

Priest Rapids Fish Forum
Rocky Reach Fish Forum
Aquatic Settlement Work Group

Wednesday, 4 October 2017

9:00 a.m. – 1:00 p.m.

Grant PUD, 11 Spokane St., Suite 205B Wenatchee, WA

Pacific Lamprey
Subgroups

Participants:

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* Joined via phone.

Meeting Minutes

I. Welcome and Introductions

Tracy Hillman welcomed everyone to the Pacific Lamprey Subgroup meeting. Participants introduced themselves.

II. Agenda Review

The agenda was reviewed without any additions.

III. Current Passage Rates

Passage Success Through Fishways and Reservoirs

Priest Rapids Project Area—Mike Clement reported that over the past six years of cumulative passage studies, Grant PUD measured an adult lamprey passage efficiency rate of 84% to 87% through Priest Rapids and Wanapum dams. Mike reported that because of the comprehensive data set, Grant PUD did not tag adult lamprey to assess passage efficiency this year. However, this year, Grant PUD did support Chelan PUD's studies by collecting 300 adult lamprey at Priest Rapids Dam. Chelan PUD tagged these fish and is using them in their 2017 Rocky Reach Dam passage study. Mike indicated that Grant PUD trapped an additional 316 lamprey for the Yakama Nation (YN) and Colville Tribes (CCT) translocation programs. YN and CCT and others tagged and released these lamprey upstream from Wells Dam.

Mike reported that because of the PRFF's previous discussions related to fish ladder entrance efficiency, he and Rod O'Connor discussed the tagging of 100 adult lamprey to reaffirm the results from previous relicensing studies and to provide a continuous data set. Currently, very few downstream-tagged fish (tagged by the Warm Springs Tribes in the Lower Columbia River) have been detected in the Priest Rapids Project Area. Mike said the 100-tagged lamprey were released downstream from both projects (Priest Rapids and Wanapum dams). These fish were tagged with HDX PIT tags. Based on the most recent data download, the entrance efficiency for Priest Rapids at left and right banks is 96%, and for Wanapum the entrance efficiency is 92% for the left bank and 96% for the right bank. Mike also noted that there was an even distribution of tagged lamprey approaching the left and right-bank fishways at both dams (i.e., tagged adult lamprey did not select one ladder over the other at each dam). Mike noted that they do not know the detection history of those lamprey moving through the fish ladders, but it is presumed it will be similar to previous years. Mike stated that a complete summary of this information will be included in this year's annual report.

Rocky Reach Project Area—Steve Hemstrom reported that in 2016, Chelan PUD tagged and released 211 adult lamprey over a five-day period in August. The lamprey were released at Kirby-Billingsley Hydro Park; 90% along the right bank and 10% along the left bank. Of the 211 lamprey released, 164 were detected in the Rocky Reach Fishway and 162 were last detected at the top (exit) of the fishway. This equates to a passage efficiency of 98.6%. Steve Hemstrom noted that as of the last download on 18 September, this efficiency estimate still stands. Steve Hemstrom noted that he received few comments on the draft 2016 report. The final report for the 2016 study is almost complete and will be released soon.

Steve Hemstrom reported the goal in 2017 was to tag and release 225 adult lamprey, but because of the large run this year, 300 adult lamprey were tagged and released. The lamprey were tagged with FDX PIT tags and released at Kirby-Billingsley Hydro Park; 90% along the right bank and 10% along the left bank. Steve Hemstrom indicated that of the 300 fish released this year, so far 257 have been detected in the Rocky Reach fishway and 249 of those have been detected at the exit. None of these have been redetected downstream. This equates to an in-progress passage efficiency of 96.9%.

Wells Project Area—Douglas PUD was unable to attend the joint subgroup meeting and therefore there was no update provided on adult lamprey passage success at Wells Dam.

IV. Possible Factors Affecting Passage Through Reservoirs

Project Operations on Reservoir Dynamics

Steve Hemstrom reported that adult lamprey passage counts have been persistently low at Wells Dam and passage counts have been high and increasing at Rocky Reach Dam. He added that during past Fish Forum meetings it has been hypothesized that Rocky Reach Reservoir might be a migratory barrier for adult lamprey approaching Wells Dam. Steve Hemstrom gave a presentation that described both past and present operations at Rocky Reach Dam and how those operations affect reservoir operations and dynamics. The title of Steve's presentation was "Rocky Reach Reservoir Operations: Evaluation of Operating Characteristics and Potential Influence on Migration of Adult Lamprey to Wells Dam" (see Attachment 1).

Steve Hemstrom showed counts of adult lamprey at Rocky Reach and Wells dams, 2000-2017, and the average count conversion percentage between the two dams. Mike Clement asked if the ASWG had ideas about what happened during 2005-2006 to cause such a significant drop in conversion rates to Wells Dam, which have remained very low since then. Steve Lewis stated that the ASWG has looked into operational effects at Wells Dam, but nothing out of the ordinary has been found. Patrick Verhey noted that there is a hypothesis regarding the loss of pheromones, possibly resulting from the fires in the Methow River basin during the time when passage rates at Wells Dam dropped significantly. Mike stated that he believes that the pheromone signal would be short term and would likely not account for the long term low passage counts at Wells Dam. Ralph Lampman described the extensive surveys conducted in the Methow and the drastic decline in larval numbers there, which could affect adult migration. Ralph offered the suggestion that there may be a pheromone threshold that must be reached to attract adults. He added that this is a hypothesis and he does not know what the threshold level is.

Steve Hemstrom described the 18-year cumulative passage run timing for adult lamprey at Rocky Reach Dam from 2000-2017. These data indicate that 95% of the movement of adult lamprey through Rocky Reach Dam and into the Rocky Reach Reservoir in those years was from 24 July through 26 September. Steve Hemstrom also presented the duration curves for the surface-operating elevations for Rocky Reach Reservoir forebay for 2005-2006 and 2014-2016. The curves demonstrate that there are no project operation changes that occurred at Rocky Reach Dam or in the reservoir before, during, or after the large decline in lamprey conversion rates at Wells Dam.

Steve Hemstrom then described relationships between Wells Dam discharge and Rocky Reach forebay-to-Wells tailwater elevation differences over six years (2005-2007 and 2014-2016). The daily maximum and minimum reservoir elevation differences between Rocky Reach forebay and Wells tailwater in all years correlated strongly with the day of annual maximum and minimum discharges from Wells Dam. Rocky Reach day-average forebay elevations are in sync with the corresponding dates of Wells

maximum day-average discharge and forebay-tailwater elevation differences. The data showed that Rocky Reach forebay elevations and reservoir operations have no apparent effect on forebay-tailwater elevation differences. Backwater curves showed Wells Dam discharges are the primary driver of upper Rocky Reach Reservoir elevations. Tracy Hillman asked if the Rocky Reach tailrace elevation fluctuations and effects on upper Rock Island Reservoir resulting from Rocky Reach operations would be similar to fluctuations resulting from Wells Dam operations. Steve Hemstrom answered yes, they would be similar and the Rock Island Reservoir elevation fluctuations would be tied between the two projects. Tracy then asked why it is that adult lamprey appear to easily pass Rocky Reach Dam but not Wells Dam, even though both projects have similar tailrace fluctuations. It is unknown why.

Ralph Lampman commented on the forebay elevation fluctuations, stating that if juvenile lamprey reside along the margins of the reservoir, it does not matter how much time the water level stays at a particular position. What matters more is how quickly the water elevation changes (i.e., ramping rates). He added that it is the steepness of the curve that is most concerning to larval lamprey. He estimated from the steepest part of the graph that the elevation change would be about 19 cm/hr. Ralph noted that the USGS has been looking at what a natural dewatering rate might be for natural systems and they observed in the Frasier River a natural decrease in water level at a rate of 7.6 cm/hr. Ralph said the operators of Wapato Diversion were asked to reduce their ramping rate to 10 cm/hr and this significantly reduced the mortality of larval lamprey along the stream margin. He added, however, that what has been observed is that larval lamprey may avoid moving back into areas that were recently dewatered because of changes in sediment conditions. Tracy Hillman asked if the current ramping rates of 19 cm/hr would affect adult lamprey survival and passage. Ralph stated that he did not think this would affect adult lamprey because they are likely migrating in deeper water (note, he is not stating that reservoirs have no impacts on adult passage, but rather related to ramping and specifically the water level changes along the bank, he does not foresee any effects on adult lamprey).

Steve Hemstrom concluded the presentation by stating that there have been no changes in project operations at Rocky Reach Dam over time that would explain the significant reduction in adult lamprey conversion rates between Rocky Reach and Wells dams, and he asked the Subgroup, based on the data provided, if they could think of any Rocky Reach Reservoir operation effects that could cause adult lamprey migration problems. Members present did not identify a migration effect based on Rocky Reach Reservoir operations.

Identification of Testable Hypotheses Linking Project Operations to Lamprey Reservoir Passage

The group discussed possible hypotheses linking project operations to the “fate” of adult lamprey in reservoirs. Tracy Hillman reminded the subgroups of the hypotheses identified during previous PRFF and RRF meetings. Those were:

- Hypothesis 1 (Kirk Truscott): Operations may affect the quantity and quality of spawning habitat used by Pacific lamprey in the reservoirs. If lamprey spawn successfully in the reservoir and operations change flows such that redds are scoured, dewatered, or covered with fine sediments, then operations may affect lamprey survival in the reservoir.
- Hypothesis 2 (Steve Lewis): White sturgeon predation. Although predation is not directly linked to project operations, supplementation of sturgeon is a project-operation mitigation measure.
- Hypothesis 3 (Kirk Truscott): Changes in operations at the dams associated with salmonid passage could affect Pacific lamprey entrance efficiency. This hypothesis targets dams with fish passage enhancements or bypasses.
- Hypothesis 4 (Ralph Lampman): A lack of pheromones of sufficient concentrations upstream from projects may reduce the tendency of adult lamprey to migrate upstream.

Tracy also reminded members that Bob Rose, during a previous Fish Forum meeting, identified the following factors that may explain why adult lamprey remain in reservoirs: (1) they are spawning in the reservoirs, (2) they die because of predation, (3) they die from disease, or (4) they lack the energy or ability to migrate further upstream.

Steve Hemstrom asked if there was a summary of adult lamprey passage efficiency studies conducted at Wells Dam that could be provided to the Subgroups. Patrick Verhey responded that Douglas PUD has reported that adult lamprey are not approaching Wells dam. Steve Lewis added that more information is needed to fill in data gaps to better understand what is happening at Wells Dam. Alene Underwood noted that Steve Hemstrom provided extensive data on Rocky Reach Reservoir operations and asked what additional data are needed to identify what the issue may be. Steve Lewis noted that it may not be an issue, we just need more information to determine why adult lamprey do not leave Rocky Reach Reservoir. Alene asked for viable alternatives to explore in the absence of data showing reservoir operation effects.

Regarding possible predation occurring within the reservoirs, Tom Skiles asked about the use of a predator tag for adult lamprey. Rod O'Connor stated that there are some concerns with the predator tag including "tag burden" and the mechanism (e.g., digestive enzymes) that causes the tag to emit a distress signal. Mike Clement stated that adult lamprey must migrate through a gauntlet of predators before arriving in the Project Areas. He asked why predation would be an important issue only in Wanapum or Rocky Reach reservoirs, especially given the lower diversity of predators in these reservoirs compared to downstream reservoirs.

Tom asked if there were any adult abundance trends in the Entiat that would help explain the low numbers of adults passing Wells Dam. RD Nelle noted that there are few years in which adults are tagged with FDX PIT tags, which are the tags that can be read by the interrogation systems in the Entiat. Tom then asked if the Entiat has been isolated from the reservoir (i.e., is there a migration barrier near the mouth of the Entiat?). Steve Hemstrom said no, and noted that in 2016, of the 162 lamprey that passed Rocky Reach Dam, 13 were detected in the Entiat. He added that these data suggest that about 7-10% of the tagged lamprey are detected in the Entiat. He cautioned, however, that if lamprey enter

the Entiat in the spring, a large percentage could be missed at the interrogation arrays because of high flows, which reduces detection efficiencies.

Tracy Hillman asked if adult lamprey can pass Wells Dam undetected. That is, are there tagged lamprey detected upstream from Wells Dam that were not detected at the dam? Steve Lewis stated that there have been some adults detected upstream but not at the dam; however, it is not a large number.

Steve Lewis reported that passage at Wells Dam is poor but a lot of the fish are not getting past the gateway array. Tom Skiles asked what Wells Dam is doing to improve passage. Steve Lewis responded that Wells Dam is implementing measures to improve passage efficiency. These include fine-tuning the passage study for next year, lowering the head differential at the fishway to help get lamprey into the fishway, and translocation of adult lamprey upstream of the dam to increase the pheromone signal.

Given that operations at Rocky Reach Dam did not change before, during, or after the large decrease in conversion rates, members present identified the following questions for the ASWG.

1. Is there any evidence that adult sturgeon are in the fishways and tailrace of Wells Dam during the time adult lamprey are migrating through the project area?
2. Is there a summary of results of tailrace and fishway passage efficiencies and entrance efficiencies for adult lamprey at Wells Dam? If so, would the ASWG please share those with the Subgroups?
3. Are there velocity profiles for various flow conditions at the entrances of the fishways at Wells Dam? If so, would the ASWG share those with the Subgroups?
4. Why is the ASWG not comfortable using adult lamprey trapped downstream (e.g., at Priest Rapids Dam or other downstream locations) for conducting passage efficiency studies?

Members asked Tracy to share these questions with John Ferguson, Chair of the ASWG. Members would like the ASWG to respond to these questions at their earliest convenience.

Alene Underwood noted, based on the information shared today, that it has been determined that passage at Wells Dam is not good and the actions implemented by the ASWG to address passage there, such as translocation to address pheromone issues and lowering the head differential at the fishway, may not provide conclusive results for four or five years. Given this, she asked why members are placing pressure on Chelan PUD to address unknown migration problems in Rocky Reach Reservoir. She asked if a lack of pheromones is the reason adult lamprey do not pass Wells Dam in large numbers, why is Chelan PUD being pushed into doing something in Rocky Reach Reservoir? Ralph Lampman responded that translocation is a first step in the process along with determining a pheromone threshold level. He said there is a hope that there will be improvement in the number of adults reaching Wells Dam based on translocation. Ralph noted that from Douglas PUD's perspective, if lamprey do not have a desire to migrate upstream from the dam because of a lack of pheromones, then the PUD questions why they should do a tagging study with fish that may have no motivation to move upstream. Others from the ASWG have stressed the need to continue studies at Wells Dam simultaneously. Patrick Verhey added

that there is something going on in Rocky Reach Reservoir, and while we are not sure what the project effect is, we need additional information to better understand the situation.

Alene asked the group if there are additional hypotheses that could be investigated that link project operations to adult lamprey holding in Rocky Reach Reservoir. She said given that operations at Rocky Reach Dam did not change before, during, or after the reduction in conversion rates, what is it that Chelan PUD is doing that causes adult lamprey to remain in the reservoir? Steve Lewis suggested that it may be nothing that Chelan PUD is doing, but rather lamprey are spawning there. However, we will not know this unless we do a survey in the reservoir. Rod O'Connor noted that deep-water surveys for fall Chinook are conducted in the Snake River. This is done using GPS and GIS. RD Nelle questioned the pheromone hypothesis and noted that if pheromones are driving passage, why does Rocky Reach have a better conversion rate than Priest Rapids (based on dam counts)? If pheromones drive the migration behavior of lamprey, then Priest Rapids to Rock Island should have a better conversion than Rock Island to Rocky Reach.

Members agreed to consider additional hypotheses after they receive responses from the ASWG on the four questions.

Action Items:

- **Tracy Hillman will share the four questions with John Ferguson, Chair of the ASWG.**
- **Steve Lewis will review the comprehensive study at Wells Dam for information that may help answer the four questions.**

Identification of Possible Effect-Minimization Measures

This item will be discussed at a later date.

Subgroup meeting adjourned at 1:00 pm.

Attachment 1

Presentation by Steve Hemstrom on Rocky Reach Reservoir Operations

Rocky Reach Reservoir Operations

Evaluation of Operating Characteristics and Potential
Influence on Migration of Adult Lamprey to Wells Dam

Back Ground and Issue Identification

- Adult Lamprey Passage Counts Have Been “Low” at Wells Dam
- Adult Lamprey Passage Counts Have Been “High” at Rocky Reach Dam
- RR Reservoir Hypothesized as Migratory Barrier in Approach to Wells Dam
- Mechanism(s) of this Hypothesized Condition Not Known or Described
- RR Reservoir Past and Present Operations Described in this Presentation

Rock Reach Reservoir Has:

- Licensed Min and Max Forebay Elevations of 703.0 and 707.0 ft msl
- 4 Feet of Licensed Vertical Operating Range (measured in forebay)
- Useable Storage Volume of 36,000 Acre-Feet (one 18,100 cfs-day)
- Daily and Weekly Use of Available Stored Water
- Active, Flow-through Hydraulics and Short Water Retention Times
- Control of Forebay Elevations
- Consistent Forebay Operating Ranges July - October

Rocky Reach Reservoir Does Not Have:

- Seasonal Water Storage Capability
- Fall Draft Period
- Spring Run-Off Refill Period or Flood Control
- Long Duration Reservoir Draft
- Control of Surface Elevations in Upper Reservoir
- Operating Ranges in excess of 4 feet

Table 1. Columbia River Hydroelectric Project Reservoir elevations and useable storage volumes.

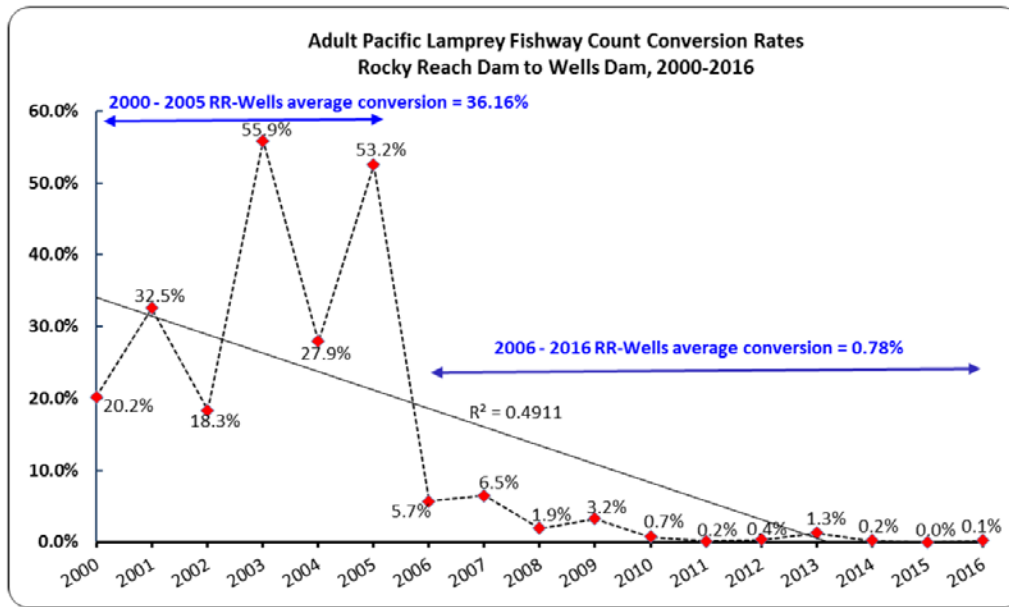
Project	Max Resv Elev (ft msl)	Min Resv Elev (ft msl)	Max Vertical Draft (ft)	Useable Storage (thousand acre-ft*)	Useable Storage (thousand cfs-day**)
Grand Coulee	1290.0	1208.5	81.5	5,185.0	2,613.0
Chief Joe	956.0	930.0	26.0	116.0	58.5
Wells	781.0	771.0	10.0	74.0	37.3
Rocky Reach	707.0	703.0	4.0	36.0	18.1
Rock Island	613.0	609.0	4.0	9.5	4.8
Wanapum	571.5	560.0	11.5	161.0	81.1
Priest Rapids	488.0	481.5	6.5	44.0	22.6
Ice Harbor	440.0	437.0	3.0	25.0	12.6
McNary	340.0	335.0	5.0	185.0	12.6
John Day	268.0	257.0	11.0	534.0	269.1
The Dalles	160.0	155.6	4.4	53.0	26.7
Bonneville	77.0	70.0	7.0	138.0	69.5

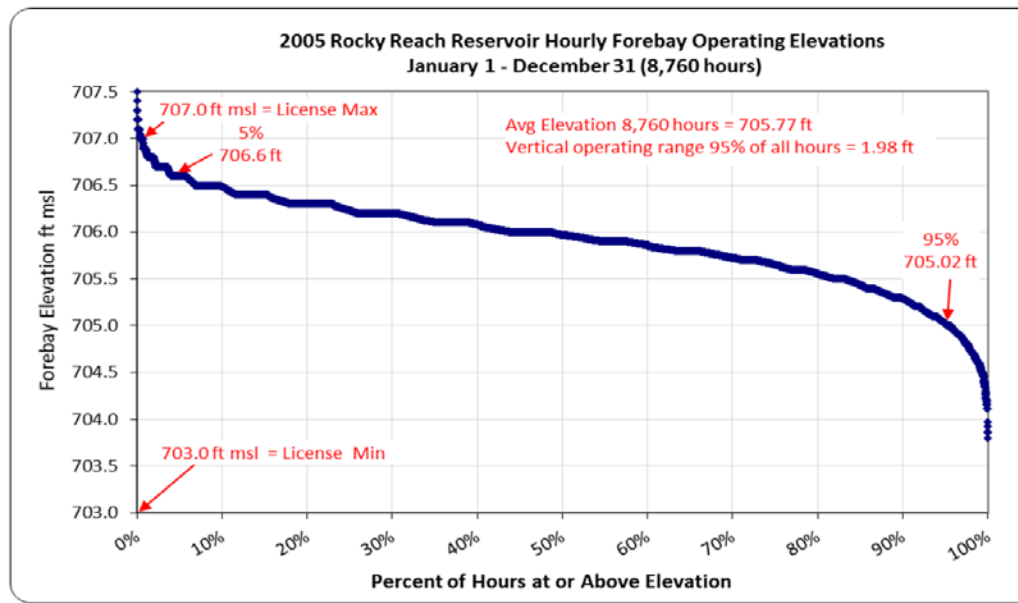
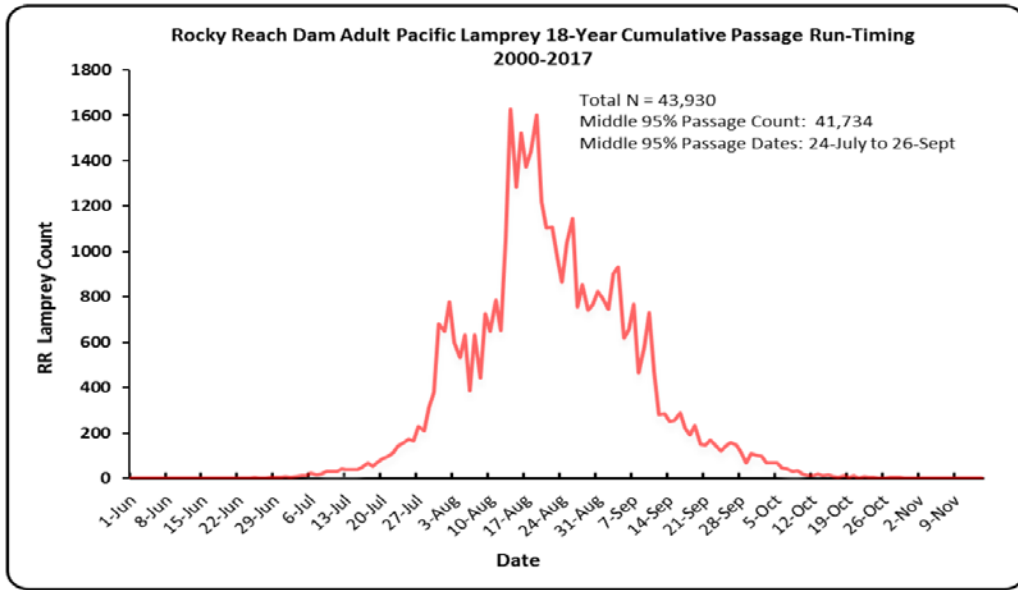
* One acre-foot of water equals 43,560 cubic feet of water

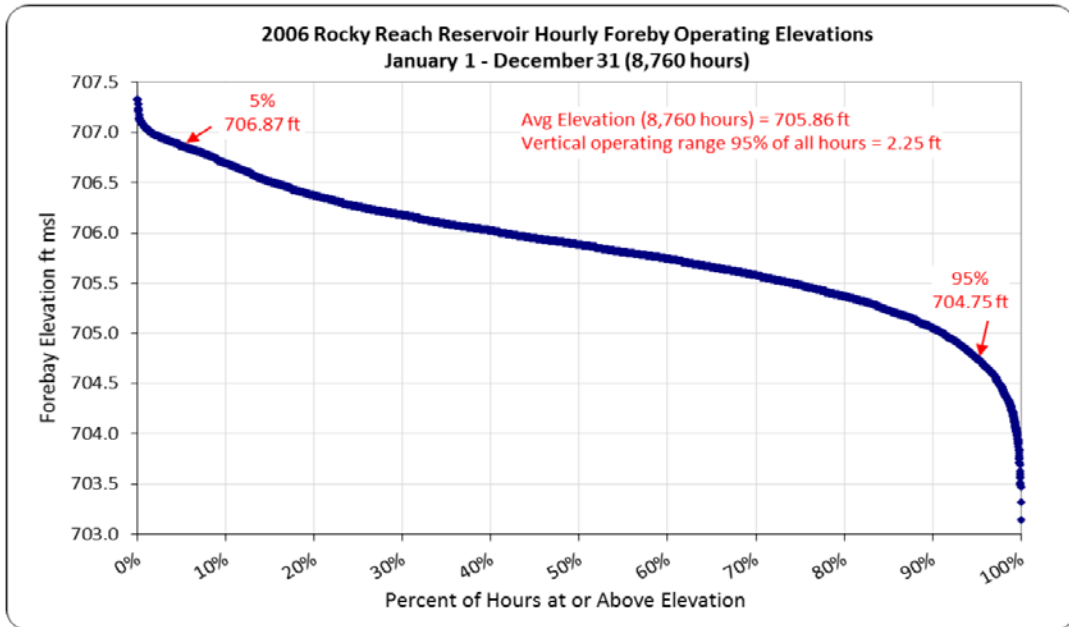
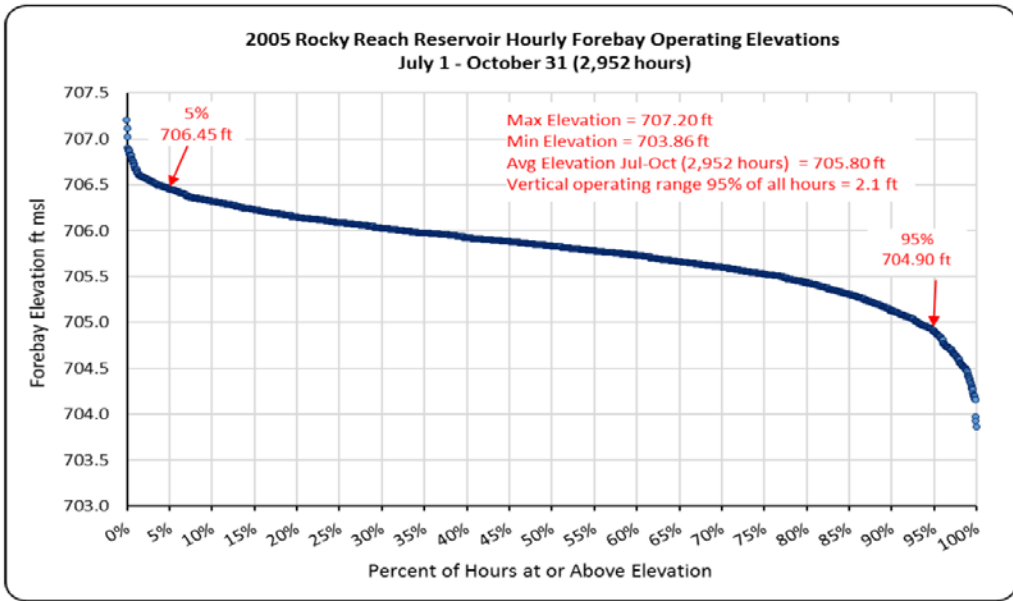
** cfs-day is a water volume equal to a water flow rate in cubic feet per second each second of one day.

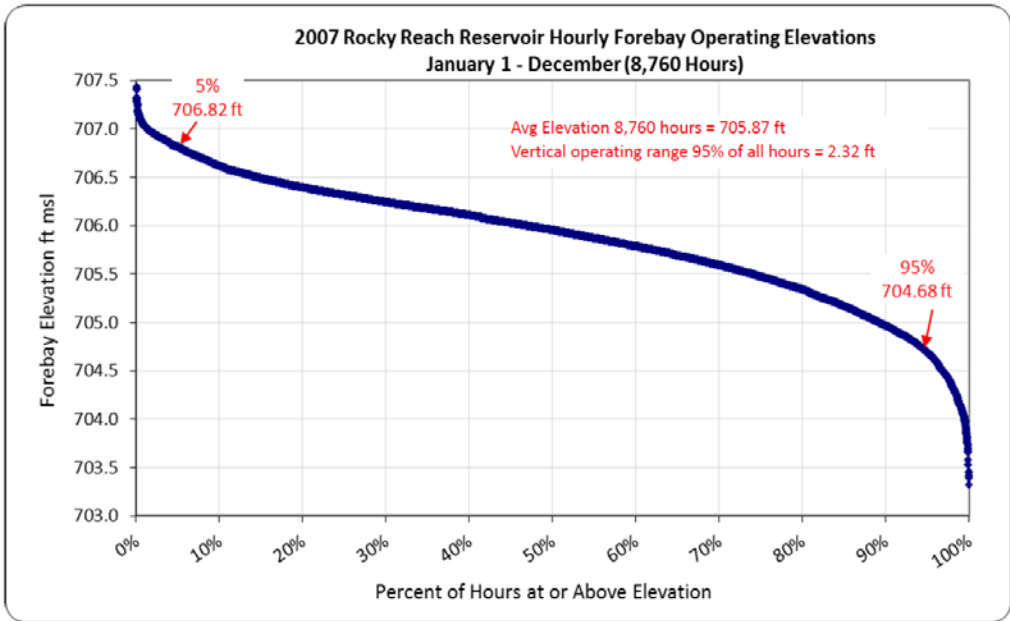
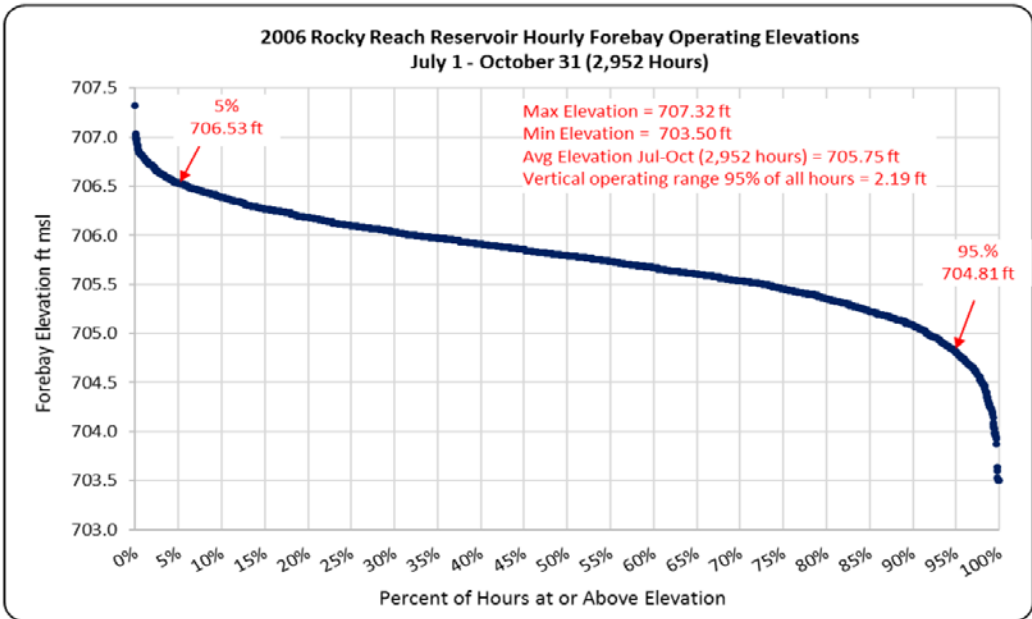
Table 2. Counts of adult Pacific lamprey at Rocky Reach Dam and Wells Dam, 2000-2017, and the average count- conversion percent between the two dams (*2017 count as of 9/30, still in progress).

YEAR	ROCKY REACH LAMPREY COUNT	WELLS LAMPREY COUNT	AVG COUNT CONVERSION %
2000	767	155	20.21
2001	805	262	32.55
2002	1842	338	18.35
2003	2521	1408	55.85
2004	1043	291	27.90
2005	404	215	53.22
2006	370	21	5.68
2007	541	35	6.47
2008	368	7	1.90
2009	278	9	3.24
2010	268	2	0.75
2011	618	1	0.16
2012	805	3	0.37
2013	1625	21	1.29
2014	3799	7	0.18
2015	2133	0	0.00
2016	3595	5	0.14
2017*	23,652	275	1.16
Total 2000-2005	7,382	2,669	36.16
Total 2006-2016	14,400	111	0.77
Total All Years	45,434	3,049	6.72









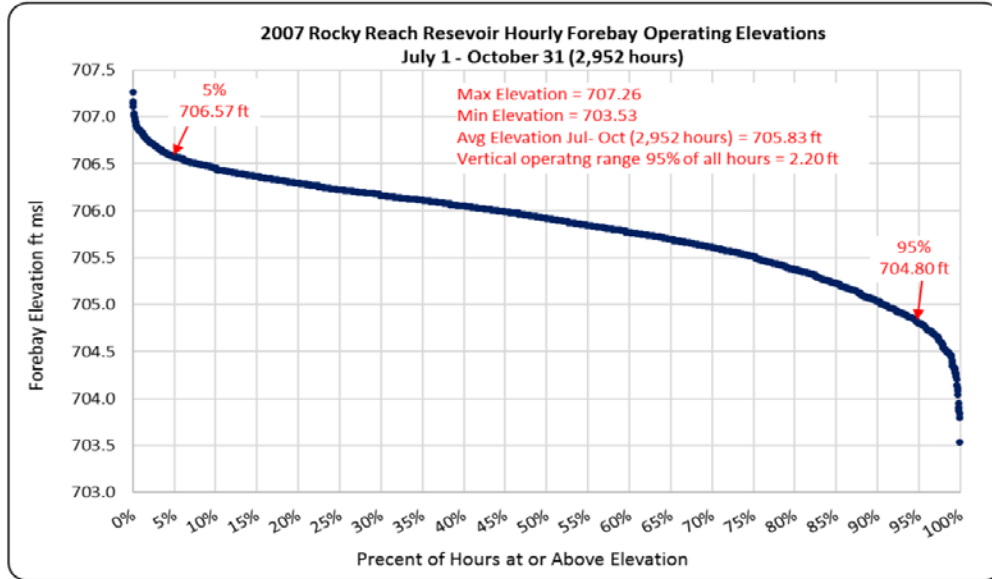


Table 4. Wells Dam single day maximum average discharges, corresponding maximum Rocky Reach forebay to Wells tailwater elevation differences, and the corresponding Rocky Reach day-average forebay elevations.

Year	Wells Day-Avg Maximum Q (cfs)	Day of Occurrence	RR FB-Wells TW Maximum Day-Avg Elevation Diff (ft)	Day of Occurrence	RR Forebay Day-Avg Operating Elevation (ft msl)	Day of Occurrence
2016	205,880	Apr 17	12.21	Apr 17	706.58	Apr 17
2015	170,180	Feb 23	10.34	Feb 23	706.77	Feb 23
2014	216,270	Jun 1	13.18	Jun 1	706.08	Jun 1
2007	197,720	May 8	12.14	May 8	706.38	May 8
2006	250,270	May 28	14.51	May 28	706.79	May 28
2005	177,070	May 27	10.89	May 27	705.64	May 27

