

Rocky Reach Fish Forum

Wednesday, 5 October 2016

1:00 – 4:00 p.m.

Chelan PUD Second Floor Conference Room

Wenatchee, WA



Meeting called by Steve Hemstrom

Chairperson, Tracy Hillman

Notes taken by Meaghan Connell

Attending Representatives:

Hemstrom, Steve	Chelan PUD	(509) 661-4281	steven.hemstrom@chelanpud.org
Lewis, Steve	USFWS	(509) 665-3508 x14	stephen_lewis@fws.gov
Zimmerman, Breean*	WDOE	(509) 575-2808	Breean.zimmerman@ecy.gov

Attending Participants:

Connell, Meaghan	Chelan PUD	(509) 661-4757	meaghan.connell@chelanpud.org
Hillman, Tracy	BioAnalysts	(208) 321-0363	tracy.hillman@bioanalysts.net
McLellan, Jason*	CCT	(509) 263-1082	Jason.McLellan@colvilletribes.com
Nelle, RD*	USFWS	(509) 548-7579	RD_Nelle@fws.gov
Jackson, Chad*	WDFW	(509) 754-4624 x250	chad.jackson@dfw.wa.gov

* Joined via phone.

Meeting Minutes

I. Welcome and Introductions

Tracy Hillman welcomed everyone to the Rocky Reach Fish Forum (RRFF) meeting. Participants introduced themselves.

II. Agenda Review

The agenda was reviewed and approved with one addition. Steve Lewis added a discussion on Pacific lamprey passage at Tumwater Dam.

III. Approval of Meeting Minutes

The August meeting minutes were approved with edits.

IV. Review Action Items

- RD will send out an updated version of the report, *Final Draft Rapid Assessment of Adult Pacific Lamprey Passage at Tumwater Dam*. **Ongoing**
- Steve Hemstrom will complete the lamprey conversion rate analysis. **Completed**
- Alene Underwood will provide the RRFF with a revised copy of the Tumwater Dam Lamprey Passage Feasibility Study. **Ongoing**
- Tracy Hillman will respond to the last three questions in the questionnaire and provide those responses to Lance Keller. **Completed**
- Lance Keller will send Tracy Hillman draft responses to the questionnaire for distribution to the RRFF. **Completed**

V. White Sturgeon

Juvenile Rearing

Steve Hemstrom reported that in 2016, because of staffing issues, sturgeon eggs were hatched at Marion Drain and sturgeon fry were then brought to the Chelan Hatchery. Steve did not recall the number of sturgeon fry transferred to the Chelan Hatchery; however, about 1,200 sturgeon fry are currently on station at Chelan Hatchery. Steve Hemstrom also reported that the success of Roosevelt sturgeon larval collection has produced a surplus of juvenile sturgeon at Wells Hatchery. Some of the surplus production will be transported to Chelan Hatchery pending results of disease testing. The total number sturgeon fry on station at Chelan Hatchery after transport will be 2,250 fish.

Update on Adult Monitoring

Steve Hemstrom reported that there are four monitoring sessions scheduled for 2016. Two of the four are complete. The first session occurred 29 August through 7 September and the second occurred 12 September through 21 September. Steve did not know the total number of recaptured fish. This information will be provided during the next RRF meeting.

Larvae Collection

Chad Jackson reported that there were no new updates beyond what Patrick Verhey reported during the August RRF meeting. Chad stated that Brad James will complete a report on larvae sampling by the end of November.

Update on Success of Sturgeon Fishery in the Priest Rapids Project Area

Chad Jackson reported that based on WDFW creel surveys to date, 380 legal-sized sturgeon have been harvested from Wanapum and Priest Rapids reservoirs. Most of these (227 sturgeon) were harvested from Wanapum reservoir. An additional 392 were captured and released because they were too small to retain; 126 were captured and released because they were too large to retain. Fishing effort so far is estimated at 25,505 angler hours. Chad said WDFW extended the fishery two more months and increased the limit to three sturgeon in the same slot size.

Action Item:

- **Steve Hemstrom will confirm and report the total number of recaptured white sturgeon sampled during monitoring in Rocky Reach Reservoir.**

VI. PACIFIC LAMPREY

Pacific Lamprey Subgroup Meeting Results

Tracy Hillman discussed the results from the Pacific Lamprey Subgroup Meeting (see Attachment 1). He said the PRFF and RRF Pacific Lamprey Subgroups met on 4 August 2016 to (1) identify lamprey passage metrics, (2) describe methods to estimate passage metrics, and (3) describe methods for assessing unavoidable effects (NNI). The Subgroups first reviewed regional notes and documents to assess the applicability of lamprey passage metrics and methods used in the Columbia River basin. In short, the region has not identified passage metrics or described methods to assess passage metrics or applied them for lamprey. Therefore, the Subgroups decided to identify and develop their own metrics (measurements; not standards or targets) and methods with respect to the Chelan PUD and Grant PUD Pacific Lamprey Management Plans.

The Subgroups identified and defined the following adult lamprey passage metrics: (1) *Within-Fishway Passage Efficiency* = Fraction of adult lamprey that successfully egress a fishway after being detected in the fishway; (2) *Entrance Efficiency* = Proportion of adult lamprey being detected at a fishway entrance at least once after release and then being detected within the fishway; and (3) *Adjusted Inter-Dam*

Conversion Rates = Ratio of adult lamprey counted at an upstream dam to the number counted at a downstream dam, adjusted using estimates of overwintering, tributary escapement, predation, fallback/re-ascension, and reservoir/tailrace spawning. The Subgroups then identified and discussed methods and assumptions associated with each metric. They concluded that Within-Fishway Passage Efficiency is the passage metric most likely to be measured accurately. The other passage metrics have data needs or assumptions that are difficult to acquire or validate at this time.

The Subgroups indicated that once an adequate estimate of Within-Fishway Passage Efficiency is generated (based on at least three valid study estimates with study assumptions achieved), one can then estimate unavoidable effects (NNI) if all possible fishway improvements have been made. However, at this time, the Subgroups were unable to define NNI in terms of passage success. That is, does 100% passage efficiency define passage success, or is it defined as something less than 100% assuming that some level of natural mortality – like predation – occurs under natural conditions? In addition, the Subgroups did not determine what NNI tools (actions) would be used to address any unavoidable effects. These are issues that may need to be determined using a model or by consensus of the policy representatives.

Steve Hemstrom noted that the Pacific Lamprey Management Plan states that if passage at Rocky Reach Dam is not as good as the best passage estimate measured at other dams, then additional improvements within the fishway would be evaluated and implemented at Rocky Reach and the passage studies repeated. If additional improvements are made and passage studies repeated with results unchanged, then at that time unavoidable effects may be determined and Chelan PUD would move to the NNI phase of the Lamprey Plan.

Steve Lewis asked if the plan was steadfast at three years in order to formulate a percentage for NNI? He asked if it would be beneficial to implement NNI and adjust NNI as additional passage information comes in? Steve Hemstrom said Chelan PUD would desire three years of passage data, if necessary, to determine unavoidable effects prior to implementing NNI as stated in the Lamprey Management Plan. Steve Lewis agreed that three years of passage data are needed.

Tracy stated that PRFF would like to reconvene their Pacific Lamprey Subgroup early next year. The PRFF stated that they did not want the upper passage efficiency metric to be determined at the policy level and would like the Fish Forums to determine the metric. Tracy asked the RRF if they would like to convene the RRF Pacific Lamprey Subgroup and meet jointly with the PRFF Subgroup. The RRF agreed. Steve Hemstrom stated that it would be important at the Subgroup meeting to develop criteria that make sense for the natural biological effects as well as the life-history traits of adult Pacific Lamprey. The RRF agreed to continue to discussion NNI at the November RRF meeting. After that, it may be assigned to the subgroup.

Update on Adult Lamprey Tagging, Dam Passage, and Tributary Escapement

Steve Hemstrom reported that Chelan PUD conducted ten different releases totaling 211 PIT-tagged adult Pacific lampreys in 2016 (see Table 1). The purpose of the tagging study is to evaluate passage through the Rocky Reach fishway and estimate tributary escapement. Lampreys were tagged at Priest Rapids Dam and transported upstream and released the same day at Kirby Billingsley Hydro Park (KBHP)

in Rock Island Reservoir downstream of the Wenatchee River and Rocky Reach Dam. The first lamprey release (46 fish) occurred on 3 August; the final release occurred on 17 August. In total, 190 tagged lampreys were released on river right at KBHP and 21 on river left. This division represents the approximate proportions moving through right-bank and left-bank fishways at Rock Island Dam annually.

Table 1. Chelan PUD's 2016 PIT-tagged Pacific lamprey release numbers, dates, times, and locations at KBHP.

Tag Date	Release Date	Release Location	Release Time	Release Count
8/3	8/3	Left Bank	13:15	5
8/3	8/3	Right Bank	13:17	41
8/5	8/5	Left Bank	13:39	6
8/5	8/5	Right Bank	13:42	52
8/10	8/10	Left Bank	13:00	3
8/10	8/10	Right Bank	13:02	36
8/12	8/12	Left Bank	13:01	4
8/12	8/12	Right Bank	12:54	33
8/17	8/17	Left Bank	13:04	3
8/17	8/17	Right Bank	12:47	28
TOTAL				211

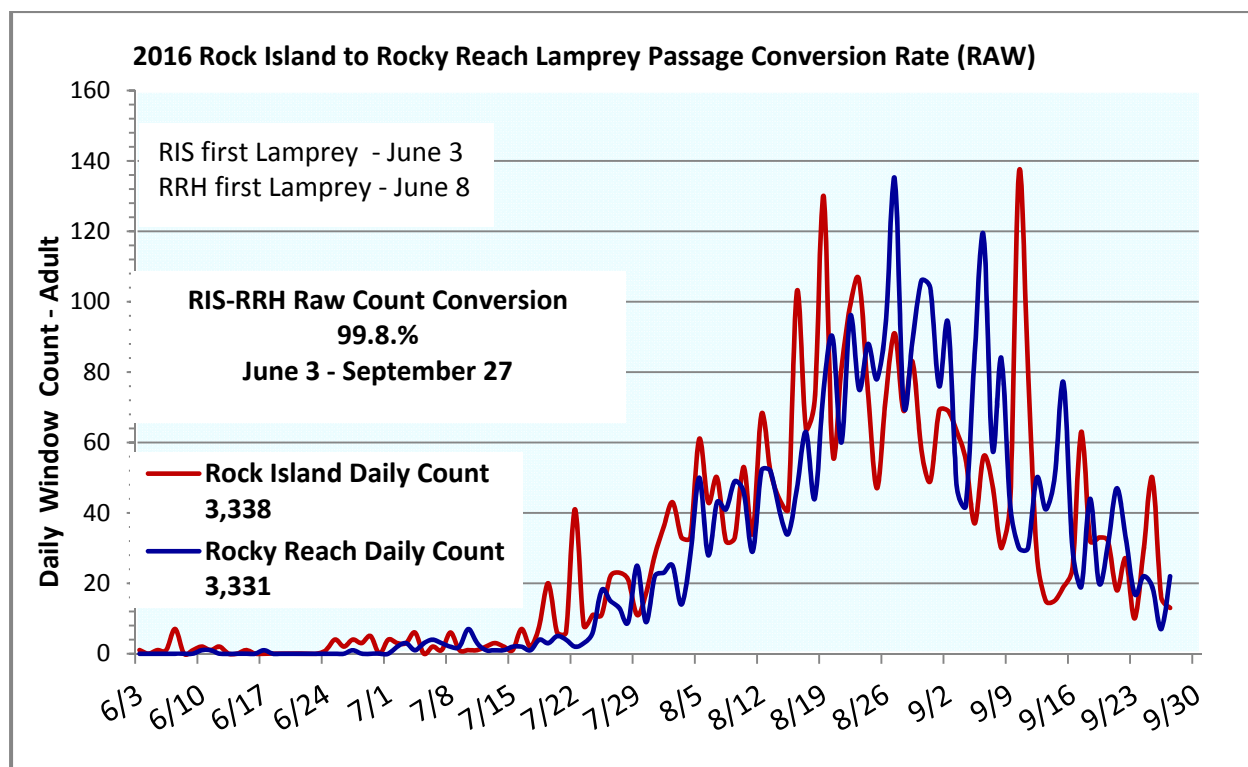
Steve Hemstrom then reported on lamprey PIT-tag detections (Table 2). As of 20 September, a total of 169 Chelan PUD lampreys have been detected (80%). Of these, 163 have been detected in the Rocky Reach fishway (96.4%), five (2.6%) in the lower Wenatchee River, and one (0.6%) in the Methow River basin (in the Chewuch River). Of the 163 lampreys detected at the Rocky Reach lower-fishway antenna, 162 were also last detected at the trap weir antenna, the uppermost exit detection point in the upper fishway. Final detection at this location without a later detection elsewhere in the fishway or downstream indicates successful passage. PIT-tag detections thus far within the fishway indicate a passage rate of 99.4%. Future PIT-tag detections will be monitored at all available detection sites in the mid-Columbia. An additional 24 Grant PUD tagged lamprey have been detected within the Rocky Reach fishway with a preliminary passage rate of 87.5%. Three tagged lamprey still reside in the fishway. It was also noted that five adult lamprey have passed Wells Dam this year.

Table 2: Detection locations of PIT-tagged adult Pacific lamprey as of 20 September 2016. Tags detected are Chelan PUD (N=169) and Grant PUD (N=24) tags. *Still in progress

RRH Fishway and Tributary PIT Detections	Chelan PUD Lamprey Total N = 169*
RR fishway lower weir antenna	163
RR fishway upper exit antenna	163
Last detected on upper exit antenna	162
Lower weir antenna only	1

RRH Fishway and Tributary PIT Detections	Chelan PUD Lamprey Total N = 169*
Upper weir antenna and Trap weir antenna	162
Exit antenna only	1
Lower Wenatchee River	5
Chewuch River above Winthrop	1
RRH Passage rate estimate*	99.4%
RRH Fishway and Tributary PIT Detections	Grant PUD Lamprey Total N = 24*
RR fishway lower weir antenna	24
RR fishway upper exit antenna	23
Last detected on upper exit antenna	21
Lower weir antenna only	0
Upper weir antenna and exit antenna	23
Upper exit antenna only	0
Lower Wenatchee River	0
Chewuch River above Winthrop	0
RRH Passage rate estimate*	87.5%

Steve Hemstrom reported on the 2016, in-progress, window-count conversion rate between Rock Island Dam and Rocky Reach Dam (RIS reservoir and RRD dam) from 3 June to 27 August (see figure below). The count conversion rate from Rock Island to Rocky Reach in this period was 99.8%, which comports well with the ongoing PIT-tag passage estimate of 87.5% to 99.4%. Window count conversion rate is defined as the number of adult lamprey counted in the fishway window at Rocky Reach Dam, divided by the number of adult lamprey counted passing Rock Island Dam. This conversion is “raw” or “unadjusted” because it does not account for the swim-time lag between Rock Island and Rocky Reach dams, lamprey entering the Wenatchee River, mainstem spawning downstream from Rocky Reach Dam, fallback and re-count rates, or over-wintering in Rock Island reservoir. Most of the “unknowns” would bias the Rocky Reach conversion rate “low”. The first lamprey of the year (2016) was counted at Rock Island on 3 June and at Rocky Reach on 8 June.



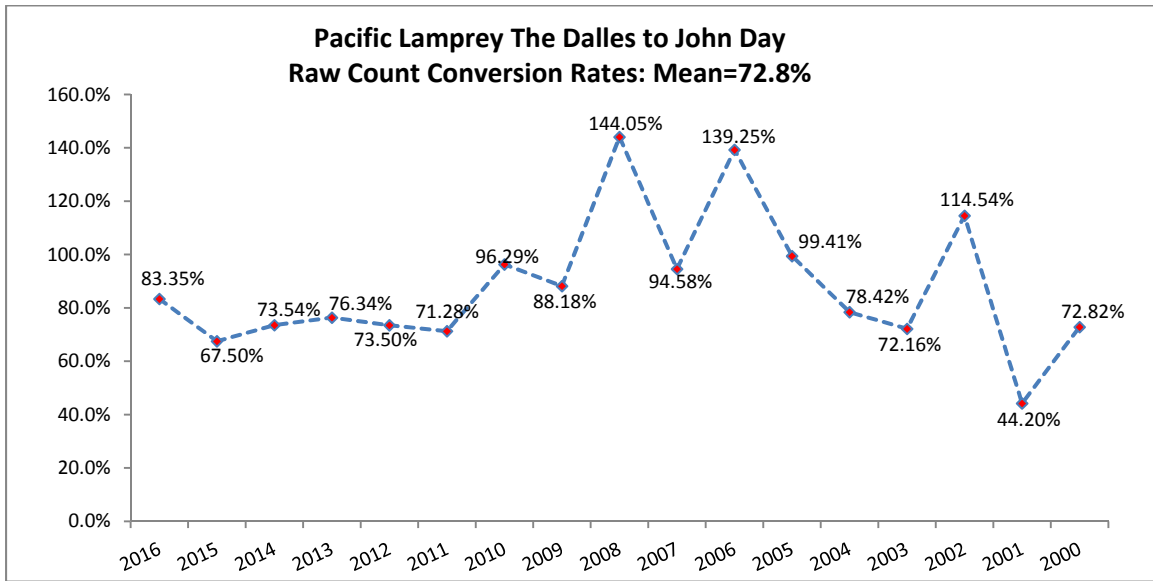
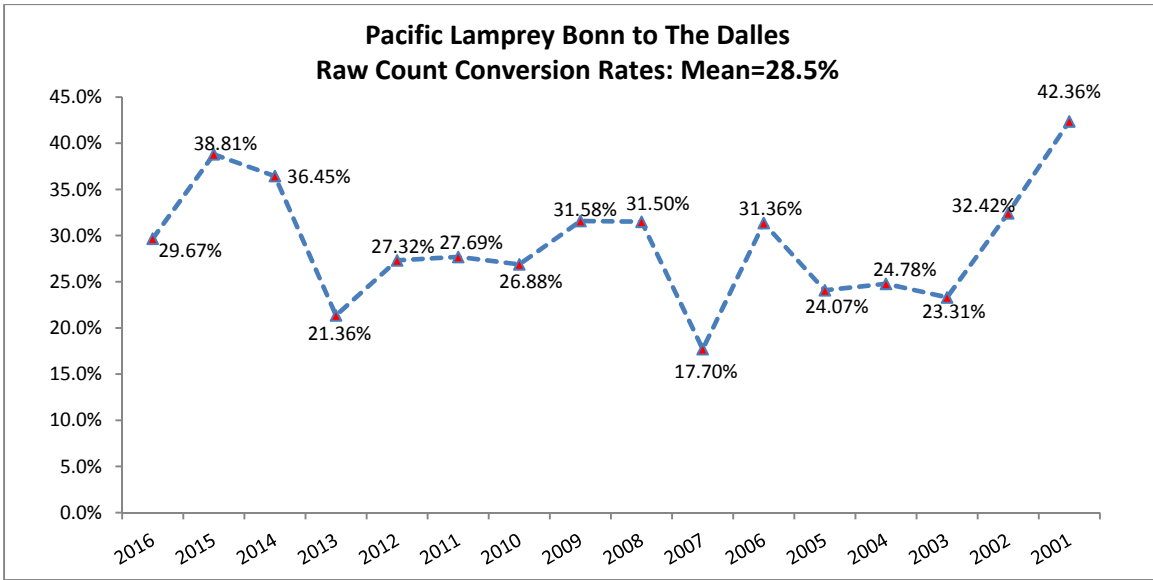
Steve Hemstrom indicated that the 211 lamprey that were transported to KBHP were obviously not counted at Rock Island Dam. These tagged fish can pass Rocky Reach Dam if they choose to do so. Of those transported fish, 169 of them were counted at Rocky Reach Dam and therefore are part of the total count at Rocky Reach Dam. This will change the data for the PIT-tag adjustments, but it was noted that passage rates are still above 90%.

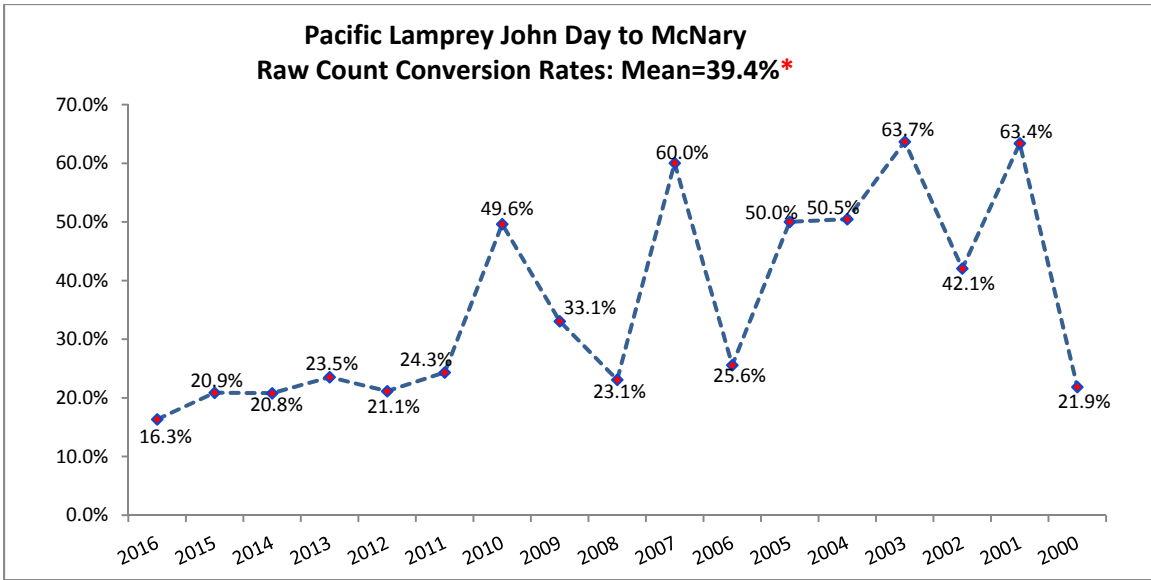
RD Nelle asked if any fish had been detected in the Entiat River. Steve Hemstrom reported that fish released by Douglas PUD have been detected in the Entiat. Steve also noted that it would be beneficial to know if they were first- or second-year fish.

Tracy Hillman reported that Mike Cimet would like to have an all PUDs workshop next year that looks at the results from all tagging work. The workshop would be a regional assessment rather than a project by project assessment. Tracy noted that he was unsure who would do the regional analysis at this time. The RRF thought this was a good idea and would like to move forward with the workshop.

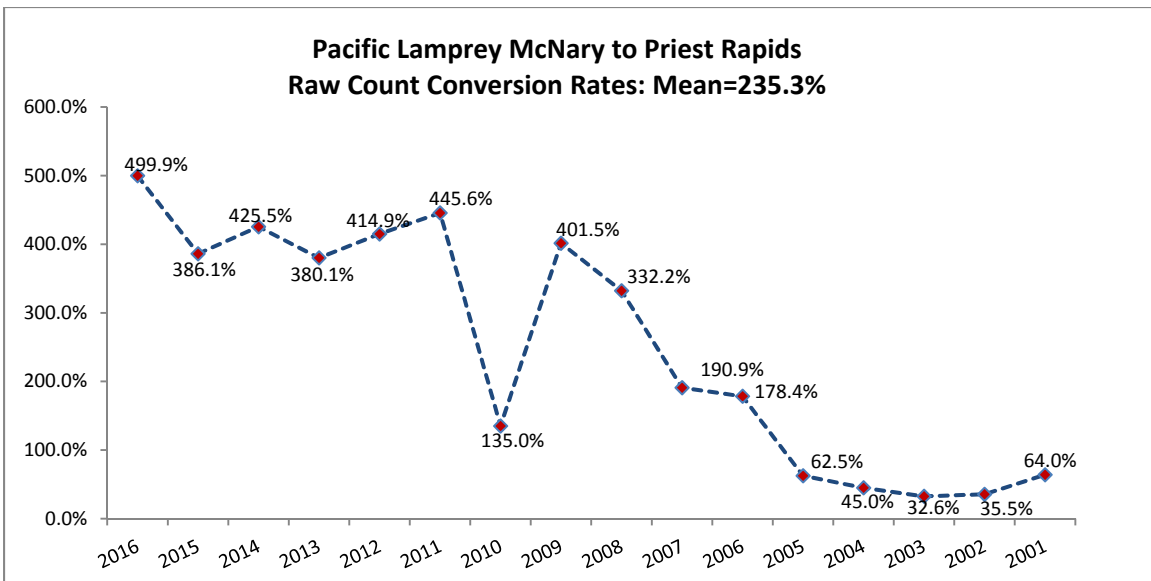
Adult Lamprey Inter-Dam Conversion Rates

Steve Hemstrom summarized seventeen years of total annual Pacific lamprey fishway window counts and unadjusted conversion rates for the lower Columbia and Snake River Projects. He compared these unadjusted rates to those estimated for Rock Island to Rocky Reach (see following figures).





* John Day and Umatilla rivers enter the Columbia between John Day and McNary Dams and both draw adult lamprey.

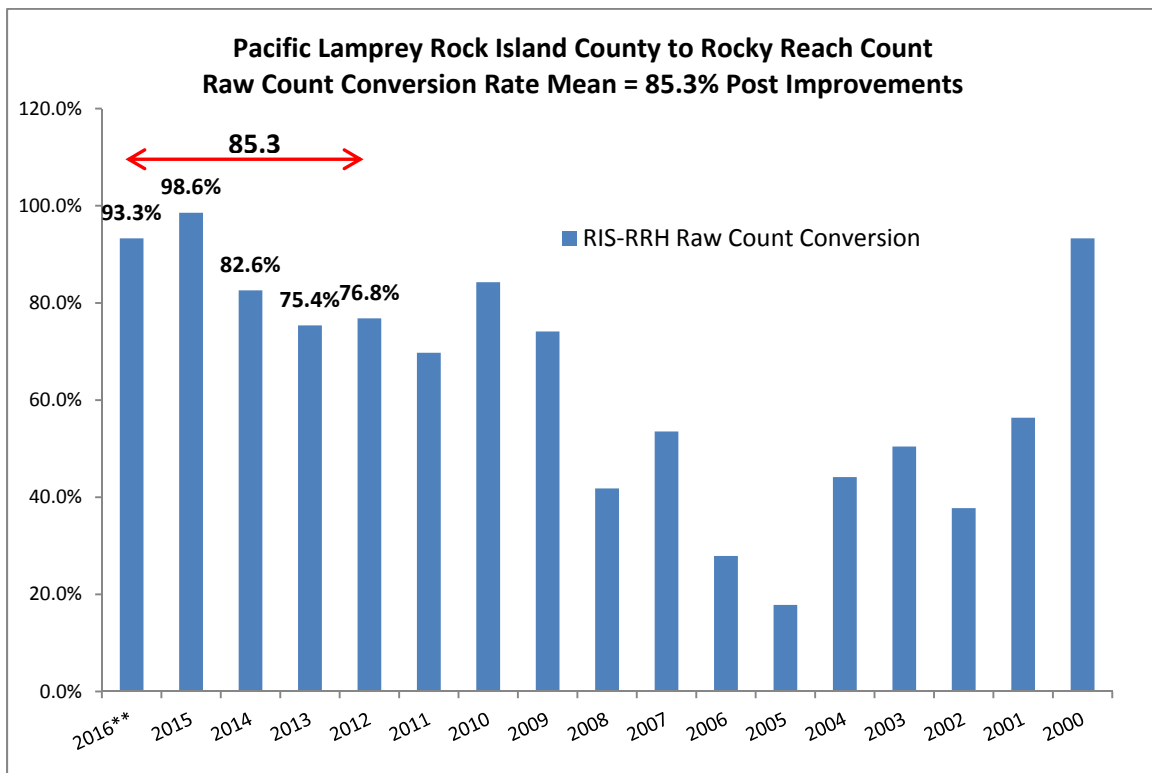


Steve Hemstrom reported that McNary to Priest Rapids conversion rates suggest that there are a lot of overwintering fish. Tracy Hillman suggested that it could be related to counting problems at McNary Dam. Steve Hemstrom noted that from 2014-2016, the conversion rates are increasing. It is not clear why this is so (see following table and figure).

**SNAKE RIVER PROJECTS ANNUAL TOTAL ADULT LAMPREY COUNTS AND COUNT-CONVERSIONS BETWEEN PROJECTS
2012-2016**

PROJECT	**2016 Count	2016 Conv %	2015 Count	2015 Conv %	2014 Count	2014 Conv %	2013 Count	2013 Conv %	2012 Count	2012 Conv %
Ice Harbor	866		764		721		328		484	
Lower Mon	239	27.6%	264	34.6%	220	30.5%	108	32.9%	135	27.9%
Little Goose	192	80.3%	58	22.0%	115	52.3%	33	30.6%	88	65.2%
Lower Granite	107	55.7%	50	86.2%	82	71.3%	19	57.6%	48	54.5%

**As of 28 September 2016



** For 2016, a total of 211 adult lamprey that were tagged, transported, and released above Rock Island are added to the RIS adult lamprey count. Counts still in progress.

Steve Hemstrom reported that the Rock Island to Rocky Reach conversion rate following the final fishway improvements (in 2011) was 85.3%. He suggested evaluating each dam to find out what the best rate for lamprey passage is based on what had been done to the fishway and use those comparisons to determine the best lamprey passage rate.

Steve Hemstrom reported that he is waiting to evaluate additional information from Blue Leaf on lamprey travel and passage times; however, the initial travel times are looking good. Of the data currently available, 162 detected fish that exited Rocky Reach had an average travel time of 122.7 hours

from river release to fishway exit. The median travel time for left and right-bank released fish was 79.8 hours and 136.1 hours, respectively. The minimum travel times reported for left and right-bank released fish was 19.4 hours and 19.9 hours, respectively. Steve will send out the final travel time data to the group when it is available.

Action Items:

- **Tracy Hillman will add to the November agenda a discussion on identifying the upper value for calculating NNI for adult passage.**
- **Steve Hemstrom will provide to the RRF the travel time data for Pacific lamprey at Rocky Reach Dam.**
- **Tracy Hillman will attach the Pacific Lamprey Subgroup Meeting Notes to the RRF Meeting Minutes.**

VII. Tumwater Dam

Steve Hemstrom reported that the Tumwater Dam fishway was dewatered on 27 September. The purpose of the dewatering was to measure and evaluate the fishway entrances and first vertical slot in order to design, fabricate, and install at least two but up to three new PIT-tag antennas that will monitor the low-water and high-water entrances and the first vertical slot in the lower pool of the fishway.

Steve Hemstrom reported that Chelan PUD crews were onsite during dewatering to recover and release any fish that were in the fishway pools. He said that one adult summer Chinook and two adult sockeye were recovered and released. He also said that a PIT-tagged adult lamprey released between weir 15 and 18 and detected moving downstream on 27 September was recovered and released downstream from the dam. That fish has not been detected again. Steve Hemstrom reported that several other juvenile fish were recovered in the fishway and released upstream from the dam. These fish included six juvenile steelhead, 37 whitefish, four longnose dace, three suckers, three northern pikeminnow, and one sculpin.

RD Nelle asked where the new PIT-tag arrays were going to be placed. Steve Hemstrom stated that currently the new PIT-tag arrays are going to be placed at the high and low-water entrances and the second Weir. RD asked why a PIT-tag array was not going to be placed at the middle entrance. Steve Hemstrom said that the primary entrances that are opened are the low and high-water entrances. RD stated that it would be interesting to know which entrances are open and how they are being operated. Steve Hemstrom will report back to the RRF about the operation of entrances.

Steve Lewis asked about the progress of the Tumwater Passage Feasibility Analysis. Steve Hemstrom reported that the first draft should be completed in November, but there may not be any decisions made about alternatives at that time.

Steve Hemstrom provided an update on the status of the 170 adult lamprey released in August and September downstream from Tumwater Dam in the Wenatchee River. He said that at least two of the fish were detected at weir 15 and then at weir 18, with the last detection indicating downstream

movement. It was asked how it is known that the last detection indicates downstream movement. Steve Hemstrom did not know, but will find out and report back to the RRFF.

Action Items:

- **Steve Hemstrom will report on the installation of the PIT-tag arrays at Tumwater Dam and why the middle entrance was not included.**
- **Steve Hemstrom will send out tag detections for the 170 fish released downstream from Tumwater Dam in August and September.**

VIII. Next Meeting

The next regular meeting of the RRFF is scheduled for Wednesday, 2 November 2016 from 1:00 to 4:00 p.m. in the Chelan PUD First Floor Large Conference Room.

Attachment 1

Results from the Pacific Lamprey Subgroup Meeting Held on 4 August 2016

Introduction

The PRFF and RRFF Pacific Lamprey Subgroups met on 4 August 2016 to (1) identify lamprey passage metrics, (2) describe methods to estimate passage metrics, and (3) describe methods for assessing unavoidable effects (NNI). The Subgroups first reviewed regional notes and documents to assess the applicability of lamprey passage metrics and methods used in the Columbia River Basin. In short, the region has not identified passage metrics or described methods to assess passage metrics or applied them for lamprey. Therefore, the PRFF and RRFF will identify and develop their own metrics (measurements; not standards or targets) and methods with respect to their Pacific Lamprey Management Plans. What follows is a summary of discussions and recommendations from the Subgroups.

Lamprey Passage Metrics

The Subgroups identified the following fish passage metrics that may be measurable for adult lamprey.

- ***Within-Fishway Passage Efficiency*** = Fraction of adult lamprey that successfully egress a fishway.
- ***Entrance Efficiency*** = Proportion of adult lamprey being detected at a fishway entrance at least once after release.
- ***Adjusted Inter-Dam Conversion Rates*** = Ratio of adult lamprey counted at an upstream dam to the number counted at a downstream dam, adjusted for overwintering, tributary escapement, predation, fallback/re-ascension, and reservoir/tailrace spawning.

The Subgroup did not identify travel time (within the fishway, to the fishway entrance, or from one dam or counting station to the next) as a passage metric, because lamprey tend to wander widely, may hold within certain areas (e.g., reservoirs, fishways, etc.) for extended time periods, and may overwinter for one or more years in the project area. On the other hand, travel time can be used as a covariate that may explain passage success. For example, delays within a segment or segments of the fishway may indicate a potential passage problem. Thus, although travel time is not a specific passage metric, it should be measured and used to help explain variation in passage metrics.

Lamprey Passage Metrics Methods and Assumptions

The Subgroups described methods and assumptions associated with each passage metric.

Within-Fishway Passage Efficiency

Within-Fishway Passage Efficiency is a measurement of adult lamprey passage success through the fish ladder. This is the metric that is often referred to when biologists speak of dam passage. Mark-recapture techniques are used to estimate Within-Fishway Passage Efficiency. Given that PIT-tag interrogation systems have been installed throughout the fishways, PIT tags are appropriate for marking fish and estimating Within-Fishway Passage Efficiency. Active tags can also be used provided they do not affect fish behavior or negatively affect swimming ability. In general, the approach includes capturing adult lamprey within the fishway being tested (assumes the fish intends to pass the project), tagging them, releasing them in the lower fishway or below the fishway, and recording the number of adult lamprey that exit the upstream end of the fishway. It is necessary to track the number of tagged fish that successfully egress the fishway, fallback, and re-ascend the fishway; track tagged fish that leave the fishway downstream and are detected at downstream dams or tributaries; and track fish that overwinter within the fishway if the fishway is not taken out of service during off-season. These data can be used to adjust Within-Fishway Passage Efficiency estimates.

Key assumptions associated with this approach include (1) tagged fish have the same probability of survival and passage through the fishway as untagged fish, (2) behavior of tagged fish is the same as untagged fish, (3) tagged fish intend to pass upstream of the dam through the fishway, (4) tags are not shed or lost, (5) tagging effects do not affect subsequent detections, and (6) enough fish are tagged, or detection efficiencies are high enough to estimate passage success accurately. An important assumption is that adult lamprey captured and tagged within the fishway desire to pass the project. Results from recent tagging studies indicate that adult lamprey can move through various projects multiple times before entering a downstream tributary, reservoir, or tailrace to spawn. This means that not all adult lamprey that enter a fishway intend to pass the dam. Rather, these fish may interact with the fishway but ultimately move downstream of the dam and reproduce successfully. Thus, it is important to track these fish for at least two years to determine their final location if they spawn downstream from the project. Within-Fishway Passage Efficiency can then be adjusted based on these results.

Because of variation in passage efficiency estimates, the Subgroups agreed that at least three valid study estimates would be best to estimate Within-Fishway Passage Efficiency.

Entrance Efficiency

Entrance Efficiency evaluates how successful adult lamprey are at entering the fishway through existing entrances, assuming the fish desire to move upstream. Mark-recapture techniques with active and/or PIT tags are needed to estimate entrance efficiency. In general, the approach includes capturing adult lamprey within the fishway (assumes the fish intends to pass the project), tagging them, releasing them downstream from the dam, and recording the number of adult lamprey that enter the fishway and are detected at two or more different interrogation stations within the fishway.

Assumptions associated with this approach include (1) tagged fish have the same probability of survival and entering the fishway as untagged fish, (2) behavior of tagged fish is the same as untagged fish, (3) tags are not shed or lost, (4) tagging effects do not affect subsequent detections, and (5) enough fish are tagged, or detection efficiencies are high enough to estimate entrance success accurately. An important assumption is that adult lamprey captured within the fishway desire to pass the project. Because this

may not be the case, it is important to track these fish after they are released downstream from the project to determine if fish subsequently move downstream or are consumed by a predator. Entrance efficiency can then be adjusted based on these results.

Adjusted Inter-Dam Conversion Rates

Adjusted Inter-Dam Conversion Rates estimate the loss of adult lamprey between dams (exit from one dam to the exit of another). In general, window counts at one dam are compared to window counts at another downstream dam. These rates are “adjusted” using results from active and passive tag studies to correct for overwintering, tributary escapement, predation, fallback, re-ascension, and reservoir/tailrace spawning. Some of these “adjustments” are not measurable at this time.

Because this approach relies on dam (window) counts, a major assumption is the dam counts are accurate (i.e., no fish are missed at the dams). Adjustments to dam counts are made using mark-recapture techniques. As before, mark-recapture assumptions include (1) tagged fish have the same probability of survival as untagged fish, (2) behavior of tagged fish is the same as untagged fish, (3) tags are not shed or lost, (4) tagging effects do not affect subsequent detections, and (5) enough fish are tagged, or detection efficiencies are high enough to estimate conversion rates accurately. The mark-recapture estimates must be precise enough to estimate overwintering, tributary escapement, predation, fallback, re-ascension, and reservoir/tailrace spawning. These estimates are then used to adjust dam counts.

Assessment of Unavoidable Effects (NNI)

The Subgroup concluded that Within-Fishway Passage Efficiency is the passage metric most likely to be measured accurately. The other passage metrics have assumptions that are difficult to accept or measure. For example, predation and reservoir/tailrace spawning are difficult to measure at this time. In addition, Within-Fishway Passage Efficiency can be estimated with PIT tags and other less preferable technologies. Thus, the Subgroups recommend Within-Fish Passage Efficiency as the primary metric for assessing adult lamprey passage success. The Subgroup believes this is the most appropriate metric for assessing unavoidable effects.

Once an adequate estimate of Within-Fishway Passage Efficiency is generated (based on at least three valid study estimates with study assumptions achieved), one can then estimate unavoidable effects (NNI). However, at this time, the Subgroups were unable to define NNI in terms of passage success. That is, does 100% passage efficiency define passage success, or is it defined as something less than 100% assuming that some level of mortality – like predation – occurs under natural conditions? In addition, the Subgroups were unable to determine at this time what NNI tools (actions) would be used to address unavoidable effects. The Subgroups did note that a greater effort would be needed to address a 70% passage efficiency than, say, a 95% passage efficiency. These are issues that may need to be determined using a model or by consensus of the policy representatives.

Juvenile Passage Success

The Subgroups evaluated the current status of methods and tags needed to evaluate juvenile survival

and concluded that evaluation of juvenile passage success is not possible at this time.