Priest Rapids Fish Forum

Wednesday, 3 May 2017
9:00 a.m. – 4:00 p.m.
Grant PUD, 11 Spokane St., Suite 205B, Wenatchee, WA
Call-In Number: 1-800-977-8002, Bridge: 7422882

MEETING MINUTES

PRFF REPRESENTATIVES

Steve Lewis, USFWS	Patrick Verhey, Chad Jackson, WDFW
Bob Rose, YN	Breean Zimmerman, WDOE
Pat Wyena, Doris Squeochs, Wanapum	Aaron Jackson, Carl Merkle, CTUIR
Jason McLellan, CCT	Keith Hatch, BIA
Mike Clement, Grant PUD	Chris Mott, Grant PUD
Tracy Hillman, Facilitator	Erin McIntyre, Grant PUD

ATTENDEES

Mike Clement, Grant PUD	RD Nelle, USFWS
Doris Squeochs, Wanapum	Steve Hemstrom, Chelan PUD
Breean Zimmerman, WDOE (via phone)	Kirk Truscott, CCT
Patrick Verhey, WDFW	Chris Mott, Grant PUD
Bob Rose, YN (via phone)	Tom Skiles, CRITFC (via phone)
Aaron Jackson, CTUIR (via phone)	Rod O'Connor, Grant PUD
Julie Maenhout, Blue Leaf	Doris Squeochs, Wanapum
Erin McIntyre, Grant PUD	Meaghan Connell, Chelan PUD
Tracy Hillman, Facilitator	

Action Items:

1. Rod O'Connor will send to the Forums the publication titled, *Movements, Habitat Use, and Population Characteristics of Adult Pacific Lamprey in a Coastal River.*
2. Rod O'Connor will examine if "campers" or "dawdlers" are more likely to move downstream. To the extent possible, he will also evaluate the effects of fish size on downstream movement.
3. Rod O'Connor will modify the table in slide 21 by including additional information or add another column indicating the number of fish that were detected at an upstream location but not at the fishway exits.

4. Rod O'Connor will add estimates of precision (confidence bounds) on the fish passage efficiency estimates.
5. Rod O'Connor will doublecheck the data and calculations in the fallback table in slide 24.
6. RD Nelle will look at the movements of adult lamprey released upstream and downstream of a diversion dam on the Yakima River.
7. Steve Hemstrom will compile data to look at the natural downstream movement behavior of Pacific lamprey in natural rivers to use in fishway passage estimates.
8. Mike Clement will estimate the proportion of acoustic tagged fish released at Desert Aire or Vantage Bridge that moved downstream over the past two years.
9. Tracy Hillman will contact Carl English (LGL) about the movement of steelhead during the 2002 radio-tag study.
10. Tracy Hillman will check with Bob Rose and Steve Lewis to confirm their availability for the 5 July meeting.

I. Welcome and Introductions - Tracy Hillman welcomed everyone to the Priest Rapids Fish Forum (PRFF or Forum) meeting. Participants introduced themselves. This meeting was held jointly with the Rocky Reach Fish Forum (RRFF).

II. Agenda Review – Members reviewed and approved the draft agenda.

III. Approve March Meeting Notes – April 2017 Meeting Minutes were reviewed and approved with edits.

A. Review Action Items from March Meeting - Due to time constraints, the April action items will be reviewed with the May action items at the June PRFF Meeting.

1. Mike Clement will discuss with Grant PUD's AIS biologist the inclusion of shoreline surveys in their aquatic invasive species surveys. Ongoing; Grant PUD is currently considering the inclusion of shoreline surveys.
2. WDFW or the Yakama Nation will provide the PRFF with biological information on sturgeon caught by the Yakama Nation during their tribal commercial fishery in the project area. Ongoing; a report from the YN should be available soon.
3. WDFW or YN will provide the PRFF with biological information on sturgeon caught by the Yakama Nation during their tribal commercial fishery in the project area.
4. Chad Jackson will let Tracy Hillman know what the managers decide regarding collection of sturgeon broodstock from the McNary Dam tailrace this year. Tracy will then share the decision with the PRFF. Complete
5. Tracy Hillman will discuss with John Ferguson (Chair of the Aquatic Settlement Work Group) the possibility of giving Daniel Deng (PNNL) more time to discuss lamprey tag development during the Pacific Lamprey Regional Passage Workshop. Complete

IV. Update on WSMP

A. Update on Juvenile Rearing

Chris Mott reported that Grant PUD released juvenile sturgeon from their 2016 broodstock on 2 May 2017. A total of 2,000 juvenile sturgeon were released at Frenchman Coulee (Wanapum Reservoir) and 1,250 juveniles into the Wanapum tailrace (Priest Rapids Reservoir). Chris noted that all fish looked good as they were released.

Steve Hemstrom reported that the 2017 juvenile sturgeon post-tagging QA/QC screening was conducted on 25 April through 27 April. Hatchery staff are currently waiting for river temperatures to approach 10°C before they release the fish. It is anticipated that the fish will be released around 15 May.

B. 2017 Broodstock Collection

Chris Mott reported that he, Corey Wright (Blue Leaf Environmental), and Lance Keller (Chelan PUD) have been tracking water temperatures to determine when they can collect broodstock. Chris said temperatures are tracking closely with the ten-year average and therefore they are planning to collect broodstock from 30 May through 5 June. Chris said that 30 May was selected because it will be after Memorial Day weekend when it is very busy in that area. They project that water temperatures will be around 13.5°C by 30 May. It was noted that they traditionally look at a water temperature of 13°C for broodstock collection, but there was agreement to try to get past the Memorial Day weekend. Chris stated that he talked with Donella Miller and she is comfortable waiting until after Memorial Day to receive fish at Marian Drain.

Tracy Hillman noted that during the last meeting there was a discussion on whether broodstock could be collected in the McNary tailrace. Chris Mott said that Grant PUD will be given seven days to collect broodstock downstream from McNary Dam and will be limited to 12 fish; 6 females and 6 males (6x6 matrix). Mike Clement stated that Grant PUD's plan is to reassess the situation after the seven days. Steve Hemstrom agreed that this is the plan.

Bob Rose asked what will happen if a female or male sturgeon is collected that is not reproductively ready. Can it be released and broodstock collection continue, or will all fish collected regardless of their maturation count toward the 6x6 matrix? Mike Clement noted that the former is what has happened in the past and this is coordinated with Donella at Marion Drain. If a fish is found to be out of synch with the rest, that fish is delivered back to the river and crews try to capture others that are more in synch. Mike added that this decision will be made onsite or via phone with the Yakama Nation after they have assessed female PI values. Mike continued that the only other concern in a high flow year is what happens if crews fish the seven days and end up with half-sib families. Under this scenario, crews may do some exploratory fishing elsewhere or request that WDFW, ODFW, and the Tribes extend broodstock collection in the McNary tailrace.

Steve Hemstrom reported that Chelan PUD, like Grant PUD, is waiting for river temperatures to approach 13.5°C. The estimated start date for broodstock collection is 30 May, but may be adjusted depending on river temperatures. Collection will start in the McNary tailrace and will be limited to seven fishing days in a ten-day window. No more than six ripe males and six ripe females (6x6 matrix) can be collected.

Mike Clement noted under a worst-case scenario of a 2x1 or 1x1 matrix, crews may have to leave the McNary tailrace and collect broodstock downstream from Priest Rapids Dam or Rock Island Dam.

Mike Clement reminded the group that there is only one transport trailer to be shared between Grant PUD and Chelan PUD.

C. Other White Sturgeon Items

None.

V. Update on PLMP

A. Current Adult Pacific Lamprey Passage Success

Rod O'Connor gave a presentation on adult lamprey passage through the Priest Rapids Project Area (see Attachment 1). He started by providing an overview of the study and then described the study objectives, approach/methods, and HD-PIT configuration and changes in methods over time. He described the counting station and identified the number of unique detections over time at both Priest Rapids and Wanapum dams. Rod explained the calculation of detection efficiency and the use of the Cormack-Jolly-Seber method for analyzing mark-recapture/resight data.

For each fishway at each dam, Rod showed the fish passage efficiencies for the survey years 2010-2011, 2012, 2013, 2015, and 2016. He showed both exit array detection efficiencies and revised efficiencies, which were based on upstream detections of adult lamprey that were not detected exiting the fishways. He also described passage times, cross-over events, fallback, drop back, and drop out at each project. He showed results on reservoir passage and overwintering. Overall, he stated that the cumulative fish passage efficiency at Priest Rapids Dam was 84.0% and 87.1% at Wanapum Dam. He concluded that the study plan objectives are being achieved, fish passage efficiency will be adjusted through redetection of fish at large, and that fish passage and median fishway travel times of tagged adults in 2016 were better than or comparable to previous years.

Rod then described the OLAFT passage evaluation conducted in 2015-2016. The purpose of the evaluation was to determine if slow passage through the upper left-bank fishway at Priest Rapids Dam continues to be an issue. Results from 2015 and 2016 indicate that 96-100% of the tagged adult lamprey passed the upper fishway successfully and rapidly. Thus, it does not appear that there was an issue in the upper fishway in 2015 and 2016; however, it was noted that adult sturgeon may have been absent in 2015 and 2016.

Extensive discussion occurred during and after the presentation. There were questions about the count station and the effects of flows through the crowder affecting adult lamprey passage. Mike Clement indicated that video monitoring shows no effects of flows or lights on lamprey passage through the count station. There also were questions about the physical characteristics of lamprey that overwinter in the project area. Mike stated that they have not sampled morphological characteristics of overwintered lamprey. Aaron Jackson said they are finding some adults that do not mature for 1-3 years after freshwater entry.

It was noted that passage efficiencies through the right fishway at Wanapum Dam are variable and low. Mike indicated that few lamprey use the right fishway at Wanapum Dam. This led to a question about the possibility that slow-moving adults through the fishways may have a greater tendency to drop back or move downstream. Rod said that they can look to see if "campers" or "dawdlers" are more likely to move downstream. He said he may be able to see if fish size also affects downstream movement.

The Forum recommended that Grant PUD modify the table in slide 21 by including additional information or add another column indicating the number of fish that were detected at an upstream location but not at the fishway exits. These are fish that exited the fishway undetected but were later detected at an interrogation site upstream from the project and were used to revise fish passage efficiencies. The Forum also recommended that Grant PUD include estimates of precision (confidence bounds) on the fish passage efficiency estimates. Finally, the Forum requested that Grant PUD doublecheck the data and calculations in the fallback table in slide 24. For example, for 2010, there are fallback estimates even though no fish were identified as falling back.

B. How to Calculate Passage Success

Tracy Hillman summarized the current passage efficiency estimates from entrance to exit for the Priest Rapids and Rocky Reach project areas. It was noted that "fishway exit" and "passage success" includes those lampreys detected upstream of the dam(s), but not detected at the dam.

Priest Rapids Dam	**84.0 %**
Wanapum Dam	**87.1 %**
Rocky Reach Dam	**98.8 %**

Steve Hemstrom reported that Chelan PUD has not used the detection efficiency matrix to date but he would follow the same efficiency calculation and adjustment as Grant PUD did. This adjustment includes lamprey not being detected exiting the fishway but were detected at an upstream location. These fish obviously passed the project even though they were not detected at the fishway exit. Thus, they do not represent a project effect but rather a detection issue. Kirk asked if it was possible to put confidence bounds on the estimates provided. Rod O'Connor said they can calculate confidence bounds on passage estimates. Mike Clement noted that all of Grant PUDs tagged fish, once they get above Rock Island can be used by Chelan PUD to estimate passage efficiency at Rocky Reach Dam.

It was noted that the current passage efficiency numbers are preliminary as there could be additional detections of overwintered fish this spring and summer. Mike

Clement asked if overwintering fish are truly a part of the fish passage efficiency calculation. The group agreed that overwintered fish, detected in the spring or summer the following year, should be counted and included in the passage efficiency estimate. Mike noted that Rod O'Connor has tracked this over the past three years and has demonstrated that 3-4% of the tagged fish overwinter and contribute to upstream passage the following year. The group also agreed with how passage success is being calculated and further agreed to calculating confidence limits on the passage estimates.

C. What if a "Failed" Passage Ends with Fish in a Downstream Tributary?

Tracy Hillman presented a question that has been asked in the RRFF: Is an adult lamprey that is detected in the fishway and does not pass but is later detected somewhere downstream considered a passage failure?

Steve Hemstrom asked if there is any information on the behavior of migrating Pacific lamprey and the choices they make as adults as a means to determine the rates of natural behavior and upstream and downstream movements adult lamprey make in free-flowing, unblocked, river systems. This could be used to assess downstream movement as a natural choice fish make in the absence of dam effects. Rod O'Connor noted, based on his evaluation of the literature, that downstream movement of adult lamprey is a common behavior. For example, there are adult lamprey that show up at Bonneville Dam and then move downstream and into the Willamette River. Steve stated that it would be beneficial to have acoustic telemetry to help determine if a barrier affects this result. He asked if there was radio telemetry in the Yakama or elsewhere to observe rates of downstream movement in systems with no barriers. RD Nelle stated that there were some lamprey that move down in the Yakima River, but more work is needed to determine the extent of this behavior. Mike Clement noted that Grant PUD released PIT-tagged lamprey in the forebay at Priest Rapids Dam and some of those fish were later detected at McNary Dam. Tracy Hillman noted that calculation of passage success is sensitive to the size of the denominator, so it is important to know what to do with those fish that enter the fishway but do not pass the project and are later detected downstream. Are these fish included in the denominator or not?

Steve Hemstrom noted that there are two issues: (1) what are the effects on the study and its results and (2) what do we do with those results. Steve noted that within a typical adult salmon passage model, the adult fish should move upstream and any that do not are considered unsuccessful. In contrast, for the lamprey model, an adult failing to pass a project may not be unsuccessful if it is later detected in a spawning area downstream from the project. The lamprey passage model must consider the behavior of an adult that decides to move downstream and spawn in a downstream location. RD Nelle noted that the issue is concerned with distribution and has been discussed before. Even if we do not know where they are going and they spawn in another tributary, the distribution is not what it once was. Steve stated that this is why it would be beneficial to have a fishway passage model that incorporates the natural rate of downstream movements of tagged lampreys that make the choice to move downstream during an upstream passage study. Rod O'Connor discussed research conducted in the Umpqua River basin that looked at overwintered adult lamprey and their behavior in the spring. The study found that adult lamprey movement is sporadic and they move both upstream and downstream.

Tracy Hillman asked if there are other studies that can be used to help adjust the passage efficiency ratio. RD Nelle asked what is being done on the lower dams to adjust for downstream movement behavior. Mike Clement stated that he participates on the Lamprey Technical Passage Work Group and the workgroup agreed that there is no standardized recognized formula because there are too many unknowns about adult lamprey and their upstream passage behavior. Tracy asked if anyone is opposed to subtracting downstream moving fish from the passage efficiency equation. To be removed from the equation, these fish must be detected within a fishway, not detected exiting the fishway (no upstream passage), and later detected in a downstream spawning location. Steve Hemstrom noted that it would be best if the lamprey was re-detected in a tributary. RD Nelle suggested any area where they are spawning. Mike noted that there is a large behavioral component that is unknown, but there is also a tag effect and it depends on the type of tag used. Tracy indicated that if a fish is detected at a downstream dam, you know that the fish did not die in the project area.

Tracy asked the group how far downstream a lamprey would need to be detected before it would not be included in the passage efficiency calculation. For example, would a fish detected at Priest Rapids then at McNary and possibly at a Snake River dam but never in a tributary be included in the Priest Rapids Dam calculation? Mike noted that there is documented mainstem spawning in rivers and lakes, but this cannot currently be measured. Steve agreed but noted that if a lamprey is within a tributary, we can be relatively certain that it will spawn there and therefore we can remove it from the passage efficiency calculation as long as it is not a large proportion of the tagged fish. RD Nelle noted that hypothetically, under this scenario, if no fish pass the project and all go downstream, then it could be said that there is no project effect. Patrick Verhey noted that there may be specific times of the year where more fallback might occur, but he assumes that if the lamprey enter the fishway, the intent is to pass the dam and had the dam not been there, the fish would have continued upstream. The opinion is there was some sort of dam effect, but if the fish reproduce downstream, is there a dam effect? Tracy reminded the groups that the numbers of adult lamprey entering fishways and then later detected downstream are small.

Regarding distribution, Steve Hemstrom noted that lamprey, unlike salmon, are non-philopatric (do not home back to natal areas to spawn) and therefore there is no guarantee they will migrate back to the same place where they were spawned. Kirk Truscott suggested that we need to determine what percent of those fish entering the ladder and return downstream to spawn is appropriate. Steve Hemstrom said that he is interested in looking at an undammed river system where upstream lamprey movement has been studied to determine if rates of downstream volitional movement by lamprey can be quantified where no barrier exists to affect upstream movement. Steve noted that based on Rocky Reach's current passage efficiency, he did not think downstream movement rates of 2-3% would affect passage success much. Kirk suggested picking an appropriate target to be validated. This could be done by releasing tagged fish downstream from the confluence of the Wenatchee River and determining what proportion of those fish end up in the Wenatchee River. Steve said he does not believe there would be any data showing more than 10% downstream movement, but he could analyze the rate. The group decided to look at additional research from other rivers and studies, including the study titled, *Movements, Habitat Use, and Population Characteristics of Adult Pacific Lamprey in a Coastal River*. It was also noted that there were 50 adult lamprey released by Douglas PUD in the forebay of Rocky Reach Dam that could be used to estimate downstream movement.

Mike Clement asked if it should be assumed that those lamprey that enter the fishway want to pass the dam. Steve noted this is why a natural system should be observed to determine the rate of those fish that choose to go downstream when there is no barrier present. Mike Clement recalled an adult steelhead tagging study conducted by all three PUDs where released steelhead were detected within 36 hours in the Methow River and 72 hours later they were detected at Lower Granite Dam.

The group agreed to subtract out those fish that enter the fishway and are later detected downstream provided they make up less than 10% of the fish entering a fishway (or whatever the number is from research in undammed systems). If more than 10% of the tagged fish detected in a fishway are later detected downstream, the downstream moving fish exceeding the 10% limit will be included in the calculation of passage efficiency.

D. Are there Additional Actions that can be Implemented Within the Fishways to Improve Passage Success?

Steve Hemstrom reported that Chelan PUD will finish plating the fishway at Rocky Reach Dam.

Mike Clement indicated that all plating and screening has been completed at Priest Rapids and Wanapum dams and there are no other improvements left to do. Patrick Verhey asked if there was any aversion to the lights in the fish ladder. Mike reported that no aversion to light has been observed.

E. What is the Upper Passage Limit for Calculating NNI?

Given an agreement on the method to use for estimating adult lamprey passage efficiency, Tracy Hillman asked how the group intends to calculate NNI. In other words, what passage value represents the upper limit for calculating NNI? Steve Hemstrom stated that 100% is not appropriate for adult lamprey given that there are no data to support a target of 100% passage. Patrick Verhey noted that once fallback has been determined, you could then subtract that number from NNI. Mike Clement noted that the Tribal Restoration Plan with the CRITFC Tribes and U.S. Fish and Wildlife Services stated that 80% was the goal. Mike noted that there was no calculation to determine the 80%, but it was a starting point. Kirk Truscott asked if 80% is the goal, would anything less than 80% be NNI? Steve Hemstrom noted that NNI was not discussed, it was only about dam passage rates.

RD Nelle asked why NNI could not be 100% and why we would think lamprey survival through the project would be lower than for salmonids. Steve Hemstrom stated that we do not know, but passage rates could be only 90% because of the plasticity that exists in lampreys we are studying. Kirk Truscott recalled the discussion earlier about some fish entering the ladder and going back downstream. Currently, there are no data that indicate these fish turned around in the ladder unless they are detected downstream. He asked what are the chances that lamprey are going to make a decision within the ladder and go someplace else. It was suggested a paired release could be implemented to find out if this phenomenon was related to those fish that choose to stay in the ladder.

Steve asked how to deal with the variability of passage and noted that the highest passage rate measured (i.e., 98.8% at Rocky Reach Dam) was the capability of the fish, so how do researchers account for passage variability from year to year? Patrick Verhey suggested variability in pheromones upstream from the fishway may affect passage success. Steve noted that pheromone levels would not be a fishway passage problem issue, but would be a consequence of the natural environment and therefore it is important to separate environmental conditions unrelated to the project from fishway passage problems to determine how many years of study are needed to estimate fishway passage efficiency. He said fishway conditions are being measured and those conditions are relatively constant regardless of river and environmental variability present from year to year. Therefore, a high passage rate as measured at Rocky Reach Dam in 2016 demonstrates very good in-fishway passage. The anadromous Habitat Conservation Plans use three years of data to capture the variability in the river environment. Kirk noted that there are years where you may have different flow rates in the ladder even though you are within operating criteria for the head differential.

Tracy Hillman noted that the Pacific Lamprey Subgroups discussed calculating the mean from at least three years of fish-passage data to estimate passage efficiency (see Sections 3.1 and 4.0 in the August 2016 Pacific Lamprey Subgroups Meeting Notes). Steve Hemstrom noted if three years of data are needed, then Chelan PUD will need at least two to three more years of study before they can calculate NNI.

Tracy Hillman shared the Concept Paper for Evaluations to Determine Project Effects and Implementation of NNI that was prepared by the managers and facilitated by Bob Rose in 2014. He read from the section titled “Rationale for Employing NNI” where 80% was the goal for passage efficiency. RD Nelle noted that 80% was discussed as a starting point and specific to Rocky Reach project. Tracy noted that if 80% is used as a starting point for NNI, then the Priest Rapids and Rocky Reach projects have met or exceeded the target. Tracy asked if the goal in the CRITFC plan is that all projects achieve 80% adult passage. Members present did not know. It was noted that no other projects in the Columbia River basin have an NNI component. Steve Hemstrom noted that a 100% passage target does not take into consideration what happens naturally and lamprey survival was never 100% in the natural system. Steve Hemstrom suggested using new lamprey data that is now available to help determine an NNI target. Patrick Verhey stated that if a lamprey is in the fishway, it is a fair assumption that it wants to pass the dam but fallback and mortality should be considered. Patrick suggested looking at the fallback rate and other data to help determine NNI. Patrick asked if the management plans state that once the passage objective is achieved, then there is no NNI. Steve noted that this is unclear. Kirk stated that for some parties, the interpretation may be that you have a passage standard (e.g., 80%) and an NNI target.

Tracy Hillman asked what we need to do to identify the upper limit for NNI and if this will be a value based on mark-recapture/resight studies or a negotiated value. Mike Clement said the Agreement states that we need to address unavoidable project impacts. Grant PUD's expectation is that the impacts are identified and measured so these impacts can be mitigated or there is a negotiation that is amendable to all parties in fulfillment of that obligation. Mike noted that existing project impacts represent the environmental baseline. He added that this is not to say there are no project impacts, but to fulfill the NNI obligation would mean mitigation for unavoidable project operational impacts. Issues such as potential for overwintering, mainstem spawning, and predation are not measurable project impacts.

The group agreed that critical perspectives are needed to provide input on mitigation for known project impacts. The group noted that next steps will need to be discussed once the unavoidable impact is calculated.

F. Update on Juvenile Lamprey Passage Estimation

Tag technology is currently in field trials and advancing. Several assumptions of possible survey designs are still compromised because of the behavior of macrophthalmia.

G. Next Steps

The 5 July 2017 meeting of the PRFF will be a joint meeting with RRFF to continue the discussion of Pacific lamprey NNI. Location and time will be confirmed at a later day.

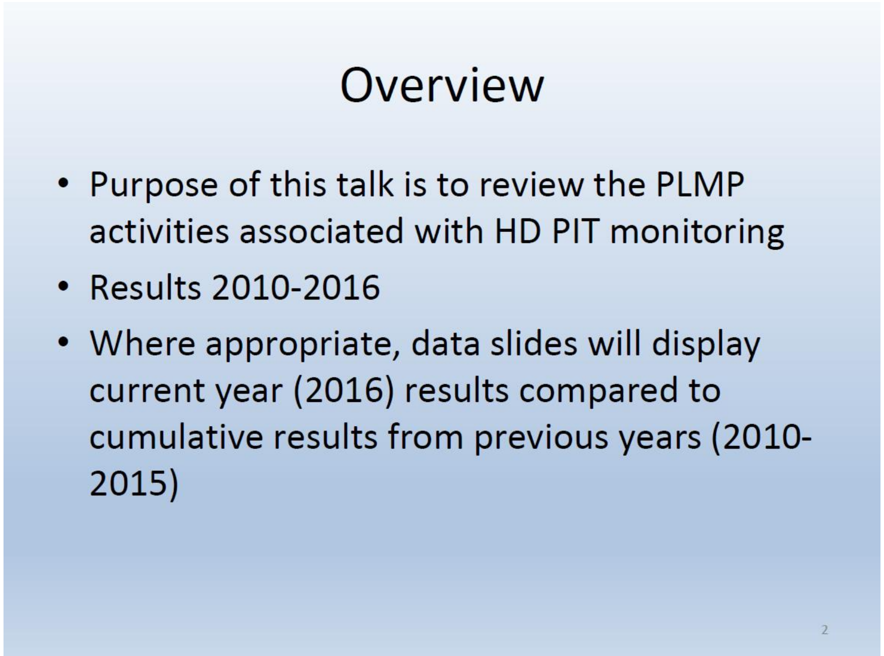
H. Other Pacific Lamprey Items

None.

VI. Next Meeting: 7 June 2017 – Grant PUD Natural Resources Wenatchee Office

Attachment 1

Presentation by Rod O'Connor on Adult Pacific Lamprey Passage Success at Priest Rapids and Wanapum Dams



Study Objectives

- Study Plan
  - "*Assessment of Pacific Lamprey behavior and passage efficiency at Priest Rapids and Wanapum dams*"
- Relevant Objectives
  - Determine the Fish Passage Efficiency (FPE) for adult lamprey at Priest Rapids and Wanapum dams and participate in collaborative data sharing with ACOE and CPUD to assess adult passage in the Columbia River basin;
  - Evaluate the passage of adult lamprey through sections of the Priest Rapids fishways where new structures have been installed to facilitate upstream movement.

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Study Approach – Passage Metrics

- HD PIT
  - Uniquely identifiable fish;
  - Application to entire size range of adult population;
  - Antennas installed at strategic locations;
- Fishway efficiency
  - Number of exits divided by number entrances
  - Passage behavior (i.e. Fallback after exit)
- Travel times
  - Time at location B minus time at location A.

Study Activities

- Deploy and test HD PIT array;
  - Effort associated with array testing (annual tag-read tests during dewatered work period)
- Operate array during lamprey passage;
- In-season data processing bi-monthly;
- Conduct analysis of lamprey detections to estimate passage metrics;
- Produce annual report
- Present to PRFF

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HD PIT - Configuration

Changes and improvements since 2010

- In 2010, 20 HD PIT stations were installed
  - Entrance(s), lower fishway, below count, above count, exit
  - Look for abnormal passage trends within specific areas of fishways
- In 2015, the total was streamlined to 16 stations
  - Entrance(s), above count, exit, except at PRD left bank
  - PRD left bank: entrances, above count, above OLAFT, exit
  - Aging detection system, focus on FPE

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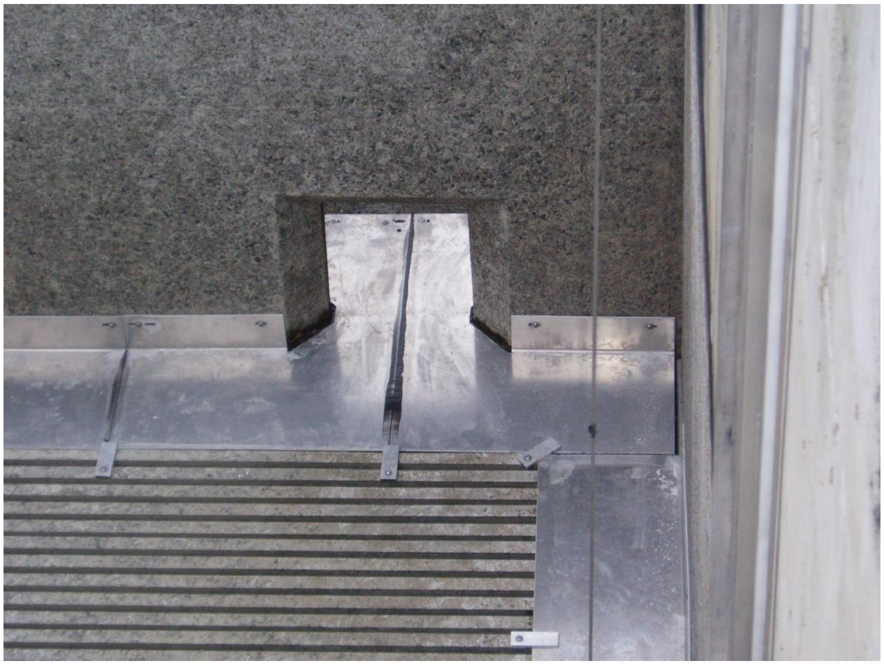
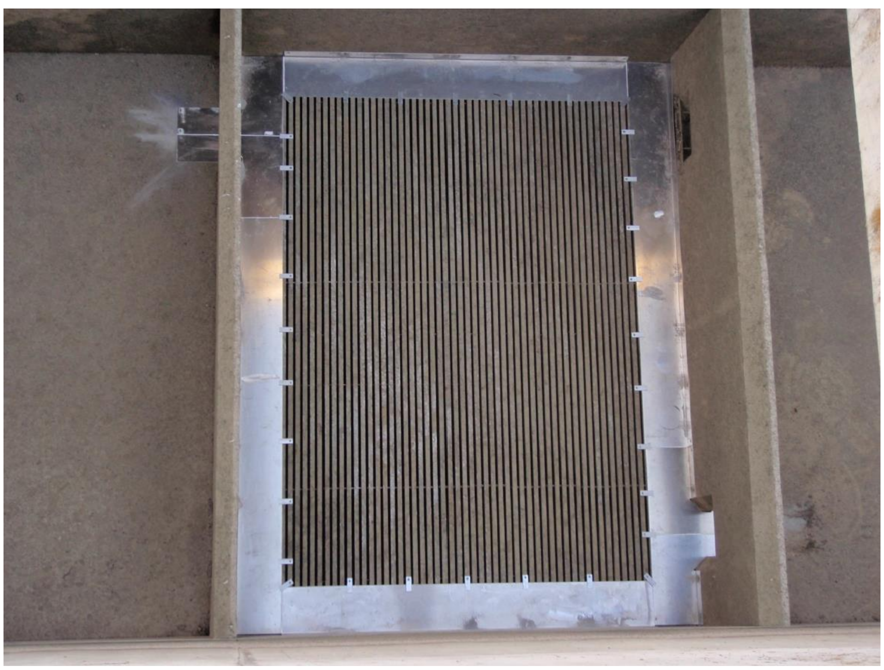
Changes and improvements since 2010, continued

- Installation of aluminum plating and ramps for lamprey passage – winter 2009-2010



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HD PIT – Data Processing

- Diagnostics and download every two weeks during active migration;
- QA/QC Rx files;
- Review Rx files for valid codes;
- Import Rx files into Relational Database;
- QA/QC individual fish histories;
  - Data sharing USACE, U of I, Chelan PUD – regional contributions
  - Power outages lead to missed fish that are then "at large"
  - Long view of annual data sets will shed light on life histories
- Calculate metrics.

Background

Year	Comment	BON Count	BON Tagged	PRD Count	PRD ROR Tags
2010	• Low run • GPUD implements PRFF approved study plan	6,234*	470	1,114	13
2011	• Low run	18,315*	1,000	3,868	54
2012	• Robust run	~100,000	1,200	4,025	87
2013	• Robust run	~88,000	901	5,968	100
2014	• Robust run • WAN fracture – lamprey ramps at modified WAN fishway exits	>100,000	1,854	7,579	161
2015	• Robust run • Limited tagging at Bonneville • Grant PUD trapped, tagged, and released 133 fish in PR lower left fishway	>100,000	349	6,749	28
2016	• Robust run • Limited tagging at Bonneville • Grant PUD trapped, tagged, and released 150 fish in PR lower left fishway	121,633	425	8,139	45

* Uncorrected count at Bonneville

Priest Rapids Dam Left Bank Count Station

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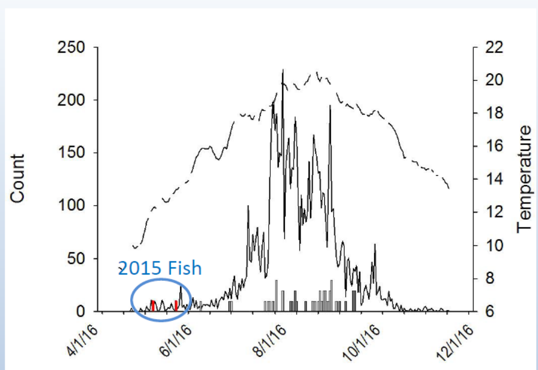

- Arrival of tagged lamprey (tagged primarily at BON) occurred throughout the run at-large
- Most first-detections occurred during peak seasonal temperatures (>16° C, reached approx. 2 weeks earlier than average)
- Monitoring in 2016 started in May and continued until fishway maintenance and dewatering

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HD PIT results – Combined 2010-2016

	PR	WA*
Unique tags detected at dam	483	463
Total passage and exit	360	342
Total detected only at entrance	34	46

* 2014 numbers removed, Wanapum fishways modified due to fracture.

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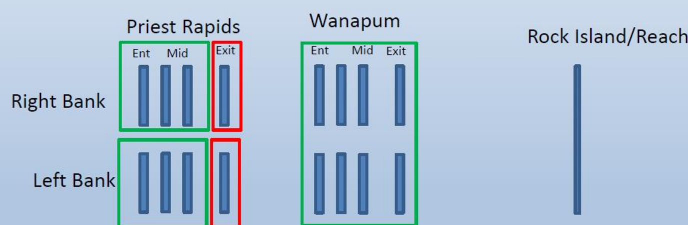
Detection efficiency at the exits–revised FPE

- Cormack-Jolly-Seber method
- Use detection efficiency to expand passage count at exits



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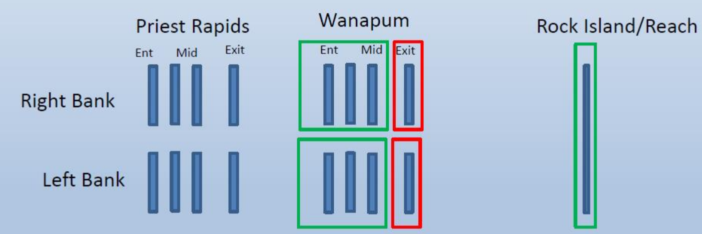
Detection efficiency at the exits– revised FPE

- Cormack-Jolly-Seber method
- Use detection efficiency to expand passage count at exits



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Detection efficiency calculation

- P = r/r+z; where
- r = quantity of tags detected at the exit array AND detected at subsequent upstream arrays (i.e. detected at PR left exit AND anywhere at WAN)
- z = quantity of tags detected within a ladder, missed at the exit array, AND detected at subsequent upstream arrays (i.e. detected in PR left ladder AND at WAN but MISSED at PR exit)
- EXAMPLE CALCULATION
  - r = 42
  - z = 4
  - P = (42)/(42+4) = 0.913 or 91.3% detection efficiency at the exit array

  - If 50 fish were detected at the exit array, revise using DE
  - Revised count at exit = 50/0.913 = 55 fish

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HD PIT results – FPE fishways

Year	Dam and ladder	Qty Det in Ladder	Qty Det at Exit	Exit array Det Efficiency	Revised FPE
2010-2011	PR Left	53	30	0.83	68.0%
2012	PR Left	53	42	0.64	near 100%
2013	PR Left	71	51	0.96	74.6%
2015	PR Left	14	9	0.87	73.6%
2016	PR Left	30	28	0.92	near 100%**
2010-2011	PR Right	24	17	0.77	92.1%
2012	PR Right	34	20	0.94	62.3%
2013	PR Right	29	26	0.81	near 100%
2015	PR Right	14	9	0.83	77.2%
2016	PR Right	n/a	n/a	n/a	n/a
2010-2011	WAN Left	31	22	n/a	70.9%*
2012	WAN Left	35	26	1	74.3%
2013	WAN Left	56	48	0.96	89.5%
2015	WAN Left	102	79	0.86	90.4%
2016	WAN Left	111	97	0.91	95.7%
2010-2011	WAN Right	24	17	n/a	69.0%*
2012	WAN Right	9	2	0.5	44.4%
2013	WAN Right	16	9	0.67	84.3%
2015	WAN Right	44	22	0.53	94.5%
2016	WAN Right	46	28	0.37	near 100%

* Raw FPE reported because of lack of detections upstream of WAN in 2011

** FD PIT antennas at PR exits configured to read HD PIT tags in 2016, resulting in improved DE

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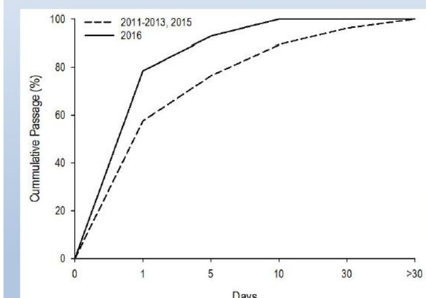
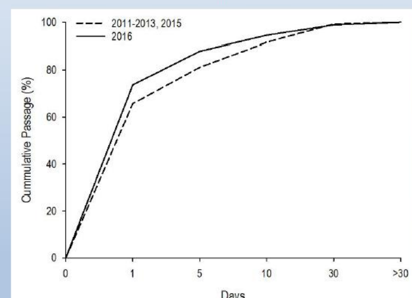
HD PIT results – Passage Times

Priest Rapids



Wanapum



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HD PIT – Cross Over Events

- Detected at both right and left bank fish ladders at the same dam.

Year	Priest Rapids	Wanapum
2010	23% (3/13)	22% (2/9)
2011	13% (8/64)	11% (4/35)
2012	10% (9/87)	11% (5/44)
2013	10% (10/100)	11% (8/72)
2014	16% (25/161)	---
2015	25% (7/28)	21% (31/146)
2016	27% (8/30)	20% (31/157)
Total	14% (70/483)	17% (81/463)

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HD PIT – Fallback Events

- Passed the fish ladder, then next detection was at the entrance of either fish ladder at the same dam.
- Fallback occurred through an unmonitored route (turbine, spillway).

	Priest Rapids			**Wanapum**		
Year	Fallback	Reascend	**Net Fallback**	Fallback	Reascend	**Net Fallback**
2010	0	0	**8% (1/13)**	0	0	**11% (1/9)**
2011	1	1	**0% (0/64)**	3	1	**6% (2/35)**
2012	0	0	**0% (0/87)**	1	1	**0% (0/44)**
2013	2	2	**0% (0/100)**	6	4	**3% (2/72)**
2014	3	3	**0% (0/161)**	---	---	**---**
2015	0	0	**0% (0/28)**	7	6	**1% (1/146)**
2016	2	1	**3% (1/30)**	11	10	**1% (1/157)**
Total	8	7	**<1% (1/483)**	28	22	**1% (6/463)**

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HD PIT – Drop Back Events

- Detected in the mid/upper portion of the fish ladder then next detection was downstream within the same ladder.

	Priest Rapids		Wanapum	
Year	Drop back	Pass	Drop back	Pass
2010	3	67% (2/3)	1	0% (0/1)
2011	15	67% (10/15)	3	67% (2/3)
2012	27	59% (16/27)	9	33% (3/9)
2013	15	80% (12/15)	22	41% (9/22)
2014	6	67% (4/6)	---	---
2015	6	67% (4/6)	9	56% (5/9)
2016	2	100% (2/2)	9	56% (5/9)
Total	74	68% (50/74)	53	45% (24/53)

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HD PIT – Drop Out Events

- Detected above entrance within the fish ladder and then last detection was at the fish ladder entrance, with no subsequent detections that year.

Year	Priest Rapids	Wanapum
2010	0% (0/13)	11% (1/9)
2011	6% (4/64)	9% (3/35)
2012	13% (11/87)	9% (4/44)
2013	10% (10/100)	11% (8/72)
2014	3% (5/161)	---
2015	7% (2/28)	10% (14/146)
2016	7% (2/30)	14% (22/157)
Total	7% (34/483)	11% (52/463)

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HD PIT results – Reservoir passage and overwintering

Year	Median PR Reservoir passage time (d)	Qty tags from previous year (overwintering fish)
2011-2015	4.3	22 (5%)
2016	5.9	2 (4%)

- 5% of detected tags were from the previous year 2011-2016;

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Cumulative FPE (2010-2016)*

- 84.0% for Priest Rapids Dam
- 87.1% for Wanapum Dam

*excluding 2014

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Conclusions

- Grant PUD PLMP HD PIT program contributes substantially to the passage database, locally and regionally;
- Limited tagging effort at Bonneville in 2015 and 2016 reduced sample sizes for ROR lamprey passage metrics
- FPE and median fishway travel times of tagged fish in 2016 were improved or comparable to previous years;

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Conclusions, cont.

- FPE will continue to be adjusted through redetection of fish at large
- Study plan objectives are being achieved.

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OLAFT Passage Evaluation 2015-2016

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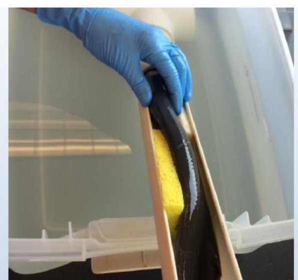
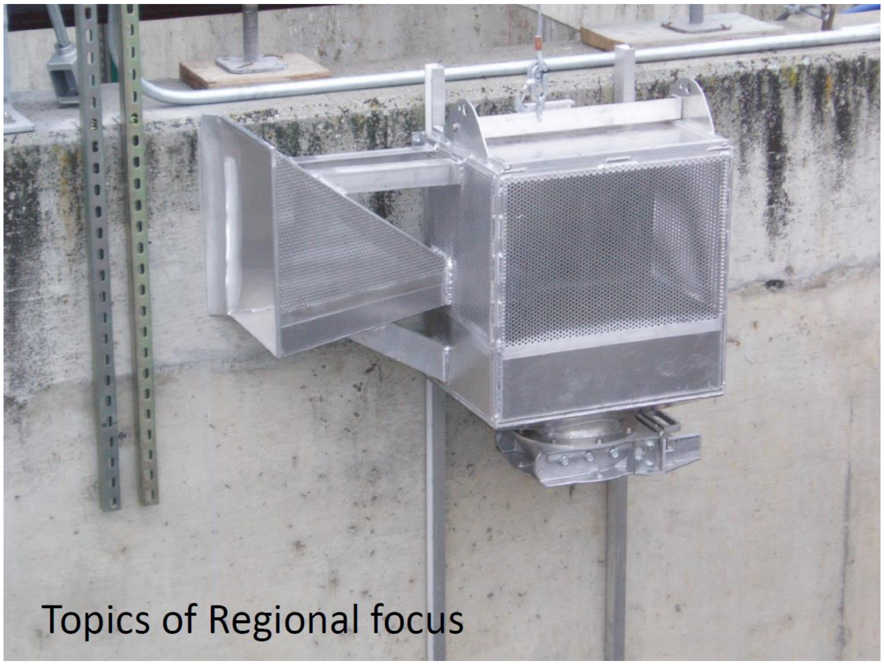
2015-2016 seasons – evaluation of passage through Priest Rapids upper left fishway – OLAFT Study

- Purpose to determine whether persistent slow passage through PRD upper left bank fishway in 2010-2013 continued to occur
- Tagged 283 adult lamprey trapped at PRD lower fishways with HD PIT tags in July and August 2015-2016;
- Released into lower left bank fishway at PRD;
- Monitored all HD PIT stations throughout usual monitoring period (bi-monthly until ladders dewatered for winter maintenance).




Topics of Regional focus


Topics of Regional focus

OLAFT study FPE

Year	Dam and ladder	Qty Det in Ladder	Qty Det at Exit	Exit array Det Efficiency	Revised FPE
2015	PR OLAFT	131	109	0.87	95.6%
2016	PR OLAFT	149	139	0.92	near 100%

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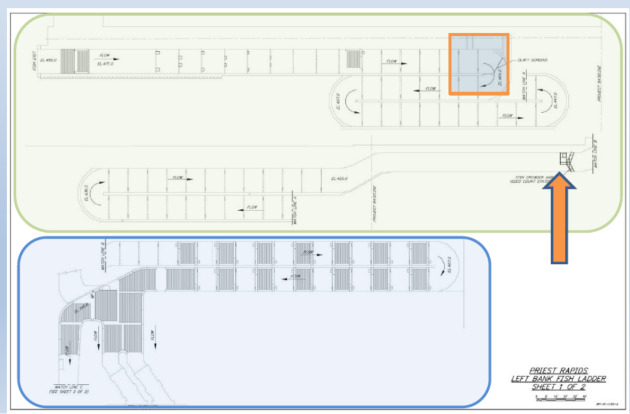
	Median fishway passage time (h)			
Year	n	PR Left Below Count	n	PR Left Above Count
2010-2011	20	2.6	28	47.3
2012	32	2.5	20	45.8
2013	39	2.2	40	36.5
2015 (OLAFT study)		n/a	92	6.0
2016 (OLAFT study)		n/a	103	8.4



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