

Rock Island and Rocky Reach Anadromous Fish Agreements and Habitat Conservation Plans

2013 COMPREHENSIVE PROGRESS REPORT



CHELAN COUNTY

Prepared for
*Rock Island
and Rocky
Reach HCP
Coordinating
Committee*
*Wenatchee,
Washington*

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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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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 $\pm 2.5\%$. 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)

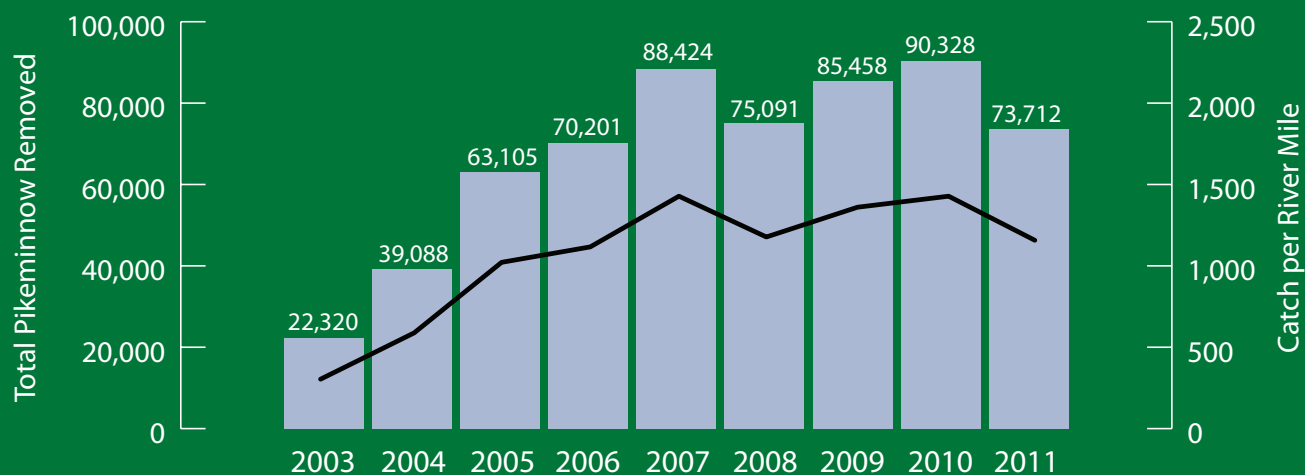
Table 2. Summary of current seasonal spill at Rocky Reach and Rock Island projects

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 development of acoustic tag technology that has allowed the District to measure 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 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. 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 turbine 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 manager and tribal entities, 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.



Summary of Passage Survival Plan Phase Designations

Rock Island

Yearling Chinook

Chelan PUD conducted six years of valid survival studies with juvenile yearling Chinook salmon at the Rock Island Project between 2004 and 2009. Each study achieved the necessary precision of $\leq 2.5\%$ SE. The most recent arithmetic mean for these studies (three years between 2007 and 2009) 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 (94.30%) under a different project operation beginning in 2004.

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 $\leq 2.5\%$ 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 (94.04%) under a different project operation beginning in 2004.

Sockeye

Chelan PUD conducted three years of valid survival studies with juvenile sockeye salmon at the Rock Island Project between 2007 and 2009. Each study achieved the necessary precision of $\leq 2.5\%$ SE. The three-year arithmetic mean for these studies 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.

Coho

On June 26th, 2007, the Rock Island and Rocky Reach HCP Coordinating Committees acknowledged that the Hatchery Committees agreed to provide a coho hatchery compensation program to fulfill NNI obligations as detailed in Section 8.4.3 of the respective HCPs. 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 that mortality exceeding seven percent on coho salmon. Adult returns of coho salmon during the most recent return (31,045 adults in 2011) were 519% of 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 Chinook

Sub-yearling summer/fall Chinook salmon were initially tested during early studies at Rock Island. Measurement of sub-yearling juvenile project survival was deemed impracticable due to technology limitations and uncertainties surrounding the sub-yearling life history of summer/fall Chinook salmon in the mid-Columbia River Basin. Nonetheless, hatchery compensation of up to 3.7 million summer/fall Chinook, including up to 1.6 million sub-yearling and 2.0 million yearling releases have fulfilled NNI requirements under the Rock Island and Rocky HCPs. Chelan PUD will provide additional funding through an agreement with the Confederated Tribes of the Colville Reservation for production at the Chief Joseph Hatchery beginning in 2013: releases are expected to total 166,569 yearlings and 94,570 sub-yearling summer Chinook (12.81% and 13.51% of production costs, respectively). The Coordinating Committees have further supported additional tools, including investigating sub-yearling life history through monitoring at the Rocky Reach Juvenile Bypass System, and monitoring and evaluation work conducted in the Wenatchee, Methow, and Okanogan rivers. 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 (0.9237) and adult (0.9990) Chinook salmon at the Rocky Reach Hydroelectric Project was 0.9228, exceeding the HCP standard of 91%. Each study achieved the necessary precision of $\leq 2.5\%$ SE. On August 30th, 2011, the Rocky Reach HCP Coordinating Committee agreed that Phase III Standard Achieved was met for yearling spring Chinook salmon at the Rock Island 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 $\leq 2.5\%$ 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.



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 $\leq 2.5\%$ 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.

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Hatchery Compensation Plan

Overview

The Rock Island and Rocky Reach HCPs require compensation for Plan Species, including steelhead, and spring Chinook, summer/fall Chinook, sockeye, and coho salmon. 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).

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.

Plan	Species	Inundation (fixed)	Initial production (releases through 2013)	NNI Production		Location(s)
				Calculated 7% (Reference)	Recalculated production (releases scheduled for 2014–23)	
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 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 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 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 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.

Summary of 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 of 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, Bonaparte Pond, Blackbird 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 is currently co-funding the construction of the Penticton Sockeye Hatchery in British Columbia with Grant PUD. 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.

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.



Summary of Monitoring and Evaluation

The hatchery programs implemented by Chelan PUD as part of the Rock Island and Rocky Reach HCPs have 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.” 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 or managing hatchery fish in a manner segregates them from the naturally spawning populations in tributaries.

Monitoring is needed 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 approach identified several objectives with the intent of monitoring in-hatchery and in-river performance of hatchery-reared smolts, along with long-term monitoring to determine if the hatchery programs are conserving the long-term fitness of natural populations. 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 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.

Innovation

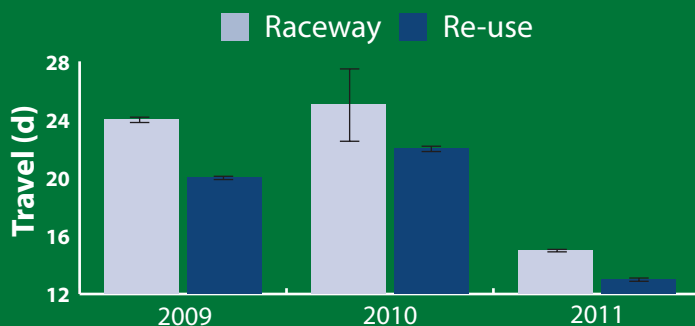
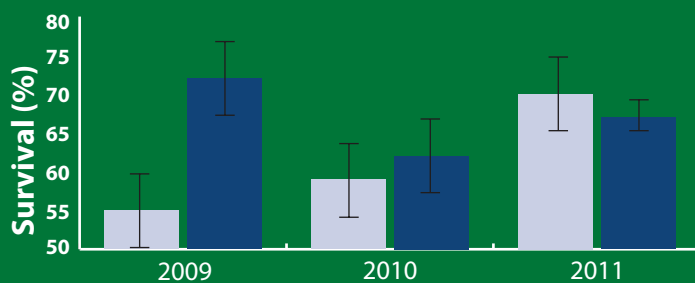
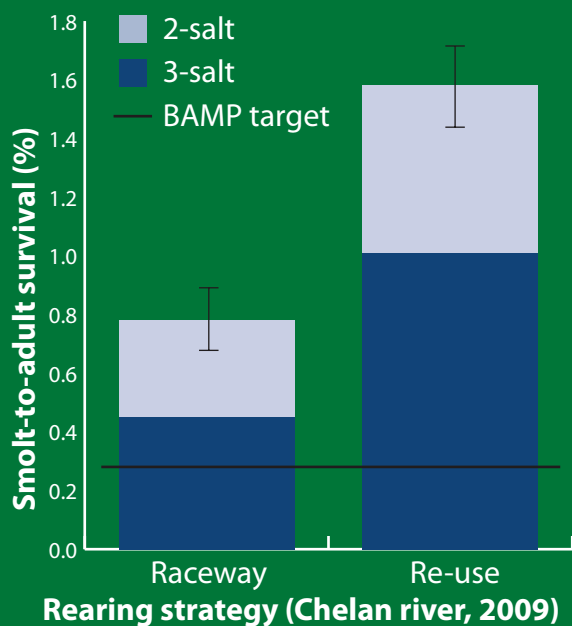
The implementation of the HCPs’ hatchery programs has led to a number of noteworthy success stories that may contribute to increased performance of hatchery releases and the overall abundance of Plan Species for years to come. The first example is water re-use/circular tank technology, which originally was piloted as a means to conserve water but also improved the performance of hatchery releases. In the first years of the pilot, summer Chinook reared in water re-use circular tanks program migrated more quickly downstream and had higher survival than their raceway counterparts. In the years following, the story improved with fewer returning jacks and higher smolt-to-adult returns for older age classes. These results demonstrated the potential for other species and have led to a paradigm shift in facility design within the region.

¹Hillman, 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. The Natural Resources Department invested in passive integrated transponders (PIT), physiological assessments, and health monitoring throughout the pilot study. Partial water reuse vessels at Eastbank have produced 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.



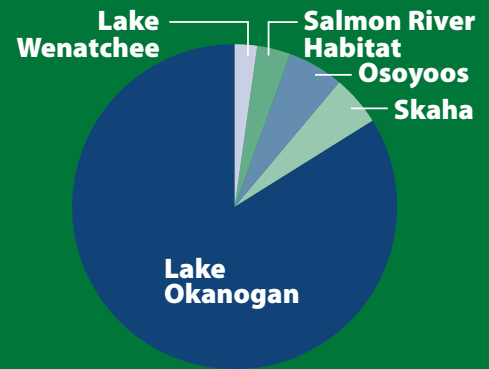
Another example of innovation is the Skaha Sockeye Reintroduction program. This hatchery program is actually intended to open significant new rearing habitat in the Okanogan Basin and provide a founding population for future colonization. The Hatchery Committees approved this program as part of the Rocky 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.

HCP Highlight

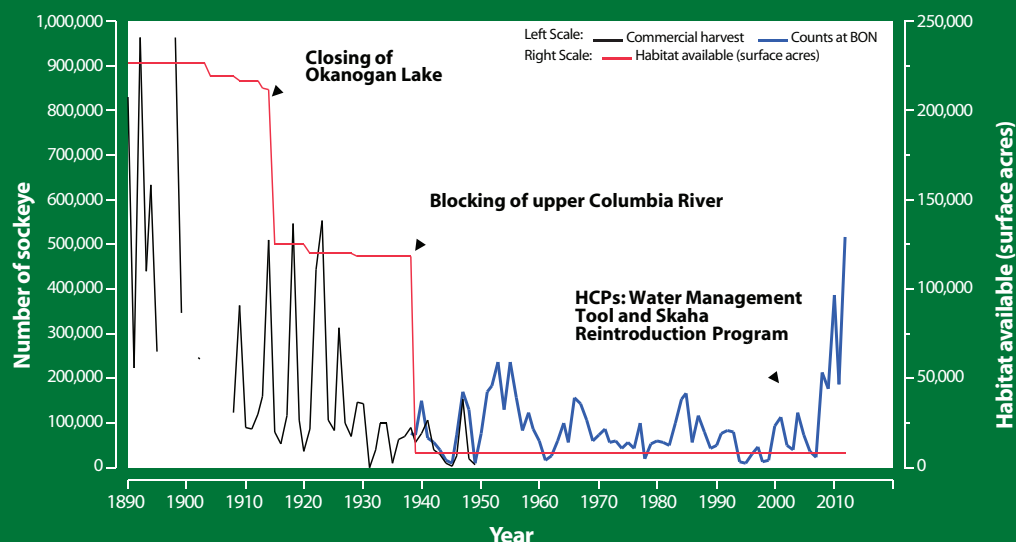
Skaha Lake Reintroduction Program

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 Okanogan 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, Okanogan Lake for natural sockeye rearing and production.



The rationale for re-introducing sockeye to Skaha and Okanogan 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 Okanogan Lake is much higher (35,100 ha). Okanogan 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 Okanogan Basin Fish Water Management Tool) that have already increased the survival of juvenile sockeye within the Okanogan 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 Okanogan 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 provides a Plan Species Account to fund projects for the protection and restoration of 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, is 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.

Summary of 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 made 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.

Table 5. Total project funding provided by the Rocky Reach and Rock Island Plan Species accounts (as of December 2011).

Table 5. Total project funding provided by the Rocky Reach and Rock Island Plan Species accounts (as of December 2011).

Plan Species Account	No. of Projects	Funding to Date
Rocky Reach	19	\$1,291,308
Rock Island	27	\$2,774,767
Total	46	\$4,066,075

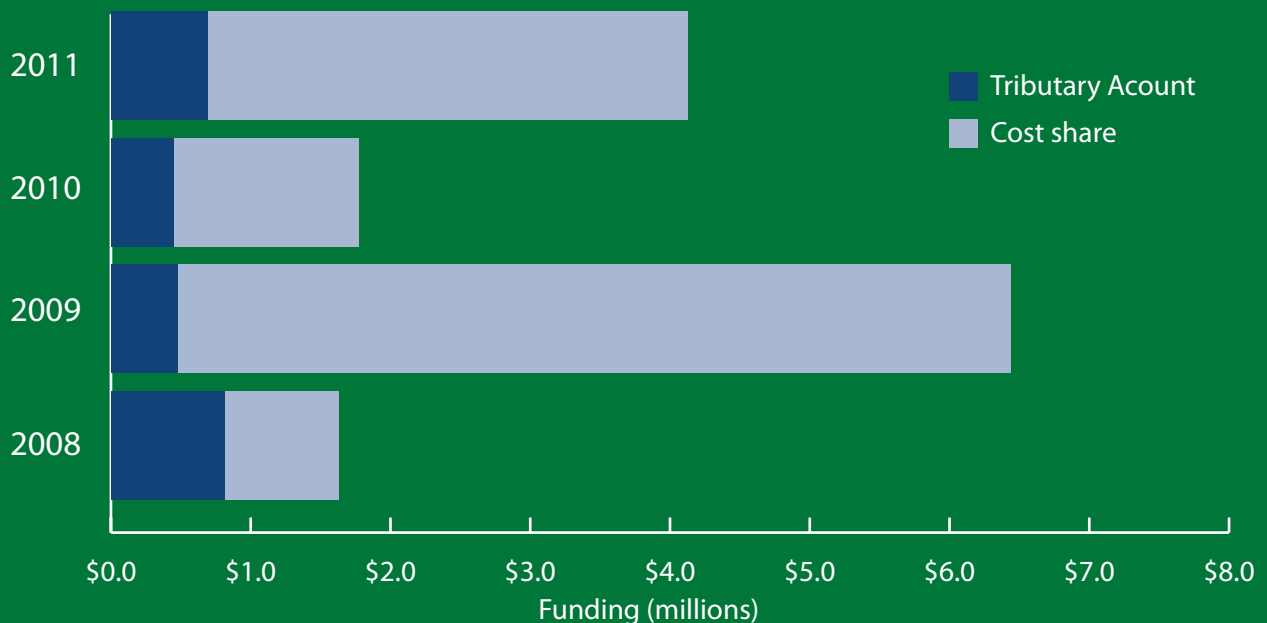
Innovation

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 (i.e., ESA listed bull trout).

HCP Highlight

Leveraging funding with the Plan Species Account

The Tributary Committee has been able to successfully cost share on 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

Twisp River Acquisition Project – 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.

Harrison Side Channel Project – 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.

Pond at MSRF property



White River Floodplain Protection – 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 from five properties will protect 305 acres of floodplain and nearly 2.5 acres of prime White River riparian habitat.

Nason Creek Oxbow Reconnection – 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.

White River floodplain habitat



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 both Rock Island and Rocky Reach projects (Table 6 & 7). The Coordinating Committees have made successful 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 Chinook are also have Phase III designations and it is recognized that the coho reintroduction effort will continue and additional studies are required for sub-yearlings. The Hatchery Committees have successfully provided hatchery capacity for conservation and harvest purposes. The next ten years of NNI production levels have also 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.

The simplest distillation of NNI is represented in the numerical abundance of all Plan Species which have experienced significant increases during the HCPs compared to the 1990s (Figure 2), with some species returning in numbers not observed since the 1920s. The HCPs are not solely responsible for every improvement in the upper Columbia Basin but they have been important contributors and provided the resources and capacity necessary for managers to meet their individual and collective goals while providing the public with sustainable power. Moreover the HCPs have provided a durable framework for decision making that has led to collaborative improvements without 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 6. 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-Juvenile Project	Yes	Yes	Yes
Sockeye (Not Listed)	Yes-Juvenile Project	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 7. 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-Juvenile Project	Yes	Yes	Yes
Steelhead (ESA Listed)	Yes-Juvenile Project	Yes	Yes	Yes
Sockeye (Not Listed)	Yes-Juvenile Project	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 ($\pm$ 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 ($p < 0.01$).

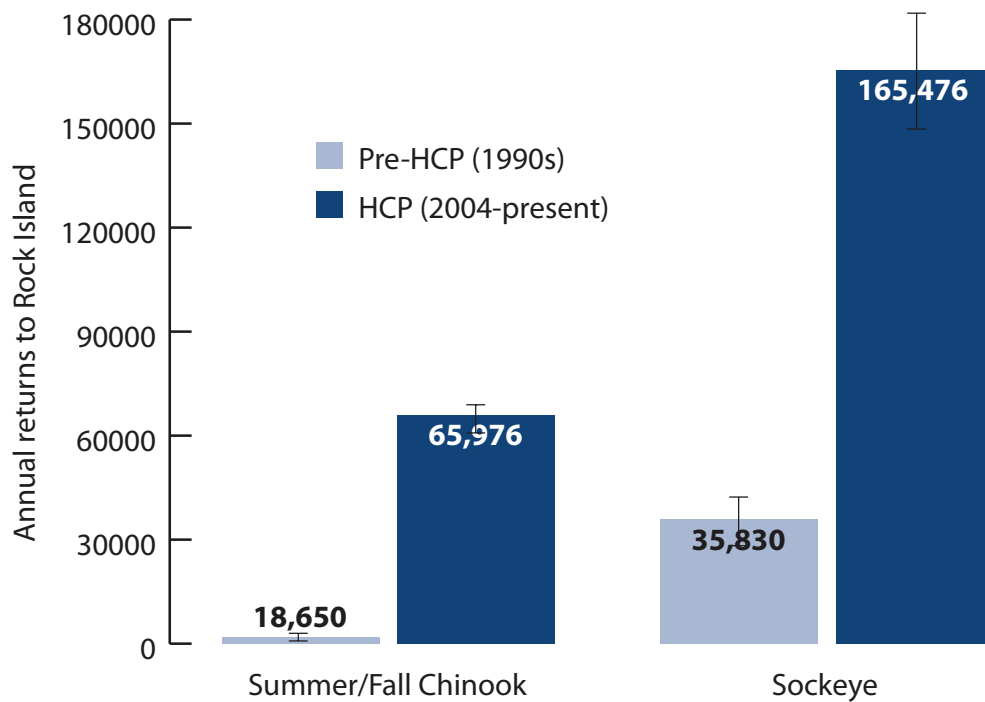
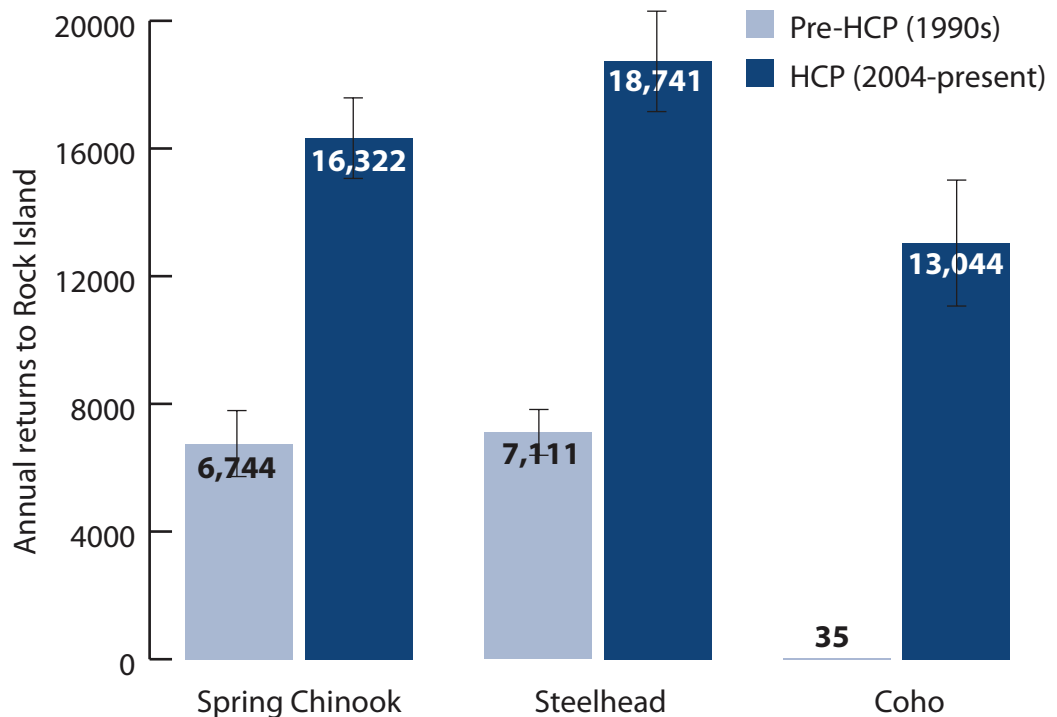


Figure 3. Average ($\pm$ SE) annual passage of adult salmon at Rock Island Dam during the HCP era (2004-present) compared to runs observed prior to HCP activities (1990s). Numerical abundance of Plan Species is significantly greater compared to runs observed in the 1990s for all Plan Species, including 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), 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 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), Steve Hays 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 Geres, (Anchor QEA) are thanked for chairing both the Coordinating and Hatchery committees. Tracy Hillman (BioAnalysts) is thanked for chairing the Tributary Committee. Lastly, Chelan PUD thanks the determined efforts of all that supported the HCP, including natural resources, operations, engineering, and management staff, and Chelan PUD Commissioners and General Managers.



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