Big Meadow Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Alder Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Brush Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Clear Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Y Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Grand Total	**1.2**	**0.000**	**159**	**±37**	**0.23**	**161**	**±34**	**0.21**

[1] Includes lower 0.2 miles of Minnow Creek.

Table 9. Estimated mean densities (fish/hectare and fish/m^3), total numbers, 95% confidence bounds on total numbers, and error of the estimated total number of adult bull trout (>8 in) in reaches in the Chiwawa River basin, Washington, August 2012.

Reach	Mean density		Surface area (ha)			Volume (m^3)		
	Fish/ha	Fish/m^3	Total No.	95% C.B.	± Error	Total No.	95% C.B.	± Error
Chiwawa River								
1	0.7	0.000	13	±5	0.38	16	±14	0.88
2	2.5	0.001	20	±7	0.35	21	±20	0.95
3	0.3	0.000	3	±0	0.00	5	±0	0.00
4	3.9	0.001	15	±7	0.47	14	±10	0.71
5	2.4	0.001	22	±4	0.18	24	±4	0.08
6	0.7	0.000	3	±0	0.00	4	±0	0.00
7	8.3	0.001	254	±71	0.28	236	±108	0.46
8	7.6	0.001	190	±58	0.31	188	±129	0.69
9	12.0	0.002	125	±15	0.12	142	±33	0.23
10	14.6	0.003	120	±19	0.16	110	±28	0.25
Phelps Creek								
1	28.6	0.011	2	±0	0.00	2	±0	0.00
Chikamin Creek[1]								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Rock Creek								
1	1.2	0.001	1	±0	0.00	1	±0	0.00
Unnamed Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Big Meadow Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Alder Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Brush Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Clear Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Y Creek								
1	0.0	0.000	0	±0	0.00	0	±0	0.00
Grand Total	**5.8**	**0.001**	**768**	**±96**	**0.13**	**763**	**±176**	**0.23**

[1] Includes lower 0.2 miles of Minnow Creek.

APPENDIX A. Numbers of redds, eggs, age-0 Chinook salmon, parr per redd, and percent egg-to-parr survival in the Chiwawa River basin, brood years 1991-2011; NS = not sampled. Numbers of eggs were calculated as the number of redds times the mean fecundity of females collected for broodstock.

Brood Year	Chinook Salmon			Parr/Redd	Egg-to-parr survival (%)
	Redds	Eggs	Age-0 (parr)		
1991	104	478,400	45,483	437	9.5
1992	302	1,570,098	79,113	262	5.0
1993	106	556,394	55,056	519	9.9
1994	82	485,686	55,240	674	11.4
1995	13	66,248	5,815	447	8.8
1996	23	106,835	16,066	699	15.0
1997	82	374,740	68,415	834	18.3
1998	41	218,325	41,629	1,015	19.1
1999	34	166,090	NS	NS	NS
2000	128	642,944	114,617	895	17.8
2001	1,078	4,984,672	134,874	125	2.7
2002	345	1,605,630	91,278	265	5.7
2003	111	648,684	45,177	407	7.0
2004	241	1,156,559	49,631	206	4.3
2005	332	1,436,564	79,902	241	5.6
2006	297	1,284,228	60,752	205	4.7
2007	283	1,256,803	82,351	291	6.6
2008	689	3,163,888	106,705	155	3.4
2009	421	1,925,233	128,220	305	6.7
2010	502	2,165,628	141,510	282	6.5
2011	492	2,157,420	103,940	211	4.8
Average	**272**	**1,259,575**	**75,289**	**265**	**5.7**

APPENDIX B. Estimated numbers of salmonids (based on fish/ha) in the Chiwawa River basin, Washington, 1992-2012; NS = not sampled.

Survey year	Chinook salmon		Steelhead/Rainbow			Bull trout	
	Age-0	Age-1+	Age-0	Age-1+	>8 in[1]	2-8 in	>8 in
1992[2]	45,483	563	4,927	2,533	1,869	299	208
1993	79,113	174	4,004	2,860	768	158	156
1994	55,056	18	1,410	5,856	67	90	76
1995	55,241	13	7,357	9,517	140	97	664
1996	5,815	22	4,245	11,849	78	79	343
1997	16,066	5	8,823	6,905	48	220	472
1998	68,415	63	3,921	10,585	78	300	900
1999	41,629	41	5,838	22,130	33	130	423
2000	NS	NS	NS	NS	NS	NS	NS
2001	114,617	69	45,727	10,623	420	505	542
2002	134,874	32	20,521	9,090	181	217	521
2003	91,278	134	18,020	6,179	49	196	282
2004	45,177	21	10,380	8,190	8	140	157
2005	49,631	79	11,463	6,188	48	125	346
2006	79,902	388	16,245	10,533	50	238	686
2007	60,752	41	14,073	8,448	77	95	520
2008	82,351	189	15,230	10,576	144	124	510
2009	106,705	54	17,179	5,629	85	82	618
2010	128,220	291	25,018	9,616	63	79	547
2011	141,510	967	39,446	14,903	65	86	621
2012	103,940	767	27,134	8,576	65	159	768

[1]During 1992-1993, numbers included both hatchery and wild rainbow trout. Thereafter, only wild trout were observed.
[2]Only the Chiwawa River was sampled in 1992. No tributaries were sampled in that year.

APPENDIX C. Proportion of total habitat available, fraction of all age-0 Chinook within each habitat type, and densities (fish/ha) and numbers of age-0 Chinook within each habitat type in the Chiwawa River basin, survey years 1992-2012; NS = not sampled.

Habitat	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Proportion of total habitat available											
Glide	0.10	0.09	0.10	0.10	0.10	0.09	0.09	0.09	NS	0.07	0.08
Pool	0.19	0.19	0.21	0.18	0.18	0.17	0.16	0.17	NS	0.15	0.16
Riffle	0.61	0.61	0.57	0.59	0.57	0.57	0.58	0.55	NS	0.49	0.48
M. Chan	0.10	0.11	0.12	0.14	0.14	0.17	0.17	0.19	NS	0.29	0.28
Fraction of all age-0 Chinook within habitat types											
Glide	0.07	0.03	0.02	0.01	0.02	0.01	0.01	0.01	NS	0.03	0.01
Pool	0.30	0.28	0.22	0.21	0.30	0.16	0.17	0.14	NS	0.23	0.24
Riffle	0.19	0.16	0.12	0.11	0.43	0.23	0.08	0.11	NS	0.18	0.15
M. Chan	0.45	0.53	0.64	0.67	0.24	0.60	0.74	0.74	NS	0.57	0.60
Densities of age-0 Chinook within habitat types (fish/ha)											
Glide	254	251	93	55	11	12	78	13	NS	351	187
Pool	584	1,049	619	541	82	122	607	257	NS	1,392	1,468
Riffle	116	188	124	91	38	52	79	62	NS	336	300
M. Chan	1,710	3,408	2,985	2,328	84	449	2,620	1,201	NS	1,820	2,069
Number of age-0 Chinook within habitat types											
Glide	2,967	2,458	857	623	137	130	837	157	NS	3,231	1,931
Pool	13,468	21,814	12,131	11,294	1,755	2,553	11,454	5,933	NS	25,890	32,612
Riffle	8,531	12,616	6,698	6,197	2,525	3,699	5,392	4,626	NS	20,629	19,754
M. Chan	20,517	42,225	35,370	36,965	1,396	9,682	50,728	30,912	NS	64,866	80,576

APPENDIX C. Concluded.

Habitat	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Mean
Proportion of total habitat available											
Glide	0.07	0.07	0.08	0.08	0.07	0.09	0.08	0.08	0.08	0.07	**0.08**
Pool	0.17	0.16	0.16	0.16	0.17	0.23	0.22	0.23	0.18	0.23	**0.18**
Riffle	0.49	0.50	0.47	0.47	0.47	0.51	0.54	0.53	0.57	0.53	**0.53**
M. Chan	0.26	0.27	0.29	0.30	0.29	0.17	0.15	0.16	0.17	0.17	**0.21**
Fraction of all age-0 Chinook within habitat types											
Glide	0.02	0.01	0.01	0.03	0.02	0.03	0.02	0.02	0.04	0.01	**0.02**
Pool	0.23	0.07	0.19	0.31	0.46	0.40	0.36	0.34	0.34	0.41	**0.29**
Riffle	0.15	0.14	0.07	0.12	0.12	0.11	0.11	0.11	0.19	0.15	**0.14**
M. Chan	0.60	0.77	0.73	0.54	0.40	0.45	0.51	0.53	0.43	0.43	**0.55**
Densities of age-0 Chinook within habitat types (fish/ha)											
Glide	200	58	49	237	113	238	230	286	526	173	**171**
Pool	951	155	492	1,240	1,211	1,210	1,453	1,436	1,805	1,360	**948**
Riffle	216	101	60	166	118	156	175	200	330	221	**158**
M. Chan	1,626	1,008	1,057	1,147	603	1,872	2,993	3,293	2,515	2,061	**1,676**
Number of age-0 Chinook within habitat types											
Glide	1,884	540	442	2,498	1,120	2,668	2,371	3,164	6,122	1,535	**1,784**
Pool	21,091	3,183	9,626	26,754	28,851	34,314	39,382	44,765	48,846	42,209	**21,896**
Riffle	13,783	6,501	3,367	10,753	7,809	9,773	11,558	14,446	27,883	15,418	**10,598**
M. Chan	54,519	34,952	36,196	46,580	25,409	38,275	55,607	69,609	61,944	44,779	**42,055**

Appendix B

Fish Trapping at the Chiwawa and Upper Wenatchee Smolt Traps during 2012

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
FISH PROGRAM -SCIENCE DIVISION
SUPPLEMENTATION RESEARCH TEAM
3515 Chelan HWY, Wenatchee, WA 98801
Voice (509) 664-3148 FAX (509) 662-6606

February 21, 2013

To: HCP Hatchery Committee

From: John Walter, Ben Truscott, Andrew Murdoch and Todd Miller

Cc: Distribution List

Subject: 2012 Chiwawa and Wenatchee River Smolt Estimates

Smolt monitoring programs in the Wenatchee Basin were intended to estimate the number of naturally produced migrating smolts at either the subbasin (e.g., Chiwawa River) or watershed scale (e.g., Wenatchee River Basin) depending on the target stock (Table 1). In addition, population estimates of hatchery sockeye emigrating from Lake Wenatchee were used to calculate post release survival (i.e., subyearling parr to yearling smolt). The size of smolt traps operated was determined by water depth and river discharge at each of the locations. The number of smolt traps operated was determined by the expected trap efficiency. Smolt traps were located downstream from all (i.e., Chiwawa spring Chinook, Wenatchee spring Chinook, and Wenatchee sockeye), or the majority (i.e., Wenatchee summer Chinook and Wenatchee steelhead) of the spawning areas (Figure 1).

Table 1. Target stocks and corresponding smolt trapping locations used in 2012.

Stock	Smolt trap location	Smolt trap	
		Number	Diameter (m)
Chiwawa spring Chinook	Chiwawa	1	2.6
Wenatchee sockeye	Upper Wenatchee	2	1.5
Wenatchee spring Chinook [a]	Monitor (Lower Wenatchee)	2	2.6
Wenatchee summer Chinook [a]	Monitor (Lower Wenatchee)	2	2.6
Wenatchee steelhead [a]	Monitor (Lower Wenatchee)	2	2.6

[a] Trap did not operate in 2012

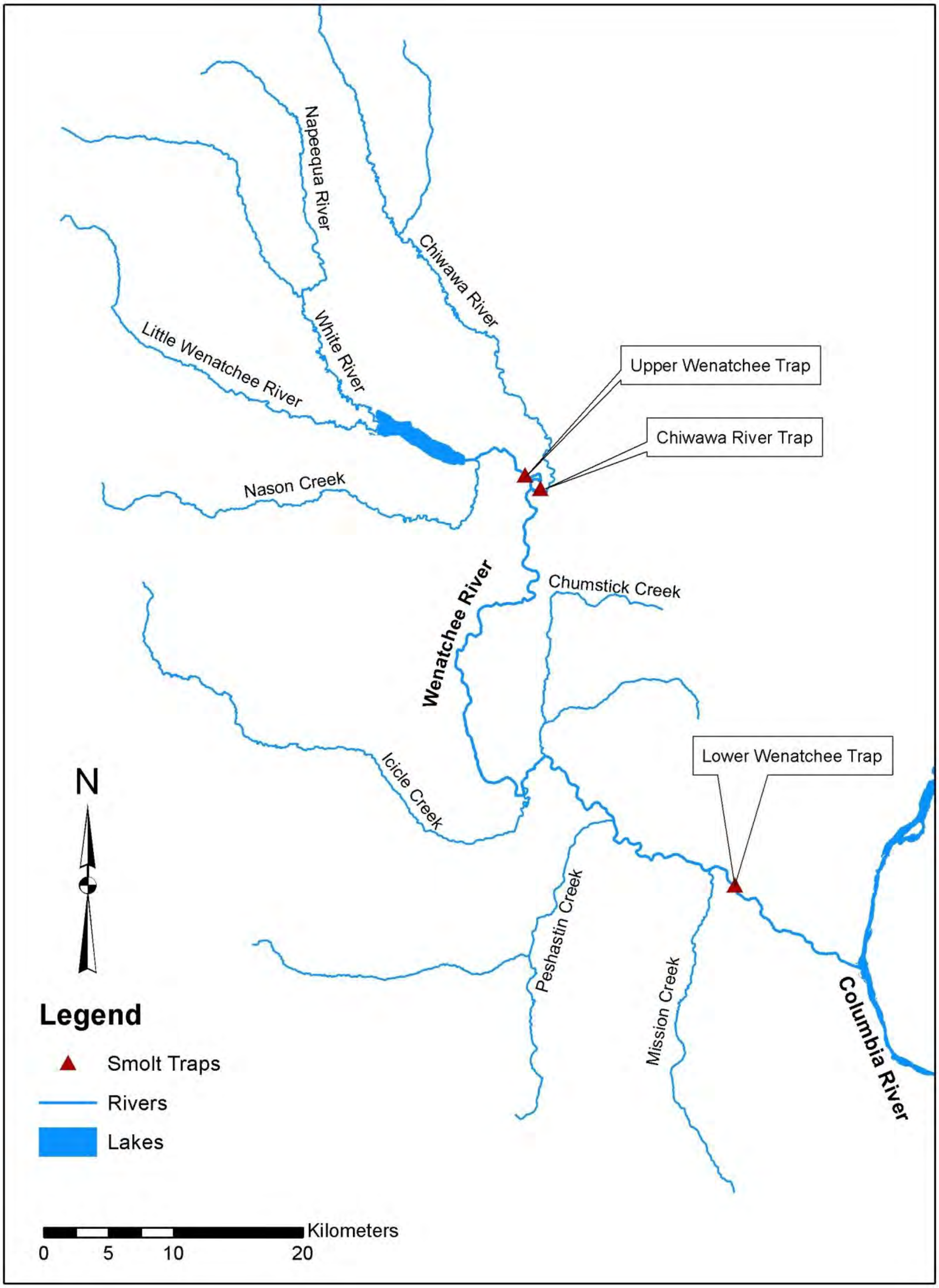


Figure 1. Locations of the Upper Wenatchee, Chiwawa, and Lower Wenatchee River smolt traps.

Methods

Fish were removed from the trap at a minimum every morning and placed in an anesthetic solution of MS-222. Fish were identified to species and counted. Non-target species were allowed to fully recover in fresh water prior to being released in an area of calm water downstream from the smolt trap. Target species were held in separate live boxes when needed for mark/recapture efficiency trials conducted in the evening.

Fork length was measured to the nearest millimeter and weight to the nearest 0.1 g. A Fulton type condition factor ($WH10^5/FL^3$) was calculated for all target species. The degree of smoltification (parr, transitional, or smolt) was assessed by visual examination. Juvenile spring Chinook and steelhead were classified as parr if parr marks were distinct, transitional if parr marks were not distinct, and smolts if parr marks were not visible and the fish exhibited a silvery appearance.

Mark/recapture efficiency trials were conducted throughout the trapping season. The frequency of mark/recapture trials was dependent on the number of fish captured (i.e., no less than 100) and the river discharge. These trials were conducted over the widest range of discharge possible (interval depends on trap location). Fish utilized for mark/recapture trials were marked by clipping the tip of either the upper or lower lobe of the caudal fin or were PIT tagged by Chelan County PUD (CCPUD) personnel. Chinook fry (i.e., FL < 50 mm) used in mark/recapture trials were dyed using a Bismark brown solution. Marked fish were distributed evenly on both sides of the river in pools or in calm pockets of water around boulders. Marked fish were released between 1800 h and 2000 h. All recaptures of marked fish typically occurred within 48 h after each trial. Emigration estimates were calculated using estimated daily trap efficiency derived from the regression formula using trap efficiency (dependent variable) and discharge (independent variable). In past years the Peterson estimator of population was used (Seber 1982; 59). For the 2011 brood year and 2010 brood year spring Chinook, at the Chiwawa Trap, the Bailey estimator was used (Bailey 1951).

Peterson Population and Variance Equations

Trap efficiency was calculated using the following formula:

$$\text{Trap efficiency} = E_i = R\ / Mi_{,}$$

Where E_i is the trap efficiency during time period i; M_i is the number of marked fish released during time period i; and R_i is the number of marked fish recaptured during time period i. The number of fish captured was expanded by the estimated daily trap efficiency (e) to estimate the daily number of fish migrating past the trap using the following formula:

$$\text{Estimated daily migration} = \hat{N}_i = C_i / \hat{e}_i$$

where N_i is the estimated number of fish passing the trap during time period i; C_i is the number of unmarked fish captured during time period i; and e_i is the estimated trap efficiency for time period i based on the regression equation.

The variance for the total daily number of fish migrating past the trap was calculated using the following formulas:

$$\text{Variance of daily migration estimate} = \text{var}\left[\hat{N}_i\right] = \hat{N}_i^2 \frac{\text{MSE}\left(1 + \frac{1}{n} + \frac{\left(X_i - \overline{X}\right)^2}{\left(n-1\right)s_X^2}\right)}{\hat{e}_i^2}$$

where X_i is the discharge for time period i, and n is the sample size. If a relationship between discharge and trap efficiency was not present (i.e., $P < 0.05$; r^2 ~0.5), a pooled trap efficiency was used to estimate daily emigration:

$$\text{Pooled trap efficiency} = e_p = \sum R / \sum M$$

The daily emigration estimate was calculated using the formula:

$$\text{Daily emigration estimate} = \hat{N}_i = C_i / e_p$$

The variance for daily emigration estimates using the pooled trap efficiency was calculated using the formula:

$$\text{Variance for daily emigration estimate} = \text{var}\left[\hat{N}_i\right] = \hat{N}_i^2 \frac{e_p(1-e_p)/\sum M}{e_p^2}$$

The total emigration estimate and confidence interval was calculated using the following formulas:

$$\text{Total emigration estimate} = \sum \hat{N}_i$$

$$95\%\ \text{confidence interval} = 1.96 \times \sqrt{\sum \text{var}}\left[\hat{N}_i\right]$$

Bailey Population and Variance Equations

Trap efficiency was calculated using the following formula:

$$\text{Trap efficiency} = E_i = R+1\ /\ Mi,$$

$$\text{Estimated daily emigration} = \hat{N}_i = \frac{C_i + 1}{\hat{e}_i}$$

The variance of the total population abundance was calculated as follows:

$$Var\left(\sum_{i=1}^{n} \hat{N}_i\right) = \underbrace{\sum_i Var\left(\frac{(C_i+1)}{\hat{e}_i}\right)}_{Part\ A} + \underbrace{\sum_i \sum_j Cov\left(\frac{(C_i+1)}{\hat{e}_i}, \frac{(C_j+1)}{\hat{e}_j}\right)}_{Part\ B}$$

Part A is the variance of the daily estimates where C_i is the number of fish caught in period *i*, e_i is the estimated trap efficiency for period *i*, and *Cov* is the between day covariance for days that the same linear model is used (part B). For a more detailed explanation and derivation of Peterson and Bailey estimation methods see Murdoch et al. (2012).

Results

Chiwawa River Smolt Trap

The Chiwawa River smolt trap was located approximately 1 km upstream from the confluence with the Wenatchee River. The smolt trap operated between 25 February and 29 November. During that time period the trap was inoperable for 14 days as a result of high river flows, debris, snow/ice, or mechanical failure. During breaks in operation, the estimated number of Chinook captured was calculated from the mean number of fish captured two days prior and two days after the break in operation. The trap was operated in two positions dependent on river discharge (i.e., lower > 12 m^3/s and upper < 12 m^3/s). Daily trap efficiencies were estimated from four regression models (independent variable = discharge) depending on trap position and age class (i.e., lower and upper position subyearling and lower and upper position yearling Chinook).

2010 Brood Year

Wild yearling spring Chinook (2010 brood) were primarily captured between 25 March and 7 July (Figure 2). A total of 7,626 yearling Chinook were captured (Appendix A) and an estimated 8,174 yearling Chinook would have been captured if the trap had operated without interruption. Mortality for the season totaled 78 yearling spring Chinook (1 %). Ten mark/recapture efficiency trials were conducted in the lower position with a mean (SD) trap efficiency of 13.49 (0.08) %. Five trials were conducted in the upper position with a mean (SD) trap efficiency of 35.26 (0.06) %. In 2012, mark/recapture trials were conducted at all desired discharge levels and a statistically significant flow-efficiency regression model was obtained for the lower position, however, an upper position in-year regression was not obtained and trials from previous years were included. The 2012 regression models for the lower position ($R^2 = 0.63$, $P < 0.05$) and upper position ($R^2 = 0.80$, $P < 0.01$) were used to estimate yearling Chinook emigration. The estimated number (95% C.I.) of yearling Chinook that emigrated from the Chiwawa River in 2012 was 47,511 (±9,363).

2011 Brood Year

Wild subyearling spring Chinook were captured between 25 February and 29 November, with major peaks occurring in August, September, and October (Figure 2). A total of 14,831 subyearling Chinook were captured and an estimated 15,091 subyearling Chinook would have been captured if the trap had operated without interruption (Figure 2). Mortality for the season totaled 69 subyearling spring Chinook (0.5%). Thirteen mark/recapture efficiency trials were conducted with a mean (SD) trap efficiency of 17.0 (0.10) %, which resulted in a significant regression model (i.e., upper trap position; $R^2 = 0.84$, $P < 0.01$). However, subyearling Chinook were also captured while the trap was operated in the lower position. Hence, a separate regression model from combined years of 2002 and 2003 was used for that time period ($R^2 = 0.63$, $P < 0.01$). In 2012, the estimated number of subyearling spring Chinook (excluding fry < 50 mm FL) that moved downstream of the Chiwawa River smolt trap during the sampling period was 67,982 (± 11,382).

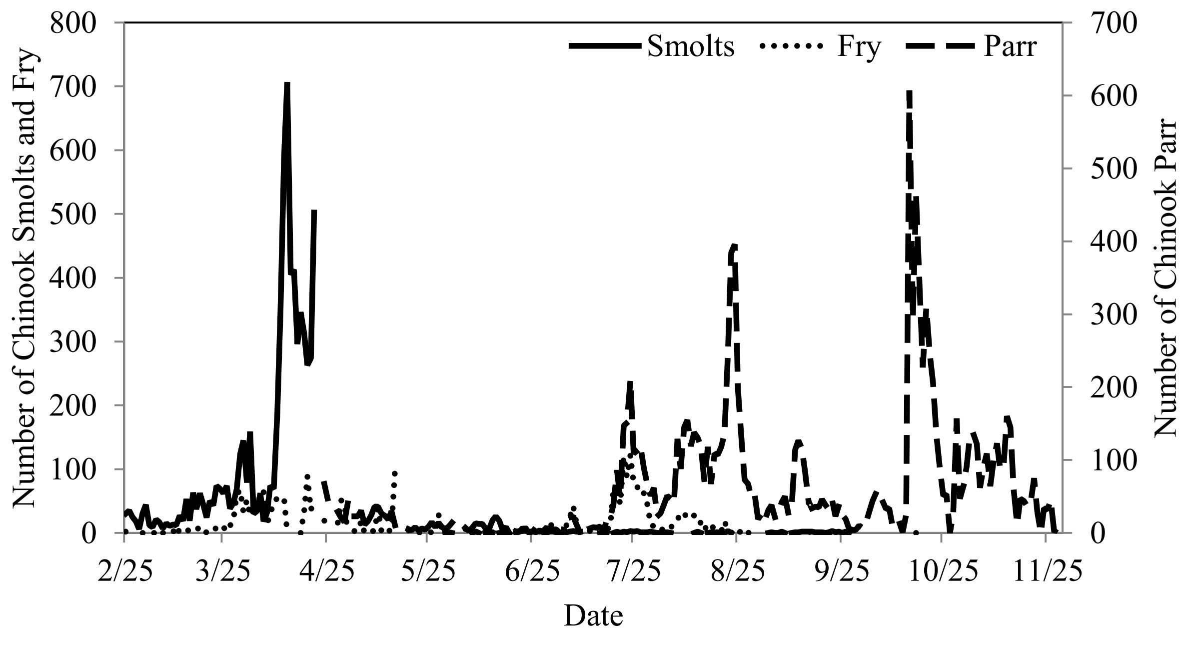


Figure 2. Daily number of spring Chinook smolts, parr, and fry captured at the Chiwawa River smolt trap in 2012.

Subyearling Fry and Over Winter Parr Movement

The proportion of subyearling Chinook that were captured and classified as fry was lower in 2012 (19%) than 2011 (52%) or 2010 (58%). Fry have not been included in our estimate of subyearling emigrants because previously reported data suggests fry capture is a result of displacement, not emigration, due to the inability of fry to maintain their position in the water column and the interaction of water temperature and discharge levels. Abundance of fry captured was also related to the redd abundance within close proximity to the trap site (Walter et al. 2011). Additionally, Hillman and Miller (2002) reported large numbers of subyearling Chinook in areas of the Chiwawa River where no spawning had been reported. These data suggest considerable movement of subyearling Chinook during summer rearing.

As part of a separate study, funded through the McNary Mitigation Fund, WDFW conducted remote tagging and capture of subyearling Chinook during September and October. The purpose of this study is to evaluate winter migration by developing a flow-based regression model at the Lower Chiwawa River instream PIT tag antenna array (CHL). The regression model will provide an estimate of winter migration and possible over-winter survival in the Chiwawa River. In order to estimate migration, PIT tag detections at CHL are expanded by a tag rate developed using Chinook parr abundance estimates from summer parr snorkel surveys conducted by BioAnalysts (BioAnalysts 2012, unpublished data). A total of 3,547 subyearling Chinook were captured and 3,181 PIT tags were applied. An attempt was made to distribute the tags throughout the basin to match the distribution of Chinook based on snorkel surveys during the month of August (Figure 3). Development of the regression model is ongoing and results will be presented when analysis is completed.

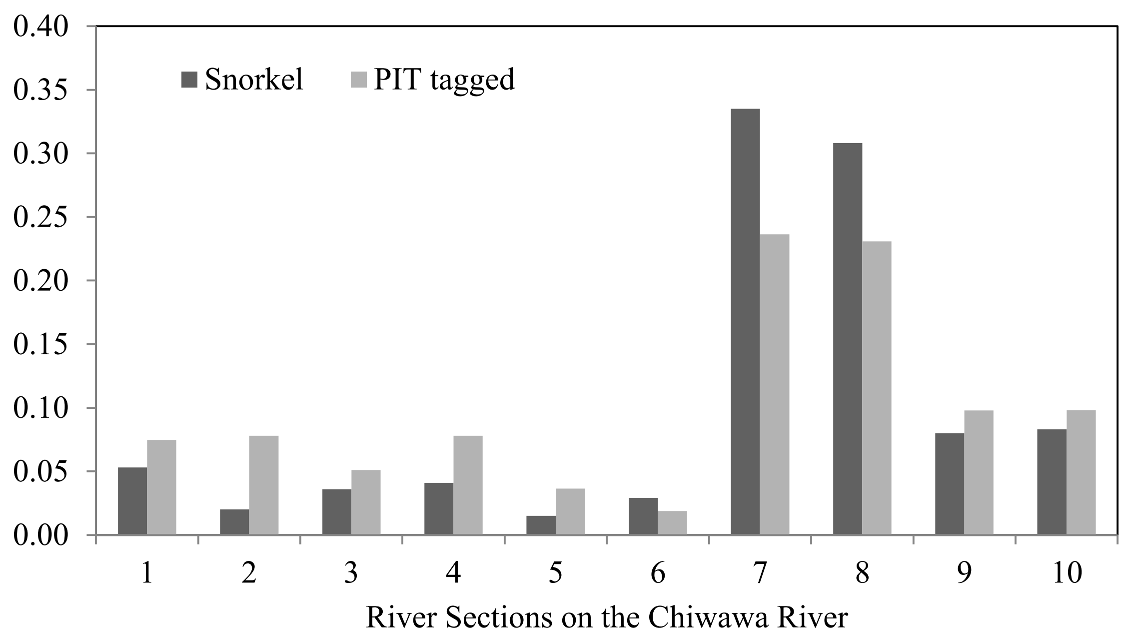


Figure 3. Distribution by reach of both Chinook parr based on snorkel surveys and PIT tagged parr in the Chiwawa River.

Emigrant Survival

The estimated total egg deposition was calculated by multiplying the mean fecundity of the 2010 brood spawners by the total number of redds found during surveys in the Chiwawa River basin in 2011 (WDFW personal communication). Egg-to-emigrant survival was calculated by dividing the estimated egg deposition by the total number of subyearling (excluding fry) that emigrated in

2011 and yearling spring Chinook that emigrated in 2012. The estimated egg-to-emigrant survival for the 2010 brood Chiwawa spring Chinook was 4.7% (Table 2).

Table 2. Estimated egg deposition (# of redds x mean broodstock fecundity) and egg-to-emigrant survival rates for Chiwawa River spring Chinook salmon.

Brood year	Number of redds	Estimated egg deposition	Estimated number			Egg-to-emigrant survival (%)
			Subyearling	Yearling	Total emigrants	
1992	302	1,570,098	25,818	39,723	65,541	4.2
1993	106	556,394	14,036	8,662	22,698	4.1
1994	82	485,686	8,595	16,472	25,067	5.2
1995	13	66,248	2,121	3,830	5,951	9.0
1996	23	106,835	3,708	15,475	19,183	18.0
1997	82	374,740	16,228	28,334	44,562	11.9
1998	41	207,675	2,855	23,068	25,923	11.9
1999	34	166,090	4,988	10,661	15,649	9.4
2000	128	642,944	14,854	40,831	55,685	8.7
2001	1,078	4,836,704	459,784	86,482	546,266	11.0
2002	345	1,605,630	93,331	90,948	184,279	11.5
2003	111	648,684	16,881	16,755	33,637	5.2
2004	241	1,156,559	44,079	72,080	116,158	10.0
2005	333	1,436,564	108,595	69,064	177,659	12.3
2006	297	1,284,228	62,922	45,050	107,972	8.4
2007	283	1,241,521	60,196	25,809	86,006	6.9
2008	689	3,163,199	85,161	35,023	120,184	3.8
2009	421	1,925,233	30,996	30,959	61,955	3.2
2010[a]	502	2,165,628	53,619	47,511	101,130	4.7
2011[a]	491	2,115,228	67,982	--	--	--

[a] calculated with Bailey model

Refinement of Variance Calculation

Smolt abundance and variance calculation methods were investigated and compared by Murdoch et al. (2012) after data showed the previous methods employed may have been incorrect. The study revised the total variance estimator based on the inclusion of the covariance between daily totals, process error of daily catches and the arcsine, square root transformation of the efficiency (Murdoch et al. 2012; Ryding 2000). The 2011 and 2010 brood years have been estimated with the newly derived estimators, however, until the study has been peer reviewed recalculation of all previous years estimates would be presumptive.

Length and Weight

Individual length and weight measurements were recorded from a sample of the daily catch. The mean fork length (SD) of captured yearling and subyearling Chinook (fry excluded) was 90 (7) mm and 75 (10) mm, respectively (Table 3).

Table 3. Mean fork lengths (mm), weights (g), and body condition factor of spring Chinook salmon captured in the Chiwawa River smolt trap during 2012.

	Yearling smolts			Subyearling parr		
	Mean	SD	*N*	Mean	SD	*N*
Fork length	90	7	7,389	75	10	8,858
Weight	8.0	2.6	7,290	4.8	2.2	8,756
K factor	1.06	0.24	7,290	1.13	0.28	8,756

Nontarget Salmonids

During the trapping period, 183 steelhead smolts and 1,738 steelhead/rainbow parr were captured. Mortality for the season totaled 15 steelhead juveniles (0.78%). The mean fork length (SD) of steelhead parr and smolts captured was 78 (35) mm and 161 (27) mm, respectively (Table 4). Bull trout also comprised a large proportion of incidental species captured. During the trapping period, 31 adult (i.e., >300 mm) and 488 juvenile bull trout were captured (Table 5). Mortality for the season totaled 1 juvenile bull trout (0.19%). The total number of steelhead and bull trout that emigrated from the Chiwawa River was not calculated due to the low numbers of fish captured during the sampling period. The monthly totals of all fish captured are presented in Appendix A.

Table 4. Mean fork lengths (mm), weights (g), and body condition factor of steelhead/rainbow parr and steelhead smolts captured in the Chiwawa River smolt trap during 2012.

	Parr			Smolts		
	Mean	SD	*N*	Mean	SD	*N*
Fork length	78	35	1,551	161	27	117
Weight	9.0	16.3	1,505	44.4	20.4	116
K factor	1.06	0.22	1,505	0.99	0.08	116

Table 5. Mean fork lengths (mm), weights (g), and body condition factor of bull trout captured in the Chiwawa River smolt trap during 2012. Weights were not measured on adults.

	Juvenile			Adult		
	Mean	SD	*N*	Mean	SD	*N*
Fork length	181	37	483	473	79	31
Weight	71.0	37.6	313	--	--	--
K factor	0.97	0.15	313	--	--	--

Upper Wenatchee River Smolt Trap

The Upper Wenatchee River smolt trap was relocated to rkm 81 or 5.3 km downstream from the previous trapping site. All permits were finalized by 28 March and the trap was installed on 30 March. The trap was operated between 31 March and 5 September 2012 until low discharge levels prevented the trap from operating. During that time period the trap was not operated for a total of 11 days due to high discharge levels and debris loads. The trap was operated again for three days in October when discharge levels increased but fish capture was low and it was decided to cease operation for the year. The trap was removed from the river on 28 October. A total of 603 wild and 45 hatchery sockeye were captured during the trapping period (Figure 4). Mortality during the season totaled. The trap also captured 88 wild spring Chinook smolts, 166 wild juvenile steelhead, and 1,107 steelhead/rainbow fry. Mortality totaled 7 wild sockeye (1.2%), 2 wild yearling Chinook (2.3%), 2 wild steelhead (1.2%) and 3 steelhead/rainbow fry (0.3%). The monthly totals of all fish captured are presented in Appendix B.

Due to lower than expected sockeye capture only one mark/recapture trial was carried out and no fish were recaptured during the trial. Another subyearling Chinook trial was conducted but recapture was also zero. Due to the lack of a successful mark/recapture trial, and associated trap efficiency, no wild sockeye production estimate was calculated for the 2012 migration. Scale samples were analyzed for the 2011 migration and the original estimate from 2011 was finalized (Tables 6 and 7).

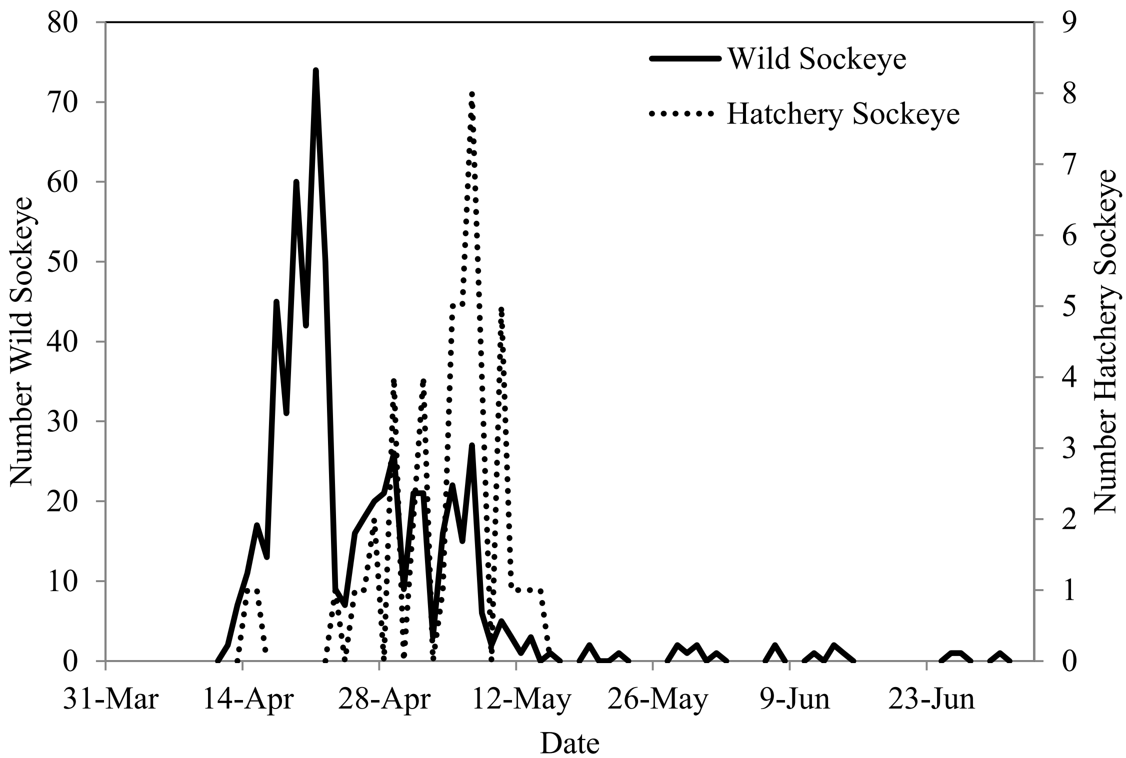


Figure 4. Number of wild and hatchery sockeye captured at the Upper Wenatchee River smolt trap, 2012.

Table 6. Age composition derived from scale samples and estimated number of wild sockeye smolts emigrating from Lake Wenatchee.

Run year	Proportion of wild smolts			Total emigrants
	Age 1+	Age 2+	Age 3+	
1997	0.075	0.906	0.019	55,359
1998	0.955	0.037	0.008	1,447,259
1999	0.619	0.381	0.000	1,944,966
2000	0.599	0.400	0.001	985,490
2001	0.943	0.051	0.006	39,353
2002	0.961	0.039	0.000	729,716
2003	0.740	0.026	0.000	5,439,032
2004	0.929	0.071	0.000	5,771,187
2005	0.230	0.748	0.022	723,413
2006	0.994	0.006	0.000	1,266,971
2007	0.996	0.004	0.000	2,797,313
2008	0.804	0.195	0.001	549,682
2009[b]	0.927	0.073	0.000	355,549
2010[b]	0.963	0.036	0.001	3,958,888
2011	0.786	0.214	0.000	1,500,730
2012[a]	0.700	0.30	0.000	NA

[a] No estimate available and ages have not been confirmed with scale analysis.
[b] estimates refined based on PIT tag survival to McNary Dam

Table 7. Estimated egg deposition (mean fecundity x estimated # of females) and egg-to-emigrant survival rates for Lake Wenatchee sockeye salmon.

Brood year	Estimated egg deposition	Estimated number of wild smolts				Egg-to-smolt survival (%)
		Age 1+	Age 2+	Age 3+	Total	
1995	4,902,120	4,174	53,549	0	57,723	1.2
1996	10,035,288	1,382,133	741,032	985	2,124,150	21.2
1997	13,223,588	1,203,934	394,196	236	1,598,366	12.1
1998	5,692,106	590,309	2,007	0	592,316	10.4
1999	1,188,488	37,110	28,459	0	65,569	5.5
2000	30,506,949	701,257	1,378,795	0	2,080,052	6.8
2001	64,187,600	4,024,884	409,754	15,915	4,450,553	6.9
2002	49,197,456	5,361,433	541,113	0	5,902,546	12.0
2003	7,576,738	166,385	7,602	0	173,987	2.3
2004	38,749,845	1,259,369	11,189	275	1,270,833	3.3
2005	15,946,506	2,786,123	107,243	0	2,893,366	18.1
2006[b]	7,296,032	442,164	25,919	1,507	469,590	6.4
2007[b]	6,232,804	329,629	142,916	594	473,139	7.6
2008[b]	30,084,691	3,814,226	320,567	0	4,134,794	13.74
2009[a]	9,684,965	1,179,569	--	--	--	--
2010[a,c]	33,226,220	--	--	--	--	--

[a] Incomplete brood year.
[b] estimates refined based on PIT tag survival to McNary Dam
[c] no estimate available

Table 8. Release-to-smolt survival rates for Lake Wenatchee hatchery sockeye.

Brood year	Releas e year	Run year	Number of fish released	Fork length (mm) at release (SD)	Date of release	Number of fish captured	Estimated number of smolts	Release to smolt survival
1995	1996	1997	150,808	106 (6)	25 Oct	130	28,828	19.1%
1996	1997	1998	284,630	107 (7)	22 Oct	279	55,985	19.8%
1997	1998	1999	197,195	122 (7)	09 Nov	586	112,524	57.1%
1998	1999	2000	121,344	112 (8)	29 Oct	66	24,684	20.3%
1999	2000	2001	84,466	94 (9)	28 Aug	319	30,326	35.9%
1999	2000	2001	83,489	134 (15)	01 Nov	548	63,720	76.3%
2000	2001	2002	92,055	123 (8)	27 Aug	142	30,918	33.6%
2000	2001	2002	98,119	146 (12)	27 Sept	416	90,593	92.3%
2001	2002	2003	96,486	118 (9)	28 Aug	162	36,484	37.8%
2001	2002	2003	104,452	135 (9)	23 Sept	465	103,838	99.4%
2002	2003	2004	98,509	73 (5)	16 Jun	31	5,192	4.4%
2002	2003	2004	104,855	118 (9)	25 Aug	376	98,412	85.9%
2002	2003	2004	112,419	145 (14)	22 Oct	292	112,419	100.0%
2003	2004	2005	32,755	79 (4)	15 Jun	0	0	0.0%
2003	2004	2005	104,879	118 (7)	25 Aug	229	19,574	18.7%
2003	2004	2005	102,825	158 (13)	03 Nov	1,185	102,825	100.0%
2004	2005	2006	81,428	116 (7)	29 Aug	1,500	159,500	92.2%
2004	2005	2006	91,495	151 (7)	02 Nov			
2005	2006	2007	140,542	149 (14)	30 Oct	516	140,542	100.0%
2006[a]	2007	2008	225,670	138 (15)	31 Oct	1,367	121,843	54.0%
2007[a]	2008	2009	252,133	137 (7)	29 Oct	263	119,908	47.6%
2008[a]	2009	2010	154,772	138 (13)	28 Oct	1,909	126,326	81.3%
2009	2010	2011	227,743	145 (13)	27 Oct	3,017	159,089	69.9%
2010[b]	2011	2012	241,918	132(19)	26 Oct	45		

[a] Estimates were refined based on the relative PIT tag survival rates to McNary Dam
[b] No estimate available

Lower Wenatchee River Smolt Trap

The Lower Wenatchee River smolt trap was previously located at the West Monitor Bridge (rkm 9.6). The trap did not operate during the 2011 or 2012 sampling years. CCPUD has completed construction and site preparation for a new Lower Wenatchee River smolt trap site at rkm 13.4. Trap operations at this site began in February 2013.

Discussion

Chiwawa River Smolt Trap

Two separate regression models were used to estimate the 2010 brood yearling spring Chinook migration. From 29 February to 9 April, when low discharge levels prevented the cone from being lowered fully, an "upper" position daily migration was estimated using a 2012, 2002, and 2001 combined regression. When river discharge levels increased the cone was moved to the "lower" position and an in-year (2012 mark groups only) flow regression was obtained. The yearling estimate accounted for 46% of the total emigration for the 2010 brood year (Table 2).

The 2011 brood subyearling Chinook estimate also was calculated using two separate regressions. No mark-recapture trials were conducted in 2012 for subyearling Chinook while operating in the lower position due to low numbers of subyearling Chinook captured (0.99% of total 2012 subyearling capture). The lower position regression used 2002 and 2003 data sets. The majority of the migration occurred from 1 July to 29 November, while operating in the upper position. During this time period an in-year upper position regression was obtained. The first 17 days of trapping in the upper position (1–17 July) occurred at higher than normal discharge ranges (1393–2400 cfs) where trap efficiencies are low (0.7–4.5%). As a result, 97% of the variance for the upper position estimate occurred within this time period, contributing to the higher than usual 95% confidence interval (±11,382).

Additional studies are in progress examining subyearling fry migration, subyearling parr movement and over-winter survival rates. Remote tagging and antenna array infrastructure provide opportunities to evaluate migration of fish when smolt trapping cannot (i.e., high discharge and winter weather conditions). As well, continued validation of our estimation methods, population estimates, and variance calculations are in process of publication and peer review. These studies, receiving funding from other sources, compliment the ongoing monitoring and evaluation of juvenile wild and hatchery salmonid propagation within the Wenatchee basin, funded by the Chelan County PUD.

Upper Wenatchee River Smolt Trap

Trapping did not begin until 31 March at the new Upper Wenatchee River smolt trap site due to delays in obtaining necessary permits. In previous years trapping began on 1 March. It is reasonable to assume that some fish migrated prior to trapping operations in 2012. Sockeye capture was low for 2012. It is unknown whether this was due to low trap efficiency, trap avoidance, or poor egg-to-fry survival potentially caused by high discharge events on the spawning grounds during incubation. Due to low capture numbers, no successful mark-recapture trials were obtained. Therefore, no population estimate of wild or hatchery sockeye was calculated in 2012. Based on PIT tags, hatchery survival (SE) from release to McNary Dam was 0.30 (0.05), consistent with the previous 5 year average of 0.30. These data suggest lake rearing and migration conditions were similar to previous years. For the upcoming 2013 season the trap will be operated in the same location and efficiency trials will be a priority. If an efficiency model is obtained, that model will be applied to the 2012 data set.

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Appendix A. Monthly total juvenile capture information for the Chiwawa River smolt trap.

					2012						
Species/Origin	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Chinook											
Wild yearling	114	1335	5403	510	194	35	10	25	0	0	7626
Wild subyearling	8	284	907	227	148	2472	3925	1198	3670	1992	14831
Hatchery yearling	0	1	29253	1496	0	0	1	0	0	0	30751
Steelhead											
Wild											
Smolt	0	0	117	47	11	4	4	0	0	0	183
Parr	4	16	157	237	155	54	147	187	527	254	1738
Hatchery	0	0	11	1626	16	1	1	4	3	2	1664
Coho											
Wild yearling	0	0	0	0	0	0	0	0	1	0	1
Wild subyearling	0	0	0	0	0	0	0	0	0	0	0
Hatchery yearling	0	0	3	0	0	0	0	0	0	0	3
Bull trout											
Juvenile	2	13	39	50	35	21	10	58	183	77	488
Adult	0	0	0	0	0	0	1	23	7	0	31
Cutthroat	0	1	0	1	1	4	26	22	4	1	60
Eastern brook	0	0	0	0	3	2	1	0	57	3	66
Whitefish	0	9	7	1	7	148	1946	1152	14	13	3297
Northern pikeminnow	0	0	0	0	0	5	23	6	0	0	34
Longnose dace	2	1	69	160	224	269	73	716	229	19	1762
Sucker spp.	0	0	0	0	0	0	0	0	0	0	0
Redside shiner	0	0	0	0	0	0	0	0	0	0	0
Yellow perch	0	0	0	0	0	0	0	1	0	0	1
Sculpin spp.	4	3	1	9	6	2	40	63	25	7	157

Appendix B. Monthly total juvenile capture information for the Upper Wenatchee River smolt trap.

	2012									
Species/Origin	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
Chinook										
Wild yearling	3	54	18	5	3	5	0			88
Wild subyearling	21	844	2,817	1,131	121	44	0			4978
Hatchery yearling	0	0	0	7	0	0	0			7
Steelhead										
Wild	1	55	21	78	729	344	9			1237
Smolt	0	4	0	1	0	0	0			5
Parr	1	51	21	16	11	25	2			127
Fry	0	0	0	61	718	319	7			1105
Hatchery	0	1	61	3	0	0	0			65
Sockeye										
Wild	0	424	154	10	1	13	1			603
Hatchery	0	7	38	0	0	0	0			45
Coho										
Wild yearling	0	3	0	1	0	0	0			4
Wild subyearling	0	59	1	1	0	0	0			61
Hatchery yearling	2	101	87	13	0	0	0			203
Bull trout										
Juvenile	0	0	0	0	0	0	0			0
Adult	0	0	0	0	0	0	0			0
Cutthroat	0	0	0	0	0	0	0			0
Lake Chub	0	0	21	3	8	9	0			41
Whitefish	0	0	0	0	0	0	0			0
Northern pikeminnow	0	0	0	0	0	0	0			0
Longnose dace	0	0	0	0	0	0	0			0
Sucker spp.	0	0	0	0	0	0	0			0
Redside shiner	0	0	0	0	0	0	0			0
Yellow perch	0	0	0	0	0	0	0			0
Sculpin spp.	1	4	5	7	15	72	1			105

Appendix C. Yearly total juvenile capture information for the Chiwawa River smolt trap.

Species origin	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
Chinook														
Wild yearling	4,848	6,482	3,765	8,711	4,433	4,974	2,874	4,326	8,012	1,423	2,763	1,791	3,917	3,460
Wild subyearling	20,561	13,344	30,641	12,741	16,286	14,584	10,933	5,257	25,150	53,818	5,188	1,480	564	3,844
Hatchery yearling	25,620	22,481	14,097	22,367	17,634	9,796	3,965	7,557	5,893	2,926	0	6	60	97
Steelhead														
Wild	1,176	1,226	1,957	1,700	1,211	1,789	1,672	2,441	1,662	778	1,091	326	253	622
Smolt	195	210	248	448	152	53	45	280	32	86	63	181	133	160
Parr	981	1,016	1,709	1,250	1,056	1,736	1,627	2,161	1,630	692	1,028	145	120	462
Hatchery	8,250	9,921	2,708	2,684	1,964	1,384	2,104	9,678	5,886	2,720	134	45	78	3
Coho														
Wild yearling	3	4	0	0	0	3	4	0	0	0	0	0	0	0
Wild subyearling	4	5	1	13	12	2	0	0	0	0	0	0	0	0
Hatchery yearling	0	3	3	1	0	126	8	0	0	0	2	0	0	0
Bull Trout *Juvenile*	351	499	496	513	250	125	175	238	438	339	264	421	234	605
Bull Trout *Adult*	7	45	24	33	29	39	41	12	6	8	25	19	16	57
Cutthroat	38	54	66	52	40	56	44	45	28	37	183	22	13	34
Eastern brook	3	0	8	4	3	4	4	2	6	7	25	10	9	17
Whitefish	990	778	3,340	2,672	2,186	2,267	3,672	3,669	1,212	871	1,825	837	317	1,565
Northern pikeminnow	20	5	47	7	15	0	0	13	1	3	14	12	2	54

Appendix C. cont.

Species origin	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
Longnose dace	1,526	1,393	2,081	2,934	2,349	1,951	3,133	3,162	1,557	604	1,217	1,456	130	1,481
Sucker spp.	0	0	7	9	1	8	10	5	4	0	6	40	3	11
Redside shiner	0	0	0	0	0	1	2	1	1	0	0	0	0	0
Yellow perch	0	0	0	0	0	0	0	0	0	1	14	0	1	4
Sculpin spp.	129	51	78	143	73	104	23	34	13	58	77	56	24	119

Appendix D. Yearly total juvenile capture information for the Upper Wenatchee River smolt trap.

Species/Origin	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998
Chinook														
Wild yearling	786	569	323	194	1,597	138	61	355	257	34	62	49	228	90
Wild subyearling	109	254	312	71	213	2,012	2,541	139	40	5	118	10	84	0
Hatchery yearling	292	245	1,074	398	750	10	6	1	0	0	0	0	5	0
Steelhead														
Wild	135	95	66	28	80	42	36	55	14	2	37	1	9	4
Smolt	8	43	37	14	15	10	1	1	0	2	4	1	1	3
Parr	127	52	29	14	65	32	35	54	14	0	33	0	8	1
Hatchery	376	357	637	61	178	160	354	27	43	41	0	0	0	0
Sockeye														
Wild	48,128	60,792	7,314	9,133	38,628	20,309	6,580	37,953	25,165	3,299	848	2,635	9,887	6,926
Hatchery	3,017	1,909	2,444	1,367	2,387	1,500	1,416	1,866	668	558	1,581	66	572	268
Coho														
Wild yearling	9	4	9	6	3	10	2	1	0	0	0	0	0	0
Wild subyearling	0	15	1	16	0	0	5	0	0	0	0	0	0	0
Hatchery yearling	688	632	585	120	311	125	340	81	98	27	119	11	10	0
Bull Trout *Juvenile*	14	4	9	3	5	1	5	0	0	1	3	6	4	1
Bull Trout *Adult*	1	0	0	0	2	0	3	1	0	0	2	0	0	0
Cutthroat	2	2	2	2	1	0	1	2	0	0	12	0	0	1
Whitefish	74	81	78	35	49	3	26	19	6	4	16	4	16	10
Northern pikeminnow	279	201	234	106	113	46	17	46	23	5	28	26	43	33
Longnose dace	8	9	42	8	24	2	53	58	0	0	20	3	6	2
Sucker spp.	9	14	30	3	18	2	28	47	12	0	23	5	25	6
Redside shiner	49	66	90	21	37	21	47	62	14	0	21	15	23	12
Yellow perch	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Sculpin spp.	109	244	188	251	201	35	85	68	34	12	96	46	67	59

Appendix E. Yearly total juvenile capture information for the Lower Wenatchee River smolt trap.

Species/Origin	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Chinook											
Wild yearling	1,079	5,346	612	1,906	652	333	1,061	1,619	336	206	284
Wild subyearling	50,685	37,568	30,547	86,142	63,580	224,858	225,549	110,528	39,714	70,952	72,244
Hatchery yearling	43,613	6,709	19,440	45,467	35,261	23,709	11,846	20,939	3,421	8,758	2,753
Steelhead											
Wild	484	264	319	495	151	246	360	413	252	341	468
Smolt	407	216	220	433	105	210	299	343	187	273	426
Parr	77	48	99	62	45	36	61	70	76	68	42
Hatchery	2,735	1,949	2,106	2,697	3,769	2,013	3,465	2,175	2,260	1,711	2,219
Sockeye											
Wild	3,153	1,259	216	6,340	5,204	202	3,224	7,544	5,042	58	1,114
Hatchery		263	207	248	68	79	335	271	281	131	12
Coho											
Wild yearling	188	114	111	292	103	189	58	199	72	0	0
Wild subyearling	2,112	515	1,013	431	1,460	1,846	927	29	1,443	191	0
Hatchery yearling	8,013	9,709	4,296	29,305	13,627	11,943	15,455	8,034	12,363	11,265	12,305
Bull Trout *Juvenile*	2	0	1	2	1	3	2	0	1	1	4
Bull Trout *Adult*	0	0	0	0	0	0	0	0	0	0	0
Cutthroat	0	1	1	0	0	0	0	0	0	2	0
Whitefish	48	52	67	23	118	9	34	115	31	78	73
Northern pikeminnow	198	13	57	135	475	90	75	21	93	10	9
Longnose dace	643	383	568	1,820	801	659	2,374	488	593	445	319
Speckled dace	0	0	1	0	0	0	5	4	3	7	17
Umatilla dace	0	0	2	0	0	0	2	1	12	36	17
Sucker spp.	390	63	612	339	3,420	203	208	172	169	201	121
Peamouth	62	1	2	1	0	0	0	0	0	0	11

Appendix E. cont.

Species/Origin	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Chiselmouth	1	0	0	1	32	0	7	2	7	1	6
Redside shiner	570	18	69	84	952	166	100	14	47	47	8
Yellow bullhead	1	0	0	0	0	0	0	0	0	0	1
Pacific lamprey	680	1,245	1,431	2,876	1,933	685	650	922	978	1,267	1,393
River lamprey	0	0	0	0	0	0	0	1	0	18	20
Sculpin spp.	70	123	49	64	118	171	86	71	97	55	76
Stickleback (3 spined)	4	7	4	39	78	51	85	18	48	246	0

Appendix C

Summary of PIT Tagging Activities in the Wenatchee Basin, 2012

Appendix C. Numbers of fish captured, PIT tagged, lost, and released in the Wenatchee Basin during February through November, 2012.

Sampling Location	Species and Life Stage	Number held	Number of recaptures	Number tagged	Number died	Shed Tags	Total released	Percent mortality
Chiwawa Trap	Wild Subyearling Chinook	8,370	467	7,659	15	0	7,644	0.18
	Wild Yearling Chinook	8,353	314	7,990	10	0	7,980	0.12
	Wild Steelhead/Rainbow	1,050	17	1,011	0	0	1,011	0.00
	Hatchery Steelhead/Rainbow	2	0	2	0	0	2	0.00
	Wild Coho	0	0	0	0	0	0	--
	Total	**17,775**	**798**	**16,662**	**25**	**0**	**16,637**	**0.14**
Upper Wenatchee Trap	Wild Subyearling Chinook	1	0	1	0	0	1	0.00
	Wild Yearling Chinook	76	1	75	0	0	75	0.00
	Wild Steelhead/Rainbow	86	15	70	0	0	70	0.00
	Hatchery Steelhead/Rainbow	0	0	0	0	0	0	--
	Wild Coho	0	0	0	0	0	0	--
	Wild Sockeye	0	0	0	0	0	0	--
	Total	**163**	**16**	**146**	**0**	**0**	**146**	**0.00**
Total:	**Wild Subyearling Chinook**	**8,371**	**467**	**7,660**	**15**	**0**	**7,645**	**0.18**
	Wild Yearling Chinook	**8,429**	**315**	**8,065**	**10**	**0**	**8,055**	**0.12**
	Wild Steelhead/Rainbow	**1,136**	**32**	**1,081**	**0**	**0**	**1,081**	**0.00**
	Hatchery Steelhead/Rainbow	**2**	**0**	**2**	**0**	**0**	**2**	**0.00**
	Wild Coho	**0**	**0**	**0**	**0**	**0**	**0**	**--**
	Wild Sockeye	**0**	**0**	**0**	**0**	**0**	**0**	**--**
Grand Total:		**17,938**	**814**	**16,808**	**25**	**0**	**16,783**	**0.14**

Appendix D

Wenatchee Steelhead Spawning Ground Surveys, 2012

STATE OF WASHINGTON
DEPARTMENT OF FISH AND WILDLIFE
FISH PROGRAM – SCIENCE DIVISION
SUPPLEMENTATION RESEARCH TEAM

3515 Chelan HWY, Wenatchee, WA 98801
Voice (509) 663-9678 FAX (509) 662-6606

February 27th, 2013

To: Distribution List

From: Chris Moran, Fish Biologist, WDFW

Subject: 2012 Wenatchee River Basin Steelhead Spawning Ground Surveys

Summer steelhead migrate to their spawning grounds as early as nine months prior to spawning. Run escapement estimates of summer steelhead counted at Columbia River dams or at Tumwater Dam in the Wenatchee River may not accurately reflect the size of the spawning population because of fallback and prespawn mortality that may occur prior to spawning. English et al. (2003) reported fallback rates for Rock Island (4.9%) and Rocky Reach (6.5%) dams were similar, but no information regarding Tumwater Dam was reported. In the same study, survival to spawning was not explicitly calculated, but kelting rates for the Wenatchee River ranged between 68% and 77% and may serve as a minimum survival rate. Keefer et al. (2008) conducted a more comprehensive study throughout the Columbia Basin and reported mortality rates of summer steelhead that overwintered in the Columbia River or tributaries was 14.5% and 18.9%, respectively.

Redd counts may be used to calculate a more accurate estimate of the spawning population, but requires knowledge concerning the number of redds constructed per female and the number of fish per redd. Female steelhead have been reported to construct multiple redds, ranging between 1.02 and 6.91 redds (Reingold 1965; Gallagher and Gallagher 2005; Kuligowski et al. 2005). Large variation in the reported number of redds per female within and across populations may be natural or more simply a lack of precision in the methodology used (e.g., errors in redd counts or the number of female spawners). While the sex ratio may be an appropriate surrogate for the number of fish per redd under the assumption females construct a single redd. However, if female steelhead construct multiple redds, it is also likely male steelhead spawn at multiple redd locations with either the same or different females resulting in an overestimate of the spawning population. An estimate of the spawning population coupled with other population specific information (i.e., ratio of hatchery and wild spawners and age composition) are critical data needed to assess the productivity of the population (i.e., recruits per spawner).

Our objectives in conducting steelhead spawning ground surveys were to 1) determine spawn timing of naturally spawning steelhead (both hatchery and wild origin) and 2) estimate the abundance of redds constructed within selected tributaries. We also examined the relationship between run escapement upstream of Tumwater Dam (i.e., female and total) and redd counts as a method of assessing the precision of our estimates.

Methods

Run Escapement

Steelhead migrating upstream of Tumwater Dam were captured, sampled (sex, length, weight, scales), and PIT tagged as part of a separate study. Gender was determined using ultrasonography and secondary sexual characteristics (i.e., kype, coloration, body shape). Origin was determined using hatchery marks (i.e., fin clip, VIE, CWT, or eroded fins) or scale pattern analysis if no marks were identified.

Spawning Ground Surveys

Spawning grounds surveys were primarily concentrated in the upper Wenatchee Basin because all hatchery fish were released upstream of Tumwater Dam. Peshastin Creek was included in our surveys because it was identified as a potential reference stream (i.e., no hatchery releases since 1998) for the Wenatchee Basin. Survey methodology involved surveying non-random index areas, defined as major spawning area(s) for each stream. Index areas in the major spawning streams (i.e. Wenatchee, Nason, Peshastin, Icicle and Chiwawa) were surveyed every third day, with the remaining index areas surveyed as frequently as once a week. Redds were either individually flagged or in the case of large aggregates of localized spawning, mapped and numbered sequentially. All redds were also geo-referenced using handheld global positioning devices. Between 2000 and 2003, the number of index areas has increased as more information became available. Beginning in 2004, survey methodology has remained similar. Hence, direct comparisons of redd counts for years before 2004 may not be appropriate.

Index area spawning ground surveys were conducted by foot or raft on the Wenatchee River and most major tributaries (Appendix A). For each index area, the same surveyor(s) conducted all surveys. However, when the end of spawning within an index area was thought to be nearly complete, a different observer (i.e., naïve) surveyed the index area to determine the number of redds still visible at the end of spawning. At approximately the same time, non-index areas within a reach or stream were also surveyed. The total number of redds in non-index areas was estimated by dividing the number of redds found in non-index areas by the proportion of redds still visible inside the index area. The reach total redd count was calculated by combining the number of redds in the index area and the estimated number of redds in the non-index areas. Murdoch and Peven (2005) provide a more detailed description of the methodology (Appendix F, Task 7-3).

The sex ratio of the entire population upstream of Tumwater Dam was used as the redd expansion factor (i.e., number fish per redd). The sex ratio was calculated using the number of female and male steelhead allowed to pass upstream of Tumwater Dam during trapping and video count operations. Spawning escapement was estimated by multiplying the estimated total number of redds by the number of fish per redd. Linear regression analysis was used to examine the relationship between run escapement estimates, index area redd counts, and total redd counts upstream of Tumwater Dam. Fallback rates at Tumwater Dam were calculated based on the number of PIT tagged steelhead recaptured or tagged at Tumwater Dam that were detected downstream of Tumwater Dam prior to spawning divided by the total number of PIT tagged steelhead.

Results

Run Escapement

The estimated total run escapement to Tumwater Dam was 1,657 steelhead. This includes 42 wild and 61 hatchery steelhead collected as broodstock and 521 hatchery steelhead removed to reduce the abundance of hatchery fish on the spawning grounds. The estimated steelhead run escapement upstream of Tumwater Dam was 1,055 fish that includes 780 fish detected on videotape and 275 trapped and released upstream. Run escapement in 2012 was 7% lower than in 2011, and was 26% lower than the previous 5-year average of 1,433 fish (Table 1). Without the removal of a large proportion of hatchery origin steelhead, run escapement for 2012 would be 31% lower than the 2010 run escapement but 1% greater than the 2006-2010 average. The male to female steelhead ratio observed at Tumwater Dam were similar resulting in a fish per redd value of 2.00, assuming each female constructed a single redd. Of those steelhead passed upstream of Tumwater Dam 65% (N = 681) were determined to be naturally produced.

Spawning Ground Surveys

Above average snow pack coupled with cool air temperatures led to below average stream flows for most of the survey season. During the third week of April an increase in air temperature resulted in a temporary increase in stream flow resulting in poor survey conditions for approximately 12 days. After the second week of May, air temperatures increased such that snowmelt resulted in elevated water conditions for up to 18 days preventing spawning ground surveys. Overall, survey conditions in 2012 were less than optimal compared to previous years. Poor environmental conditions (i.e., snow, rain, wind and clouds) were more common in 2012 and likely had a negative impact on redd detection rates.

Steelhead spawning commenced the fourth week of March in Peshastin Creek with most redds being documented starting the first week of April. Steelhead began spawning during the first week of April in Icicle Creek, Nason Creek, and the Wenatchee River. Spawning activity appeared to begin once the mean daily stream temperature reached ~4.4^{o}C and was observed in water temperatures ranging from 3.0 - 7.5 ^{o}C. Steelhead spawning peaked in Icicle and Peshastin Creeks the third week of April. Peak spawning occurred the first week in May for the Nason Creek and in the mainstem Wenatchee River (Appendix B).

The estimated number of redds in the Wenatchee Basin decreased 45% between 2011 (N = 932) and 2012 (N = 415) and was 10% lower than the previous 5-year average of 461 redds (Appendix C). In 2012, the proportion of redds in Nason Creek (38.1%) was greater than the 5-year mean (30.5%; Table 3). Redd distribution in Nason Creek continues to primarily be occurring in the middle two reaches (87%; Appendix D1). The steelhead redds observed in the Chiwawa River were also found in locations consistent with previous years (Appendix D2). The proportion of redds found in all streams upstream of Tumwater Dam decreased from a high of 96% in 2006 to 71% in 2012 (Appendix D3). The number of redds in Peshastin Creek decreased 44% between 2011 and 2012 (Appendix D4). The number of steelhead redds in Icicle Creek, another major spawning tributary downstream of Tumwater Dam, decreased in 2012 and was 74% lower than the number of redds observed in 2011. The overall number of redds in the Wenatchee River decreased from 323 in 2011 to 137 in 2012, the proportion of all redds in the Wenatchee River also decreased from 34.7% in 2011 to 33% in 2012. The proportion of redds found within index and non-index areas upstream of Tumwater Dam in 2012 was similar to 2011 (93%), and was higher than the previous 10 year average (79%;Table 4).

Table 1. The total number, gender, and sex ratio of steelhead migrating upstream of Tumwater Dam between 2001 and 2012. Sex ratio in 2001 was determined by the number of fish passed and collected during broodstock collection at Tumwater and Dryden dams. For 2002-2008, gender was determined visually at Tumwater Dam. For 2009 - 2012, gender was determined visually and/or by ultrasound.

Year	Number of steelhead to Tumwater Dam			Male to female ratio	Number of fish per redd
	Total	Female	Male		
2001	820	394	426	1.08	2.08
2002	1,720	641	1,079	1.68	2.68
2003	1,813	1,137	676	0.59	1.59
2004	1,918	869	1,049	1.21	2.21
2005	2,598	1,620	978	0.60	1.60
2006	1,057	505	552	1.09	2.09
2007	657	339	318	0.94	1.94
2008	1,328	473	855	1.81	2.81
2009	1,781	973	808	0.83	1.83
2010	2,270	973	1,297	1.33	2.33
2011	1,130	631	499	0.79	1.79
2012	1,055	527	528	1.00	2.00

Table 2. Comparison of the number and distribution of steelhead redds in 2012 and the five year geometric mean (2007-2011).

Stream	2012		Geo. mean (2007-2011)	
	Number of redds	Distribution (%)	Number of redds	Distribution (%)
Nason Creek	158	38.1	141	30.5
Chiwawa River	8	1.9	35	7.6
White River	0	0.0	0	0.0
L. Wenatchee River	0	0.0	0	0.0
Peshastin Creek	65	15.7	51	11.2
Icicle Creek	47	11.3	55	11.9
Wenatchee River	137	33.0	179	38.9
Above Tumwater	129	31.1	117	25.4
Below Tumwater	8	1.9	44	9.7
Total	415	100.0	461	100.0

Table 3. Comparison of the number of redds found within index areas and the estimated number of redds in non-index areas upstream of Tumwater Dam between 2001 and 2012.

Year	Index area	Non-index area	Estimated total	Within index area (%)
2001	118	19	137	86
2002	296	179	475	62
2003	353	88	441	80
2004	277	92	369	75
2005	828	136	964	86
2006	192	34	226	85
2007	105	29	134	78
2008	124	35	159	78
2009	284	107	391	73
2010	546	95	641	85
2011	427	33	460	93
2012	273	22	295	93

Female and total escapement explained a similar proportion of the variation in the estimated total number of redds (Figure 1). Given the variation in sex ratios and that only female steelhead construct redds, we would expect female escapement to explain a greater proportion of the variation in number of redds. This would suggest that the mean number of redds constructed by a female is relatively constant.

However, total run escapement explained a greater proportion of the variation in total redd counts than index redd counts (Figure 2). As run escapement increases, habitat within the index areas may be near capacity and subsequently a greater proportion of redds are found outside index areas.

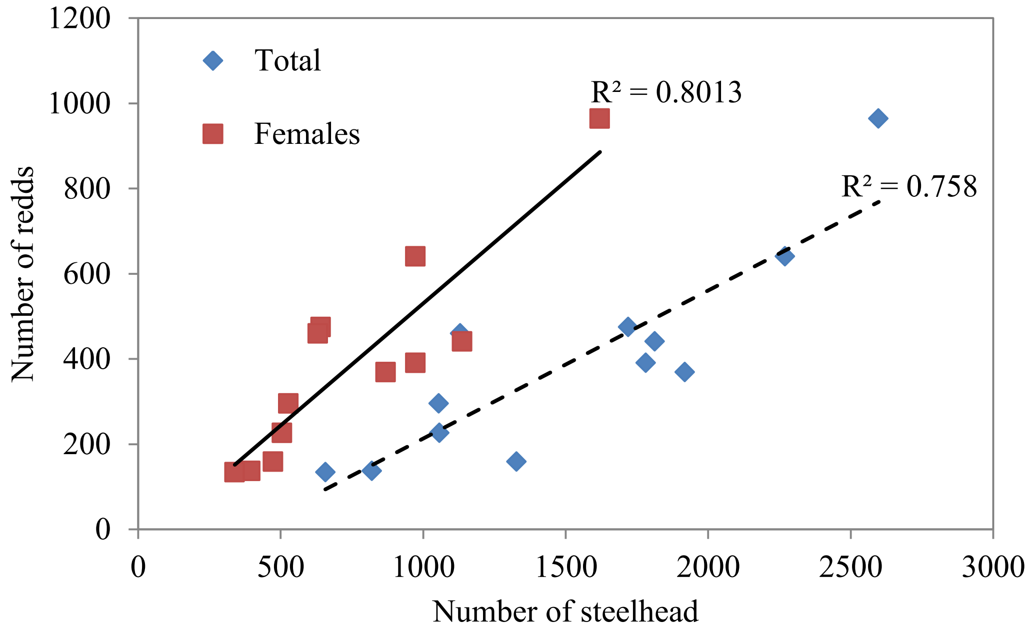

Figure 1. Relationship between steelhead run escapement (total and female) upstream of Tumwater Dam and total redd counts.

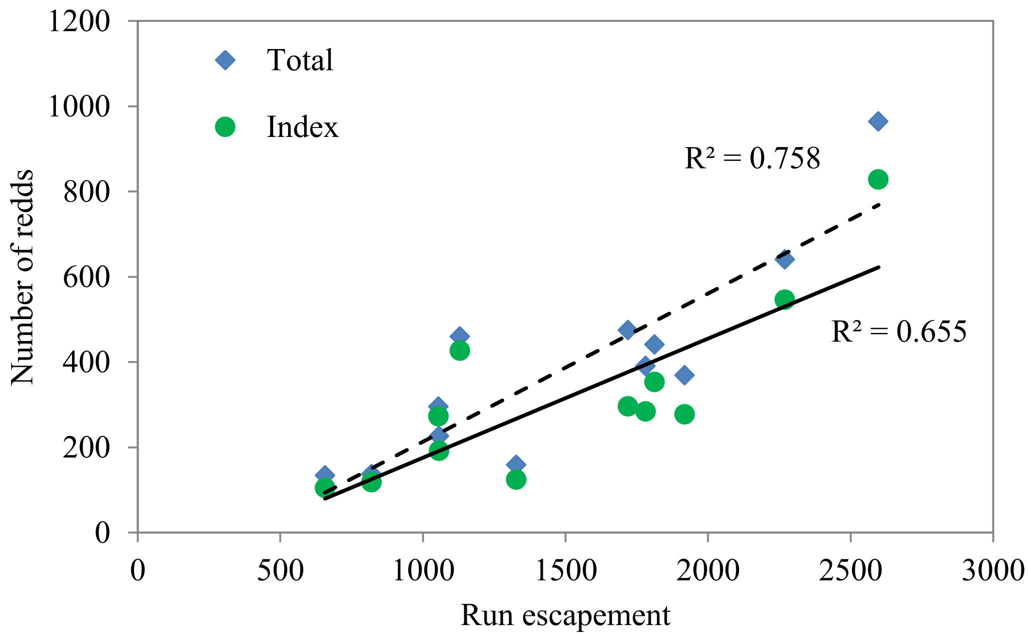

Figure 2. Relationship between steelhead run escapement upstream of Tumwater Dam and total and index area redd counts.

Spawning Escapement

In 2012, only 56% of the steelhead migrating above Tumwater Dam were accounted for on spawning grounds compared to the 5-year average (2006-2010) of 45% (Table 4). While environmental conditions do affect the accuracy of our estimates, other factors also contribute to the differences observed between run and spawning escapement estimates that can be estimated or quantified (i.e., prespawn mortality and fallback). Because no estimate of survival to spawning is available for steelhead in the Wenatchee Basin, we assumed that survival to spawning was at a minimum similar to that of steelhead overwintering in lower Columbia River tributaries (i.e., Deschutes and John Day) reported by Keefer et al (2008). Actual survival in the Wenatchee River may be considerably lower than that reported by Keefer et al. (2008) as a result of colder water temperatures and depleted energy reserves attributed to a greater migration distance.

While direct enumeration of steelhead upstream of Tumwater Dam is possible, it may not be appropriate to assume that all steelhead that migrate upstream of Tumwater Dam spawn upstream of Tumwater Dam (i.e., fallback). Using PIT tag recapture data, we were able to calculate a minimum fallback rate of steelhead at Tumwater Dam in 2011. However in 2012 we were not able to detect fallbacks for steelhead sampled and released above Tumwater Dam. Only 27% of the steelhead that migrated past Tumwater Dam were implanted with a PIT tag in the pelvic girdle. PIT tag detection at all Columbia and Snake River hydroelectric projects and some major spawning tributaries downstream of Tumwater Dam (e.g., lower Wenatchee, Icicle, Mission, Chumstick and Peshastin Creek) provided recapture data. Because a lower proportion of the steelhead were PIT tagged and some may have spawned in areas downstream of Tumwater Dam with no PIT tag antenna array and/or simply lost their tag, fallback rates were considered minimum values. Of the PIT tagged steelhead that were passed upstream of Tumwater Dam (N = 290), there were none detected prior to spawning downstream of Tumwater Dam. We used estimates of prespawn mortality and applied a 3.0% fallback rate to adjust run escapement estimates upstream of Tumwater Dam that may better represent the actual size of the spawning population. After adjustment, the proportion of the run escapement accounted for on the spawning grounds increased from 56% to 71% (Table 5).

Table 4. Comparison of run and estimated spawning escapement for steelhead upstream of Tumwater Dam between 2001 and 2012.

Year	Run escapement (A)	Number of redds (B)	Number of fish per redd (C)	Estimated spawning escapement (D = B x C)	Proportion of run escapement (E = D/A)
2001	820	137	2.08	285	0.35
2002	1,720	475	2.68	1,273	0.74
2003	1,813	441	1.59	701	0.39
2004	1,918	369	2.21	815	0.42
2005	2,598	964	1.60	1,542	0.59
2006	1,057	226	2.09	472	0.45
2007	657	134	1.94	260	0.40
2008	1,328	159	2.81	447	0.34
2009	1,781	391	1.83	716	0.40
2010	2,270	641	2.33	1,494	0.66
2011	1,130	460	1.79	823	0.73
2012	1,055	295	2.00	590	0.56

Table 5. Comparison of steelhead run escapement estimates at Tumwater Dam to the estimate spawning escapement derived from redd counts after adjusting for fallback and prespawn mortality.

Year	Tumwater Dam count	Adjusted Tumwater Dam counts		Number of redds	Number of fish per redd	Estimated spawning escapement	Proportion of run escapement
		Fallback	Prespawn mortality				
	(A)	(B = A - 3.0%)	(C = B - 18.9%)	(D)	(E)	(F = D x E)	(G = F/C)
2001	820	795	645	137	2.08	285	0.44
2002	1,720	1,668	1,353	475	2.68	1,273	0.94
2003	1,810	1,756	1,424	441	1.60	706	0.50
2004	1,869	1,813	1,470	369	2.21	815	0.55
2005	2,650	2,571	2,085	964	1.61	1,552	0.74
2006	1,053	1,021	828	226	2.05	463	0.56
2007	657	637	517	134	1.94	260	0.50
2008	1,358	1,317	1,068	159	2.81	447	0.42
2009	1,781	1,639[a]	1,329	391	1.83	716	0.54
2010	2,270	2,240[b]	1,817	641	2.33	1,494	0.82
2011	1,130	1,119[c]	908	460	1.79	823	0.91
2012	1,055	985	799	295	2.00	590	0.74

[a] Adjusted for a fallback rate of 8.0% as determined by PIT tag detections for the 2009 brood.
[b] Adjusted for a fallback rate of 1.3% as determined by PIT tag detections for the 2010 brood.
[c] Adjusted for a fallback rate of 0.9% as determined by PIT tag detections for the 2011 brood.

Discussion

The 2011 steelhead run year, was the first year an adult management program was initiated at Tumwater Dam with an escapement goal of 1,094 steelhead. The escapement goal prioritizes maximizing the number of natural origin recruits with shortfalls in escapement being made up with hatchery origin fish with natural origin parents (i.e., WxW matings). As a result of adult management at Tumwater Dam, the proportion of natural origin fish on the spawning grounds increased from a previous three year mean of 31% to 71% in 2011 and 65% in 2012.

Suboptimal survey conditions as a result of above normal river discharge during and following the peak of spawning likely decreased observer efficiency compared to previous years and may have resulted in an underestimate of redd abundance. Despite these factors, the proportion of the run escapement accounted for on the spawning grounds was much greater than expected. We attributed this increase to the increase in survey frequency. In previous years, index areas were surveyed approximately once a week. Female steelhead appear to have a relatively short redd residence time (1-3 d) compared to Chinook salmon (4-16 d). Hence, the probability of detecting a steelhead redd is likely greater when the redd is newly constructed and the female steelhead is still present on the redd. However, redd density was correlated to observer efficiency and may have contributed to a greater proportion of run escapement.

High correlation between the expanded total redd counts and run escapement ($r = 0.86$; $P < 0.0002$) suggests that the methodology used to estimate spawner abundance can inform trends in abundance. It also suggests that factors responsible for the observed difference in run and estimated spawning escapement are relatively constant with respect to escapement levels across years. Given the large differences between run and spawn escapement upstream of Tumwater Dam, it is evident that multiple factors are contributing to the difference in the escapement estimates.

Estimates of the Number of Redds

The current methodology does not involve conducting weekly surveys of the entire available spawning habitat (e.g., spring Chinook, summer Chinook, and sockeye). Steelhead are thought to have a greater range of spawning habitats than other anadromous species making a total redd census logistically impractical and costly. In the Wenatchee Basin, the Integrated Status and Effectiveness Monitoring Program (ISEMP) has been conducting probabilistic sampling (e.g., GRTS) of those areas not covered under the current methodology. When available, annual estimates of redd abundance outside of the current survey area should provide some indication regarding the extent of steelhead spawning habitat. Beginning in 2011, temporary PIT tag arrays were placed at the upper extent of spawning ground survey reaches in an effort to enumerate spawning activity outside the current survey area. Based on these data spawning escapement estimates will be recalculated at the tributary level at a later date. Within the current survey area, while a majority of the steelhead redds are consistently found within index areas, this may simply be a result of an artifact in the methodology and river reaches surveyed. Furthermore, observer efficiency is potentially a large source of error in conducting redd counts (Dunham et al. 2001; Muhlfeld et al. 2006). Studies were conducted in 2011 and 2012 to estimate observer efficiency and not only identify, but also quantify sources of error (redd omission or false identification). When data from these studies have been analyzed the results will be incorporated into existing spawning escapement estimates.

Spawning Escapement Estimates

Monitoring and evaluation plans require estimates of the spawning population in order to evaluate hatchery program effectiveness (e.g., wild and hatchery abundance and productivity) and determine appropriate escapement levels (i.e., carrying capacity). Steelhead exhibit a diverse life history and complex migration patterns thereby reducing the reliability that run escapement estimates (i.e., dam counts) accurately reflect the size of the spawning population. Steelhead spawning ground surveys are currently conducted in every major steelhead population in the Upper Columbia Basin. However, uncertainty in using these data to estimate the size of the spawning population lies in some factors previously discussed (i.e., observer efficiency and sampling design), but also in the manner in which redd counts are expanded to estimate the population.

The conversion of redd counts to an estimate of the spawning population requires knowledge of the average number of redds constructed per female and the number of fish per redd (Gallagher et al. 2007). In some populations, female steelhead were reported to construct multiple redds. If steelhead in the Wenatchee Basin do construct multiple redds, differences in run and escapement estimates would increase as a result of a lower spawning escapement estimate. For example, if female steelhead construct an average of 1.5 redds, the difference in run and spawning escapement estimates would increase 9%. Redd abundance estimates are used to estimate the female escapement, which are then expanded by the sex ratio to estimate the male population on the spawning grounds. The number of fish per redd is based on the sex ratio of the population. This approach assumes 1) equal survival to spawning and 2) every male spawns on average at one redd location. A tagging study is needed and planned in the next few years to test these assumptions.

Recommendations

Of all the factors that are contributing to the difference between run and spawning escapement estimates, redds constructed in streams not included in the survey area have the potential to account for a significant portion of the observed difference. The reported number of redds upstream of Tumwater Dam underestimate the total number of redds because all available spawning habitat (i.e., low order streams) is not surveyed. Studies have been ongoing in the Wenatchee Basin designed to estimate the number of redds in areas not covered under the current survey design. Data from these studies (i.e., ISEMP) must be analyzed and incorporated into spawning escapement estimates.

The accuracy and precision of the current methodology used in estimating the redd abundance and observer efficiency are currently ongoing. Studies focused on testing assumptions used in estimating the size of the spawning population (number of redds per female and number of fish per redd) should incorporate an assessment of 1) fallback 2) survival to spawning 3) the spawning distribution of the hatchery and wild steelhead. Information from these studies is required to ensure spawning escapement estimates have sufficient accuracy and precision, such that inferences regarding the efficacy of naturally spawning hatchery steelhead can be made in a timely manner.

Spawning distributions of hatchery and wild steelhead in the Wenatchee Basin can be assessed at the tributary level using PIT tags. All major and minor spawning areas will eventually have instream PIT tag antenna arrays. However, this methodology requires that an adequate and representative sample of adults is tagged every year. Spawning distribution within tributaries at a reach level can also be assessed using instream arrays if desired. However, assessment of spawn timing in the natural environment is problematic and will require a periodic assessment of individuals on the spawning grounds.

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Appendix A. Wenatchee River Basin survey reaches and index/reference areas – surveys conducted weekly from March through June.

Reach	Index/reference area
Wenatchee River	
Sleepy Hollow Br. to Lower Cashmere Br. (W2)	Monitor boat ramp to Cashmere boat ramp
Leavenworth Bridge to Icicle Road Bridge (W6)	Leavenworth boat ramp to Icicle River
Tumwater Dam to Tumwater Bridge (W8)	Swiftwater boat ramp to Tumwater Bridge
Tumwater Bridge to Mouth of Chiwawa river(W9)	Tumwater Bridge to Plain
Mouth of Chiwawa River to Lake Wenatchee (W10)	Chiwawa pump station to Lake Wenatchee
Peshastin Creek	
Mouth to Camas Creek (P1)	Kings Bridge to Camas Creek
Camas Creek to mouth of Scotty Creek (P2A)	Ingalls Creek to Ruby Creek
Camas Creek to mouth of Scotty Creek (P2C)	HWY 97 MP 175 to FR7320
Ingalls Creek	
Mouth to Trailhead rm 1.0 (D1)	Mouth to Trailhead rm 1.0
Trailhead to Wilderness Boundary rm 1.5 (D2)	Trailhead to Wilderness Boundary rm 1.5
Chiwawa River	
Mouth to Grouse Creek (C1)	Mouth to Road 62 Bridge rm 6.4
Grouse Creek to Rock Creek (C2)	Grouse Creek to Chikamin Creek
Clear Creek	
Mouth to HWY 22 (V1)	Mouth to HWY 22
HWY 22 to Lower culvert rm 2.0 (V2)	HWY 22 to Lower culvert
Nason Creek	
Mouth to Kahler Creek Bridge (N1)	Mouth to Swamp Creek
Kahler Cr. Bridge to HWY 2 Bridge (N2)	Round Mtn. RD Bridge to HWY 2 Bridge
HWY 2 Bridge to Lower R.R. Bridge (N3)	HWY 2 Bridge to PIT tag antenna array site
Lower R.R. Bridge to Whitepine Creek (N4)	Lower R.R. Bridge to Whitepine Creek
Icicle River	
Mouth to Hatchery (I1)	Mouth to Hatchery
Little Wenatchee River	
Mouth to Lost Creek (L2)	Fish Weir to Lost Creek
Lost Creek to Rainy Creek Bridge (L3)	Lost Creek to Rainy Creek Bridge
White River	
Sears Cr. Bridge to Napeequa River (H2)	Riprap bank to Napeequa River
Napeequa River to mouth of Panther Creek (H3)	Napeequa River to Grasshopper Meadows.
Napeequa River	
Mouth to rm 1.0 (Q1)	Mouth to rm 1.0

Appendix B. Summary of steelhead spawning ground index surveys in the Wenatchee River basin in 2012.

Reach	Survey Week of index Area															Index Total	Reach Total	Expanded # of redds
	26 Feb	4 Mar	11 Mar	18 Mar	25 Mar	1 Apr	8 Apr	15 Apr	22 Apr	29 Apr	6 May	13 May	20 May	27 May	3 Jun			
Wenatchee River																		
W1																	0	0
W2	0	0	0	0	0	0	1									1	6	6
W3																0	1	1
W4																	0	0
W5																	0	0
W6		0	0	0	0	0	1		0	0						1	1	1
W7																	0	0
W8	0		0	0	0	0	0									0	0	0
W9	0	0	0	0	1	5	11	1	8	6			3			35	35	35
W10	0	0	0	0	3	15	0			45	29					92	92	92
Total	0	0	0	0	4	20	13	1	8	51	29	0	3	0		129	135	135
Beaver Creek																		
Total										0	0	2	0			2	2	2
Peshastin Creek																		
P1		0	0	1	0	4	1	16		2	8	0	0	0		32	34	35
P2				0		0	0	0		0	0	10	6	10	1	27	30	30
Total		0	0	1	0	4	1	16	0	2	8	10	6	10	1	59	64	65
Chiwawa River																		
C1				0	0	0	1	0			1			1		2	2	2
C2				0	0	0	0	0			0			0		0	0	0
Total		0	0	0	0	0	1	0	0	0	1			1		3	3	3

Appendix B. Continued.

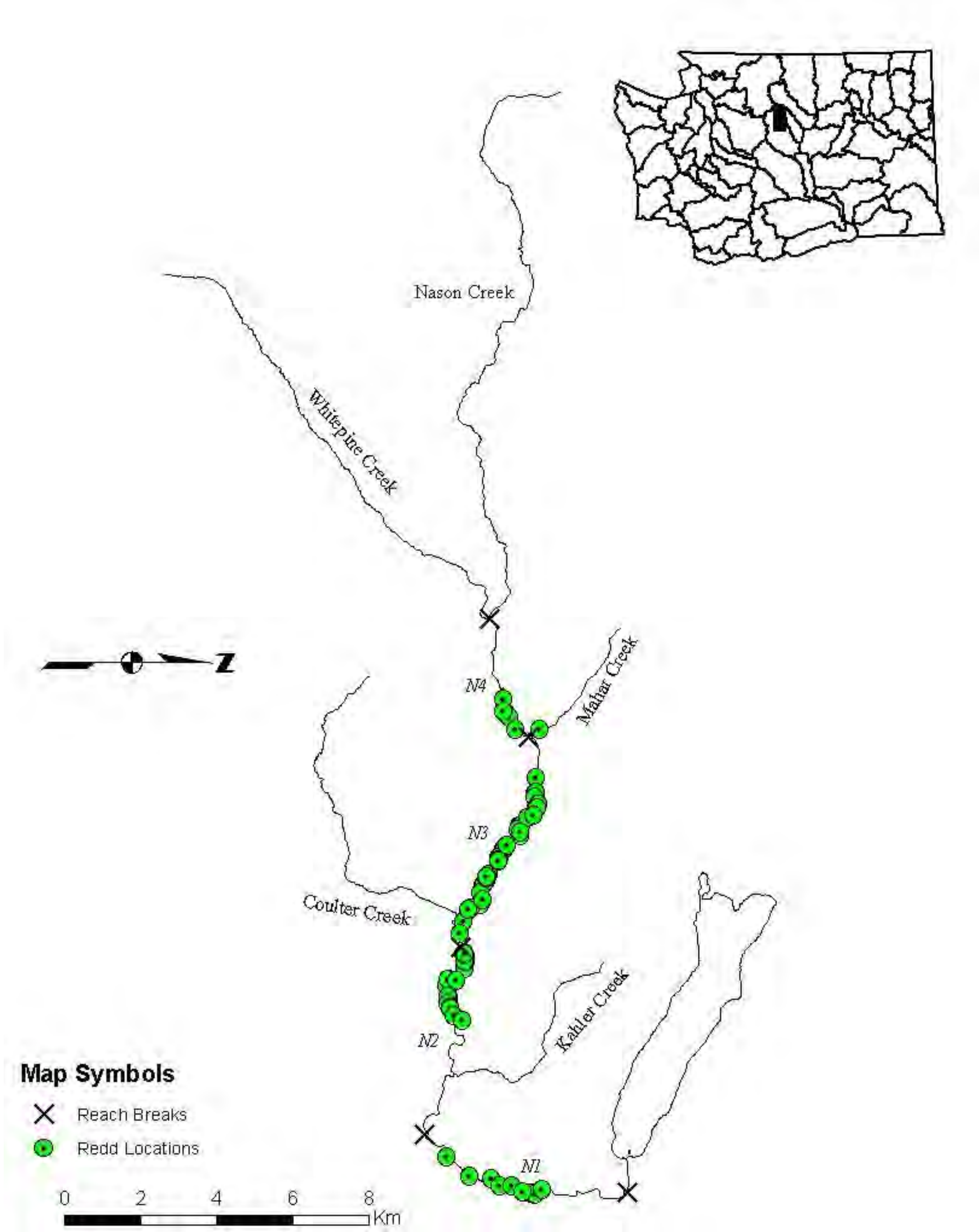
Reach	Survey Week of index Area															Index Total	Reach Total	Expanded # of redds
	26 Feb	4 Mar	11 Mar	18 Mar	25 Mar	1 Apr	8 Apr	15 Apr	22 Apr	29 Apr	6 May	13 May	20 May	27 May	3 Jun			
										Clear Creek								
V1						0	0	0		2	1	1	1			5	5	5
V2																	0	0
Total						0	0	0		2	1	1	1			5	5	5
										Nason Creek								
N1		0	0	0		2	1	2			5			2		12	12	12
N2		0	0	0	1	0	2	1	2	14	23					43	61	65
N3		0	0	0	0	0	7	14	4	11	34			3		73	73	73
N4		0	0	0	0	0	1	4			3	0		0		8	8	8
Total		0	0	0	1	2	11	21	6	25	65	0		5		136	154	158
										Icicle River								
I1		0	0	0	0	1	7	16		4	13	1		1		43	43	43
I2				0	0	0	0	2		1	1					4	4	4
Total		0	0	0	0	1	7	18	0	5	14	1		1		47	47	47
										Wenatchee River Basin								
Total		0	0	1	1	11	40	68	7	42	140	41	7	20	1	381	410	415

Appendix C. Steelhead spawning surveys in the Wenatchee River basin, 2001 – 2012. Redd counts are expanded values derived from sample rates within index areas.

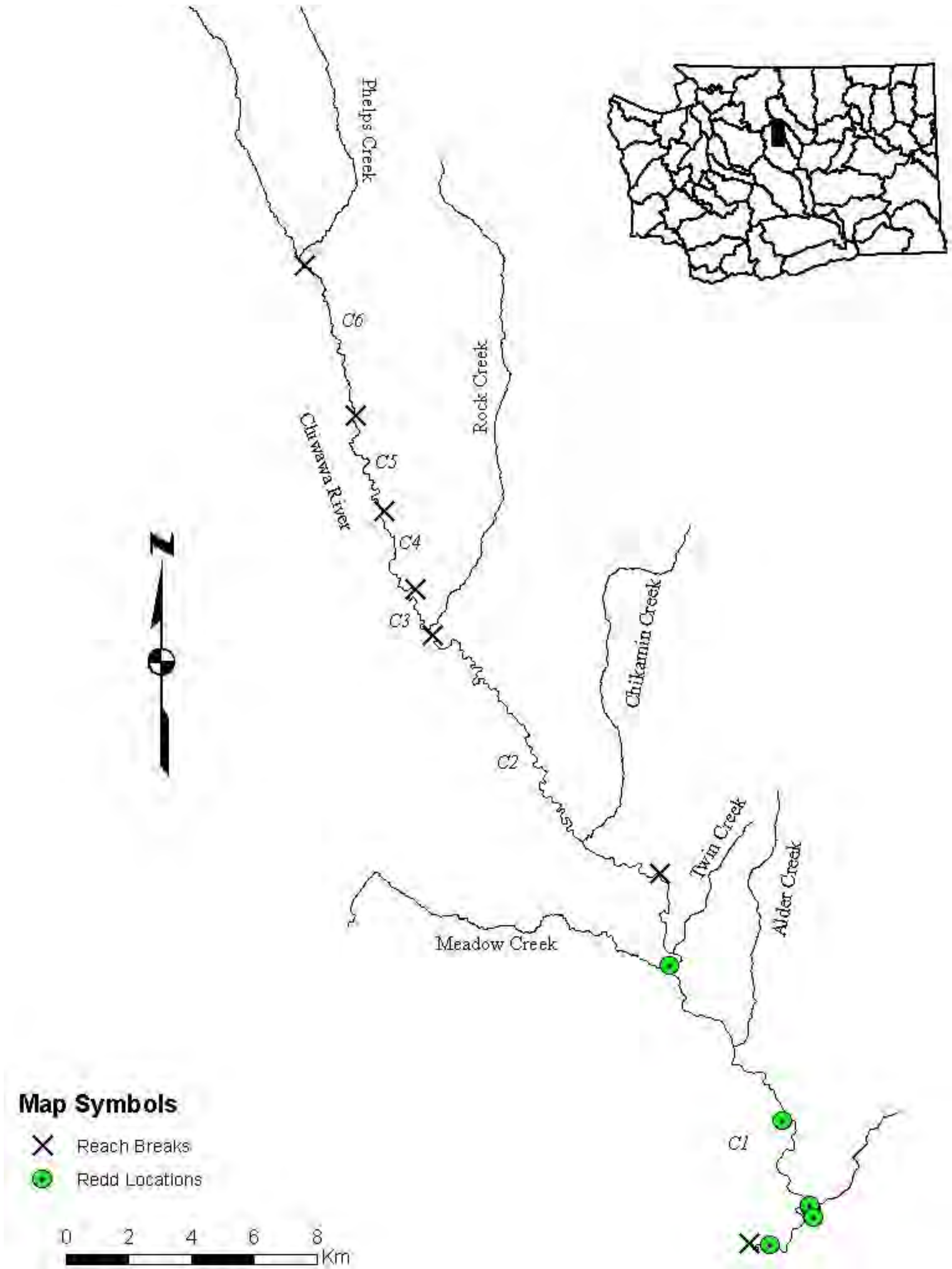
Basin/subbasin	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
				Chiwawa River Basin								
Chiwawa River	25	27	26	17	118	8	3	9	68	40	63	3
Rock Creek	--	1	0	0	0	0	--	--	0	0	0	0
Chikamin creek	--	0	0	1	2	1	0	--	2	11	2	0
Meadow Creek	--	5	1	5	16	3	0	0	3	3	0	0
Twin Creek	--	4	0	--	0	--	--	--	--	0	--	--
Goose Creek	--	0	--	--	--	--	--	--	--	--	--	--
Alder Creek	--	0	5	2	14	0	0	0	0	8	1	0
Deep Creek	--	0	--	--	--	--	--	--	--	--	--	--
Clear Creek	--	43	32	37	12	7	8	2	2	12	11	5
Subtotal	25	80	64	62	162	19	11	11	75	74	77	8
				Nason Creek Basin								
Nason Creek	27	80	121	124	410	74	78	87	126	269	235	158
White Pine Creek	--	--	--	0	0	0	0	--	0	1	0	--
Un-named Creek	--	--	--	3	0	3	0	1	0	0	0	0
Roaring Creek	--	--	--	--	2	0	0	0	0	0	0	0
Subtotal	27	80	121	127	412	77	78	88	126	270	235	158
				White River Basin								
White River	--	0	1	0	2	0	1	0	0	3	0	--
Panther Creek	--	--	0	0	0	0	0	0	0	--	--	--
Napeequa River	--	0	2	0	0	0	0	1	0	0	--	--
Subtotal		0	3	0	2	0	1	1	0	3	0	
				Little Wenatchee River								
Mainstem	--	1	5	0	0	--	0	--	0	4	2	--
				Icicle Creek								
Mainstem	19	27	16	23	8	41	6	37	102	120	180	[b] 47
				Peshastin Creek Basin								
Peshastin Creek	--	--	15	32	91	67	17	48	32	115	113	65
Mill Creek	--	--	--	--	1	0	0	1	0	0	0	0
Ingalls Creek	--	--	0	0	0	0	--	--	--	--	--	--
Ruby Creek	--	--	0	0	0	--	--	--	0	0	0	--
Tronsen Creek	--	--	0	2	5	0	0	0	0	3	2	--
Scotty Creek	--	--	0	0	0	0	0	0	0	0	0	--
Shaser Creek	--	--	0	0	0	0	0	0	0	0	0	--
Schafer Creek	--	--	--	0	0	0	0	0	0	0	0	--

Subtotal	--	--	15	34	97	67	17	49	32	118	115	65
			Wenatchee River									
Mainstem	116	315	248	136	456	191	46	100	327	377	320	135
Beaver Creek	--	0	0	[a] 15	3	0	0	0	0	2	2	2
Chiwaukum Creek	--	--	0	--	0	0	--	0	0	1	1	--
Subtotal	116	315	248	151	459	191	46	100	327	380	323	137
Wenatchee Basin Total	**187**	**503**	**472**	**397**	**1,140**	**395**	**159**	**286**	**662**	**969**	**932**	**415**

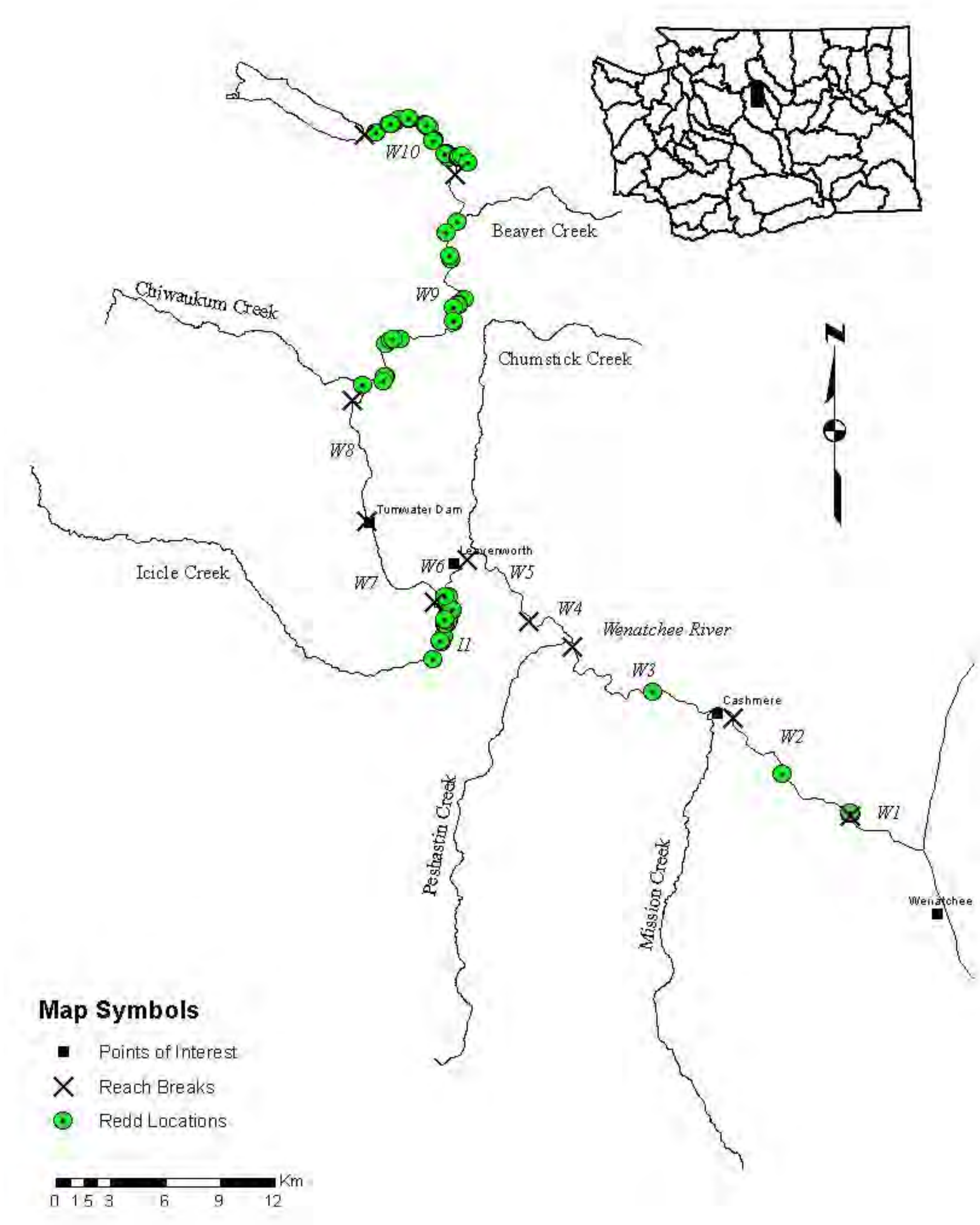
[a]Redds were enumerated by USFS
[b]Redds were a total of reaches I1 and I2



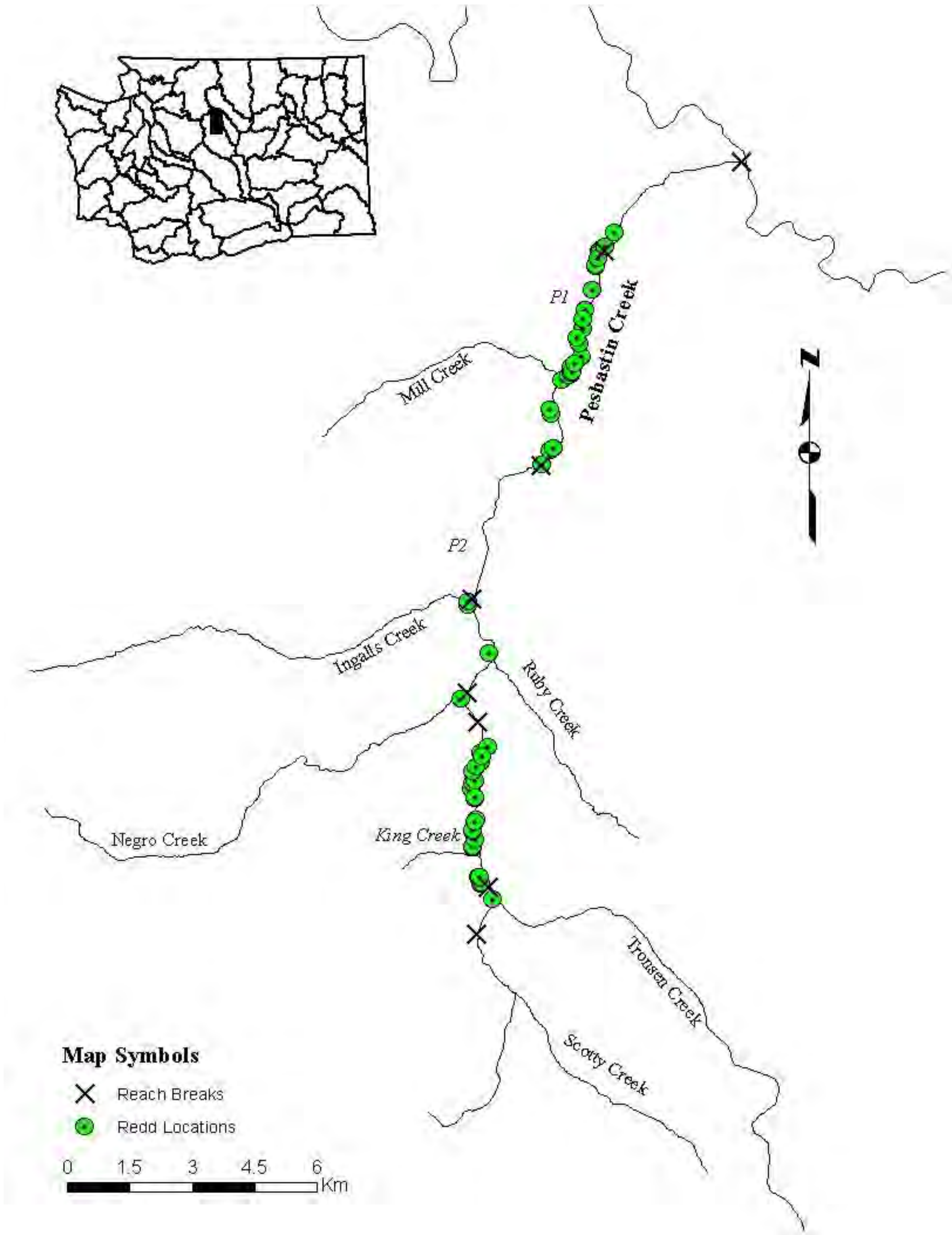
Appendix D1. Steelhead spawning distribution in the Nason Creek Basin in 2012.



Appendix D2. Steelhead spawning distribution in the Chiwawa River Basin in 2012.



Appendix D3. Steelhead spawning distribution in the Wenatchee River and Icicle Creek in 2012.



Appendix D4. Steelhead spawning distribution in the Peshastin Creek Basin in 2012.

Appendix E

Genetic Diversity of Wenatchee Summer Steelhead

Examining the Genetic Structure of Wenatchee Basin Steelhead and Evaluating the Effects of the Supplementation Program

Developed for

Chelan County PUD

and the

Rock Island Habitat Conservation Plan Hatchery Committee

Developed by
Todd R. Seamons, Sewall Young, Cherril Bowman, and Kenneth I. Warheit
WDFW Molecular Genetics Laboratory
Olympia, WA

and

Andrew R. Murdoch
Supplementation Research Team
Wenatchee, WA

17 January 2012

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Executive Summary

In 1997, Wenatchee River summer steelhead, as part of the upper Columbia River evolutionarily significant unit (ESU), were listed as threatened under the Endangered Species Act (ESA). To address concerns about effects of hatchery supplementation, the hatchery program for hatchery produced (HOR) summer steelhead to be planted in the Wenatchee River changed from using mixed ancestry broodstock collected in the Columbia River to using Wenatchee River broodstock collected in the Wenatchee River. Three monitoring and evaluation (M&E) indicators were developed to measure the genetic effects of hatchery production on wild fish populations. To address these indicators, temporal collections of tissue samples from Wenatchee River hatchery-produced (HOR) and natural origin (NOR) adults captured and sampled at Dryden and Tumwater dams and from NOR juveniles from three Wenatchee River tributaries and the Entiat River were surveyed for genetic variation with 132 genetic (SNPs) markers. Peshastin Creek (a Wenatchee River tributary) and the Entiat River served as no-hatchery-outplant controls, meaning they have stopped receiving HOR juvenile outplants. As per the M&E plan, we interrogated these data for the presence or absence of spatial and temporal trends in allele frequencies, genetic distances, and effective population size.

Allele frequencies – Changes to the summer steelhead hatchery supplementation program had no detectable effect on genetic diversity of wild populations. On average, HOR adults had higher minor allele frequencies (MAF) than NOR adults, which may simply reflect the mixed ancestry of HOR adults. Both HOR and NOR adults had MAF similar to juveniles collected in spawning tributaries and in the Entiat River. There was no temporal trend in allele frequencies or observed heterozygosity in adult or juvenile collections and allele frequencies in control populations were no different than those still receiving hatchery outplants. This suggests that the hatchery program has had little effect on allele frequencies since broodstock sources changed in 1998.

Genetic distances – As intended, interbreeding of Wenatchee River HOR and NOR adults reduced the genetic differences between Wells Hatchery HOR adults and Wenatchee River NOR adults observed in the first few years after changing the broodstock collection protocol. Though there were detectable genetic differences between HOR and HOR adults, the magnitude of that

difference declined over time. HOR adults were genetically quite different from NOR adults and juveniles based on pair-wise F_{ST} and principal components analysis (PCA), most likely because of the much smaller effective population size (N_b) in the hatchery population (see below). Pair-wise F_{ST} estimates and genetic distances between HOR and NOR adults collected the same year declined over time suggesting that the interbreeding of HOR and NOR adults in the hatchery (and presumably in the wild) is slowly homogenizing Wenatchee River summer steelhead. Analyses using brood year (the year fish were hatched, determined using scale-based age estimates) were inconclusive because of limitations of the data.

Effective population size (N_b) – Although the effective population size of the Wenatchee River hatchery summer steelhead program was consistently small, it does not appear to have caused a reduction in the effective population size of wild populations. On average, estimates of N_b were much lower and varied less for HOR adults than for NOR adults and juveniles. Estimates of N_b for HOR adults declined from the earliest brood years to a stable new low value after broodstock practices were changed in 1997. There was no indication that this had any effect on N_b in NOR adults and juveniles; N_b estimates for NOR adults and juveniles were, on average, higher and varied considerably over the time period covered by our dataset (1998 – 2010) and showed no temporal trend.

Introduction

The National Marine Fisheries Service (NMFS) recognizes 15 Evolutionary Significant Units (ESU) for west coast steelhead (*Oncorhynchus mykiss*). The Upper Columbia ESU, which contains steelhead in the Wenatchee Basin, was listed as endangered under the Endangered Species Act (ESA) in 1997. Included in this listing were the Wells hatchery steelhead (program initiated in the late 1960s) that originated from a mixed group of native steelhead and are considered to be genetically similar to natural spawning populations above Wells Dam. Juvenile steelhead from Wells Fish Hatchery was the primary stock released into the Wenatchee River (Murdoch et al. 2003). The 1998 steelhead status review identified several areas of concern for this ESU including the risk of genetic homogenization due to hatchery practices and the high proportion (65% for the Wenatchee River) of hatchery fish present on the spawning grounds (Good et al. 2005). The Biological Review Team (BRT) further identified the relationship between the resident and anadromous forms of *O. mykiss* and possible changes in the population structure ('genetic heritage of the naturally spawning fish') in the basin as two areas requiring additional study. Furthermore, the West Coast Steelhead BRT (2003) recommended that stocks in the Wenatchee, Entiat, and Methow rivers, within the Upper Columbia ESU, be managed as separate populations.

A review of the presence of resident *O. mykiss* in the Upper Columbia ESU (Good et al. 2005) shows that rainbow trout are relatively abundant in upper Columbia River tributaries currently accessible to steelhead as well as in upriver tributaries unavailable to anadromous access by Chief Joseph and Grand Coulee dams (Kostow 2003). U.S. Fish and Wildlife Service (USFWS) biologists surveyed the abundance of trout and steelhead juveniles in the Wenatchee, Entiat, and Methow river drainages in the mid-1980s and found adult trout (defined as those with fork length > 20 cm) in all basins (Mullan et al. 1992). The results also supported the hypothesis that resident *O. mykiss* are more abundant in tributary or mainstem areas upstream of the areas used by steelhead for rearing. No samples of rainbow trout from the Wenatchee were available for this study.

In addition to the mixed ancestry Wells Hatchery steelhead, Skamania Hatchery (Washougal River steelhead ancestry) steelhead were also released into the Wenatchee River basin for several years in the late 1980s (L. Brown, Washington Dept. of Fish and Wildlife [WDFW], personal communication). In 1996, broodstock for the Wenatchee River steelhead program were collected from Priest Rapids Dam and Dryden (rkm 24.9) and Tumwater (rkm 52.6) dams on the Wenatchee River. Because of the ESA listing, broodstock collection after 1996 was restricted to the Wenatchee River in an effort to develop a localized broodstock (Murdoch et al. 2003). Thus, starting in 1998, all juvenile steelhead released into the Wenatchee River and Wenatchee River tributaries were offspring of only Wenatchee River captured broodstock.

In response to the need for evaluation of the supplementation program, both a monitoring and evaluation plan (Murdoch and Peven 2005) and the associated analytical framework (Hays et al. 2006) were developed for the Habitat Conservation Plans Hatchery Committee through the joint effort of the fishery co-managers (Confederated Tribes of the Colville Reservation [CCT], NMFS, USFWS, WDFW, and Yakama Nation [YN]) and Chelan County, Douglas County, and Grant County Public Utility Districts (PUD). These reports outline 10 objectives to be applied to various species assessing the impacts of hatchery operations mitigating the operation of Rock Island and Rocky Reach Dams. This report pertains to Wenatchee River basin steelhead (*O. mykiss*) and the steelhead supplementation program as addressed by objective 3, specifically the first three evaluation indicators.

> **Objective 3:** Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

3.1 Allele Frequency

3.2 Genetic Distances Between Populations

3.3 Effective Spawning Population

To address these evaluation indicators the WDFW Molecular Genetics Lab (MGL) obtained pertinent tissue collections and samples, surveyed genetic variation with SNP markers using our standard laboratory protocols, and calculated the relevant genetic metrics and statistics. We used collections from both the Entiat River and Wenatchee River basins. Both have received hatchery plants from non-local stocks [i.e. Entiat was stocked with both Wenatchee and Wells program juveniles averaging 12K and 18K respectively during 1995-2001, and Wenatchee received on average 177K juveniles from the Wells program during 1995-2001; (Good et al. 2005)], and both have all or some part of the basin designated as natural production "reference" drainage – no hatchery outplanting (i.e., the entire Entiat Basin, and Peshastin Creek in the Wenatchee River basin) (Good et al. 2005).

Materials and methods

Sample collections

To address objectives 3.1 through 3.3, we obtained samples from hatchery (HOR, adipose fin clipped) and natural origin (NOR, adipose fin intact) adult summer steelhead captured at Dryden or Tumwater diversion dams in the summer and fall of 1997 through 2009 (excepting 2004 and 2005; Table 1). All or some fraction of these fish was later used as hatchery broodstock the calendar year following the sampling year. In order to keep things simple we have reported years as the spawning year, i.e., the calendar year the fish were spawned, not the calendar year they were captured.

To address objective 3.2, it was necessary to have samples from natural origin fish from each of the spawning populations in the basin. It is difficult to obtain adult samples from known spawning populations due to the life history and behavior of steelhead, without tributary weirs or some other blocking method of collection. The NOR adult samples used as broodstock collected from Dryden and Tumwater Dams were a mixed collection representing all of the spawning populations located upstream. Therefore to determine population substructure within the basin we obtained collections of juvenile fish from smolt traps located within tributaries representing three major populations in the basin and from the Entiat River (Chiwawa River, Nason Creek, and Peshastin Creek; Table 2). We also obtained two collections of juvenile fish caught in a smolt trap in the lower Wenatchee River. These, like the NOR adult collections, were a mixed collection presumably representing all populations located upstream. Fin tissue was taken from each fish and preserved in 95% ethanol.

Sample processing

Fin tissue samples were processed for 1468 HOR and NOR adult steelhead broodstock (Table 1) and for 1542 juvenile *O. mykiss* from the Wenatchee and Entiat Rivers (Table 2). Samples were genotyped at 152 single nucleotide polymorphism loci (SNPs, Tables 3, 4). We originally proposed to use microsatellites, but WDFW MGL and other regional genetic laboratories (Columbia River Inter-Tribal Fish Commission [CRITFC], Idaho Fish and Game [IDFG], USFWS) are moving toward using SNPs and they provide the same kinds of information with faster processing. Twenty SNP loci were developed to discriminate among trout species; 14 distinguish *O. mykiss* from coastal cutthroat trout (*O. clarkii clarkii*) and westslope cutthroat (*O. clarkii lewisi*), and 6 distinguish steelhead and coastal cutthroat from westslope cutthroat (Table 4). The remaining 132 SNP loci were developed to be used for population structure, parentage assignment, or other population genetic studies of *O. mykiss* (Table 3). These markers comprised the current standard set of SNP markers used for genetic studies of *O. mykiss* at WDFW MGL.

We used Qiagen DNEasy ® kits (Qiagen Inc., Valencia, CA), following the recommended protocol for animal tissues, to extract and isolate DNA from fin tissue. SNP genotypes were obtained through PCR and visualization on Fluidigm EP1 integrated fluidic circuits (chips). Protocols followed Fluidigm's recommendations for TaqMan SNP assays as follows: Samples were pre-amplified by Specific Target Amplification (STA) following Fluidigm's recommended protocol with one modification. The 152 assays were pooled to a concentration of 0.2X and mixed with 2X Qiagen Multiplexing Kit (Qiagen, Inc., Valencia CA), instead of TaqMan PreAmp Master Mix (Applied Biosystems), to a volume of 3.75µl, to which 1.25µl of unquantified sample DNA was added for a total reaction volume of 5µl. Pre-amp PCR was conducted on a MJ Research or Applied Biosystems thermal cycler using the following profile: 95°C for 15 min followed by 14 cycles of 95°C for 15 sec and 60°C for 4 minutes. Post-PCR reactions were diluted with 20µl dH_2O to a final volume of 25µl.

Specific SNP locus PCRs were conducted on the Fluidigm chips. Assay loading mixture contained 1X Assay Loading Reagent (Fluidigm), 2.5X ROX Reference Dye (Invetrogen) and 10X custom TaqMan Assay (Applied Biosystems); sample loading mixture contains 1X TaqMan Universal PCR Master Mix (Applied Biosystems), 0.05X AmpliTaq Gold DNA polymerase (Applied Biosystems), 1X GT sampling loading reagent (Fluidigm) and 2.1 µL template DNA. Four µL assay loading mix and 5 µL sample loading mix were pipetted onto the chip and loaded by the IFC loader (Fluidigm). PCR was conducted on a Fluidigm thermal cycler using a two step profile. Initial mix thermal profile was 70°C for 30min, 25°C for 5 min, 52.3° for 10 sec, 50.1°C for 1 min 50sec, 98°C for 5 sec, 96°C for 9 min 55 sec, 96°C for 15 sec, 58.6°C for 8 sec, and 60.1°C for 43 sec. Amplification thermal profile was 40 cycles of 58.6°C for 10 sec, 96°C for 5 sec, 58.6°C for 8 sec and 60.1°C for 43 sec with a final hold at 20°C.

The SNP assays were visualized on the Fluidigm EP1 machine using the BioMark data collection software and analyzed using Fluidigm SNP genotyping analysis software. To ensure all SNP markers were being scored accurately and consistently, all data were scored by two researchers and scores of each researcher were compared. Disputed scores were called missing data (i.e., no genotype).

Evaluation of loci

A two-tailed exact test of Hardy–Weinberg equilibrium (HWE) was performed for each locus in each collection or population using the Markov Chain method implemented in GENEPOP v4.1 (dememorization number 1000, 100 batches, 1000 iterations per batch; Raymond and Rousset 1995; Rousset 2008). Significance of probability values was adjusted for multiple tests using false discovery rate (Verhoeven et al. 2005). F_{IS}, a measure of the fractional reduction in heterozygosity due to inbreeding in individuals within a subpopulation and an additional indicator of scoring issues, was calculated according to Weir and Cockerham (1984) using GENEPOP v4.1. Allele frequencies were calculated using CONVERT v1.0 (Glaubitz 2004). Expected and observed heterozygosities were calculated using GDA v1.1 (Lewis and Zaykin 2001).

Allele frequencies, genetic distances and population differentiation

To evaluate Q1 of Objective 3.1 and 3.2, we evaluated trends and patterns in allele frequencies, genetic distances and population differentiation. To test for temporal patterns in allele frequencies, we compared sample or spawn year to two diversity metrics, allele frequency and observed heterozygosity, from each adult and juvenile collection. Each SNP locus had only one or two alleles, so we used the minor allele frequency (MAF) of each SNP locus for each adult collection and averaged across loci. We also calculated the average observed heterozygosity (Ho) for each SNP locus within each adult and juvenile collection. We examined the presence or absence of a temporal trend in average allele frequency and observed heterozygosity with logistic regression analysis in R (R Development Core Team 2009).

To partition genetic variance into temporal, spatial (juvenile) and origin (adult) fractions, we performed hierarchical analysis of molecular variance (AMOVA) using ARLEQUIN v3.0 (Excoffier et al. 2005) with 1,000 permutations. We performed this analysis separately for juvenile and adult collections. Juveniles were grouped by sampling location (tributary) and adults were grouped by origin (HOR or NOR). To estimate the magnitude of genetic differences among temporal and spatial collections we calculated pairwise F_{ST} estimates among collections using FSTAT (Goudet 1995) with 1000 permutations. Statistical significance was adjusted using false discovery rate (Verhoeven et al. 2005).

To evaluate the temporal changes in genetic relationships, we compared spawn year to within spawn year pairwise F_{ST} estimates between NOR and NOR adults using beta regression (Simas and Rocha 2010). We used beta regression because the dependent variable was bound by zero and one but not binomial. Analysis was performed in R (package "betareg", Cribari-Neto and Zeileis 2010), with a loglog link.

We used principal component analyses (PCA) to explore the relationship between the covariation among the SNP loci within each collection and genetic differentiation between HOR and NOR collections, and to determine if the degree of differentiation has changed with time. Since each SNP is represented by only two alleles, only one allele per SNP is necessary to fully describe the covariation among all SNPs. We used MATLAB® scripts (2007a, The Mathworks, Natlick, MA) to calculate the principal components from SNP allele frequencies using only the major allele (1-MAF) for each SNP. We defined the major allele as the allele with the higher mean frequency across all collections, regardless of its status within any individual collection. We conducted three PCA analyses using: (1) all adult samples, aggregated based on origin (HOR versus NOR) and spawn year (i.e., the year the adult fish were used as broodstock) (N = 1437, 22 collections), (2) same as #1, but with the addition of all juvenile samples (N = 2938, 37 collections), and (3) only those adults samples with available age information (Mike Hughes, WDFW, personal communication) aggregated based on origin, and spawn year or brood year (i.e., the year the fish were hatched) (N = 1313, 20 spawn-year or 25 brood-year collections).

Molecular differentiation between HOR and NOR adults within a year was calculated based on principal component scores using Euclidian distances. We calculated pair-wise Euclidian distances between HOR and NOR fish within a spawn year or brood year using the first three principal components, and standardized each distance by subtracting from it the mean Euclidian distance calculated across all pair-wise distances. We used Mahalanobis distances to calculate the variation among HOR and NOR collections (calculated separately), again using the first three principal components. Here, we calculated Mahalanobis distances as the Euclidian distances between each collection and the centroid of all collections (HOR and NOR combined), but the Euclidian distances are scaled based on the dispersion of collections around the centroid (i.e., the variance). Euclidian and Mahalanobis distances were calculated using MATLAB scripts.

Effective spawning population

To evaluate Q1 of Objective 3.3, we estimated N_e using the single-sample linkage disequilibrium methods implemented in the program LDNE (Waples and Do 2008). This method requires that you input the P_{crit} value, the minimum frequency at which alleles were included in the analysis, since results can be biased depending on this setting (Waples and Do 2010). SNP markers typically have only one or two alleles; if one of two alleles is excluded based on its frequency in the collection it essentially excludes the locus, reducing the overall dataset. Therefore, we used P_{crit} values ranging from 0.1 to 0.001 to evaluate whether trends in N_e changed given which loci were used. Confidence intervals were calculated using a jackknife procedure.

We calculated an estimate of N_e for all adult and juvenile collections individually. However, the intention of an integrated hatchery program such as the Wenatchee River steelhead hatchery program is that HOR and NOR fish are integrated and progress as a single population through intentional interbreeding in the hatchery and presumed natural interbreeding in the wild. Thus, we also combined annual HOR and NOR collections to calculate an overall N_e estimate as has been done in other genetic monitoring and evaluation analyses (e.g., Small et al. 2007, [Chinook salmon, *O. tshawytscha*]).

Estimates of N_e from linkage refer to the generations that produced the sample. To calculate the ratio of effective population size to census size (N_e/N), we obtained the number of fish spawned in the hatchery (1993 through 2006, i.e., those that produced the adipose fin clipped adults that returned to spawn in the Wenatchee River 1998 through 2010) and the estimated escapement of fish spawning naturally (HOR and NOR separately) for the same time period. Estimates of census population size in spawning tributaries was obtained by multiplying the fraction of redds counted within tributaries (Chad Herring ,WDFW, unpublished data) by the total Wenatchee River census population estimate (Andrew Murdoch, WDFW, unpublished data). To calculate N_e/N, we performed two analyses. First, for adults, we assumed a five year generation time for natural origin adults and a four year generation time for hatchery origin adults and divided the N_e estimate by the census population estimate from four or five years earlier. For juveniles, we assumed an age at outmigration of two years and divided the N_e estimates by the estimate of census population size for the appropriate tributary. Second, we used available adult age data to parse individuals into cohorts originating in brood years (rather than spawn years) and then used LDNE to estimate N_e from cohort collections. We performed both analyses to make full use of all available data; age data were not available for many adults, and because of variable survival and sampling not all cohorts had sufficient numbers of HOR and NOR adults. According to Luikart et al. (2010), estimates produced using linkage disequilibrium should be interpreted as something between effective population size (N_e) and the effective number of breeders (N_b). Using cohorts, the estimate produced by LDNE is clearly an estimate of N_b rather than N_e. In order to keep things simple, we have referred to all estimates as N_b.

Results and Discussion

Collections and samples received

From 1468 samples from HOR and NOR adult steelhead broodstock, 1437 produced sufficient genetic data for further analysis (Table 1). From 1542 samples from NOR juvenile steelhead from Wenatchee River tributaries and the Entiat River, 1501 produced sufficient genetic data for further analysis and were genetically identified as *O. mykiss* (Table 2). Samples genetically identified as *O. clarki* (2 samples from the Chiwawa River, 1 from the Entiat River) or *O. clarki*/*O. mykiss* hybrids (4 – lower Wenatchee River, 4 – Nason Creek, 4 – Chiwawa River, and 1 – Entiat River) were omitted from further analysis.

Evaluation of loci

Three loci showed deviations from HWE in 10 or more of 37 Wenatchee steelhead collections before correcting for multiple tests (AOmy016, AOmy051, AOmy252, Table A1) indicating possible scoring issues. These loci were omitted from further analysis. Nine of the remaining loci were monomorphic or nearly monomorphic in all collections (average MAF < 0.1, AOmy023, AOmy028, AOmy123, AOmy129, AOmy132, AOmy209, AOmy229, AOmy270, AOmy271, Table A1) contributing little or nothing to analytical power. These loci were also omitted from further analysis. No genetic data was available for collection 10FD due to poor PCR amplification at locus AOmy213 for the entire collection. AOmy213 had a relatively low MAF in most collections so rather than re-processing this collection at this locus or running different sets of loci for different tests, we omitted this locus from further analysis. Only six tests of deviation from HWE were significant after correcting for 4348 tests using false discovery rate. Two of these tests were in loci already omitted. The remaining four tests were spread among the remaining loci, indicating no more loci needed to be omitted from further analysis.

Objective 3.1, 3.2 – Allele frequencies and Genetic distances

Allele frequencies

Average MAF of SNP loci ranged from 0.00 to 0.60 in HOR adult collections and from 0.00 to 0.61 in NOR adult collections (Table A1). Observed heterozygosity ranged from 0.00 to 0.75 in HOR adult collections and from 0.01 to 0.67 in NOR adult collections. Juvenile collections produced similar ranges of MAF and Ho (Table A1). Average MAF and Ho of HOR adult collections appeared to be greater than those of natural origin collections. However, logistic regression analysis indicated there was no significant temporal trend in either diversity statistic (Figure 1). Similarly, there was no consistent temporal trend in MAF or Ho of juvenile collections (Figure 2). Both the Chiwawa River and Nason Creek, the two tributaries that currently still receive hatchery juvenile outplants, both appeared to have declining allele frequencies, but neither was statistically significant ($P > 0.90$). However, the power to detect significant trends was limited by the small sample sizes (n = 3 sample years).

Analysis of Molecular Variance

Analysis of molecular variance (AMOVA) of adult collections (i.e., temporal and origin structure) indicated most of the genetic variance was among individuals or among individuals within populations (99.04%). Most of the remaining variance was temporal variation within hatchery and natural origin groups (0.61%) with the remaining variation from origin (0.35%). AMOVA of juvenile collections (i.e., spatial structure) indicated most of the genetic variance was among individuals (98.44%) or among individuals within populations (0.94%). Most of the remaining variance existed among temporal collections within tributary collections (0.37%) with the smallest fraction as among tributary variance (0.24%). Thus, overall, there was more variability among years than among tributaries or origins, but no trend in the temporal variability.

Pair-wise F_{ST} *estimates*

HOR adults were genetically different that NOR adults as estimated by F_{ST} (full pair-wise table in Table A2, all pair-wise F_{ST} estimates with P-values ≤ 0.05 before correcting for multiple tests were significantly different from zero after correcting for multiple tests using false discovery rate). On average, HOR adult collections were as different from one another (mean F_{ST} = 0.011) as they were from NOR adult collections among years (mean F_{ST} = 0.009) or from NOR adult collections within years (mean F_{ST} = 0.010). Among year comparisons of NOR adult collections were, on average, nearly an order of magnitude lower (mean = 0.002). These patterns held whether spawn year or brood year (data not shown) was used to group individuals. Over time, within spawn year pair-wise F_{ST} estimates between HOR and NOR adults declined over time (β = -0.014, P = 0.0185; Figure 3), suggesting that the integration of hatchery and wild fish is slowly genetically homogenizing the groups. That relationship disappeared when adults were grouped by brood year (i.e., comparing fish produced the same year) and all brood years were used (β = -0.009, P = 0.615, data not shown). However, when the dataset was restricted to just those brood years when all typical (age at maturation frequency among all years > 0.10) age classes were present in the dataset (HOR = age 3, 4; NOR = age 4, 5, 6; brood years 1996-1998, 2004-2005) a non-significant (P = 0.278) negative relationship (β = -0.12) of F_{ST} and brood year was apparent. When the data were further restricted to just the years after the hatchery program changed to only collecting broodstock in the Wenatchee River (brood years 1998, 2004-2005), the slope was also negative (β = -0.09), but the relationship was not statistically significant (P = 0.962).

Within tributary among sample year pair-wise comparisons of juvenile collections were, on average, only very slightly smaller than comparisons among tributaries (0.005 vs. 0.006, respectively, Table 5, all pair-wise F_{ST} estimates with P-values ≤ 0.05 before correcting for multiple tests were significantly different from zero after correcting for multiple tests using false discovery rate). Nason Creek and Peshastin Creek on average showed higher among sample year F_{ST} estimates (0.010 and 0.007, respectively) than the Chiwawa or Entiat Rivers (0.004 and 0.002, respectively). The pair-wise comparison of the two collections of lower Wenatchee River smolts, presumably a mix of Chiwawa, Nason, Peshastin smolts and smolts from other spawning tributaries, was an order of magnitude smaller (F_{ST} = 0.0002), and not significantly different than zero (Table 5). There was no temporal trend in pair-wise comparisons of juvenile collections. However with, at most, four annual collections, detecting any temporal trend was unlikely. We also had no collections from years prior to 1998 (the first year of new hatchery program broodstock collecting protocols) with which to compare contemporary data, nor could we find any reports or papers containing pre-hatchery-program-change genetic comparisons among Wenatchee River tributary populations, making it impossible to determine whether or not changing the hatchery program has had any effect at all on population structure. However, these data will be useful for future studies.

Principal Components

Each principal component analysis (Figures 4, 5) indicated that the genetic structure among HOR collections differed from that among NOR collections, and that this difference has decreased with time. When adult fish were aggregated based on origin and spawn-year, there was a clear differentiation between HOR and NOR adult collections along PC 1, and a separation among HOR collections, differentiating the early spawn-years (1998 – 2003) from the later spawn-years (2004 – 2010) along PC 2 and PC 3, respectively (Figure 4). The pair-wise genetic distances between HOR and NOR collections from the same spawn year (i.e., the HOR and NOR fish used as broodstock within the same year) decreased from the largest distance in 1998 to small distances in 2009 and 2010, although the smallest distance occurred in 2004 (Figure 4, top right). That is, within hatchery broodstock, the genetic difference between HOR and NOR fish decreased, on average, from 1998 to 2010, and the decrease appeared to be a mutual convergence of NOR fish shifting right along PC 1 and HOR fish shifting downward along PC 2 and PC 3. This increasing similarity in adult fish mirrored that seen in within year pair-wise F_{ST} estimates between HOR and NOR adults which also declined over time (Figure 3).

Overall, there was considerably more genetic variation among the HOR collections than there was among the NOR collections with average Mahalanobis distances (distance between each collection and the overall centroid [0,0,0]) among the HOR and NOR collections being 4.2 and 1.5, respectively. Since each NOR collection was generally composed of 3-4 brood-years, while HOR collections rarely were composed of more than two brood-years, we attributed the lower year-to-year genetic variability of the NOR broodstock to the greater homogenizing effect of including four or more brood-years compared with only two brood years for the HOR broodstock.

Including the 15 juvenile collections, along with the 22 adult collections, did not materially alter the principal component structure (Figure 6), although the total genetic variation accounted for by the three principal components decreased from 44% using only the adults to 33% when juveniles were included. For the most-part, the juvenile fish appeared intermediate between HOR and NOR fish, but there was greater overlap in principal component scores (and therefore greater genetic similarity) of the juvenile and NOR collections, than of the juvenile and HOR collections. The average Euclidian distance between the juvenile and HOR collections was 0.49, compared to 0.23 between the juvenile and NOR collections, which was no different than 0.23 and 0.22 for the within juvenile and NOR collections, respectively.

By using the available adult age data, we were able to compare the genetic differentiation among the same set of fish when they are aggregated by origin (hatchery versus natural) and brood-year (year fish were hatched) with aggregates based on origin and spawn-year (year adult fish were spawned). A brood-year analysis compares within a year the genetic diversity generated from hatchery broodstock with that naturally produced in the spawning grounds. A spawn-year analysis compares the HOR and NOR genetic diversity that was mixed among cohorts of the parental generations. The same basic pattern of genetic structure that we have seen in spawn-year analyses (Figure 4, Figure 6, and the right side of Figure 5) also occurred in the brood-year analysis (left side of Figure 5). That is, from Figure 5 we saw (1) that HOR and NOR fish were differentiated from each other; (2) there was considerably more genetic variation (temporal variation) among the hatchery-origin collections than there was among the natural-origin collections (for brood-year, Mahalanobis distances = 5.18 and 0.75, respectively; for spawn-year, Mahalanobis distances = 4.25 and 1.25, respectively), and (3) that the genetic distances between HOR and NOR collections were lower in the more recent brood- and spawn-years, than in the earlier brood- and spawn-years (Figure 7; R^2 = 0.41 or 41%, $P < 0.05$). This indicated that the HOR and NOR fish used as broodstock in 2010 were more similar to each other than they were at the inception of the new hatchery program.

The relationship between genetic distance and brood-year was not the same as the relationship between genetic distance and spawn-year. For brood-year, although the slope was negative (i.e., trending downward or decreased differentiation with time) and the two most-recent brood years (2005-2006) showed relatively small HOR and NOR adult differentiation, the negative slope was not significantly different from zero and the regression accounted for only 7% of the variation. This was likely the result of insufficient sampling of certain age classes from many brood years (especially from NOR adults) due to two un-processed sample years (2005 and 2006).

Objective 3.3 – Effective spawning population

There was no difference in the temporal trends in estimates of N_b with P_{crit} set from 0.1 to 0.001 (Figure 8, data not shown for all collections), so we have reported only results with $P_{crit} = 0.001$, i.e., the full genetic dataset. Using either spawn-year or brood year, estimates of NOR adult N_b were higher and varied more than those of HOR adults (Figures 9, 10), concordant with the PCA analysis. Estimates for HOR adults ranged from 17 to 174 (by spawn year, mean = 65) or from 6 to 130 (by brood year, mean = 39). Estimates for NOR adults ranged from 36 to 982 (by spawn year, mean = 405) or from 59 to 2966 (by brood year, mean = 645). Many N_b estimates for NOR adults had confidence intervals extending to infinity on the upper bound. This reflected the difficulty in obtaining precise estimates of N_b for large populations (Waples and Do 2010).

Estimates of N_b for HOR steelhead dropped by approximately half from 1994, when broodstock were still collected at Wells Hatchery, to 1998, when the program used Wenatchee River trapped adults only, suggesting an effect of changing broodstock collection practices, which began in 1997 (Figures 8, 9). Since 1997, the hatchery population N_b remained at a relatively stable lower level (Figures 8, 9, and 10). There was no obvious change in N_b for NOR steelhead since 1993; the N_b estimate for 1993 was the largest, however the confidence interval overlapped estimates from many other years. The temporal trend in N_b estimates from combined collections mirrored those of the HOR collections alone, though estimates using combined collections were slightly larger (Figure 11).

As with N_b estimates, estimates of the ratio of N_b/N for NOR adults varied more than those of HOR adults (Figures 12, 13). However, using spawn year, i.e., mixtures of cohorts, the average N_b/N ratio for HOR adults was equal to that of NOR adults (mean $N_b/N = 0.26$), whereas when using brood year, the average N_b/N ratio for NOR adults was double that of HOR adults (NOR average =0.40, HOR average = 0.20). This is likely a consequence of the homogenizing effect of mixed cohorts. Estimates of N_b for HOR adults using spawn year were close to those estimated using brood year because of the lower diversity in age at maturation, whereas for NOR, grouping by brood year produces different estimates than when grouping by spawn year because of higher diversity in age at maturation. Regardless of which estimate was used, there was no temporal trend in N_b/N for either NOR or HOR adults.

Summary

On average, HOR adults had higher minor allele frequencies (MAF) than NOR adults, and both had similar MAF as juveniles collected in spawning tributaries and in the Entiat River. There was no temporal trend in allele frequencies or observed heterozygosity in adult or juvenile collections and allele frequencies in control populations were no different than those still receiving hatchery outplants suggesting that the hatchery program has had little effect on allele frequencies since 1998.

HOR adults were genetically quite different from NOR adults and juveniles based on pair-wise F_{ST} and principal components analysis (PCA), most likely because of the much smaller effective population size (N_b) in the hatchery population. Pair-wise F_{ST} estimates and genetic distances between HOR and NOR adults collected the same year declined over time suggesting that the interbreeding of HOR and NOR adults in the hatchery (and presumably in the wild) is slowly homogenizing Wenatchee River summer steelhead. Analyses using brood year (the year fish were hatched, determined using scale-based age estimates) were inconclusive because of limitations of the data.

On average, estimates of N_b were much lower and varied less for HOR adults than for NOR adults and juveniles. Estimates of N_b for HOR adults declined from the earliest brood years to a stable new low value after broodstock practices were changed in 1997. There was no indication that this had any effect on N_b in NOR adults and juveniles; N_b estimates for NOR adults and juveniles were, on average, higher and varied considerably over the time period covered by our dataset (1998 – 2010) and showed no temporal trend. Small N_b sizes increase the risk of loss of genetic diversity due to inbreeding and random effects (genetic drift). The N_b of the hatchery component of the population may be increased by spawning more families, using specific mating designs, and minimizing variance in reproductive success. However, given the apparent lack of effects overall, changes to the hatchery protocol may not be necessary.

Overall, hatchery practices appear to have had little effect on natural origin Wenatchee summer steelhead neutral genetic diversity or N_b. We cannot accurately assess their effects on population structure at this time. However, it is interesting to note that when juvenile collections are analyzed separately from adult collections, Peshastin Creek, which has received fewer hatchery outplants in the past and is currently a refuge from hatchery outplants, is genetically different than other tributaries and the Entiat River (data not shown). On the other hand, the Entiat River, which is also a refuge from hatchery outplants and is not a tributary of the Wenatchee River, is genetically very similar to Nason Creek and the Chiwawa River, both Wenatchee River tributaries. This suggests, though it does not conclude, that within basin population structure may have existed before summer steelhead hatchery production began in the upper Columbia River and that the population structure was eliminated by hatchery influence long before 1998.

Acknowledgements

We thank Chad Herring, Clint Deason, John Walters and the numerous technicians that sampled these thousands of fish. We thank Sonia Peterson and Sarah Bell for help in the laboratory and thank Maureen Small for help with some analyses. The project was implemented with funding from the Chelan Co. PUD and Washington State general funds.

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Figures

Figure 1. Observed average minor allele frequencies (MAF) and observed heterozygosities (Ho) of 119 SNP loci from 11 annual collections of hatchery-produced (HOR) and natural origin (NOR) adult steelhead from the Wenatchee River. Trend lines are from a logistic regression. Note the X axis does not cross the Y axis at the origin. Neither the slopes nor the intercepts were statistically significant.

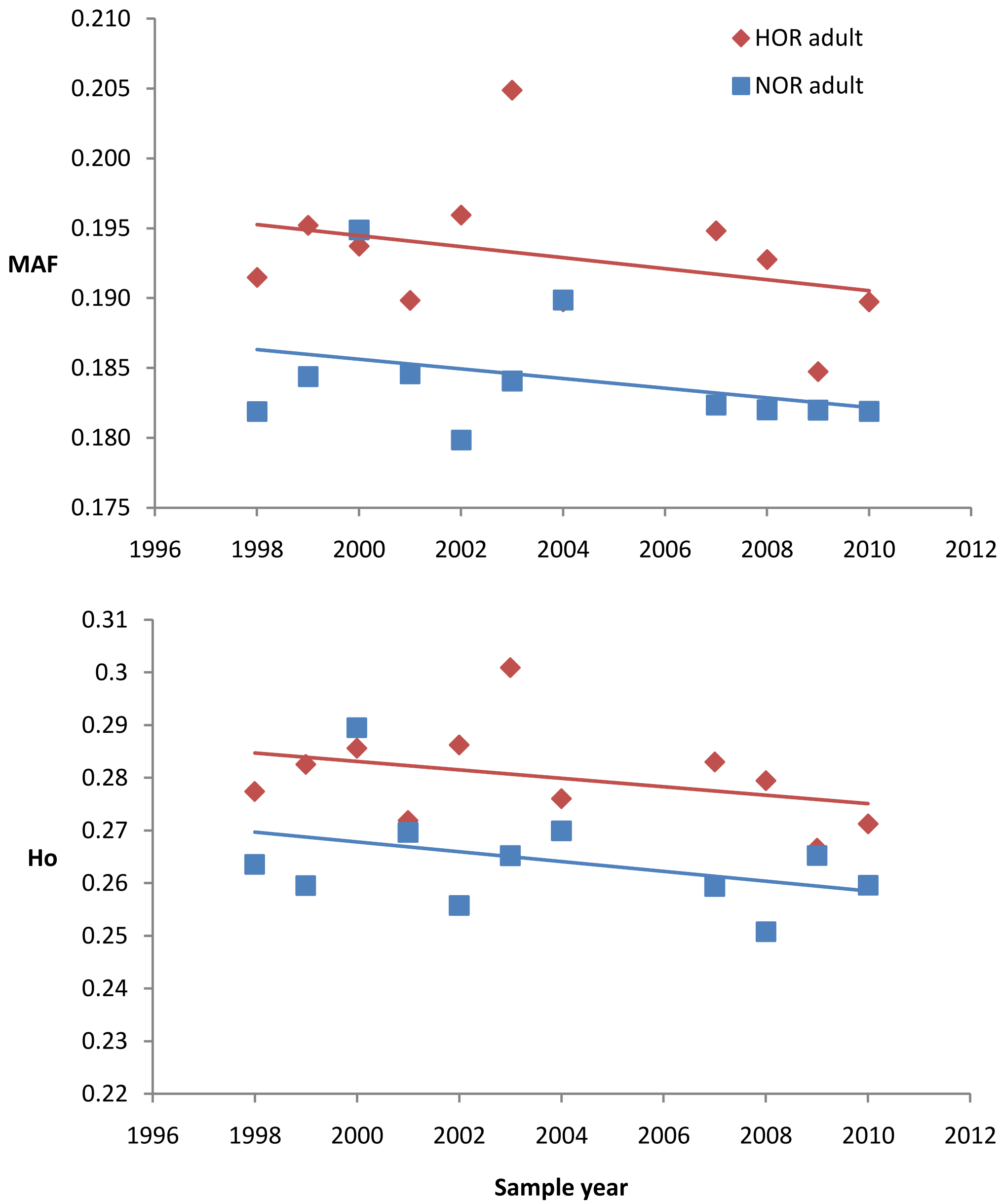


Figure 2. Observed average minor allele frequencies (MAF) and observed heterozygosities (Ho) of 119 SNP loci from 15 collections of natural origin juvenile steelhead from Wenatchee River tributaries, the lower Wenatchee River and the Entiat River. There were no consistent temporal trends in MAF or Ho in these collections.

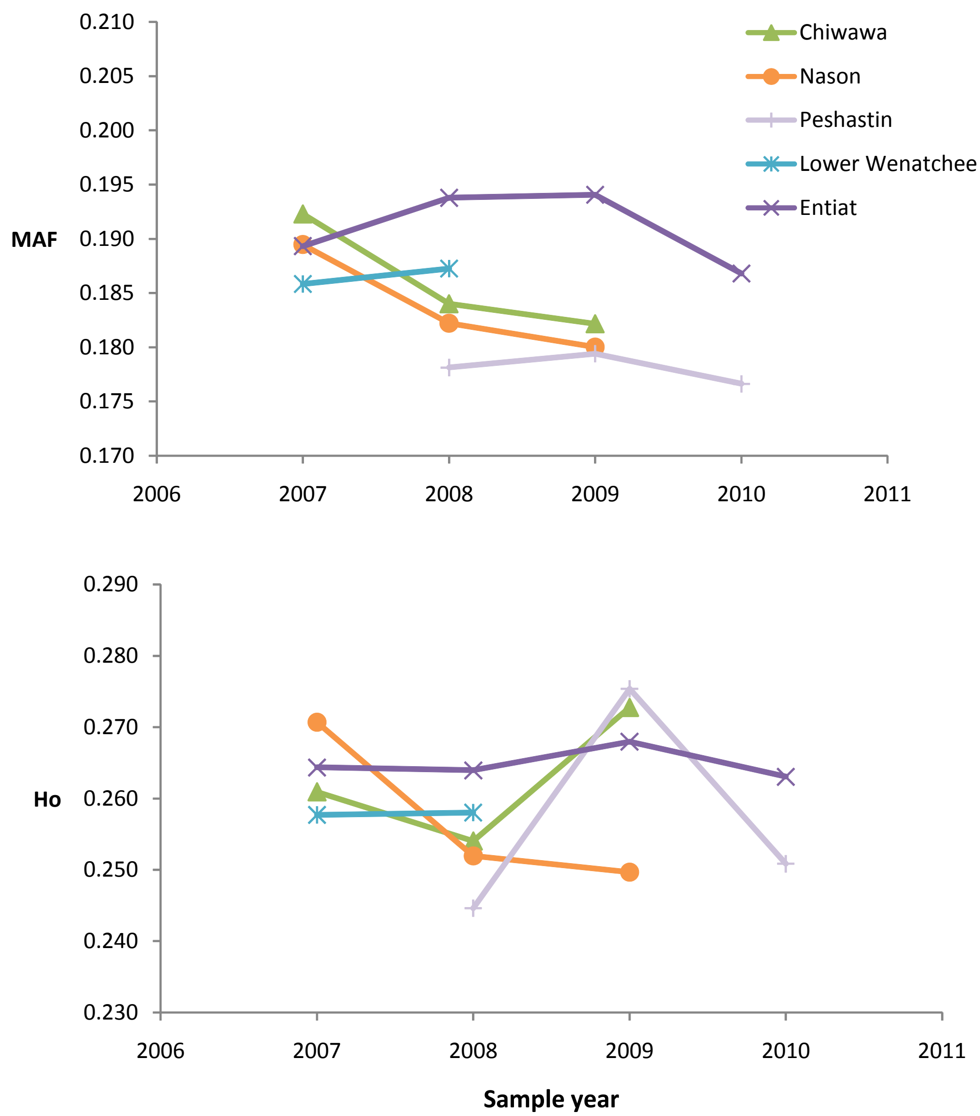


Figure 3. The relationship of time with pairwise F_{ST} estimates between hatchery-produced (adipose fin clipped) and natural origin (unclipped) adults of the same sample year. The line is the prediction based on beta regression.

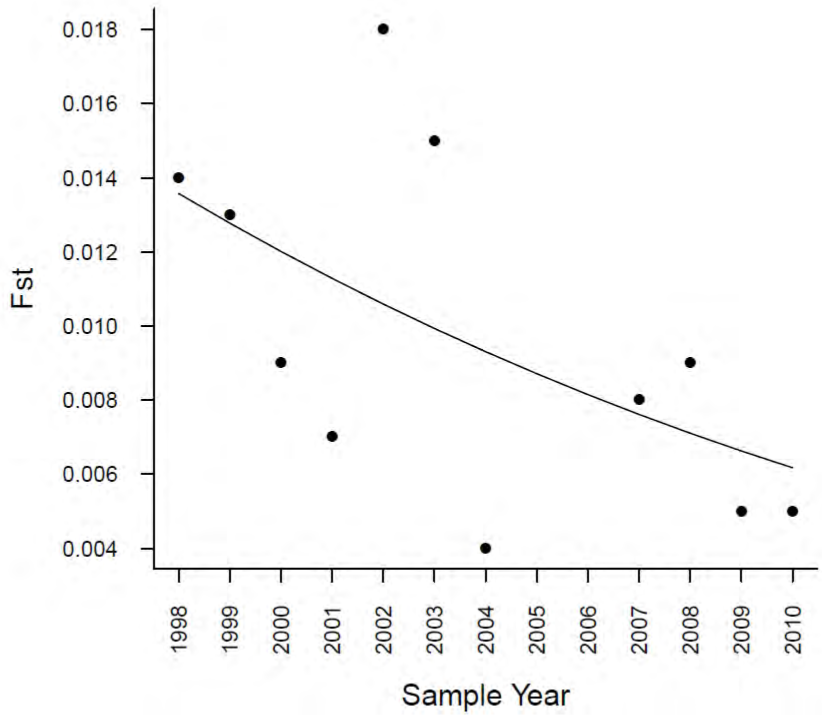


Figure 4. Principal component (PC) 1 versus 2 (top left), PC 1 versus 3 (bottom left), and PC 2 versus 3 (bottom right) based on an analysis using all adults aggregated into origin and spawn-year collections. Natural-origin spawn-years are shown in italicized typeface. The percentage within the label of each axis convey the percent of total genetic variance that is accounted for by that axis. Taken together, the three principal components account for 44% of the total SNP variation. Top right shows pairwise Euclidian distances versus spawn-year, with zero distance equal to average distance across all pairwise distances. Blue line is least-squares fit with $R^2 = 0.45$.

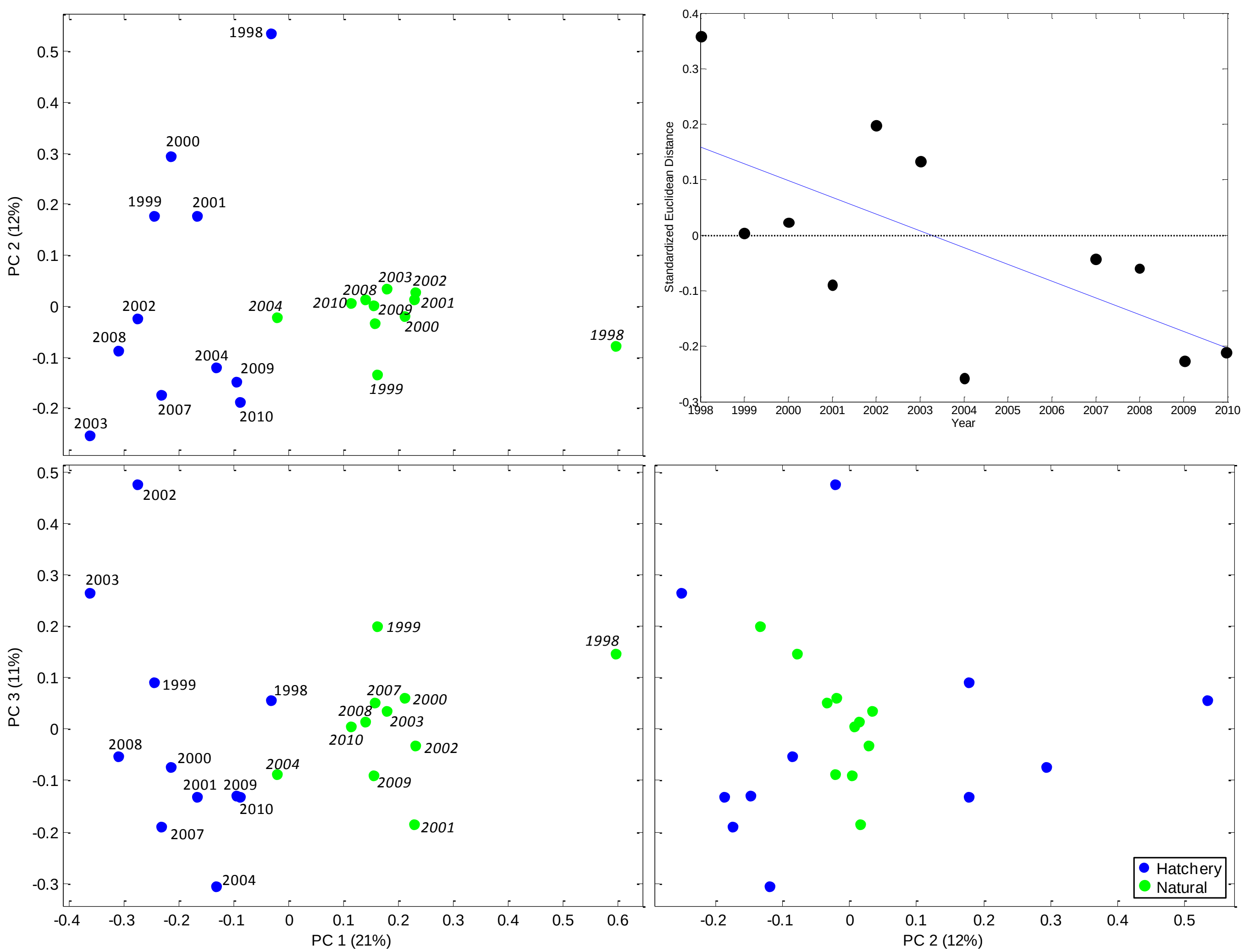


Figure 5. Principal components (PC) 1 versus 2 (top) and 3 (bottom) for adults aggregated into brood-year (BY; left) and spawn-year (SY; right). Spawn-year analysis is the same as in Figure x1, except fewer individuals per collection were included (see methods). Note that for the SY analysis here PC 2 and 3 are similar to PC 3 and 2, respectively, in Figure x1. Only BY1995 (earliest year with paired hatchery-natural data), BY2000 (extreme PC 1 score), and BY2006 (latest year with paired hatchery-natural data) are labeled. Hatchery- and natural-origin individuals from BY1995, BY2000, and BY2006, returned to spawn (spawn-year) in 1999 (hatchery)/1999-2001 (natural), 2003-2004 (hatchery)/2004 and 2007 (natural), and 2009-2010 (hatchery)/2010 (natural), respectively. These years are labeled in the upper right figure. Only 4 year-old BY 2006 natural-origin fish are represented in the SY 2010 collection.

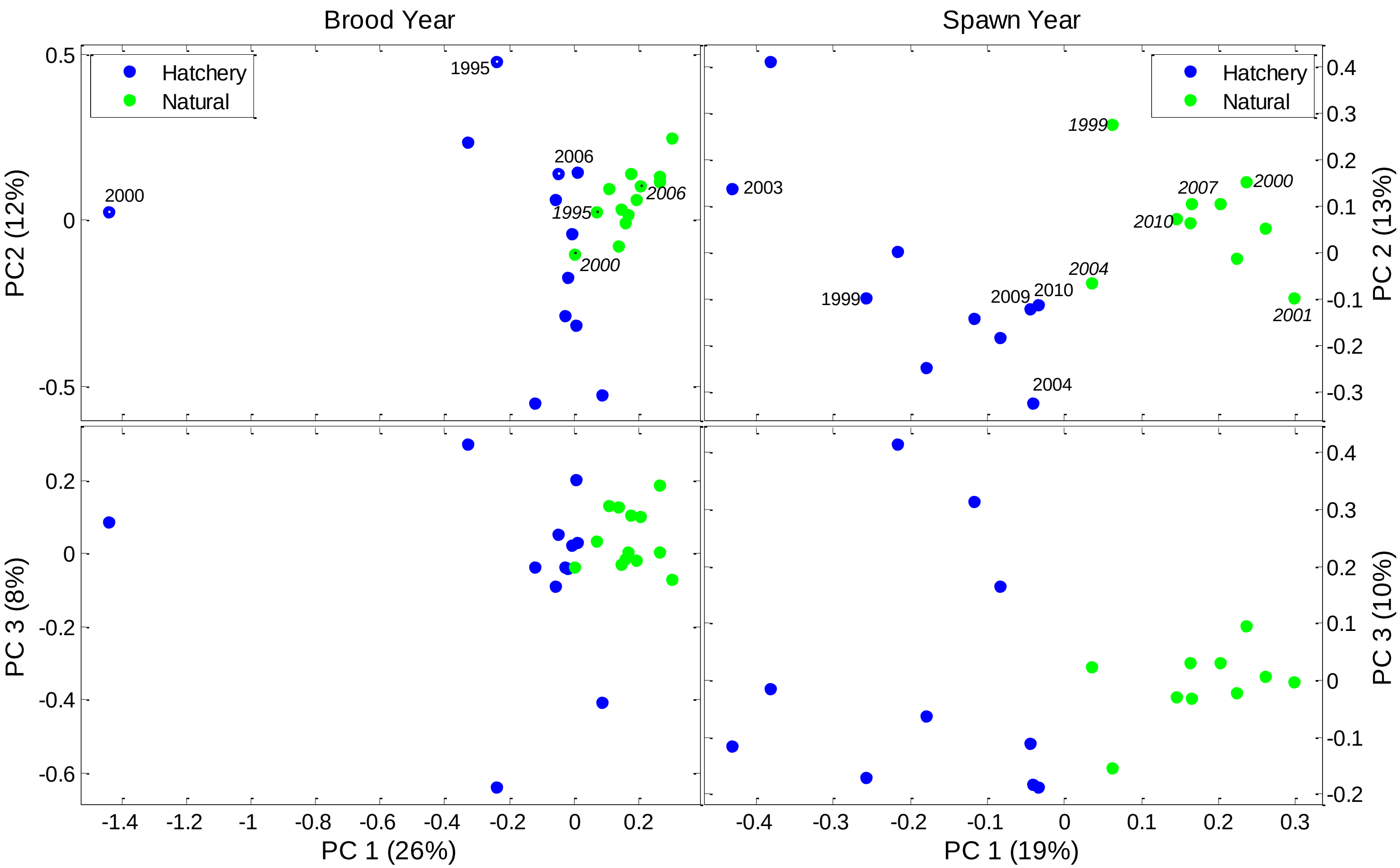


Figure 6. Principal component (PC) 1 versus 2 (top) and PC 1 versus 3 (bottom) based on an analysis using all adult and juvenile fish aggregated into age (juvenile versus adult), origin (hatchery versus adult) and spawn-year collections.

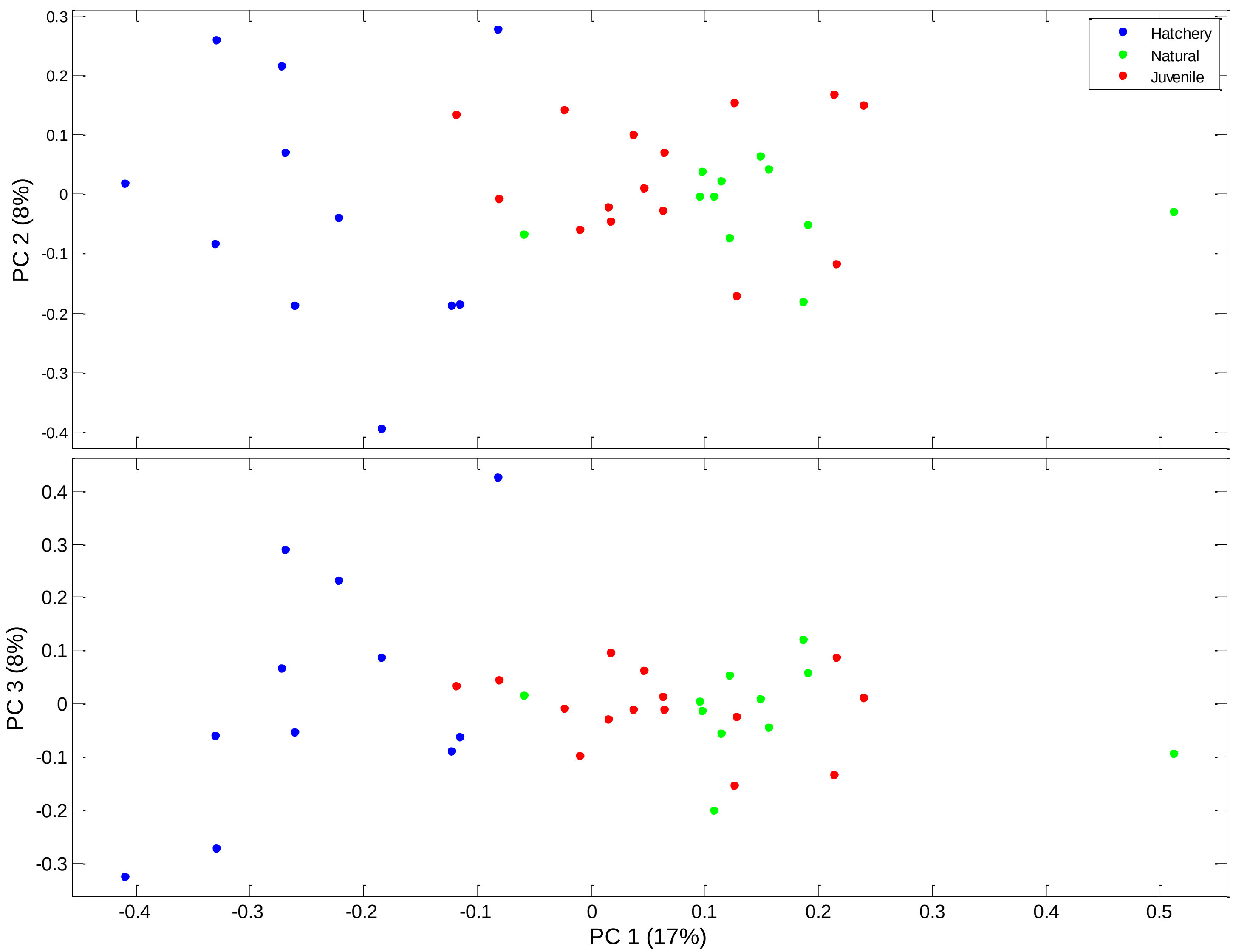


Figure 7. Pairwise Euclidian distances versus brood-year (top) and spawn-year (bottom), with zero distance equal to average distance across all pairwise distances. Blue lines are least-squares fits, which is not significant (slope = 0) for brood-year, but significant (slope > 0) for spawn-year.

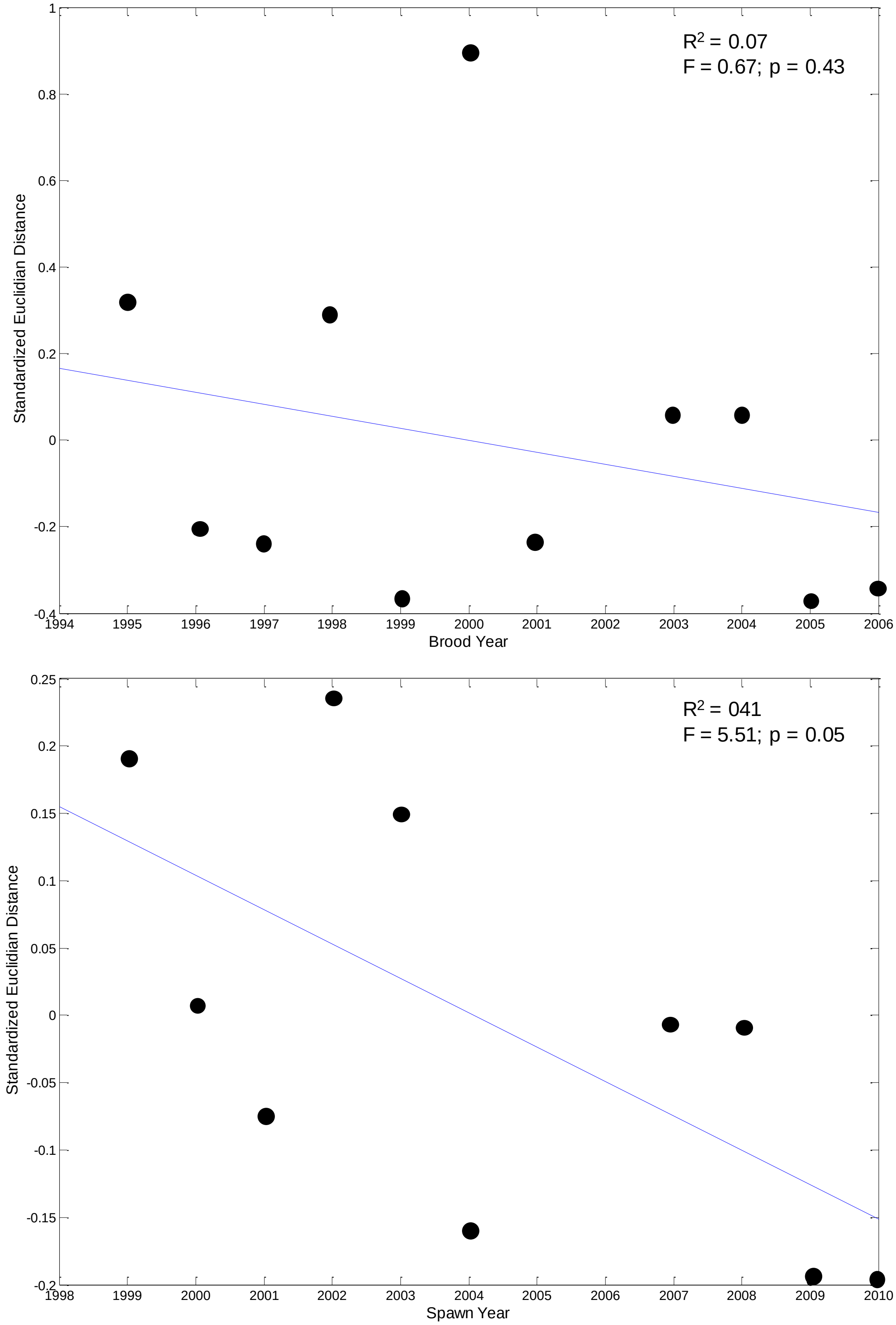


Figure 8. Effective population size estimates (N_b) from Wenatchee River adult hatchery-produced steelhead annual collections calculated using single sample methods implemented in the program LDNE (Waples and Do 2008). Each line connects annual estimates of N_b estimated with a different value of P_{crit}, the smallest allelic proportion allowed during analysis. With SNP data, omitting an allele omits the locus. Estimates of N_b changed very little when P_{crit} varied from 0.1 to 0.001. Setting P_{crit} = 0.001 forced the use of all available loci.

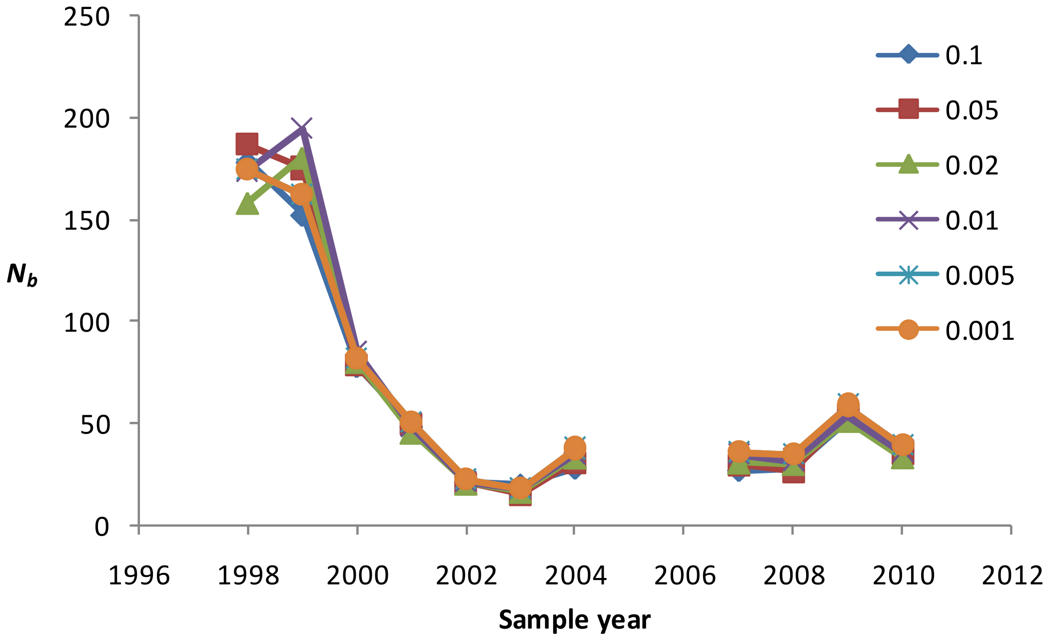


Figure 9. Estimates of Wenatchee River steelhead effective number of breeders (N_b) estimated using the single sample methods incorporated in the program LDNE (Waples and Do 2008). Estimates of N_b refer to parental (and even grantparental) generations. N_b data were plotted against their estimated parental brood year. We assumed a 5 year generation time for natural origin adults (NOR), a 4 year generation time for hatchery-produced adults (HOR) and an age of smolt outmigration of age 2 for smolt collections from Wenatchee River tributaries (Chiwawa River, Nason Creek, Peshastin Creek), the lower Wenatchee River, and the Entiat River. Bars represent the 95% confidence interval estimated by jackknife procedure. Bars that exceed the upper limit of the Y axis are labeled with the upper bound (Inf. = infinity).

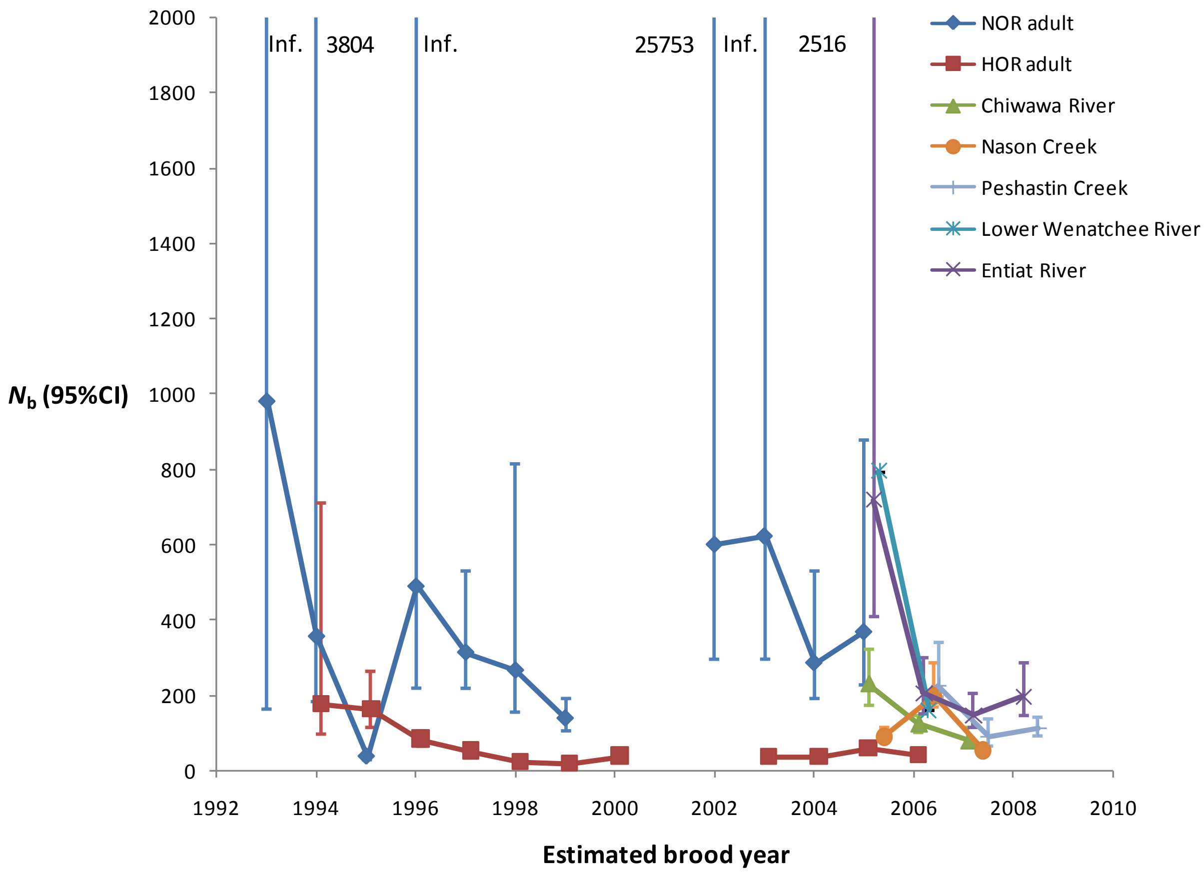


Figure 10. Estimates of N_b for collections of hatchery-produced (HOR) and natural origin (NOR) Wenatchee River summer steelhead grouped by brood year rather than spawn year. Brood year was estimated using scale-based age data. Error bars that extend past the top of the chart are all bounded by infinity.

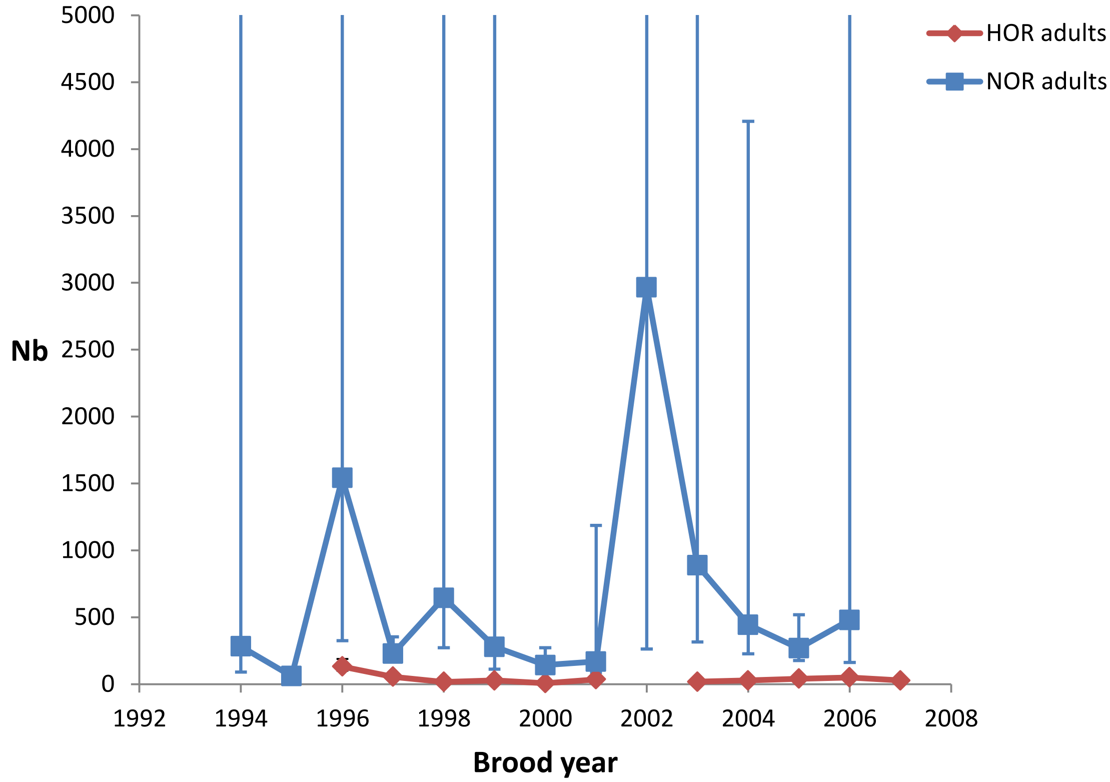


Figure 11. Estimates of N_b for combined annual adult hatchery-produced (HOR) and natural origin (NOR) steelhead and for HOR adults alone. The temporal patterns are similar, though estimates from combined collections are larger than those from HOR collections alone.

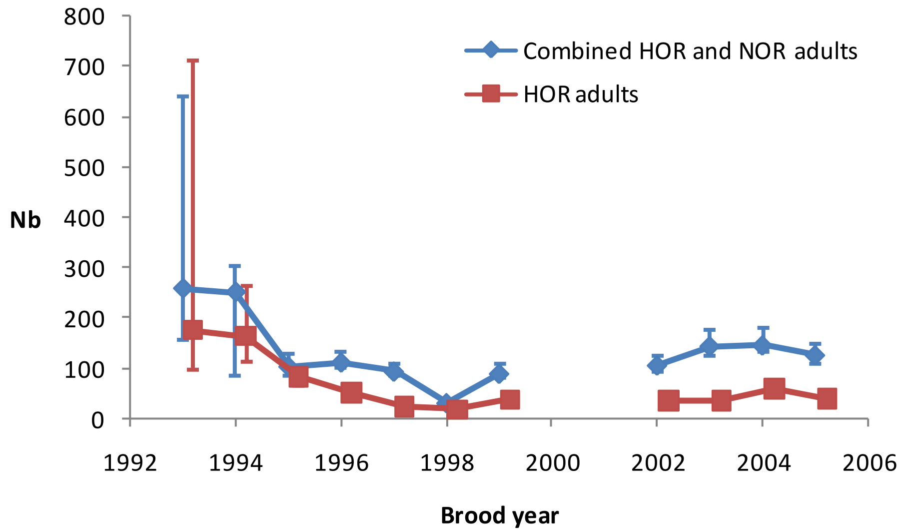


Figure 12. N_b/N ratios for hatchery-produced (HOR) and natural origin (NOR) adult Wenatchee River summer steelhead grouped by spawn year. The average N_b/N ratios are not different, though in later years NOR adults appear to have lower N_b/N ratios.

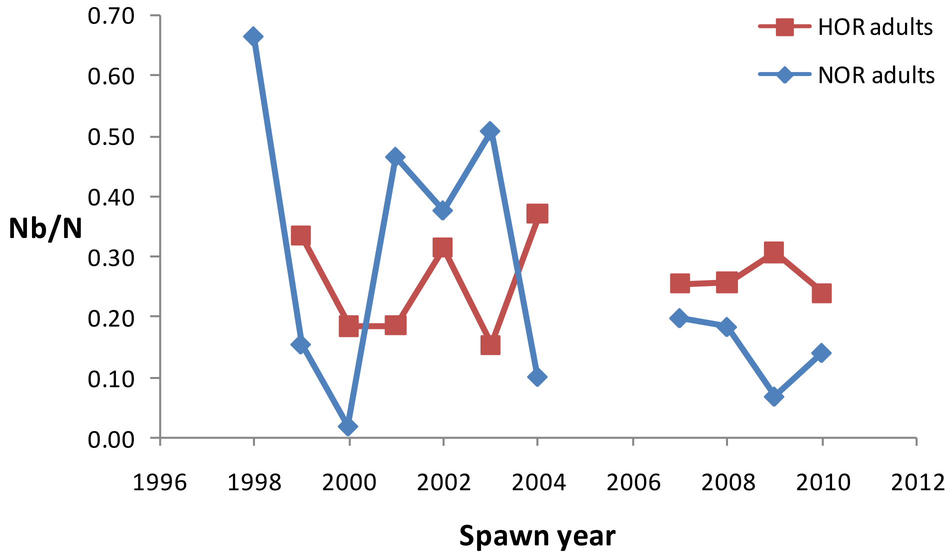
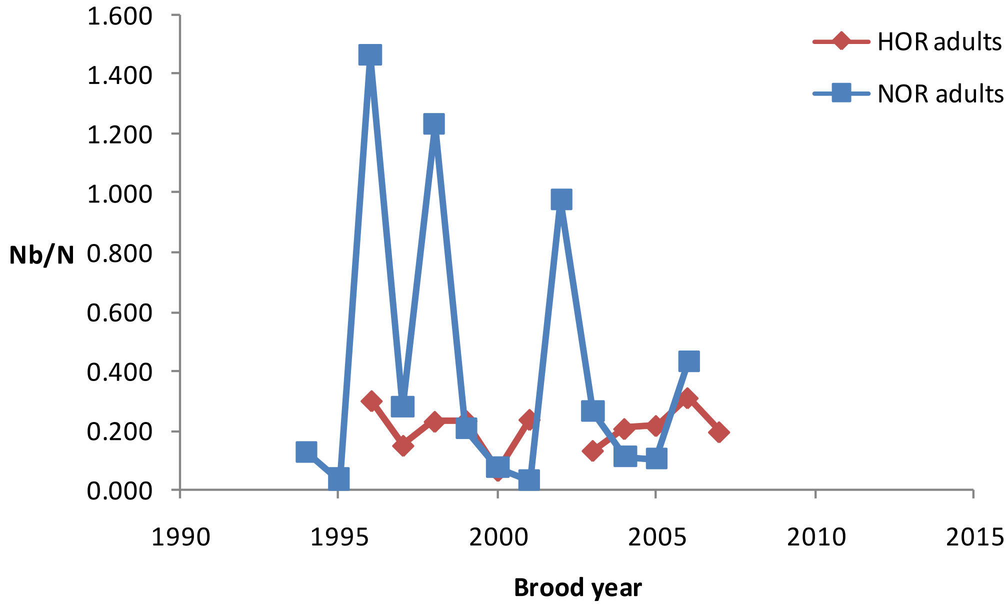


Figure 13. N_b/N ratios for hatchery-produced (HOR) and natural origin (NOR) adult Wenatchee River summer steelhead collections with individuals grouped in brood years rather than spawn years. Individual brood year was estimated using scale-based age data.



Tables

Table 1. Samples of adult steelhead collected for Wenatchee Program broodstock and used for genetic monitoring and evaluation.

Origin	Sampling Location	Year spawned	WDFW Collection code	Samples (N)	Unused Samples[a]
Hatchery	Dryden/Tumwater Dams	1998	98AE	32	4
		1999	98LJ	62	2
		2000	99NE	60	5
		2001	00DQ	99	1
		2002	01MS	64	
		2003	02NP	89	
		2004	03KW	61	
		2007	06CW	64	1
		2008	08AG	56	
		2009	09AV	74	
		2010	10FE	76	1
			Total	737	14
Natural	Dryden/Tumwater Dams	1998	98AF	30	5
		1999	99AA	51	1
		2000	99ND	33	3
		2001	00DP	50	
		2002	01MR	95	
		2003	02NO	50	
		2004	03KV	71	3
		2007	06CX	74	
		2008	08AF	74	1
		2009	09AU	82	2
		2010	10FD	90	2
			Total	700	17

[a]Samples were not used if they had incomplete (≤ 80% or 95 of 119 loci) or duplicate genotypes.

Table 2. Samples of natural origin juvenile steelhead and rainbow trout collected from four Wenatchee basin rivers or creeks and the Entiat River.

Sampling Location	Collection Year	WDFW Collection Code	Samples (N)	Unused samples[a]
Chiwawa River	2007	07AO	127	5
	2008	08CG	143	1
	2009	09NF	35	2
Entiat River	2007	07AL	134	4
	2008	08CI	82	4
	2009	09NC	74	1
	2010	10OX	82	1
Lower Wenatchee River	2007	07AM	139	5
	2008	08CE	98	2
Nason Creek	2007	07AN	81	4
	2008	08CF	133	6
	2009	09NG	103	2
Peshastin Creek	2008	08CH	142	2
	2009	09NE	34	1
	2010	10OY	94	1
		Total	1501	41

[a]Samples were not used if they were genetically identified as cutthroat trout or cutthroat/rainbow trout hybrids, or if they had incomplete (≤ 80% or 95 of 119 loci) or duplicate genotypes.

Table 3. List of 132 general use, diploid single nucleotide polymorphic (SNP) loci genotyped in Wenatchee River basin and Entiat River steelhead.

WDFW Name	Locus Name	Allele 1	Allele 2	Reference
AOmy005	Omy_aspAT-123	T	C	(Campbell et al. 2009)
AOmy014	Omy_e1-147	G	T	(Sprowles et al. 2006)
AOmy015	Omy_gdh-271	C	T	(Campbell et al. 2009)
AOmy016	Omy_GH1P1_2	C	T	(Aguilar and Garza 2008)
AOmy021	Omy_LDHB-2_e5	T	C	(Aguilar and Garza 2008)
AOmy023	Omy_MYC_2	T	C	(Aguilar and Garza 2008)
AOmy027	Omy_nkef-241	C	A	(Campbell et al. 2009)
AOmy028	Omy_nramp-146	G	A	(Campbell et al. 2009)
AOmy047	Omy_u07-79-166	G	T	WDFW - S. Young unpubl.
AOmy051	Omy_121713-115	T	A	(Abadía-Cardoso et al. 2011)
AOmy056	Omy_128693-455	T	C	(Abadía-Cardoso et al. 2011)
AOmy059	Omy_187760-385	A	T	(Abadía-Cardoso et al. 2011)
AOmy061	Omy_96222-125	T	C	(Abadía-Cardoso et al. 2011)
AOmy062	Omy_97077-73	T	A	(Abadía-Cardoso et al. 2011)
AOmy063	Omy_97660-230	C	G	(Abadía-Cardoso et al. 2011)
AOmy065	Omy_97954-618	C	T	(Abadía-Cardoso et al. 2011)
AOmy067	Omy_aromat-280	A	T	WSU - J. DeKoning unpubl.
AOmy068	Omy_arp-630	G	A	(Campbell et al. 2009)
AOmy071	Omy_cd59-206	C	T	WSU - J. DeKoning unpubl.
AOmy073	Omy_colla1-525	C	T	WSU - J. DeKoning unpubl.
AOmy079	Omy_g12-82	T	C	WSU - J. DeKoning unpubl.
AOmy081	Omy_gh-475	C	T	(Campbell et al. 2009)
AOmy082	Omy_gsdf-291	T	C	WSU - J. DeKoning unpubl.
AOmy089	Omy_hsp90BA-193	C	T	(Campbell and Narum 2009)
AOmy094	Omy_inos-97	C	A	WSU - J. DeKoning unpubl.
AOmy095	Omy_mapK3-103	A	T	CRITFC - N. Campbell unpubl.
AOmy096	Omy_mcsf-268	T	C	WSU - J. DeKoning unpubl.
AOmy100	Omy_nach-200	A	T	WSU - J. DeKoning unpubl.

AOmy107	Omy_Ots249-227	C	T	(Campbell et al. 2009)
AOmy108	Omy_oxct-85	A	T	WSU - J. DeKoning unpubl.
AOmy110	Omy_star-206	A	G	WSU - J. DeKoning unpubl.
AOmy111	Omy_stat3-273	G	Deletion	WSU - J. DeKoning unpubl.
AOmy113	Omy_tlr3-377	C	T	WSU - J. DeKoning unpubl.
AOmy117	Omy_u09-52-284	T	G	WDFW - S. Young unpubl.
AOmy118	Omy_u09-53-469	T	C	WDFW - S. Young unpubl.
AOmy120	Omy_u09-54.311	C	T	WDFW - S. Young unpubl.
AOmy123	Omy_u09-55-233	A	G	WDFW - S. Young unpubl.
AOmy125	Omy_u09-56-119	T	C	WDFW - S. Young unpubl.
AOmy129	Omy_BAMBI4.238	T	C	WDFW - S. Young unpubl.
AOmy132	Omy_G3PD_2.246	C	T	WDFW - S. Young unpubl.
AOmy134	Omy_Il-1b-028	T	C	WDFW - S. Young unpubl.
AOmy137	Omy_u09-61.043	A	T	WDFW - S. Young unpubl.
AOmy151	Omy_p53-262	T	A	CRITFC - N. Campbell unpubl.
AOmy173	BH2VHSVip10	C	T	Pascal & Hansen unpubl.
AOmy174	OMS00003	T	G	(Sánchez et al. 2009)
AOmy176	OMS00013	A	G	(Sánchez et al. 2009)
AOmy177	OMS00018	T	G	(Sánchez et al. 2009)
AOmy179	OMS00041	G	C	(Sánchez et al. 2009)
AOmy181	OMS00052	T	G	(Sánchez et al. 2009)
AOmy182	OMS00053	T	C	(Sánchez et al. 2009)
AOmy183	OMS00056	T	C	(Sánchez et al. 2009)
AOmy184	OMS00057	T	G	(Sánchez et al. 2009)
AOmy185	OMS00061	T	C	(Sánchez et al. 2009)
AOmy186	OMS00062	T	C	(Sánchez et al. 2009)
AOmy187	OMS00064	T	G	(Sánchez et al. 2009)
AOmy189	OMS00071	A	G	(Sánchez et al. 2009)
AOmy190	OMS00072	A	G	(Sánchez et al. 2009)
AOmy191	OMS00078	T	C	(Sánchez et al. 2009)
AOmy192	OMS00087	A	G	(Sánchez et al. 2009)

AOmy193	OMS00089	A	G	(Sánchez et al. 2009)
AOmy194	OMS00090	T	C	(Sánchez et al. 2009)
AOmy195	OMS00092	A	C	(Sánchez et al. 2009)
AOmy196	OMS00094	T	G	(Sánchez et al. 2009)
AOmy197	OMS00103	A	T	(Sánchez et al. 2009)
AOmy198	OMS00105	T	G	(Sánchez et al. 2009)
AOmy199	OMS00112	A	T	(Sánchez et al. 2009)
AOmy200	OMS00116	T	A	(Sánchez et al. 2009)
AOmy201	OMS00118	T	G	(Sánchez et al. 2009)
AOmy202	OMS00119	A	T	(Sánchez et al. 2009)
AOmy203	OMS00120	A	G	(Sánchez et al. 2009)
AOmy204	OMS00121	T	C	(Sánchez et al. 2009)
AOmy205	OMS00127	T	G	(Sánchez et al. 2009)
AOmy206	OMS00128	T	G	(Sánchez et al. 2009)
AOmy207	OMS00132	A	T	(Sánchez et al. 2009)
AOmy208	OMS00133	A	G	(Sánchez et al. 2009)
AOmy209	OMS00134	A	G	(Sánchez et al. 2009)
AOmy210	OMS00153	T	G	(Sánchez et al. 2009)
AOmy211	OMS00154	A	T	(Sánchez et al. 2009)
AOmy212	OMS00156	A	T	(Sánchez et al. 2009)
AOmy213	OMS00164	T	G	(Sánchez et al. 2009)
AOmy215	OMS00175	T	C	(Sánchez et al. 2009)
AOmy216	OMS00176	T	G	(Sánchez et al. 2009)
AOmy218	OMS00180	T	G	(Sánchez et al. 2009)
AOmy220	Omy_1004	A	T	(Hansen et al. 2011)
AOmy221	Omy_101554-306	T	C	(Abadía-Cardoso et al. 2011)
AOmy222	Omy_101832-195	A	C	(Abadía-Cardoso et al. 2011)
AOmy223	Omy_101993-189	A	T	(Abadía-Cardoso et al. 2011)
AOmy225	Omy_102505-102	A	G	(Abadía-Cardoso et al. 2011)
AOmy226	Omy_102867-443	T	G	(Abadía-Cardoso et al. 2011)
AOmy227	Omy_103705-558	T	C	(Abadía-Cardoso et al. 2011)

AOmy228	Omy_104519-624	T	C	(Abadía-Cardoso et al. 2011)
AOmy229	Omy_104569-114	A	C	(Abadía-Cardoso et al. 2011)
AOmy230	Omy_105075-162	T	G	(Abadía-Cardoso et al. 2011)
AOmy231	Omy_105385-406	T	C	(Abadía-Cardoso et al. 2011)
AOmy232	Omy_105714-265	C	T	(Abadía-Cardoso et al. 2011)
AOmy233	Omy_107031-704	C	T	(Abadía-Cardoso et al. 2011)
AOmy234	Omy_107285-69	C	G	(Abadía-Cardoso et al. 2011)
AOmy235	Omy_107336-170	C	G	(Abadía-Cardoso et al. 2011)
AOmy238	Omy_108007-193	A	G	(Abadía-Cardoso et al. 2011)
AOmy239	Omy_109243-222	A	C	(Abadía-Cardoso et al. 2011)
AOmy240	Omy_109525-403	A	G	(Abadía-Cardoso et al. 2011)
AOmy241	Omy_110064-419	T	G	(Abadía-Cardoso et al. 2011)
AOmy242	Omy_110078-294	A	G	(Abadía-Cardoso et al. 2011)
AOmy243	Omy_110362-585	G	A	(Abadía-Cardoso et al. 2011)
AOmy244	Omy_110689-148	A	C	(Abadía-Cardoso et al. 2011)
AOmy245	Omy_111005-159	C	T	(Abadía-Cardoso et al. 2011)
AOmy246	Omy_111084-526	A	C	(Abadía-Cardoso et al. 2011)
AOmy247	Omy_111383-51	C	T	(Abadía-Cardoso et al. 2011)
AOmy248	Omy_111666-301	T	A	(Abadía-Cardoso et al. 2011)
AOmy249	Omy_112301-202	T	G	(Abadía-Cardoso et al. 2011)
AOmy250	Omy_112820-82	G	A	(Abadía-Cardoso et al. 2011)
AOmy252	Omy_114976-223	T	G	(Abadía-Cardoso et al. 2011)
AOmy253	Omy_116733-349	C	T	(Abadía-Cardoso et al. 2011)
AOmy254	Omy_116938-264	A	G	(Abadía-Cardoso et al. 2011)
AOmy255	Omy_117259-96	T	C	(Abadía-Cardoso et al. 2011)
AOmy256	Omy_117286-374	A	T	(Abadía-Cardoso et al. 2011)
AOmy257	Omy_117370-400	A	G	(Abadía-Cardoso et al. 2011)
AOmy258	Omy_117540-259	T	G	(Abadía-Cardoso et al. 2011)
AOmy260	Omy_117815-81	C	T	(Abadía-Cardoso et al. 2011)
AOmy261	Omy_118175-396	T	A	(Abadía-Cardoso et al. 2011)
AOmy262	Omy_118205-116	A	G	(Abadía-Cardoso et al. 2011)

AOmy263	Omy_118654-91	A	G	(Abadía-Cardoso et al. 2011)
AOmy265	Omy_120255-332	A	T	(Abadía-Cardoso et al. 2011)
AOmy266	Omy_128996-481	T	G	(Abadía-Cardoso et al. 2011)
AOmy267	Omy_129870-756	C	T	(Abadía-Cardoso et al. 2011)
AOmy268	Omy_131460-646	C	T	(Abadía-Cardoso et al. 2011)
AOmy269	Omy_98683-165	A	C	(Abadía-Cardoso et al. 2011)
AOmy270	Omy_cyp17-153	C	T	WSU - J. DeKoning unpubl.
AOmy271	Omy_ftzf1-217	A	T	WSU - J. DeKoning unpubl.
AOmy272	Omy_GHSR-121	T	C	CRITFC - N. Campbell unpubl.
AOmy273	Omy_metA-161	T	G	CRITFC - N. Campbell unpubl.
AOmy274	Omy_UBA3b	A	T	(Hansen et al. 2011)

Primer and probe sequences for unpublished loci available by request.

Table 4. List of 20 species identification single nucleotide polymorphic (SNP) loci genotyped in Wenatchee River basin and Entiat River steelhead.

		Expected genotype			
WDFW Name	Locus Name	*O. mykiss*	*O. clarkii clarkii*	*O. clarkii lewisi*	Reference
ASpI001	Ocl_Okerca	T	C	C	(McGlauflin et al. 2010)
ASpI002	Ocl_Oku202	A	C	C	(McGlauflin et al. 2010)
ASpI003	Ocl_Oku211	G	T	T	(McGlauflin et al. 2010)
ASpI004	Ocl_Oku216	C	C	A	(McGlauflin et al. 2010)
ASpI005	Ocl_Oku217	C	C	A	(McGlauflin et al. 2010)
ASpI006	Ocl_SsaHM5	A	A	G	(McGlauflin et al. 2010)
ASpI007	Ocl_u800	T	C	C	(McGlauflin et al. 2010)
ASpI008	Ocl_u801	A	T	T	(McGlauflin et al. 2010)
ASpI009	Ocl_u802	C	C	T	(McGlauflin et al. 2010)
ASpI010	Ocl_u803	C	T	T	(McGlauflin et al. 2010)
ASpI011	Ocl_u804	G	G	C	(McGlauflin et al. 2010)
ASpI012	Omy_B9_228	A	A	C	(Finger et al. 2009)
ASpI013	Omy_CTDL1_243	C	A	A	(Finger et al. 2009)
ASpI014	Omy_F5_136	C	G	G	(Finger et al. 2009)
ASpI016	Omy_myclarp404-111	T	G	G	CRITFC - S. Narum - unpubl.
ASpI017	Omy_myclgh1043-156	C	T	T	CRITFC - S. Narum - unpubl.
ASpI018	Omy_Omyclmk436-96	A	C	C	CRITFC - S. Narum - unpubl.
ASpI019	Omy_RAG11_280	T	A	A	(Sprowles et al. 2006)
ASpI020	Omy_URO_302	T	C	C	(Finger et al. 2009)
ASpI021	Omy_BAC-F5.238	C	G	G	WDFW - S. Young unpubl.

Primer and probe sequences for unpublished loci available by request.

Table 5. Pairwise F_{ST} estimates for collections from Wenatchee River tributaries and the Entiat River (below diagonal) and associated bootstrap estimated *P*-values (above diagonal).

		Chiwawa River			Nason Creek			Peshastin Creek			Lower Wenatchee River		Entiat River			
Population	Year	2007	2008	2009	2007	2008	2009	2008	2009	2010	2007	2008	2007	2008	2009	2010
Chiwawa	2007		**0.000**	**0.003**	**0.000**	**0.000**	**0.000**	**0.000**	**0.002**	**0.000**	**0.001**	**0.001**	**0.000**	**0.001**	**0.000**	**0.000**
River	2008	0.004		**0.004**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
	2009	0.004	0.003		**0.000**	**0.001**	0.061	**0.000**	**0.001**	**0.000**	0.086	**0.050**	**0.022**	0.108	**0.005**	**0.045**
Nason	2007	0.011	0.010	0.007		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Creek	2008	0.007	0.007	0.005	0.009		**0.003**	**0.000**	**0.002**	**0.000**	0.079	**0.000**	**0.001**	**0.000**	**0.000**	**0.000**
	2009	0.007	0.007	0.003	0.014	0.006		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Peshastin	2008	0.010	0.011	0.008	0.013	0.010	0.013		**0.001**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Creek	2009	0.005	0.005	0.006	0.010	0.007	0.008	0.003		**0.002**	**0.002**	**0.047**	**0.028**	**0.004**	**0.005**	**0.001**
	2010	0.010	0.011	0.008	0.015	0.008	0.011	0.003	0.003		**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
Lower Wenatchee	2007	0.003	0.003	0.000	0.005	0.008	0.007	0.009	0.010	0.008		0.112	**0.020**	**0.012**	**0.002**	**0.017**
River	2008	0.002	0.005	0.002	0.003	0.004	0.005	0.007	0.009	0.006	0.000		**0.049**	0.459	**0.047**	**0.002**
Entiat	2007	0.005	0.006	0.002	0.005	0.006	0.005	0.005	0.007	0.006	0.001	0.002		0.451	0.173	**0.000**
River	2008	0.004	0.004	0.000	0.007	0.005	0.007	0.008	0.009	0.011	0.002	0.001	0.000		0.644	**0.002**
	2009	0.005	0.006	0.002	0.003	-0.001	0.003	0.002	0.003	0.004	0.003	0.002	0.002	0.000		**0.028**
	2010	0.005	0.006	0.003	0.006	0.004	0.006	0.006	0.008	0.009	0.002	0.003	0.003	0.003	0.002	

P-values in bold were significant at $\alpha = 0.05$ after correcting for multiple tests using false discovery rate.

Appendix F

NPDES Hatchery Effluent Monitoring, 2012

NPDES MONITORING FOR WDFW FACILITIES

All WDFW hatcheries monitor their discharge in accordance with the National Pollutant Discharge Elimination System (NPDES) permit. This permit is administered in Washington by the Washington Department of Ecology under agreement with the United States Environmental Protection Agency. The permit was renewed effective 1 August 2010 and will expire 1 August 2015.

Facilities are exempted from sampling during any month that pounds of fish on hand fall below 20,000 lbs and pounds of feed used fall below 5,000 lbs, with the exception of offline settling basin discharges which are to be monitored once per month when ponds are in use and discharging to receiving waters.

Sampling at permitted facilities includes the following parameters:

<FLOW	Measured in millions of gallons per day (MGD) discharge.
<SS EFF	Average net settleable solids in the hatchery effluent, measured in ml/L.
<TSS COMP	Average net total suspended solids, composite sample (6 x/day) of the hatchery effluent, measured in mg/L.
<TSS MAX	Maximum daily net total suspended solids, composite sample (6 x/day) of the hatchery effluent, measured in mg/L.
<SS PA	Maximum settleable solids discharge from the pollution abatement pond, measured in ml/L.
<SS %	Removal of settleable solids within the pollution abatement pond from inlet to outlet, measured as a percent. No longer required under permit effective June 1, 2000.
<TSS PA	Maximum total suspended solids effluent grab from the pollution abatement pond discharge, measured in mg/L.
<TSS %	Removal of suspended solids within the pollution abatement pond from inlet to outlet, measured as a percent. No longer required under permit effective June 1, 2000.
<SS DD	Settleable solids discharged during drawdown for fish release. One sample per pond drawdown, measured in ml/L.
<TRC	Total residual chlorine discharge after rearing vessel disinfection and after neutralization with sodium thiosulfate. One sample per disinfection, measured in ug/L.

In addition, at Similkameen Hatchery only, the following sampling was conducted at the request of WA Dept of Ecology, but is not required under NPDES permit:

<SS IW	Settleable solids influent grab taken as wastes are pumped into the pollution abatement pond, measured in mg/L. No longer monitored as of January 2008.
<TSS IW	Total suspended solids influent grab as wastes are pumped into the pollution abatement pond, measured in mg/L. No longer monitored as of January 2008.

Eastbank Hatchery
NPDES Permit Number WAG13-5011

		FLOW	SS EFF	TSS COMP	TSS MAX	FLOW PA	SS PA	SS %	TSS PA	TSS %	Lbs of Fish	Lbs of Feed
2012	JAN	28.44	0	0.4	0.4	15000	0.01		18.6		61700	15508
	FEB	28.44	0	0	0	12000	0.01		38.8		83853	20893
	MAR	27.96	0	0.3	0.4	15000	0.01		22.3		50401	10060
	APR	14.22	0	0	0	5000	0.01		14		1883	1083
	MAY	14.22	0	1	1	7500	0.01		47.3		4116	1826
	JUN	21.97	0	0	0	15000	0.01		14.2		9632	4259
	JUL	28.43	0	0	0	5000	0.01		34.6		1883	8317
	AUG	28.43	0	0.2	0.2	7500	0.01		26.8		31466	10207
	SEP	28.43	0	0.5	0.6	15000	0.01		23.4		45632	13638
	OCT	29.08	0	1.2	1.2	15000	0.01		21		55912	18513
	NOV	28.43	0	0	0	7500	0.01		*131.3		46150	9059
	DEC	28.43	0	0.6	0.6	5000	0.01		11		38403	9386

*One violation reported.

Wells Hatchery
NPDES Permit Number WAG13-5009

		FLOW	SS EFF	TSS COMP	TSS MAX	FLOW PA	SS PA	SS %	TSS PA	TSS %	Lbs of Fish	Lbs of Feed	SS DD	TSS DD
2012	JAN	18.6	0	0	0	*					82951	16498		
	FEB	20.2	0	0	0	*					103415	13074		
	MAR	21.5	0	0.2	0.2	*					102956	16185		
	APR	18.8	0	0	0	*					109875	17491		
	MAY	13.6	0	-0.4	-0.4	495	0		4.2		41798	4516	0	2.15
	JUN	3.9	0	2	2	495	0		5.4		4937	1538		
	JUL	3	0	-0.6	-0.6	495	0		1.2		5931	2869		
	AUG	5.1	0	0	0	495	0		0.6		14073	3306		
	SEP	5.4	0	0.2	0.2	495	0		1.4		16287	6733		
	OCT	10.3	0	0.2	0.2	495	0		3.8		29604	7172		
	NOV	9.5	0	0.2	0.2	*					39528	7232		
	DEC	16.3	0	0.2	0.2	*					51763	13343		

* PA pond - No discharge this month

Chiwawa Ponds - Chiwawa River
NPDES Permit Number WAG13-5015

		FLOW	SS EFF	TSS COMP	TSS MAX	Lbs of Fish	Lbs of Feed	SS DD	TSS DD
2012	JAN	6.4	0	0.4	0.4	9945	1000		
	FEB	5.1	0	-0.4	-0.4	10981	1517		
	MAR	3.8	0	0	0	15420	2030		
	APR	3.8	0	0.4	0.4	12965	2265	0.08	1
	MAY	4.53	0	0.4	0.8	12032	429	0.03	3.6
	JUN	No Monitoring				0	0		
	JUL	No Monitoring				0	0		
	AUG	No Monitoring				0	0		
	SEP	4.6	0	0	0	13000	396		
	OCT	4.75	0	0.7	1.4	12017	1584		
	NOV	4.35	0	-1.2	-1.2	14403	1055		
	DEC	4.74	0	-2.8	-2.8	15405	380		

Chiwawa Ponds - Wenatchee River
NPDES Permit Number WAG13-5015

		FLOW	SS EFF	TSS COMP	TSS MAX	Lbs of Fish	Lbs of Feed	SS DD	TSS DD
2012	JAN	No Monitoring				0	0		
	FEB	No Monitoring				0	0		
	MAR	No Monitoring				0	0		
	APR	No Monitoring				0	0		
	MAY	No Monitoring				0	0		
	JUN	No Monitoring				0	0		
	JUL	No Monitoring				0	0		
	AUG	No Monitoring				0	0		
	SEP	No Monitoring				0	0		
	OCT	No Monitoring				0	0		
	NOV	3.85	0	0.2	0.2	7908	2.4		
	DEC	6.95	0	0.4	0.4	10475	1789		

Carlton Acclimation Pond
NPDES Permit Number WAG13-5013

		FLOW	SS EFF	TSS COMP	TSS MAX	Lbs of Fish	Lbs of Feed	SS DD	TSS DD
2012	JAN	No Monitoring				0	0		
	FEB	No Monitoring				0	0		
	MAR	10.08	0	0.4	0.4	31000	4200		
	APR	10.08	-0.62	0.1	0.6	34000	5900	0.7	32
	MAY	No Monitoring				0	0		
	JUN	No Monitoring				0	0		
	JUL	No Monitoring				0	0		
	AUG	No Monitoring				0	0		
	SEP	No Monitoring				0	0		
	OCT	No Monitoring				0	0		
	NOV	No Monitoring				0	0		
	DEC	No Monitoring				0	0		

Methow Hatchery
NPDES Permit Number WAG13-5000

		FLOW	SS EFF	TSS COMP	TSS MAX	FLOW PA	SS PA	SS %	TSS PA	TSS %	Lbs of Fish	Lbs of Feed	SS DD	TSS DD
2012	JAN	11.3	0	-0.4	-0.4	14400	0.1		2.4		17000	4200		
	FEB	6.48	0	3.2	3.2	14400	0.1		0.2		19950	5600		
	MAR	15.1	0	-0.6	-0.6	14400	0.1		17		25000	6400		
	APR	6.9	0	-0.4	-0.4	14400	0.1		6.8		19000	4200	0.5	4.6
	MAY	5.62	0	0	0	14400	0.1		3.4		3000	830		
	JUN	6.48	0	0	0	14400	0.1		2.4		4200	1200		
	JUL	6.48	0	0	0	14400	0.1		2.8		6200	1500		
	AUG	6.48	0	0.2	0.2	14400	0.1		9.8		9200	2000		
	SEP	6.48	0	0	0	14400	0.1		0.2		11500	2700		
	OCT	6.34	0	1.6	1.6	14400	0.1		8.4		15500	2600		
	NOV	6.34	0	0	0	14400	0.1		0.8		18146	3600		
	DEC	9.82	0	0.2	0.2	14400	0.1		0.6		21000	2100		

Similkameen Hatchery
NPDES Permit Number WAG13-5007

		FLOW	SS EFF	TSS COMP	TSS MAX	FLOW PA	SS IW	TSS IW	Lbs of Fish	Lbs of Feed	SS DD	TSS DD
2012	JAN	5.7	0	0.2	0.2				17728	0		
	FEB	5.7	0	-0.8	-0.8				17667	396		
	MAR	11.7	0	0.4	0.4				19450	6072		
	APR	8.64	-0.04	0	0				1578	4796		
	MAY	5.7	-0.02	-0.5	1.8				511	0	*19.8	77.8
	JUN	No Monitoring							0	0		
	JUL	No Monitoring							0	0		
	AUG	No Monitoring							0	0		
	SEP	No Monitoring							0	0		
	OCT	5.7	0	0.6	0.6				19077	1188		
	NOV	5.9	0	0.8	0.8				20500	2640		
	DEC	5.9	0	0.2	0.2				23916	748		

*One violation reported.

Chelan Hatchery
NPDES Permit Number WAG13-5006

		FLOW	SS EFF	TSS COMP	TSS MAX	FLOW PA	SS PA	SS %	TSS PA	TSS %	Lbs of Fish	Lbs of Feed
2012	JAN	4.15	0.05	2.4	2.4	68000	0.01		6		18119	10466
	FEB	4.15	0.05	0.8	0.8	68000	0.05		10.2		36238	20962
	MAR	8.9	0.05	0.2	0.2	68000	0.05		3.4		41428	13256
	APR	8	0.04	-5.6	-5.6	68000	0.05		1.4		31000	1223
	MAY	6	0.05	-0.4	-0.4	68000	0.05		1.2		7212	3747
	JUN	4.4	0.05	1.6	1.6	68000	0.05		1		6599	6803
	JUL	9.5	0.05	0.6	0.6	9502560	0.05		2.4		6599	6950
	AUG	9.6	0.05	1.4	1.4	9581760	0.05		2.6		18452	8316
	SEP	10.1	0.05	2.4	2.4	10090080	0.05		5.2		27768	10496
	OCT	10	0.05	0	0.4	68000	0.05		6.4		32000	10482
	NOV	6	0.05	1.6	1.6	68000	0.05		2		9466	3012
	DEC	6	0.05	1.2	1.2	68000	0.05		4.8		13492	3594

Chelan Falls Acclimation Ponds
NPDES Permit Number WAG13-7019

		FLOW	SS EFF	TSS COMP	TSS MAX	FLOW PA	SS PA	SS %	TSS PA	TSS %	Lbs of Fish	Lbs of Feed
2012	JAN	12.8	0.05	1.4	1.4	857	0.05		5.2		33725	5418
	FEB	12.8	0.05	0.4	0.4	857	0.05		2.2		40321	9366
	MAR	12.8	0.05	-4.1	-4	857	0.05		11.8		58592	11396
	APR	No Monitoring									0	0
	MAY	No Monitoring									0	0
	JUN	No Monitoring									0	0
	JUL	No Monitoring									0	0
	AUG	No Monitoring									0	0
	SEP	No Monitoring									0	0
	OCT	No Monitoring									0	0
	NOV	12	0.04	-0.4	-0.4	3000	0.05		2.8		26346	9091
	DEC	12	0.04	0.3	0.6	3000	0.05		13.8		38524	10040

Dryden Acclimation Pond
NPDES Permit Number WAG13-5014

		FLOW	SS EFF	TSS COMP	TSS MAX	Lbs of Fish	Lbs of Feed	SS DD	TSS DD
2012	JAN	No Monitoring				0	0		
	FEB	No Monitoring				0	0		
	MAR	8.99	-0.01	0	0	66444	1056		
	APR	20.88	-0.01	0.6	1.2	72449	9768	0.01	39.8
	MAY	No Monitoring				0	0		
	JUN	No Monitoring				0	0		
	JUL	No Monitoring				0	0		
	AUG	No Monitoring				0	0		
	SEP	No Monitoring				0	0		
	OCT	No Monitoring				0	0		
	NOV	No Monitoring				0	0		
	DEC	No Monitoring				0	0		

NPDES Permit Number WAG13-7013

		FLOW	SS EFF	TSS COMP	TSS MAX	Lbs of Fish	Lbs of Feed	SS DD	TSS DD
2012	JAN	13.6				0	0		
	FEB	26.3		0.4	0.4	0	0		
	MAR	26.3	0	0.3	0.4	15255	0		
	APR	30.31	0	0	0	38138	16119		
	MAY	49.51	0	-1.3	-1.3	78764	36893		
	JUN	58.2	0			142440	19262	0	2.24
	JUL	No Monitoring				0	0		
	AUG	No Monitoring				0	0		
	SEP	64.63	0			15000	0		
	OCT	64.75				0	0		
	NOV	64.75				0	0		
	DEC	13.1	0	-0.2	-0.2	9770	0		

Appendix G

Steelhead Stock Assessment at Priest Rapids Dam, 2010-2011

Priest Rapids Dam 2010-2011 Adult Upper Columbia River Steelhead Run-Cycle Stock Assessment Report

Introduction

Upper Columbia River (UCR) steelhead stock assessment sampling at Priest Rapids Dam (PRD) is authorized through the Endangered Species Act (ESA) Section 10 Permit 1395 (NMFS 2003). Permit authorizations include interception and biological sampling of up to 10 percent of the UCR steelhead passing PRD to determine upriver population size, estimate hatchery to wild ratios, determine age class contribution and evaluate the need for managing hatchery steelhead consistent with ESA recovery objectives which include fully seeding spawning habitat with naturally produced UCR steelhead supplemented with artificially propagated enhancement steelhead (NMFS 2003).

Stock Assessment

The 2010 steelhead sampling at Priest Rapids Dam began 6 July and concluded 4 November. Sampling consisted of operating the Priest Rapids Off Ladder Trap (OLAFT), located on the left bank Priest Rapids Dam, 8 hours per day, on Tuesdays and Thursdays, for a total of 34 sampling days. Steelhead were trapped, handled and released in accordance with Section 2.1 and 2.2.1 of the National Marine Fisheries Service (NMFS) Biological Opinion for ESA Permit 1395 (NMFS 2003). The cumulative sample rate attained during 2010 totaled 8.4% with one steelhead mortality observed (the fish was found dead the following morning in the release chamber).

The Washington Department of Fish and Wildlife (WDFW) sampled 2,212 steelhead of the 2010/2011 run-cycle passing PRD, totaling 26,431 steelhead, for an overall sampling rate of 8.4%. Of the 1,212 steelhead sampled, 1,572 (71.1%) were hatchery origin and 640 (28.9%) were wild origin. The estimated 2010-2011 run- cycle total wild steelhead return was 7,647 representing 307.6% of the 1986-2009 average and about 208.1% of the recent 5-year average (Table 1).

Based on external marks and external and internal tags, 1,572 hatchery origin steelhead sampled at Priest Rapids Dam during the 2010 return cycle included, 30.8% Wenatchee hatchery-origin steelhead and 52.9% "above Wells Dam" hatchery origin steelhead [1/] (Table 2)., while 8.8% of the hatchery origin steelhead sampled could not be assigned to a specific hatchery program. Ringold FH origin steelhead represented about 3.9% of the sample (Table 2).

1/- Defined as "above Wells Dam" because hatchery origin, adipose-clipped steelhead release into the Methow River from the Wells FH and Winthrop NFH have the same marks and are indistinguishable for one another.

Table 1. Priest Rapids Dam adult steelhead returns and stock composition, 1974-2010

Run-cycle[1/]	Hatchery	Wild	Wild percent	Total run
1974				2,950
1975				2,560
1976				9,490
1977				9,630
1978				4,510
1979				8,710
1980				8,290
1981				9,110
1982				10,770
1983				32,000
1984				26,200
1985				34,010
1986	20,022	2,342	10.5	22,364
1987	9,955	4,058	29.0	14,013
1988	7,530	2,670	26.2	10,200
1989	8,033	2,685	25.1	10,718
1990	6,252	1,585	20.2	7,837
1991	11,169	2,799	20.0	13,968
1992	12,102	1,618	11.8	13,720
1993	4,538	890	16.4	5,428
1994	5,880	855	12.7	6,735
1995	3,377	993	22.7	4,370
1996	7,757	843	9.8	8,600
1997	8,157	785	8.8	8,942
1998	4,919	928	15.9	5,847
1999	6,903	1,374	16.6	8,277
2000	9,023	2,341	20.6	11,364
2001	24,362	5,715	19.0	30,077
2002	12,884	2,983	18.8	15,867
2003	14,890	2,837	16.0	17,729
2004	15,670	2,985	16.0	18,655
2005	10,352	3,127	23.2	13,479
2006	8,738	1,677	16.1	10,415
2007	12,160	3,097	20.3	15,257
2008	13,528	3,030	18.3	16,558
2009	32,557	7,439	18.6	39,996
2010	18,784	7,647	28.9	26,431
1986-2009 average	**11,282**	**2,486**	**18.1**	**13,768**
2005-2009 average	**15,467**	**3,674**	**19.2**	**19,141**

[1/] A return cycle is the combined total of steelhead passing PRD from 1 June – 30 November during year (x), plus steelhead passing PRD between 15 April and 31 May on year (x+1).

Table 2. Origin classification of steelhead sampled at Priest Rapids Dam, 6 July – 4 November 2010.

Steelhead origin																						
Wild			Hatchery																			
Wild			Wenatchee						Above Wells				Ringold FH			Unk. Hat.						
Criteria			VIE						Criteria				Criteria			Criteria			Total	Total	Total	
NS	NM	Total	LTGR	RTGR	RTOR	RTPK	RTRD	Total	AD	LTYL	RTYL	Total	AD	RV	Total	SD	NM	Total	Wild	Hatchery	Total	
x	x	640	x					184	x			831	x	x	61	x	x	196	640	1,572	2,212	
				x				163		x		0										
					x			0			x	0										
						x		135														
							x	2														
Total		**640**						**484**				**831**			**61**			**196**	**640**	**1,572**	**2,212**	
% Hatchery								**30.8**				**52.9**			**3.9**			**12.4**		**100.0**		
% Total		**28.9%**						**21.9**				**37.6**			**2.8**			**8.8**	**28.9**	**71.1**	**100.0**	

Reconciliation of salt water age of wild and hatchery steelhead sampled at Priest Rapids Dam during 2010 was accomplished through scale sample analysis. Salt-age analysis of the 2010 UCR steelhead run-cycle provides an estimated hatchery-origin dominated by 1-salt and 2-salt age composition of 35.6% and 64.3%, respectively (Table 3). Natural origin steelhead salt ages were 27.1% and 72.8% for salt ages 1 and 2, respectively. Three-salt age fish represented only 0.2% of the combined hatchery/wild sample (Table 3).

Table 3. Salt-water age composition of 2010 - 2011 return cycle Upper Columbia River steelhead sampled at Priest Rapids Dam, corrected by scale age/origin determination.

	Origin					
	Hatchery		Wild		Combined	
Salt-age	*N*	%	*N*	%	*N*	%
1-salt	299	35.6	170	27.1	469	31.9
2-salt	540	64.3	457	72.8	997	67.9
3-salt	1	0.1	1	0.1	2	0.2
4-salt	-	-	-	-	-	-
Total	**840**	**100**	**628**	**100**	**1,468**	**100**

Freshwater residency of naturally produced Upper Columbia River steelhead present in the 2010-2011 run cycle were dominated by age-2 freshwater fish (77.7%), and was slightly higher than the 1986-2009 average of 74.6% (Table 4).

Table 4. 2010 return year freshwater age of wild Upper Columbia River steelhead sampled at Priest Rapids Dam during steelhead stock assessment activities, compared to July – October 1986-2009 average.

Freshwater age	2010-2011 run cycle		1986-2009 proportion	
	N	%	*N*	%
1.x	58	10.2	318	8.1
2.x	443	77.7	2,921	74.6
3.x	65	11.4	649	16.6
4.x	4	0.7	26	0.7
5.x	-	-	2	<0.1
Total	**570**	**100**	**3,916**	**100**

Wild and hatchery origin steelhead exhibited similar saltwater growth in the 2010 run-cycle. Wild 1and 2-salt adults were slightly larger than their hatchery cohorts (Table 5). Age 1-salt hatchery and age 1 and 2-salt wild steelhead observed in the 2010-2011 adult run-cycle return past PRD were comparable in size to the 1986-2009 run-cycle average (Table 5).

Table 5. Average fork length of 1-salt and 2-salt, Upper Columbia River steelhead sampled at Priest Rapids Dam during July – November 2010 and the period between 1986-2009.

	Average fork length (cm)			
	2010-2011 run cycle		1986-2009 run cycle	
Salt age	Wild	Hatchery	Wild	Hatchery
x.1	59.0	58.1	60.5	59.3
x.2	72.7	72.3	72.9	72.1

Appendix H

Wenatchee Sockeye and Summer Chinook Spawning Ground Surveys, 2012

PUBLIC UTILITY DISTRICT NUMBER 1 OF CHELAN COUNTY
Natural Resource Division
Fish and Wildlife Department
327 N. Wenatchee Ave., Wenatchee WA 98801 (509) 663-8121

March 9, 2013

To: HCP Hatchery Committee

From: Lance Keller and Josh Murauskas

Subject: 2012 Wenatchee River Basin Summer Chinook and Sockeye Salmon Spawning Ground Surveys

Introduction

The Chelan County Public Utility District (District) has conducted or funded others to conduct intensive spawning ground surveys of spring and summer/fall (late run)[1] Chinook salmon (*Oncorhyncus tshawytscha*) and sockeye salmon (*O. nerka*) in river basins of the Columbia River upstream of Rock Island Dam. Summer/fall Chinook spawn in the entire mainstem of the Wenatchee River, from the mouth to the lake (Figure 1; Table 1). Sockeye spawn in the White and Little Wenatchee River basins (Figure 2).

The spawning surveys are performed yearly to assist in evaluating the effectiveness of the District's hatchery program. The purpose of this document is to report the results of the 2012 Chinook and sockeye salmon spawning ground surveys in the Wenatchee River basin. Information included in this document describes abundance, distribution, and timing of spawning activity.

[1] The majority of Chinook that ascend the mid-Columbia River as adults after July spawn between October and November in the mainstem of the Columbia, Wenatchee, Methow, Similkameen and Okanogan rivers. These fish have been called "summer" and "fall" Chinook based on their migration timing past the dams. Their life histories are identical (Mullan 1987), and should be termed "late-run" to separate them from earlier running "spring" Chinook that have a different life history. For consistency with previous year's reports, only the earlier segment of the late-run (those that ascend Rock Island Dam between June 24 and September 1; "summers") will be focused on in this report.

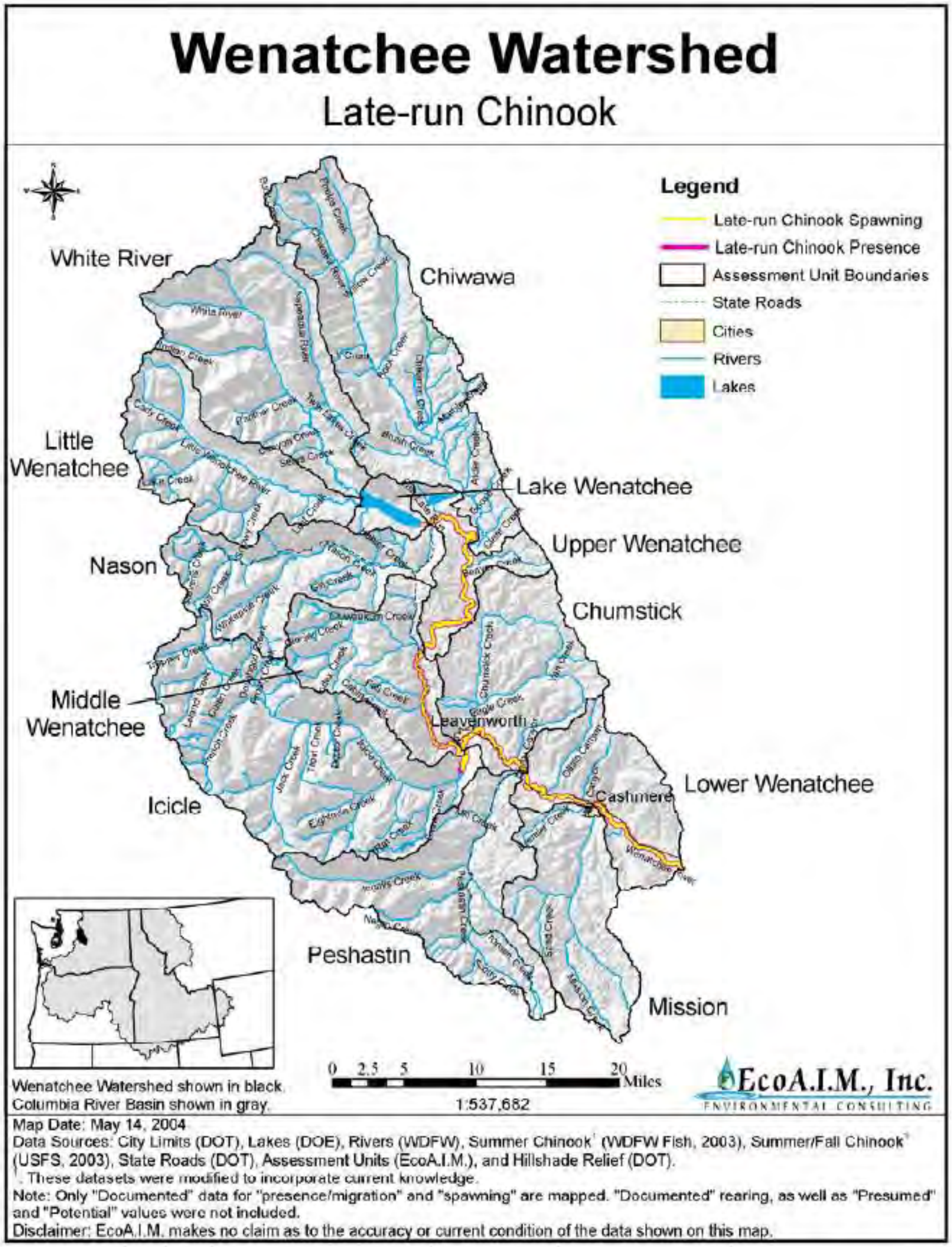


Figure 1. Map of the Wenatchee River Basin with spawning and migrational areas of late-run (summer/fall Chinook) areas highlighted (copied from the Wenatchee Sub basin Plan, NWPCC 2004).

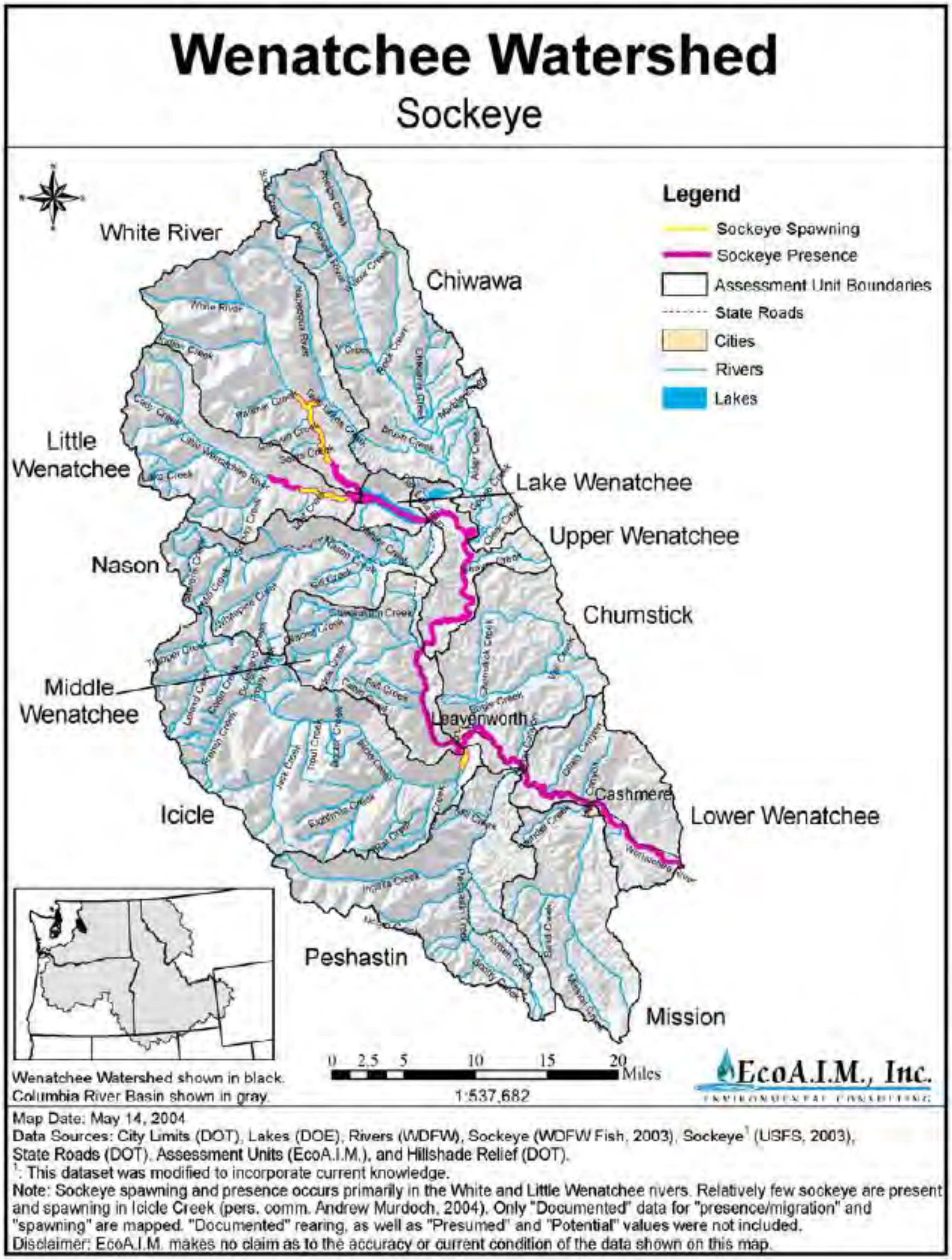


Figure 2. Map of the Wenatchee River Basin with spawning and migrational areas for sockeye highlighted (copied from the Wenatchee Sub basin Plan, NWPCC 2004).

Methods

In 2012, the study methodology was the same as used in 2011. In 2008, the summer Chinook spawning surveys were modified to incorporate additional mapping index areas in all ten river reach strata. Additionally, summer Chinook naïve counts were also performed in all river reach strata by the District. Previously, mapping index counts focused on six of the ten reaches and naïve counts were conducted solely by WDFW.

Chinook Spawning Ground Surveys

Chinook spawning ground surveys were conducted by foot, raft, or canoe. The most appropriate survey method was chosen for a given stream reach based on stream size, flow, and density of spawners. Because of the broad stream width and high spawner densities, individual summer Chinook redds were not flagged. Each reach was surveyed approximately once per week.

In 2012, summer Chinook spawning ground surveys occurred from September 17 to October 30.

Table 1. Designated survey reaches for spawning ground areas on the Wenatchee, Little Wenatchee, White, and Nepeequa rivers for all species.

Survey Section	River Mile
Wenatchee River-Summer Chinook	
Mouth to Sleepy Hollow Bridge	0 – 3.5
Sleepy Hollow Bridge to Lower Cashmere Bridge	3.5 – 9.5
Lower Cashmere Bridge to Dryden Dam	9.5 - 17.5
Dryden Dam to Peshastin Bridge	17.5 – 20.0
Peshastin Bridge to Leavenworth Bridge	20.0 – 23.9
Leavenworth Bridge to Icicle Road Bridge	23.9 – 26.4
Icicle Road Bridge to Tumwater Dam	26.4 – 30.9
Tumwater Dam to Tumwater Bridge	30.9 – 35.6
Tumwater Bridge to Chiwawa River	35.6 – 48.4
Chiwawa River to Lake Wenatchee	48.4 – 54.2
Little Wenatchee River-Sockeye	
Mouth to Old Fish Weir	0 – 2.7
Old Fish Weir to Lost Creek	2.7 – 5.2
Lost Creek to Rainey Creek	5.2 – 9.2
Rainey Creek to End	9.2 – End
White River-Sockeye	
Mouth to Sears Creek Bridge	0 – 6.4
Sears Creek Bridge to Napeequa River	6.4 – 11.0
Napeequa River to Grasshopper Meadows	11.0 – 12.9
Grasshopper Meadows to Falls	12.9 – 14.3
Napeequa River-Sockeye	
Mouth to End	0 - End

Peak and total redd count methodologies were used during the summer Chinook surveys in 2012 (see Appendix F of Murdoch and Peven (2005) for more detail). A peak count was conducted by counting all visible redds (new and old) observed within a reach on each survey. The objective of the peak redd count methodology was to capture the apex of spawning activity over an entire spawning season. This apex occurs at different times between reaches during the season, i.e. spawning begins sooner in the upstream reaches compared to the downstream reaches. The sum of all of the apex counts for the entire river was the peak redd count for the year. Peak counts provided an index of spawning and have been used historically (Attachment 1).

Two different approaches were used to estimate the total number of redds within the Wenatchee River. The first method used map counts to expand peak counts. Under this approach, a total redd count was conducted by counting or mapping only new or recently constructed redds within an area. Each new redd was mapped on aerial photos and enumerated. The objective of the total redd count methodology was to capture 1) "early" redds that may fade over time due to siltation or algae growth, and 2) redds that become disfigured by superimposition (when new redds are constructed on top of previously existing redds).

Since it was not feasible to map all new redds within the entire river, an expansion was used to estimate the total count for the entire Wenatchee River. To account for the different spawning substrate types in the main stem Wenatchee River, the river was delineated into ten distinct reaches in consultation with WDFW (Table 2). Within each of these reaches, index areas were identified as being representative areas of spawning activity. Peak counts were performed within each total reach (referred to as non-index areas), while mapping new redds only occurred within the index areas. An expansion was developed based on the ratio of mapped to peak counts for each reach (i.e., each reach had its own expansion factor), and the sum of the expanded counts was the estimate of the total redd counts. Additional details of how total redd counts were calculated are provided below.

a. Calculate an index peak expansion factor (*IP*) by dividing the peak number of redds in the index by the total number of redds (map count) in the index area.

$$IP = n_{peak} / n_{total}$$

b. Expand the non-index area peak redd counts by the *IP* to estimate the total number of redds in the entire reach (reach total; *RT*).

$$RT_{peak} = n_{peak} / IP$$

c. Estimate the total number of redds (total redds; *TR*) by summing the reach totals.

$$TR_{peak} = \sum RT$$

The second approach relied on a "naïve" count to expand redd numbers in reaches that did not have map counts. As noted above, the reaches with map counts were referred to as index reaches and those that were not mapped were called non-index reaches. Near the end of the spawning period (early November), one team of observers counted all visible redds within all non-index reaches. A separate, independent team counted all visible redds within the index reaches (these were the naïve counts). Surveys within the index and non-index areas occurred within one day of each other near the end of the spawning period. The naïve counts were divided by the total map count to estimate an index expansion factor. This factor was then applied to the total visible count in the non-index areas to estimate the total number of redds within each reach. The sum of the expanded counts was the estimate of the total redd count for the river. Additional details of how total numbers of redds are estimated using this approach are provided below.

a. Calculate an index expansion factor (*IF*) by dividing the number of visible redds in the index by the total number of redds (map counts) in the index area.

$$IF = n_{visible} / n_{total}$$

b. Expand the non-index area redd counts by the proportion of visible redds in the index to estimate the total number of redds in the entire reach (reach total; *RT*).

$$RT_{visible} = n_{non-index} / IF$$

c. Estimate the total number of redds (total redds; *TR*) by summing the reach totals.

$$TR_{visible} = \sum RT$$

The total redd count methods are believed to provide a more accurate indication of total spawning than the peak redd count methodology, because the peak count methodology only accounts for <u>visible</u> redds each week during the survey season. For example, summer Chinook redds that were visible during the first week of spawning may not be visible during the third week; those redds would be missed in the third and subsequent weeks' redd counts. Using the total count methodology, the redds in the first week would be mapped and accounted for in subsequent weeks, even though they may fade at some point during the future surveys.

Table 2. Index (Mapping) Areas on the Wenatchee River for 2012.

Reach	Reach description	Distance (miles)	Mapping index area within reach
1	Sleepy Hollow Br to River Mouth	3.5	Sleepy Hollow Br to River Bend
2	Cashmere Br to Sleepy Hollow Br	6	Cashmere Br 2 to Old Monitor Br.
3	Dryden Dam to Cashmere Br	8	Dryden Dam to Williams Canyon
4	Peshastin Br to Dryden Dam	2.5	Peshastin Br to Dryden Dam
5	Leavenworth Br to Peshastin Br	3.9	Leavenworth Br to Irrigation Flume
6	Icicle Rd Br to Leavenworth Br	2.5	Icicle Mouth to Boat Takeout
7	Tumwater Dam to Icicle Rd Br	4.5	Penstock Br to Icicle Rd Br
8	Tumwater Br to Tumwater Dam	4.7	Tumwater Br to Swiftwater Campground
9	Old Plain Br to Tumwater Br	12.8	RR Tunnel to Swing Pool
10	Lake Wenatchee to Old Plain Br	5.8	Bridge to Swamp

Sockeye Spawning Abundance

In 2012, sockeye abundance was enumerated using two methods: (1) on-the-ground surveys using an "area-under-the-curve" (AUC) approach and (2) a PIT-tag-based mark recapture study.

AUC Method:

Sockeye spawning ground surveys began August 27 and ended October 4. Spawning areas in the Little Wenatchee (Table 1) were surveyed at least once per week. Both the Little Wenatchee and White rivers have falls that are migration barriers to sockeye, and spawning is known to occur only within the first few miles of the Napeequa River, a tributary to the White River.

The AUC method was based on the number of live spawners counted. Using AUC, the number of fish observed in a survey was plotted against the day of the year and the number of fish-days was estimated using an algorithm. The number of fish spawning was then estimated by dividing the cumulative fish-days by the estimated mean number of days that the average spawner was alive in the survey area (survey- or stream-life). This was then multiplied by a correction factor for fish visibility (observer efficiency; Hillborn et al. 1999).

Hillborn et al. (1999) outlined what they termed as the most commonly used form of AUC, *trapezoidal approximation*:

$$AUC = \sum_{i=2}^{n} (t_i - t_{i-1}) \frac{(x_i + x_{i-1})}{2}$$

where t_i is the day of the year and x_i is the number of salmon observed for the ith survey. Attempts were made to initiate surveys before the presence of fish; however, when the first or last survey was not zero, then the above algorithm was not valid and Hillborn et al. (1999) recommend using the rules that the Alaska Department of Fish and Game use:

$$AUC_{first} = (x_i s)/2$$

where s is the survey life. Survey attempts should also be made until all salmon die, but when this was not possible, then the final survey should be calculated as:

$$AUC_{last} = (x_{last} s)/2$$

Then total escapement (E) is estimated as:

$$\hat{E} = \frac{AUC}{s} v$$

where v is a correction for observer efficiency. Since survey life has not been empirically estimated for the Wenatchee system, we used 11 days based on Perrin and Irvine (1990) and Hyatt et al. (2006).

Mark Recapture Method:

Adult sockeye salmon were removed from the adult fishway at Tumwater Dam on the Wenatchee River, northwest of Leavenworth, Washington during the 2012 migration. Fish were anesthetized, tagged with a PIT, and released into the forebay consistent with techniques used by the Washington Department of Fish and Wildlife. Resulting tag files were queried in PITAGIS (2012), providing detection histories for each study fish. Adult sockeye salmon were tagged at Bonneville Dam by another organization in 2012; fish from this tag group that were detected at Tumwater Dam were also used in the analyses. Total passage of adult sockeye salmon through Tumwater Dam was obtained from Columbia River Data Access in Real Time (DART 2012).

Detection efficiency of in-stream arrays was calculated for the Little Wenatchee River in 2012. The in-stream arrays include a series of upstream and downstream coils (**Error! Reference source not found.**). Combined, these coils represented the upstream and downstream detection arrays, respectively. Overall detection efficiency P_{all} of the arrays was calculated based on observed detection probabilities of individual arrays:

$$P_{all} = 1 - (1 - P_{array\,1})(1 - P_{array\,2})$$

where the probability of missing a fish on both the upstream P_{array1} and downstream P_{array2} arrays were combined for an overall efficiency P_{all} (Connolly et al. 2008).

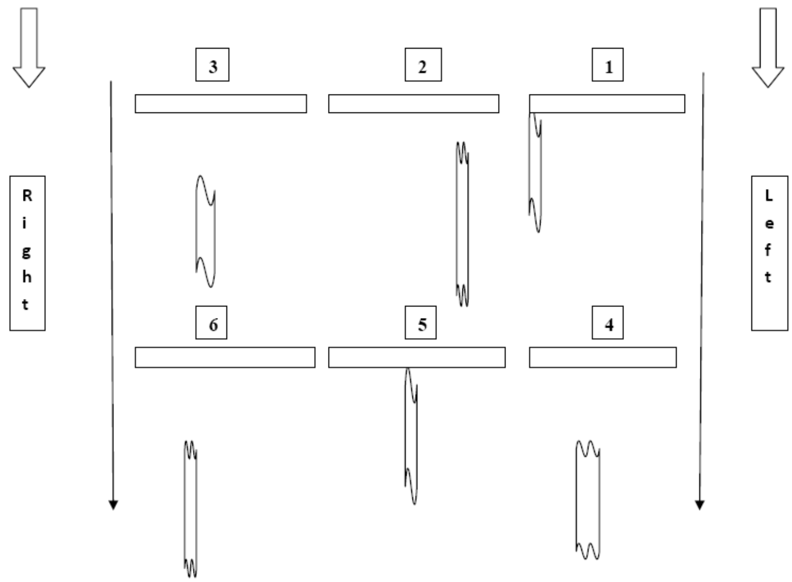


Figure 3. PIT array configuration on the Little Wenatchee River, 2009.

Resulting data from passage at Tumwater Dam, mark and recapture using PITs, and detection efficiency estimates can provide estimation of escapement to spawning tributaries. Basic assumptions include: (1) the study population is “closed,” i.e., no individuals die or emigrate between the initial mark and subsequent recaptures; (2) tags are not lost and detections are correctly identified; (3) all individuals have the same probability of being detected, and (4) the number of recapture events are proportional to the total population. Lastly, it was assumed that PIT-tagging efforts at Tumwater have negligible influence on fish behavior and tagged individuals behave similarly to untagged individuals. The resulting escapement rate, adjusted for detection efficiency, was then applied to the total population as such:

$$Escapement = \left(\frac{\left(\frac{Obs_{LWN}}{Eff_{LWN}} + \frac{Obs_{WTL}}{Eff_{WTL}} \right)}{PITs_{TUM}} \right) \times Counts_{TUM}$$

where the PIT detections (*Obs*) at the Little Wenatchee (*LWN*) and lower White River (*WTL*) were adjusted for detection efficiency (*Eff*) at both sites, compared to the number released (*PITs*) at Tumwater Dam (*TUM*), and the resulting proportion was applied to the population observed (*Counts*) passing Tumwater Dam.

Results

Summer Chinook

Peak Counts

The cumulative peak summer Chinook redd count was 2,301 in 2012, based on District ground surveys along the Wenatchee River (Table 3). Spawning activity began the third week of September and peaked during middle of October.

Table 3. Summary of summer Chinook redd peak counts, total redd estimates (TR) and spawner densities by reach in the Wenatchee River, 2012. Expansion factors were rounded to two decimal places (0.00) prior to calculating reach totals.

Reach	Peak Count	CCPUD Estimates		CCPUD Naïve Estimates	
		RT_{Peak}	$Density_{Peak}$ (redds/mile)	$RT_{Visible}$	$Density_{Visible}$ (redds/mile)
1	7	9	3	8	2
2	162	166	27	209	34
3	160	227	27	207	25
4	67	70	32	70	32
5	49	62	16	71	18
6	831	865	346	1,009	404
7	149	153	34	158	35
8	127	173	37	199	42
9	437	400	33	689	56
10	312	377	60	337	53
Total	***2,301***	***2,502***	***62***	***2,957***	***70***

Total Counts

The total number of redds in the Wenatchee River was 2,502 (RT_{peak}), using data from District surveys and the peak expansion factor. The District also estimated 2,957 redds (RT_{visble}) based on their naïve surveys (Table 3). All survey methods (peak and visible) indicated that redd densities were highest in Reach 6 and lowest in Reach 1 (Table 3; Figure 4), consistent with the previous four years. The historical summer Chinook peak counts (1996-2012) for the Wenatchee River basin are summarized in Attachment 1.

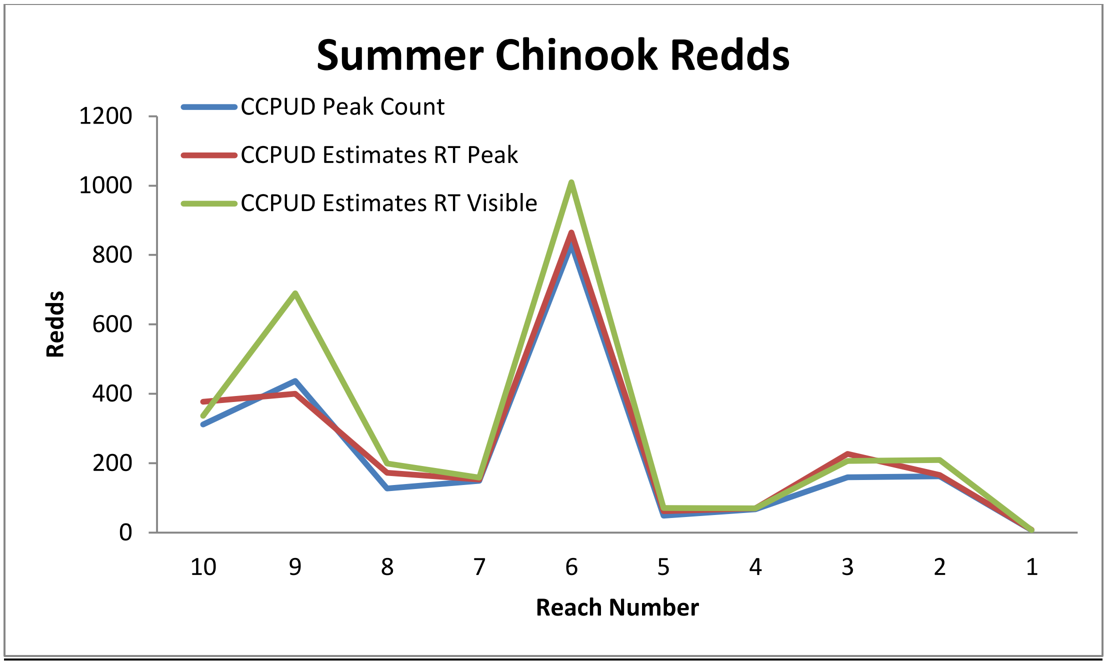


Figure 4. Alternative estimates of reach totals (RT) for summer Chinook redds in the Wenatchee River in 2012 [RT_{peak}=District peak counts expanded by peak expansion method and RT_{visble} =District naïve counts expanded by naïve expansion factor].

Sockeye Salmon

Sockeye AUC Method

<u>Live fish counts</u>
Fish counts were conducted for sockeye from August 27 through October 4. Peak spawning occurred in the Little Wenatchee (3,891 spawners) during the middle of September (Figure 5; Table 4).

<u>Escapement</u>
The total estimated spawning escapement of sockeye to the Little Wenatchee tributarie was 5,686 in 2012 (Table 4). The escapement estimate is based solely on tributary observations.

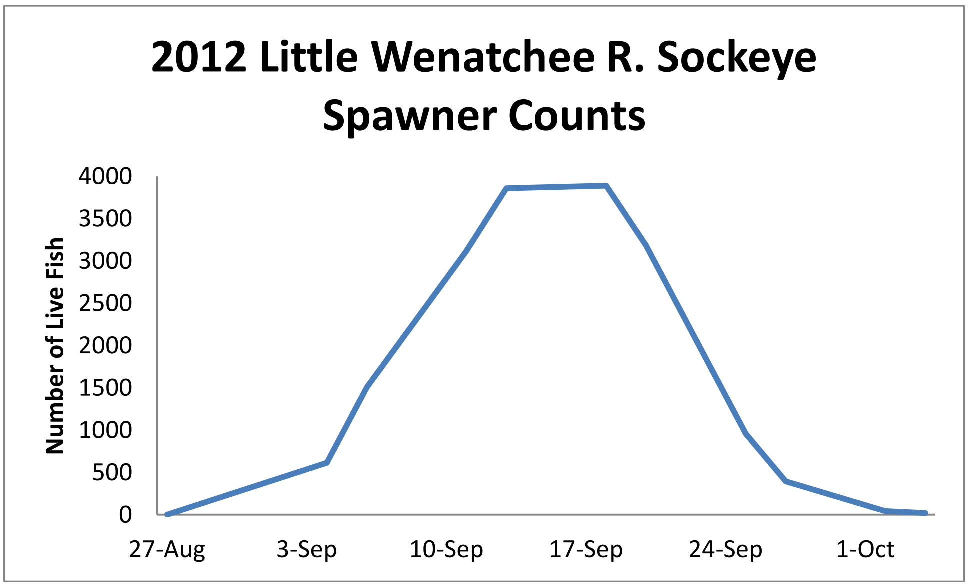


Figure 5. Approximate live counts and survey dates for sockeye salmon in the Little Wenatchee R., 2012.

Table 4. Number of live fish and total spawning escapement estimates for sockeye salmon in the Wenatchee Basin, August through October, 2012.

River	Peak number of live fish	Escapement
Little Wenatchee	**3,891**	**5,686**
Napeequa	**N/A**[1]	**N/A**[1]
White	**N/A**[1]	**N/A**[1]
Total	***3,891***	***5,686***

[1] No AUC counts were conducted on these streams in 2012.

Sockeye Mark Recapture Method

Fishway enumeration at Tumwater Dam indicated that 66,520 adult sockeye salmon passed the facility during the 2012 migration. Adult return counts at Tumwater Dam were sufficient to open a recreational fishery in Lake Wenatchee for 2012. PIT tags were implanted in 1,154 (Table 5) of these fish prior to subsequent detections in nearby tributaries. Based on the recapture of PIT-tagged adult sockeye and assigned detection efficiency, total estimated escapement from Tumwater Dam to the White and Little Wenatchee rivers was 28,473, including 23,866 fish into the White River and 4,607 fish into the Little Wenatchee River. Combined escapement rates represented 0.428 of the population in 2012 (Table 6).

Table 5. Number of adult sockeye salmon PIT-tagged, released, and detected upstream of Tumwater Dam in 2009, 2010, 2011, and 2012, including escapement estimates of PIT-tagged fish based on array detection probabilities.

Release Location	Number Released	White River [3]		L. Wenatchee River [4]		Chiwawa R.	Nason Creek
		Observed	*Estimated*	Observed	*Estimated*	Observed	Observed
Tumwater (2009) [1]	998	347	*855*	34	*35*	35	7
Bonneville (2009) [2]	87	34	*84*	4	*4*	2	0
Tumwater (2010) [1]	1,054	530	*589*	61	*61*	3	1
Bonneville (2010) [2]	110	41	*46*	6	*6*	0	0
Tumwater (2011) [1]	381	64	*N/A*[5]	26	*27*	0	0
Bonneville (2011) [2]	103	19	*N/A*[5]	14	*14*	0	0
Tumwater (2012) [1]	960	351	*372*	68	*69*	0	0
Bonneville (2012) [2]	194	59	*63*	6	*6*	0	0
Combined (2009)	1,085	381	*939*	38	*39*	37	7
Combined (2010)	1,164	571	*635*	67	*67*	3	1
Combined (2011)	484	40	*41*	84	*0*	0	0
Combined (2012)	1,154	410	*435*	74	*75*	0	0

[1] Also includes fish detected downstream of release point (fallbacks).
[2] Number of fish released at Bonneville and subsequently detected at Tumwater Dam.

[3] Based on a detection efficiency p_{all} = 0.406 in 2009 (assigned from 2010 data), p_{all} = 0.900 in 2010, p_{all} = 0.981 in 2011, and p_{all} = 0.943 in 2012.
[4] Based on a detection efficiency p_{all} = 0.971 in 2009, p_{all} = 1.000 in 2010, and p_{all} = 0.987 in 2012.
[5] Technical difficulties with the White R. PIT array prevented the calculation of detection efficiency.

Table 6. Estimated escapement of adult sockeye salmon to Little Wenatchee and White rivers based on mark-recapture events, in-stream detection efficiency, and adult enumeration at Tumwater Dam, 2009-2012.

Year	Tumwater count	Recreational harvest	Little Wenatchee	White River	Combined	Escapement
2009	16,034	2,229	576	13,876	14,452	0.901
2010	35,821	4,129	2,062	19,542	21,604	0.603
2011[1]	*18,634*	*0*	*2,431*	*14,582*	*17,013*	*0.913*
2012	*66,520*	*12,107*	*4,607*	*23,866*	*28,473*	*0.428*
Average	*34,252*	*4,616*	*2,419*	*17,967*	*20,386*	*0.595*

[1] Escapement was calculated using AUC counts for the Little Wenatchee R. and a linear regression relationship to the Little Wenatchee R. for the White R.

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Attachment 1

Historic peak redd counts in the Wenatchee River for summer/fall Chinook salmon. Prior to 1995, all counts based on highest count of multiple agencies surveys, which were usually aerial counts from fixed-wing aircraft. Since 1995, counts are ground counts based on Chelan PUD surveys.

Year	Highest Count	Year	Highest Count	Year	Highest Count
1960	502	1970	1333	1980	2024
1961	872	1971	1419	1981	1469
1962	1035	1972	1364	1982	1140
1963	1223	1973	1119	1983	723
1964	1300	1974	1155	1984	1332
1965	706	1975	925	1985	1058
1966	1260	1976	1106	1986	1322
1967	1593	1977	1365	1987	2955
1968	1776	1978	1956	1988	2102
1969	1354	1979	1698	1989	3331
1990	2479	2000	2022	2010	2553
1991	2180	2001	2857	2011	2583
1992	2328	2002	5419	2012	2301
1993	2334	2003	4281		
1994	2426	2004	3764		
1995	1872	2005	3327		
1996	1435	2006	7165		
1997	1388	2007	1857		
1998	1660	2008	2338		
1999	2188	2009	2667		

Appendix I

Genetic Diversity of Wenatchee Sockeye Salmon

Assessing the Genetic Diversity of Lake Wenatchee Sockeye Salmon And Evaluating The Effectiveness Of Its Supportive Hatchery Supplementation Program

Developed for

Chelan County PUD

and the

Habitat Conservation Plan's Hatchery Committee

Developed by
Scott M. Blankenship, Cheryl A. Dean, Jennifer Von Bargen
WDFW Molecular Genetics Laboratory
Olympia, WA

and

Andrew Murdoch
Supplementation Research Team
Wenatchee, WA

March 2008

Executive Summary

Nine spawning populations of sockeye (*Oncorhynchus nerka*) salmon have been identified in Washington, including stocks in the Lake Wenatchee basin (SaSI 5800) (Washington Department of Fisheries et al. 1993). Lake Wenatchee sockeye are classified as an Evolutionary Significant Unit (ESU), and consists of sockeye salmon that spawn primarily in tributaries above Lake Wenatchee (the White River, Napeequa River, and Little Wenatchee Rivers). Since 1990, the Wenatchee Sockeye Program has released juveniles into Lake Wenatchee to supplement natural production of sockeye salmon in the basin. The program's broodstock are predominantly natural-origin sockeye adults returning to the Wenatchee River captured at Tumwater Dam (Rkm 52.0), where a net-pen system is used to house both maturing adults and juveniles prior to release into Lake Wenatchee to over-winter.

Previous genetic studies have generally found a lack of concordance between population genetic relationships and their geographic distributions. These studies indicate that the nearest geographic neighbors of sockeye salmon populations are not necessarily the most genetically similar. Specifically for the Columbia River Basin, sockeye from Lake Wenatchee, Okanogan River, and Redfish Lake may be more closely related to a population from outside the Columbia River (depending on marker used) then to each other.

In this study we investigated the temporal and spatial genetic structure of Lake Wenatchee sockeye collections, without regard to sockeye populations outside of the Lake Wenatchee area. Our primary objective here was to determine if the Wenatchee Sockeye Program affected the natural Lake Wenatchee sockeye population. More specifically, we were tasked to determine if the genetic composition of Lake Wenatchee sockeye population had been altered by a supplementation program that was based on the artificial propagation of a small subset of that population. Using microsatellite DNA allele frequencies, we investigated population differentiation between temporally replicated collections of natural-origin Lake Wenatchee sockeye and program broodstock. We analyzed thirteen collections of Lake Wenatchee sockeye (Table 1), eight temporally replicated collections of natural-origin Lake Wenatchee sockeye (N=786) and five temporally replicated collections of Wenatchee Sockeye Program broodstock (N=248). Paired natural – broodstock collections were available from years 2000, 2001, 2004, 2006, and 2007.

Conclusions

We observed that allele frequency distributions were consistent over time, irrespective of collection origin, resulting in small and statistically insignificant measures of genetic differentiation among collections. We interpreted these results to indicate no year-to-year differences in allele frequencies among natural-origin or broodstock collections. Furthermore, there were no observed difference between pre- and post-supplementation collections. Therefore, we accepted our null hypothesis that the allele frequencies of the broodstock collections equaled the allele frequencies of the natural collections, which

equaled the allele frequency of the donor population. Given the small differences in genetic composition among collections, the genetic model for estimating N_e produced estimates with extremely large variances, preventing the observation of any trend in N_e.

Introduction

A report titled "Conceptual Approach to Monitoring and Evaluating the Chelan County Public Utility District Hatchery Programs" was prepared July 2005 by Andrew Murdoch and Chuck Peven for the Chelan PUD Habitat Conservation Plan's Hatchery Committee. This report outlined 10 objectives to be applied to various species assessing the impact (positive or negative) of hatchery operations mitigating the operation of Rock Island Dam. This current study pertains only to Lake Wenatchee sockeye and objective 3:

> *Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.*

In order to evaluate cause and effect of hatchery supplementation, WDFW Molecular Genetics Lab surveyed genetic variation of Lake Wenatchee sockeye. The conceptual approach for this project follows that of a parallel study regarding the Wenatchee River spring Chinook supplementation program (Blankenship et al. 2007). We determined the genetic diversity present in the Lake Wenatchee sockeye population by analyzing temporally replicated collections spanning 1989 – 2007, which included collections from before and following the inception of the Wenatchee Sockeye Program. Documenting the genetic composition of the Lake Wenatchee sockeye population is necessary to assess the effect of the hatchery program on the Lake Wenatchee population. In addition, this work provides a genetic baseline for future projects requiring genetic data. See study objectives below for specific details about how this project addresses Murdoch and Peven (2005) objective 3.

Lake Wenatchee Sockeye Salmon

Nine spawning populations of sockeye (*Oncorhynchus nerka*) salmon have been identified in Washington (Washington Department of Fisheries et al. 1993): 1) Baker

River, 2) Ozette Lake, 3) Lake Pleasant, 4) Quinault Lake, and 5) Okanogan River (classified as native stock); 6) Cedar River (classified as non-native stock); 7) Lake Wenatchee, classified as mixed stock); 8) Lake Washington/Lake Sammamish tributaries; and 9) Lake Washington beach spawners (classified as unknown origin). Chapman et al. (1995) listed four additional spawning aggregations of sockeye salmon that appear consistently in Columbia River tributaries: the Methow, Entiat, and Similkameen Rivers; and Icicle Creek in the Wenatchee River drainage.

Located in north central Washington, the Wenatchee River basin drains a portion of the eastern slope of the Cascade Mountains, including high mountainous regions of the Cascade crest. The headwater area of the Wenatchee River is Lake Wenatchee, a typical low productivity oligotrophic or ultra-oligotrophic sockeye salmon nursery lake (Allen and Meekin 1980, Mullan 1986, Chapman et al. 1995). Sockeye salmon bound for Lake Wenatchee enter the Columbia River in April and May and arrive at Lake Wenatchee in late July to early August (Chapman et al. 1995; Washington Department of Fisheries et al. 1993). The run timing of Lake Wenatchee sockeye salmon, classified as an Evolutionary Significant Unit (ESU), appears to have become earlier by 6 - 30 days during the past 70 years (Chapman et al. 1995; Quinn and Adams 1996). Additionally, scale pattern analysis suggests Wenatchee sockeye migrate past Bonneville Dam earlier than the sockeye bound for the Okanogan River (Fryer and Schwartzberg 1994). The Wenatchee population spawns from mid-September through October in the Little Wenatchee, White, and Napeequa Rivers above Lake Wenatchee (Washington Department of Fisheries et al. 1993), peaking in late September (Chapman et al. 1995). Limited beach spawning is believed to occur in Lake Wenatchee (L. Lavoy pers. com.; Mullan 1986), although Gangmark and Fulton (1952) reported two lakeshore seepage areas in Lake Wenatchee that were used by spawning sockeye salmon. Sockeye salmon fry enter Lake Wenatchee between March and May (Dawson et al. 1973), and typically rear in the lake for one year before leaving as smolts (Gustafson et al. 1997; Peven 1987).

Both the physical properties of the habitat and ecological/biological factors of the sockeye populations differ between the Lake Wenatchee ESU and the geographically proximate Okanogan ESU. For example: 1) Different limnology is encountered by sockeye salmon in Lakes Wenatchee and Osoyoos; 2) Lake Wenatchee sockeye predominantly return at ages four and five (a near absence of 3-year-olds), where a large percentage of 3-year-olds return to the Okanogan population; and 3) the apparent one month separation in juvenile outmigration-timing between Okanogan- and Wenatchee-origin fish (Gustafson et al. 1997 and references therein).

Sockeye Artificial Propagation In Lake Wenatchee

The construction of Grand Coulee Dam completely blocked fish passage to the upper Columbia River, and 85% of sockeye salmon passing Rock Island Dam between 1935 and 1936 were estimated to be from natural stocks bound for areas up-river to Grand Coulee Dam (Mullan 1986; Washington Department of Fisheries et al. 1938). To compensate for loss of habitat resulting from Grand Coulee Dam, the federal government initiated the Grand Coulee Fish-Maintenance Project (GCFMP) in 1939 to maintain fish runs in the Columbia River above Rock Island Dam. Between 1939 and 1943, all sockeye salmon entering the mid-Columbia River were trapped at Rock Island Dam, and over 32,000 mixed Lake Wenatchee, Okanogan River, and Arrow Lake adult sockeye salmon were released into Lake Wenatchee (Gustafson et al. 1997 Appendix Table D-2). In addition to adult relocation, between 1941 and 1969 over 52.8 million fry descended from original spawners collected at Rock Island and Bonneville Dams, were released into Lake Wenatchee (Gustafson et al. 1997 Appendix Table D-2).

No releases of artificially-reared sockeye salmon occurred in the Wenatchee watershed during the years 1970 to 1989 (Gustafson et al. 1997 Appendix Table D-2). Since 1990, the Wenatchee Sockeye Program has released juveniles into Lake Wenatchee to supplement natural production of sockeye salmon in the basin. Sockeye adults returning to the Wenatchee River are captured at Tumwater Dam (Rkm 52.0) and transferred to Lake Wenatchee net pens until mature. The Wenatchee Sockeye Program goals are 260 adults with an equal sex ratio, <10% hatchery-origin returns (identified by coded wire tags), and the adults removed for broodstock account for <10% of the run size. Fish are spawned at Lake Wenatchee and their gametes are taken to Rock Island Fish Hatchery

Complex (i.e., Eastbank) for fertilization and incubation. Fry are returned to the Lake Wenatchee net -pens after they are large enough to be coded wire tagged, and are housed in the pens until fall (one year after spawning), when they are liberated into the lake to over-winter. For brood years 1991 – 2004 an average of 218,683 (std. dev. = 71,090) pen-reared Lake Wenatchee-origin juvenile sockeye salmon have been released yearly into Lake Wenatchee.

Previous Genetic Studies

Protein (allozyme) variation – Surveying genetic variation at 12 allozyme loci, Utter et al. (1984) reported moderate population structure among 16 sockeye collections from southeast Alaska through the Columbia River Basin, including Okanogan and Wenatchee stocks, with an apparent genetic association between upper Fraser River and Columbia River sockeye salmon. Winans et al. (1996) surveyed variation at 55 allozyme loci for 25 sockeye salmon and two kokanee collections from 21 sites in Washington, Idaho, and British Columbia, and reported the lowest level of allozyme variability of any species of Pacific salmon and a highest level of inter-population differentiation. Furthermore, these authors reported that there was no clear relationship between geographic and genetic differentiation among the populations within there study. Other studies corroborate the results of Winans et al. (1996), finding a lack of discernible geographic patterning for sockeye salmon populations in British Columbia, Alaska, and Kamchatka (Varnavskaya et al. 1994, Wood et al. 1994, Wood 1995). These studies indicate that the nearest geographic neighbors of sockeye salmon populations are not necessarily the most genetically similar, which contrasts with the other Pacific salmon species that exhibit concordance between geographic and genetic differentiation (Utter et al. 1989, Winans et al. 1994, Shaklee et al. 1991). As part of the comprehensive status review of west coast sockeye salmon (Gustafson et al. 1997), NMFS biologists collected new allozyme genetic information for 17 sockeye salmon populations and one kokanee population in Washington and combined these data for analysis with the existing Pacific Northwest sockeye salmon and kokanee data from Winans et al. (1996). Results of the updated study were consistent with Winans et al. (1996), with no clear concordance between geographic and genetic distances. Sockeye salmon from Lake Wenatchee, Redfish Lake, Ozette Lake, and Lake Pleasant are very distinct from other collections in the study, and Columbia River populations were not necessarily most closely related to each other. Gustafson et al. (1997) also examined between-year variability within a collection location and found low levels of statistical significance among the five Lake Wenatchee collections included in the study (For 10 pair-wise comparisons using sum-G test, five were statistically significant). Lake Wenatchee brood year 1987 accounted for three of the significant comparisons, which were driven by unusually high frequencies of two allozyme alleles (ALAT*95 and ALAT*108) (Winans et al. 1996). Nevertheless, Gustafson et al. (1997) conclude that, in general, temporal variation at a locale was considerably less than between-locale variation.

Nucleic acid variation - Beacham et al. (1995) reported levels of variation in nuclear DNA of *O. nerka* using minisatellite probes. They analyzed 10 collections, including a sample from Lake Wenatchee. Cluster analysis showed the Lake Wenatchee sample was different from all the other collections, including those from the Columbia River. Using a similar molecular technique, Thorgaard et al. (1995) examined the use of multi-locus DNA fingerprinting (i.e., banding patterns) to discriminate among 14 sockeye salmon and kokanee populations. Dendrograms based on analysis of banding patterns produced different genetic affinity groups depending on the probes used. While none of the five DNA probes showed a close relationship between Lake Wenatchee and Okanogan River sockeye salmon, if information from all probes were combined, *O. nerka* from Redfish Lake, Wenatchee, and Okanogan were separate from kokanee of Oregon and Idaho and a sockeye salmon sample from the mid-Fraser River.

Study Objective

We documented temporal variation in genetic diversity (i.e., heterozygosity and allelic diversity), and investigated population differentiation between temporally replicated collections of natural-origin Lake Wenatchee sockeye and program broodstock, using microsatellite DNA allele frequencies. Temporally replicated collections from the same location can also be used to estimate effective population size (N_e). If populations are "ideal", the census size of a population is equal to the "genetic size" of the population.

Yet, numerous factors lower the "genetic size" below census, such as, non-equal sex ratios, changes in population size, and variance in the numbers of offspring produced from parent pairs. N_e is thought to be between 0.10 and 0.33 of the estimated census size (Bartley et al. 1992; RS Waples pers. comm.), although numerous observations differ from this general rule. N_e can be calculated directly from demographic data, or inferred from observed differences in genetic variance over time. Essentially, when calculated from genetic data, N_e is the estimated size of an "ideal" population that accounts for the genetic diversity changes observed, irrespective of abundance.

We will address the hypotheses associated with Objective 3 in Murdock and Peven (2005) using the following four specific tasks:

Task 1 - Document the observed genetic diversity.

Task 2 - Test for population differentiation among Lake Wenatchee collections and the associated supplementation program.

Task 2 was designed to address two hypotheses listed as part of Objective 3 in Murdoch and Peven (2005):

- Ho: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Donor pop}}$.
- Ho: Genetic distance between subpopulations $_{\text{Year x}}$ = Genetic distance between subpopulations $_{\text{Year y}}$

Murdoch and Peven (2005) proposed these two hypotheses to help evaluate supplementation programs through a "Conceptual Process" (Figure 5 in Murdoch and Peven 2005). There are two components to the first hypothesis, which must be considered separately for Lake Wenatchee sockeye. The first component involves comparisons between natural-origin populations from Lake Wenatchee to determine if there have been changes in allele frequencies through time starting with the donor population. Documenting a change does not necessarily indicate that the supplementation program has directly affected the natural-origin fish, as additional tests would be necessary to support that hypothesis. The intent of the second component is to determine if the hatchery produced populations have the same genetic composition as the naturally produced populations.

Task 3 - Calculate N_e using the temporal method for multiple samples from the same location to document trend.

Task 4 - Compare N_e estimates with trend in census size for Lake Wenatchee sockeye.

Methods and Materials

Sampling

Thirteen collections of Lake Wenatchee sockeye were analyzed, eight temporally replicated collections of natural Lake Wenatchee sockeye (N=786) and five temporally replicated collections of Wenatchee Sockeye Program broodstock (N=248) (Table 1). Paired natural – broodstock collections were available from years 2000, 2001, 2004, 2006, and 2007 (Table 1). All collections were made at Tumwater Dam on the Wenatchee River. Note that collections classified as broodstock were predominantly natural-origin sockeye. A majority of the genetic samples were from dried scales. The tissue collections from 2006 and 2007 were fin clips stored immediately in ethanol after collection. DNA was extracted from stored tissue using Nucleospin 96 Tissue following the manufacturer's standard protocol (Macherey-Nagel, Easton, PA, U.S.A.).

Laboratory Analysis

Polymerase chain reaction (PCR) amplification was performed using 17 fluorescently end-labeled microsatellite marker loci, *One* 2 (Scribner et al 1996) *One* 100, 101, 102, 105, 108, 110, 114, and 115 (Olsen et al. 2000), *Omm* 1130, 1135, 1139, 1142, 1070, and 1085 (Rexroad et al. 2001), *Ots* 3M (Banks et al. 1999) and *Ots* 103 (Small et al. 1998). PCR reaction volumes were 10 μL, with the reaction variables being 2 μL 5x PCR buffer (Promega), 0.6 μL $MgCl_2$ (1.5 mM) (Promega), 0.2 μL 10 mM dNTP mix (Promega), and 0.1 μL *Go Taq* DNA polymerase (Promega). Loci were amplified as part of multiplexed sets, so primer molarities and annealing temperatures varied. Multiplex one had an annealing temperature of 55°C, and used 0.09 Molar (M) *One* 108, 0.06 M *One* 110, and 0.11 M *One* 100. Multiplex two had an annealing temperature of 53°C, and used 0.08 M *One* 102, 0.1 M *One* 114, and 0.05 M *One* 115. Multiplex three had an annealing temperature of 55°C, and used 0.08 M *One* 105 and 0.07 M *Ots* 103. Multiplex four had an annealing temperature of 53°C, and used 0.09 M *Omm* 1135 and 0.08 M *Omm* 1139. Multiplex five had an annealing temperature of 60°C, and used 0.2 M *Omm* 1085, 0.09 M *Omm* 1070, and 0.05 M *Ots* 3M. Multiplex six had an annealing temperature of 48°C, and used 0.06 M *One* 2, 0.08 M *Omm* 1142, and 0.08 M *Omm* 1130. *One* 101 was run in isolation with a primer molarity of 0.06. Thermal cycling was conducted on either PTC200 (MJ Research) or GeneAmp 9700 thermal cyclers as follows: 94°C (2 min); 30 cycles of 94°C for 15 sec., 30 sec. annealing, and 72°C for 1 min.; a final 72°C extension and then a 10°C hold. PCR products were visualized by denaturing polyacrylamide gel electrophoresis on an ABI 3730 automated capillary analyzer (Applied Biosystems). Fragment analysis was completed using GeneMapper 3.7 (Applied Biosystems).

Genetic data analysis

Assessing within collection genetic diversity - Heterozygosity measurements were reported using Nei's (1987) unbiased gene diversity formula (i.e., expected heterozygosity) and Hedrick's (1983) formula for observed heterozygosity. Both tests were implemented using the microsatellite toolkit (Park 2001). For each locus and collection FSTAT version 2.9.3.2 (Goudet 1995) was used to assess Hardy-Weinberg equilibrium, where deviations from the neutral expectation of random associations among alleles were calculated using a randomization procedure. Alleles were randomized among individuals within collections (4160 randomizations for this dataset) and the F_{IS} (Weir and Cockerham 1984) calculated for the randomized datasets were compared to the observed F_{IS} to obtain an unbiased estimation of the probability that the null hypothesis was true. The 5% nominal level of statistical significance was adjusted for multiple tests (Rice 1989). Genotypic linkage disequilibrium was calculated following Weir (1979) using GENETIX version 4.05 (Belkhir et al. 1996). Statistical significance of linkage disequilibrium results was assessed using a permutation procedure implemented in GENETIX for each locus by locus combination within each collection.

Assessing among collection genetic differentiation - The temporal stability of allele frequencies was assessed by the randomization chi-square test implemented in FSTAT version 2.9.3.2 (Goudet 1995). Multi-locus genotypes were randomized between collections. The G-statistic for observed data was compared to G-statistic distributions from randomized datasets (i.e., null distribution of no differentiation between collections). Population differentiation was also investigated using pairwise estimates of F_{ST}. Multi-locus estimates of pairwise F_{ST}, estimated by a "weighted" analysis of variance (Weir and Cockerham, 1984), were calculated using GENETIX version 4.05 (Belkhir et al.1996). F_{ST} was used to quantify population structure, the deviation from statistical expectations (i.e., excess homozygosity) due to non-random mating between populations. To determine if the observed F_{ST} estimate was consistent with statistically expectations of no population structure, a permutation test was implemented in GENETIX (1000 permutations).

Effective population size (N_e) – Estimates of the effective population size were obtained using a multi-collection temporal method (Waples 1990a). The temporal method assumes that cohorts are used, but we did not decompose the collection year samples into their respective cohorts using age data. Therefore, N_e estimates that pertain to individual year classes of breeders are not valid; however the harmonic mean over all samples will estimate an N_e that pertains to the time period from which the collections are derived. Comparing samples from years *i* and *j*, Waples' (1990a) temporal method estimates the effective number of breeders ($\hat{N}_{b(i,j)}$) according to:

$$\hat{N}_{b(i,j)} = \frac{b}{2(\hat{F} - 1/\tilde{S}_{i,j})}$$

The standardized variance in allele frequency ($\hat{F}$) is calculated according to Pollack (1983). The parameter b is calculated analytically from age structure information and the number of years between samples (Tajima 1992). The age-at-maturity information required to calculate b was obtained from ecological data (Hillman et al. 2007). The harmonic mean of sample sizes from years *i* and *j* is $\tilde{S}_{i,j}$. The harmonic mean over all pairwise estimates of $\hat{N}_{b(i,j)}$ is $\tilde{N}_b$. SALMONNb (Waples et al. 2007) was used to calculate $\tilde{N}_b$.

Results and Discussion

In this section we combine our presentation and interpretations of the genetic analyses. Additionally, this section is organized based on the task list presented in the study plan.

Task 1 - Document the observed genetic diversity.

Substantial genetic diversity was observed over all Lake Wenatchee sockeye collections analyzed (Table 1), with heterozygosity estimates over all loci having a mean of 0.79. Genetic diversity was consistent with expected Hardy-Weinberg random mating genotypic proportions for all collections. The F_{IS} observed for each collection was not statistically significant given the distribution of F_{IS} generated using a randomization procedure. Additionally, there were no statistically significant associations observed between alleles across loci (i.e., linkage equilibrium) (data not shown). We concluded from these results that the genetic data from each collection was consistent with statistical expectations for random association of alleles within and between loci. In other words, each collection represents samples from a single gene pool (i.e., populations), and the genetic diversity observed has no detectable technical artifacts or evidence of natural selection.

Task 2 - Test for differentiation among Lake Wenatchee collections and the associated supplementation program.

We explicitly tested the hypothesis of no significant differentiation within natural-origin or broodstock collections from Lake Wenatchee using a randomization chi-square test. The null hypothesis for these tests was that the allele frequencies from two different populations were drawn from the same underlying distribution. We show the results for the pairwise comparisons among eight temporally replicated natural-origin collections from Lake Wenatchee (28 pairwise tests), and report all tests were non-significant (Table 2A). Similarly, for five temporally replicated broodstock collections, 10 of 10 pairwise tests were non-significant (Table 2B). We also tested if natural-origin and broodstock collections were differentiated from each other over time, and report that 40 of 40 tests were non-significant (Table 2C). The nominal level of statistical significance ($\alpha = 0.05$) was adjusted for multiple comparisons using strict Bonferroni correction (Rice 1989). Yet, there are perhaps slight differences between paired natural-broodstock collections. Note that the p-values for comparisons regarding 2006 and 2007 paired collections are lower than for comparisons regarding 2000, 2001, and 2004. The small sample sizes for broodstock collections in 2006 and 2007 may not have been random samples from the Lake Wenatchee sockeye population.

Given the consistencies observed for allele frequency distributions over time, metrics of population structure were expected to be small. This was the case, as the estimated F_{ST} over all thirteen collections was 0.0003. This observed value fell within the distribution of F_{ST} values expected if there were no population structure present (permutation test p-value 0.12). Analysis of the paired natural-broodstock collections corroborated this result. Pairwise estimates of F_{ST} were 0.000 for years 2000, 2001, 2004, and 2007, and 0.002 for 2006. All five estimates were non-significant. Essentially, all 13 sockeye collections could be considered samples from the same population. Given these results, it is valid to combine all collections for statistical analysis. Therefore, we did not calculate genetic distances among any collections, as it is inappropriate to estimate distances that are effectively zero.

Conclusions

We interpret these data to indicate that there appears to be no significant year-to-year differences in allele frequencies among natural-origin or broodstock collections, nor are there observed differences between collections pre- and post-supplementation. As a result, we accept the null hypothesis that the allele frequencies of the broodstock collections equal the allele frequencies of the natural collections, which equals the allele frequency of the donor population. Furthermore, the observed genetic variance that can be attributed to among collection differences was negligible.

Task 3 - Calculate N_e using the temporal method for multiple samples from the same location to document trend.

The fundamental parameter for inferring N_e using genetic data is the standardized variance in allele frequency ($\hat{F}$) (Pollack 1983). Methods estimate N_e from observed changes in $\hat{F}$ over temporally replicated collections from the same location. Yet, as previously shown, there were no statistically significant differences detected in allele frequencies. The underlying model for estimating N_e produced estimates with extremely large variances, given small temporal differences in $\hat{F}$, which rendered any trend in N_e unobservable. Table 3 shows N_e estimates calculated using temporally replicated natural collections.

Task 4 - Compare N_e estimates with trend in census size for Lake Wenatchee sockeye.

See Task 3

Acknowledgements

We would like to thank Jeff Fryer (CRITFC) for providing critical collections of natural-origin sockeye from Lake Wenatchee. We would like to thank Norm Switzler for collection curation and Ken Warheit and Denise Hawkins for helpful comments regarding this project. This project was funded by Chelan County PUD and the Washington State General Fund.

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Table 1 Lake Wenatchee sockeye collections analyzed. MNA is the mean number of alleles per locus, Hz is unbiased heterozygosity, Obs Hz is observed heterozygosity, and HW is the p-value of the null hypothesis of random association of alleles (i.e., Hardy – Weinberg equilibrium). For reference, the nominal level of statistical significance at α = 0.05 is 0.0002 after correction for multiple tests.

Year	Collection Code	Tissue Type	Source	N	MNA	Hz	Obs Hz	HW
1989	89[1]	Scales	Natural	96	14.35	0.792	0.791	0.424
1990	90[1]	Scales	Natural	96	13.19	0.793	0.779	0.131
2000	00AAE	Scales	Broodstock	96	12.31	0.787	0.776	0.213
2000	00[1]	Scales	Natural	96	11.76	0.801	0.826	0.868
2001	01AAS	Scales	Broodstock	53	9.47	0.788	0.793	0.392
2001	01[1]	Scales	Natural	96	14.35	0.786	0.794	0.456
2002	02[1]	Scales	Natural	96	14.53	0.794	0.777	0.780
2004	04[1]	Scales	Natural	96	14.65	0.798	0.803	0.704
2004	04AAV	Scales	Broodstock	43	14.35	0.796	0.795	0.051
2006	06CN	Tissue	Broodstock	38	14.59	0.793	0.785	0.688
2006	06CO	Tissue	Natural	96	14.53	0.806	0.803	0.408
2007	07EE	Tissue	Broodstock	18	14.00	0.790	0.790	0.221
2007	07EF	Tissue	Natural	96	14.35	0.789	0.800	0.347

[1] Samples taken from scale cards provided by Jeff Fryer (CRITFC)

Table 2 Allelic differentiation for Lake Wenatchee sockeye collections. A single analysis tested (pairwise) the allelic differentiation between all thirteen collections; however p-values for G-statistics are partitioned in the table by A) natural-origin, B) broodstock, and C) natural versus broodstock. Underlined values are for paired natural-broodstock collections from the same year. For reference, the nominal level of statistical significance at α = 0.05 is 0.0006 after correction for multiple tests. No significant values were observed.

A) Natural-Origin Collections

	89	90	00	01	02	04	06CO	07EF
89		0.257	0.359	0.531	0.331	0.127	0.031	0.263
90			0.953	0.148	0.753	0.903	0.077	0.283
00				0.328	0.527	0.607	0.604	0.400
01					0.209	0.081	0.127	0.093
02						0.085	0.707	0.235
04							0.312	0.577
06CO								0.435
07EF								

B) Broodstock Collections

	00AAE	01AAS	04AAV	06CN	07EE
00AAE		0.189	0.090	0.008	0.058
01AAS			0.122	0.020	0.116
04AAV				0.008	0.031
06CN					0.326
07EE					

C) Natural vs. Broodstock

	89	90	00	01	02	04	06CO	07EF
00AAE	0.027	0.309	<u>0.572</u>	0.018	0.041	0.012	0.093	0.040
01AAS	0.115	0.471	0.160	<u>0.219</u>	0.519	0.049	0.654	0.133
04AAV	0.136	0.219	0.210	0.423	0.208	<u>0.328</u>	0.037	0.153
06CN	0.029	0.004	0.053	0.007	0.022	0.004	<u>0.019</u>	0.001
07EE	0.099	0.229	0.053	0.015	0.093	0.178	0.090	<u>0.037</u>

Table 3 Estimation of N_e for temporally replicated natural-original sockeye collections. Above the diagonal are pairwise estimates of N_e, where negative values mean sampling variance can account for genetic variance observed (i.e., genetic drift unnecessary). Below the diagonal are variances for pairwise estimates of N_e. Absent variance values (denoted by **-**) were too large for SalmonNb to display.

Collection	89	90	00	01	02	04	06CO	07EF
89		-3936.6	-1414	-2636.3	671.4	1871.1	1066.1	1951.2
90	2.59E+09		-1490.3	3649.1	-31144	-6808.4	817.6	93190.2
00	1.40E+09	4.45E+09		-592.2	-6842.2	-667.1	-1736.9	-1350.1
01	1.21E+09	1.47E+09	2.33E+09		977.1	6160.4	387.8	2531.5
02	1.91E+09	1.33E+09	1.16E+09	2.29E+09		1495.6	-848.5	3213.6
04	2.21E+09	3.62E+09	4.08E+09	1.27E+09	1.14E+09		896.6	2155.3
06CO	1.34E+09	1.39E+09	1.73E+09	**-**	4.51E+09	1.2E+09		3278.6
07EF	2.15E+09	1.51E+09	1.18E+09	1.68E+09	**-**	1.36E+09	2.65E+09	

Appendix J

Genetic Diversity of Chiwawa River Spring Chinook Salmon

Assessing the Genetic Diversity of Natural Chiwawa River Spring Chinook Salmon and Evaluating the Effectiveness of its Supportive Hatchery Supplementation Program

Developed for

Chelan County PUD

and the

Habitat Conservation Plan's Hatchery Committee

Developed by
Scott M. Blankenship, Jennifer Von Bargen, and Kenneth I. Warheit
WDFW Molecular Genetics Laboratory
Olympia, WA

and

Andrew R. Murdoch
Supplementation Research Team
Wenatchee, WA

March 30, 2007

Table of Contents

Executive Summary

The main objective of this study was to determine the potential impacts of the Chiwawa River Supplementation Program on natural spring Chinook in the upper Wenatchee system. We did this by investigating population differentiation between temporally replicated Chiwawa River natural and hatchery samples from the Wenatchee River watershed using microsatellite DNA allele frequencies and the statistical assignment of individual fish to specific populations. Additionally, to assess the genetic effect of the hatchery program, we investigated the relationship between census and effective population sizes using collections obtained before and after the supplementation program. In this summary, we briefly describe the salient results contained within this report; however, each "Task" within the Results/Discussion section below contains extended coverage for each topic along with an expanded interpretation of each result.

Overall, we observed substantial genetic diversity within collections, with heterozygosities equal to roughly 80%, over thirteen microsatellite markers. Microsatellite allele frequencies among temporally replicated collections from the same population (i.e., location) were variable, resulting in significant genetic differentiation among these collections. However, these difference are likely the result of salmon life history in this area, as four-year-old Chinook comprise a majority of returns each year. That is, the genetic tests are detecting the differences of contributing parents from each cohort, rather than a hatchery effect.

Analysis of Chiwawa River Collections

To assess the multiple competing hypotheses regarding population differentiation within and among Chiwawa River collections, we found it necessary to organized the Chiwawa genetic data into three data sets: (1) fish origin (hatchery versus natural), (2) spawning location (hatchery broodstock versus in-river (natural) spawners), and (3) four "treatment" groups (1. hatchery-origin hatchery broodstock, 2. hatchery-origin natural spawner, 3. natural-origin natural spawner, and 4. natural-origin hatchery broodstock). We conducted separate analyses using each of the three data sets, with each analysis touching on some aspect of the components necessary to move through the Conceptual Process outlined by Murdoch and Peven (2005).

Origin Dataset – We report that allele frequencies within and between natural- and hatchery-origin collections are significantly different, but there does not appear to be a robust signal indicating that the recent natural-origin collections have diverged greatly from the pre- or early post-supplementation collections. Genetic drift will occur in all populations, but does not appear to be a major factor affecting allele frequencies within the Chiwawa collections.

Spawning Location Dataset – There are significant allele frequency differences within and between hatchery broodstock and natural spawner collections. However, in recent years the allele frequency differences between the hatchery broodstock and natural spawner collections have declined. Furthermore, based on linkage disequilibrium, there is a genetic signal that is consistent with increasing homogenization of allele frequencies within hatchery broodstock collections, but a similar homogenization within the natural spawner collection is not apparent. These data suggest that there exists consistent year-to-year variation in allele frequencies among hatchery and natural spawning collections, but there is a trend toward homogenization of the allele frequencies of the natural- and hatchery-origin fish that compose the hatchery broodstock.

Four Treatment dataset – Although there are signals of allelic differentiation among Chiwawa River collections, there are no robust signs that these collections are substantially different from each other. We used two different analyses to measure the degree of genetic variation that exists among individuals and collections within the Chiwawa River. First, we conducted a principal component analysis using all Chiwawa samples with complete genotypes (i.e., no missing alleles from any locus). Although the first two principal component axes account for only 10.5% of the total molecular variance, a substantially greater portion of that variance is among individual fish, regardless of their identity, rather than among hatchery and natural collections. The variances in principal component scores among individuals are 11 and 13 times greater than the variance in scores among collections.

Secondly, using an Analysis of Molecular Variance (AMOVA), we were able to determine how best to group populations, with "best" being defined as that grouping that accounts for the greatest proportion of among group (i.e., population) variance. Furthermore, by partitioning molecular variance into different hierarchical components, we are able to determine what level accounts for the majority of the molecular variance. The AMOVA results clearly show that nearly all molecular variation, no matter how the data are organized, resides within a collection. The percentage of total molecular variance occurring within collections ranged from 99.68% to 99.74%. These results indicate that the significant differences among collections of Chiwawa fish account for less than one percent of the total molecular variance, and these differences cannot be attributed to fish origin or spawning location.

Effective Population Size (N_e)

The contemporary estimate of N_e calculated using genetic data combined for Chiwawa natural-origin spawners (NOS) and hatchery-origin spawners (HOS) Chinook is N_e=386.8, which is slightly larger than the pre-hatchery N_e we estimated using demographic data from 1989 – 1992. Additionally, the N_e /N ratio calculated using 386.8 for N_e and the arithmetic mean yearly census of NOS and HOS Chinook from 1989 – 2005 for N is 0.40. These results suggest the N_e has not declined during the period of Chiwawa Hatchery Supplementation Program operation.

Analysis Of Upper Wenatchee Tributary Collections

We compared genetic data for spring Chinook collected from the major spawning aggregates of the Wenatchee River. We observed significant differences in allele frequencies among temporally replicated collections within populations, and among populations within the upper Wenatchee. However, these differences account for a very small portion of the overall molecular variance, and these populations overall are very similar to each other. Of all the populations within the Wenatchee River, the White River appears to be the most distinct. Yet, this distinction is more a matter of detail than of large significance, as the median F_{ST} between White River collections and all other collections (except the Little Wenatchee collection; see Results/Discussion) is less than 1.5% among population variance. We consider the implications of these results in the Conclusion section that follows the Results/Discussion section. Additionally, there is no evidence that the Chiwawa River Supplementation Program has changed the allele frequencies in the Nason Creek and White River populations, despite the presence of hatchery-origin fish in both these systems.

Introduction

Murdoch and Peven (2005) outlined 10 objectives to assess the impact (positive or negative) of hatchery operations mitigating the operation of Rock Island Dam. Two objectives relate to monitoring the genetic integrity of populations:

Objective 3: Determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

Objective 5: Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks.

This study addresses Objective 3 (above), and documents analyses and results WDFW completed for populations of spring Chinook (*Oncorhynchus tshawytscha*) in the Wenatchee River watershed. This study was not intended to specifically address Objective 5 (above); however, genetic data provide results relevant to Objective 5. The critical component of Objective 3 is to determine if hatchery supplementation has effected change. Furthermore, change in this context means altering census size and/or genetic marker allele frequencies; we did not attempt to measure changes in fitness. Perhaps a more meaningful rewording of Objective 3 is, "Did the hatchery supplementation program succeed at increasing the census size of a target population while leaving genetic integrity intact?" In order to evaluate cause and effect of hatchery supplementation, we surveyed and compared genetic variation in samples collected before and after potential effects from the Chiwawa Hatchery Supplementation Program. Samples were acquired from the primary spawning aggregates in the upper Wenatchee River watershed: Nason Creek, Little Wenatchee River, White River, and Chiwawa River. Hatchery samples were acquired from programs that could potentially affect genetic composition of Wenatchee stocks, the integrated Chiwawa River stock (local stock), Leavenworth National Fish Hatchery spring Chinook (Carson Stock – non local), and Entiat NFH (Carson Stock – non local). Additionally, the genetic markers used were the Genetic Analysis of Pacific Salmonids (GAPS) (Seeb et al. in review) standardized microsatellites, so all data from the Wenatchee study will be available for inclusion in the GAPS Chinook coastwide microsatellite baseline.

History of Artificial Propagation

Artificial propagation in the upper Columbia River began in 1899 when hatcheries were constructed on the Wenatchee and Methow rivers (Mullan 1987). These initial operations were small, with the Tumwater Hatchery on the Wenatchee River releasing several hundred thousand fry, and the Methow River hatchery producing few Chinook salmon before it was closed in 1913 (Craig and Suomela 1941, Nelson and Bodle 1990). The Leavenworth State Hatchery operated in the Wenatchee River Basin between 1913 and 1931 using eggs from non-native stocks (Willamette River spring-run and lower Columbia Chinook hatchery fall-run). These early attempts at hatchery production were largely unsuccessful for spring-run Chinook (WDF 1934). Between 1931 and 1939, no Chinook salmon hatcheries were in operation above Rock Island Dam (Rkm 730).

In 1938, the last salmon was allowed to pass upstream through the uncompleted Grand Coulee Dam (Rkm 959). To mitigate the loss of habitat, adult Chinook salmon were trapped, under the auspices of the Grand Coulee Fish Maintenance Project (GCFMP), at Rock Island Dam beginning in May 1939, and relocated into three of the remaining accessible tributaries to the upper Columbia River: the Wenatchee, Entiat, and Methow Rivers. GCFMP transfers continued through the autumn of 1943. Spring- and summer/fall-run fish were differentiated at Rock Island Dam based on a 9 July cutoff date for Chinook arrivals at Rock Island Dam (Fish and Hanavan 1948). Spring-run adults collected at Rock Island Dam (pre 9 July fish) were either transported to Nason Creek on the Wenatchee River to spawn naturally (1939-43), or to the newly constructed Leavenworth NFH (1940) for holding and subsequent spawning (1940-43). Eggs were incubated on site or transferred to the Entiat NFH (1941) and Winthrop NFH (1941). In 1944 spring-run adults were allowed to freely pass Rock Island Dam. The GCFMP did not differentiate among late-run stocks (post 9 July fish) passing Rock Island Dam. Late-run offspring reared at the Leavenworth NFH, Entiat NFH, and Winthrop NFHs were an amalgamation of summer and fall upper Columbia River populations (Fish and Hanavan 1948). Late-run fish were transplanted into the upper and lower Wenatchee, Methow, and Entiat Rivers.

After 1943, the Winthrop NFH continued to use local spring-run Chinook for hatchery production, while the other NFHs largely focused on summer-run Chinook salmon. Renewed emphasis on spring run production in the mid-1970s saw the inclusion of local and non-local eggs (Carson NFH stock, Klickitat River stock, and Cowlitz River stock) to the NFHs. In the early 1980s, imports of non-native eggs were reduced significantly, and thereafter the Leavenworth, Entiat, and Winthrop NFHs have relied on adults returning to their facilities for their egg needs (Chapman et al. 1995). Regarding late-run Chinook, due to the variety of methods employed to collect broodstock at dams, hatcheries, or the result of juvenile introductions into various areas, Chinook populations and runs (i.e., summer and fall) have been mixed considerably in the upper Columbia system over the past five decades (reviewed in Chapman et al. 1994).

Washington Department of Fish and Wildlife (WDFW) operates two facilities producing spring-run Chinook, the Methow Fish Hatchery (MFH) owned by Douglas County PUD that began operation in 1992 and Eastbank Fish Hatchery (EFH) owned by Chelan County PUD that began operation in 1989. Both programs were designed to implement supplementation (supportive breeding) programs for naturally spawning populations on the Methow and Wenatchee Rivers, respectively (Chapman et al. 1995). As part of the Rock Island Mitigation Agreement between Chelan County Public Utility District and the fishery management parties (RISPA 1989), a supplementation (supportive breeding) program was initiated in 1989 on the Chiwawa River to mitigate smolt mortality resulting from the operation of Rock Island Hydroelectric Project. EFH uses broodstock collected at a weir on the Chiwawa River, although in recent years hatchery fish have been collected at Tumwater Dam. Similarly, the MFHC uses returning adults collected at weirs on the Methow River and its tributaries, the Twisp and Chewuch Rivers (Chapman et al. 1995; Bugert 1998). Although low run size and trap efficiency has resulted in most broodstock being collected from the hatchery outfall or in some years Wells Dam, progeny produced from these programs are reared at and released from satellite sites on the tributaries where the adults were collected. Numerous other facilities have reared spring-run Chinook salmon on an intermittent basis.

Previous Genetic Studies – Population differentiation

Waples et al. (1991a) examined 21 polymorphic allozyme loci in samples from 44 populations of Chinook salmon in the Columbia River Basin. These authors reported three major clusters of Columbia River Basin Chinook salmon: 1) Snake River spring- and summer-run Chinook salmon, and mid and upper Columbia River spring-run Chinook salmon, 2) Willamette River spring-run Chinook salmon, 3) mid and upper Columbia River fall- and summer-run Chinook salmon, Snake River fall-run Chinook salmon, and lower Columbia River fall- and spring-run Chinook salmon. Utter et al. (1995) examined allele frequency variability at 36 allozyme loci in samples of 16 upper Columbia River Chinook populations. Utter et al. (1995) indicated that spring-run populations were distinct from summer- and fall-run populations, where the average genetic distance between spring-run and late-run Chinook were about eight times the average of genetic distances between samples within each group. Additionally, allele frequency differences among spring-run populations were considerably greater than that among summer- and fall-run populations in the upper Columbia River. Utter et al. (1995) also reported hatchery populations of spring-run Chinook salmon were genetically distinct from natural spring-run populations, but hatchery populations of fall-run Chinook salmon were not genetically distinct from natural fall-run populations.

As part of an evaluation of the relative reproductive success for the Chiwawa River supplementation program, Murdoch et al. (2006), used eleven microsatellite loci to assess population differentiation among spring Chinook salmon population samples in the upper Wenatchee River. Murdoch et al. (2006) reported a >99% accuracy of correctly identifying spring-run and fall-run Chinook from the Wenatchee River. They also reported slight, but significantly different genetic variation among wild spring populations and between wild and hatchery stocks. Yet, since the spring-run populations are genetically similar, identifying individuals genetically from the upper tributaries of the Wenatchee River was difficult. This result is exemplified in their individual assignment results, where < 8% of spring-run individuals, hatchery or wild, were correctly assigned using their criterion of an LOD (log of odds) score greater than 2. Murdoch et al. (2006) also reported contemporary natural spring Chinook show heterozygote deficit and low linkage disequilibrium (LD), while contemporary hatchery spring Chinook show heterozygote excess and high LD.

Williamson et al. (submitted) have continued the work of Murdoch et al. (2006) by analyzing Chiwawa River demographic data from 1989 – 2005 to estimate the proportions of recruits that were produced by Chinook with hatchery or wild origin. In an "ideal" population, the genetic size (i.e., effective size or N_e) and the census size are equal; however various demographic factors such as unequal sex ratios and variance in reproductive success among individuals reduces the genetic size below the census size. It is generally thought that the genetic size is approximately 10-33% the census size (Bartley et al. 1992; RS Waples pers. comm.), although values have been reported outside this range (Araki et al. 2007; Arden and Kapuscinski 2003; Heath et al. 2002). Despite being difficult to estimate, the effective population size in many respects is a more important parameter to know than census size, because N_e determines how genetic diversity is distributed within populations and how the forces of evolution (i.e., forces that change genetic diversity over time) will affect the genetic variation present.

Williamson et al. (submitted) used demographic data to 1) investigate the effect of unequal sex ratio on genetic diversity, 2) investigate the effect of variation in reproductive success on genetic diversity, 3) investigate the effect of fluctuations in population size on genetic diversity, and 4) estimate the effective population size, using the inbreeding method (Ryman and Laikre 1991). Most importantly, they use demographic data from 1989 – 2000 to assess the impact of the Chiwawa Hatchery Supplementation Program on the effective population size of natural-origin Chiwawa River spring Chinook. They estimate that the N_e of naturally spawning Chiwawa Chinook (i.e., both hatchery- and wild-origin fish on the spawning grounds) from 1989 –

1992 was N_e = 2683 and in 1997 – 2000 was N_e = 989. They compare spawning ground N_e to estimates calculated from combined broodstock and naturally spawning Chinook demographic data. The combined inbreeding N_e estimate from 1989 – 1992 was N_e = 147 and in 1997 – 2000 was N_e = 490. Williamson et al. (submitted) argue that since the combined N_e estimate is lower than the naturally spawning estimate, the supplementation program has had a negative impact on the Chiwawa River N_e.

Williamson et al. (submitted) also present genetic data for Chinook recovered on spawning grounds in upper Wenatchee River tributaries in 2004 and 2005. These genetic data are derived from the Murdoch et al. (2006) study. They compare samples collected from Chiwawa River (i.e., hatchery and wild), White River, Nason Creek, and Leavenworth Hatchery. Additionally, they include a 1994 Chiwawa River wild smolt sample for comparison with the 2004 brood year. Williamson et al. (submitted) report statistically significant genetic differentiation among Chiwawa River, White River and Nason Creek. Additionally, they report that the 1994 and 2004 Chiwawa River wild samples are not statistically different, but the 2004 Chiwawa wild and hatchery collections are statistically different.

Study Objectives

This study investigated within and among population genetic diversity to assess the effect of the Chiwawa Hatchery's supplemental program on the natural Chiwawa River spring Chinook population. Differences among temporal population samples, the census size, heterozygosity, and allelic diversity were documented. We investigated population differentiation between the Chiwawa River natural and hatchery samples, and among all temporally replicated samples from the Wenatchee River watershed using microsatellite DNA allele frequencies and the statistical assignment of individual fish to specific populations. To assess the genetic effect of the hatchery program, correlation between census and effective population sizes were investigated using temporally replicated samples obtained before and after the supplementation program operation. To address the hypotheses associated with Objective 3 in Murdock and Peven (2005) we developed eleven specific "Tasks" (Blankenship and Murdoch 2006), to which we analyzed specific genetic data. We present the results from these analyses specific to each individual Task.

Methods and Materials

Tissue collection and DNA extraction

We analyzed thirty-two population collections of adult spring Chinook salmon (*Oncorhynchus tshawytscha*) obtained from the Wenatchee River between 1989 and 2006 (Table 1). Nine collections of natural Chinook adults from the Chiwawa River (n=501), and nine collections of Chiwawa Hatchery Chinook (n=595) were collected at a weir located in the lower Chiwawa River. The 1993 and 1994 Chiwawa Hatchery samples are smolt samples from the 1991 and 1992 hatchery brood years, respectively. Additional samples were collected from upper Wenatchee River tributaries, White River, Little Wenatchee River, and Nason Creek. Six collections of natural White River Chinook (n=179), one collection from the Little Wenatchee (n=19), and six collections from Nason Creek (n=268) were obtained. Single collections were obtained for Chinook spawning in the mainstem Wenatchee River and Leavenworth National Fish Hatchery. An additional out-of-basin collection from Entiat River was also included in the analysis. Samples collected in 1992 or earlier are scale samples. All other samples were either fin clips or operculum punches, stored immediately in ethanol after collection. DNA was extracted from stored tissue using Nucleospin 96 Tissue following the manufacturer's standard protocol (Macherey-Nagel, Easton, PA, U.S.A.).

Laboratory analysis

We performed polymerase chain reaction (PCR) amplification on each fish sample using the 13 fluorescently end-labeled microsatellite marker loci standardized as part of the GAPS project (Seeb et al. in review). GAPS genetic loci are: *Ogo*2, *Ogo*4 (Olsen et al. 1998); *Oki*100 (unpublished); *Omm*1080 (Rexroad et al. 2001); *Ots*201b (unpublished); *Ots*208b, *Ots*211, *Ots*212, and *Ots*213 (Grieg et al. 2003); *Ots*3M, *Ots*9 (Banks et al.

1999); *Ots*G474 (Williamson et al. 2002); *Ssa*408 (Cairney et al. 2000). PCR reaction volumes were 10 μL, and contained 1 μL 10x PCR buffer (Promega), 1.0 μL MgCl2 (1.5 mM final) (Promega), 0.2 μL 10 mM dNTP mix (Promega), and 0.1 units/mL Taq DNA polymerase (Promega). Loci were amplified as part of multiplexed sets, so primer molarities and annealing temperatures varied. Multiplex one had an annealing temperature of 50°C, and used 0.37 Molar (M) *Oki*100, 0.35 M *Ots*201b, and 0.20 M *Ots*208b, and 0.20 M *Ssa*408. Multiplex two had an annealing temperature of 63°C, and used 0.10 M *Ogo*2, and 0.25 M of a non-GAPS locus (*Ssa* 197). Multiplex three had an annealing temperature of 56°C, and used 0.18 M *Ogo*4, 0.18 M *Ots*213, and 0.16 M *Ots*G474. Multiplex four had an annealing temperature of 53°C, and used 0.26 M *Omm*1080, and 0.12 M *Ots*3M. Multiplex five had an annealing temperature of 60°C, and used 0.30 M *Ots*212, 0.20 M *Ots*211, and 0.10 M *Ots*9. Thermal cycling was conducted on either a PTC200 thermal cycler (MJ Research) or GeneAmp 9700 (Applied Biosystems) as follows: 95°C (2 min); 30 cycles of 95°C for 30 sec., 30 sec. annealing, and 72°C for 30 sec.; a final 72°C extension and then a 10°C hold. PCR products were visualized by electrophoresis on an ABI 3730 automated capillary analyzer (Applied Biosystems). Fragment analysis was completed using GeneMapper 3.7 (Applied Biosystems). Standardization of genetic data to GAPS allele standards was conducted following Seeb et al. (in review).

Genetic data analysis

Assessing within population genetic diversity - Heterozygosity measurements are reported using Nei's (1987) unbiased gene diversity formula (i.e., expected heterozygosity) and Hedrick's (1983) formula for observed heterozygosity. Both tests are implemented using the microsatellite toolkit (Park 2001). We used GENEPOP version 3.4 (Raymond and Rousset 1995) to assess Hardy-Weinberg equilibrium (HWE), where deviations from the neutral expectation of random associations among alleles are calculated using a Markov chain method (5000 iterations in this study) to obtain unbiased estimates of Fisher's exact test. Global estimates of F_{IS} according to Weir and Cockerham (1984) were calculated using GENEPOP version 3.4. Genotypic linkage disequilibrium was calculated following Weir (1979) using GENEPOP version 3.4.

Linkage results for population collections are reported as the proportion of pairwise (locus by locus) tests that are significant (alpha = 0.01). Linkage disequilibrium is considered statistically significant if more than 5% of the pairwise tests based on permutation are significant for a collection.

Within- and among-population genetic differentiation – The temporal stability of allele frequencies within populations, and pairwise differences in allele frequencies among populations were assessed using several different procedures. First, we tested for differences in allele frequencies among populations defined in Table 1 using a randomization chi-square test implemented in GENEPOP version 3.4 (Raymond and Rousset 1995). This procedure tests for differences between pairs of populations where alleles are randomized between the populations (i.e., genic test). The null hypothesis for this test is that the allele frequency distributions between two populations are the same. A low p-value should be interpreted as the allele frequency distributions being compared are unlikely to be samples drawn from the same underlying distribution.

Second, to graphically describe allele frequency differences among populations we conducted a nonmetric multidimensional scaling analysis using allele-sharing distance matrices from two different data sets. Pairwise allele-sharing distances are calculated as 1 – (mean over all loci of the sums of the minima of the relative frequencies of each allele common to a pair of populations). To calculate the allele-sharing distances for each pair of populations we used PowerMarker v3.25 (Liu and Muse 2005). Nonmetric multidimensional scaling is a technique designed to construct an n-dimensional "map" of populations, given a set of pairwise distances between populations (Manly 1986). The output from this analysis is a set of coordinates along n-axes, with the coordinates specific to the number of n-dimensions selected. To simplify our analysis we selected a 2-dimensional analysis to represent the relative positions of each population in a typical bivariate plot. The goodness of fit between the original allele-sharing distances and the pairwise distances between all populations along the 2-dimensional plot is measured by a "stress" statistic. Kruskal (in Rohlf 2002) developed a five-tier guide for evaluating stress levels, ranging from a perfect fit (stress=0) to a poor fit (stress=0.40). We conducted the nonmetric multidimensional scaling analysis for one data set containing Chiwawa natural- and hatchery-origin collections, and another data set containing Chiwawa broodstock and in-river spawner collections. We used the mdscale module in MATLAB R2006b (The Mathworks 2006) to generate the nonmetric multidimensional scaling coordinates.

We examined the geographic and temporal structure of populations in the upper Wenatchee (Chiwawa River, Nason Creek, and White River, only) using a series of analyses of molecular variance (AMOVAs). Here, we defined an AMOVA as an analysis of variance of allele frequencies, as originally designed by Cockerham (1969), but implemented in Arlequin v2.1 (Schneider et al. 2000). These analyses permit populations to be aggregated into groups, and molecular variance is then partitioned into within collections, among collections, but within groups, and among group components. With this approach, we were able to determine how best to group populations, with "best" being defined as that grouping that accounts for the greatest proportion of among group variance. Furthermore, by partitioning molecular variance into three different hierarchical components, we are able to determine what level accounts for the majority of the molecular variance.

Finally, we explored the partitioning of molecular variance between among-individuals and among-populations using a principal component analysis and multi-locus estimates of pairwise F_{ST}, estimated by a "weighted" analysis of variance (Weir and Cockerham, 1984). Principal component analysis is a data-reduction technique whereby the correlation structure among variables can be used to combine variables into a series of multivariate components, with each original variable receiving a weighted value for each component based on its correlation with that component. Here, we used a program written by Warheit in MATLAB R2006b (The Mathworks 2006) that treats each allele for each locus as a single variable (13 loci = 26 alleles or variables), and these 26 "variables" were arranged into 26 components, with each component accounting for a decreasing amount of molecular variance. Estimates of F_{ST} were calculated using GENETIX version 4.05 (Belkhir et al.1996). To determine if the F_{ST} estimates were statistically different from random (i.e., no structure), 1000 permutations were implemented in GENETIX version 4.05 (Belkhir et al.1996).

Effective population size (N_e) – Estimates of the effective population size were obtained using two methods, a multi-collection temporal method (Waples 1990), and a single-collection method (Waples 2006) using linkage disequilibrium data. The temporal method assumes that cohorts are used, but we did not decompose the collection year samples into their respective cohorts using age data. Therefore, N_e estimates that pertain to individual year classes of breeders are not valid; however the harmonic mean over all samples will estimate the contemporary N_e. Comparing samples from years *i* and *j*, Waples' (1990) temporal method estimates the effective number of breeders ($\hat{N}_{b(i,j)}$) according to:

$$\hat{N}_{b(i,j)} = \frac{b}{2(\hat{F} - 1/\hat{S}_{i,j})}$$

The standardized variance in allele frequency ($\hat{F}$) is calculated according to Pollack (1983). The parameter b is calculated analytically from age structure information and the number of years between samples (Tajima 1992). The age-at-maturity information required to calculate b was obtained from Murdoch et al. (2006) for this analysis. They observed for Chiwawa Hatchery Chinook that 8.6% matured at age 2, 4% at age 3, 87% at age 4, and 0.4% at age 5. For Chiwawa natural Chinook, Murdoch et al. (2006) observed that 1.8% matured at age 3, 81.6% at age 4, and 16.7% at age 5. The harmonic mean of sample sizes from years *i* and *j* is $\tilde{S}_{i,j}$. Over all pairwise comparisons the harmonic mean of all $\hat{N}_{b(i,j)}$ is $\tilde{N}_b$, the contemporary estimate of the effective population size (N_e). SALMONNb (Waples et al. 2007) was used to calculate $\tilde{N}_b$. As suggested by authors, alleles with a frequency below 0.05 were excluded from the analysis to reduce potential bias.

The method of Waples (2006) uses linkage disequilibrium (i.e., mean squared correlation of allele frequencies at different gene loci) as a means of estimating effective population size (N_e) from a single sample. While this method is biased in some cases where N_e /N ratio is less the 0.1 and the sample size is less than the true N_e, it has been shown to produce comparable results to the temporal method. Burrows' delta method is used to estimate LD, and a bias corrected estimate of N_e is calculated after eliminating alleles with frequency less than 0.05. This test was implemented using LDN$_e$ (Do and Waples unpublished). In age-structured species, N_e estimates based on LD are best interpreted as the effective number of breeders (N_b) that produced the sample (Waples 2006). N_b should be multiplied by the mean generation length (i.e., 4 in this case) to obtain an overall estimate of N_e based on an N_b estimate. We analyzed collections categorized by spawning location (i.e., hatchery broodstock or in-river) and did not analyze collections categorized by origin (i.e., hatchery or natural). Waples' (2006) method estimates N_e from observed LD, therefore the corresponding N_e estimates for the hatchery collections would be low and the estimates for the natural collections would be high. Yet, since the supplementation program is integrated, and hatchery fish can spawn naturally, we feel it inappropriate to analyze the hatchery and natural samples as if they were separate, which would essentially partition all the LD into the hatchery samples.

Each collection has an N_b estimate and an associated confidence interval. If the confidence interval includes infinity, it means that sampling error accounts for all the LD observed (i.e., empirical LD is less than expected LD). The usual interpretation is that there is no evidence for any disequilibrium caused by genetic drift in a finite number of parents. Since the LD method estimates the number of breeders that contributed to the sample being analyzed, in order to calculate an N_e /N ratio, the appropriate census size must be used. The census size used to derive a ratio was the estimate four years prior to the collection analyzed using LD, which assumed a strict four-year-old lifecycle, although the observed proportion of four-year-olds was approximately 85% each year. The census numbers (Table 2) used to calculate the ratios for Chiwawa broodstock and in-river spawners were combined NOS (natural-origin spawners) and HOS (hatchery-origin spawners) census estimates.

Individual assignment – A population baseline file was constructed containing all 1704 individual Chinook from 34 population collections (Table 1; Chiwawa origin data set plus all samples from other populations). All individuals in the baseline had geneotypes that included nine or more loci. Individual Chinook were assigned to their most likely population of origin based on the partial Bayesian criteria of Rannala and Mountain (1997), using a “jack-knife” procedure, where each individual to be assigned was removed from the baseline prior to the calculation of population likelihoods. This procedure was implemented in a program written by Warheit in MATLAB R2006b (The Mathworks 2006). Two assignment criteria were used, 1) the population with the largest posterior probability for an individual was the “most-likely” population of origin (i.e., all individuals assigned to a collection), and 2) an assignment was consider valid only if the posterior probability was greater than or equal to 0.9. Please note that while the analysis used 34 population collections to assign Rannala and Mountain likelihoods for each individual, these likelihoods were aggregated based on “population” (i.e., Chiwawa, Nason, White, and so on) and posterior probabilities were calculated for population location, rather than individual collections.

Results and Discussion

In this section we combine our presentation and interpretations of the genetic analyses. Additionally, this section will be organized based on the task list presented in the study plan. Overall conclusions are provided following this section.

<u>Task 1:</u> Determine trend in census size for Chiwawa River spring Chinook.

Census data from 1989 – 2005 are provided in Table 2 for the Chiwawa Hatchery broodstock and spring Chinook present in the Chiwawa River. The demographic data for naturally spawning Chinook are based on redd sampling and carcass surveys, while broodstock data are based on Chiwawa hatchery records. As the supplementation program is integrated by design, we also present the proportion of natural-origin broodstock (pNOB) incorporated into the hatchery, in addition to the number of natural-origin (NOS) and hatchery-origin (HOS) spawners present in Chiwawa River. The census size fluctuated yearly, and a general reduction in census size was observed in the mid to late 1990's. This trend was apparent in both the broodstock and in the river. The arithmetic mean census size from 1989 – 2005 for the Chiwawa Hatchery (i.e., broodstock) was N=87.5 per year. The arithmetic mean census size from 1989 – 2005 for the Chiwawa River (i.e., NOS and HOS combined) was N=961.9 per year. For collection years when adult Chiwawa hatchery-origin fish would have been absent in the Chiwawa River (1989 – 1992), the arithmetic mean of natural Chiwawa Chinook census size is N=962.7. We will use this number as the baseline census size to assess if census size has changed. We used two different values for the contemporary census size in the Chiwawa River, NOS only and NOS + HOS. Additionally, we used collection years 2002 – 2005 for the contemporary NOS and HOS estimates, as these are the most recent data and the number of years included for estimation is the same as the pre-hatchery estimate above (i.e., four years). For NOS only, the arithmetic mean census size from 2002 – 2005 was N=536.0. For total census size (i.e., NOS and HOS combined), the arithmetic mean census size from 2002 – 2005 was N=1324.0. For the demographic data presented here, the contemporary census size is larger than the census estimate derived from the years prior to hatchery operation.

Task 2: Document the observed genetic diversity.

Genetic Diversity Categorized By Origin

For Chiwawa River collections categorized by origin (Table 1A), substantial genetic diversity was observed, with heterozygosity estimates over all loci, having a mean of 0.80. Genetic diversity was consistent with expected Hardy-Weinberg random mating genotypic proportions for ten of the eighteen collections. Eight of the nine Chiwawa natural collections were consistent with HWE, and two of nine Chiwawa Hatchery collections were consistent with HWE. F_{IS} is observed to be slight for all Chiwawa population collections, suggesting individuals within collections do not show excessive homozygosity.

The deviations from HWE observed were generally associated with hatchery collections. The two smolt collections (i.e., 1993 and 1994) showed significant deviations from HWE, which may be a function of non-random hatchery practices involving the contributing natural-origin parental broodstocks (i.e., 1991 and 1992 cohort). Deviations from HWE in the remaining hatchery collections may be the result of few individuals being represented in the broodstock (see below).

Additionally, linkage disequilibrium (LD) was also common for Chiwawa hatchery-origin collections and minimal for Chiwawa natural-origin collections. The random association of alleles between loci (i.e., linkage equilibrium) is expected under ideal conditions. LD is observed when particular genotypes are encountered more than expected by chance. Laboratory artifacts (e.g. null alleles) or physical linkage of loci on the same chromosome can cause LD, but the LD we observed was not associated with certain locus combinations, which you would expect if either artifacts or physical linkage were the cause of LD. LD was observed for seven of the nine hatchery-origin collections. As with the deviations from HWE, the high LD in the 1993 and 1994 hatchery-origin collections may be a result of non-random hatchery practices. The substantial LD observed in the hatchery-origin adult collections (collection years 2000, 2001, 2004, and 2006) might be the result of small parental broodstock sizes contributing to those returning adults. During the mid 1990's, the Chiwawa broodstock size was low, with zero individuals collected in 1995 and 1999; so fewer individuals would be contributing to the hatchery adult returns than the natural. This idea is corroborated by the lower LD observed for the 2005 hatchery-origin collection, which had a contributing parental broodstock size in 2001 (i.e., the major contributing parental generation) approximately eight times as large as the previous few collection years (Table 2). LD reappears in the 2006 Chiwawa hatchery-origin collection, which had a contributing parental broodstock size (i.e., for the most-part, the 2002 hatchery brood year) five times lower (Table 2) than that of the 2005 collection.

While seven of nine hatchery-origin collections showed significant LD, only one natural origin collection showed LD, and for this collection, only 10% of the loci-pairs were in disequilibrium (Table 1). The fact that LD predominated in the hatchery samples, suggests that variance in reproductive success (i.e., overrepresentation of particular parents) is higher in the hatchery-origin than in natural-origin collections.

Genetic Diversity Categorized By Spawning Location

For upper Wenatchee River collections categorized by spawning location (Table 1B), substantial genetic diversity was observed, with heterozygosity estimates over all loci, having a mean of 0.79 and ranging from a low of 0.69 (1993 White River) to 0.85 (1993 Little Wenatchee). Genetic diversity was consistent with HWE for nineteen of twenty-nine population collections. For the collections that departed from HWE, seven were from the Chiwawa River, one was from Leavenworth Hatchery, one was the Wenatchee mainstem collection of hatchery-origin – naturally spawning fish, and one was from the White River. F_{IS} is observed to be slight for all population collections except the 1993 White River collection (10% heterozygote deficit) (Table 1B). Collections deviating with HWE generally correlated with collections having high LD. Twelve population collections showed a proportion of pairwise linkage disequilibrium tests (across all loci) greater than 5% (Table 1B), eight of which were Chiwawa collections.

Starting in 1996, spawning location collections are composed of both natural- and hatchery-origin samples. The LD seen in the later spawning location collections may be caused by an admixing effect (i.e., mixing two populations), where random mating has not had the chance to freely associate alleles into genotypes. Interestingly, there appears to be a trend of reducing LD through time within the broodstock collections (Table 1B), which suggests that a “homogenizing” effect is taking place within the Chiwawa River. This observation is discussed more fully in Task 3 below.

Task 3: Test for population differentiation among collections within the Chiwawa River and associated supplementation program.

Introduction

Task 3 was designed to address two hypotheses listed as part of Objective 3 in Murdoch and Peven (2005):

- Ho: Allele frequency $_{\text{Hatchery}}$ = Allele frequency $_{\text{Naturally produced}}$ = Allele frequency $_{\text{Donor pop}}$.
- Ho: Genetic distance between subpopulations $_{\text{Year x}}$ = Genetic distance between subpopulations $_{\text{Year y}}$

Murdoch and Peven (2005) proposed these two hypotheses to help evaluate the Chiwawa supplementation program through the "Conceptual Process" (Figure 5 in Murdoch and Peven 2005; repeated here as Figure 1). There are two components to the first hypothesis, which must be considered separately. The first component involves comparisons between natural-origin populations in the Chiwawa to determine if there have been changes in allele frequencies or genetic distances, through time starting with the donor population. Documenting a change does not necessarily indicate that the supplementation program has directly affected the natural origin fish, as additional tests would be necessary to support that hypothesis. The intent of the second component is to determine if the hatchery produced populations have the same genetic composition as the naturally produced populations.

Although on the surface these two components and their associated comparisons may appear simple, from a hypothesis-testing perspective the analyses are complicated by the fact that natural-origin fish may have had hatchery-origin parents, and hatchery-origin fish may have had natural-origin parents. As such, we organized the Chiwawa genetic data into three data sets: (1) fish origin (hatchery versus natural), (2) spawning location (hatchery broodstock versus in-river (natural) spawners), and (3) four "treatment" groups (1. hatchery-origin hatchery broodstock, 2. hatchery-origin natural spawner, 3. natural-origin natural spawner, and 4. natural-origin hatchery broodstock). We conducted separate analyses using each of the three data sets, with each analysis touching on some aspect of the components necessary to move through the Conceptual Process (Figure 1).

Hatchery- Versus Natural-Origin

We address the following questions with the origin data set:

1. Are there changes in allele frequencies and allele sharing distances in the natural-origin collections from pre-supplementation to today?
2. Are there changes in allele frequencies and allele sharing distances in the hatchery-origin collections from early supplementation to today?
3. Are there significant differences in allele frequencies and large allele sharing distances between hatchery- and natural-origin adults from a collection year, and has this pattern changed through time?

Genic Differentiation Tests – We explicitly tested the hypothesis of no significant differentiation within natural- or hatchery-origin collections from the Chiwawa River using a randomization chi-square test. We show the results for the pairwise comparisons among natural-origin collections from the Chiwawa River populations in the first block of the second page of Table 3. Ten of the 36 (28%) pairwise comparisons have highly significant allele frequency differences, while only 12 of the 36 comparisons (33%) showed no significant differences. Eight of these 12 comparisons involved the 1996 collection, which included only eight samples and therefore provided little power to differentiate allele frequencies. If we exclude the 1996 collection, only 14% of the pairwise comparisons showed no significant differences, and here all but one of these comparisons involved the 1989 collection. The 1989 collection appeared to be the least differentiated collection in the natural-origin data set in that all pairwise comparisons were either not significant, or only mildly significant at the nominal critical value. No comparisons involving the 1989 collection were significant using a Bonferroni-corrected critical value, and 1989 is the only natural-origin collection in our data set that can be classified as "pre-supplementation."

We can interpret these results to indicate that although there appears to be significant year-to-year differences in allele frequencies among post-supplementation collections, the allele frequencies between each post-supplementation collection and the 1989 pre-supplementation collection are not greatly different. However, the level of differentiation does increase from the early post-supplementation years to the more recent years (2001, 2004-2006), although the statistical level of this significance never exceeds the Bonferroni-corrected critical value. Finally, sample sizes were also small for the 1989 collection (n = 36) and we cannot eliminate a reduction in power as a contributing factor for the lack of significance for these tests.

As with the hatchery-origin collections, most pairwise comparisons of allele frequencies between hatchery-origin samples were significant (Table 3, first page, upper block). Out of the 36 pairwise comparisons, all but three are significant at some level, and most comparisons are highly significant. Similar to the natural-origin analysis, the non-significant results were limited to comparisons involving the 1996, which included only eight samples.

As a result of this analysis *we reject the hypothesis that there was no significant differentiation among natural- or hatchery-origin collections from the Chiwawa River*. Furthermore, the allele frequencies of the hatchery-origin collections are significantly different from those of natural-origin collections (Table 3, first page, second block). For those fish collected in the same year, allele frequencies are significantly different between hatchery- and natural-origin collections, although in 2005 the level of significance was below the Bonferroni critical value (Table 3). The next step is to examine the pattern of allelic differentiation to discover first if there is a trend among the data, and second, if this trend suggests that the allele frequency differences among Chiwawa River natural-origin fish collections has been affected by the hatchery-origin fish.

Allele-sharing and Nonmetric Multidimensional Scaling – We constructed a pairwise allele-sharing distance matrix for all hatchery- and natural-origin collections from the Chiwawa River and subjected this matrix to a nonmetric multidimensional scaling analysis, restricting the analysis to two dimensions (Figure 2). The stress statistic for this analysis is 0.09, a value Kruskal (in Rohlf 2002) listed as a good to excellent fit between the actual allele-sharing distances and the Euclidean (straight-line) distances in the plot.

In other words, Figure 2 is a good visual representation of the allele sharing distance matrix; collections with a high percentage of alleles shared will be closer to each other than collections with a lower percentage of alleles shared.

With the exception of the two outlier years (1996 and 1998) the Chiwawa natural-origin collections form a tight cluster indicating an overall common set of shared alleles among these collections. Even if we ignore the 1996 and 1998 hatchery-origin collections, there appears to be a greater variance in shared alleles among the Chiwawa hatchery-origin collections than the natural-origin collections (Figure 2). In fact, the median percentage of alleles shared among the Chiwawa natural-origin collections is 76% compared with 69% alleles shared among the Chiwawa hatchery-origin collections.

Also, there appears to be a convergence in allele sharing distances (i.e., a decrease in allele frequency differences) between the hatchery- and natural-origin fish from the late 1980s/early 1990s to 2006. The series of red arrows in Figure 2 represent the progression of change in hatchery-origin allele sharing distances from 1996 (first adult hatchery origin fish in our analysis) to 2006 and this progression is decidedly in the direction of the natural-origin cluster. However, the most recent natural-origin collections (2001, 2004-2006) appear to have pulled closer to the hatchery-origin collections, compared with the 1989 natural-origin collection (note the close proximity of the 2000 and 1989 natural-origin collections). Nevertheless, the cluster of natural-origin collections adjacent to the hatchery-origin collections in Figure 2 also includes the 1993 natural-origin collection. Qualitatively, it appears that the initial hatchery-origin and natural-origin collections were more different from each other in terms of the percentage of shared alleles than are the most recent hatchery- and natural-origin collections. This may have been a result of a non-random sample of natural-origin fish that was used as broodstock in the initial years of the supplementation program (see discussion in Task 2 concerning deviations from HWE and linkage disequilibrium).

That being said, we do need to emphasize that Figure 2 is dominated by five outlier collections (two each from the 1996 and 1998 collections, and the 1994 smolt collection).

The 1996 and 1998 collections are characterized by small samples sizes, and the 1994 smolt collection has nearly all pairs of loci in linkage disequilibrium (Table 1). If we eliminate these five outlier groups, both the hatchery- and natural-origin collections form a relatively tight cluster. Excluding the five outliers, the median percentage of shared alleles among all pairwise combinations of Chiwawa hatchery versus Chiwawa natural collections is 76%. This compares with a median pairwise percentage of 79% among only Chiwawa natural-origin collections. That is, there are nearly as many alleles shared between the hatchery-origin and natural-origin collections as there are among the natural-origin collections themselves. There is also a narrowing of differences between natural- and hatchery-origin fish from the same collection years from 1993 (76% shared alleles) through 2006 (83% shared alleles).

If allelic differentiation among collections is a function of genetic drift, we would expect a positive correlation between the number of years between two collections and the allele sharing distance. That is, if genetic drift is the primary cause of allele frequency differences between two collections, the greater the number of years between the two collections the larger the allele-sharing distance. For both the natural- and hatchery-origin collections we examined the relationship between the number of years between a pair of collections and the collections' allele-sharing distance (Figure 3). Although the relationship between time interval and allele distance appears to be a positive function in the natural collections, the slope of the regression line is 0.0017, and is not significantly different from zero. Furthermore, the correlation coefficient (r^2) equals 0.1068, which means that the time interval between collections accounts for only 10% of the pairwise differences in allelic distance. The hatchery-origin collections do show a significantly positive slope (0.0037; $p = 0.0254$) and a regression coefficient nearly three times greater than that for the natural-origin collections. However, the correlation coefficient is still relatively small ($r^2 = 0.3290$), indicating that the time interval between collections accounts for one-third of the pairwise differences in allelic distance. The results suggest that if genetic drift is a factor in allelic differentiation between collections, it is only a minor factor, and appears to have affected the hatchery-origin collections more than the natural-origin collections.

If four-year-old fish dominate each collection year, we would expect a closer relationship among collections that are spaced at intervals of four years. The average percentage of alleles shared between two natural-origin collections that are separated by four years or a multiple of four years is 81%, compared with 78% for natural-origin collections separated by years that are not divisible by four. Likewise, for hatchery-origin collections the average percentage of alleles shared is 80% and 75% for collections separated by years divisible and not divisible by four, respectively. Although the percent differences described above are relatively small, they are consistent with the idea that allelic differences between collections are a function of year-to-year variability among different cohorts of four year-old fish.

Summary – The allele frequencies within and between natural- and hatchery-origin collections are significantly different, but there does not appear to be a robust signal indicating that the recent natural-origin collections have diverged greatly from the pre- or early post-supplementation collections. Genetic drift will occur in all populations, but does not appear to be a major factor with the Chiwawa collections. We propose that the differences among collections are a function of differences in allele frequencies among cohorts of the four year-old fish that dominate each collection.

Hatchery Broodstock Versus Natural (In-River) Spawners

We address the following questions with the spawner data set:

1. Are there changes in allele frequencies and allele sharing distances in the natural spawning collections from pre-supplementation to today?
2. Are there changes in allele frequencies and allele sharing distances in the hatchery broodstock collections from early supplementation to today?
3. Are there significant differences in allele frequencies and large allele sharing distances between hatchery and natural spawning adults from a collection year, and has this pattern changed through time?

Genic Differentiation Tests – For the most part there are significant differences in allele frequencies among collections for both the hatchery broodstock and natural spawners (Table 4), and these differences are consistent with the origin data set (Table 3). There are four collection years with paired samples (2001, 2004-2006) where we can compare allele frequency differences between the hatchery broodstock and natural spawners, within the same year. The 2001 hatchery broodstock and natural spawner collections have significantly different allele frequencies, but the level of significance decreased from 2001 to 2004, and become non-significant in 2005 and 2006 (Table 4). This indicates that by 2005, the hatchery broodstock and natural spawners collections were effectively sampling from the same population of fish. Additionally, the percentage of alleles shared between the hatchery broodstock and the natural spawners increased from 76% in 2001 to 86% in 2006 (allele sharing distance matrix, not shown). From this analysis, we conclude that although there are year-to-year differences in allele frequencies within the natural and hatchery spawner collections, *there appears to be a convergence of allele frequencies within collection-year, between the natural and hatchery spawner populations*.

Linkage Disequilibrium – Linkage disequilibrium is the correlation of alleles between two loci, and can occur for several reasons. If two loci are physically linked on the same chromosome, than alleles from each of these loci should be correlated. However, linkage between two loci can occur as a result of population bottlenecks, small population sizes, and natural selection. If any of these conditions had occurred or were occurring within the Chiwawa River system, we would expect to find substantial linkage disequilibrium in many or perhaps all Chiwawa collections. However, many Chiwawa collections, especially the natural-origin collections, do not show linkage disequilibrium (Table 1), and it would appear that the linkage disequilibrium within certain Chiwawa collections is not a function of the processes listed above. Linkage disequilibrium can also result if the collection is composed of an admixture. That is, if two or more reproductively isolated populations are combined into a single collection, the collection will show linkage disequilibrium. Each broodstock and natural spawning collection is composed of natural- and hatchery-origin fish. If these hatchery- and natural-origin fish are drawn from the same population, the spawning collections should not show substantial linkage disequilibrium. However, if the hatchery- and natural-origin fish are from different populations (i.e., full hatchery – natural integration has not been achieved), the spawning collections should show substantial linkage disequilibrium.

There are only three Chiwawa spawning collections that are not composed of both hatchery- and natural-origin samples: 1989 (natural-origin, natural spawner), 1993 (natural-origin, hatchery broodstock), and 2001 (natural-origin, natural spawner). Of the 10 spawning collections with both hatchery- and natural-origin fish, seven show significant linkage disequilibrium. Two of the three collections that did not show linkage disequilibrium are the 1996 and 1998 hatchery broodstock collections, which are composed of only seven natural- and six hatchery-origin fish, and two natural- and 19 hatchery-origin fish, respectively. Within the hatchery broodstock collections with linkage disequilibrium, the percent of loci pairs showing linkage decreased from 32% in 2000 to 13% in 2001 and 2004, to only 1% and 5% in 2005 and 2006, respectively (Table 1). If the homogenization of allele frequencies of natural- and hatchery-origin fish was increasing from 2000 to 2006, we would expect a decrease in linkage disequilibrium among the broodstock collections. This is what occurred within the hatchery broodstock collections, but did not occur within the natural spawner collections, where the percent of loci pairs showing linkage was 18% in 2004, 6% in 2005, and 10% in 2006 (Table 1). Furthermore, the 2001 natural spawner collection, with no hatchery-origin component showed linkage disequilibrium with 9% of loci pairs.

There is no correlation between percent of loci pairs showing linkage disequilibrium and percent of broodstock composed of hatchery-origin fish ($r^2 = 0.0045$). Furthermore, the natural spawner and hatchery broodstock collections were each composed of roughly the same average percentage of hatchery-origin fish (57% and 53%, respectively). If the decrease in linkage disequilibrium among the hatchery broodstock collections from 2000 to 2006 was a result of a homogenization of allele frequencies of natural- and hatchery-origin fish in the broodstock, the same degree of homogenization did not occur within the natural spawner collections. This would occur if natural- and hatchery-origin fish spawning within the river remain segregated, either by habitat or by fish behavior.

Summary – As with the origin data set, there are significant allele frequency differences within and between hatchery broodstock and natural spawner collections. However, in recent years the allele frequency differences between the hatchery broodstock and natural spawner collections has declined. Furthermore, based on linkage disequilibrium, there is a genetic signal that is consistent with increasing homogenization of allele frequencies within hatchery broodstock collections, but a similar homogenization within the natural spawner collection is not apparent. These data suggest that there exists consistent year-to-year variation in allele frequencies among hatchery and natural spawning collections, but there is a trend toward homogenization of the allele frequencies of the natural- and hatchery-origin fish that compose the hatchery broodstock.

Four Treatment Groups

Analyses of genetic differences between hatchery (broodstock) and natural spawner collections is confounded by the fact that each these two groups are composed of fish of natural- and hatchery-origin. To understand the effects of hatchery supplementation on *natural-origin fish that spawn naturally*, we needed to divide the Chiwawa data set into four mutually exclusive groups: (1) hatchery-origin hatchery broodstock, (2) hatchery-origin natural spawner, (3) natural-origin hatchery broodstock, and (4) natural-origin natural spawner, with each group consisting of multiple collection years, for a total of 25 different groups.

Allele-sharing and Nonmetric Multidimensional Scaling –As with previous analyses discussed above, we constructed a pairwise allele-sharing distance matrix for all collections from each of these treatment groups and subjected this matrix to a nonmetric multidimensional scaling analysis, restricting the analysis to two dimensions. Figure 4 shows that five outlier groups dominate the allele-sharing distances within this data set. These outlier groups are also present in Figure 2, as discussed above, and Figure 2 and 4 resemble each other because the same fish are included in each analysis. The difference between Figures 2 and 4 is that in Figure 4 the fish are grouped into collection year and the four treatment groups, rather than collection year and two treatment groups (hatchery- versus natural-origin).

Figure 4 does not provide useful resolution of the groups within the polygon, because the outlier groups dominate the allele sharing distances. We removed the five outlier groups from Figure 4, recalculated the allele sharing distances and subjected this new matrix to a multidimensional scaling analysis (Figure 5). Figure 5 shows separation among the 2001, 2004-2006 collections, but this separation does not necessarily indicate that within-year collections are more similar to each other than any collection is to a collection from another year. For example, the 2006 natural-origin natural spawner and the 2005 natural-origin hatchery broodstock collections share 81% alleles, while the 2006 natural-origin natural spawner and 2006 hatchery-origin hatchery broodstock collections share 75% alleles. There does not appear to be any discernable pattern of change in allele-sharing distance among the collections relevant to pre- or post-supplementation. Although the 1989 pre-supplementation natural-origin collection appears distinct (Figure 5), the 1993 natural-origin hatchery broodstock collection appears quite similar to the 2005 and 2006 natural-origin collections (Figure 5). The 1993 natural-origin hatchery broodstock collection, although not technically pre-supplementation, is composed of fish whose ancestry cannot be traced to any Chiwawa hatchery fish. Therefore, there is no clear pattern of allele sharing change from pre-supplementation to recent collections.

There does appear to be some change in the average percentage of alleles shared within the 2001 to 2006 collections, with an increase from 74% in 2001 and 2004 to 78% and 79% in 2005 and 2006, respectively. The results provided by this analysis are consistent with the results presented in the origin and spawner data sets. That is, there are allele frequency and allele sharing differences among the collections, but analyses do not strongly suggest that these differences are a function of the supplementation program. Furthermore, there is also a weak signal that the hatchery and natural collections within the most recent years are more similar to each other than in the previous years.

Overall Genetic Variance – Although there are signals of allelic differentiation among Chiwawa River collections, there are no robust signs that these collections are substantially different from each other. We used two different analyses to measure the degree of genetic variation that exists among individuals and collections within the Chiwawa River. First, we conducted a principal component analysis using all Chiwawa samples with complete genotypes (i.e., no missing alleles from any locus). Although the first two principal component axes account for only 10.5% of the total molecular variance, a substantially greater portion of that variance is among individual fish, regardless of their identity, rather than among hatchery and natural collections (Figure 6). The variances in principal component scores among individuals are 11 and 13 times greater than the variance in scores among collections, along the first and second axes, respectively.

Second, we conducted a series of analyses of molecular variance (AMOVA) to ascertain the percentage of molecular variance that could be attributed to differences among collections. We organized these analyses to test also for differences in the hierarchical structure of the data. That is, we tested for differences among collections using the following framework:

- No organizational structure – all 25 origin-spawner collections considered separately
- Origin-spawner collections organized into 10 collection year groups
- Origin-spawner collections organized into 2 breeding location groups (hatchery versus natural)
- Origin-spawner collections organized into 2 origin groups (hatchery versus natural)
- Origin-spawner collections organized into the 4 origin-spawner groups

It is clear from this analysis that nearly all molecular variation, no matter how the data are organized, resides within a collection (Table 5). The percentage of total molecular variance occurring within collections ranged from 99.68% to 99.74%. The among group variance component was limited to less than 0.26% and in all organizational structures, except “no structure,” the among group percentage was not significantly greater than zero. Furthermore, none of the organizational structures provided better resolution than “no structure” in terms of accounting for molecular variance within the data set. *These results indicate that if there are significant differences among collections of Chiwawa fish, these differences account for less than one percent of the total molecular variance, and these differences cannot be attributed to fish origin or spawning location.*

Summary and Conclusions

We reject the null hypothesis that the allele frequencies of the hatchery collections equal the allele frequencies of the natural collections, which equals the allele frequency of the donor population. Furthermore, because the allele-sharing distances are not consistent within and among collections years, we also reject the second stated hypothesis discussed above. However, there is an extremely small amount of genetic variance that can be attributed to among collection differences. The allelic differentiation that does exist among collections does not appear to be a function of fish origin, spawning location, genetic drift, or collection year. Figure 5 and related statistics does suggest that hatchery and natural collections in 2005 and 2006 are more similar to each other than previous years’ collections, and this would be expected in a successful integrated hatchery supplementation program.

Since each of these collection years are generally composed of four-year-old fish, the differentiation among these collections for the most part is differentiation among specific cohorts. The slightly greater percentage of alleles shared among collections that are separated in time by multiples of four years, compared with collections that are not separated in time as such, suggests that cohort differences may be the most important factor accounting for differences in allele frequencies among collections.

<u>Task 4:</u> Develop a model of genetic drift.

See Task 3

<u>Task 5:</u> Analyze spring Chinook population samples from the Chiwawa River and Chiwawa Hatchery from multiple generations.

See Task 3

<u>Task 6:</u> Analyze among population differences for upper Wenatchee spring Chinook.

Supplementation of the Chiwawa River spring Chinook population may affect populations within the Wenatchee River watershed other than the Chiwawa River stock. If the stray rate for Chiwawa hatchery-origin fish is greater than that for natural-origin fish, an increase in gene flow from the Chiwawa population into other populations may result. If this gene flow is high enough, Chiwawa River fish may alter the genetic structure of these other populations. Records from field observations indicate that hatchery-origin fish are present in all major spawning aggregates (A.R Murdoch, unpublished data), and these fish are successfully reproducing (Blankenship et al 2006). The intent of this task is to investigate if there have been changes to the genetic structure of the spring Chinook stocks within upper Wenatchee tributaries during the past 15-20 years, and if changes have occurred, are they a function of the Chiwawa River Supplementation Program? Therefore, we ask the following two questions:

1. Are allele frequencies within populations in the upper Wenatchee stable through time? That is, is there significant allelic differentiation among collections within upper Wenatchee populations?
2. Are the recent collections from the upper Wenatchee populations more similar to the Chiwawa population than earlier collections from the same populations?

For this task we analyzed natural spawning collections from the White River (natural-origin), Little Wenatchee River (natural-origin), Nason Creek (natural-origin), and

Wenatchee mainstem (hatchery-origin), and hatchery collections from Leavenworth NFH and Entiat River NFH (Table 1). We also included in the analysis the natural- and hatchery-origin collections from the Chiwawa River. There are no repeated collections from Leavenworth, Entiat, Little Wenatchee, and Wenatchee mainstem (Table 1), so for many of the analyses we have limited our discussion to the Chiwawa River, White River, and Nason Creek collections. Furthermore, genetic structure of the Little Wenatchee collection, which consisted of only 19 samples, was unexpectedly quite different from the other collections. For example, the F_{ST} statistic measures the percent of total molecular variation that can be attributed to differences between populations. The median F_{ST} for all pairwise combinations of collections from all populations, except Little Wenatchee (33 populations, 528 individual F_{ST} statistics) equals 0.010 (1%), with a range of 0.000 to 0.037 (Table 6). The median F_{ST} for the Little Wenatchee paired with all other collections (33 individual F_{ST} statistics) equals 0.106 (10.6%), with a range of 0.074 to 0.121. The ten-fold increase in the F_{ST} statistic indicates that either the Little Wenatchee spring Chinook is unique among the upper Wenatchee River stocks, or this 1993 collection is somehow aberrant. Therefore, we exclude the Little Wenatchee collection from many other analyses.

Population Differentiation – Table 3 provides the levels of significance for all pairwise genic differentiation tests. Most between-collection comparisons are highly significant, with no pattern of increasing or decreasing differentiation with time, and no differences when comparisons are made with Chiwawa hatchery- versus Chiwawa natural-origin fish. For example, excluding the outlier 1996 and 1998 Chiwawa hatchery- and natural-origin collections, Nason Creek showed highly significant allele frequency differences between the Chiwawa hatchery- and natural-origin collections at 100% and 86% of the comparisons, respectively. The same comparisons with the White River produced 100% and 93% highly significant allele frequency comparisons, respectively. Allele frequencies between Nason Creek and White River were likewise differentiated from each other.

The collection allele frequencies within the upper Wenatchee system are significantly different, and these differences do not appear to change as a function of time (Table 3). Nason Creek shows greater within-population year-to-year variation in allele frequencies than does the White River, with 47% of the pairwise comparisons showing highly significant differences, compared with only 13% for the White River. However, the 2005 and 2006 collections from the White River appear to be somewhat more differentiated from not only each other, but from the earlier collections from the White River.

Despite the high degree of temporal and spatial structure suggested by the genic differentiation tests, as described above for within-Chiwawa analysis (Task 3), most of the genetic variation within this data set occurs within populations, rather than between populations (Table 6). The F_{ST} values for most population comparisons are between 0.01 and 0.02, indicating 1% to 2% among-population variance, with the remaining 98% to 99% variance occurring within populations. The White River shows the highest median F_{ST} among the natural-origin collections, equal to 0.014, compared with 0.009 for both the Nason Creek and Chiwawa natural-origin collections. The median F_{ST} for the Chiwawa hatchery-origin collections (0.012) was higher than that for the Chiwawa natural-origin collections.

Table 7 summarizes the information from the F_{ST} analyses, under five different temporal and spatial scenarios. Under all scenarios, over 99% of the molecular variance is within populations. There is significantly greater spatial structure among populations ("Origin") in 2005 and 2006 than from 1989 to 1996. That is, there appears to be more spatial structure among the Chiwawa hatchery-origin, Chiwawa natural-origin, White River, and Nason Creek now, than in 1989 to 1996, despite the potential homogenizing and cumulative effect of hatchery strays. However, we stress that the amount of molecular variance associated with the among population differences, despite being significantly greater than 0.00%, is limited to only 0.43%.

Allele-sharing and Nonmetric Multidimensional Scaling – As in the Chiwawa River data discussed above, we constructed an allele-sharing distance matrix and then subjected that matrix to a multidimensional scaling analysis (Figure 7). Consistent with all previously discussed multidimensional scaling analyses, the 1996 and 1998 adult, and the 1994 smolt collections are outliers. There is clear separation between the White River collections and all other natural-origin and Chiwawa hatchery-origin collections, indicating that there are more alleles shared among the Nason Creek and Chiwawa collections, than with the White River collections. Furthermore, there is a slight separation between the Chiwawa natural-origin natural spawner collections and Nason Creek collections, suggesting different groups of shared alleles between these populations. There is more variation in the allele-sharing distances among collections involved with the Chiwawa hatchery (origin or broodstock) than any of the natural-origin collections, even if we exclude the 1994, 1996, and 1998 collections. This suggests that there is more year-to-year variation in the composition of hatchery-origin and hatchery broodstock than within natural-origin populations throughout the upper Wenatchee. All Wenatchee mainstem fish are hatchery-origin, and if these fish are from the Chiwawa Supplementation Program (rather than from Leavenworth), it is not unexpected that this collection would be plotted within the Chiwawa polygon (Figure 7).

Assignment of Individual to Populations – Finally, we conducted individual assignment tests whereby we assigned each individual fish to a population, based on a procedure developed by Rannala and Mountain (1997) (Table 8 and 9). Individual fish may be correctly assigned to the population from which they were collected, or incorrectly assigned to a different population. Incorrect assignments may occur if the fish is an actual migrant (i.e., source population different from population where collected), or because the genotype for that fish matches more closely with a population different from its source. If there are many individuals from a population incorrectly assigned to populations other than its source population, that original population is either unreal (i.e., an admixture), or there is considerable gene flow between that population and other populations. Furthermore, in assigning individuals to populations, we can either accept the assignment with the highest probability, regardless of how low that probability may be, or we can establish a more stringent criterion, such as to not accept an assignment unless the posterior probability is equal to or greater than 0.90. This value is roughly equal to having the likelihood of the most-likely population equal to 10 times that of the second most-likely population.

We provide a summary of the assignments in Tables 8 and 9. On average, nearly 50% of the fish are assigned incorrectly if we accept all assignments (Table 8), but the incorrect assignment rate drops to roughly 10% when we accept only those assignments with probabilities greater than 0.90. However, with this more stringent criterion, nearly 64% of the fish go unassigned. These results indicate that the allele frequency distributions for these populations are very similar, and it would be very difficult to assign an individual fish of unknown origin to the correct population. If all fish are assigned, there is a 50% chance, overall, of a correct assignment. If you accept only those assignment with the 0.90 criterion, nearly two-thirds of the fish would be unassigned, but there is a 90% chance of correctly assigning those fish that are indeed assigned.

Of all the populations in the data set, there are fewer errors associated with assigning fish to the White River. If all fish are assigned (Table 8), 72% of those fish assigned to the White River, are actually from the White River (115 fish out of a total of 159 fish assigned to the White River). This compares to a rate of only 52% and 53% for Nason Creek and Chiwawa natural-origin, respectively, and 60% for the Chiwawa hatchery-origin collections. With the 0.90 criterion (Table 9), 89% of the fish assigned to the White River, are actually from the White River, compared with 70% and 65% for Nason Creek and Chiwawa natural origin, respectively, and 81% for the Chiwawa hatchery origin.

When all fish are assigned, most of the incorrectly assigned fish from Nason Creek and White River are assigned to Chiwawa River, at roughly equal frequencies to the hatchery- and natural-origin populations. Incorrectly assigned fish to other populations occur at a slightly higher rate in Nason Creek than in the White River. However, when only those fish meeting the 0.90 criterion are assigned (Table 9), incorrectly assigned fish from Nason Creek are distributed among White and Chiwawa Rivers, as well as Leavenworth NFH, and the Entiat NFH. Mis-assignment to the Chiwawa hatchery-origin was the highest among the Nason Creek collections, equal to nearly 14%. This contrasts with the White River where mis-assignments do not exceed 7% anywhere, and there is a roughly even distribution of mis-assignments among Nason Creek and Chiwawa River collections.

Summary and Conclusions – There is little geographic or temporal structure among populations within the upper Wenatchee systems. Among population molecular variance is limited to 1% or less. The little variance that can be attributed to among populations indicates that the White River is more differentiated from the Chiwawa and Nason populations than these populations are from each other. Furthermore, although we cannot rule out a hatchery effect on the Nason Creek and White River populations, there is no indication there has been any temporal changes in allele frequencies within these populations that can be attributed directly to the Chiwawa River Supplementation Program. In fact, Table 7 weakly suggests that there is more differentiation among these populations now, than there was before or at the early stages of Chiwawa supplementation.

Therefore, returning to our two original questions, there are significant differences in allele frequencies among collections within populations, and among populations within the upper Wenatchee spring Chinook stocks. However, these differences account for a very small portion of the overall molecular variance, and these populations overall are very similar to each other. There is no evidence that the Chiwawa River Supplementation Program has changed the allele frequencies in the Nason Creek and White River populations, despite the presence of hatchery-origin fish in both these systems. Finally, of all the populations within the Wenatchee River, the White River appears to be the most distinct. Yet, this distinction is more a matter of detail than of large significance, as the median F_{ST} between White River collections and all other collections (except the Little Wenatchee) is less than 1.5% among population variance.

Task 7: Calculate the inbreeding effective population size using demographic data for each sample year, and document the ratio of census to effective size.

This analysis was completed by Williamson et al. (submitted).

Task 8: Calculate LD N_b using genetic data for each sample year, and document the ratio of census to effective size.

We report N_e estimated for the Chiwawa River collections based on the bias correction method of Waples (2006) implemented in LDNe (Do and Waples unpublished). N_e estimates based on LD are best interpreted as the effective number of breeders (N_b) that produced the sample (Waples 2006).

For collections categorized by spawning location (i.e., hatchery broodstock or natural), estimates of N_b are shown in Table 10. Considering the hatchery broodstock, N_b estimates range from 30.4 (1996) to 274.3 (2005). To obtain N_e /N ratios, the N_b estimate is multiplied by four (i.e., mean generation length) and divided by the total in river (i.e., NOS [natural-origin spawners] plus HOS [hatchery-origin spawners]) census data from four years prior (i.e., major cohort; see Table 2). The observed N_e /N ratios for the broodstock collections range from 11% to 54% of the census estimate, excluding the 2000 collection which is 106%. A ratio greater than one is possible under special circumstances, and certain artificial mating schemes within hatcheries can inflate N_e above N; yet, it is unknown if this is the case for this collection. While no direct comparisons are possible, the N_b estimates reported by Williamson et al. (submitted) for Chiwawa broodstock collections from 2000 – 2003 are similar in magnitude to our estimates. For Chiwawa natural spawner collections, the N_b estimates range from 5.2 (1989) to 231.5 (2005), with observed N_e /N ratios of 22% - 48% of the census estimate.

Task 9: Calculate N_b using the temporal method for multiple samples from the same location.

Estimates of effective number of breeders (N_b) derived from Waples' (1990) temporal method are shown in Tables 11-13. Eight collection years were used for the Chiwawa broodstock collections (Table 11). The harmonic mean of all pairwise estimates of N_b ($\tilde{N}_b$) was 269.4. This estimate is the contemporary N_e for Chiwawa broodstock collections. For the five collection years of Chiwawa in-river spawners (Table 12), the estimated $\tilde{N}_b = 224.2$. This estimate is the contemporary N_e for Chiwawa River natural spawner collections. Since the Chiwawa Supplementation Program is integrated by design, we also performed another estimation of N_e using composite hatchery and natural samples. There are paired samples from 2004-2006. We combined genetic data for hatchery (HOS) and natural (NOS) origin fish from 2004 – 2006 to create a single Chiwawa River natural spawner sample for each year. The three composite samples from 2004 – 2006 were then analyzed using the temporal method (Table 13), resulting in a $\tilde{N}_b = 386.8$. This estimate is the contemporary N_e for Chiwawa River.

Williamson et al. (submitted) estimated N_e using Waples' (1990) temporal method for Chinook captured in 2004 and 2005, and used age data to decompose brood years into consecutive cohorts from 2000 – 2003. They report for Chiwawa broodstock a $\tilde{N}_b = 50.4$. This estimate is not similar to our Chiwawa broodstock estimate. However, if we analyze the hatchery-origin Chinook only, our estimate is $\tilde{N}_b = 80.1$ for collection years 1989 – 2006 (data not shown). Williamson et al. (submitted) report for Chiwawa naturally spawning Chinook a $\tilde{N}_b = 242.7$, which is slightly higher than our estimate for in-river spawners from 1989 – 2006, but lower than our estimate from combined NOS and HOS Chinook from 2004 – 2006 collection years.

<u>Task 10:</u> Use available data and the Ryman-Laikre and Wang-Ryman models to determine the expected change of N_e for natural spring Chinook salmon in the Wenatchee River due to hatchery operation.

N_e is generally thought to be between 0.10 and 0.33 of the estimated census size (Bartley et al. 1992; RS Waples pers. comm.). We used this range to generate an estimate of N_e for Chiwawa natural spawners prior to hatchery operation. For brood years 1989 – 1992, the arithmetic mean census size was N=962.7 (Table 2), resulting in an estimated N_e ranging from 96.3 – 317.7. The contemporary estimate of N_e calculated using genetic data for the Chiwawa in-river spawners is N_e=224.2 (Table 12), falling in the middle of the pre-hatchery range. The N_e /N ratio calculated using 224.2 and the arithmetic census of NOS Chinook from 1989 – 2005 is 0.42. A more appropriate contemporary N_e to compare with the pre-hatchery estimate (i.e., 96.3 – 317.7) is the combined NOS and HOS estimate from natural spawners, since the supplementation program is integrated. As discussed above, the contemporary estimate of N_e calculated using genetic data for Chiwawa NOS and HOS Chinook is N_e=386.8 (Table 13), which is slightly larger than the pre-hatchery range, suggesting the N_e has not declined during the period of hatchery operation. The N_e /N ratio calculated using 386.8 and the arithmetic census of NOS and HOS Chinook from 1989 – 2005 is 0.40. These results suggest the Chiwawa Hatchery Supplementation Program has not resulted in a smaller N_e for the natural spawners from the Chiwawa River.

Williamson et al. (submitted) argued that since their combined (i.e., broodstock and natural) N_e estimate was lower than the naturally spawning estimate, the supplementation program likely had a negative impact on the Chiwawa River N_e. We disagree with this interpretation of these data. Since the natural spawning component is mixed hatchery and natural ancestry, the N_e estimates from natural spawning data are the results that bear on possible hatchery impacts. The census data show the population declined in the mid 1990's and rebounded by 2000 (Table 2). This trend is reflected in the N_e results, as shown above, and Williamson et al. (submitted) clearly show in their Table 4 the N_e was lower in 2000 (N_e = 989) than it was in 1992 (N_e = 2683). Yet, the important comparison they make in our view was the natural spawning N_e versus the natural only component N_e (i.e., hypothetically excluding hatchery program). Williamson et al. (submitted) report the 1989 – 1992 N_e estimated from naturally spawning Chinook (i.e., NOS and HOS integrated) was essentially the same as the natural only component estimate, 2683 and 2776, respectively. This result is not surprising since no HOS fish were present between 1989 – 1992. They also report that the 1997 – 2000 N_e estimated from naturally spawning Chinook (i.e., NOS and HOS integrated) was N_e =989, while the natural-origin estimate of N_e in 1997 – 2000 was N_e = 629. Since the natural-origin estimate of 629 is lower than 989, the N_e estimate from all in-river spawners, we argue that their analysis of demographic data show the N_e estimated from naturally spawning Chinook (i.e., NOS and HOS integrated) is larger only if the hatchery Chinook in the river are ignored.

Task 11: Use individual assignment methods to determine the power of self-assignment for upper Wenatchee River tributaries.

See "Assignment of Individual to Populations" in Task 6

Conclusions

Has the Chiwawa Hatchery Supplementation Program succeeded at increasing the census size of the target population while leaving genetic integrity intact? This is an important question, as hatcheries can impact natural populations by reducing overall genetic diversity (Ryman and Laikre 1991), reducing the fitness of the natural populations through relaxation of selection or inadvertent positive selection of traits advantageous in the hatchery (Ford 2002; Lynch and O'Hely 2001), and by reducing the reproductive success of natural populations (McLean et al. 2003). The census data presented here show that the current natural spawning census size is similar to the pre-supplementation census size. Despite large numbers of hatchery-origin fish on the Chiwawa River spawning grounds, the genetic diversity of the natural-origin collections appear unaffected by the supplementation program; heterozygosities are high, and contemporary N_e is similar (perhaps slightly higher) than pre-supplementation N_e. We did find significant year-to-year differences in allele frequencies in both the origin and spawner datasets, but these differences do not appear to be related to fish origin, spawning area, or genetic drift. However, we do suggest that cohort differences may be the most important factor accounting for differences in allele frequencies among collections.

The main objective of this study was to determine the potential impacts of the hatchery program on natural spring Chinook in the upper Wenatchee system. We did this by analyzing temporally replicated collections from the Chiwawa River, and by comparing genetic diversity prior to the presumed effect of the Chiwawa Hatchery Supplementation Program, with contemporary collections. We report that the genetic diversity present in the Chiwawa River is unchanged (allowing for differences among cohorts) from 1989 – 2006, and the contemporary estimate of the effective population size (N_e) using genetic data is approximately the same as the N_e estimate extrapolated from 1989 – 1992 census data (i.e., pre-hatchery collection years). We observed substantial genetic diversity, with heterozygosities ~80% over thirteen microsatellite markers. Yet, temporal variation in allele frequencies was the norm among temporal collections from the same populations (i.e., location). The genetic differentiation of replicated collections from the same population is likely the result of salmon life history in this area, as four-year-old Chinook comprise a majority of returns each year. The genetic tests are detecting the differences of contributing parents for each cohort. An important point related to the temporal variation, is that the hatchery broodstock is composed in part of the natural origin Chinook from the Chiwawa River. When we compared the genetic data (within a collection year) for Chinook brought into the hatchery as broodstock with the Chinook that remained in the river (years 2001, 2004 – 2006), there was a trend of decreasing statistical differences in allele frequencies from 2001 to 2004, and no differences were detected for 2005 and 2006. While the replicated collections may have detectable differences in allele frequencies, those differences reflect actual differences in cohorts, not the result of hatchery operations, and the hatchery broodstock collection method captures the differences in returning Chiwawa River spring adults each year. We conclude from these results that the genetic diversity of natural spring Chiwawa Chinook has been maintained during the Chiwawa Hatchery Supplementation Program.

We observe slight, but statistically significant population differentiation between Chiwawa River, White River, and Nason Creek collections. Murdoch et al (2006) and Williamson et al. (submitted) also observed population differentiation between Chiwawa River, White River, and Nason Creek collections. Yet, 99.3% of the genetic variation observed was within samples, very little variance could be attributed to population differences (i.e., population structure). The AMOVA analysis and poor individual assignment results suggest the occurrence of gene flow among Wenatchee River locations or a very recent divergence of these groups. While Murdoch et al. 2006 did not perform an AMOVA analysis, their F_{ST} results provide comparable data to our among-population results. Murdoch et al. 2006 report F_{ST} ranging from 2%-3% for pairwise comparisons between of Chiwawa, White, and Nason River collections. Since F_{ST} is an estimate of among-sample variance, these results also imply a majority of the genetic variance (i.e., 97%-98%) resides within collections. To provide further context for the magnitude of these variance estimates, we present the among-group data from Murdoch et al. 2006 comparing summer-run and spring-run Chinook from the Wenatchee River. They report that approximately 91% of observed genetic variance is within-collection for comparisons between collections of summer- and spring-run Chinook. Ultimately, the information provided by this and other reports will be incorporated into the management process for Wenatchee River Chinook. However, we would like to emphasize that the application of these genetic data to management is more about the goals related to the distribution of genetic diversity in the future than specific data values reported. If Chinook are collected at Tumwater Dam instead of within the upper Wenatchee River tributaries, a vast majority of the genetic variation present in the basin would be captured, although any differences among tributaries would be mixed. Alternatively, management policies could be crafted to promote and maintain the among-group genetic diversity that genetic studies consistently observe to be non-zero within the Wenatchee River.

We agree with Murdoch et al. (2006) that it appears hatchery Chinook are not contributing to reproduction in proportion to their abundance. Additionally, if the total census size (i.e., NOS and HOS combined) within the Chiwawa River does not continue to increase, genetic diversity may decline within this system, given the smaller N_e within the hatchery-origin collections compared with the natural-origin collections.

Acknowledgements

We would like to thank Denise Hawkins, Craig Busack, and Cheryl Dean for helpful comments regarding this project. This project was funded by Chelan County PUD and the Washington State General Fund.

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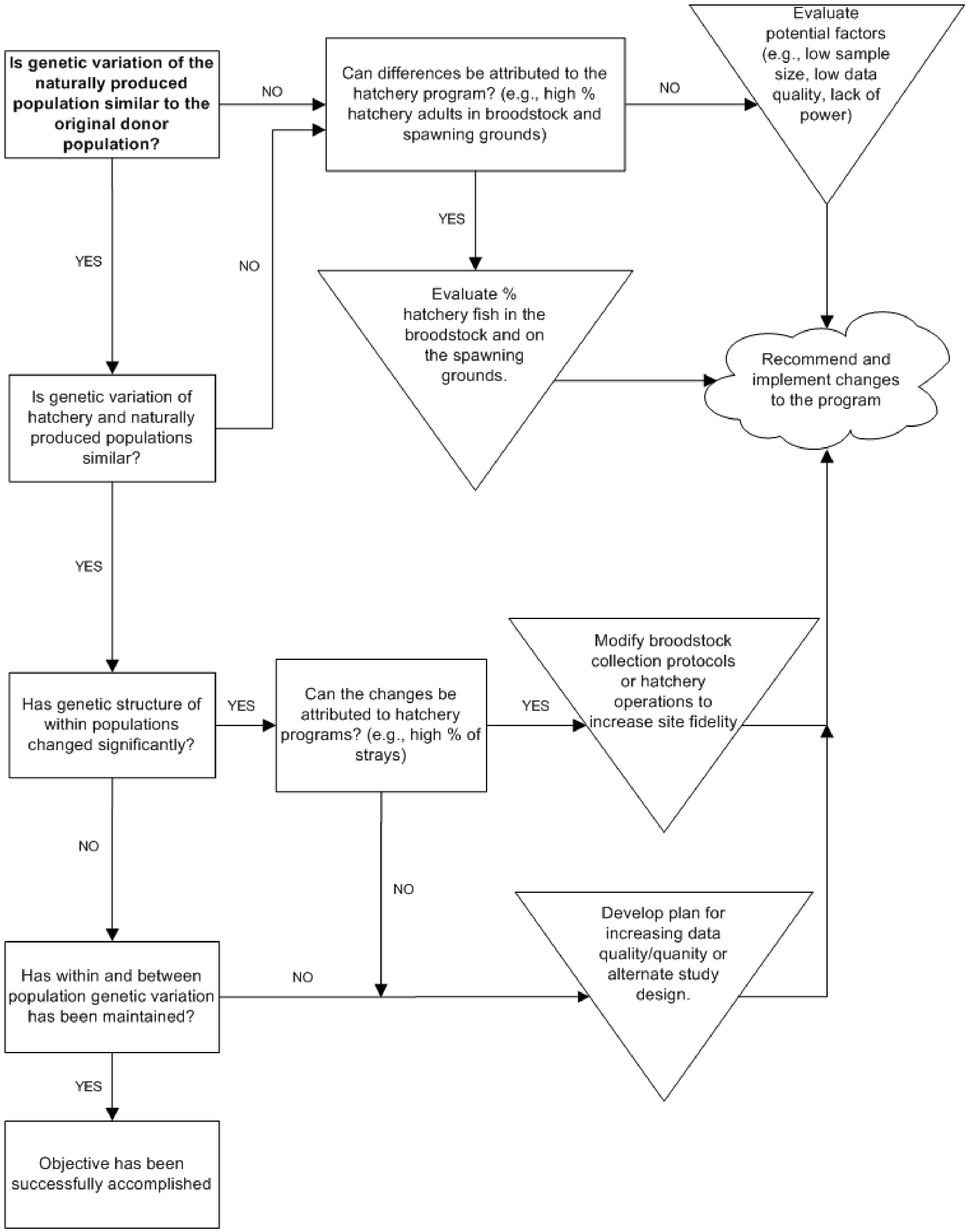

Figure 1. Conceptual process for evaluating potential changes in genetic variation in the Chiwawa naturally produced populations as a result of the supplementation hatchery programs (From Murdoch and Peven 2005).

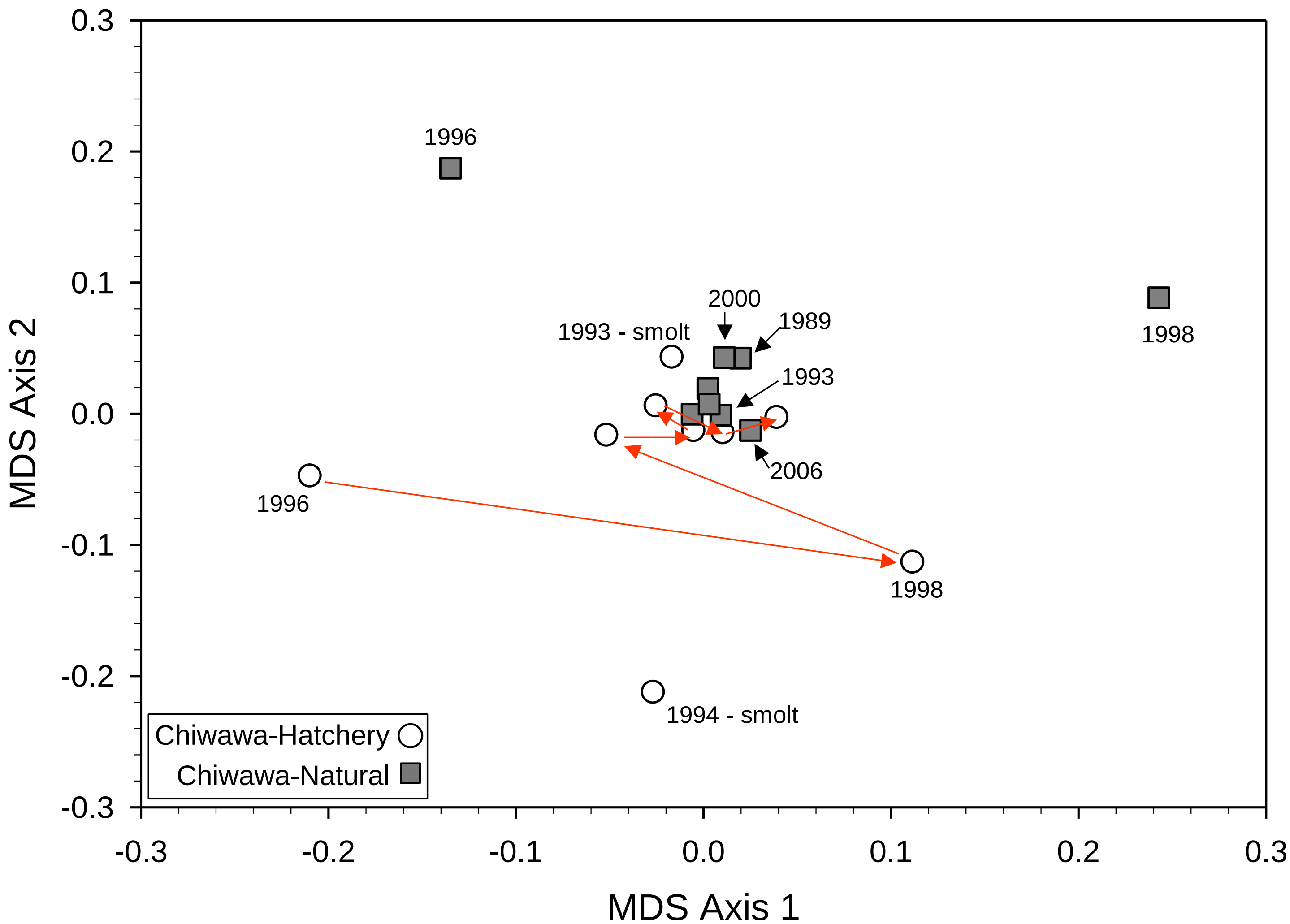

Figure 2. Multidimensional scaling plot from an allele-sharing distance matrix calculated from the Chiwawa data set organized by fish origin (i.e., hatchery versus natural). The red arrows connect consecutive hatchery-origin collections starting with the first adult collection (1996) and ending with the 2006 collection (see Table 1 for collection years).

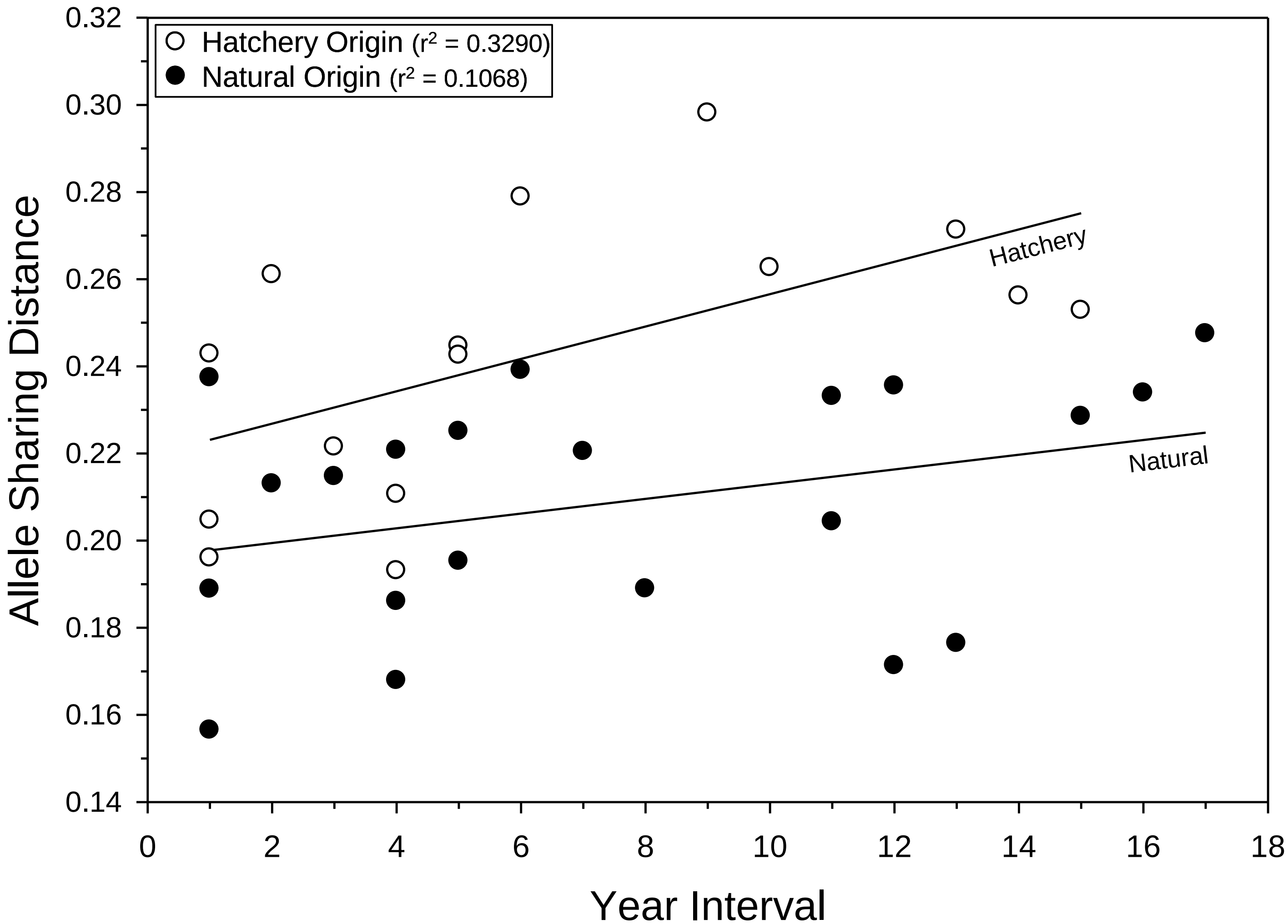

Figure 3. Relationships between the time interval in years and allele sharing distances, with each circle representing the pairwise relationship between two Chiwawa collections. Separate regression lines for the natural- and hatchery-origin collections. The slope for the natural-origin collection is not significantly different from zero (p=0.1483), while the slope for hatchery-origin collection is significantly greater than zero (p=0.0254) indicating a positive relationship between time interval and allele sharing distance.

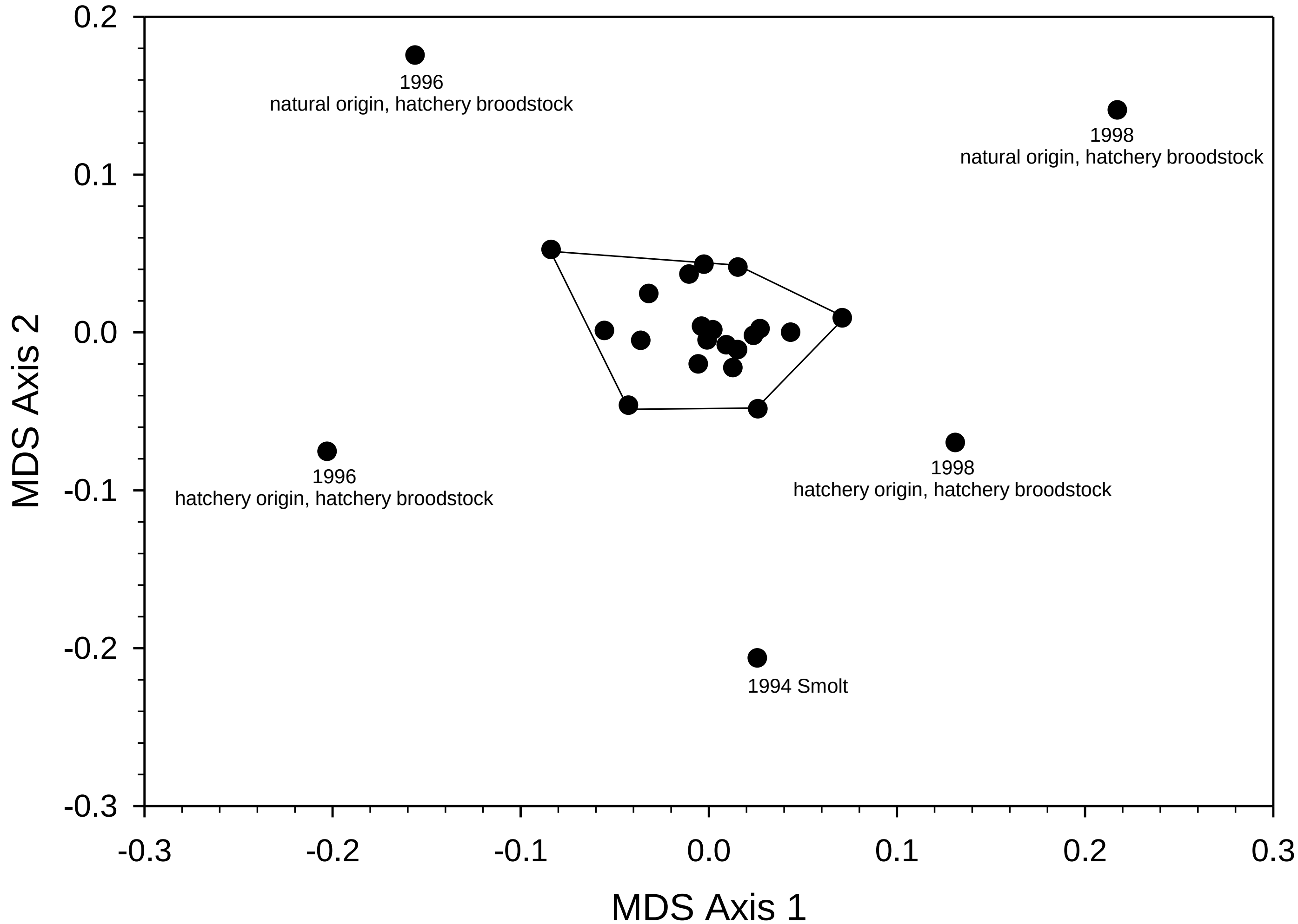

Figure 4. Multidimensional scaling plot from an allele-sharing distance matrix calculated from the Chiwawa data set organized by four treatment groups, as discussed in the text. Each circle represents a single collection within each of the four treatment groups, and the polygon encloses all groups that are not outliers. Each outlier group is specifically labeled.

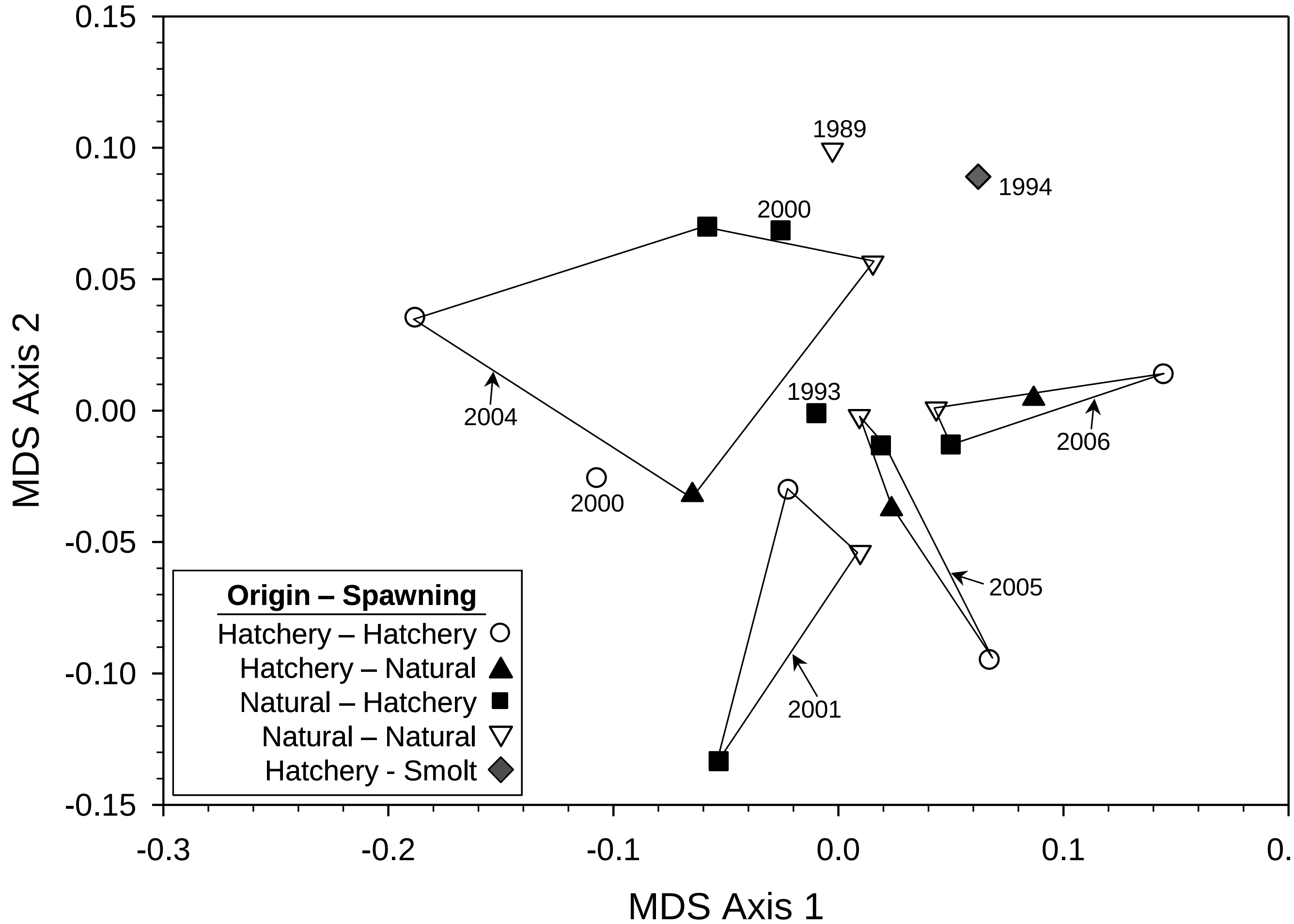

Figure 5. As in Figure 4, but allele-sharing distance matrix recalculated without the five outlier groups shown in Figure 4. Polygons group together treatment groups from the same collection year. Dates associated with symbols also refer to collection year. Collection years 2004-2006 included all four treatment groups, while collection year 2001 did not include a hatchery-origin natural spawner group. Legend is read as follows: Open circles refer to hatchery-origin hatchery spawner group, while filled box refers to natural-origin hatchery spawner group, and so on.

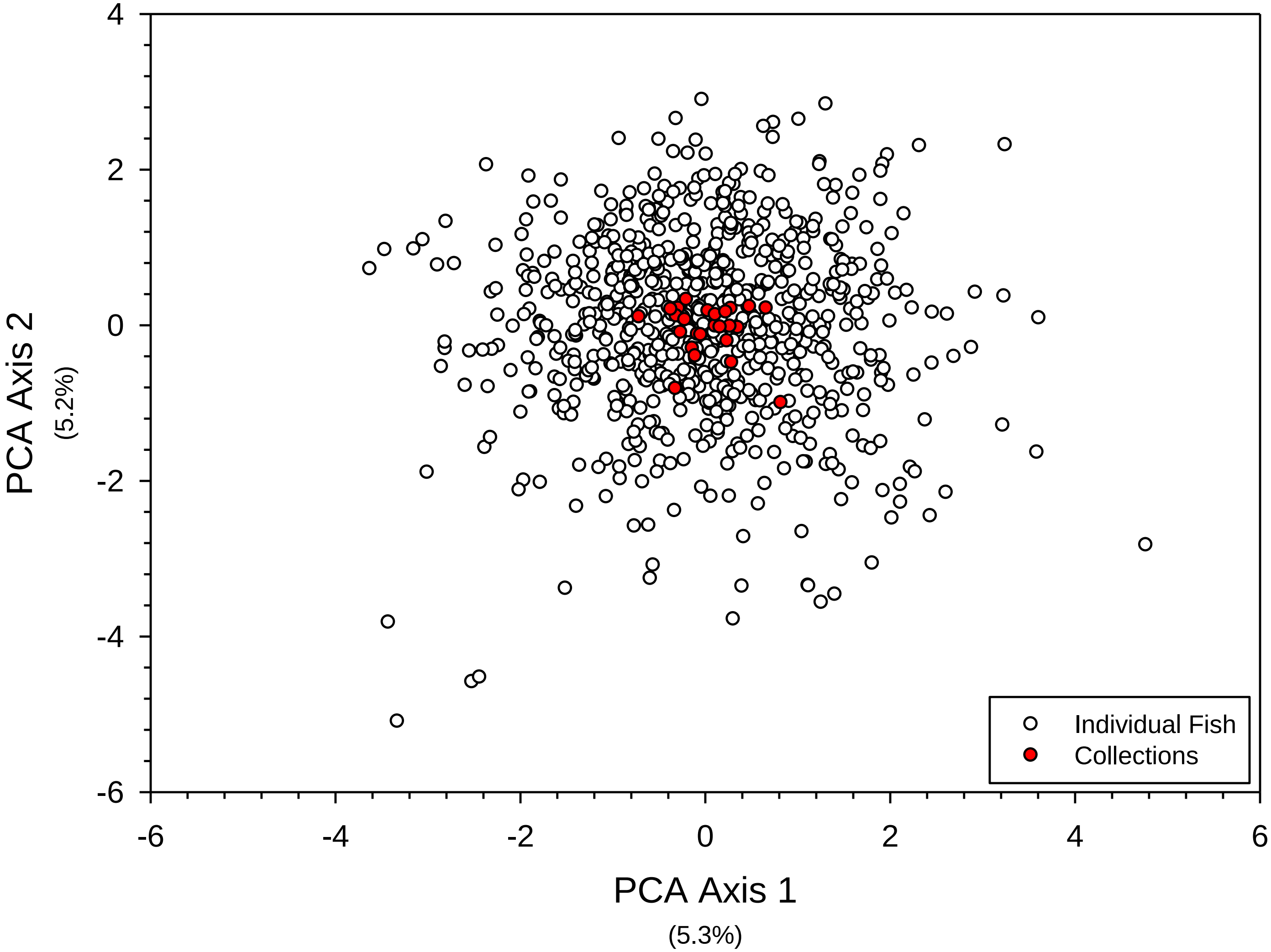

Figure 6. Principal component (PC) analysis of individual fish from the Chiwawa River. Only fish with complete microsatellite genotypes were included in the analysis (n = 757). Open circles are the PC scores for individual fish, and the filled circles are the centroids (bivariate means) for each of the 25 groups discussed in the text. PC axes 1 and 2 account for only 10.5% of the total molecular variance.

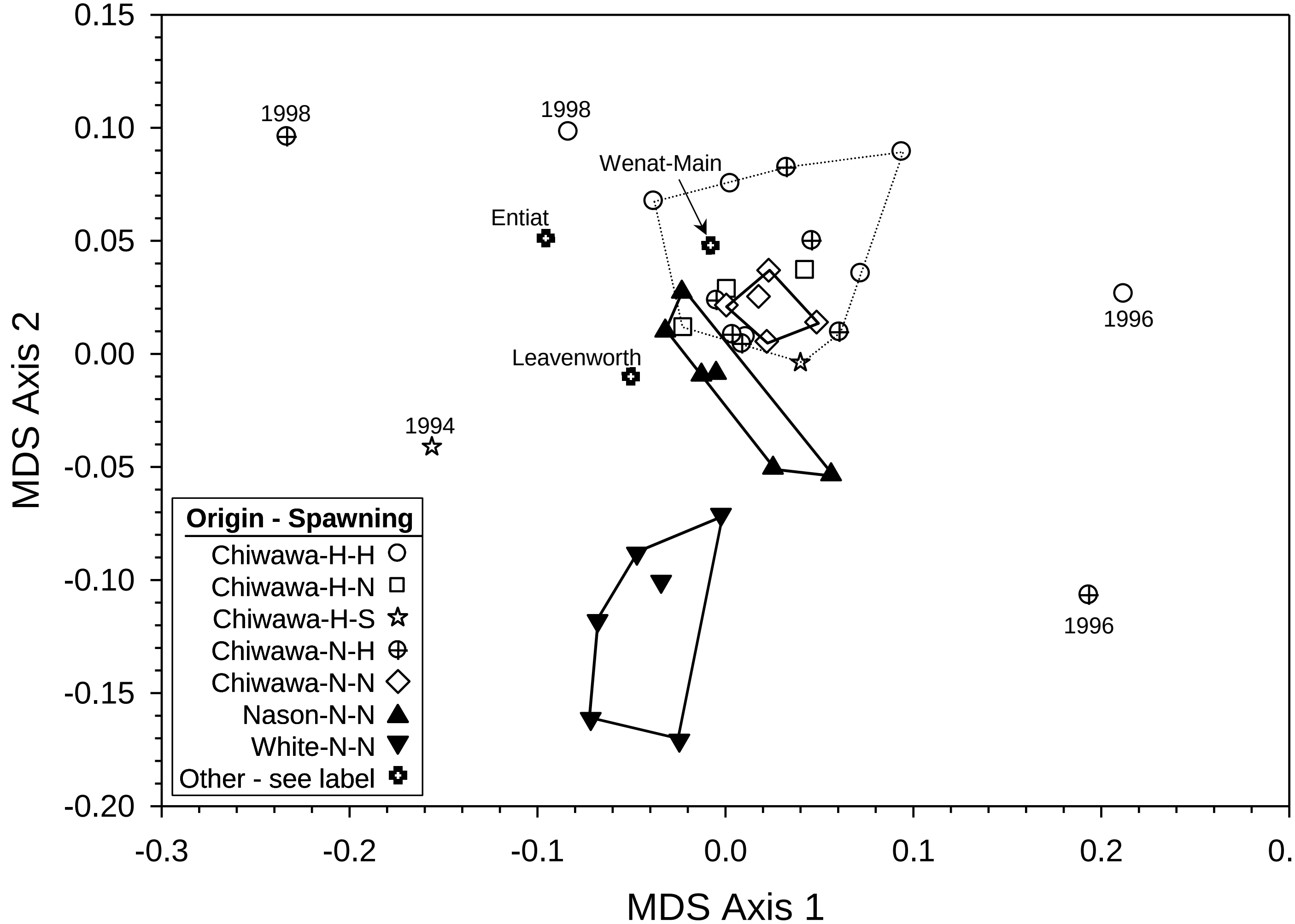

Figure 7. Multidimensional scaling plot from an allele-sharing distance matrix calculated from the Chiwawa origin data set and all other non-Chiwawa collections, except Little Wenatchee River. Legend is read with abbreviations beginning with origin and then spawning location. H=hatchery, N=natural, and S=smolts. Polygons with solid lines enclose the natural-origin natural spawner collections from each population (i.e., river). The polygon with the dotted lines enclose all Chiwawa collections, except for the five outlier collections, as discussed in text.

Table 1 Summary of within population genetic data. Chiwawa collection data are summarized in A) by origin of the sample (i.e., clipped vs. non-clipped). All collection data are summarized in B) by spawning location (i.e., hatchery broodstock or on spawning grounds). Hz is heterozygosity, HWE is the statistical significance of deviations from Hardy-Weinberg expectations (* = 0.05, ** = 0.01, and *** = 0.001), LD is the proportion of pairwise locus tests (across all populations) exhibiting linkage disequilibrium (bolded values are statistically significant), and the last column is mean number of alleles per locus.

Collection	Sample size	Gene Diversity	Observed Hz	HWE	F_{IS}	LD	Mean # Alleles
A) Origin							
1993 Chiwawa Hatchery	95	0.77	0.79	***	-0.02	**0.86**	14.00
1994 Chiwawa Hatchery	95	0.76	0.77	***	-0.01	**0.91**	11.38
1996 Chiwawa Hatchery	8	0.75	0.81	-	-0.01	0.00	8.23
1998 Chiwawa Hatchery	27	0.81	0.82	-	0.00	0.04	12.62
2000 Chiwawa Hatchery	43	0.75	0.78	***	-0.01	**0.19**	12.46
2001 Chiwawa Hatchery	69	0.77	0.80	***	-0.02	**0.14**	15.31
2004 Chiwawa Hatchery	72	0.77	0.77	***	0.01	**0.45**	15.92
2005 Chiwawa Hatchery	91	0.79	0.82	*	-0.03	**0.05**	16.15
2006 Chiwawa Hatchery	95	0.80	0.84	***	-0.05	**0.49**	15.85
1989 Chiwawa Natural	36	0.76	0.78	-	0.01	0.00	12.77
1993 Chiwawa Natural	62	0.78	0.81	-	-0.02	0.04	15.85
1996 Chiwawa Natural	8	0.72	0.78	-	-0.02	0.00	7.54
1998 Chiwawa Natural	10	0.78	0.84	-	0.00	0.00	8.23
2000 Chiwawa Natural	39	0.78	0.79	***	0.00	**0.10**	14.00
2001 Chiwawa Natural	75	0.78	0.80	-	-0.03	0.03	15.31
2004 Chiwawa Natural	85	0.78	0.77	-	0.02	0.01	15.77
2005 Chiwawa Natural	90	0.79	0.79	-	0.01	0.01	16.15
2006 Chiwawa Natural	96	0.80	0.81	-	-0.01	0.01	16.46

Table 1 Within population genetic data analysis summary continued.

Collection	Sample size	Gene Diversity	Observed Hz	HW	F_{IS}	LD	Mean # Alleles
B) Spawning Location							
1993 Chiwawa Broodstock	62	0.78	0.81	-	-0.02	0.00	15.85
1996 Chiwawa Broodstock	16	0.75	0.79	-	-0.02	0.00	10.92
1998 Chiwawa Broodstock	37	0.82	0.83	-	0.00	0.01	14.38
2000 Chiwawa Broodstock	82	0.78	0.78	***	0.00	**0.32**	15.62
2001 Chiwawa Broodstock	89	0.78	0.80	*	-0.02	**0.13**	15.77
2004 Chiwawa Broodstock	61	0.77	0.76	*	0.02	**0.13**	14.92
2005 Chiwawa Broodstock	75	0.79	0.78	*	0.02	0.01	15.85
2006 Chiwawa Broodstock	89	0.80	0.83	-	-0.03	**0.05**	16.46
1989 Chiwawa River	36	0.76	0.78	-	0.01	0.00	12.77
2001 Chiwawa River	55	0.78	0.80	-	-0.02	**0.09**	14.00
2004 Chiwawa River	96	0.78	0.78	*	0.01	**0.18**	17.23
2005 Chiwawa River	106	0.79	0.82	*	-0.02	**0.06**	16.69
2006 Chiwawa River	102	0.80	0.83	***	-0.03	**0.10**	16.77
1989 White River	48	0.75	0.75	-	0.01	0.01	12.85
1991 White River	19	0.76	0.76	-	0.03	0.00	10.92
1992 White River	22	0.75	0.79	-	-0.02	0.01	11.00
1993 White River	21	0.75	0.69	*	0.10	0.00	10.15
2005 White River	29	0.75	0.77	-	-0.01	0.03	12.23
2006 White River	40	0.76	0.76	-	0.01	0.04	13.38

Table 1 Within population genetic data analysis summary continued.

Collection	Sample size	Gene Diversity	Observed Hz	HW	F_{IS}	LD	Mean # Alleles
1993 Little Wenatchee R.	19	0.84	0.85	-	0.02	0.00	11.23
1993 Nason Creek	45	0.78	0.80	-	-0.01	0.01	13.77
2000 Nason Creek	51	0.76	0.78	-	-0.02	**0.13**	13.92
2001 Nason Creek	41	0.79	0.81	-	-0.01	**0.08**	14.23
2004 Nason Creek	38	0.76	0.76	-	0.02	0.03	13.23
2005 Nason Creek	45	0.78	0.82	-	-0.04	0.03	14.92
2006 Nason Creek	48	0.80	0.82	-	-0.01	0.00	15.77
2001 Wenatchee River	32	0.79	0.80	*	0.00	0.04	12.85
2000 Leavenworth NFH	73	0.80	0.82	*	-0.02	**0.15**	16.23
1997 Entiat NFH	37	0.81	0.83	-	-0.01	**0.06**	14.38

Table 2 Demographic data for Chiwawa Hatchery and Chiwawa natural spring Chinook salmon. BS is census size of hatchery broodstock, pNOB is the proportion of hatchery broodstock of natural origin, NOS is the census size of natural-origin spawners present in Chiwawa River, HOS is the census size of hatchery-origin spawners present in Chiwawa River, Total is NOS and HOS combined, and pNOS is the proportion of spawners present in Chiwawa River of natural origin.

	Hatchery		In River			
Brood Year	BS	pNOB	NOS	HOS	Total	pNOS
1989	28	1	1392	0	1392	1.00
1990	18	1	775	0	775	1.00
1991	32	1	585	0	585	1.00
1992	78	1	1099	0	1099	1.00
1993	94	1	677	491	1168	0.58
1994	11	0.64	190	90	280	0.68
1995	0	0	8	50	58	0.14
1996	18	0.44	131	51	182	0.72
1997	111	0.29	210	179	389	0.54
1998	47	0.28	134	45	178	0.75
1999	0	0	119	13	132	0.90
2000	30	0.3	378	310	688	0.55
2001	371	0.3	1280	2850	4130	0.31
2002	71	0.28	694	919	1613	0.43
2003	94	0.44	380	223	603	0.63
2004	215	0.39	820	788	1608	0.51
2005	270	0.33	250	1222	1472	0.17

Table 3 Levels of significance for pairwise tests of genic differentiation among all hatchery- and natural-origin collections used in this analysis. HS = highly significant (P < 0.000095; the Bonferroni corrected p-value for an alpha = 0.05); * = P < 0.05 (nominal critical value for most statistical test); - = P > 0.05 (not significant). A significant result between pairs of populations indicates that the allele frequencies between the pair are significantly different. Results are read by comparing the collections along the rows to collections along columns. The top block for each section is a symmetric matrix, as it compares collections within the same group.

		Chiwawa – Hatchery Origin								
		1993	1994	1996	1998	2000	2001	2004	2005	2006
Chiwawa – Hat. Origin	1993		HS	*	HS	HS	HS	HS	HS	HS
	1994	HS		HS	HS	HS	HS	HS	HS	HS
	1996	*	HS		*	-	*	-	-	*
	1998	HS	HS	*		HS	HS	HS	HS	HS
	2000	HS	HS	-	HS		HS	*	HS	HS
	2001	HS	HS	*	HS	HS		HS	*	HS
	2004	HS	HS	-	HS	*	HS		HS	HS
	2005	HS	HS	-	HS	HS	*	HS		HS
	2006	HS	HS	*	HS	HS	HS	HS	HS	
Chiwawa – Natural Origin	1989	HS	HS	-	HS	HS	*	HS	HS	HS
	1993	HS	HS	-	HS	HS	-	HS	*	HS
	1996	*	HS	-	*	-	-	-	-	-
	1998	HS	HS	-	-	HS	*	*	*	-
	2000	HS	HS	-	HS	HS	HS	*	HS	HS
	2001	HS	HS	-	HS	HS	HS	HS	*	HS
	2004	HS	HS	-	HS	HS	HS	HS	HS	HS
	2005	HS	HS	-	HS	HS	*	HS	*	HS
	2006	HS	HS	-	*	HS	HS	HS	HS	HS
Nason	1996	HS	HS	-	HS	HS	HS	HS	HS	HS
	2000	HS	HS	*	HS	HS	HS	HS	HS	HS
	2001	HS	HS	-	HS	HS	HS	HS	HS	HS
	2004	HS	HS	-	HS	HS	HS	HS	HS	HS
	2005	HS	HS	-	HS	HS	HS	HS	HS	HS
	2006	HS	HS	-	*	HS	HS	HS	HS	HS
White	1989	HS	HS	HS	HS	HS	HS	HS	HS	HS
	1991	HS	HS	-	HS	HS	HS	HS	HS	HS
	1992	HS	HS	*	HS	HS	HS	HS	HS	HS
	1993	HS	HS	*	HS	HS	HS	HS	HS	HS
	2005	HS	HS	-	HS	HS	HS	HS	HS	HS
	2006	HS	HS	HS	HS	HS	HS	HS	HS	HS
Other	Wen-M	HS	HS	*	HS	HS	*	*	-	HS
	Leaven	HS	HS	*	HS	HS	HS	HS	HS	HS
	Entiat	HS	HS	*	HS	HS	HS	HS	HS	HS

Table 3 (con't)

		Chiwawa – Natural Origin								
		1989	1993	1996	1998	2000	2001	2004	2005	2006
Chiwawa – Natural Origin	1989		-	-	-	-	*	*	*	*
	1993	-		-	*	*	*	HS	*	HS
	1996	-	-		-	-	-	-	-	-
	1998	-	*	-		*	*	HS	*	*
	2000	-	*	-	*		HS	-	HS	HS
	2001	*	*	-	*	HS		HS	*	HS
	2004	*	HS	-	HS	-	HS		HS	HS
	2005	*	*	-	*	HS	*	HS		*
	2006	*	HS	-	*	HS	HS	HS	*	
Nason	1996	*	*	-	*	*	HS	HS	HS	HS
	2000	HS	HS	HS	HS	HS	HS	HS	HS	HS
	2001	HS	*	-	*	HS	HS	HS	HS	HS
	2004	HS	HS	-	HS	HS	HS	HS	HS	HS
	2005	*	*	-	*	HS	HS	HS	HS	HS
	2006	HS	HS	-	-	HS	HS	HS	HS	HS
White	1989	HS	HS	*	HS	HS	HS	HS	HS	HS
	1991	HS	HS	*	-	HS	HS	HS	HS	HS
	1992	HS	HS	-	*	HS	HS	HS	HS	HS
	1993	HS	*	-	*	HS	HS	HS	HS	HS
	2005	HS	*	*	*	HS	HS	HS	*	HS
	2006	HS	HS	*	HS	HS	HS	HS	HS	HS
Other	Wen-M	*	-	-	-	*	*	HS	*	*
	Leaven	HS	HS	*	*	HS	HS	HS	HS	HS
	Entiat	HS	HS	*	HS	HS	HS	HS	HS	HS

Table 3 (con't)

		Nason					
		1996	2000	2001	2004	2005	2006
Nason	1996		HS	-	HS	-	*
	2000	HS		HS	HS	HS	HS
	2001	-	HS		*	-	*
	2004	HS	HS	*		*	HS
	2005	-	HS	-	*		-
	2006	*	HS	*	HS	-	
White	1989	HS	HS	HS	HS	HS	HS
	1991	*	HS	HS	HS	*	*
	1992	HS	HS	HS	HS	HS	HS
	1993	*	HS	HS	HS	HS	HS
	2005	*	HS	HS	HS	HS	HS
	2006	HS	HS	HS	HS	HS	HS
Other	Wen-M	HS	HS	HS	HS	*	HS
	Leaven	HS	HS	HS	HS	HS	HS
	Entiat	HS	HS	HS	HS	HS	HS

Table 3 (con't)

		White						Other		
		1989	1991	1992	1993	2005	2006	Wen-M 2001	Leaven 2000	Entiat 1997
White	1989		-	*	-	HS	HS	HS	HS	HS
	1991	-		-	-	*	*	*	HS	HS
	1992	*	-		-	*	*	HS	HS	HS
	1993	-	-	-		*	*	HS	HS	HS
	2005	HS	*	*	*		*	HS	HS	HS
	2006	HS	*	*	*	*		HS	HS	HS
Other	Wen-M	HS	*	HS	HS	HS	HS		HS	HS
	Leaven	HS	HS	HS	HS	HS	HS	HS		HS
	Entiat	HS	HS	HS	HS	HS	HS	HS	HS	

Table 4 Probabilities (above diagonal) and levels of significance (below diagonal) for pairwise tests of genic differentiation among all Chiwawa hatchery broodstock and Chiwawa natural spawner collections used in this analysis. HS = highly significant (P < 0.000476; the Bonferroni corrected p-value for an alpha = 0.05); * = P < 0.05 (nominal critical value for most statistical test); - = P > 0.05 (considered not significant). A significant result between pairs of populations indicates that the allele frequencies between the pair are significantly different. Pairwise comparisons between the hatchery broodstock and natural spawner collections from 2001, 2004, 2005, and 2006, respectively, are highlighted.

		Smolt		Hatchery Broodstock								Natural Spawners				
		1993	1994	1993	1996	1998	2000	2001	2004	2005	2006	1989	2001	2004	2005	2006
Smolt	1993		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1994	HS		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hatchery Broodstock	1993	HS	HS		0.9155	0.0000	0.0073	0.3647	0.0003	0.0694	0.0000	0.2220	0.0039	0.0008	0.0095	0.0000
	1996	HS	HS	-		0.0151	0.8388	0.0452	0.4916	0.3189	0.0716	0.5591	0.0759	0.8101	0.2364	0.0786
	1998	HS	HS	HS	*		0.0000	0.0000	0.0000	0.0000	0.0043	0.0000	0.0000	0.0000	0.0000	0.0005
	2000	HS	HS	*	-	HS		0.0000	0.4720	0.0000	0.0000	0.0036	0.0000	0.0712	0.0000	0.0000
	2001	HS	HS	-	*	HS	HS		0.0000	0.0059	0.0000	0.0003	**0.0000**	0.0000	0.0126	0.0000
	2004	HS	HS	*	-	HS	-	HS		0.0000	0.0000	0.0001	0.0000	**0.0012**	0.0000	0.0000
	2005	HS	HS	-	-	HS	HS	*	HS		0.0005	0.0024	0.0137	0.0025	**0.7782**	0.0018
	2006	HS	HS	HS	-	*	HS	HS	HS	*		0.0000	0.0000	0.0000	0.0000	**0.5770**
Natural Spawners	1989	HS	HS	-	-	HS	*	*	HS	*	HS		0.0023	0.0317	0.0000	0.0003
	2001	HS	HS	*	-	HS	HS	**HS**	HS	*	HS	*		0.0000	0.2641	0.0000
	2004	HS	HS	*	-	HS	-	HS	*****	*	HS	*	HS		0.0000	0.0000
	2005	HS	HS	*	-	HS	HS	*	HS	**-**	HS	HS	-	HS		0.0000
	2006	HS	HS	HS	-	*	HS	HS	HS	*	**-**	*	HS	HS	HS	

Table 5 Analysis of molecular variance (AMOVA) for the Chiwawa collections, showing the partition of molecular variance into (1) within collections, (2) among collections but within group, and (3) among group components. Each column in the table represents a separate analysis testing for differences under a different spatial or temporal hypothesis. The different analyses are grouped together in a single table for comparisons. The values within the table are percentages and the parenthetical values are P-values, or probabilities, associated with that percentage. P-values greater than 0.05 indicate that the percentage is not significantly different from zero. For example, when collections are organized by hatchery- versus natural-origin ("Origin" – fourth column), 0.11% of the molecular variance is attributed to among group (i.e., hatchery- versus natural-origin), which is not significantly different from zero. No collections (first column) indicates no organization or grouping among all collections, and the among-group percentage is equal to the F_{ST} for the entire data set.

	No Structure	Collection Year	Spawning Location	Origin	Origin-Spawning Location
Among Groups	0.26 (0.00)	0.20 (0.43)	0.05 (0.48)	0.11 (0.15)	0.11 (0.06)
Among collections - Within groups	-	0.08 (0.003)	0.24 (0.00)	0.21 (0.00)	0.18 (0.06)
Within collections	99.74 (0.00)	99.72 (0.00)	99.71 (0.00)	99.68 (0.00)	99.71 (0.00)

Table 6 F_{ST} values for all pairwise combinations of populations. Each F_{ST} is the median value for all pairwise combinations of collections within each population (the number of collections within each population is shown parenthetically next to each population name on each row). For example, the F_{ST} for the Chiwawa hatchery versus the White River (0.019) is the median value of 54 pairwise comparisons. The bold values along the center diagonal are the median F_{ST} values within each collection. For those populations with only one collection, the diagonal value was set at 0.000.

	Chiwawa-Hatchery	Chiwawa-Natural	Entiat	Leaven-worth	Nason	Wenatchee-main	White	Little Wenatchee
Chiwawa-Hatchery (9)	**0.013**	0.008	0.016	0.012	0.011	0.005	0.019	0.111
Chiwawa-Natural (9)		**0.003**	0.012	0.011	0.007	0.003	0.014	0.105
Entiat (1)			**0.000**	0.005	0.010	0.008	0.019	0.078
Leavenworth (1)				**0.000**	0.007	0.008	0.014	0.092
Nason (6)					**0.006**	0.008	0.015	0.099
Wenatchee-main (1)						**0.000**	0.012	0.098
White (6)							**0.005**	0.113
Little Wenatchee (1)								**0.000**

Table 7 As in Table 5, except data includes Chiwawa hatchery- and natural-origin, Nason Creek, and White River collections

	All Years	All Years	1989-1996	2005-2006	2005-2006
	No Structure	Origin	Origin	Origin	Collection Year
Among Groups	0.28 (0.00)	0.33 (0.00)	-0.07 (0.67)	0.43 (0.01)	-0.06 (0.57)
Among Collections - Within groups	-	0.04 (0.00)	0.22 (0.00)	0.25 (0.00)	0.64 (0.00)
Within Collections	99.72	99.63	99.85	99.32	99.41

Table 8 Individual assignment results reported are the numbers of individuals assigned to each population using the partial Bayesian criteria of Rannala and Mountain (1997) and a "jack-knife" procedure (see Methods). The population with the highest posterior probability is considered the stock of origin (i.e., no unassigned individuals). Individuals from each population are assigned to specific populations (along rows). Bold values indicate correct assignment back to population of origin. Individuals assigned to a population are read down columns. For example, of the 595 individuals from Chiwawa hatchery origin, 134 individuals were assigned to Chiwawa natural origin (reading across). Of the 511 individuals assigned to Chiwawa natural origin (reading down), 60 were from Nason Creek.

Population	Total	Unassigned	1	2	3	4	5	6	7	8
1) Chiwawa Hatchery	595	0	**371**	134	2	16	0	45	15	12
2) Chiwawa Natural	501	0	156	**269**	4	5	0	42	9	16
3) Entiat	37	0	4	5	**13**	8	0	6	1	0
4) Leavenworth	73	0	9	8	3	**33**	0	17	0	3
5) Little Wenatchee	19	0	0	0	0	0	**19**	0	0	0
6) Nason	268	0	49	60	5	11	0	**131**	1	11
7) Wenatchee Mainstem	32	0	12	9	0	1	0	2	**6**	2
8) White	179	0	22	26	0	2	0	13	1	**115**
TOTAL	1704	0	623	511	27	76	19	256	33	159

Table 9 As in Table 8, except the posterior probability from the partial Bayesian criteria of Rannala and Mountain (1997) must be 0.90 or greater, to be assigned to a population. Those individuals with posterior probabilities less than 0.90 are unassigned.

Aggregate	Total	Unassigned	1	2	3	4	5	6	7	8
1) Chiwawa Hatchery	595	332	**214**	31	1	4	0	10	3	0
2) Chiwawa Natural	501	375	30	**82**	0	1	0	5	2	6
3) Entiat	37	24	1	1	**5**	4	0	2	0	0
4) Leavenworth	73	51	0	1	1	**19**	0	1	0	0
5) Little Wenatchee	19	2	0	0	0	0	**17**	0	0	0
6) Nason	268	188	11	6	2	5	0	**53**	0	3
7) Wenatchee Mainstem	32	23	4	3	0	0	0	0	**2**	0
8) White	179	92	4	3	0	1	0	5	1	**73**
TOTAL	1704	1087	264	127	9	34	17	76	8	82

Table 10 Estimates of N_e based on bias correction method of Waples (2006) implemented in LDNe (Do and Waples unpublished). Collections are categorized by spawning location. Sample size is the harmonic mean of the sample size, 95% CI is the confidence interval calculated using Waples' (2006) equation 12, and Major Cohort assumes that each collection is 100% four-year-olds.

	Sample size	Estimated N_b	95% CI	Major Cohort	Census	N_e/N
1993 Chiwawa Broodstock	58.4	103.1	77.0 - 149.7	1989	1392	0.30
1996 Chiwawa Broodstock	15.5	30.4	19.6 - 58.1	1992	1099	0.11
1998 Chiwawa Broodstock	33.4	37.7	29.8 - 49.7	1994	280	0.54
2000 Chiwawa Broodstock	77.8	48.4	41.4 - 57.2	1996	182	1.06
2001 Chiwawa Broodstock	80.4	49.6	42.2 - 59.2	1997	389	0.51
2004 Chiwawa Broodstock	56.6	48.1	39.0 - 60.9	2000	688	0.28
2005 Chiwawa Broodstock	73	274.3	148.9 - 1131.8	2001	4130	0.27
2006 Chiwawa Broodstock	88.4	198.3	136.1 - 340.5	2002	1613	0.49
1989 Chiwawa River	26.6	5.2	3.9 - 6.3	1985		
2001 Chiwawa River	46.7	38.6	31.0 - 49.3	1997	389	0.40
2004 Chiwawa River	88.5	82.6	67.3 - 104.4	2000	688	0.48
2005 Chiwawa River	104.2	231.5	161.8 - 382.7	2001	4130	0.22
2006 Chiwawa River	101.1	107.3	87.2 - 136	2002	1613	0.27

Table 11 Summary of output from program SALMONNb and data for eight Chiwawa broodstock collections from Wenatchee River. For each pairwise comparison of samples *i* and *j*, $\tilde{S}$ is the harmonic mean sample size, *n* is the number of independent alleles used in the comparison, $\hat{N}_{b(i,j)}$ are the pairwise estimates of N_b, and Var [$\hat{N}_{b(i,j)}$] is the variance of $\hat{N}_{b(i,j)}$. $\tilde{N}_b$ is the harmonic mean of the $\hat{N}_{b(i,j)}$. Alleles with a frequency below 0.05 were excluded from the analysis to reduce potential bias.

Year	1993	1996	1998	2000	2001	2004	2005	2006
Pairwise $\tilde{S}$ (above diagonal) and *n* (below diagonal):								
1993	-	24.5	42.5	66.4	67.2	57.2	64.6	70.3
1996	82	-	21.2	25.8	26.0	24.4	25.6	26.4
1998	80	81	-	46.7	47.2	42.0	45.8	48.4
2000	80	82	84	-	78.6	65.2	75.1	82.7
2001	73	77	81	76	-	66.0	76.2	84.2
2004	77	81	75	76	78	-	63.5	69.0
2005	71	75	82	73	73	69	-	80.0
2006	81	80	84	75	74	75	72	-
Pairwise $\hat{N}_{b(i,j)}$ (above diagonal) and Var [$\hat{N}_{b(i,j)}$] (below diagonal):								
1993	-	-742.7	406.9	1240.8	-5432.0	829.8	808.9	729.0
1996	22491.2	-	110.4	-1786.5	765.9	162.8	824.7	382.7
1998	10910.4	67299.1	-	101.8	237.1	69.6	307.0	140.0
2000	6910.0	742895.8	19122.7	-	490.6	1498.2	706.9	201.6
2001	49318.3	21402.8	9754.2	6126.6	-	307.8	82.0	362.5
2004	8338.4	257267.7	24283.0	145043.4	7095.7	-	269.7	140.1
2005	31511.8	22242.5	10015.8	6596.6	114931.1	8240.4	-	599.6
2006	6223.8	43935.2	73518.7	10152.5	5885.3	12827.0	6370.8	-

$\tilde{N}_b = 269.4$

Table 12 Summary of output from program SALMONNb and data for five Chiwawa in-river spawner collections from Wenatchee River. For each pairwise comparison of samples *i* and *j*, $\tilde{S}$ is the harmonic mean sample size, *n* is the number of independent alleles used in the comparison, $\hat{N}_{b(i,j)}$ are the pairwise estimates of N_b, and Var [$\hat{N}_{b(i,j)}$] is the variance of $\hat{N}_{b(i,j)}$. $\tilde{N}_b$ is the harmonic mean of the $\hat{N}_{b(i,j)}$. Alleles with a frequency below 0.05 were excluded from the analysis to reduce potential bias.

Year	1989	2001	2004	2005	2006
Pairwise $\tilde{S}$ (above diagonal) and *n* (below diagonal):					
1989	-	33.3	40.2	41.7	42.2
2001	72	-	60.5	63.9	63.3
2004	72	77	-	95.3	94.0
2005	69	72	75	-	102.5
2006	76	76	77	78	-
Pairwise $\hat{N}_{b(i,j)}$ (above diagonal) and Var [$\hat{N}_{b(i,j)}$] (below diagonal):					
1989	-	118.4	299.0	143.3	165.3
2001	40378.8	-	181.7	-1537.3	153.5
2004	10455.2	7265.5	-	387.1	329.4
2005	20923.6	68660.6	5040.7	-	356.8
2006	16227.2	8886.9	3802.0	4522.8	-

$\tilde{N}_b = 224.2$

Table 13 Summary of output from program SALMONNb and data for three brood years that combined Chiwawa natural- and hatchery-origin samples from Wenatchee River. For each pairwise comparison of samples *i* and *j*, $\tilde{S}$ is the harmonic mean sample size, *n* is the number of independent alleles used in the comparison, $\hat{N}_{b(i,j)}$ are the pairwise estimates of N_b, and Var [$\hat{N}_{b(i,j)}$] is the variance of $\hat{N}_{b(i,j)}$. $\tilde{N}_b$ is the harmonic mean of the $\hat{N}_{b(i,j)}$. Alleles with a frequency below 0.05 were excluded from the analysis to reduce potential bias.

Year	2004	2005	2006
Pairwise $\tilde{S}$ (above diagonal) and *n* (below diagonal):			
2004	-	162	164.3
2005	77	-	188.2
2006	76	75	-
Pairwise $\hat{N}_{b(i,j)}$ (above diagonal) and Var [$\hat{N}_{b(i,j)}$] (below diagonal):			
2004	-	611.3	210.8
2005	9351.5	-	727.5
2006	14965.5	8673.9	-

$\tilde{N}_b = 386.8$

Appendix K

Genetic Diversity of Upper Columbia River Summer Chinook Salmon

Genetic Structure of upper Columbia River Summer Chinook and Evaluation of the Effects of Supplementation Programs

by

Todd W. Kassler and Scott Blankenship
Washington Department of Fish and Wildlife
Molecular Genetics Laboratory
600 Capitol Way N
Olympia, WA 98501

and

Andrew R. Murdoch
Washington Department of Fish and Wildlife
Hatchery/Wild Interactions
3515 State Highway 97A
Wenatchee, WA 98801

February 2011

Abstract

We investigated genetic relationships among temporally replicated collections of summer Chinook from the Wenatchee River, Methow River, and Okanogan River in the upper Columbia River basin. Samples from the Eastbank Hatchery – Wenatchee stock, Eastbank Hatchery – MEOK stock, and Wells Hatchery were also included in the analysis. Samples of natural- and hatchery-origin summer Chinook were analyzed and compared to determine if the supplementation program has had any impacts to the genetic structure of these populations. We also calculated the effective number of breeders for collection locations of natural- and hatchery-origin summer Chinook from 1993 and 2008. In general, population differentiation was not observed among the temporally replicated collection locations. A single collection from the Okanogan River (1993) was the only collection showing statistically significant differences. The effective number of breeders was not statistically different from the early collection in 1993 in comparison to the late collection in 2008. Overall, these analyses revealed a lack of differentiation among the temporal replicates from the same locations and among the collection from different locations, suggesting the populations have been homogenized or that there has been substantial gene flow among populations. Additional comparisons among summer-run and fall-run Chinook populations in the upper Columbia River were conducted to determine if there was any differentiation between Chinook with different run timing. These analyses revealed pairwise F_{ST} values that were less than 0.01 for the collections of summer Chinook to collections of fall Chinook from Hanford Reach, lower Yakima River, Priest Rapids, and Umatilla. Collections of fall Chinook from Crab Creek, Lyons Ferry Hatchery, Marion Drain, and Snake River had pairwise F_{ST} values that were higher in comparison to the collections of summer Chinook. The consensus clustering analysis did not provide good statistical support to the groupings, but did show relationships among collections based on geographic proximity. Overall the summer and fall run Chinook that have historically been

spawned together were not differentiated while fall Chinook from greater geographic distances were differentiated.

Introduction

The National Marine Fisheries Service (NMFS) recognizes 15 Evolutionary Significant Units (ESU) for Chinook salmon (*Oncorhynchus tshawytscha*) (Myers et al. 1998). The summer Chinook from the upper Columbia River are included in the Upper Columbia River Summer- and Fall-Run ESU, which encompasses all late-run (summer and fall), ocean-type Chinook salmon from the mainstem Columbia River and its tributaries (excluding the Snake River) between Chief Joseph and McNary Dams (Waknitz et al. 1995). Waknitz et al. (1995) concluded that due to high total abundance this ESU was not likely to become at risk from extinction. Yet, a majority of natural spawning activity was in the vicinity of Hanford Reach, and it was unclear whether natural production was self-sustaining given the vast summer Chinook artificial propagation efforts (Waknitz et al. 1995). Additionally, the Biological Review Team expressed concern about potential consequences to genetic and life-history traits from an increasing contribution of hatchery fish to total spawning escapement (Waknitz et al. 1995).

Artificial propagation of ocean-type Chinook from the middle/upper Columbia has been continuous since the implementation of the Grand Coulee Fish Maintenance Project (GCFMP) in 1939 (Myers et al. 1998). The US Fish and Wildlife Service established three hatchery programs for summer/fall Chinook during the GCFMP, Leavenworth NFH, Entiat NFH, and Winthrop NFH. The Washington Department of Fisheries (now Washington Department of Fish and Wildlife) followed with hatchery programs at Rocky Reach (1964), Wells Dam (1967), Priest Rapids (1974), and Eastbank (1990) facilities. Currently, only Leavenworth NFH and Winthrop NFH are not producing summer/fall Chinook. Entiat NFH has resumed production of summer/fall Chinook (Wells FH Stock) in 2009 and released their first yearling summer Chinook smolts in 2010. Since

1941, over 200 million ocean-type Chinook salmon have been released into the middle Columbia River Basin (Myers et al. 1998). Initially, the hatchery programs differentiated between early returning fish (i.e., stream-type) and later returning fish (i.e., ocean-type), but no distinction was made regarding the “summer” and “fall” components of the ocean-type stocks (Waknitz et al. 1995). Therefore, all Chinook salmon now migrating above Rock Island Dam descend from not only a mixture between different stocks from the basin, but also a mixture between the endemic summer and fall life histories. While hatchery protocols have been modified of late to maintain discreet summer and fall Chinook hatchery stocks (Utter et al. 1995; see also HGMP), physical evidence and genetic data suggests that summer and fall Chinook may have become homogenized. During the 1970’s and 80’s, given coded-wire tag recoveries, summer-run Chinook originating from above Rock Island Dam were believed to have spawned extensively with Hanford Reach and Priest Rapids Hatchery fish (Chapman 1994). Stuehrenberg et al. (1995) reported that 10% of their radio tagged summer Chinook were occupying typical fall-run spawning habitat on the mainstem Columbia river, and 25% of fall fish released from Priest Rapids were recovered as summers at (or above) Wells Hatchery. Genetic data reported by Marshall et al. (1995) and Waknitz et al. (1995) corroborate these observations, as genetic distances observed between summer and fall Chinook within the Upper Columbia River Summer- and Fall-Run ESU were essentially zero.

In response to the need for evaluation of the supplementation hatchery programs, both a monitoring and evaluation plan (DCPUD 2005; Murdoch and Peven 2005) and the associated analytical framework (Hays et al. 2006) were developed for the Habitat Conservation Plan’s Hatchery Committee through the joint effort of the fishery co-managers (CCT, NMFS, USFWS, WDFW, and YN) and Chelan County and Douglas County PUDs. These reports outline 10 objectives to be applied to various species assessing the impacts of hatchery operations mitigating the operation of Wells, Rocky Reach, and Rock Island hydroelectric projects. The present monitoring and evaluation study plan differs in scope from previous monitoring and evaluation projects proposed by WDFW Molecular Genetics Lab, in that it does not investigate a single watershed, but instead will encompass all summer Chinook stocks from the upper Columbia River including the three supplementation (Wenatchee, Methow, and Okanogan) and the harvest augmentation program (Wells summer Chinook). The objectives of this study were to determine if genetic diversity, population structure, and effective population size have changed in natural spawning populations as a result of the hatchery programs.

Materials and Methods

Collections

A total of 2,416 summer Chinook were collected from tributaries in the upper Columbia River basin and were analyzed (Table 1). Two collections of natural-origin summer Chinook from 1993 (prior to the supplementation program) were taken from the Wenatchee River Basin and were compared to collections of hatchery and natural-origin from 2006 and 2008 that were post-supplementation. Two pre-supplementation collections from the Methow River (1991 and 1993) were compared to post-supplementation collections from 2006 and 2008. Three pre-supplementation collections from the Okanogan River Basin (1991, 1992, and 1993) were compared with post-supplementation collections from 2006 and 2008. A collection of natural-origin summer Chinook from the Chelan River was also analyzed. Additionally, hatchery collections from Eastbank Hatchery (Wenatchee and MEOK stock) and Wells Hatchery were analyzed and compared to the in-river collections. Summer Chinook data (provided by the USFWS) from the Entiat River was also used for comparison. Lastly, data from eight collections of fall Chinook was compared to the collections of summer Chinook.

Laboratory Analyses

All laboratory analyses were conducted at the WDFW Genetics Laboratory in Olympia, Washington. Genomic DNA was extracted by digesting a small piece of fin tissue using the nucleospin tissue kits obtained from Macherey-Nagel following the recommended conditions in the user manual. Extracted DNA was eluted with a final volume of 100 µL.

Genotype information was generated using thirteen microsatellite markers following standard laboratory protocols and analysis methods. Descriptions of the loci assessed in this study and polymerase chain reaction (PCR) conditions are given in Table 2. PCR reactions were run with a thermal profile consisting of: denaturation at 95^{o}C for 3 min, denaturation at 95^{o}C for 15 sec, anneal for 30 sec at the appropriate temperature for each locus (Table 2), extension at 72^{o}C for 1 min, repeat cycle (steps 2-4), final extension at 72^{o}C for 30 minutes. PCR products were then processed with an ABI-3730 DNA Analyzer. Genotypes were visualized with a known size standard (GS500LIZ 3730) using GENEMAPPER 3.7 software. Alleles were binned in GENEMAPPER using the standardized allele sizes established for the Chinook GAPS dataset (Seeb et al. 2007).

Within-collection Statistical Analyses

Allele frequencies were calculated with CONVERT (version 1.3, Glaubitz 2003). Hardy-Weinberg proportions for all loci within each collection were calculated using GENEPOP (version 3.4, Raymond and Rousset 1995). Heterozygosity (observed and expected) was computed for each collection group using GDA (Lewis and Zaykin 2001).

Allelic richness and F_{IS} (Weir and Cockerham 1984) inbreeding coefficient were calculated using FSTAT (version 2.9.3.2, Goudet 2001). Linkage disequilibrium for each pair of loci in each collection was calculated using GENEPOP v 3.4 (10,000 dememorizations, 100 batches, and 5,000 iterations per batch). Pairwise estimates of genetic differentiation between collection groups were calculated using GENEPOP (version 3.4, Raymond and Rousset 1995). Statistical significance for the tests of Hardy-Weinberg proportions, linkage disequilibrium, and genotypic differentiation was evaluated using a Bonferroni correction of p-values to account for multiple, simultaneous tests (Rice 1989).

Between-collection Statistical Analyses

Pairwise F_{ST} estimates were computed to examine population structure among collections using GENETIX (version 4.03, Belkhir et al. 2001). This estimate uses allelic frequency data and departures from expected heterozygosity to assess differences between pairs of populations.

We used PHYLIP (version 3.5c, Felsenstein 1993) to calculate Cavalli-Sforza and Edwards (1967) pairwise chord distances between collections. Bootstrap calculations were performed using SEQBOOT followed by calculations of genetic distance using GENDIST. The NEIGHBOR-JOINING method of Saitou and Nei (1987) was used to generate the dendrograms and CONSENSE to generate a final consensus tree from the 1,000 replicates. The dendrogram generated in PHYLIP was plotted as an unrooted radial tree using TREEVIEW (version 1.6.6, Page 1996).

Effective Number of Breeders

The effective number of breeders (N_b) was estimated for pre- and post-supplementation program collections (where possible) to investigate whether hatchery programs had affected that genetic metric over the operational period. Wang (2009) derived an equation for effective size (N_e) as a function of the frequency of nested full-sib and half-sib families in a random collection of individuals.

$$\frac{1}{N_e} = \frac{1+3\alpha}{4}\left(Q_1 + Q_2 + 2Q_3\right) - \frac{\alpha}{2}\left(\frac{1}{N_1} + \frac{1}{N_2}\right) \qquad \text{(equation 10)}$$

Where α is a measure of the deviation of genotype frequencies from Hardy-Weinberg expectation (equivalent to Wright's (1969) F_{IS}), Q_i are the probabilities that a pair of offspring are paternal half sibs, maternal half sibs, or full sibs, respectively, and N_1 and N_2 are the number of male and female parents that generation, respectively. Genetic parameters (i.e., sibship distributions) were estimated for summer Chinook collections using algorithms implemented in COLONY (Jones and Wang 2009). To be clear, Wang's (2009) method as implemented here will estimate N_b, given multi-locus genotypes from each collection were partitioned by brood year for this analysis. To obtain an estimate of N_e each N_b value must be multiplied by the mean generation time of that population.

Results

Collections

A total of 2,350 individuals from 32 collections of temporally replicated samples (six locations) were analyzed (Table 1). Temporally replicated collections of hatchery and natural-origin samples were from the Wenatchee, Methow, and Okanogan Rivers. Temporally replicated hatchery-origin summer Chinook were from Wells Hatchery, Eastbank Hatchery - Wenatchee stock, and Eastbank Hatchery - Methow/Okanogan (MEOK) stock. A total of 232 of those individuals were excluded from any analyses because they failed to amplify at nine or more loci. Data for remaining 2,118 individuals were analyzed to assess differences between temporally replicated natural- and hatchery-origin summer Chinook for each location and to compare the differences among the different collection locations. Summer Chinook data from the temporally replicated collection locations were then combined and compared to fall Chinook data from the GAPS v.3.0 dataset.

Statistical Analyses

The population statistics (Hardy-Weinberg equilibrium and F_{IS}) calculated for each of the 32 temporally replicated collection locations were consistent with neutral expectations (i.e., no associations among alleles). Three collections did have a single locus that did not meet expectations (Wenatchee hatchery-origin 2006, Wells hatchery 2006, and Okanogan hatchery-origin 2009). Based on these results we suggest the collections represented randomly breeding groups and were not comprised of mixtures of individuals from different genetic source populations.

Population differentiation was assessed for each of the temporally replicated collections from within each location (Table 3). This analysis revealed the only significant difference observed within a collection location pertained to the collection from 1993 Okanogan River natural-origin samples. Because of the significant difference of this collection to the other temporal replicates it was not included in further analyses.

Given the absence of genetic differentiation observed among the temporally replicated collections, the 32 collections from the Wenatchee, Methow, and Okanogan River were combined to form three location-specific collections for analysis. Population differentiation metrics were compared among the composite Wenatchee, Methow, and Okanogan collections and eight other location-specific collections (11 locations total). Comparing all collections, there were a total of 39 significant genic test comparisons out of a total 496 (Table 4). Thirty-eight of the 39 statistically significant pairwise differences pertained to the Okanogan River and 2006 Wells Hatchery collections (Table 4). F_{ST} results are described further below.

Within-collection genetic metrics were estimated for the 11 location-specific collections of summer Chinook from the upper Columbia River, in addition to eight collections of fall Chinook (Table 1). The population statistics (Hardy-Weinberg equilibrium and F_{IS}) calculated for these collections of summer and fall

Chinook were also consistent with neutral expectations. The collection from Lyons Ferry Hatchery had one locus that did not meet expectations and the collections from Crab Creek and Marion Drain both had three loci that did not meet expectations.

The hatchery collections in general had a higher percentage of significantly linked loci; however the observed genetic diversity were similar for the natural and hatchery-origin collections. Analysis of allelic richness was based on 11 individuals per collection, the minimum number of individuals across all collections with complete multilocus genotypes. The largest number of linked loci occurred in the Crab Creek, Entiat River, and Okanogan natural-origin collections. Allelic richness was on average lower in the collections of summer Chinook (10.7) collections in comparison to the collections of fall Chinook (11.0).

Pairwise F_{ST} (Table 4) estimates revealed low levels of differentiation, where all observed F_{ST} values between the collections of summer Chinook were lower than 0.0096. There were 15 out of 28 comparisons between collections of summer Chinook that were significantly different from zero and occurred primarily from comparisons of the Okanogan River (hatchery and natural-origin) and Wells Hatchery to all other collections. The collection of Eastbank Hatchery – MEOK stock was differentiated from the Wenatchee River natural-origin and Entiat River collections. The collection from the Chelan River had a small sample size of 23 individuals and only differentiated from the Eastbank Hatchery – MEOK stock. F_{ST} estimates regarding pairwise comparisons between each of four fall Chinook collection locations (Crab Creek, Lyons Ferry Hatchery, Marion Drain, and Snake River) to all other collections were significantly different from zero (Table 5). Pairwise comparisons for three other fall Chinook collections (Hanford Reach, lower Yakima River, and Umatilla River) to the collections of summer Chinook were significantly different from zero (Table 6). The only fall Chinook collection that was not significantly differentiated from all of the summer Chinook was Priest Rapids.

The relative genetic relationships among the test groups were assessed using the consensus clustering analysis (Figure 1). Statistical support for the dendrogram topology (i.e., tree shape) was low regarding the branching that separated the collections of summer Chinook from the upper Columbia River. The collections of fall Chinook; however were supported with bootstrap support over 76% with the exception of three collections (lower Yakima River, Crab Creek, and Umatilla River). In other words, 760 of the 1000 bootstrap replicates supported the placement of the node separating summer and fall collections. The collection from the Chelan River had bootstrap support of 68%; however the sample size for that collections was small (N = 23). Even though the bootstrap support was low among the collections of summer Chinook there was concordance between geography and genetic distance.

Where comparisons were possible between pre- and post-supplementation program collections, the effective number of breeders (N_b) estimated to have comprised those collections were slightly lower for contemporary (2008) collections; however in all cases the 95% confidence intervals overlapped between historical and contemporary collections, suggesting statistical equivalency. Regarding Wenatchee River collections, the point estimates of N_b ranged from 134 (08FU) to 190 (93DD), where all collections had overlapping confidence intervals (Table 7). The upper bound of the 1989 brood year for collection 93DD was very large, suggesting the sample size was insufficient for properly inferring the sibship distribution within the collection. Comparing the Okanogan natural collections 93ED and 08GA, the estimated N_b were 142 (CI 102 – 203) and 127 (CI 92 – 180), respectively. For the Eastbank Hatchery MEOK stock comparisons, the N_b estimated for the 93DF collection was 171 (CI 129 – 229), as compared to the 166 (CI 126 – 226) estimated for collection 08MO. In all cases, the estimated N_b can be converted to effective population size (N_e) by multiplying the estimate by the mean generation time.

Discussion

The collections of summer Chinook populations from the upper Columbia River are of interest because census sizes are reduced below historic levels and are the subject of mitigation and supplementation hatchery programs. Concern over the impacts of hatchery supplementation programs on the genetic integrity of natural-origin populations led to our primary objective, which was to evaluate genetic metrics for temporally replicated collections of summer Chinook in the upper Columbia River pre and post hatchery supplementation. A similar analysis by Kassler and Dean (2010) was conducted on spring Chinook in the Tucannon River to evaluate the effects of a supplementation and captive brood program on natural-origin stocks. Additionally, upper Columbia River spring Chinook supplementation programs (Blankenship et al. 2007; Small et al. 2007), spring and fall Chinook populations in the Yakima Basin (Kassler et al. 2008), and a potentially unique population of fall Chinook in Crab Creek (Small et al. 2010) have been evaluated. In the present analysis of summer Chinook populations, collections of pre- and post- supplementation summer Chinook were collected from the Wenatchee River, Methow River, and Okanogan River Basins and analyzed to determine if the genetic profile has changed as a result of the supplementation program. Analysis was then conducted on the collections of summer run to compare the fall run Chinook collections in the upper Columbia River basin.

Allozyme analyses of these three summer run Chinook stocks in the upper Columbia River have identified that each stock was distinct, with a closer relationship detected between the Wenatchee and Methow Rivers (WDF and WDW 1993, Marshall 2002). Wenatchee summer Chinook are thought to be a mixture of native summer Chinook and Chinook from the Grand Coulee Fish Maintenance Project (GCFMP). The goal of the GCFMP project between 1939 and 1943 was to trap migrating Chinook salmon at Rock Island dam (75 miles below Grand Coulee) and homogenize the populations, which reduced the genetic uniqueness of the distinct tributary populations present in the upper Columbia River.

We found allele frequencies for individual temporally replicated hatchery- and natural-origin collection locations of adult summer Chinook were not significantly different from that expected of a single underlying population, except for one collection (1993 Okanogan natural-origin; Table 3). This collection was differentiated to the Okanogan collections in 2006 and 2008; however it was not differentiated from the collection in 1992. The Okanogan collection from 1992 was also not differentiated to any other collection; therefore the difference in the collection from Okanogan 1993 was likely not an indication of genetic change from pre supplementation to post supplementation. The collection was however dropped from further analyses so as to not confuse interpretation of results. The lack of allelic differentiation observed among the temporally replicated collections was interpreted as the genetic metrics from each location in the early 1990's did not differ from the samples collected in 2008. Spanning a few generations, allele frequencies are not expected to change for large populations at genetic equilibrium. In contrast, changes in allele frequencies of small populations may occur due to the stochastic sampling of genes from one generation to the next (i.e., genetic drift).

A second round of analyses was conducted to evaluate the genetic relationships of the summer run collections (temporal collections were combined) with data from the Entiat River, Chelan River, and eight collections of fall Chinook. Assessment of the relationship between the summer run collections in comparison to each other provided very little evidence of genetic differentiation between these collections. While population differentiation did show some significant differences between the Okanogan River and Wells Hatchery collections, all of the pairwise F_{ST} values were below 0.003. Meaning that a very small proportion of the observed genetic variation could be attributed to restrictions in gene flow (i.e., population structure)

The comparison of the hatchery-origin collections revealed a lack of differentiation between the Eastbank Hatchery – Wenatchee stock, Eastbank Hatchery – MEOK stock, and the Wells Hatchery (with exception of the 2006 collection). The genetic similarity or low level of genetic differentiation among these stocks suggests that there has been an integration of natural- and hatchery-origin summer Chinook in the upper Columbia River or a lack of ancestral genetic difference. The difference of the 2006 Wells Hatchery collection to the other collections is most likely a result of sampling effect because of the lack of differentiation among the stocks in the basin. If the 2006 collection had been mixed from different sources of summer Chinook there would not be a detectable level of differentiation as was seen with the 2006 sample.

The analyses to compare summer and fall Chinook collections provided some understanding on the genetic relationships of Chinook with different run timings in the upper Columbia River basin. Historically, the hatchery programs in the upper Columbia River were separated into groups of the early returning fish (i.e., stream-type) and later returning fish (i.e., ocean-type), but the programs did not sort individuals identified as “summer” or “fall” stocks (Waknitz et al. 1995). Now all Chinook salmon that are migrating above Rock Island Dam descend from a mixture of different stocks from the upper Columbia River basin, but also a mixture between the endemic summer and fall life histories.

Small et al. (2010) conducted an analysis on summer run and fall run Chinook in the upper Columbia River and concluded that Crab Creek Chinook in the upper Columbia River were genetically distinct to all other fall and summer run Chinook stocks that were analyzed. They did note a departure from Hardy Weinberg expectation as a result of a null allele at the microsatellite locus *Ogo-4* and a higher linkage disequilibrium value due to the inclusion of family groups in one of their samples. Kassler et al. (2008) found differentiation among spring and fall Chinook populations in the Yakima River.

The tests of pairwise F_{ST} indicated a very low level of genetic differentiation (less than one percent difference) between collections of summer-run Chinook and fall-run Chinook. The range of pairwise F_{ST} values for comparisons between the summer run and fall run collections was 0.0016 – 0.0248. The larger values from the range were associated to the collections from Crab Creek, Lyons Ferry Hatchery, and Marion Drain. Studies by Kassler et al. (2008) and Small et al. (2010) have documented differences among the populations of these collections to others within the upper Columbia River basin. The low pairwise F_{ST} values between Priest Rapids and Hanford Reach collections and the summer run collections were not surprising because summer-run Chinook originating from above Rock Island Dam were believed to have spawned extensively with Hanford Reach and Priest Rapids Hatchery fish during the 1970's and 80's (Chapman 1994). The lack of differentiation among the summer and fall stocks in the Columbia River was also identified by Utter et al. (1995) and the HGMP where they state physical evidence and genetic data suggests that summer and fall Chinook may have become homogenized.

Despite low levels of statistical bootstrap support for dendrogram topology (i.e., tree shape), there was concordance observed between geographic location and the genetic relationships among the summer and fall Chinook populations. The collections from the Okanogan (hatchery and natural-origin) did separate out with collections from Wells Dam Hatchery, Entiat River, and Eastbank Hatchery – MEOK stock, and were next to a group of the Methow and Wenatchee collections. The fall Chinook populations are also separated to the summer collections and the position of all but three of these collections (lower Yakima River, Crab Creek, and Umatilla River) were statistically supported. The geographic proximity of the fall collections seemed to follow the observed pattern in this dendrogram. The relationship of the Snake River and Lyons Ferry Hatchery in proximity to the collection from Marion Drain was not surprising while the relationship between Priest Rapids and Hanford Reach was easily a result of the stocking practices of fall Chinook in the 1970 and 1980's.

A secondary objective of this study was to determine if the effective population size of upper Columbia River summer Chinook populations had changed over time due to supplementation efforts. We observed that the number of effective breeders in the collections from 1993 and 2008 has not changed thus providing reason to believe that the genetic diversity of summer Chinook in the upper Columbia River has not been altered through the supplementation program.

Acknowledgements

Chelan County PUD, Grant County PUD, and Washington State General Funds provided funding for this project. Cherril Bowman (WDFW – Molecular Genetics Laboratory) processed samples in the laboratory. Maureen (Mo) Small provided data for some collections and discussion of the analyses. USFWS provided data from the Entiat River.

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Table 1. Samples of adult hatchery- and natural-origin summer and fall Chinook that were analyzed from the upper Columbia River. Total number of individuals that were analyzed / individuals with data for 9 or more loci that were included in the analysis. Collection statistics (allelic richness, linkage disequilibrium (before and after Bonferroni correction), F_{IS}, heterozygosity (H_O and H_E)) and p-values for deviations from Hardy-Weinberg equilibrium (HWE). P-values were defined as significant after implementation of Bonferroni correction for multiple tests (Rice 1989).

WDFW GSI code[a]	Collection location	N =	Allelic Richness[b]	Linkage Disequilibrium[c]	F_{IS} (p-value)[d]	H_O	H_E
93DD	Wenatchee River upstream of Tumwater Dam - natural origin	51 / 45					
93DE	Wenatchee River downstream of Tumwater Dam - natural origin	88 / 88					
06CQ	Wenatchee River upstream of Tumwater Dam - natural origin	95 / 86					
06CR	Wenatchee River downstream of Tumwater Dam - natural origin	95 / 82					
08FV	Wenatchee River upstream of Tumwater Dam - natural origin	95 / 82					
08FW	Wenatchee River downstream of Tumwater Dam - natural origin	95 / 87					
	Wenatchee River - Natural origin combined	**519 / 470**	**10.7**	**17 / 4**	**0.001 (0.403)**	**0.8504**	**0.8513**
06CP	Wenatchee River - hatchery origin	95 / 70					
08FU	Wenatchee River - hatchery origin	95 / 83					
	Wenatchee River - Hatchery origin combined	**190 / 153**	**10.6**	**18 / 6**	**0.018 (0.013)**	**0.8409**	**0.8561**
93EC	Methow River - natural origin	27 / 27					
06CT	Methow River - natural origin	95 / 90					
08FY	Methow River - natural origin	95 / 88					
09CO	Methow River - natural origin	91 / 80					
	Methow River - Natural origin combined	**308 / 285**	**10.7**	**4 / 1**	**0.006 (0.160)**	**0.8506**	**0.8554**
06CS	Methow River - hatchery origin	14 / 8					
08FX	Methow River - hatchery origin	21 / 18					
09CP	Methow River - hatchery origin	19 / 18					
	Methow River - Hatchery origin combined	**54 / 44**	**10.8**	**11 / 2**	**-0.003 (0.593)**	**0.8553**	**0.8523**

Table 1 continued.

92FM	Okanogan River - natural origin	49 / 46					
93ED*	Okanogan River - natural origin	103 / 87					
06CV	Okanogan River - natural origin	95 / 88					
08GA	Okanogan River - natural origin	95 / 92					
09CN	Okanogan River - natural origin	133 / 126					
	Okanogan River - Natural origin combined	**475 / 439**	**10.8**	**9 / 4**	**0.003 (0.304)**	**0.8563**	**0.8596**
* - not included in the combined dataset							
06CU	Okanogan River - hatchery origin	58 / 49					
08FZ	Okanogan River - hatchery origin	19 / 18					
09CM	Okanogan River - hatchery origin	117 / 107					
	Okanogan River - hatchery origin combined	**194 / 174**	**10.8**	**31 / 10**	**-0.011 (0.920)**	**0.8678**	**0.8586**
91FL	Wells Hatchery	68 / 42					
92FK	Wells Hatchery	25 / 23					
93DG	Wells Hatchery	11 / 9					
06DM	Wells Hatchery	95 / 91					
08HY	Wells Hatchery	95 / 91					
	Wells Hatchery combined	**294 / 256**	**10.7**	**8 / 3**	**-0.001 (0.529)**	**0.8670**	**0.8665**
08MN	**Eastbank Hatchery - Wenatchee River stock**	**95 / 90**	**10.7**	**6 / 1**	**0.020 (0.024)**	**0.8326**	**0.8498**
92FO	Eastbank Hatchery - Methow / Okanogan (MEOK) stock	36 / 33					
93DF	Eastbank Hatchery - Methow / Okanogan (MEOK) stock	90 / 86					
08MO	Eastbank Hatchery - Methow / Okanogan (MEOK) stock	95 / 88					
	Eastbank Hatchery - MEOK stock combined	**221 / 207**	**10.7**	**2 / 0**	**-0.005 (0.782)**	**0.8647**	**0.8604**
		2,350 / 2,118					

Table 1 continued.

06KN	**Chelan River**	**70 / 23**	**10.3**	**11 / 0**	**0.027 (0.118)**	**0.8334**	**0.8556**
Data provided by USFWS							
	Entiat River - summer Chinook	**190**	**10.9**	**33 / 10**	**0.008 (0.119)**	**0.8553**	**0.8625**
Data from Small et al. (2010)							
08EH	Crab Creek	108					
09AZ	Crab Creek	291					
	Crab Creek	**399**	**10.5**	**35 / 14**	**0.018 (0.000)**	**0.8519**	**0.8676**
GAPS v.3.0 data							
	Priest Rapids Hatchery - fall Chinook	**81**	**11.1**	**3 / 2**	**0.015 (0.079)**	**0.8591**	**0.8723**
	Hanford Reach - fall Chinook	**220**	**11.3**	**4 / 0**	**0.010 (0.068)**	**0.8661**	**0.8746**
	Umatilla - fall Chinook	**96**	**11.2**	**17 / 6**	**-0.003 (0.623)**	**0.8719**	**0.8693**
	lower Yakima River - fall Chinook	**103**	**11.0**	**3 / 1**	**0.000 (0.511)**	**0.8724**	**0.8721**
	Marion Drain - fall Chinook	**190**	**10.8**	**9 / 4**	**0.022 (0.001)**	**0.8586**	**0.8782**
	Lyons Ferry Hatchery - fall Chinook	**186**	**10.6**	**7 / 4**	**0.013 (0.033)**	**0.8527**	**0.8641**
	Snake River - fall Chinook	**521**	**11.1**	**0 / 0**	**-0.001 (0.634)**	**0.8720**	**0.8708**
		NA / 2,009					

[a] - Year that samples were collected is identifed by the two numbers in the WDFW GSI code

[b] - based on a minimum of 11 diploid individuals

[c] - adjusted alpha p-value = 0.0006

[d] - adjusted alpha p-value = 0.0002

Table 2. PCR conditions and microsatellite locus information (number alleles/locus and allele size range) for multiplexed loci used for the analysis of Chinook. Also included are the observed and expected heterozygosity (H_o and H_e) for each locus.

PCR Conditions			Locus statistics		Heterozygosity		
Poolplex	Locus	Dye Label	# Alleles/ Locus	Allele Size Range (bp)	H_o	H_e	References
Ots-M	*Ots-201b*	blue	49	137 - 334	0.9474	0.9544	Unpublished
	Ots-208b	yellow	56	154 - 378	0.9523	0.9672	Greig et al. 2003
	Ssa-408	red	32	184 - 308	0.9177	0.9214	Cairney et al. 2000
Ots-N	*Ogo-2*	red	22	206 - 260	0.8526	0.8673	Olsen et al. 1998
Ots-O	*Ogo-4*	blue	20	128 - 170	0.6694	0.7028	Olsen et al. 1998
	Ots-213	yellow	45	178 - 370	0.9430	0.9525	Greig et al. 2003
	Ots-G474	red	16	152 - 212	0.6816	0.6838	Williamson et al. 2002
Ots-R	*Ots-3M*	blue	15	128 - 158	0.7854	0.7938	Banks et al. 1999
	Omm-1080	green	54	162 - 374	0.9517	0.9670	Rexroad et al. 2001
Ots-S	*Ots-9*	red	9	99 - 115	0.6531	0.6543	Banks et al. 1999
	Ots-212	blue	33	123 - 251	0.9205	0.9360	Greig et al. 2003
Ots-T	*Oki-100*	blue	50	164 - 361	0.9500	0.9567	Unpublished
	Ots-211	red	34	188 - 327	0.9325	0.9414	Greig et al. 2003

Table 3. Tests of population differentiation for temporal collections of summer Chinook from natural and hatchery-origin populations in the upper Columbia River. P-values that are highlighted grey are significantly different after Bonferroni correction (Rice 1989). Adjusted alpha p-value was 0.0001 . The H and W in the collection identifier is for wild or hatchery-origin and the two digit number identifes the year samples were collected.

Wenatchee River

	WenW93U	WenW93D	WenH06	WenW06U	WenW06D	WenH08	WenW08U	WenW08D
WenW93U	****							
WenW93D	0.0162	****						
WenH06	0.0033	0.0102	****					
WenW06U	0.3039	0.1642	0.4795	****				
WenW06D	0.0261	0.0160	0.0678	0.5300	****			
WenH08	0.1126	0.0708	0.0073	0.4359	0.0893	****		
WenW08U	0.2115	0.1148	0.4191	0.7243	0.3830	0.8856	****	
WenW08D	0.1915	0.0014	0.7047	0.4928	0.1671	0.7755	0.7665	****

D - collection was downstream of Tumwater Dam; U - collection was upstream of Tumwater Dam

Methow River

	MetW93	MetH06	MetW06	MetH08	MetW08	MetW09	MetH09
MetW93	****						
MetH06	0.3962	****					
MetW06	0.5481	0.4688	****				
MetH08	0.1408	0.1192	0.2052	****			
MetW08	0.8219	0.8937	0.6156	0.3779	****		
MetW09	0.2564	0.4282	0.2502	0.0328	0.7309	****	
MetH09	0.1543	0.5678	0.0547	0.0017	0.0098	0.0073	****

Okanogan River

	OkanW92	OkanW93	OkanH06	OkanW06	OkanH08	OkanW08	OkanH09	OkanW09
OkanW92	****							
OkanW93	0.0066	****						
OkanH06	0.0193	0.0000	****					
OkanW06	0.2843	0.0082	0.0031	****				
OkanH08	0.1290	0.1106	0.0652	0.7329	****			
OkanW08	0.0106	0.0029	0.0082	0.4075	0.7396	****		
OkanH09	0.0187	0.0001	0.0094	0.0551	0.2214	0.0281	****	
OkanW09	0.0527	0.0000	0.0024	0.7130	0.0262	0.0065	0.0002	****

Table 3 continued.

Wells Dam Hatchery

	Wells91	Wells92	Wells93	Wells06	Wells08
Wells91	****				
Wells92	0.5863	****			
Wells93	0.0490	0.0784	****		
Wells06	0.0089	0.0100	0.0542	****	
Wells08	0.0819	0.1088	0.2552	0.0256	****

Eastbank Hatchery - Wenatchee and MEOK stocks

	EBHWen08	EBHME92	EBHME93	EBHME08
EBHWen08	****			
EBHME92	0.8681	****		
EBHME93	0.0251	0.8661	****	
EBHME08	0.0086	0.9563	0.1895	****

Table 4. F_{ST} pairwise comparisons and genotypic tests of differentiation for hatchery- and natural-origin summer Chinook from the upper Columbia River. Above the diagonol are the F_{ST} values and below are p-values for the test of genotypic differentiation. Non-significant p-values for the result of the genotypic differentiation test are in bold type and F_{ST} values that are not significantly different from zero are in bold type.

	Wenatchee Hatchery	Wenatchee Natural	Methow Hatchery	Methow Natural	Okanogan Hatchery	Okanogan Natural	Wells Hatchery	Eastbank Wenatchee stock	Eastbank MEOK stock	Entiat River	Chelan River
Wenatchee Hatchery	****	**0.0000**	**0.0011**	**0.0000**	**0.0013**	**0.0010**	0.0015	**0.0004**	**0.0007**	**0.0004**	**0.0072**
Wenatchee Natural	**0.4351**	****	**0.0016**	**0.0000**	0.0014	0.0016	0.0024	**0.0006**	0.0012	0.0009	**0.0068**
Methow Hatchery	**0.3800**	**0.0205**	****	**0.0012**	0.0029	**0.0008**	**0.0027**	**0.0014**	**0.0022**	**0.0019**	**0.0078**
Methow Natural	**0.2237**	**0.6566**	**0.1502**	****	**0.0011**	0.0011	0.0013	**0.0007**	**0.0007**	**0.0008**	**0.0053**
Okanogan Hatchery	0.0001	0.0000	**0.0364**	**0.0008**	****	**0.0010**	**0.0014**	0.0029	**0.0000**	**0.0007**	**0.0055**
Okanogan Natural	0.0000	0.0000	**0.1755**	0.0000	**0.0003**	****	0.0016	0.0023	**0.0005**	**0.0008**	**0.0049**
Wells Hatchery	0.0000	0.0000	**0.0129**	0.0000	0.0000	0.0000	****	0.0036	**0.0006**	**0.0008**	**0.0041**
Eastbank Wenatchee	**0.5261**	**0.4102**	**0.1215**	**0.8404**	**0.0015**	0.0000	0.0000	****	**0.0018**	0.0030	0.0096
Eastbank MEOK stock	**0.0485**	0.0000	**0.4246**	**0.0009**	**0.5786**	**0.0051**	0.0000	**0.0065**	****	**0.0005**	**0.0039**
Entiat River	**0.0565**	0.0000	**0.1795**	**0.0044**	**0.0005**	0.0000	**0.0032**	**0.0039**	**0.0042**	****	**0.0052**
Chelan River	**0.0091**	**0.0026**	**0.0182**	**0.0156**	**0.0048**	**0.0030**	**0.0066**	**0.0059**	**0.0493**	**0.0617**	****

Table 5. F_{ST} pairwise comparisons and genotypic tests of differentiation for fall Chinook. Above the diagonol are the F_{ST} values and below are p-values for the test of genotypic differentiation. Non-significant p-values for the result of the genotypic differentiation test are in bold type and F_{ST} values that are not significantly different from zero are in bold type.

	Crab Creek	Hanford Reach Fall	Lyons Ferry Hatchery Fall	lower Yakima River Fall	Marion Drain Fall	Priest Rapids Fall	Umatilla River Fall	Snake River Fall
Crab Creek	****	0.0087	0.0134	0.0079	0.0143	0.0107	0.0073	0.0097
Hanford Reach Fall	0.0000	****	0.0077	**0.0000**	0.0064	**0.0000**	**0.0000**	0.0022
Lyons Ferry Hatchery Fall	0.0000	0.0000	****	0.0063	0.0074	0.0092	0.0062	0.0029
lower Yakima River Fall	0.0000	**0.4140**	0.0000	****	0.0054	**0.0000**	**0.0000**	0.0018
Marion Drain Fall	0.0000	0.0000	0.0000	0.0000	****	0.0067	0.0061	0.0060
Priest Rapids Fall	0.0000	**0.0695**	0.0000	**0.0083**	0.0000	****	**0.0000**	0.0027
Umatilla River Fall	0.0000	**0.4879**	0.0000	**0.4896**	0.0000	**0.2539**	****	0.0011
Snake River Fall	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	****

Table 6. F_{ST} pairwise comparisons and genotypic tests of differentiation for hatchery- and natural-origin summer Chinook from the upper Columbia River and fall Chinook. Above the diagonol are the F_{ST} values and below are p-values for the test of genotypic differentiation. Non-significant p-values for the result of the genotypic differentiation test are in bold type and F_{ST} values that are not significantly different from zero are in bold type.

Population Differentiation

	Wenatchee Hatchery	Wenatchee Natural	Methow Hatchery	Methow Natural	Okanogan Hatchery	Okanogan Natural	Wells Hatchery	Eastbank Wenatchee stock	Eastbank MEOK stock	Entiat River	Chelan River
Crab Creek	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hanford Reach Fall	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0349**
Lyons Ferry Hatchery Fall	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
lower Yakima River Fall	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0074**
Marion Drain Fall	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Priest Rapids Fall	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0642**
Umatilla River Fall	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0579**
Snake River Fall	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 6 continued.

Pairwise F_{ST}

	Crab Creek	Hanford Reach Fall	Ferry Hatchery	Yakima River	Marion Drain Fall	Priest Rapids Fall	Umatilla River Fall	Snake River Fall
Wenatchee Hatchery	0.0158	0.0054	0.0180	0.0056	0.0153	**0.0025**	0.0053	0.0103
Wenatchee Natural	0.0162	0.0059	0.0185	0.0063	0.0157	0.0030	0.0059	0.0102
Methow Hatchery	0.0191	0.0104	0.0248	0.0095	0.0220	0.0069	0.0107	0.0165
Methow Natural	0.0148	0.0057	0.0182	0.0051	0.0148	0.0033	0.0055	0.0101
Okanogan Hatchery	0.0146	0.0041	0.0166	0.0042	0.0151	**0.0016**	0.0041	0.0082
Okanogan Natural	0.0163	0.0064	0.0187	0.0062	0.0170	0.0035	0.0068	0.0113
Wells Hatchery	0.0120	0.0051	0.0135	0.0044	0.0120	0.0028	0.0046	0.0077
Wenatchee stock	0.0184	0.0073	0.0203	0.0074	0.0167	0.0047	0.0084	0.0128
Eastbank MEOK stock	0.0128	0.0036	0.0143	0.0038	0.0135	**0.0019**	0.0038	0.0079
Entiat River	0.0147	0.0059	0.0176	0.0057	0.0156	0.0028	0.0056	0.0100
Chelan River	0.0074	**0.0046**	0.0110	**0.0040**	0.0160	**0.0047**	**0.0035**	0.0072

Table 7. Effective number of breeders per brood year with the largest number of samples of summer Chinook in the upper Columbia River. Brood years with sample size less than 19 individuals (shown in bold type) were not analyzed with exception of the 2008 Wells Hatchery collection. A comparison could not be made between an early and late collection from Wells Hatchery.

WDFW Code	Collection Location	Sample Size	Nb =	CI95(L) =	CI95(U) =
93DD[A]	Wenatchee Natural - upstream	23 / 19	152 / 190	77 / 87	616 / 2,147,483,647
08FV	Wenatchee Natural - upstream	56	162	112	249
93DE[A]	Wenatchee Natural - downstream	39 / 34	145 / 152	94 / 95	256 / 302
08FW	Wenatchee Natural - downstream	67	140	105	199
08FU	Wenatchee Hatchery	60	134	90	213
93EC[A]	Methow Natural	**10 / 15**	---	---	---
08FY	Methow Natural	62	150	106	218
08FX	Methow Hatchery	**9**	---	---	---
93ED	Okanogan Natural	69	142	102	203
08GA	Okanogan Natural	59	127	92	180
08FZ	Okanogan Hatchery	**16**	---	---	---
93DG	Wells Hatchery	**6**	---	---	---
08HY[B]	Wells Hatchery	24 / 39	---	---	---
08MN	Eastbank Hatchery - Wenatchee	88	190	144	263
93DF	Eastbank Hatchery - MEOK	84	171	129	229
08MO	Eastbank Hatchery - MEOK	88	166	126	226

[A] - calculations were made for samples from brood year 1988 / brood year 1989

[B] - samples were collected from brood year 2003 / brood year 2004

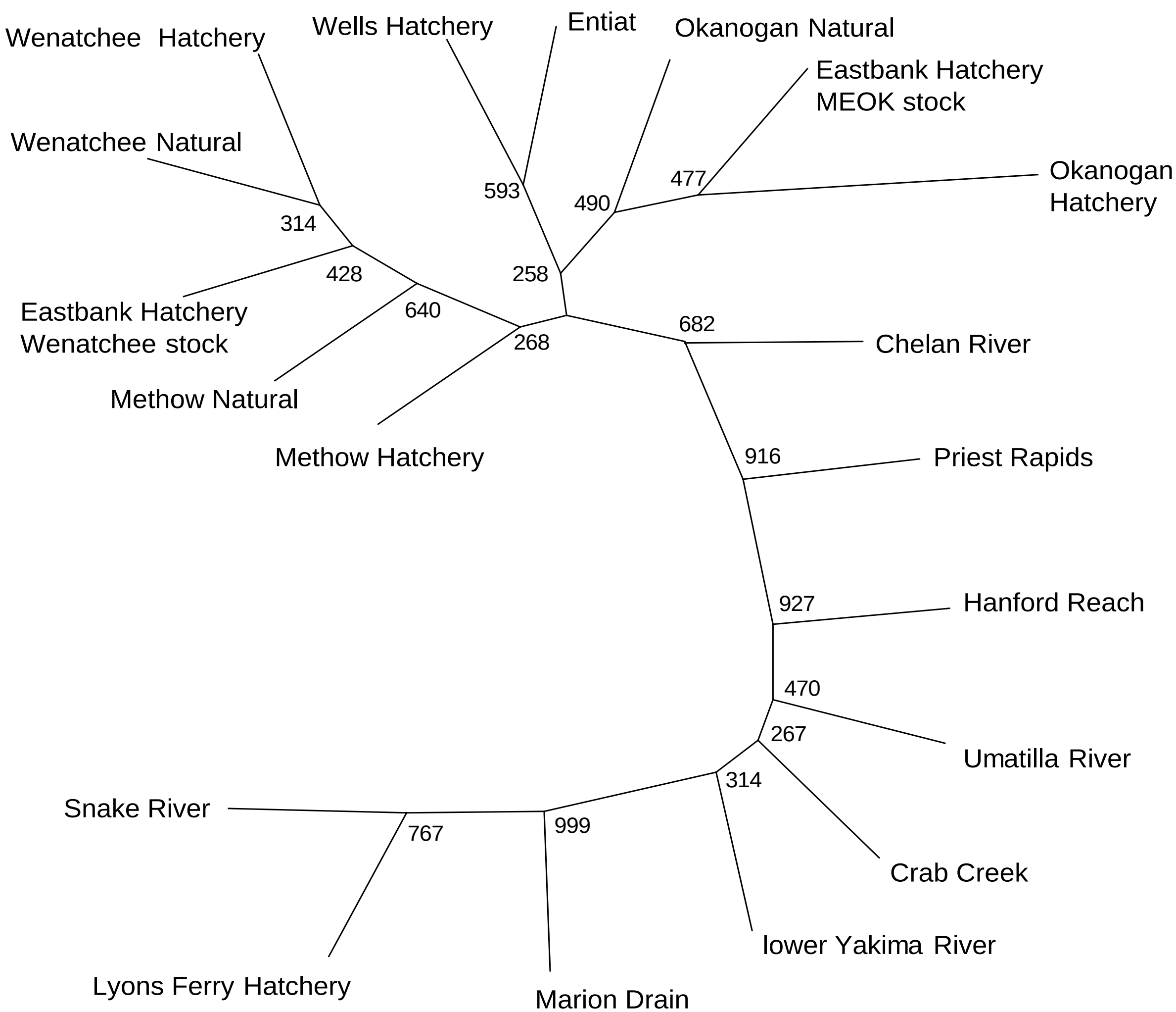

Figure 1. Relationship of natural- and hatchery-origin Chinook collections from the upper Columbia River basin using Cavalli-Sforza and Edwards (1967) chord distance. Bootstrap values are shown at each node.

Appendix L

Summer Chinook Spawning Ground Surveys in the Methow and Okanogan Basins, 2012

BioAnalysts, Inc.℠
4725 North Cloverdale Road, Ste 102
Boise Idaho 83713

January 16, 2013

To: HCP Hatchery Committee

From: Denny Snyder and Mark Miller

Re: 2012 Spawning Ground Surveys in the Okanogan and Methow Basins

The purpose of this memo is to provide information on the hatchery-supplemented natural spawning population of summer Chinook in the Methow and Okanogan basins. This work is part of a larger effort focused on monitoring and evaluating Chelan PUD's hatchery supplementation program. The tasks and objectives associated with implementing Chelan PUD's hatchery M&E plan for 2012 are outlined in several documents (Murdoch and Peven 2005; Peven 2006; Hays et al. 2006). Figures and tables are presented at the end of this memo.

METHODS

Spawning ground surveys were conducted by foot, raft, and aircraft beginning the last week of September and ending mid-November. During aerial surveys an observer recorded the location and number of redds on topographic maps. We did not use aerial surveys on the Methow River because past work has demonstrated that ground counts were more accurate than aerial surveys (Miller and Hillman 1997). Because of the depth of redds, aerial surveys were the only census method used for the Columbia River downstream from Wells (tailrace area only) and Chief Joseph dams. Ground surveys were used to provide more accurate counts and a complete census of Chinook redds within their spawning distribution. Observers floated through sampling reaches and recorded the location and numbers of redds each week. Observers recorded the date, water temperature, river mile, and constructed a drawing of the area where redds were located. A different symbol was used each week to record the number of new and incomplete redds.

To maintain consistency, at least one observer surveyed the same stream reach on successive dates. In areas where numerous summer Chinook spawn, we constructed detailed maps of the river and used the cell-area method (Hamilton and Bergersen 1984) to identify the number of redds within each cell. Cells were bound by noticeable landmarks along the banks (e.g., bridges or trees) or at stream habitat boundaries (e.g., transitions between pools and riffles). The number of redds were then recorded in the corresponding grid on the map. When possible, observers estimated the number of redds in a large disturbed area by counting females that defended redds. We assumed that the area or territory defended by a female was one redd.

Carcasses of summer Chinook were sampled to describe the spawning population. Biological data included collection of scale samples for age analysis, length measurements (POH and FKL), sex, egg voidance, and a check for tags or marks. These data will be used to assess length-at-age, size-at-age, egg voidance, origin (hatchery or naturally produced), and stray rates. No DNA samples were collected on summer Chinook this year. Information on summer Chinook spawning in the Chelan River was collected by Chelan PUD and is presented in the results.

RESULTS

Methow

There were 960 summer Chinook redds counted within seven reaches of the Methow River (Table 1). No redds was counted in the Chewuch River this year. This was the fifth highest redd count observed in the last 22 years for the Methow River (Table 3). Spawning began the last week of September and peaked in mid-October and continued into the first week of November (Figure 1). Stream temperatures in the Methow River, when spawning began, varied from 8.0-10.5 °C. Peak spawning occurred in reaches (M2, M4 and M5) of the Methow River during the second week of October. Spawning peaked the third week of October in reaches (M1 and M3). Most redds (89%) were located in reaches (M1-M3) downstream from the town of Twisp and in reach (M5) between Methow Valley Irrigation Diversion (MVID) and Winthrop Bridge (Table 1). Few summer Chinook spawned (1%) upstream from the Winthrop Bridge in reaches M6 and M7. Estimated escapement based on redd counts and the sex-ratio observed at Wells Dam during broodstock collection suggests that 2,947 summer Chinook (960 redds x 3.07 fish/redd) escaped to the Methow River.

There were 629 summer Chinook salmon carcasses sampled within the seven reaches of the Methow River (Table 2). Twenty-one percent of the fish returning to the Methow River were sampled based on the estimated escapement of 2,947 summer Chinook. Females made up 45% and males 55% of the carcasses examined. Mean percent egg voidance assessed from 286 female carcasses was 99%. Two females (1%) died before spawning (i.e., they retained all their eggs). Ad-clipped hatchery fish made up 41% and naturally produced fish (adipose fin present) were 59% of the sample collected (Table 2). The distribution of ad-clipped hatchery and naturally produced fish showed that more than half (91%) of the ad-clipped hatchery fish were located in the lower three reaches while naturally produced fish were more evenly distributed with just over half (58%) in the lower three reaches (Figure 2).

Okanogan

There were 1,613 summer Chinook redds counted within six reaches of the Okanogan River (Table 1). This was the fifth highest redd count observed in the last 22 years for the Okanogan River (Table 3). Peak aerial redd counts (1,170 redds) were about 72 % of redds counted from the ground. Spawning began the first week of October and continued until the first week of November (Figure 1). Spawning was initiated in the Okanogan River when the stream temperature varied from 12.0-15.0°C. Redd counts were difficult to unattainable during the last week of October through the second week of November due to high flows from the Similkameen River. Flows nearly tripled, 1,090 cfs-2,940 cfs, (USGS 12445000 Okanogan river near Tonasket, WA) during this time making water visibility less than one foot. New redds were observed the last week of October in some areas (shallow spawning habitat), but no new redds were observed thereafter. It is possible that new redds could have been constructed but we were unable to see them. We suspect that spawning activity ended the first week of November (Table 1; Figure 1). Peak spawning in the Okanogan River occurred during the third week of October for reaches (O3-O6) with the lower two reaches (O1 and O2) peaking the following week. Most redds (82%) were located in the upper reaches (O5 and O6) between Zosel Dam and the town of Riverside (Table 1). Estimated escapement (1,613 redds x 3.07 fish/redd) to the Okanogan River was 4,952 summer Chinook.

There were 865 summer Chinook salmon carcasses sampled within 6 reaches of the Okanogan River (Table 2). Seventeen percent of the fish returning to the Okanogan River were sampled based on the estimated escapement of 4,952 summer Chinook. High flows the last week of October and the first two weeks of November limited the number of carcass recoveries. Females made up fifty percent of the carcasses examined and males the other half. Mean percent egg voidance from 434 female carcasses was 99%. Four females (1%) died before they spawned. Ad-clipped hatchery fish made up 31% and naturally produced fish 69% of the sample collected (Table 2). Most naturally produced (95%) and ad-clipped hatchery fish (83%) were collected in the upper reaches (O5 and O6) of the Okanogan River closely following the distribution of redds (Figure 2).

Similkameen

There were 1,066 summer Chinook redds counted within the two reaches of the Similkameen River (Table 1). This was the tenth highest redd count recorded in the Similkameen River in the last 22 years (Table 3). The peak aerial count (762 redds) was about 71% of redds counted on the ground. Spawning began the last week of September and peaked the second week in October (Figure 5). Spawning was initiated in the Similkameen River when the temperature varied from 11.0-16.0°C. Spawning activity ended the last week of October (Table 1). It is possible that new redds could have been constructed but we were unable to see them because high flows and water clarity affected redd counts the last week of October and into the second week of November. Water clarity on October 30th was less than one foot. Most (86%) spawning occurred in the lower reach from the Oroville Bridge, downstream to the Driscoll channel on the Similkameen River. Estimated escapement (1,066 redds x 3.07 fish/redd) to the Similkameen River was 3,273 summer Chinook.

There were 549 summer Chinook salmon carcasses sampled within the two reaches of the Similkameen River (Table 2). Carcasses recovery was difficult with the higher flows and water clarity. Two carcass surveys were not conducted due to the high flows and low water visibility. Seventeen percent of the fish returning to the Similkameen River were sampled based on the estimated escapement of 3,273 summer Chinook. Females made up 59% and males 41% of the carcasses examined. Mean percent egg voidance from 326 female carcasses was 98%. Four females (1%) died before spawning. Ad-clipped hatchery fish made up 57% and naturally produced fish 43% of the sample collected (Table 2).

Chelan River

Chelan County PUD biologists counted 426 redds in the Chelan River area. Spawning activity in the Chelan River began mid-October and peaked two weeks later (Table 1). Spawning continued into the second week of November and a follow up survey was conducted in early December counting three additional redds. The majority (82%) of spawning occurred in the Powerhouse tailrace and in the Habitat channel (Table 1). Estimated escapement (426 redds x 3.07 fish/redd) to the Chelan River was 1,308 summer Chinook.

There were 317 summer Chinook carcasses sampled, 13 of those carcasses were classified as unknown origin when sampled (Table 2). Twenty-four percent of the summer Chinook returning to the Chelan River were sampled based on the estimated escapement of 1,308 fish. Females made up 65% and males 35% of the carcasses examined. Mean percent egg voidance from 205 female carcasses was 86%. Nine females (4%) died before spawning. Ad-clipped hatchery fish made up 72% and naturally produced fish were 28% of the fish examined.

Columbia River

Aerial surveys were used to count the number of redds in the Columbia River. The surveys were conducted downstream from Wells Dam and in Wells pool. The redd counts likely underestimate the true number of redds because peak aerial surveys only count visible old and new redds. Spawning may also occur in water that is too deep to observe. There were 83 Chinook redds counted in the Columbia River (Table 1). Estimated escapement (83 redds x 3.07 fish/redd) based on aerial surveys suggests that at least 255 Chinook spawned in the Columbia River.

Forty-four redds were located downstream from Wells Dam in an area that has been documented before (Giorgi 1992). A radio telemetry study conducted in 2011and 2012 on the movement and migration patterns of summer Chinook suggests that spawning also occurs upstream of Wells Dam in the Columbia River (R. Mann, Washington Department of Fish Wildlife, personnel communication). Many of the radio-tagged summer Chinook resided near the tailrace of Chief Joseph Dam along the right and left banks. An aerial survey in Wells pool located an estimated 39 redds downstream from Chief Joseph Dam between the town of Bridgeport and Foster Creek near the east bank. Observations in this area were difficult because distinct outlines of some redds were not readily apparent and most of the spawning occurred in a large single cluster. This is the third year that redds have been counted with aerial surveys at this location. An underwater video count of 59 redds was conducted by R. Mann, Washington Department of Fish and Wildlife, (personnal communication).

There were six summer Chinook salmon carcasses sampled in the Columbia River near the town of Bridgeport (Table 2). Fifteen percent of the fish returning to the Columbia River in this area were sampled based on the estimated escapement of 120 summer Chinook (39 redds x 3.07 fish/redd). Females made up 50% and males the other half of the carcasses examined. This area was surveyed only one time for carcasses by BioAnalysts personnel. Mean percent egg voidance from female carcasses was 99%. No females died before spawning. Ad-clipped hatchery fish made up 50% and naturally produced fish the other half of the sample collected (Table 2).

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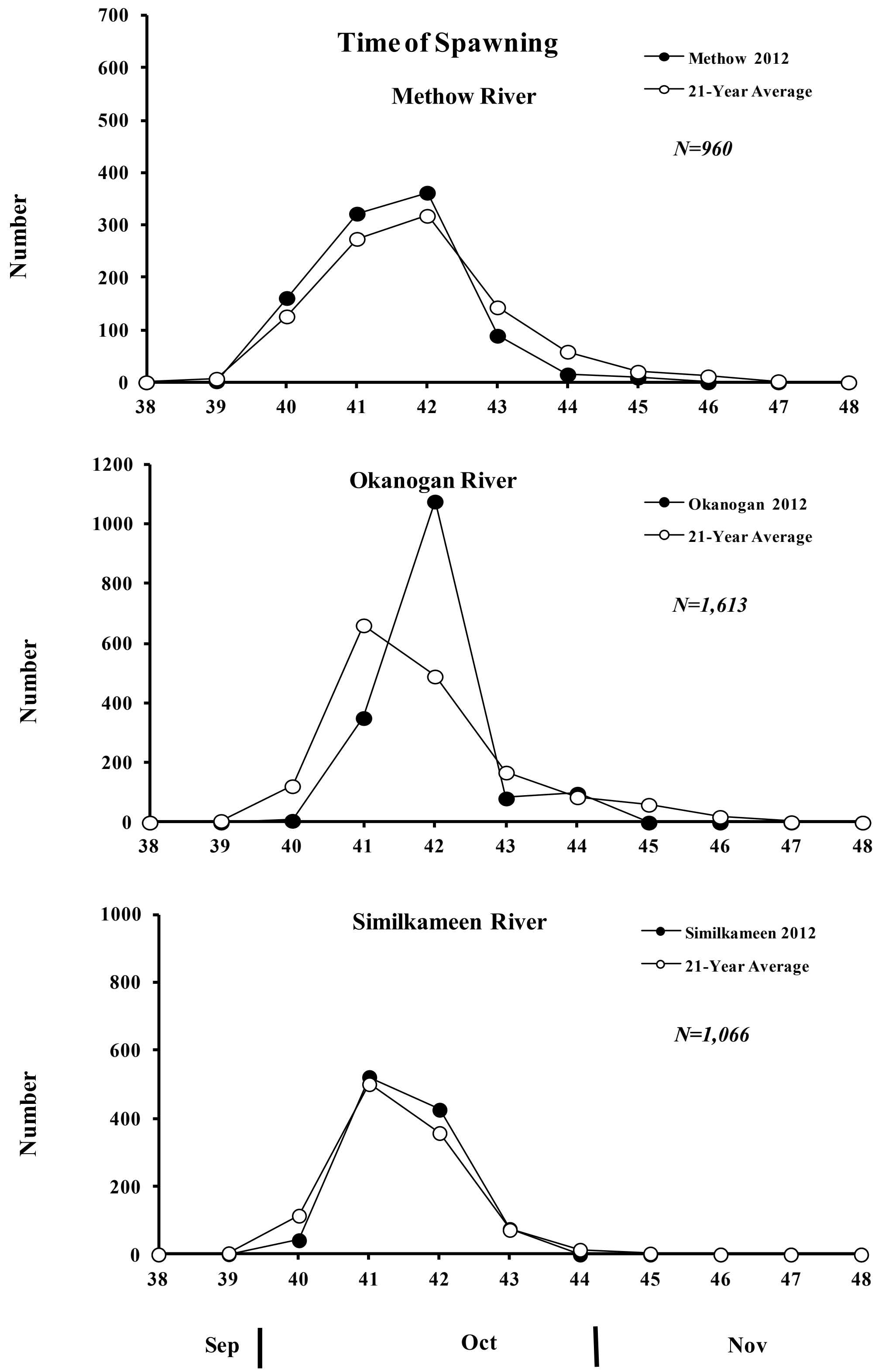

Figure 1. Number of new redds counted each week from mid-September to mid-November. The figure displays the beginning, peak, and end of spawning for summer Chinook in the Methow, Okanogan, and Similkameen rivers in 2012 compared to a 21-year average (1991-2011).

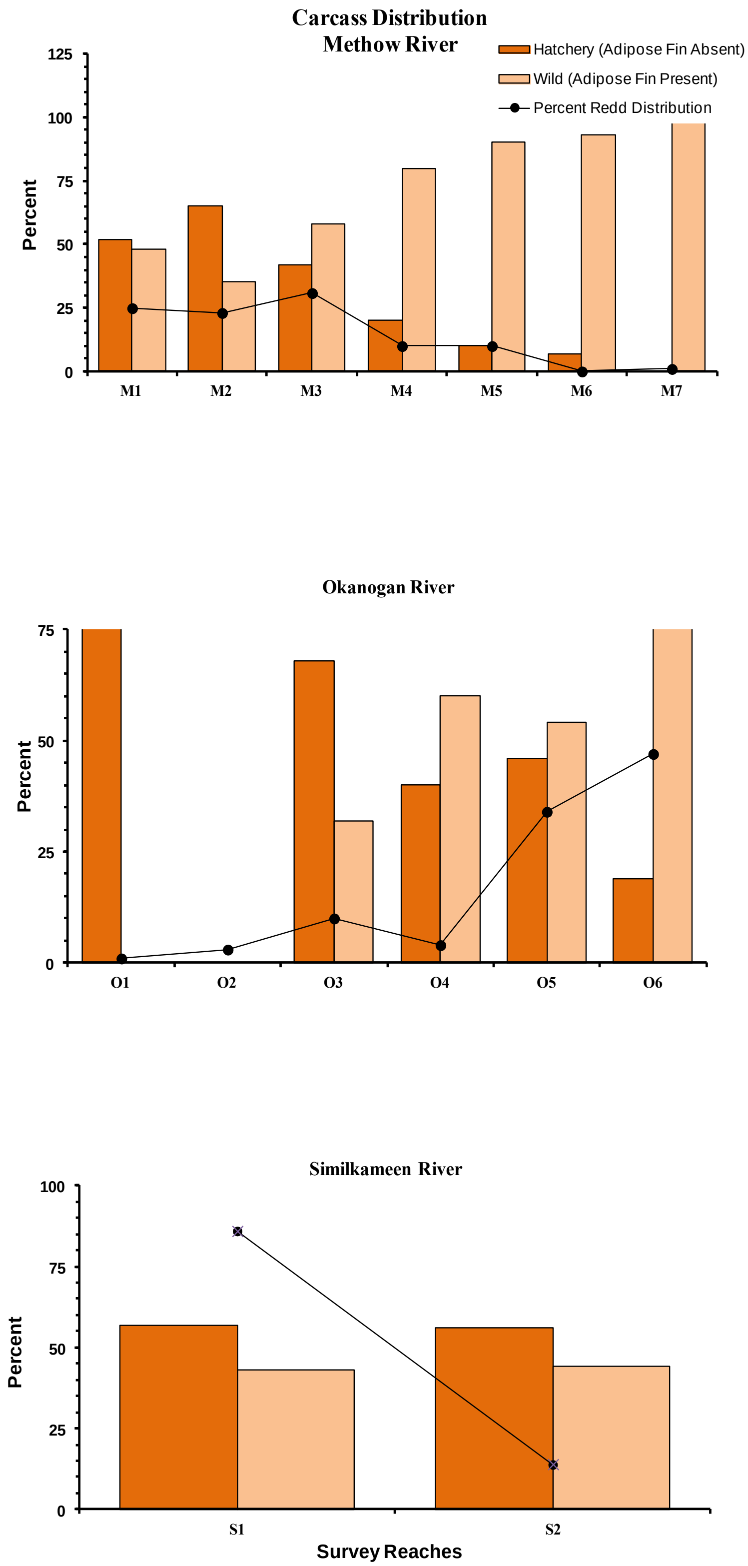

Figure 2. Percent distribution of ad-clipped hatchery and naturally produced fish plotted against the percent distribution of redds observed in reaches of the Methow, Okanogan, and Similkameen rivers, 2012.

Table 1. Number of summer Chinook redds observed each week within the Methow, Chewuch, Okanogan, Similkameen, Chelan, and Columbia rivers, 2012. Dashes indicate no survey occurred.

Reach	Location (Rkm)	Sep	Oct				Nov			Total	Percent
		23-29	30-6	7-13	14-20	21-27	28-3	4-10	11-17		
		39	40	41	42	43	44	45	46		
Methow River											
M1	0.0-25.0	0	5	74	110	41	0	9	0	**239**	**25**
M2	25.0-45.9	0	28	103	66	19	0	5	0	**221**	**23**
M3	45.9-63.6	2	78	70	136	0	10	0	0	**296**	**31**
M4	63.6-75.8	0	13	36	21	22	0	0	0	**92**	**10**
M5	75.8-84.2	0	21	49	26	3	0	0	0	**99**	**10**
M6	84.2-87.2	0	0	0	3	0	0	0	0	**3**	**0**
M7	87.2-90.2	0	6	0	0	4	0	0	0	**10**	**1**
Total		**2**	**151**	**332**	**362**	**89**	**10**	**14**	**0**	**960**	**100**
Okanogan River											
O1	0.0-27.2	0	0	0	1	10	1	0	0	**12**	**1**
O2	27.2-41.9	0	0	0	19	26	9	0	0	**54**	**3**
O3	41.9-49.4	0	0	7	88	23	41	0	0	**159**	**10**
O4	49.4-65.4	0	0	1	54	0	13	0	0	**68**	**4**
O5	65.4-91.4	0	0	149	356	17	33	0	0	**555**	**34**
O6	91.4-129.6	0	6	194	560	5	0	0	0	**765**	**47**
Total		**0**	**6**	**351**	**1078**	**81**	**97**	**0**	**0**	**1,613**	**100**
Similkameen River											
S1	0.0-2.9	1	37	459	353	64	0	0	0	**914**	**86**
S2	2.9-9.1	0	6	63	72	11	0	0	0	**152**	**14**
Total		**1**	**43**	**522**	**425**	**75**	**0**	**0**	**0**	**1,066**	**100**
Chelan River											
Powerhouse Tailrace		0	0	3	83	89	11	35	10 [1]	**231**	**54**
Columbia R. Tailrace		0	0	0	14	26	9	6	1	**56**	**13**
Pool		0	0	5	2	2	7	2	1	**19**	**4**
Habitat Channel		0	0	6	22	68	13	6	5	**120**	**28**
Total		**0**	**0**	**14**	**121**	**185**	**40**	**49**	**7**	**426**	**100**
Columbia River (below Wells Dam and below Chief Joseph Dam)											
828.0-829.6		0	0	0	5	3	0	0	36	**44**	**100**
875.9-876.4		0	0	0	0	0	0	10	29	**39**	**100**
Total		**0**	**0**	**0**	**5**	**3**	**0**	**10**	**65**	**83**	**100**
Chewuch River											
0.0-9.8		0	0	0	-	-	-	-	-	**0**	**0**

[1] Three new redds were counted on Dec. 4th. These redds were added to week 46.

Table 2. Number and percent of hatchery (ad-clipped) and naturally produced (not ad-clipped) summer Chinook collected in Methow, Chelan, Columbia, Similkameen, and Okanogan rivers, 2012.

Reach	Location (Rkm)	Ad-Clipped Hatchery				Naturally Produced				Reach Total
		Male	Female	Total	Percent	Male	Female	Total	Percent	
Methow River										
M1	0.0-23.8	43	23	66	52	34	27	61	48	**127**
M2	23.8-43.8	72	28	100	65	32	22	54	35	**154**
M3	43.8-63.7	33	38	71	42	33	66	99	58	**170**
M4	63.7-72.3	10	5	15	20	34	26	60	80	**75**
M5	72.3-80.1	6	2	8	10	36	38	74	90	**82**
M6	80.1-83.0	0	1	1	7	9	4	13	93	**14**
M7	83.0-96.1	0	0	0	0	1	6	7	100	**7**
Total		**164**	**97**	**261**	**41**	**179**	**189**	**368**	**59**	**629**
Okanogan River										
O1	0.0-27.2	1	0	1	100	0	0	0	0	**1**
O2	27.2-42.0	0	0	0	0	0	0	0	0	**0**
O3	42.0-49.4	23	15	38	68	12	6	18	32	**56**
O4	49.4-65.5	3	3	6	40	5	4	9	60	**15**
O5	65.5-91.4	67	50	117	46	67	72	139	54	**256**
O6	91.4-124.6	54	49	103	19	199	235	434	81	**537**
Total		**148**	**117**	**265**	**31**	**283**	**317**	**600**	**69**	**865**
Similkameen River										
S1	0.0-2.9	107	174	281	57	99	115	214	43	**495**
S2	2.9-9.2	7	23	30	56	10	14	24	44	**54**
Total		**114**	**197**	**311**	**57**	**109**	**129**	**238**	**43**	**549**
Chelan River										
Chelan R.		81	139	220	72	24	60	84	28	**304**
Total		81	139	220	72	24	60	84	28	**304**[1]
Columbia R. below Chief Joseph Dam										
Columbia R.		1	2	3	50	0	3	3	50	**6**
Total		1	2	3	50	0	3	3	50	**6**

[1] Thirteen additional carcasses not shown here were sampled.

Table 3. Historical aerial and ground redd counts of summer Chinook in the Methow, Okanogan, and Similkameen rivers, 1957-2012.

Year	Methow		Okanogan		Similkameen	
	Aerial	Ground	Aerial	Ground	Aerial	Ground
1956	109	--	37	--	30	--
1957	451	--	53	--	30	--
1958	335	--	94	--	31	--
1959	130	--	50	--	23	--
1960	194	--	29	--	--	--
1961	120	--	--	--	--	--
1962	678	--	--	--	17	--
1963	298	--	9	--	51	--
1964	795	--	112	--	67	--
1965	562	--	109	--	154	--
1966	1,275	--	389	--	77	--
1967	733	--	149	--	107	--
1968	659	--	232	--	83	--
1969	329	--	103	--	357	--
1970	705	--	656	--	210	--
1971	562	--	310	--	55	--
1972	325	--	182	--	64	--
1973	366	--	138	--	130	--
1974	223	--	112	--	201	--
1975	432	--	273	--	184	--
1976	191	--	107	--	139	--
1977	365	--	276	--	268	--
1978	507	--	195	--	268	--
1979	622	--	173	--	138	--
1980	345	--	118	--	172	--
1981	195	--	55	--	121	--
1982	142	--	23	--	56	--
1983	65	--	36	--	57	--
1984	162	--	235	--	301	--
1985	164	--	138	--	309	--
1986	169	--	197	--	300	--
1987	211	--	201	--	164	--
1988	123	--	113	--	191	--
1989	126	--	134	--	221	370
1990	229	--	88	47	94	147
1991	--	153	55	64	68	91
1992	--	107	35	53	48	57
1993	--	154	144	162	152	288
1994	--	310	372	375	463	777

Year	Methow		Okanogan		Similkameen	
	Aerial	Ground	Aerial	Ground	Aerial	Ground
1995	--	357	260	267	337	616
1996	--	181	100	116	252	419
1997	--	205	149	158	297	486
1998	--	225	75	88	238	276
1999	--	448	222	369	903	1,275
2000	--	500	384	549	549	993
2001	--	675	883	1,108	865	1,540
2002	--	2,013	1,958	2,667	2,000[a]	3,358
2003	--	1,624	1,099	1,035	103	378
2004	--	973	1,310	1,327	2,127	1,660
2005	--	874	1,084	1,611	1,111	1,423
2006	--	1,353	1,857	2,592	1,337	1,666
2007	--	620	1,265	1,301	523	707
2008	--	599	1,019	1,146	673	1,000
2009	--	692	1,109	1,672	907	1,298
2010	--	887	688	1,011	642	1,107
2011	--	941	1,203	1,714	1,047	1,409
2012		960	1,170	1,613	762	1,066

APPENDIX P
METHOW SPRING CHINOOK HGMP ADDENDUM

HATCHERY AND GENETIC MANAGEMENT PLAN

(HGMP)

ADDENDUM

Hatchery Program:	Methow River Spring Chinook Program
Species or Hatchery Stock:	Upper Columbia River Spring Chinook *(Oncorhynchus tshawytscha)*
Agency/Operator:	Chelan County Public Utility District No. 1 (Chelan PUD) Washington Department of Fish and Wildlife (WDFW)
Watershed and Region:	Methow Sub-basin/Columbia Cascade Province
Date Submitted:	May 13, 2013
Date Last Update	May 13, 2013

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Figures and Tables

This document sets forth the planned implementation of Chelan's Methow Spring Chinook hatchery program. The information provided below supplements the Methow Spring Chinook Hatchery Genetic and Management Plan that was approved by the HCP Hatchery Committee and submitted to NMFS February 12, 2010 (the "Existing HGMP"). Chelan's request for a Section 10(a)(1)(A) permit is supported by both this document and the Existing HGMP (collectively referred to as the "Application").

1. Administration

1.1. Name of Program

Chelan PUD Methow River Spring Chinook Program.

1.2. Species propagated

Upper Columbia River Spring Chinook (*Oncorhynchus tshawytscha*), Endangered.

1.3. Permit Applicants

Public Utility District No. 1 of Chelan County (Chelan PUD)

and

Washington State Department of Fish and Wildlife

1.4. Contact Information

Name and Title: Joe Miller, Fisheries Manager
Agency: Public Utility District No.1 of Chelan County
Address: 327 North Wenatchee, Wenatchee WA 98801
Phone: (509) 661 4473
Email: joseph.miller@chelanpud.org

Name and Title: Keith Truscott, Natural Resource Director
Agency: Public Utility District No.1 of Chelan County
Address: 327 North Wenatchee, Wenatchee WA 98801
Phone: (509) 661-4831
Email: keith.truscott@chelanpud.org

Name and Title: Jeff Korth, Region 2 Fish Program Manager
Agency: Washington Department of Fish and Wildlife
Address: 327 North Wenatchee, Wenatchee WA 98801
Phone (509) 754-6032
Email: korthjwk@dfw.wa.gov

1.5. Other Agencies, Tribes, and co-operators:

- Rock Island and Rocky Reach Habitat Conservation Plan (HCP) Hatchery Committees: Oversee development of recommendations for implementation of the hatchery elements of the HCP. Hatchery Committee members include: Chelan PUD, WDFW, Confederated Tribes of the Colville Indian Reservation, Confederated Tribes and Bands of the Yakama Nation, National Marine Fisheries Service, and U.S. Fish and Wildlife Service.
- Washington Department of Fish and Wildlife (WDFW): Co-manager; current contracted hatchery operator, co-permittee for the current permit (number 1196) for Chiwawa spring Chinook
- Confederated Bands and Tribes of the Yakama Nation (YN): Co-manager.
- Confederated Tribes of the Colville Indian Reservation (CCT): Co-manager.
- National Marine Fisheries Service (NMFS): Administration of the Endangered Species Act.
- U.S. Fish and Wildlife Service (USFWS): Administration of the Endangered Species Act.
- Joint Fisheries Parties (JFP): USFWS, NMFS, WDFW, YN, and CCT

1.6. Funding Source

Chelan PUD funds this program as authorized and obligated by the Rocky Reach and Rock Island HCPs. The total annual operational cost is expected to be between $250,000 and $750,000.

1.7. Purpose (Goal) of program.

With respect to Chelan PUD, the purpose of this hatchery program is to satisfy the hatchery compensation requirements of the Rock Island and Rocky Reach Hydroelectric Projects HCPs. The HCPs were executed pursuant to Section 10 of the Endangered Species Act (ESA) as a vehicle to permit Chelan PUD to carry out its functions in a manner consistent with the ESA. The overriding goal of the HCPs – developed in accordance with the ESA's goals of conserving and facilitating the recovery of natural populations – is to achieve No Net Impact (NNI) on anadromous salmonids as they pass the Projects. NNI goals should be met in a manner consistent with the objective of rebuilding natural populations. Under the terms of the HCPs, and for the purpose of achieving NNI, Chelan PUD provides the funding and capacity required to meet seven (7) percent hatchery compensation for all Plan Species that results from unavoidable losses at the Project.

Section 8 of the HCPs details the objectives, responsibilities, and requirements of hatchery programs required as mitigation for the operation of the Project.

Section 8.1.2 includes the following objective:

> *8.1 Hatchery Objectives*
> *8.1.2 The District shall implement the specific elements of the hatchery program consistent with overall objectives of rebuilding natural populations and achieving NNI. Species specific hatchery program objectives developed by the JFP [Joint Fisheries Parties] may include contributing to the rebuilding and recovery of naturally reproducing populations in their native habitats, while maintaining genetic and ecologic integrity, and supporting harvest.*

In addition, the JFP developed program goal statements that were documented in the 2005 Conceptual Framework for Chelan PUD Hatchery Programs (Hillman et al. 2007). The stated spring Chinook program goal is to support the recovery of ESA-listed species by increasing the abundance of the natural adult population, while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity (Murdoch and Peven 2005; HCP HC July 2005).

1.8. Justification for Program

The artificial propagation program for Methow spring Chinook specifically addresses the unavoidable losses associated with the operation of Rock Island and Rocky Reach Projects, and contributes to the long-term persistence of ESA-listed Upper Columbia River spring Chinook by increasing the abundance of the population. NMFS has determined that the program is likely necessary to prevent the extinction of the ESU until habitat conditions that limit the productivity of naturally-produced spring Chinook in the region are improved.

1.9. Legal Agreements and Requirements

This Application includes actions required of Chelan PUD pursuant to its Rock Island and Rocky Reach HCPs, as well as other actions that are beyond Chelan PUD's HCP obligations but represent important fishery management activities that may be implemented by WDFW and the other JFPs. This section is intended to provide background and context to aid in the interpretation and application of the terms and obligations set forth below and in the Existing HGMP. Specifically, this section (1) identifies and describes the purposes and objectives of the HCPs, as relevant to the hatchery program; (2) outlines certain responsibilities and obligations of Chelan PUD based on the commitments and assurances provided in the HCPs; and (3) describes certain obligations and responsibilities applicable to the requested permit.

Chelan PUD's HCPs

Section 8 of the HCPs details the objectives, responsibilities, and requirements of hatchery programs required as mitigation for the operation of the Projects; specifically, Section 8.1.1 indicates that the District shall provide hatchery compensation for spring Chinook salmon upstream of the Rocky Reach and Rock Island Dams.

Adaptive Management & Section 10 Permits

Chelan PUD's spring Chinook hatchery program obligations under the HCPs are implemented through an adaptive management process set forth in the HCPs and overseen by the HCP Hatchery Committee. Specifically, the HCP Hatchery Committee may periodically adjust Chelan PUD's hatchery production levels (see HCPs at section 8.4.3) and make program modifications to achieve program objectives, including changes to facilities, release methods, and rearing strategies necessary to achieve and maintain NNI (see HCPs at section 8.6.1).

The HCPs' adaptive management processes are integral to the effective operation of the spring Chinook hatchery program described in this Application. Any updated section 10 permit and associated environmental reviews should incorporate, rely on, and anticipate compliance with the HCPs' adaptive management provisions. Incorporating adaptive management into the requested Section 10 permit, as contemplated by the HCPs, will minimize the need for future modification of the Section 10 permit and facilitate the efficient management and oversight of the program by the HCP Hatchery Committee. As an HCP Hatchery Committee member, NMFS plays a key role in this process.

The program described herein represents an attempt to use the adaptive management provisions of the HCP to address the Hatchery Scientific Review Group (HSRG) recommendation wherein pHOS should be < 0.30, and that pNOB exceed pHOS by at least a factor of two, corresponding to a PNI ≥ 0.67 .

Roles and Responsibilities of Applicants:

In accordance with their respective obligations and authorities, the specific roles and responsibilities of Chelan PUD and WDFW in conducting permit activities are as follows:

The Chelan PUD will:

- Provide and maintain or acquire hatchery capacity for the Methow spring Chinook hatchery program.
- Fund or conduct hatchery operations related to spawning, incubation, rearing and acclimation activities at locations approved by the HCP Hatchery Committee.
- Fund or conduct hatchery monitoring and evaluation under Section 8 of the HCPs.

The WDFW will:

- Collect broodstock, conduct hatchery operations, and implement monitoring and evaluation as a contractor to Chelan PUD[1].
- Remove hatchery fish from the Methow River to achieve Proportionate Natural Influence (PNI) goals.
- Develop, coordinate and implement fishery related management plans and activities.

2. Hatchery Production

2.1. Summary of Hatchery Facilities

[1] The District currently funds WDFW to operate its hatcheries and conduct M&E activities under a separate agreement.

Activity	Facility
Broodstock Collection	Wells Dam, Rocky Reach Dam, Winthrop NFH outfalls and other locations approved by HCP Hatchery Committee
Adult Holding	Eastbank Hatchery and Winthrop NFH and other locations approved by HCP Hatchery Committee
Spawning	Eastbank Hatchery and Winthrop NFH and other locations approved by HCP Hatchery Committee
Incubation	Eastbank Hatchery and Winthrop NFH and other locations approved by HCP Hatchery Committee
Early Rearing	Eastbank Hatchery or Winthrop NFH and other locations approved by HCP Hatchery Committee
Overwinter Rearing	Carlton Acclimation Pond or Winthrop NFH and other locations approved by HCP Hatchery Committee
Final Acclimation	Yakama Nation Expanded Acclimation sites: Goat Wall Acclimation Site, Mid Valley Pond, Chewuch River (future YN site) and other locations approved by the HCP Hatchery Committee

2.2. Type of program

Integrated Recovery Program

2.3. HCP Targets

All targets reflect existing HCP targets subject to the adaptive management requirements of the HCPs.

- Number of smolts released = 60,516
- Smolt-to-adult returns (SAR) = 0.003 (From Table 6 in Appendix D in Murdoch and Peven 2005)
- Adult Equivalents = 182 (derived from SAR x smolts released: 60,516x0.003 = 181.54)
- Number of smolts/adult = 333(From Table 6 in Appendix D in Murdoch and Peven 2005)
- Hatchery Return Rate = 5.3 (From Table 6 in Appendix D in Murdoch and Peven 2005)

2.4. Generalized Methow Hatchery Program Schedule

The basic life-history stages and hatchery locations (parenthetically) for Chelan's spring Chinook Hatchery program are described in Table 1.

Table 1: Three year hatchery life-history for Chelan's spring Chinook Methow production.

	January	February	March	April	May	June	July	August	September	October	November	December
Year 1					Brood Collection (Wells or RR)			Incubation (Eastbank)				
Year 2	Incubation		Early Rearing (Eastbank)							Overwinter (Carlton)		
Year 3	Overwinter	Acclimation (Goat wall or Mid-Valley)										

2.5. Broodstock Collection

2.5.1. Program Targets

- Approximate number of adults collected: not to exceed 38[2] (derived from Existing HGMP where 225,000 smolts required 142 broodstock and 60,516/225,000 = 26.9%, therefore 26.9% of 142 = 38.19)
- Sex Ratio 1:1 (see Existing HGMP)

2.5.2. Broodstock Source

Broodstock will be of wild x wild (WxW) parentage or hatchery x wild (HxW) parentage. HxH crosses may be used only in years of very low abundance. Wild-origin broodstock collection will not exceed 33% of the wild run. Hatchery-origin broodstock will be used to augment wild-origin broodstock to the extent necessary to meet the program production target. The proportion of natural-origin fish in the hatchery broodstock (pNOB) will be maximized to the extent possible to meet a PNI goal of >0.67 annually.

2.5.3. Collection Process

WDFW, in coordination with the HCP Hatchery Committee, will annually develop site-based broodstock-collection protocols for NMFS approval. These objectives and protocols may be adjusted in-season to meet changes in the abundance, composition, and location of adult returns, and to minimize impacts on non-target fish. The protocol described below will be used to facilitate the collection of hatchery spring Chinook broodstock throughout the run while achieving the target extraction rate and ensuring full broodstock collection.

Based on forecasted run size, the HCP Hatchery Committee will identify target PNI levels and associated pHOS, pNOB values, and overall broodstock targets for both the Methow/Chewuch and Twisp components of the program. Based on the target PNI levels and broodstock numbers, WDFW will develop weekly broodstock-collection goals. WDFW and the HCP Hatchery Committee will use in-season data (e.g., dam counts, PIT-tag detections) to verify pre-season estimates of run size and composition to

[2] All values based on a current, mean Age-4 fecundity of 4,000, an egg-to-smolt survival of 0.90, an 8.2% over-collection allowance for BKD management, a 1:1 male:female ratio, and 95% pre-spawn adult survival.

ensure that the selected PNI, pHOS, and broodstock goals are appropriate, and will modify those goals in-season as necessary. Weekly collection goals will target the collection of broodstock distributed throughout the run.

2.5.4. Locations

Broodstock will be collected at one of three locations in a given year: Wells Dam, Rocky Reach Dam or Winthrop National Fish Hatchery (NFH):

Wells Trap: Trapping at Wells Dam generally occurs at the east and west ladder traps beginning in early May, or at such time as the first spring Chinook are observed passing Wells Dam, and continues through about the third week of June. The trapping schedule consists of 3 days/week (Monday-Wednesday), and up to 16 hours/day. Non-lethal tissue samples (fin clips) for genetic analysis and scale samples will be obtained from adipose present, non-CWT, non-ventral clipped spring Chinook (suspected natural-origin spring Chinook) collected at Wells Dam for origin analysis (see Existing HGMP).

Rocky Reach Trap: As one of several broodstocking options, Chelan proposes to use the Rocky Reach Fish Trap to obtain broodstock for its Methow Program (Figure 1). The trap would be operational from early May through June, at the time and duration required and approved by the hatchery committee to collect broodstock.

The Rocky Reach Trap has been used historically to capture listed steelhead and bull trout (Alexander et al. 2003; Stevenson et al. 2009) without causing delays to non-target fish. The trap can remove individual fish from the top of the Rocky Reach Fish Ladder using visual selection criteria. The trap is operated by use of a pneumatic gate which directs individual target fish to a collection area and a trapping vessel. The trap design mimics a basket: it is lowered into the fish ladder and can remove one fish at a time. As fish enter the viewing area of the ladder, the trap operator observes its progress and makes a determination whether to trap or not. The trap operator can collect individual fish on the basis of visual identification of external marks observed at the counting window. The Rocky Reach Trap does not block passage except for the moment the gate is actuated. Fish collected at the Rocky Reach Trap would be transported to Eastbank Hatchery, immediately adjacent to the Rocky Reach Project.

Prior to using the Rocky Reach Trap for broodstock collection, Chelan will pilot the use of the facility and obtain any necessary HCP Hatchery Committee approvals. Specifically, Chelan will document the amount of handling time and handling effects of trap operation. The trap may be outfitted with additional PIT detection equipment that allows sort by code or other non-visual actuation if supported by the HCP Hatchery Committee.

It is important to note that the Rocky Reach Trap has been successfully used to safely capture other listed species since the HCPs were implemented. The fact that the trap collects one targeted fish at a time is a critical advantage over other trapping systems that block the run at-large. Overall, the consideration of this trapping method for spring Chinook broodstock collection is based on its active selection capability and previous regulatory approvals by NMFS and USFWS.

Winthrop NFH : In 2013, Chelan PUD will obtain hatchery origin broodstock from the USFWS Winthrop NFH outfall. Winthrop NFH is identified as a potential hatchery origin broodstock collection location in the Existing HGMP.

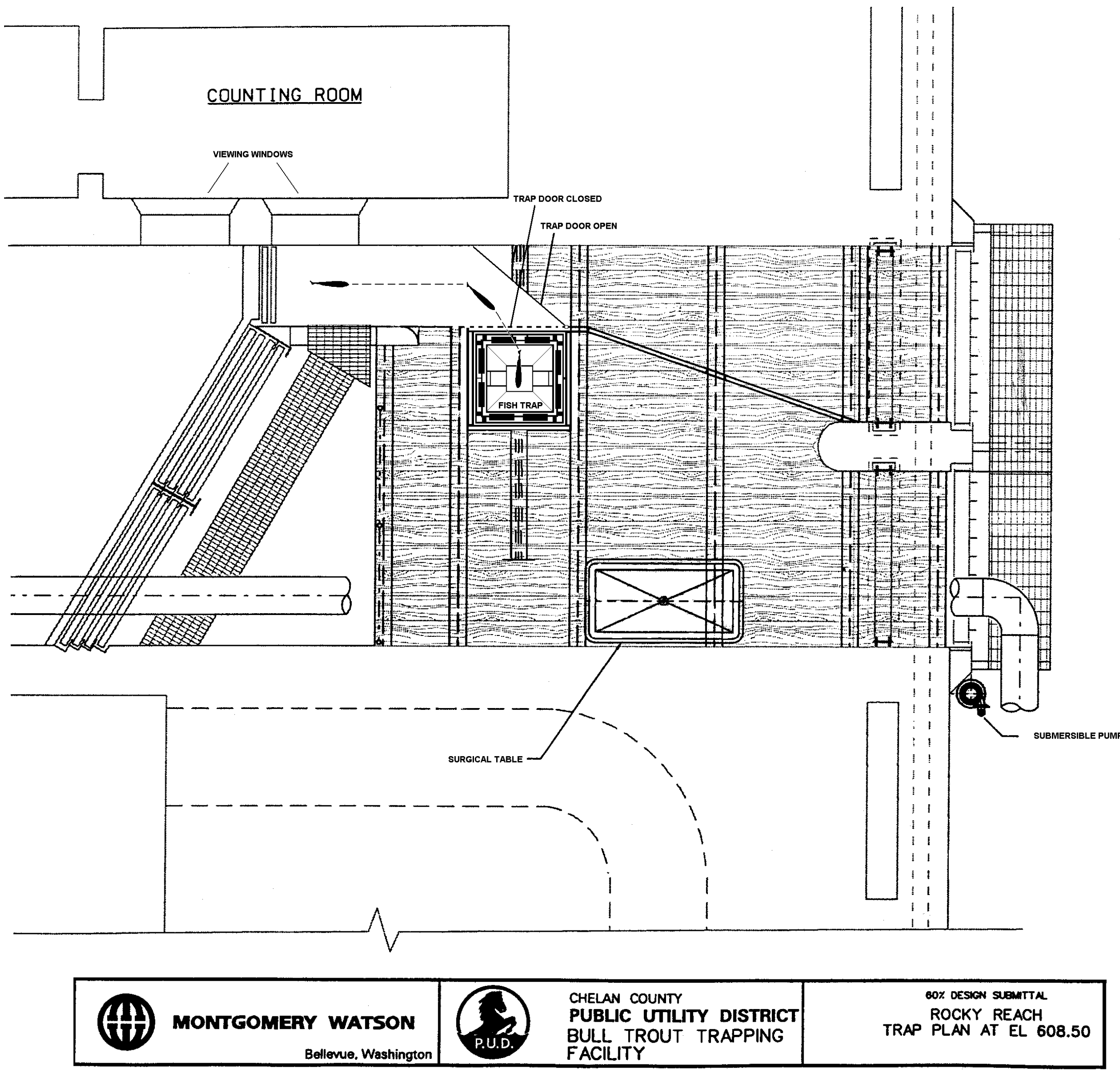

Figure 1. Rocky Reach Trap.

2.5.5. **Trapping and transport risk reduction measures**

- All species will be held for a minimal duration in the traps and holding areas (less than 24 hours).

- Traps and holding areas will be locked or secured against tampering or vandalism.
- All natural-origin spring Chinook in excess of broodstock goals will be released upstream immediately without harm.
- All NTTOC will be released upstream immediately without harm.
- Spring Chinook will be transferred using water-to-water techniques.
- Broodstock collection protocols will be developed in coordination with the HCP Hatchery Committee annually.

2.6. Incubation and Early Rearing:

Incubation and rearing is expected to occur primarily at Eastbank Hatchery. Winthrop NFH is included because it is expected to be used for brood year 2013. The use of Winthrop NFH in future years would be contingent upon approvals from the HCP Hatchery Committee.

2.6.1. **Locations**

Eastbank Hatchery: Water is supplied by the Eastbank Aquifer, a high quality ground water source with connectivity to the Columbia River. The Eastbank Aquifer is used by both the Eastbank Hatchery Complex and the Regional Water System which provides municipal water to the customers of Chelan County PUD, the City of Wenatchee, and the East Wenatchee Water District. The Eastbank Hatchery water right permit provides for 55 cubic foot per second (cfs) of instantaneous water supply. On an annual basis, temperatures range from approximately 45.5˚F to 59.0 ˚F. Spring Chinook are held for broodstock, incubated, and early-reared on this water. Water can be chilled to meet specific growth and incubation criteria.

At Eastbank, eggs would be incubated in MariSource vertical incubators. The incubators are configured with 8 tray units called "half-stacks". Each tray consists of a "water tray" which conducts the water flow through egg trays that are inserted in the water trays. The egg trays have a mesh lid on them. The water flows into the back of the water tray; flows forward through the eggs or fry; flows back down the sides; then exits to the back of the next tray below. Each tray is supplied with 2 gallons per minute (gpm) of chilled water, and 1 gpm of well water. The chilled water is 38 ˚F and is mixed with well water to meet an incubation temperature of 42 ˚F to 45 ˚F (adjusted based on developmental needs and desired emergence timing). At spawning, the eggs from a single female are added to a single tray. The capacity of a single tray is about 6,500 eggs.

At Eastbank Hatchery, water withdrawal for hatchery use is regulated by the Washington State Department of Ecology under Chapter 90.03 of the Revised Code of Washington (RCW) (water code). None of the hatchery facilities employed to carry out the proposed artificial propagation programs de-water river reaches used by listed fish for migration, spawning, or rearing. All hatcheries owned and/ or operated by WDFW discharge water in compliance with the National Pollutant Discharge Elimination System (NPDES) General Permit No. WAG 13, valid through August 1, 2015. This permit is administered in Washington by the Washington Department of Ecology under agreement with the United States Environmental Protection Agency.

The following measures will be employed to minimize the likelihood for the take of listed natural fish:

• Ensure that water intakes into artificial propagation facilities are properly screened in compliance with 1995 NMFS screening criteria and as per the 1996 addendum to those criteria (NMFS 1996). As an alternative, water intakes shall comply with transitional criteria set forth by NMFS in 1999 for juvenile fish screens constructed prior to the establishment of the 1995 criteria (NMFS 1996), to minimize risks to listed salmon and steelhead. The water intake screen structures will be inspected and monitored at their hatchery facilities to determine if listed salmon and steelhead are being drawn into the facility; the results of this monitoring shall be included in annual reports.

Winthrop NFH: All spring Chinook salmon eggs are incubated on 100% ground water. This water source is free of silt, does not create fungus problems, and provides temperatures in the 39 (chilled) to 52 ˚F (unchilled) range during incubation. Dissolved oxygen is relatively constant at 9 ppm on the inflow and not less than 8 ppm at the outflow. It is not necessary to use formalin during incubation since *Saprolegnia sp.* fungus has not been a problem. Heath trays are loaded at one female per tray through the entire incubation cycle (3000 to 6000 eggs/tray). Flows through the incubation stacks are 1 to 2 gpm to the eyed stage and 3 to 5 gpm from the eyed to button-up fry stage (See WNFH HGMP).

2.6.2. **BKD Management:**

Chelan PUD proposes to implement a BKD management approach that relies on HSRG recommendations as well as historic program data (from 1996-2008) consistent with agreements in the HCP-HC. At present, many of the decisions in the program will depend on a lethal, enzyme-linked immunosorbent assay (ELISA) to determine the probability of broodstock transmitting BKD vertically to their progeny. In the future, non-lethal screening techniques may offer new opportunities to manage for BKD. Until that time however, the incidence of BKD in the Methow River spring Chinook program will be minimized using three management practices: Prevention, Treatment and Replacement.

Prevention

Disinfection and antibiotics: Female (hatchery- and natural-origin) spring Chinook broodstock will be injected, prespawning with an appropriate antibiotic (e.g., azithromycin at 40 mg/kg fish) and the resulting eggs will be surface disinfected with iodophor consistent with methods in The Salmonid Disease Control Policy of the Fisheries Co-Managers of Washington State.

Screening: Female broodstock will be assayed (ELISA) to determine titer score [e.g., optical density (OD)]

Culling titer progeny of OD ≥ 0.12: Hatchery-origin eggs/progeny with ELISA titers of OD ≥ 0.12 will be culled from the program.

Rearing titer progeny of OD ≥ 0.12: Wild-origin eggs/progeny with ELISA titers of OD ≥ 0.12 will be raised at lower density of 0.06.

Culling titer progeny of OD > 0.19: All hatchery- and natural-origin eggs/progeny with ELISA titers of OD > 0.19 should be culled from the program.

Screening (future): The HCP Hatchery Committee will evaluate emerging technology to provide non-lethal BKD screening (e.g., near infrared spectroscopy and genetic tests) as these tools become commercially available.

Treatment:

Antibiotics: At the first signs of infection with BKD, juvenile spring Chinook will be treated with orally administered antibiotics at a type, dosage and duration as determined by fish health personnel. The treatments may be repeated if there is evidence that the BKD agent has persisted in the hatchlings and fish health determines additional treatment is warranted.

Rearing Density: Chelan will provide adequate facilities to rear up to 20 percent of the conservation program at a lower density (0.06 density index). The low density rearing environment would be designated for wild origin fish with titers of 0.12 ≤ OD ≤ 0.19[3]. When less than 5 percent of the program production is in the 0.12 ≤ OD ≤ 0.19 titer range, the HCP Hatchery Committee may elect not to rear these fish to program size and instead utilize the available hatchery space for other purposes.

Replacement:

Broodstock Collection: Collect up to 20 percent extra hatchery-origin spring Chinook females to meet any production shortfalls related to culling hatchery fish with titers of OD > 0.12 and wild fish with titers of OD>0.19.

2.7. Overwinter Rearing

Fish would be transported from Eastbank to Carlton (or other locations within the Methow Basin as determined by the HC) in October to allow overwinter rearing to occur on Methow River water.

[3] These values may change depending on lab technologies and methodologies employed.

2.7.1. **Program Targets:**

- Target size at transfer to overwinter rearing site: approximately 26-30 fish per pound.
- Target transfer date to overwinter rearing site: October-November depending on annual temperature variation and observed temperature differentials between transfer and receiving facilities. .

2.7.2. **Location:**

Carlton Pond: Chelan's facility site is located approximately 2.5 miles south of Twisp, Washington off the east side of the Twisp-Carlton Road (Methow River; mile 35 [rkm 56]). The current capacity is represented by a single 84,000ft^3 pond and 14.9 CFS of Methow River surface water. It is slated for improvements in 2013 that would provide overwinter rearing capabilities including groundwater to prevent icing. The construction of the proposed improvements will involve Grant PUD and is depicted below (these improvements are undergoing a separate review and permitting process that are administered through Grant PUD's Priest Rapids Coordinating Committee Hatchery Subcommittee). Chelan's fish may be reared in the existing or new capacity depending on approvals from the HCP committees.

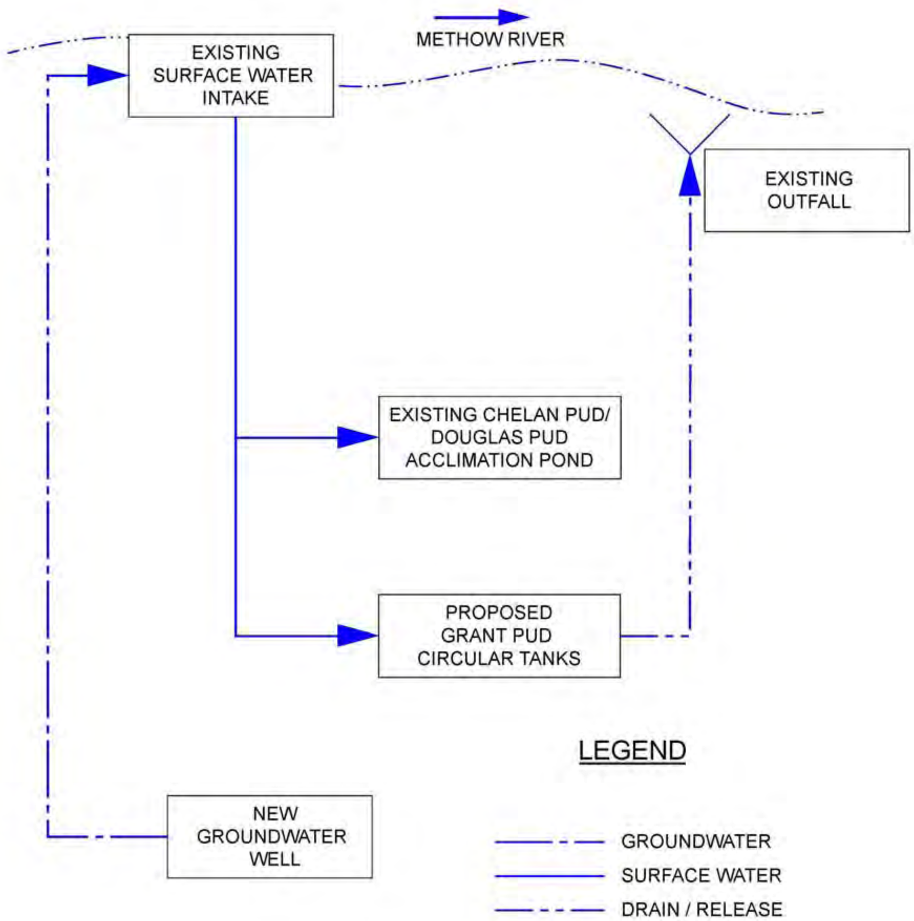

Figure 2. Process modifications proposed at Chelan's Carlton Acclimation Pond

Currently, surface water supply to the facility is from the Methow River through a screened surface water pumped intake located on the right bank of the Methow River. The existing screen system consists of a pair of 30-inch diameter tee screens with a high pressure air backwash cleaning system. The screens have a total screened area of 163 ft^2, which would allow a maximum intake flow rate of 32.6 cfs at the typical screen approach velocity of 0.4 ft/s.

At Carlton water withdrawal for hatchery use is regulated by the Washington State Department of Ecology under Chapter 90.03 of the Revised Code of Washington (RCW) (water code). None of the hatchery facilities employed to carry out the proposed artificial propagation programs de-water river reaches used by listed fish for migration, spawning, or rearing. All hatcheries owned and/ or operated by WDFW discharge water in compliance with the National Pollutant Discharge Elimination System (NPDES) General Permit No. WAG 13, valid through August 1, 2015. This permit is administered in Washington by the Washington Department of Ecology under agreement with the United States Environmental Protection Agency.

The following measures will be employed to minimize the likelihood for the take of listed natural fish:

• Ensure that water intakes into artificial propagation facilities are properly screened in compliance with 1995 NMFS screening criteria and as per the 1996 addendum to those criteria (NMFS 1996). As an alternative, water intakes shall comply with transitional criteria set forth by NMFS in 1999 for juvenile fish screens constructed prior to the establishment of the 1995 criteria (NMFS 1996), to minimize risks to listed salmon and steelhead. Water intake screen structures will be inspected and monitored at hatchery facilities to determine if listed salmon and steelhead are being drawn into the facility; the results of this monitoring shall be included in annual reports.

2.8. Acclimation.

2.8.1. **Program Targets**

- Target transfer date to acclimation site: February-March depending on annual temperature variation.
- Target release size: 15-18 fish per pound.
- Target release dates: April-May
- Release method: volitional

2.8.2. **Locations**

Acclimation of Chelan's spring Chinook program would occur within the Yakama Nation (YN) Expanded Acclimation sites[4] or other sites approved by the HCP Hatchery Committee. To encourage hatchery origin spawners to migrate further upstream, YN proposes to acclimate (spring only) 15,000 Chinook pre-smolts at YN's Goat Wall acclimation site and 46,000 at Mid-Valley Pond. The sum of 61,000 would represent Chelan PUD's spring Chinook obligation in the Methow River starting in 2015.

Goat Wall (Yakama Nation): The Goat Wall acclimation site is a disconnected side channel system on the upper Methow River, located near of the mouth of the Lost River (Methow River; mile 70 [rkm 112]). There is a pond at the downstream end of a disconnected side channel. The pond is fed by both surface water and ground water. Surface water is provided by a diversion on the adjacent Gate Creek and ground water is supplied by Cold Creek (a groundwater seep). The estimated capacity is 34,000 spring Chinook.

Mid-Valley (Yakama Nation): A series of large springs originate in the Methow valley floor; ponds have previously been constructed in the past to impound the spring water for irrigation purposes. Habitat restoration efforts are currently underway to provide fish passage into and past the ponds. The pond

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[4] See "Expanded Acclimation Plan" (December 16, 2012), submitted to Rocky Reach and Rock Island HCP Hatchery Committees.

proposed for acclimation is the most downstream in the springs complex. The site is located on the Methow River (mile 54, [rkm 87]) and is downstream of the section of the Methow River that annually dewaters. The pond measures approximately 450' x 70'. A temporary seine system would allow passage by other fish species in the spring system. The adjacent upstream property is WDFW's Big Valley Unit of the Methow Wildlife Area and is managed for riparian habitat protection and wildlife conservation. The site has capacity for up to 122,650 spring Chinook.

Chewuch River (Yakama Nation): Currently, YN's Expanded Acclimation program does not have any overwinter acclimation capability in the Chewuch River , however, Chelan would support the use of a Chewuch facility operated by YN if available in the future. The use of a Chewuch Facility is contemplated in the Existing HGMP.

3. Expected Performance of Program

3.1. Number of Adults Produced

The number of adults produced by this program is expected to range from 13 to 320 fish with an average of 165 (Table 2).

Table 2: Expected range of adult production originating from Chelan's Methow spring Chinook obligation based on HCP SAR target and observed SARs.

SAR Origin	SAR %	Source of SAR	Expected Number of Adults Produced (from 60,516 smolt release)
HCP target	.300	Table 6 in Appendix D in Murdoch and Peven 2005	182
Historical average	**.273**	Murdoch et al. 2012	**165**
Min SAR (since 1993 BY)	.022	Murdoch et al. 2012	13
Max SAR (since 1993 BY)	.528	Murdoch et al. 2012	320

Table 3. Historic Methow SARs[5] from PUD funded Methow Program.

Brood year	Smolts released	Adult returns	SAR%
1993	210,849	192	0.091
1994	4,477	1	0.022
1995	28,878	122	0.422
1996	202,947	500	0.246
1997	332,484	821	0.247
1998	435,670	2,300	0.528
1999	180,775	145	0.080
2000	266,392	852	0.320
2001	130,787	508	0.388
2002	181,235	599	0.331
2003	48,831	57	0.117
2004	65,146	316	0.485
Mean (SD)			0.273 (0.168)

3.2. Stray Rates

Expected stray rates resulting from the Chelan PUD Methow Spring Chinook Program are likely to be similar to the historic Methow Program and other overwintered acclimated programs based out of Eastbank (see Murdoch et al. 2012). The number of strays originating from Chelan's program is expected to be low because (1) Chelan will acclimate juveniles on Methow River water, which will maximize homing fidelity; and (2) the number of adults produced by the program is expected to be very small based on release sizes and empirical SAR data. Based on comparisons with existing programs, the proportion of strays within and among populations is expected to remain below the 10% and 5% target levels, respectively, of the HCPs.

In the event stray rates exceed the HCP targets, Chelan will fund additional in-basin imprinting opportunities including (1) development of new water sources within the basin or (2) early life history acclimation (i.e., incubation and fry) or (3) other measures approved by the HCP Hatchery Committee. These activities are part of the adaptive framework of the HCPs and will be decided upon by the hatchery committees.

[5] From Murdoch et al. (2012)

4. Adult Management

Chelan's smolt release numbers (60,516) represent 10% of the spring Chinook production in the Methow Basin (Table 6). The Douglas and Grant production group represents 23% (i.e., 135,000 smolts) and the USFWS is releasing the remaining 67% (i.e., 400,000 smolts). Chelan will provide WDFW with tools and resources to ensure that WDFW has the capability to remove at least the number of hatchery-origin fish that are expected to be produced by Chelan's program (165 adults on average).

Chelan PUD and WDFW have distinct roles and responsibilities for implementing the actions described in this application: Chelan PUD has an independent responsibility to meet hatchery compensation obligations described in the HCPs. WDFW has assumed responsibility due the authority to conduct activities necessary to manage fisheries resources of the State of Washington. Harvest is not addressed in the HCPs because it is not within the regulatory jurisdiction of the FERC license (NMFS 2007). Annual decisions related to the active management of adult returns, including fisheries and the disposition of collected adults, do require approval of authorized managers.

Achieving Proportionate Natural Influence (PNI) goals, where PNI = pNOB /(pHOS + pNOB), will require decisions and actions to control the proportion of hatchery-origin spawners on the spawning grounds (i.e., pHOS). Chelan will mark fish and provide funding and access to available infrastructure to ensure that WDFW, as an authorized manager, can conduct actions necessary to meet specific pHOS goals. The current pHOS target is currently understood to be less than or equal to 0.25 for the Methow River.

The WDFW will remove excess Methow River hatchery-origin spring Chinook to meet pHOS, at levels determined by WDFW (in coordination with other managers in the appropriate management venues). It is expected that attaining the 0.25 pHOS level will take several years to achieve as returns from earlier, larger brood years will continue to be represented in spawning escapements through 2017.

Table 4. Expected adult returns based on SAR data and program release quantities for Methow based programs

Methow Production	SAR (%)	Smolts Released	Expected Hatchery Returns
Methow Hatchery (Douglas and Grant PUDs)	0.273[6]	135,000	369
Winthrop NFH (USFWS)	0.134[7]	400,000	536
Chelan Methow Program (Chelan PUD)	0.273[8]	60,516	165

[6] From Murdoch *et al.* 2012
[7] From HCP hatchery recalculation 2011
[8] From Murdoch *et al.* 2012

		Total Adult Returns	1,070

Based on expected natural origin returns for the Upper Methow River (mean = 283; 95% CI = 216-367) [9], the attainment of a 0.25 pHOS would, on average, require removal of all but 94 hatchery-origin spawners from the total adult returns from all three programs in Table 4. Both Methow Hatchery and Winthrop NFH have also described specific measures to meet pHOS goals.

For the Chelan PUD Methow Spring Chinook program, adult management actions are summarized below.

4.1.1. Broodstock collection

Excess hatchery origin adults from the Methow conservation program may be used as broodstock for the WNFH spring Chinook program and the CJH spring Chinook program when managing for pHOS less than or equal to 0.25 (Augments Existing HGMP Section 1.8.2.4). The number of broodstock available for other facilities will decrease commensurately with increasing escapement of hatchery returns to the natural spawning grounds in order to meet spawning escapement goals.

4.1.2. PIT tag and external marks:

Chelan will PIT tag up to 25% of released smolts from Chelan's program to ensure that up to 25% of returning adults can be readily identified and potentially removed using non-lethal sorting techniques at any traps located throughout the basin. Chelan will also fund external marking required for conservation and harvest management. Chelan will fund up to 100% external marking if necessary to support the adaptive management and ESA compliance of the program. WDFW will determine annual external marking levels and coordinate or obtain approval from other managers as needed.

4.1.3. Rocky Reach Trap

Based on previous efforts with bull trout and steelhead, the Rocky Reach Trap can effectively remove externally marked fish, one fish at a time, without delaying unmarked fish of those species or causing take of non-target fish. Based on the average distribution of the most recent 10 years of data (DART: http://www.cbr.washington.edu/dart/), the first 5% of the spring Chinook run passes Rocky Reach by April 18, and the 95% passage date is June 17. Therefore, 90% of the run passes during an approximately 60 day period. Under an extremely conservative trapping scenario (40 days of operation and no more than four fish removed per day), WDFW could remove up to 160 excess hatchery-origin spring Chinook annually at Rocky Reach. With the installation of sort-by-code PIT technology, it is expected that additional fish, not externally marked, could also be removed, if desired by managers.

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[9] See Table 5 from: *"SUPPORTING INFORMATION SUBMITTED TO THE NATIONAL MARINE FISHERIES SERVICE REGARDING THE WINTHROP NATIONAL FISH HATCHERY SPRING CHINOOK HGMP," November 15, 2012.*

4.1.4. **Wells Trap**

Hatchery origin returns may be managed at the ladder traps at Wells Dam in years when pHOS is expected to exceed 0.25 and minimum spawning escapement goals have been achieved. (See Existing HGMP)

4.1.5. **FTE funding to WDFW**

In order to ensure that WDFW has the capacity to manage excess hatchery origin spring Chinook from Chelan's program, Chelan will provide funding to WDFW sufficient to support an FTE.

4.1.6. **Conservation Fishery.**

Conducting a conservation fishery will help reduce the number of hatchery-origin adults; however, a fishery would be directed at WNFH returning adults, and not necessarily at fish originating from this program. Therefore, a fishery may help overall adult management in the basin, but may not have a substantial effect on adult management of Chelan's spring Chinook production in the Methow River unless alternative marking strategies were employed.

4.1.7. **Estimated Removal**

Through a combination of marking, infrastructure and FTE funding, Chelan will ensure that WDFW has the tools necessary to successfully remove at least 165 hatchery-origin fish annually (i.e., 100% of the expected average number of fish produced by Chelan's program)–if necessary. These removals may include Chelan origin fish or other hatchery production groups originating from the Methow Basin depending on prioritization by managers. WDFW will remove excess hatchery origin fish, as authorized under applicable laws and regulatory frameworks. Attainment of annual pHOS goals will be monitored by the Chelan funded M&E program (See Existing HGMP).

5. <u>M&E</u>

(M&E and Research is described completely in the Existing HGMP)

Monitoring and evaluation plays an important role in helping measure program results and determining future directions (adaptive management). The HCP Hatchery Committee has developed a rigorous monitoring program for the Methow River spring Chinook program (see Existing HGMP). Currently, the M&E program monitors survival and growth within the hatchery and the effects of hatchery fish on population productivity, genetic diversity, run and spawn timing, spawning distribution, and age and size at maturity. This information is collected directly from or derived from spawning ground surveys, broodstock sampling, stock composition sampling (stock assessment), hatchery juvenile sampling, smolt trapping, precocity sampling, PIT tagging, CWT tagging, genetic sampling, disease sampling, and snorkeling. Importantly, the monitoring and evaluation program is consistent with the draft monitoring and evaluation plan prepared by NMFS for the Upper Columbia Spring Chinook and Steelhead Recovery

Plan (see Appendix P to the Recovery Plan) and the Ad Hoc Supplementation Monitoring and Evaluation Workgroup recommendations (Galbreath et al. 2008).

In 2013, Chelan's M&E obligations will be updated by the Hatchery Committee. Chelan, Douglas and Grant PUDs will proportionally co-fund the M&E activities for this program as agreed to by the HCP Hatchery Committee in accordance with the processes outlined in the HCP (see Existing HGMP).

6. Certification Language and Signature of Responsible Party

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this application is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicants:

Name: ___________________________

Title: ____________________________

Certified by: _______________________

Date: _____________

Name: ____________________________

Title: ______________________________

Certified by: _______________________

Date: _____________

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APPENDIX Q
STEELHEAD REPRODUCTIVE SUCCESS STUDY – 2012 SUMMARY REPORT

Relative reproductive success of Twisp River hatchery and wild steelhead (*Oncorhynchus mykiss*): Summary report for SNP genotyping of adult collections – Return Year 2012

Todd R. Seamons* and Sarah Bell

Washington Department of Fish and Wildlife, Molecular Genetics Laboratory

9 September, 2013

*Corresponding Author: WDFW Molecular Genetics Laboratory. 600 Capitol Way N., Olympia, WA 98501-1091. Todd.Seamons@dfw.wa.gov. (360) 902-2765

Introduction

The Wells HCP requires Douglas County PUD to investigate the relative reproductive success of naturally spawning hatchery-produced steelhead (*Oncorhynchus mykiss*). This project was initiated to fulfill that requirement. Starting in 2011, the Twisp River hatchery program became an integrated program: only naturally produced adults are used as hatchery broodstock and the number of naturally spawning hatchery-produced adults will be controlled (HSRG 2009). Specifically, only wild or naturally-produced adult steelhead from the Twisp River will be used as broodstock to produce offspring to be released in the Twisp River and the number of hatchery-produced adult steelhead allowed to spawn naturally upstream of the Twisp River weir will be limited. All hatchery broodstock and all naturally spawning adults will be sampled for DNA parentage assignment analysis. Their adult offspring will be sampled in later years. The purpose of this report is to summarize the methods and results of genetic analysis of adult steelhead sampling at the Twisp River weir in 2012. Laboratory methods are outlined and the genetic characteristics of the hatchery and natural origin collections are reported.

Methods

Sampling location and methods

Adult hatchery-produced and wild steelhead were collected from a weir located in the Twisp River, a tributary to the Methow River in north central Washington State in 2012. Adult steelhead that entered the trap were sorted by origin (hatchery or wild). A roughly 1:1 ratio of hatchery-produced to natural origin adults were sampled, tagged with a floy or PIT tag and released upstream to spawn naturally. Surplus hatchery-produced fish were killed, and some natural origin fish were retained for hatchery broodstock. Hatchery-produced steelhead were identified by a missing adipose fin (which was removed prior to release from the hatchery as a juvenile), an elastomer mark, a coded-wire tag, or dorsal fin erosion. Individual fish were sampled for body length, sex, arrival date, spawning location and date (when possible), scales were removed for ageing and confirmation of fish origin, and a small fin clip was taken for genetic analysis. Fin clips were preserved in 95% ethanol and stored at room temperature. A few additional adults were captured by the Yakama Tribe in a temporary weir designed to capture kelts on Little Bridge Creek, a tributary to the Twisp River, located upstream of the Twisp weir. These fish were subjected to a similar sampling protocol as those sampled at the Twisp weir.

Genetic sample processing

The panel of WDFW *O. mykiss* single nucleotide polymorphic loci (SNPs) that is used for analysis statewide has been updated and finalized since the completion of the 2012 report. Samples were genotyped using the finalized set of loci. The suite of 192 SNP markers included 189 SNP loci developed to be used for population structure, parentage assignment, or other population genetic studies of *O. mykiss* (Table 1) and three SNP loci developed to distinguish cutthroat trout (*O. clarkii*) from steelhead and rainbow trout (Table 2).

To extract and isolate DNA from fin tissue, Qiagen DNEasy ® kits (Qiagen Inc., Valencia, CA) were used, following the recommended protocol for animal tissues. SNP genotypes were obtained through PCR and visualization on Fluidigm EP1 integrated fluidic circuits (chips). Protocols followed Fluidigm's recommendations for TaqMan SNP assays as follows: Samples were pre-amplified by Specific Target Amplification (STA) following Fluidigm's recommended protocol with one modification. The 192 assays were pooled to a concentration of 0.2X and mixed with 2X Qiagen Multiplexing Kit (Qiagen, Inc., Valencia CA), instead of TaqMan PreAmp Master Mix (Applied Biosystems), to a volume of 3.75µl, to which 1.25µl of unquantified sample DNA was added for a total reaction volume of 5µl. Pre-amp PCR was conducted on a MJ Research or Applied Biosystems themal cycler using the following profile: 95°C for 15 min followed by 14 cycles of 95°C for 15 sec and 60°C for 4 minutes. Post-PCR reactions were diluted with 20µl dH_2O to a final volume of 25µl.

Specific SNP locus PCRs were conducted on the Fluidigm chips. Assay loading mixture contained 1X Assay Loading Reagent (Fluidigm), 2.5X ROX Reference Dye (Invetrogen) and 10X custom TaqMan Assay (Applied Biosystems); sample loading mixture contains 1X TaqMan Universal PCR Master Mix (Applied Biosystems), 0.05X AmpliTaq Gold DNA polymerase (Applied Biosystems), 1X GT sampling loading reagent (Fluidigm) and 2.1 µL template DNA. Four µL assay loading mix and 5 µL sample loading mix were pipetted onto the chip and loaded by the IFC loader (Fluidigm). PCR was conducted on a Fluidigm thermal cycler using a two step profile. Initial mix thermal profile was 70°C for 30min, 25°C for 5 min, 52.3° for 10 sec, 50.1°C for 1 min 50sec, 98°C for 5 sec, 96°C for 9 min 55 sec, 96°C for 15 sec, 58.6°C for 8 sec, and 60.1°C for 43 sec. Amplification thermal profile was 40 cycles of 58.6°C for 10 sec, 96°C for 5 sec, 58.6°C for 8 sec and 60.1°C for 43 sec with a final hold at 20°C.

The SNP assays were visualized on the Fluidigm EP1 machine using the BioMark data collection software and analyzed using Fluidigm SNP genotyping analysis software. To ensure all SNP markers were being scored accurately and consistently, all data were scored by two researchers and scores of each researcher were compared. Disputed scores were called missing data (i.e., no genotype).

Evaluation of loci

To evaluate genetic qualities of loci, we quantified several genetic parameters in the Twisp River adult steelhead collections. To check for systematic scoring issues, we performed a two-tailed exact test of Hardy–Weinberg equilibrium (HWE) for each locus in each collection using the Markov Chain method implemented in Genepop 4.2 (dememorization number 1000, batches 100, 1000 iterations per batch; (Raymond and Rousset 1995; Rousset 2008)). Significance of probability values was adjusted for multiple tests using false discovery rate (Verhoeven et al. 2005). F_{IS}, a measure of the fractional reduction in heterozygosity due to inbreeding in individuals within a subpopulation and an additional indicator of scoring issues, was calculated according to Weir & Cockerham (1984) using Genepop 4.2. Expected heterozygosity was calculated using GENETIX 4.05 software (Belkhir et al. 2001). Pairwise F_{ST} estimates among collections were calculated and statistical significance was estimated by permutation tests using FSTAT (Goudet 1995) with 1000 permutations.

Results

Samples received

From spring 2012 sampling at the Twisp River weir, 305 tissue samples from hatchery and wild origin steelhead were received by Washington Department of Fish and Wildlife (WDFW) Molecular Genetics Laboratory (MGL; Table 3). Of these, 262 were singled out for genotyping based on whether or not they were allowed upstream to spawn, i.e., all fish euthanized at the weir were not genotyped for this analysis.

Genotyping success

Genotyping success was high, with an average of 98.9% complete (374 alleles out of a total of 378 possible) and a range of 91.0% to 100.0% complete. We had complete genotypes from 10% of samples (28/262) and 99% of samples had between 95% and 100% genotyping success. No adult samples from 2012 had matching genotypes with any other 2012 sample or any sample from previous years. Two wild origin fish appeared to be F1 cutthroat/steelhead hybrids (12DI0088 and 12DI0091). These fish were removed from analysis to evaluate the loci, but will be included in any future parentage assignment analysis.

Evaluation of loci

No loci had significant *P* values for exact tests of HWE after false discovery rate adjustment for multiple tests (Table 4). In both the wild and hatchery origin fish, several loci were in linkage disequilibrium (LD), after correction for multiple tests. Five loci in particular were in LD in both groups of fish. A*Omy*137, A*Omy*152, and A*Omy*214 all showed LD with one another ($P \ll 0.0001$, all six pairwise tests) and A*Omy*095 and A*Omy*272 were in LD ($P \ll 0.0001$, both tests). The presence of these linked loci will not affect parentage assignment.

The pairwise F_{ST} estimate for 2012 hatchery and wild steelhead was similar to F_{ST} estimates from previous years ($F_{ST} = 0.005$).

Genotypes of all individuals are in Appendix 1.

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Appendix 1

See attached Appendix 1 (Twisp_2012_adult_genotyping_Appendix_1_2012.xlsx).

Table 1. List of general use, diploid single nucleotide polymorphic (SNP) loci genotyped in Twisp River steelhead

WDFW Name	Locus Name	Allele 1	Allele 2	Reference
AOmy005	Omy_aspAT-123	T	C	(Campbell et al. 2009)
AOmy010	Omy_CRB2677.106	G	T	(Sprowles et al. 2006)
AOmy014	Omy_e1-147	G	T	(Sprowles et al. 2006)
AOmy015	Omy_gdh-271	C	T	(Campbell et al. 2009)
AOmy016	Omy_GH1P1_2	C	T	(Aguilar and Garza 2008)
AOmy021	Omy_LDHB-2_e5	T	C	(Aguilar and Garza 2008)
AOmy023	Omy_MYC_2	T	C	(Aguilar and Garza 2008)
AOmy026	Omy_myoD.178	A	C	(Campbell et al. 2009)
AOmy027	Omy_nkef-241	C	A	(Campbell et al. 2009)
AOmy028	Omy_nramp-146	G	A	(Campbell et al. 2009)
AOmy029	Omy_Ogo4.212	T	C	(Campbell et al. 2009)
AOmy042	Omy_BAC-F5.284	C	T	(Limborg et al. 2012)
AOmy047	Omy_u07-79-166	G	T	(Limborg et al. 2012)
AOmy048	Omy_113490-159	C	T	(Abadía-Cardoso et al. 2011)
AOmy049	Omy_114315-438	T	G	(Abadía-Cardoso et al. 2011)
AOmy051	Omy_121713-115	T	A	(Abadía-Cardoso et al. 2011)
AOmy056	Omy_128693-455	T	C	(Abadía-Cardoso et al. 2011)
AOmy058	Omy_130524-160	C	G	(Abadía-Cardoso et al. 2011)
AOmy059	Omy_187760-385	A	T	(Abadía-Cardoso et al. 2011)
AOmy061	Omy_96222-125	T	C	(Abadía-Cardoso et al. 2011)
AOmy062	Omy_97077-73	T	A	(Abadía-Cardoso et al. 2011)
AOmy065	Omy_97954-618	C	T	(Abadía-Cardoso et al. 2011)
AOmy067	Omy_aromat-280	T	C	WSU - J. DeKoning unpubl.
AOmy068	Omy_arp-630	G	A	(Campbell et al. 2009)
AOmy072	Omy_cd59b-112	C	T	WSU - J. DeKoning unpubl.
AOmy073	Omy_colla1-525	C	T	WSU - J. DeKoning unpubl.
AOmy074	Omy_cox2-335	T	G	WSU - J. DeKoning unpubl.
AOmy078	Omy_g1-103	T	C	(Stephens et al. 2009)
AOmy079	Omy_g12-82	T	C	WSU - J. DeKoning unpubl.
AOmy081	Omy_gh-475	C	T	(Campbell et al. 2009)
AOmy082	Omy_gsdf-291	T	C	WSU - J. DeKoning unpubl.
AOmy084	Omy_hsc715-80	C	A	WDFW - S. Young unpubl.
AOmy087	Omy_hsp47-86	T	A	WDFW - S. Young unpubl.
AOmy088	Omy_hsp70aPro-329	A	G	(Campbell and Narum 2009)
AOmy089	Omy_hsp90BA-193	C	T	(Campbell and Narum 2009)
AOmy091	Omy_IL17-185	G	A	WSU - J. DeKoning unpubl.
AOmy092	Omy_IL1b-163	T	G	WSU - J. DeKoning unpubl.
AOmy094	Omy_inos-97	C	A	WSU - J. DeKoning unpubl.

WDFW Name	Locus Name	Allele 1	Allele 2	Reference
AOmy095	Omy_mapK3-103	A	T	CRITFC - N. Campbell unpubl.
AOmy096	Omy_mcsf-268	T	C	WSU - J. DeKoning unpubl.
AOmy100	Omy_nach-200	A	T	WSU - J. DeKoning unpubl.
AOmy105	Omy_OmyP9-180	C	G	(Sprowles et al. 2006)
AOmy107	Omy_Ots249-227	C	T	(Campbell et al. 2009)
AOmy108	Omy_oxct-85	A	T	WSU - J. DeKoning unpubl.
AOmy110	Omy_star-206	A	G	WSU - J. DeKoning unpubl.
AOmy111	Omy_stat3-273	G	Deletion	WSU - J. DeKoning unpubl.
AOmy113	Omy_tlr3-377	C	T	WSU - J. DeKoning unpubl.
AOmy114	Omy_tlr5-205	T	A	WSU - J. DeKoning unpubl.
AOmy117	Omy_u09-52-284	T	G	(Limborg et al. 2012)
AOmy118	Omy_u09-53-469	T	C	(Limborg et al. 2012)
AOmy120	Omy_u09-54.311	C	T	WDFW - S. Young unpubl.
AOmy123	Omy_u09-55-233	A	G	(Limborg et al. 2012)
AOmy125	Omy_u09-56-119	T	C	(Limborg et al. 2012)
AOmy129	Omy_BAMBI4.238	T	C	WDFW - S. Young unpubl.
AOmy132	Omy_G3PD_2.246	C	T	WDFW - S. Young unpubl.
AOmy134	Omy_Il-1b-028	T	C	WDFW - S. Young unpubl.
AOmy137	Omy_u09-61.043	A	T	WDFW - S. Young unpubl.
AOmy144	Omy_UT16_2.173	C	T	WDFW - S. Young unpubl.
AOmy147	Omy_U11_2b.154	T	C	WDFW - S. Young unpubl.
AOmy149	Omy_gluR-79	C	T	CRITFC - unpubl.
AOmy152	Omy_SECC22b-88	T	C	CRITFC - unpubl.
AOmy173	BH2VHSVip10	C	T	Pascal & Hansen unpubl.
AOmy174	OMS00003	T	G	(Sánchez et al. 2009)
AOmy176	OMS00013	A	G	(Sánchez et al. 2009)
AOmy177	OMS00018	T	G	(Sánchez et al. 2009)
AOmy179	OMS00041	G	C	(Sánchez et al. 2009)
AOmy180	OMS00048	T	C	(Sánchez et al. 2009)
AOmy181	OMS00052	T	G	(Sánchez et al. 2009)
AOmy182	OMS00053	T	C	(Sánchez et al. 2009)
AOmy183	OMS00056	T	C	(Sánchez et al. 2009)
AOmy184	OMS00057	T	G	(Sánchez et al. 2009)
AOmy185	OMS00061	T	C	(Sánchez et al. 2009)
AOmy186	OMS00062	T	C	(Sánchez et al. 2009)
AOmy187	OMS00064	T	G	(Sánchez et al. 2009)
AOmy189	OMS00071	A	G	(Sánchez et al. 2009)
AOmy190	OMS00072	A	G	(Sánchez et al. 2009)
AOmy191	OMS00078	T	C	(Sánchez et al. 2009)
AOmy192	OMS00087	A	G	(Sánchez et al. 2009)
AOmy193	OMS00089	A	G	(Sánchez et al. 2009)

WDFW Name	Locus Name	Allele 1	Allele 2	Reference
AOmy194	OMS00090	T	C	(Sánchez et al. 2009)
AOmy195	OMS00092	A	C	(Sánchez et al. 2009)
AOmy197	OMS00103	A	T	(Sánchez et al. 2009)
AOmy198	OMS00105	T	G	(Sánchez et al. 2009)
AOmy199	OMS00112	A	T	(Sánchez et al. 2009)
AOmy200	OMS00116	T	A	(Sánchez et al. 2009)
AOmy201	OMS00118	T	G	(Sánchez et al. 2009)
AOmy202	OMS00119	A	T	(Sánchez et al. 2009)
AOmy203	OMS00120	A	G	(Sánchez et al. 2009)
AOmy204	OMS00121	T	C	(Sánchez et al. 2009)
AOmy205	OMS00127	T	G	(Sánchez et al. 2009)
AOmy206	OMS00128	T	G	(Sánchez et al. 2009)
AOmy207	OMS00132	A	T	(Sánchez et al. 2009)
AOmy208	OMS00133	A	G	(Sánchez et al. 2009)
AOmy209	OMS00134	A	G	(Sánchez et al. 2009)
AOmy210	OMS00153	T	G	(Sánchez et al. 2009)
AOmy211	OMS00154	A	T	(Sánchez et al. 2009)
AOmy212	OMS00156	A	T	(Sánchez et al. 2009)
AOmy213	OMS00164	T	G	(Sánchez et al. 2009)
AOmy214	OMS00169	A	G	(Sánchez et al. 2009)
AOmy215	OMS00175	T	C	(Sánchez et al. 2009)
AOmy216	OMS00176	T	G	(Sánchez et al. 2009)
AOmy218	OMS00180	T	G	(Sánchez et al. 2009)
AOmy220	Omy_1004	A	T	(Hansen et al. 2011)
AOmy221	Omy_101554-306	T	C	(Abadía-Cardoso et al. 2011)
AOmy222	Omy_101832-195	A	C	(Abadía-Cardoso et al. 2011)
AOmy223	Omy_101993-189	A	T	(Abadía-Cardoso et al. 2011)
AOmy225	Omy_102505-102	A	G	(Abadía-Cardoso et al. 2011)
AOmy226	Omy_102867-443	T	G	(Abadía-Cardoso et al. 2011)
AOmy227	Omy_103705-558	T	C	(Abadía-Cardoso et al. 2011)
AOmy228	Omy_104519-624	T	C	(Abadía-Cardoso et al. 2011)
AOmy229	Omy_104569-114	A	C	(Abadía-Cardoso et al. 2011)
AOmy230	Omy_105075-162	T	G	(Abadía-Cardoso et al. 2011)
AOmy231	Omy_105385-406	T	C	(Abadía-Cardoso et al. 2011)
AOmy232	Omy_105714-265	C	T	(Abadía-Cardoso et al. 2011)
AOmy233	Omy_107031-704	C	T	(Abadía-Cardoso et al. 2011)
AOmy234	Omy_107285-69	C	G	(Abadía-Cardoso et al. 2011)
AOmy235	Omy_107336-170	C	G	(Abadía-Cardoso et al. 2011)
AOmy237	Omy_107806-34	C	T	(Abadía-Cardoso et al. 2011)
AOmy238	Omy_108007-193	A	G	(Abadía-Cardoso et al. 2011)
AOmy239	Omy_109243-222	A	C	(Abadía-Cardoso et al. 2011)

WDFW Name	Locus Name	Allele 1	Allele 2	Reference
AOmy240	Omy_109525-403	A	G	(Abadía-Cardoso et al. 2011)
AOmy241	Omy_110064-419	T	G	(Abadía-Cardoso et al. 2011)
AOmy242	Omy_110078-294	A	G	(Abadía-Cardoso et al. 2011)
AOmy243	Omy_110362-585	G	A	(Abadía-Cardoso et al. 2011)
AOmy244	Omy_110689-148	A	C	(Abadía-Cardoso et al. 2011)
AOmy246	Omy_111084-526	A	C	(Abadía-Cardoso et al. 2011)
AOmy247	Omy_111383-51	C	T	(Abadía-Cardoso et al. 2011)
AOmy248	Omy_111666-301	T	A	(Abadía-Cardoso et al. 2011)
AOmy249	Omy_112301-202	T	G	(Abadía-Cardoso et al. 2011)
AOmy250	Omy_112820-82	G	A	(Abadía-Cardoso et al. 2011)
AOmy252	Omy_114976-223	T	G	(Abadía-Cardoso et al. 2011)
AOmy253	Omy_116733-349	C	T	(Abadía-Cardoso et al. 2011)
AOmy254	Omy_116938-264	A	G	(Abadía-Cardoso et al. 2011)
AOmy255	Omy_117259-96	T	C	(Abadía-Cardoso et al. 2011)
AOmy256	Omy_117286-374	A	T	(Abadía-Cardoso et al. 2011)
AOmy257	Omy_117370-400	A	G	(Abadía-Cardoso et al. 2011)
AOmy258	Omy_117540-259	T	G	(Abadía-Cardoso et al. 2011)
AOmy260	Omy_117815-81	C	T	(Abadía-Cardoso et al. 2011)
AOmy261	Omy_118175-396	T	A	(Abadía-Cardoso et al. 2011)
AOmy262	Omy_118205-116	A	G	(Abadía-Cardoso et al. 2011)
AOmy263	Omy_118654-91	A	G	(Abadía-Cardoso et al. 2011)
AOmy265	Omy_120255-332	A	T	(Abadía-Cardoso et al. 2011)
AOmy266	Omy_128996-481	T	G	(Abadía-Cardoso et al. 2011)
AOmy267	Omy_129870-756	C	T	(Abadía-Cardoso et al. 2011)
AOmy268	Omy_131460-646	C	T	(Abadía-Cardoso et al. 2011)
AOmy269	Omy_98683-165	A	C	(Abadía-Cardoso et al. 2011)
AOmy270	Omy_cyp17-153	C	T	WSU - J. DeKoning unpubl.
AOmy271	Omy_ftzf1-217	A	T	WSU - J. DeKoning unpubl.
AOmy272	Omy_GHSR-121	T	C	CRITFC - unpubl.
AOmy273	Omy_metA-161	T	G	CRITFC - unpubl.
AOmy274	Omy_UBA3b	A	T	(Hansen et al. 2011)
AOmy275	M09AAC.055	C	T	WDFW - S. Young unpubl.
AOmy276	M09AAE-082	T	G	WDFW - S. Young unpubl.
AOmy277	OMGH1PROM1-SNP1	A	T	(Abadía-Cardoso et al. 2011)
AOmy279	OMS00015	A	T	(Sánchez et al. 2009)
AOmy280	OMS00024	T	G	(Sánchez et al. 2009)
AOmy283	OMS00070	T	C	(Sánchez et al. 2009)
AOmy284	OMS00074	T	G	(Sánchez et al. 2009)
AOmy285	OMS00096	T	G	(Sánchez et al. 2009)
AOmy286	OMS00111	T	C	(Sánchez et al. 2009)

WDFW Name	Locus Name	Allele 1	Allele 2	Reference
AOmy288	OMS00149	T	G	(Sánchez et al. 2009)
AOmy289	OMS00173	T	C	(Sánchez et al. 2009)
AOmy290	Omy_105105-448	C	T	(Abadía-Cardoso et al. 2011)
AOmy291	Omy_110201-359	T	G	(Abadía-Cardoso et al. 2011)
AOmy292	Omy_128923-433	T	C	(Abadía-Cardoso et al. 2011)
AOmy293	Omy_anp-17	C	A	CRITFC - N. Campbell unpubl.
AOmy294	Omy_bcAKala-380rd	G	A	CRITFC - N. Campbell unpubl.
AOmy295	Omy_cin-172	C	T	CRITFC - N. Campbell unpubl.
AOmy296	Omy_ndk-152	A	G	CRITFC - N. Campbell unpubl.
AOmy297	Omy_nips-299	T	Deletion	CRITFC - N. Campbell unpubl.
AOmy298	Omy_ntl-27	G	A	CRITFC - N. Campbell unpubl.
AOmy299	Omy_rbm4b-203	Deletion	T	CRITFC - N. Campbell unpubl.
AOmy300	Omy_sys1-188	C	A	CRITFC - N. Campbell unpubl.
AOmy301	Omy_txnip-343	T	C	CRITFC - N. Campbell unpubl.
AOmy302	Omy_vamp5-303	A	Deletion	CRITFC - N. Campbell unpubl.
AOmy303	Omy_vatf-406	T	C	CRITFC - N. Campbell unpubl.
AOmy305	OMS00077	C	G	(Sánchez et al. 2009)
AOmy306	OMS00101	A	G	(Sánchez et al. 2009)
AOmy311	Omy_G3PD_2-371	C	A	CRITFC - N. Campbell unpubl.
AOmy320	Omy_redd1-410	C	T	CRITFC - N. Campbell unpubl.
AOmy322	Omy_srp09-37	C	T	CRITFC - N. Campbell unpubl.
AOmy324	Omy1011	C	A	(Hansen et al. 2011)
AOmy326	OMS00068	A	G	(Sánchez et al. 2009)
AOmy327	OMS00079	T	C	(Sánchez et al. 2009)
AOmy328	OMS00106	T	G	(Sánchez et al. 2009)
AOmy329	OMS00179	A	C	(Sánchez et al. 2009)
AOmy331	Omy_114587-480	T	G	(Abadía-Cardoso et al. 2011)
AOmy335	OMS00017	A	G	(Sánchez et al. 2009)
AOmy341	Omy_metB-138	T	A	CRITFC - unpubl.

Primer and probe sequences for unpublished loci available by request.

Table 2. List of species identification single nucleotide polymorphic (SNP) loci genotyped in Twisp River steelhead.

		Expected genotype			
WDFW Name	Locus Name	*O. mykiss*	*O. clarkii clarkii*	*O. clarkii lewisi*	Reference
ASpI001	Ocl_Okerca	T	C	C	(McGlauflin et al. 2010)
ASpI014	Omy_F5_136	C	G	G	(Finger et al. 2009)
ASpI018	Omy_Omyclmk436-96	A	C	C	CRITFC - S. Narum - unpubl.

Primer and probe sequences for unpublished loci available by request.

Table 3. Twisp River sample inventory.

Collection Description	WDFW Code	# Received	# Genotyped[a]	Notes
Adult Steelhead, Wild origin, Twisp weir	12DI, 12DJ	123	102	
Adult Steelhead, Hatchery origin, Twisp weir	12DI, 12DJ, and 12DL	156	133	
Adult Steelhead Wild origin, Twisp weir, broodstock	12DL	26	24	

[a] Only fish that had the possibility of spawning were genotyped.

Table 4. Genetic parameters for all Twisp River steelhead collections at all SNP loci. See attached MS Excel spreadsheet (Twisp_2012_adult_genotyping_Table_4.xlsx).

APPENDIX R
PROPOSAL FOR CHINOOK PILOT TRAPPING STUDY AT ROCKY REACH

Proposal to trap spring-run Chinook salmon at Rocky Reach Dam, 2013

Purpose. To pilot the use of the Rocky Reach Trap (RRT) to evaluate its efficacy for future broodstock collection or adult management efforts.

Objectives. The RRT has been used historically to capture listed steelhead and bull trout (Alexander et al. 2003; Stevenson et al. 2009) without causing delays to non-target fish. For the pilot, the RRT will be operated to target ad-clipped spring Chinook. The trap operator can target individual fish on the basis of visual identification of external marks observed at the counting window (i.e., ad clipped). There are three specific objectives of the pilot:

1) Capture Time Quantification: The primary objective is to measure the individual capture time of approximately 20 fish over a 4 week period (i.e., 5 fish /week for 4 weeks during the period of May –June (see Figure 1 for spring migration timing)) to generate basic descriptive statistics related to trap operation and passage effects for spring Chinook. Statistics will focus on "capture time" which reflects the amount of time necessary to close the pneumatic trap door to collect an individual fish and then return the door to the normal open position. Capture time statistics will include Range, Average, and Standard Deviation. These statistics will be used to evaluate the amount of time necessary to collect an individual fish, which is equivalent to the amount of time fish passage would be obstructed by the trap door for the run-at large. Based on previous trapping efforts, it is expected that an individual fish would have a capture time of less than 10 seconds, and therefore would have a minimal effect on passage at-large at Rocky Reach.

2) Qualitative Evaluation of Capture Process: Document operational procedures on video and provide access to the RRT for manager consideration. The purpose of this effort is to obtain input from managers on the best operational approach, and identify any concerns that would need to be addressed before a larger-scale pilot or implementation of adult management.

3) Analysis of passage time: Passage of spring Chinook will be monitored at Rocky Reach Dam during trap evaluation efforts using PIT tagged adult returns. The monitoring will occur using two PIT arrays within the fishway to determine fallback and/or delay, in combination with upstream detections. Passage and median travel time will be compared between trapping and non-trapping periods throughout the return.

Risk reduction. The following risk reduction measures will be implemented during the pilot:

1) Trapping will be active and a technician present at all times.

2) Individual trap events will require the visual identification of an isolated, adipose clipped Chinook in the viewing window. More specifically, the trap will only be operated when a single target fish is present and the trap will not be operated if more than one fish of the same or different species is present.

3) Only one trap event will be allowed per hour with a maximum of three trap events per day. No more than five trap events per week.

4) Fish collected in the trap will be released in the forebay of Rocky Reach, immediately adjacent to the top of the ladder. The release will not require transferring or lifting the fish. Instead, a weir door will be opened allowing the fish to exit volitionally (from the trap) out of the top of the ladder.

General Overview of Trap Design

Trap facilities at Rocky Reach are integrated with the existing fish-viewing structures within the ladder. Essentially, the fish-viewing guide wall extends upstream to the exit weir, where a pneumatically-activated gate guides fish into a collection area (Figure 2 and 3). On the other side of the pneumatic gate the collection area contains a removable capture vessel. As adult fish enter the viewing area, a technician activates the pneumatic gate, which blocks passage into the forebay and diverts the adult fish into the collection area. Using an underwater camera, the technician observes the adult fish enter the collection area, at which time the gate is closed, trapping the fish. Non-target species are allowed to exit the ladder by simply not activating the pneumatic gate. After an adult fish is contained within the collection area, either an electric or hand-operated winch raises the collection vessel from the collection area up to the work-surface platform. As the vessel emerges from the water, a wooden cover is placed on top of the vessel to reduce stress to the fish and eliminate the possibility of the fish jumping out of the vessel. Captured fish can then be anesthetized and transferred to a processing area. At the RRT, the collection vessel is moved laterally along an I-beam monorail close to the processing facility located under the roadway of the ladder.

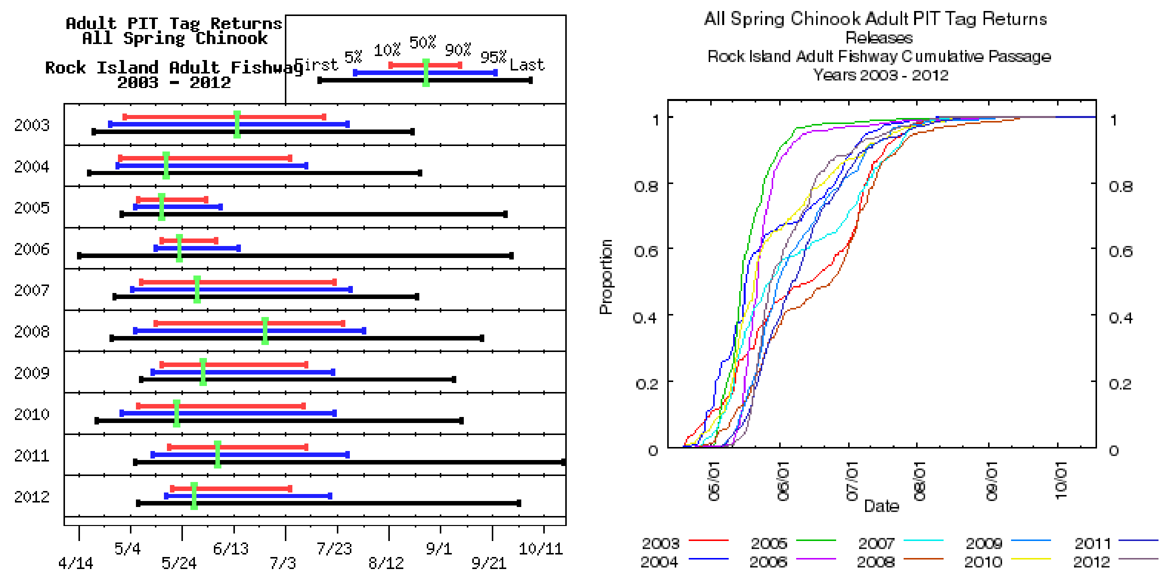

Figure 1. Historical run timing of PIT-tagged wild- and hatcher-origin spring-Run Chinook at Rock Island Dam, 2003-2012 (note that early years may be based on a limited number of adult returns).

Figure 2. Adult trapping facility at Rocky Reach Dam. The pneumatic arm (left and top right) activates a gate that guides fish into a holding vessel (bottom right, shown lifted). Trapped fish are either allowed to exit the holding vessel by opening the gate, or are lifted for processing.

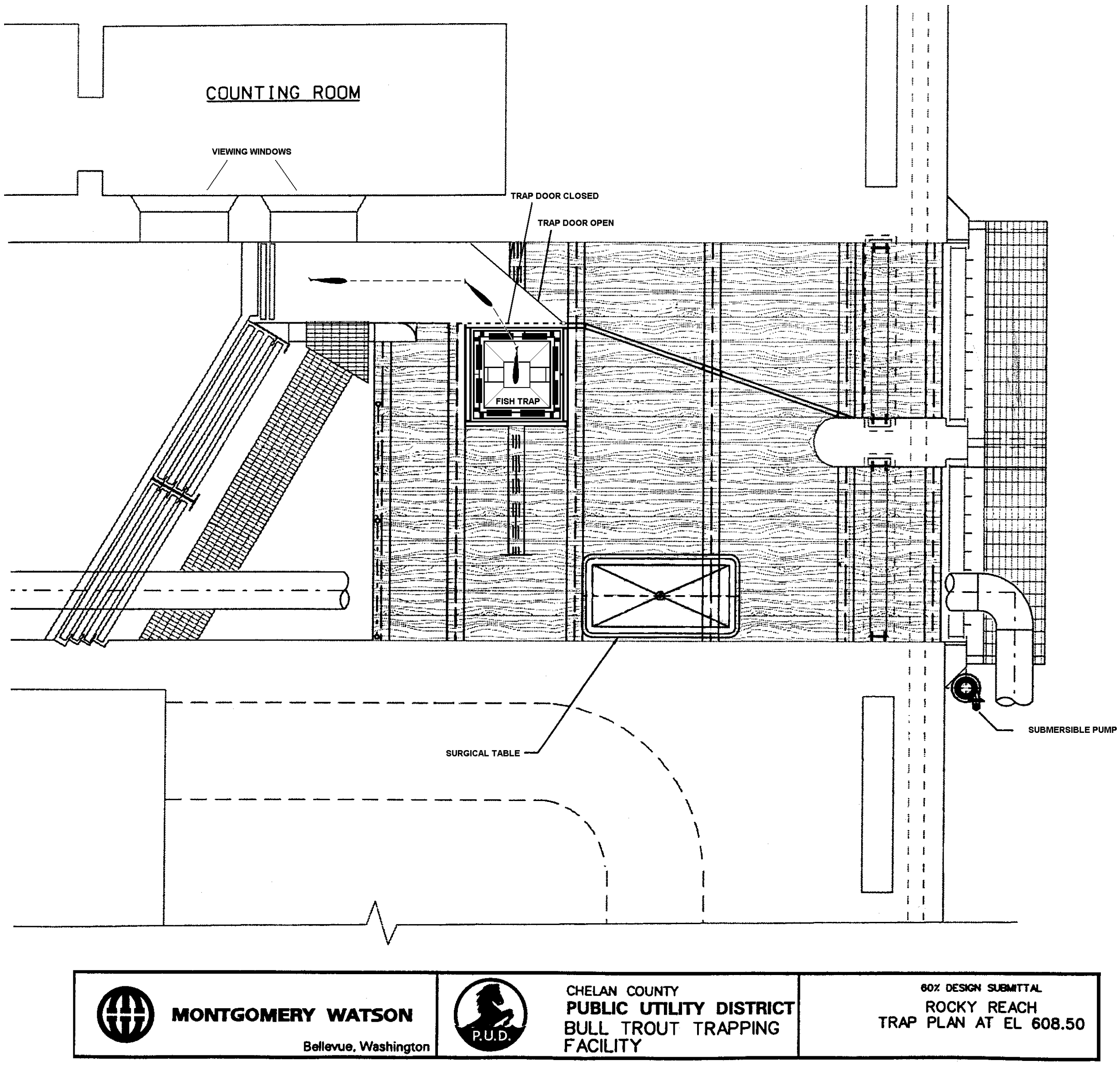

Figure 3. Rocky Reach Trap Layout

References

Alexander, R.F., C. Sliwinksi, B.L. Nass and J.R. Stevenson. An assessment of impacts associated with construction activities on adult steelhead migrating through Rocky Reach Dam, 2002. Report to Chelan PUD. LGL Limited Environmental Research Associates. Sidney, BC.

Stevenson, J.R., D.J. Snyder, and M.M. Miller. 2009. Movements of radio-tagged bull trout through Rocky Reach and Rock island dams and reservoirs: 2055-09. Summary report prepared for Chelan County Public Utility District. Wenatchee, WA.

APPENDIX S
ROCKY REACH HYDRO PROJECT HABITAT CONSERVATION PLAN 2013 ANNUAL FINANCIAL REPORT, PLAN SPECIES ACCOUNT



PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

MEMORANDUM

DATE: **January 7, 2014**

TO: **Becky Gallaher, Natural Resources Contract Coordinator**
Keith Truscott, Director - Natural Resources

FROM: **Debbie Litchfield, Treasurer/Director – Treasury**

RE: **Rocky Reach Hydro Project Habitat Conservation Plan**
2013 Annual Financial Report, Plan Species Account

In accordance with Section 7.4.3 of the Rocky Reach Habitat Conservation Plan attached is the 2013 year end annual financial report of the Plan Species Account activity completed by Chelan County Public Utility District No. 1.

Chelan County PUD

Rocky Reach Hydroelectric Project
Habitat Conservation Plan
Plan Species Cash Account Activity
Annual Financial Report Per Section 7.4.3
Reporting Period: 1/1/2013 - 12/31/2013

Beginning Balance:	**1/1/2013**		**$ 2,063,006.53**
Transfers In:			
Rocky Reach Funding		327,041.00	
Interest Earnings		1,144.63	
Total Transfers In			328,185.63
Transfers Out:			
Payments		(173,303.40)	
Bank Service Fees		(86.40)	
Total Transfers Out			(173,389.80)
Ending Balance:	**12/31/2013**		**$ 2,217,802.36**

The Plan Species Account was established per the Rocky Reach Habitat Conservation Plan, Section 7.4.
Interest earnings shall remain in the Account in accordance with Appendix E, Section 7.4.1.