



Priest Rapids Fish Forum

Conference Call

Wednesday, 1 April 2026

9:00 a.m. – 12:00 p.m.

FINAL MINUTES

PRFF Members

Michael Lucid, USFWS
Ralph Lampman, Keely Murdoch, YN
Nathan and Clayton Buck, Wanapum
Jason McLellan, Bret Nine, CTCR
Mike Clement, Chris Mott, Grant PUD
Tracy Hillman, Chair

Patrick Verhey, Laura Heironimus, WDFW
Melissa Peterson, Chad Brown, Ecology
Aaron Jackson, Carl Merkle, CTUIR
Steve Lewis, BIA
Pete McHugh, CRITFC

Meeting Attendees

Mike Clement, Grant PUD
Melissa Peterson, Ecology
Chris Mott, Grant PUD
Tygh Schuster, YN
Michael Lucid, USFWS
Pete McHugh, CRITFC
Patrick Verhey, WDFW
Nathan Buck, Wanapum
Shannon Adams, YN
Tracy Hillman, Chair

Ralph Lampman, YN
Nate Patterson, YN
Dave Robichaud, LGL
Joseph LeMoine, Grant PUD
Erin Harris, Grant PUD
Tim Taylor, Grant PUD
Paul Grutter, WSP
Scott Hopkins, Chelan PUD
Cory Kamphaus, YN

Action Items:

- Tim Taylor will finalize the TMDL WQAP evaluation criteria with Ecology and begin evaluating temperature-related options once the criteria are approved.
- Laura Heironimus will update the White Sturgeon Spontaneous Autopolyploidy Guidance document based on recently published literature.

- Ralph Lampman will ask Ryan Harnish (PNNL) whether they estimate juvenile lamprey losses due to predation downstream from a dam. If so, how do they estimate losses due to predation downstream from a dam? Would releasing live tagged juveniles below the dam (i.e., paired release) help estimate losses due to predation downstream from the dam? Finally, does Ryan have thoughts on using predation tags inserted into the dead fish to estimate losses due to predation downstream from a dam.
- Ralph Lampman will send the updated juvenile lamprey source table to Tracy Hillman for distribution to the PRFF.
- The PRFF will review the sample size analyses for conducting a Pacific Lamprey juvenile survival study and be prepared to discuss study design options, including precision targets and fish sourcing strategies, at the next meeting.
- Members will review the draft Aquatic Invasive Species Control and Prevention Plan Annual Report and send their comments to Nate Dietrich by 1 April 2026.

I. Welcome and Introductions

Tracy Hillman welcomed everyone to the meeting and identified all attendees.

II. Agenda Review

The PRFF reviewed and approved the April agenda.

III. Approve March Meeting Notes

The PRFF reviewed and approved the 4 March 2026 meeting minutes.

IV. Review Action Items

The PRFF reviewed the following action items from the March meeting:

- Laura Heironimus will update the White Sturgeon Spontaneous Autopolyploidy Guidance document based on recently published literature. **Ongoing.**
- Tracy Hillman will ask Ryan Harnish (PNNL) whether they estimate juvenile lamprey losses due to predation downstream from a dam. If so, how do they estimate losses due to predation downstream from a dam? Would releasing live tagged juveniles below the dam (i.e., paired release) help estimate losses due to predation downstream from the dam? Finally, does Ryan have thoughts on using predation tags inserted into the dead fish to estimate losses due to predation downstream from a dam. **Ongoing. Ralph Lampman will also reach out to Ryan.**
- Ralph Lampman will update the juvenile lamprey source table. **Complete. The spreadsheet will be shared with the group today.**
- Ralph Lampman will share language from the Fish Passage Center memo regarding juvenile lamprey studies. **Complete. Ralph provided the following information in an email and discussed this during the meeting.**

Here is the FPC memo that I brought up.

<https://www.fpc.org/documents/memos/43-25.pdf>

This memo has 3 parts.

1. *Lamprey Adult Passage Relative to Spill for Fish Passage*
2. *Review of Acoustic Tag Studies of Juvenile Lamprey Survival Through Spillway and Powerhouse Passage Routes Review*
3. *FPC Memorandum: Review of PIT-tag Data for Juvenile Lamprey in the Columbia River Basin. Request by Joe Skalicky, USFWS, November 14, 2014*

I won't go into too much details, but...

#1 is stating that they didn't see any clear evidence that spill impacts adult Pacific Lamprey passage. (but I think it could be year specific and some years it shows that there is a hike in #s right after the spill - combining it across all the years incorporates the complexity in the data)

#2 is basically stating that the PNNL study lacked adequate sample sizes to compare the survival rates of different migration routes at the dam (spill vs turbine vs bypass). Conclusions of "no difference" may be premature (and need to be careful in making these statements).

#3 talks about the 2014 FPC model. They clarified that their conclusion that lamprey collected downstream of the study in the mainstem environment would not be a good study fish compared to fish collected upstream of the dam, but this is because of the potential impacts of migrating through the same dam twice and the extra handling and transport, and not due to its genetic difference.

They clarified that "The conclusion statement is not about genetic representation. Rather, it was about the inability of these PIT-tagged juvenile lamprey to represent the run-at-large because of the impacts of being captured downstream, tagged, and released back upstream for their specific study."

"By analogy, if one were to stop a marathon runner at mile 15, tag them, and make them restart the race at mile 5. One could imagine the time it takes them to get from mile 5 to the finish line would be impacted by the first 15 miles they ran before tagging and not represent the run-at-large of runners that were not treated in this way."

While I understand the points they are making here regarding #3, this does not consider lamprey collected from tributaries in the downstream environment, which would not have had "any prior experience passing the dam of interest" (or any major mainstem dam for that matter). If they are genetically homogenous, and have not passed the dam of interest yet, these should not be considered inappropriate study fish. Certainly handling and transport impact is something we need to consider, but virtually any fish will need to be handled and transported, and there are ways to make this more or less equal by keeping the transport hours similar (or a certain range) for all fish, etc. Whether they come from upstream tributaries or downstream tributaries, the amount of transport and handling is likely to be similar (& there are ways to make them similar). And no distinct genetic differences are observed at this scale.

The memo also didn't consider the fact that for example if we were to do a study at Rocky Reach Dam for example, some lamprey would have had to pass Wells Dam and some would not have had to pass Wells Dam as it came from Entiat River. One group may be more "exhausted" and "tired" due to the passage experience at Wells Dam (or not), so I don't see why we expect to see a huge difference in outcome related to

whether they went through one dam already or not. Every lamprey will have a slightly different experience approaching the dam. Bypassing the lamprey from tributary to the mainstem have some level of impacts (whether we truly understand that or not). And bypassing an entire reservoir reach, if collected at a dam upstream, has some level of impacts as well. Basically, there is no "perfect" fish and even if there was, it would be impossible to collect it, so I think we just need to document these differences and be ready to analyze it differently in case they perform significantly differently (but with the PNNL studies, they are not seeing any strong evidence of that).

- Members will review the potential options for temperature improvement identified in the attached TMDL WQAP presentation (see slides 16-21 in the attachment) and provide ideas or concepts for consideration by 1 April 2026. **Complete. Discussed in Section V.**
- Mike Clement will ask Dave Robichaud to provide a short writeup on his power analysis and sample size calculations for conducting a juvenile Pacific Lamprey survival study in the Priest Rapids project area. **Complete. Dave provided the information in a PowerPoint presentation (see Section VII).**
- Mike Clement will request that Dave Robichaud attend the PRFF April meeting to discuss his power analysis and sample size calculations. **Complete. See Section VII.**
- Members will review the draft Aquatic Invasive Species Control and Prevention Plan Annual Report and send their comments to Nate Dietrich by 1 April 2026. **Ongoing. Comments are due today.**
- Members will review the draft 2025 White Sturgeon Management Plan Report and provide comments to Mike Clement by 5 March 2026. **Complete.**

V. Water Quality

Water Temperature TMDL WQAP Proposed Improvement Options – Tracy Hillman shared that last month Grant PUD presented a draft list of potential temperature improvement options for the temperature TMDL Water Quality Attainment Plan (WQAP). He explained that the purpose of this step is to assemble a comprehensive list of possible options before evaluating them for feasibility. Tracy reminded the group that last month the PRFF was asked to review the proposed options and identify any additional ones that should be considered. He quickly reviewed the different options identified during the last meeting. These included operation options, structural options, in-river options, and riparian and hyporheic options. After asking for comments and feedback on the proposed options, he recorded that the PRFF had no feedback or comments on the proposed options. In addition, the PRFF identified no additional options for consideration. Tracy confirmed that Grant PUD will move forward with finalizing evaluation criteria.

Tim Taylor explained that Grant PUD is working with Ecology to finalize the evaluation criteria that will be used to assess the full list of potential options. He shared that Ecology's feedback is expected within the next few weeks, after which Grant PUD will revise the criteria as needed and resubmit them to Ecology for confirmation. Tim stated that once the criteria are finalized, Grant PUD will begin evaluating the proposed options and will return to the PRFF at multiple points to provide updates, seek feedback from the PRFF, and to maintain transparency. He also noted that Pete McHugh had provided comments separately, but none involved adding or removing options from the list.

Grant PUD will continue coordinating with Ecology to finalize the evaluation criteria and will begin evaluating the full list of potential options once the criteria are approved. Updates will be provided to the PRFF.

Other Water Quality Items – No additional water quality items were discussed.

VI. White Sturgeon

White Sturgeon Rearing, Tagging, and Testing – Tygh Schuster reported that a total of 1,513 juvenile White Sturgeon were tagged in March. These fish averaged about 65.15 grams per fish. Tygh noted that testing for autopolyploidy went well, with only five fish identified as non-octaploid (non 8N), representing roughly 0.3 percent of the group. Since tagging, only four fish have died. Tygh stated that the intention is to release all tagged fish except those identified as non-octaploid. Chris Mott added that among the five non-octaploid fish, one tested positive for 12N and the remaining four were considered abnormal enough that they should not be released.

White Sturgeon M&E Presentation – Paul Grutter presented the 2025 White Sturgeon Monitoring and Evaluation results for the Priest Rapids Project (see Attachment 1). He acknowledged the contributions of Grant PUD staff, LGL, Yakama Nation staff, hatchery personnel, and field crews who supported broodstock collection, tagging, juvenile indexing, and spawning assessment work.

Paul provided an overview of the presentation and gave a general description of the project area. He noted that 2025 was the third consecutive low-flow year and that water temperatures remained above average, including during juvenile indexing. He reported that 2024 brood year hatchery fish were tagged in late March 2025 and released in early April 2025. A total of 3,321 fish were tagged and released, with 62 percent released into Wanapum Reservoir and 38 percent into Priest Rapids Reservoir. He noted the fish were generally good sized at release and that fin deformities were present at a lower rate (27%) than in some previous years.

Paul also summarized long-term stocking and broodstock information. Nearly 54,000 hatchery fish have been released to date, excluding earlier Rock Island fish. Since 2021, the program has consistently achieved its target 6x6 broodstock crossing matrix, improving genetic representation in hatchery production.

For the 2025 broodstock collection downstream from McNary Dam, Paul reported that 86 sturgeon were landed, with six ripe males and six ripe females transferred to the hatchery. These fish produced 36 genetic families. However, a July 2025 hatchery mortality event substantially reduced available fish across families. As a result, only about 1,500 fish were tagged this year, and many remaining fish were too small for tagging. Paul stated the exact cause of the mortality event has not been fully determined, although a diet related issue may have contributed.

Paul then reviewed the 2025 natural spawning work conducted downstream from Rock Island Dam. Sampling was conducted using egg mats and D-ring nets as part of the five-year spawning assessment cycle. Effort was limited this year, but two spawning events were detected in early July based on egg developmental stage. He noted this confirms that spawning activity continues in the project area, although warm water temperatures and low flow conditions likely reduced the probability of successful survival from these late season spawning events. Paul compared the 2025 spawning results with previous efforts (2010, 2013, 2015, 2020, and 2025) and noted that although all sampling events documented spawning downstream from Rock Island Dam, the sampling effort in 2025 was more truncated than in previous years. He pointed out that no larval or juvenile sturgeon were captured in D-rings; however, one juvenile lamprey was collected incidentally.

Paul summarized juvenile indexing results from fall 2025 sampling, noting catch rates improved from 2024 and were more similar to 2023. Catch rates remained highest in upper reservoir sections and generally declined moving downstream. Juvenile indexing resulted in the capture of 544 sturgeon in Wanapum Reservoir and 163 sturgeon in Priest Rapids Reservoir in 2025. Paul also compared the catch by brood year, origin, and reservoir section and then showed the catch, effort (hook hours), and catch per unit effort (fish per 100 hook-hours) by river mile. Using the multi-state model, Wanapum Reservoir was estimated to contain about 8,700 juvenile hatchery sturgeon and Priest Rapids Reservoir about 4,400. Population estimates were generally consistent with recent years. He reported strong representation from the 2017 and 2018 brood years and continued low numbers from the earliest brood years.

Paul also reviewed growth and survival analyses. He showed changes in length frequencies among brood years for both Priest Rapids and Wanapum reservoirs. He stated that growth rates remained higher in Wanapum than in Priest Rapids across most brood years. Survival estimates remained generally strong after the first year (>75%) but quite variable during the first year (<50%). He then focused on evidence for density dependence in the project area. He showed relative weight as a function of length across brood years, reservoir, and section within each reservoir and compared growth rate as a function of length. All these comparisons seem to indicate that growth is more restricted in Priest Rapids Reservoir than in Wanapum Reservoir. This is also supported by fitting von Bertalanffy growth curves to mean fork length at age data for each brood year. Growth tends to asymptote in the Priest Rapids Reservoir but not in Wanapum Reservoir. Thus, there is little to no evidence of density-dependent growth in Wanapum Reservoir but there is some evidence of it in the Priest Rapids Reservoir.

Paul concluded his presentation by offering the following summary:

- The release of the 2024 brood year was successful, and the fish had relatively low fin deformity and were of good size.
- The collection of 2025 brood stock was successful and resulted in a 6x6 spawning matrix (36 genetic families); however, there was a high mortality event during rearing that reduced numbers across all families.
- Natural spawning of sturgeon was documented downstream from Rock Island Dam.
- Juvenile index monitoring in 2025 resulted in a lower catch of older brood years in the upper segment of Priest Rapids Reservoir; however, there was an overall increase in population size in both reservoirs (large contribution of younger brood years).
- Size at age data (von Bertalanffy) indicate plateauing growth in Priest Rapids Reservoir compared to Wanapum Reservoir.
- Growth rates based on recapture data were greater in Wanapum Reservoir than in Priest Rapids Reservoir, but growth in the project area was relatively high compared to Lower Columbia River populations.
- There is some evidence of density-dependent growth in younger brood years in Priest Rapids Reservoir and little or no evidence of density-dependent growth in Wanapum Reservoir.

During discussion, members asked about D-ring sampling, incidental lamprey capture, egg stage interpretation, and whether future spawning assessments should include a broader sampling window. Paul explained that the 2025 spawning effort was limited and more of a pilot effort, particularly for larval sampling. He agreed that a broader and more intensive sampling window would provide more robust information if management needs warranted it. He also noted the D-ring effort was intended to explore whether larval capture methods could be further developed for future use.

The PRFF thanked Paul for the presentation and noted the value of the annual White Sturgeon M&E update.

Other White Sturgeon Items – Joe LeMoine reported that juvenile sturgeon releases are scheduled for 20 April 2026. Based on current numbers, he anticipates releasing about 940 juveniles into Wanapum Reservoir and about 570 into Priest Rapids Reservoir, for a total of 1,510 juveniles with final numbers dependent on any additional mortalities before release. Joe also shared that adult broodstock collection will occur again this year downstream from McNary Dam, beginning 11 May 2026 and continuing through 22 May 2026. As in previous years, the goal is to collect a 6x6 spawning matrix.

VII. Pacific Lamprey

Juvenile Pacific Lamprey Survival Studies – Tracy Hillman reminded members that during the last PRFF meeting, they discussed precision (standard error or SE) of a survival estimate and the number of fish needed to conduct a valid survival study. He also reminded members that they previously supported survival studies conducted at the scale of the dams and the use of the Virtual Release/Dead-Fish Correction (ViRDCT) model. During the discussion last month, Mike Clement indicated that Dave Robichaud had estimated a sample size of about 2,300 juveniles assuming a 2.5% SE. Based on information from PNNL, members thought this sample size was high and asked for a brief report and presentation from Dave on how he calculated sample size and the assumptions he used in the estimate. Mike invited Dave to this meeting to present his calculations of sample size.

Dave Robichaud provided a presentation titled, “Sample Sizes for a ViRDCT-based Juvenile Lamprey Survival Study at PR Project” (see Attachment 2). The purpose of the presentation is to provide background, methods, and results of the power analysis conducted by Dave, including assumptions made during modeling.

Dave described the survival study framework using a “dead fish” (ViRDCT) model, which requires estimating multiple parameters including survival through dam passage, detection probabilities, and the size of a “virtual release” group (fish that successfully reach the dam after release well upstream from the dam) and “dead release” group. Analyses were conducted in a simulation tool on the Columbia Basin Research website (<https://www.cbr.washington.edu/analysis/apps/samplesize>). Dave emphasized that only two parameters are directly controlled by the study design: (1) the number of live fish released upstream from the dam and (2) the number of dead fish released at the dam. All other parameters must be estimated or assumed for purposes of sample size modeling.

Using parameter estimates from a 2022 study at Lower Granite Dam as a reference, Dave conducted a power analysis to evaluate sample size needs under a conservative (“bad case”) scenario. The bad case scenario assumed published values were worse than two times the SEs for the proportion of live release that become part of the virtual release (S_{R-V}), dam survival (S_D), detection of virtual release on the tailrace array (P), detection of dead release on the tailrace array (Φ), and survival to and detection of the virtual release at the far downstream array (λ). Dave showed how the information is fed into the simulation tool and provided output from the model, including a figure showing the relationship between 95% confidence interval and size of the virtual release for different dead release sizes. Depending on the size of the dead release group, survival estimates with a 2.5% SE would require about 2,300-9,300 total fish across Wanapum and Priest Rapids dams, including both live and dead releases. Again, these estimates assume relatively low survival and detection probabilities and represent a conservative planning benchmark. The analyses also assumed that a 2.5% precision threshold would be acceptable.

Dave noted that required sample size is highly sensitive to both the number of dead fish released and the desired level of precision. Increasing the number of dead fish reduces the number of live fish needed, although benefits diminish at higher dead fish levels. He also demonstrated that relaxing

precision requirements (e.g., to 5% or 10%) substantially reduces total fish needs, which may be appropriate for pilot or exploratory studies.

PRFF discussion focused on key uncertainties and tradeoffs. Ralph Lampman noted that survival may vary significantly between years due to environmental conditions, raising questions about the value of a single-year, high-precision estimate. He suggested treating the initial effort as a pilot study to establish baseline estimates and inform future study design. Tracy Hillman discussed the constraints related to availability of source fish and the potential to offset this limitation by increasing use of dead fish, which may be sourced more flexibly (e.g., from downstream locations and hatchery production). This would reduce the number of live fish sourced from upstream locations. Ralph suggested that the group consider alternative study approaches, including phased or lower-precision designs, to balance cost, feasibility, and information needs. He acknowledged the importance of aligning study design with intended management use (e.g., exploratory understanding versus mitigation decision-making). Dave confirmed that higher precision is more critical when results directly inform management decisions or mitigation requirements. For exploratory purposes, lower precision may be acceptable and achievable with fewer fish.

Tracy asked whether the sample size analyses only addressed dam passage survival and not route-specific passage survival. Dave responded that the analyses only include dam passage survival; route-specific survival would likely require a larger sample size. It would also require additional study design considerations.

The committee expressed appreciation for the presentation and agreed that further discussion is needed to determine study objectives, acceptable precision levels, and feasible sample sizes. The PRFF will review the sample size analysis and be prepared to discuss study design options, including precision targets and fish sourcing strategies, at the next meeting.

Following the presentation by Dave, Ralph provided an update on the source of juvenile Pacific Lamprey for a survival study. Ralph shared his screen and explained that he has compiled a simplified dataset showing annual lamprey counts from various traps, extending back as far as records allow. He noted that some data gaps remain and he plans to follow up with trap operators to obtain the missing information. Ralph summarized that recent years have shown increased numbers of juveniles at several sites, particularly in the Upper Columbia, and that overall counts across all traps often exceed 5,000 fish annually. He added that McNary Dam and the Yakima River continue to be major sources and could serve as backup sources if upstream collections fall short.

Tracy noted that while downstream sources may be acceptable for dead fish used in studies, some members have expressed concern about ensuring that live, tagged fish originate from upstream sources. He emphasized that this issue would require further discussion, particularly because some management plans such as those guiding the Aquatic Settlement Work Group (ASWG) explicitly require upstream-origin fish unless the group agrees to deviate from the plan. Ralph suggested revisiting the question of whether upstream-only sourcing is necessary, noting that not all co-managers may feel strongly about that requirement. Tracy agreed that the topic should be discussed at the next meeting.

Tim Taylor asked whether there are limitations on how many lamprey can be collected from each trap for study purposes, including whether permits or co-manager expectations restrict the number of fish that can be used. Ralph explained that the traps are within Yakama Nation ceded lands, and the Yakama Nation could obtain a scientific take permit if needed. He added that while logistics and coordination with trap operators would be required, the low trap efficiencies, often around 1% or less, mean that even large trap counts represent only a small fraction of the fish passing the trapping locations. Tim asked whether trap efficiency trials are conducted for juvenile lamprey. Ralph confirmed that they are in

the Yakima River basin, noting that efficiencies vary by site and are generally low because lamprey tend to travel near the bottom, making them harder to capture in screw traps.

Tracy asked whether there is guidance on how long juveniles can be held before tagging and release. Ralph responded that while lamprey can be held long term, previous work suggests releasing them within about a week, possibly up to ten days, to avoid disrupting their natural movement patterns and behavior.

Ralph asked about language in the management plans regarding route-specific survival. Tracy and Mike Clement reviewed the Pacific Lamprey Management Plan and confirmed that it requires evaluation of bypass, turbine, and spillway survival, but does not specify precision requirements for survival estimates.

Tracy concluded the discussion by noting that Ralph's spreadsheet will be shared with the group and that the next meeting will include further discussion of power analysis, precision needs, and source-fish considerations.

Other Pacific Lamprey Items – Ralph Lampman provided several general updates. He noted that a Pacific Lamprey Conservation Initiative (PLCI) funding opportunity with Bonneville Power Administration funds will open on 13 April and close on 29 June 2026. The National Fish Habitat Partnership (NFHP) will open on 1 June and close on 5 October 2026. He also mentioned that PLCI is beginning to plan the 2026 Annual Lamprey Information Exchange and would appreciate input. To provide input, please use this link: [PLCI IX Feedback Survey \(2026\)](#). Ralph noted that the next meeting of the Pacific Northwest Aquatic Monitoring Partnership (PNAMP) Fish Monitoring Group will feature two talks on lamprey restoration in the Tucannon River. Finally, Ralph indicated that Regional Management Units (RMUs) are currently meeting to discuss updates to their Regional Implementation Plans and preparing the 2027 Pacific Lamprey Assessment. The Upper Columbia RMU meeting will be held on 20 April 2026 from 1:00-3:00 pm.

VIII. Administration

In-Person Meeting – Tracy Hillman asked whether the PRFF would be interested in holding an in-person meeting this summer. He indicated that the ASWG is planning an in-person meeting in July or August and because several members of the ASWG are also members of the PRFF, there is a desire for all groups to meet on the same day at Wells Dam. The meeting date would coincide with adult lamprey passage studies conducted at Wells Dam and possibly include a site tour. Several members (Chris Mott, Joe LeMoine, Pete McHugh, Melissa Peterson, and Nathan Buck) indicated they could attend an in-person meeting this summer. Tracy will confirm the date and details after the ASWG meets on 5 May.

Annual Reports – Tracy Hillman reminded members that comments on the Aquatic Invasive Species (AIS) Report are due today. Mike Clement indicated that the Pacific Lamprey, White Sturgeon, and Bull Trout reports were submitted to FERC earlier in the year. He thanked everyone who contributed to reviewing those documents. Mike confirmed that comments on the AIS report are due to Nate Dietrich, who will incorporate the comments and prepare the report for Ecology's approval prior to filing the report with FERC.

Tracy informed the group that Gabriella Brill (ODFW) will present her research on movement of sturgeon in John Day Reservoir during the May meeting.

IX. Adjourn

With no additional business to discuss, Tracy Hillman adjourned the meeting at 12:10 pm.

X. Next Meeting

The next meeting of the PRFF will be on Wednesday, 6 May 2026.

Attachment 1

Presentation by Paul Grutter on the 2025 White Sturgeon Monitoring and Evaluation Program



wsp

2025 Grant PUD White Sturgeon M&E Program: Final Results

Paul Grutter
1 April 2026
Presentation to the Priest Rapids Fish Forum

Agenda

- Overview of Study Area and 2025 Flow and Water Temperature
- 2024BY Tagging and Release
 - Stocking Rates – 2011-2025
 - Population Genetic Structure/Diversity
- Broodstock Capture and 2025BY Development
- 2025 Natural Spawning Assessment
- Juvenile White Sturgeon Indexing
 - Population Size Structure, Survival and population estimates
- Growth Rates – Evidence of Density Dependence?

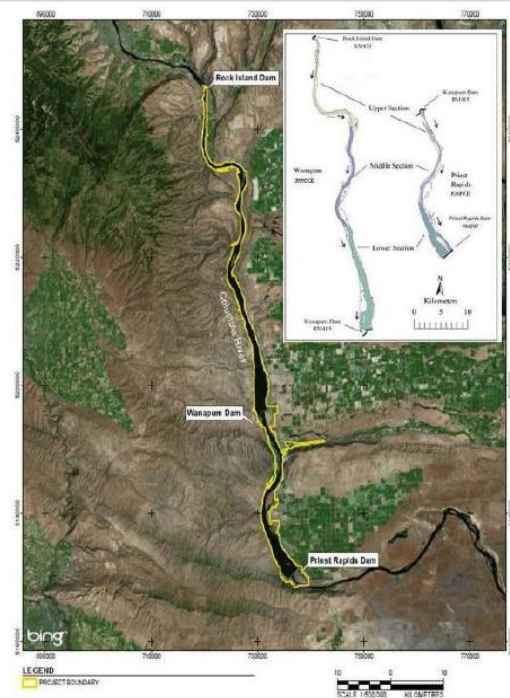
Priest Rapid Project Area

Priest Rapids Dam (Grant PUD; River Mile [RM] 397)

Wanapum Dam (Grant PUD; RM 416)

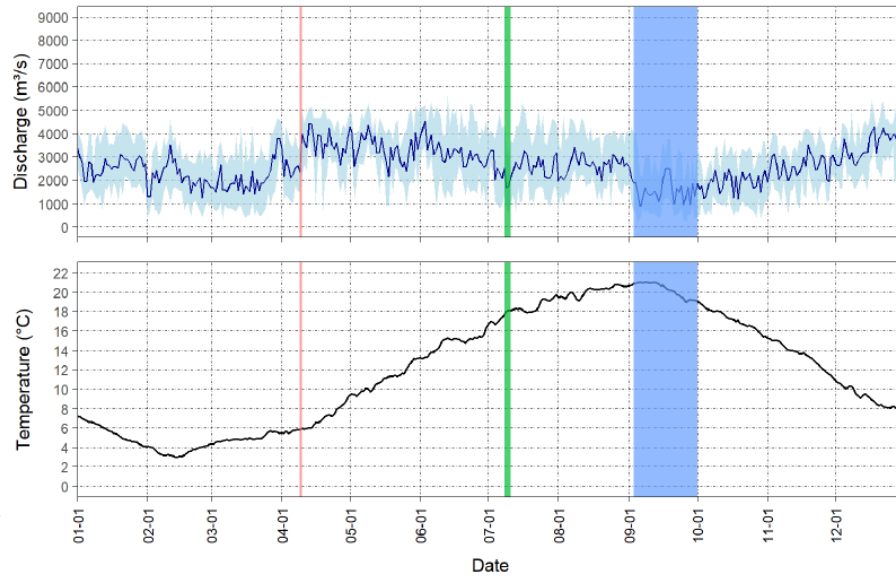
Rock Island Dam (Chelan PUD; RM 453.5)

Each reservoir divided into lower, middle, and upper sections based on hydraulic and physical transitions from riverine to lentic dominant habitats



Discharge and Temperature

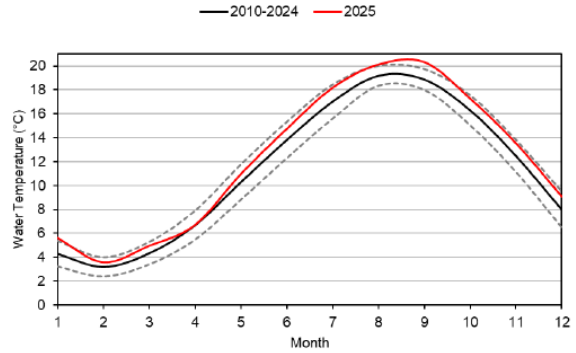
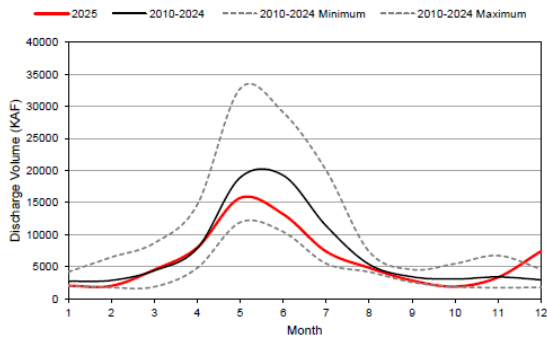
2024BY Release Spawning Assessment Juvenile Indexing



4

Discharge and Temperature

2025 vs Historical



NOAA. 2025. https://www.nwrfo.noaa.gov/water_supply/lvs_normals.cgi?id=RISW1

DART. 2025. Columbia River Data Access in Real Time webpage. DART hourly water quality data RIGW www.cbr.washington.edu/dart/river.html

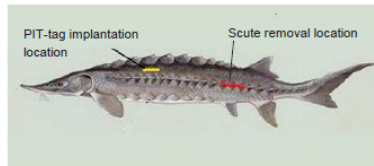
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2024BY Tagging and Release 2025 Broodstock Capture



2024BY Tagging and Release, 2025



- YNSH, Grant PUD and LGL (BLE)
- 2024BY held at YNSH were tested for spontaneous autopolyploidy (SA), measured, PIT-tagged and marked from March 24 to March 27
- SA testing conducted prior to tagging with a Coulter counter to identify 10N or 12N vs 8N (normal) fish
- 166 fish identified with SA (vs 5 in 2023BY)

Female 1 3D9.1C2DE4E625 n = 63	Female 4 3D9.1BF1B65706 n = 44
Female 2 3D9.1C2DE44E3D n = 9	Female 5 3D9.1C2DE52B75 n = 40
Female 3 3D9.1C2DE451A4 n = 2	Female 6 3DD.007752CF1E n = 8

- 3,251 2024BY released 9-10 April 2025
 - 62%WR/38%PR SOA 2016
- Low prevalence of fin deformities
 - 27% of the fish processed (n = 880 of the 3,251 fish tagged) 62% caudal fin deformity (n = 542 of 880) (vs pectoral in 2024)

2025 White Sturgeon 2025BY Release			
Release Location Reservoir (River Mile)	No. of Fish	Mean FL mm	Mean Weight g
Wanapum (420.6) ¹	2,000	289	163
Priest Rapids (400.3) ²	1,251	278	143
Total	3,251	284	155

¹ Vantage boat launch ² Desert Aire boat launch

Stocking Rates in PRPA from 2011 to 2025 CRITFC 2003 Release Rock Island Reservoir

Release Year	Year Cross	Number Released	WR/PR Release Proportion	Mean Fork Length (mm)	Mean Weight (g)
2003	2002	20600	Rock Island Res	192	45
2011	2010	9116	77/23	294	177
2013	2012	3981	77/23	291	154
2014	2013	6592	77/23	275	130
2015	2014	6502	77/23	313	198
2016	2015	3258	77/23	303	171
2017	2016	3248	62/38	272	126
2018	2017	3224	62/38	285	144
2019	2018	2657	62/38	267	128
2020/21	2019a&b	2157	62/38	443	631
2022	2021	3269	62/38	289	154
2023	2022	3243	62/38	257	114
2024	2023	3227	62/38	281	140
2025	2024	3251	62/38	285	156
		53825		304	205

Initial higher release numbers to front-load the system to provide enough spawners to replace loss of wild spawning population due to senescence.

1yr 672 2019aBY and 2yr 2019bBY 1485 released

Small compared to PRPA release and lower expected survival

Hatchery Release Genetic Composition

Brood year	F	M	Genetic Families	Origin
2002	1	2	2	LCol
2010a	1	2	2	MCol
2010b	3	2	6	LCol Captive
2010c	7	10	19	UCol
2012a	1	4	4	MCol
2012b	1	3	3	MCol
2013a	1	2	2	PRPA
2013b	3	3	8	MCol?
2014a	5	5	25	MCol
2014b	3	5	15	MCol
2015a	8	10	80	MCol
2015a	1	5	5	MCol
2016	6	6	36	MCol
2017	6	6	33	MCol
2018	5	5	25	MCol
2019a and b	5	5	24	MCol
2021	6	6	32	MCol
2022	6	6	36	MCol
2023	6	6	36	MCol
2024	6	6	34	MCol
2025	6	6	36	MCol

Unequal numbers of each genetic family released 3,597 2010a, 2,600 2010b, 2,919 2010c

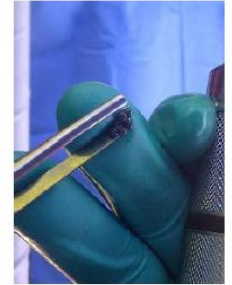
Equal numbers of each genetic family released

Broodstock capture below McNary Dam

Broodstock Capture

2025 Capture Effort

- Broodstock capture efforts were conducted over ten days from May 12 to 16 and from May 19 to 23
- Angling conducted immediately downstream of McNary Dam
- Involved Grant PUD and LGL with fishing guide support
- Candidate broodstock identified by surgical inspection of gonads
- Transported to YNSH with the Grant PUD sturgeon transport trailer



wsp GOLDER

Broodstock Capture Results 2025

- Low flow year (not as low at 2024)
- 86 sturgeon were landed (87 captures)
- 48 individual white sturgeon of mature spawning size (i.e., greater than 150 cm fork length)
- 6 ripe females and 6 ripe males were transported to YNSH
- On June 4, a 6x6 spawning matrix was attempted
- Sufficient gametes were obtained to produced 36 genetic families 2025BY



wsp

2025BY Mortality

- July 2025 elevated mortality in all six of the 2025BY genetic families
- Cause undermined, but possibly related to change in diet
- Mortality rate per family ranging from 92% to nearly 100% of each brood year maternal by 1 Oct
- 2025BY release ~ 1,500 fish in PRPA, unequal numbers among 6 genetic families

White Sturgeon Natural Spawn Monitoring 2025



2025 Natural Spawn Monitoring

- White Sturgeon spawning activity was monitored in Wanapum reservoir below Rock Island Dam from July 8 to 11, 2025.

Paired Egg Collection Mats

- 530 mat hours of sample effort



D-ring Nets with collection cannister

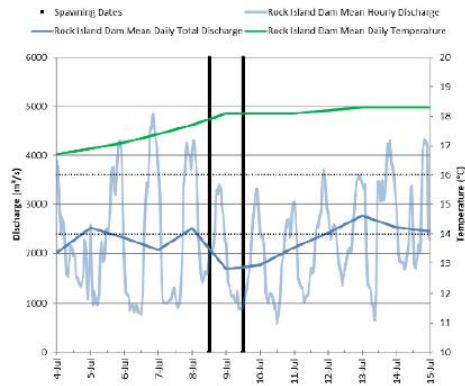
- 30 hours of daytime D ring sets
 - 7 deployments over 3 days
- 170 hours of overnight D-ring sets
 - 6 deployments over 3 days



14

Egg Collection Mats

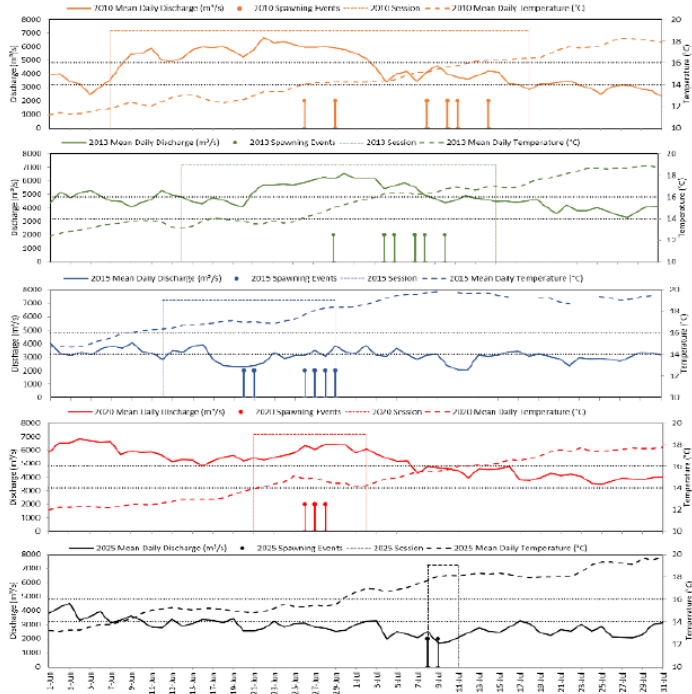
Spawning Event	Egg Collection Date/Time	Water Temp. at Capture (°C)	Egg Stage at Capture ^a	Estimated Spawning Date/Time	Water Temp. at Spawning (°C)	Mean Daily Discharge at Spawning (m ³ /s)
1	2025-07-09 10:00	18.1	17	2025-07-08 23:00	17.7	2,510
2	2025-07-10 11:00	18.1	18	2025-07-09 21:00	18.1	1,678



D-ring Sampling Results



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Past White Sturgeon Spawn Monitoring Effort and Result Below Rock Island Dam

2010, 2013, 2015, 2020,
and 2025

Juvenile Indexing 2025 Catch Distribution



Juvenile Indexing Study Design

2016-2022 40 gangions/line 2/0 & 4/0 2023 - onward 30 gangions/line 4/0 & 12/0

- Conducted by WSP and LGL biologists
- Juvenile white sturgeon population indexing September 3 to October 1
- 360 random, spatially balanced overnight sets distributed between Wanapum (n=270 overnight sets;) and Priest Rapids reservoirs (n=90 overnight sets)
- 122 m (400 ft.) 0.25 cm (1/4") diameter ground line
- 30 gangions per line
- 0.5 m (20") in length and consisted of a swivel snap,
 - 4/0 a 30 cm (12") length of 150# test monofilament
 - 12/0 30 cm (12") 660 # test round braid or three-strand nylon
- 4/0 or 12/0 sized circle hooks, space ~4m apart, size or random
- Set overnight and retrieved following day
- All gangions were baited with pickled squid



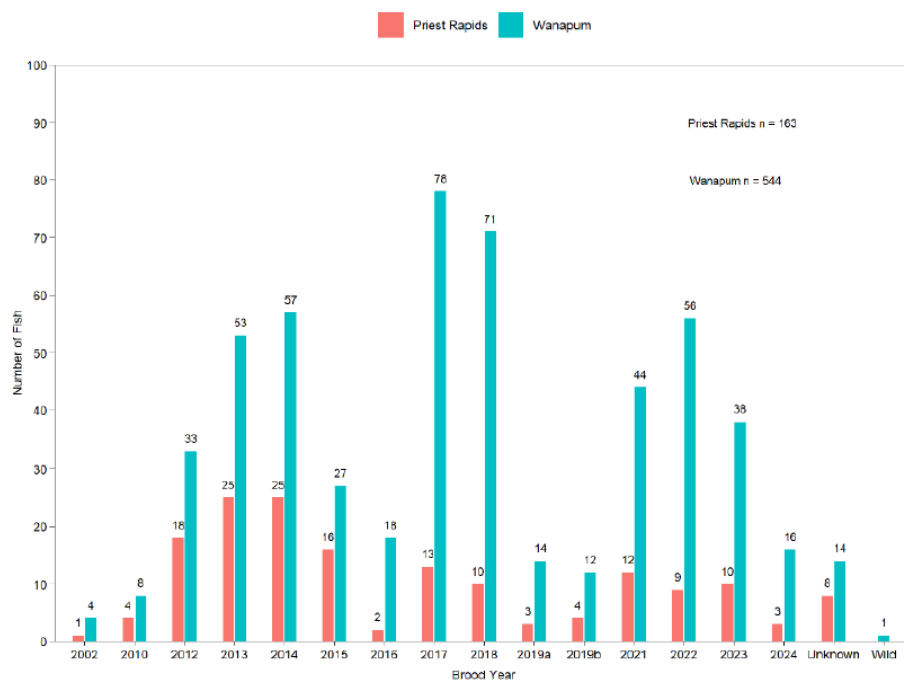
Juvenile Indexing 2025

Reservoir	Reservoir Section	Sample Effort		Wild & Hatchery CPUE (Fish/100 hook-hours)	2024	2023
		(hook-hours)	Total			
Wanapum	Upper	59,482	281	0.47	0.31	0.49
	Middle	60,281	201	0.33	0.24	0.34
	Lower	58,138	62	0.11	0.14	0.17
	All	177,901	544	0.30	0.23	0.34
Priest Rapids	Upper	19,957	80	0.40	0.55	0.60
	Middle	19,006	42	0.22	0.25	0.22
	Lower	19,424	40	0.21	0.16	0.14
	All	58,387	163	0.28	0.32	0.32
PRPA	Total	236,288	701	0.30	0.25	0.33

20

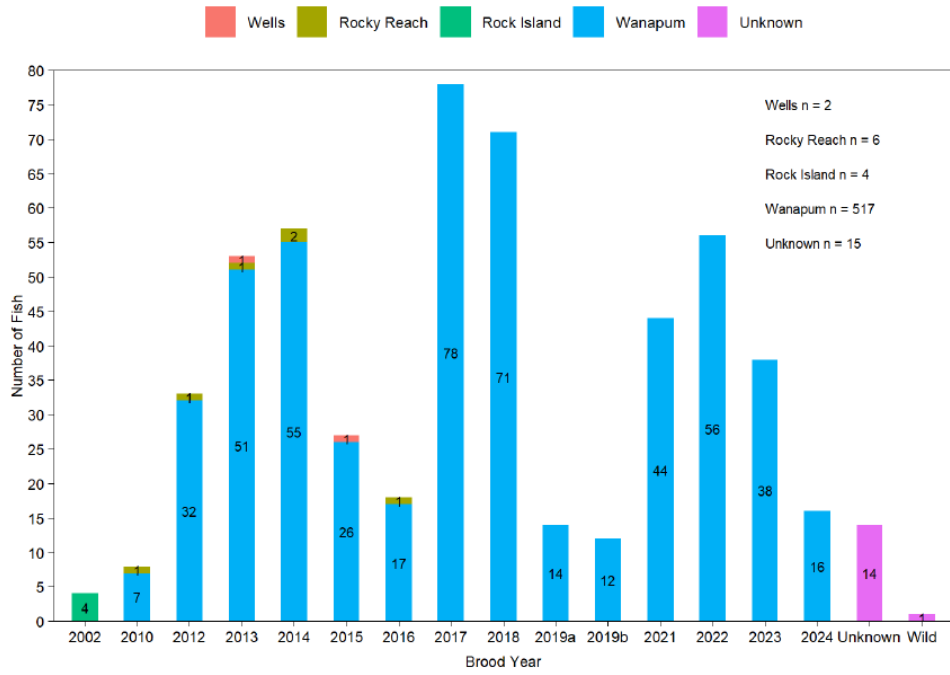


2025 Juvenile Indexing Catch by Brood Year



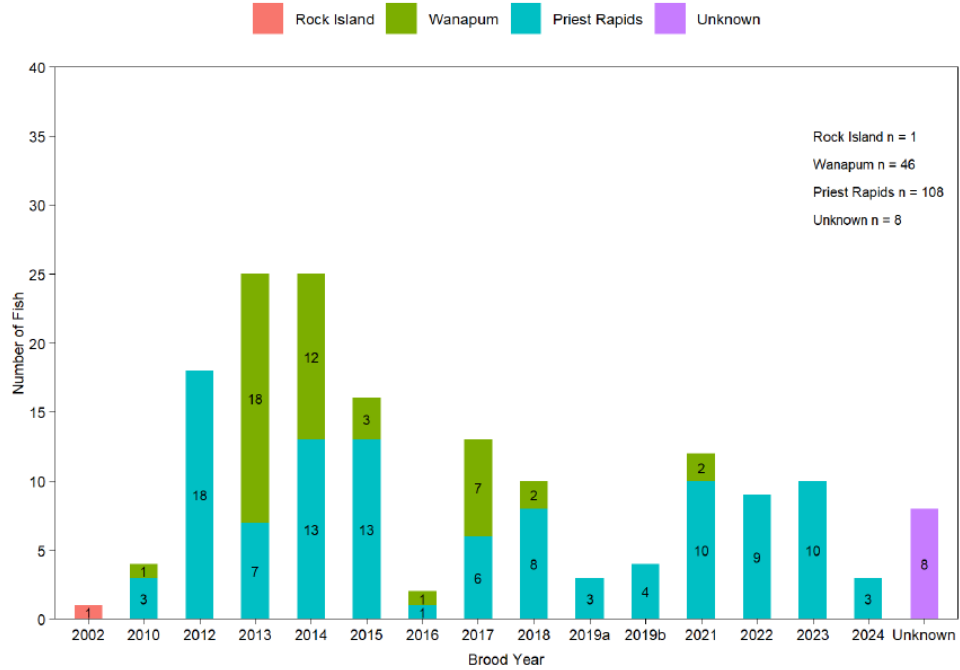
21

Wanapum 2025 Catch by Brood Year and Origin



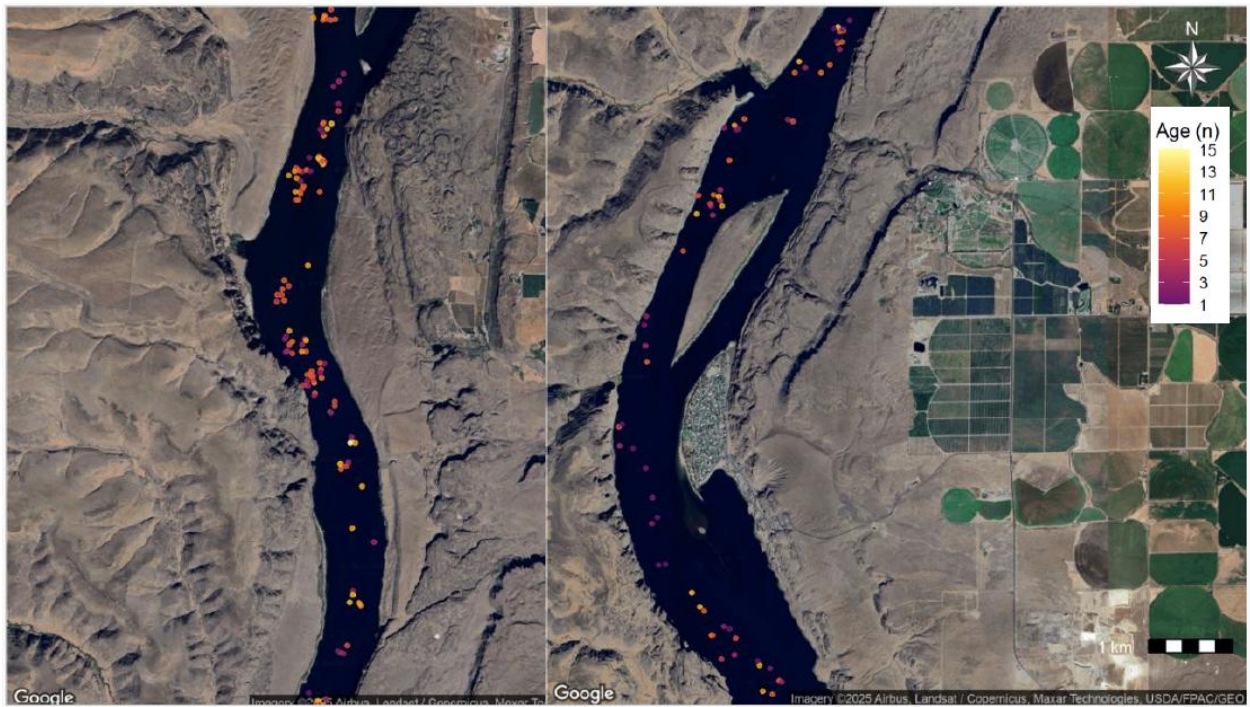
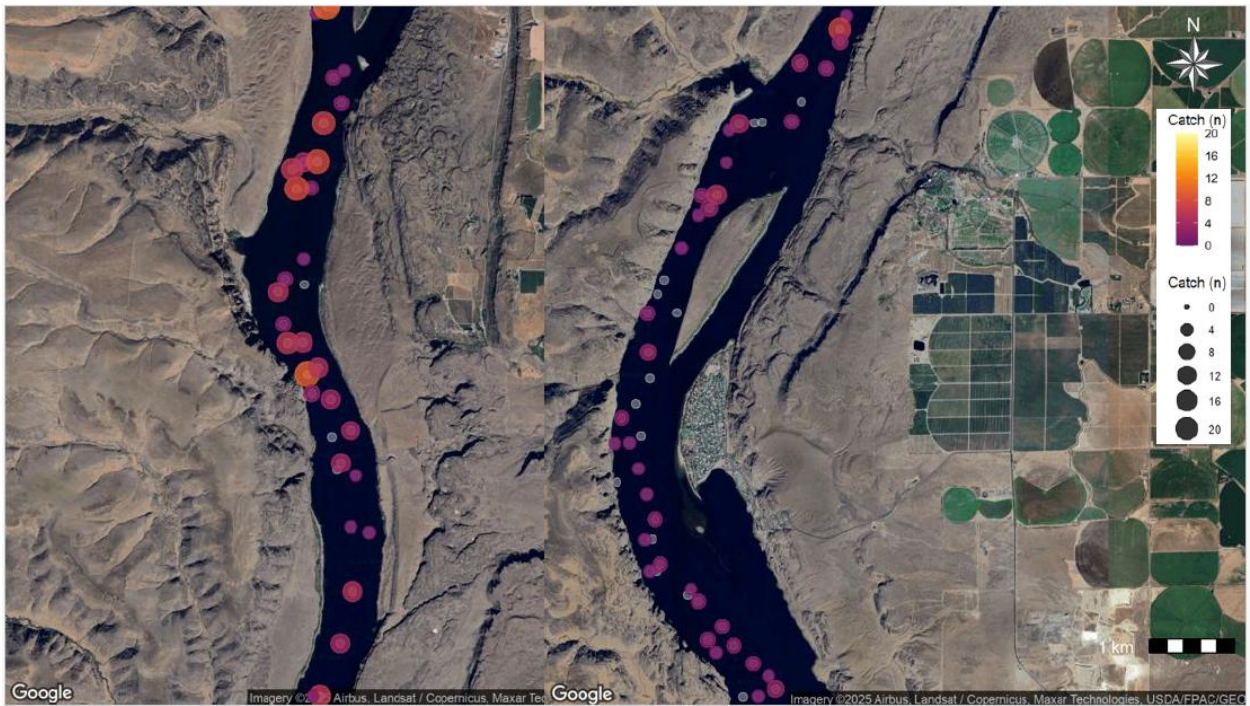
22

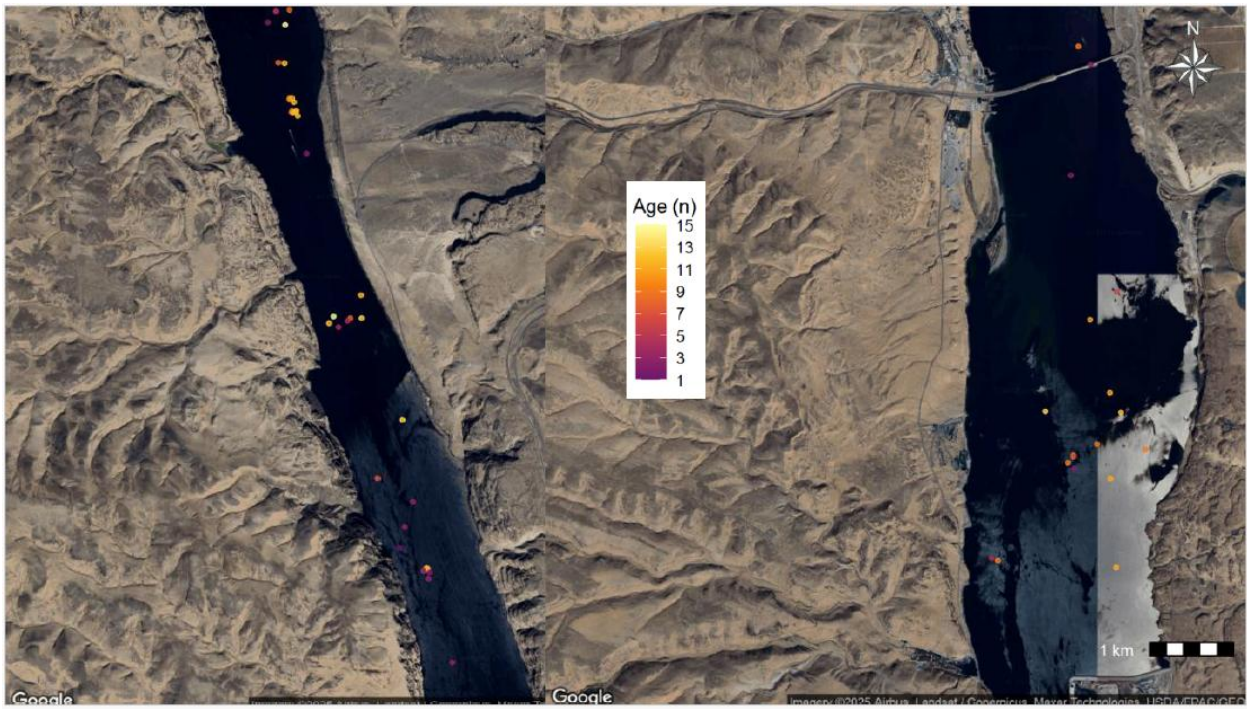
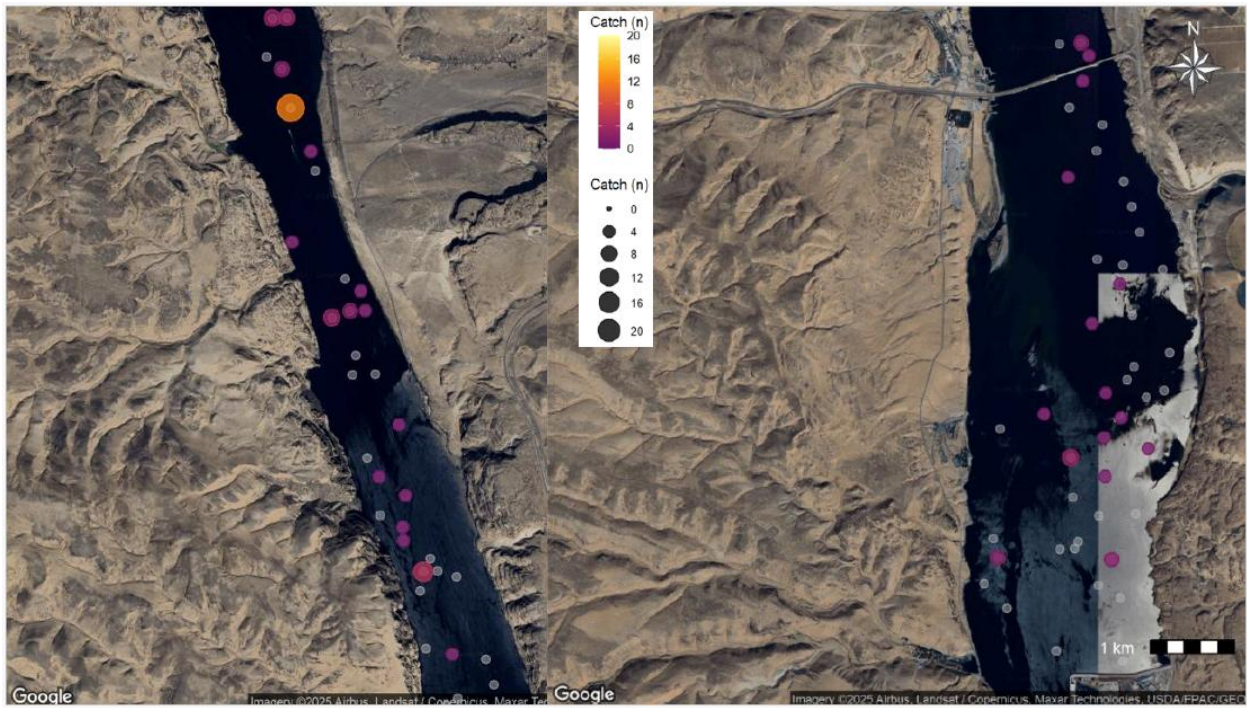
Priest Rapids 2025 Catch by Brood Year and Origin

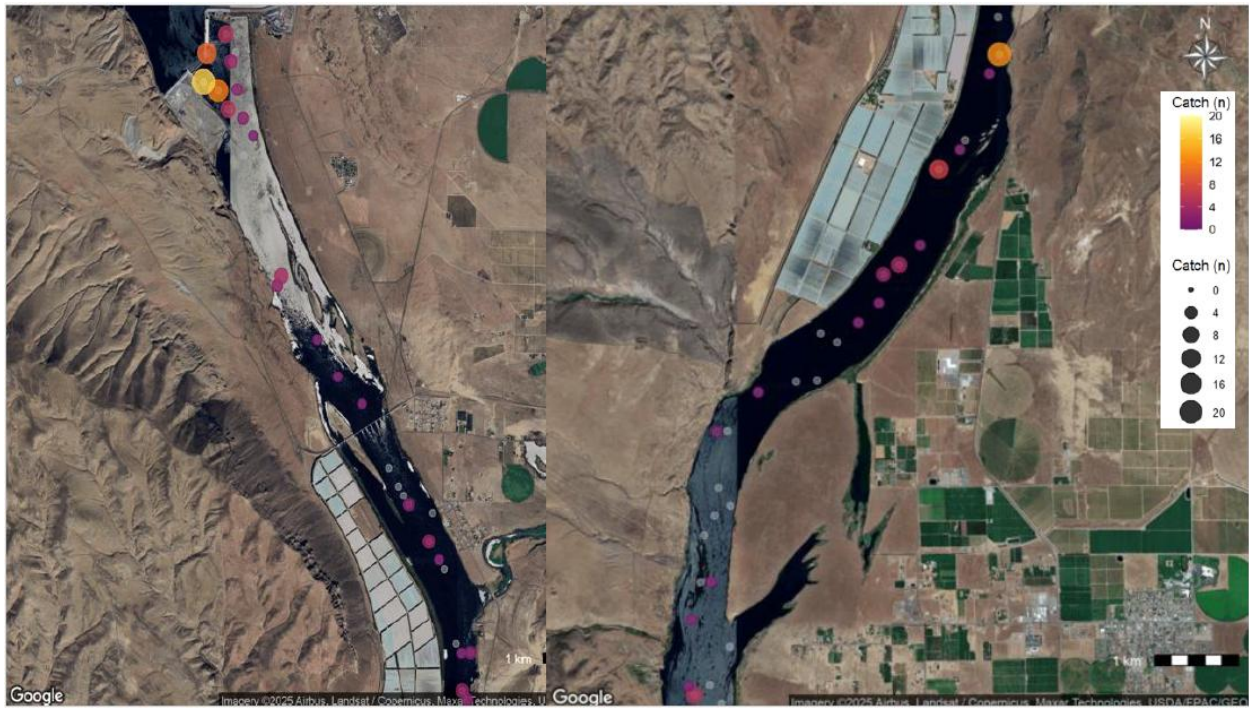


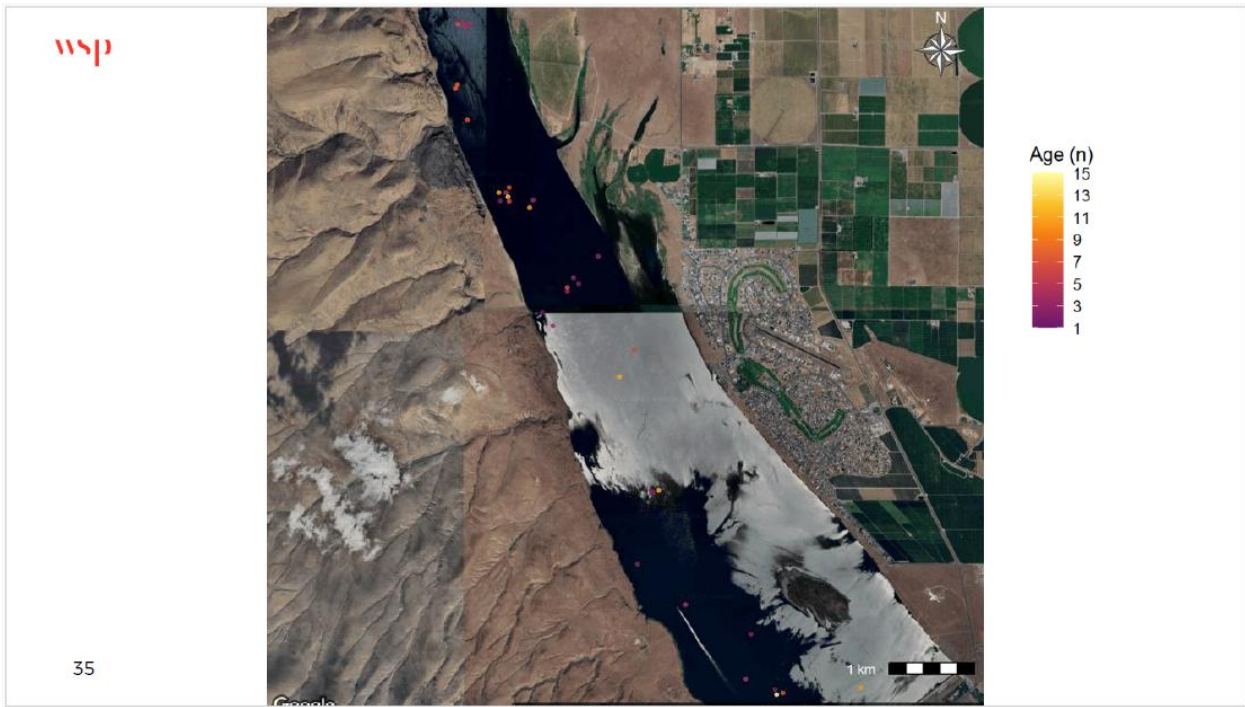
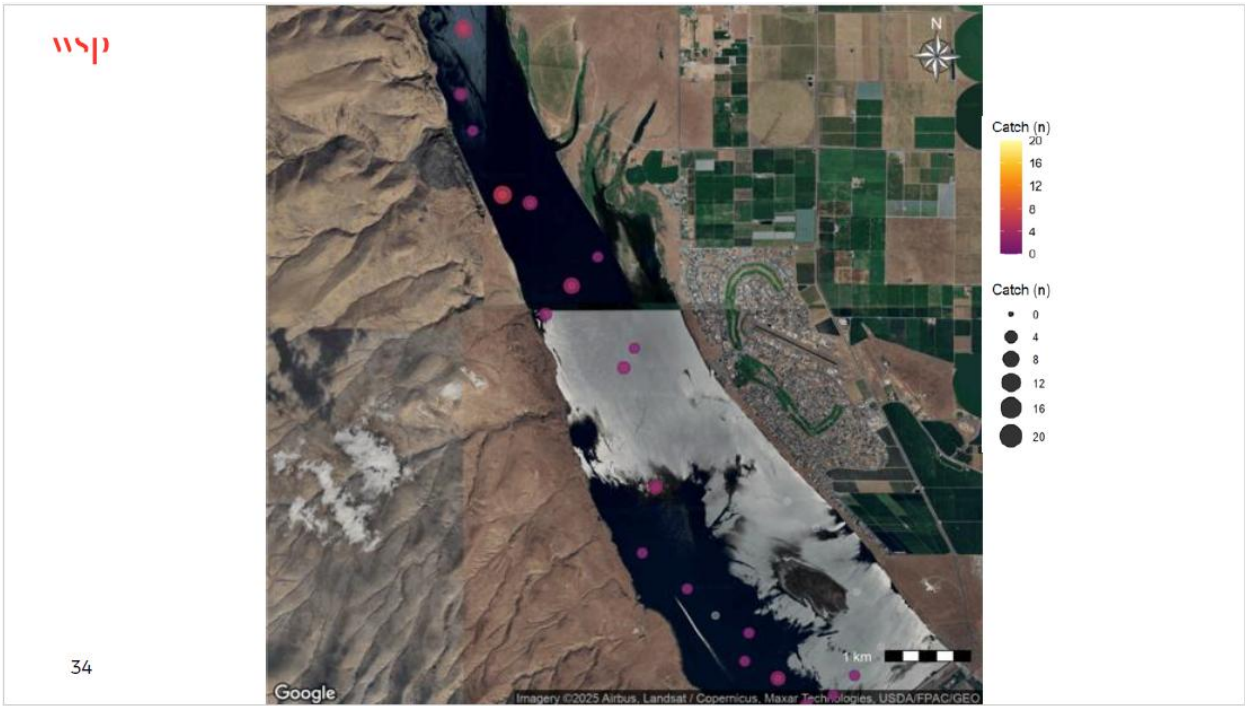
23







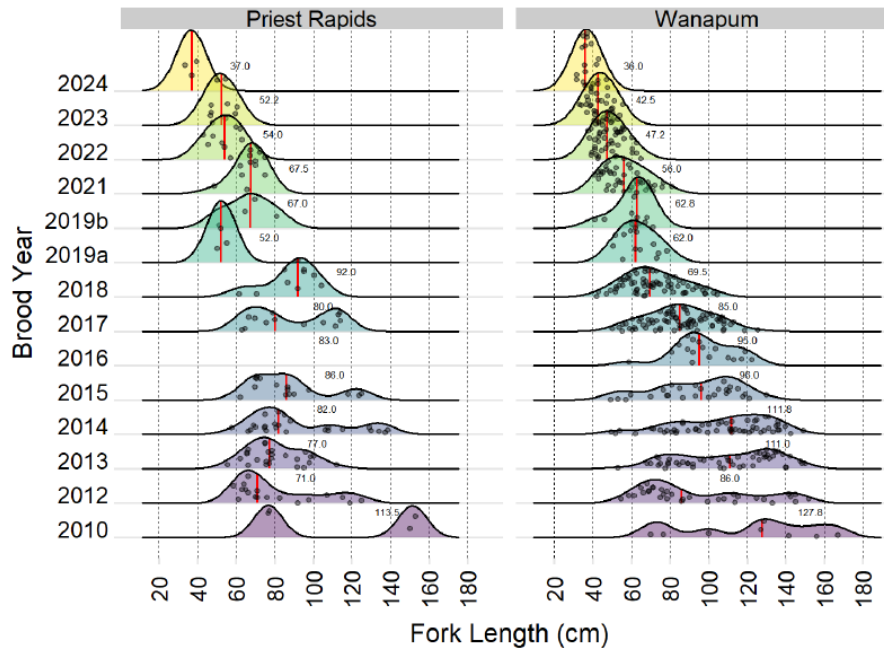




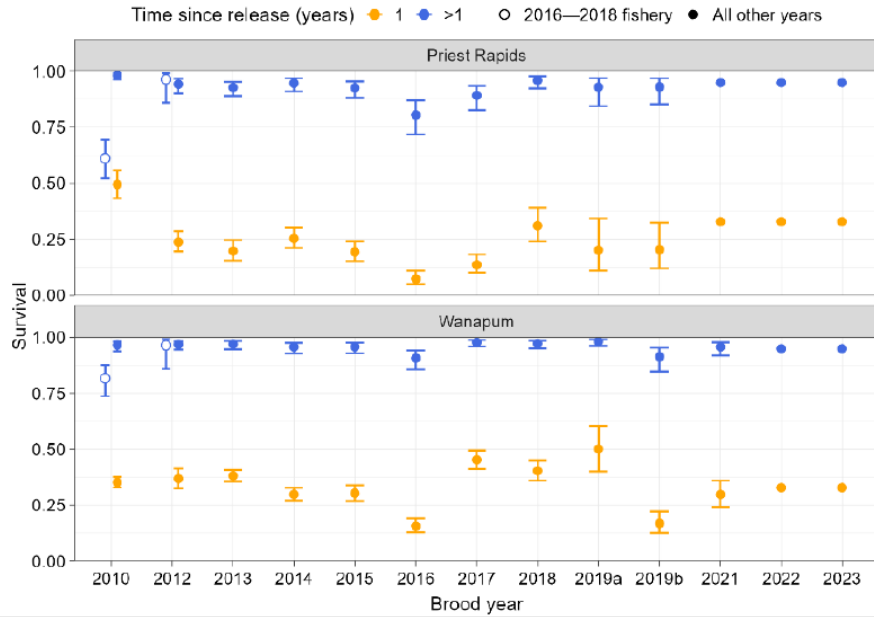
Population Size Structure, Survival and Population Estimates (2025)



PRPA 2025 Length Frequency by Brood Year

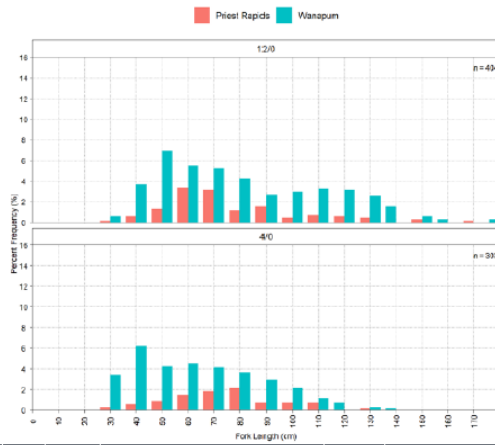


PRPA 2025 Brood Year Survival Year 1 and > Year 1 Survival Probability in PRPA



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Catch FL and WT by Gear Type

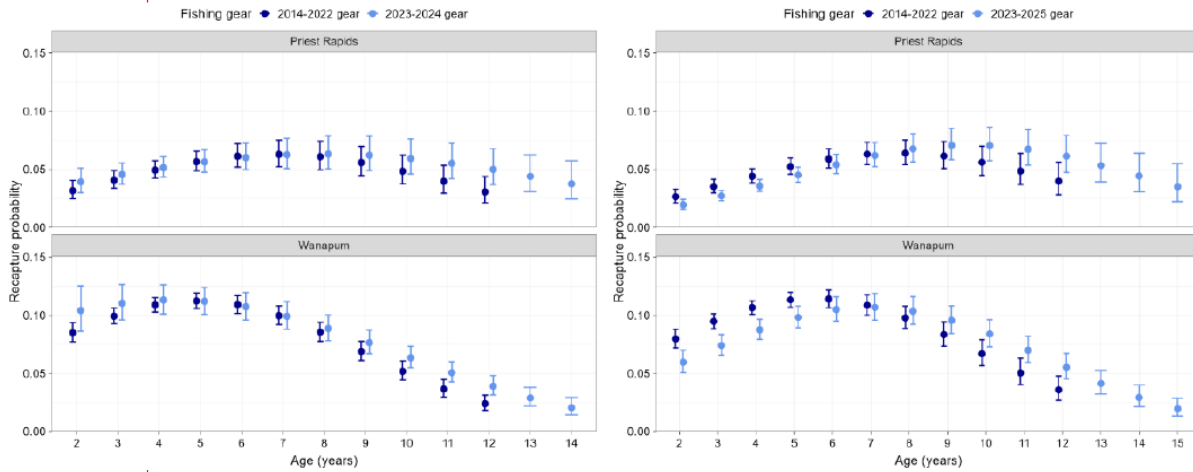


Gear Inventory		Bent
n		n
150	4/0	34
150	12/0	0
300		34
300	4/0	132
300	12/0	4
600		136
900		170

Reservoir	Hook Size	Catch	Fork Length (cm)				Weight (g)			
			n	Mean	SD	Min	Max	Mean	SD	Min
Priest Rapids	4/0	66	77.6	21.2	33.5	134.0	3,896	3,170	200	16,400
	12/0	97	81.7	26.0	37.0	177.0	5,027	6,564	320	49,450
Wanapum	4/0	237	69.4	25.0	33.0	142.0	3,301	3,521	170	19,000
	12/0	307	86.2	32.3	31.5	189.0	6,675	7,586	135	47,600

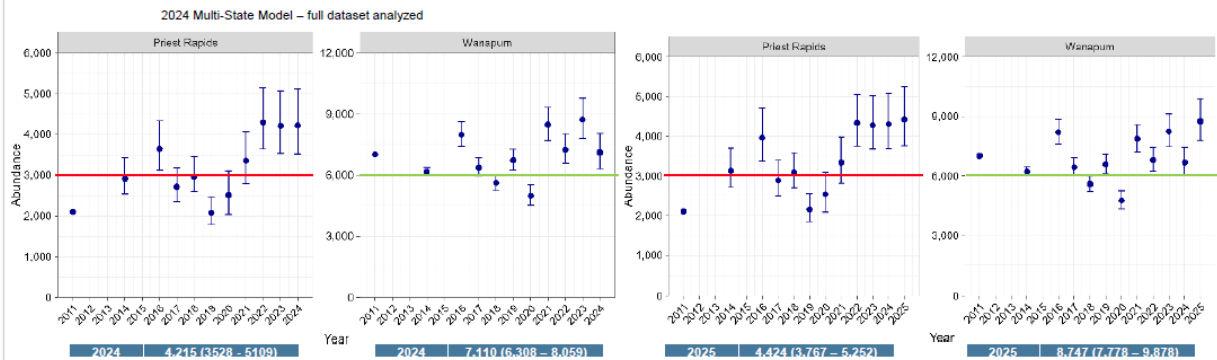
39

Recapture Probabilities by Gear Type and Fish Age



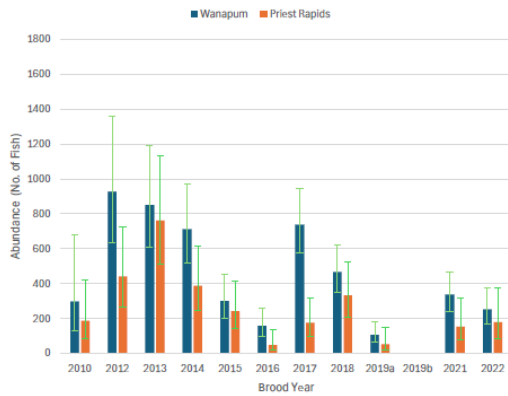
2024 vs 2025 Juvenile Population Estimates

Multi-State

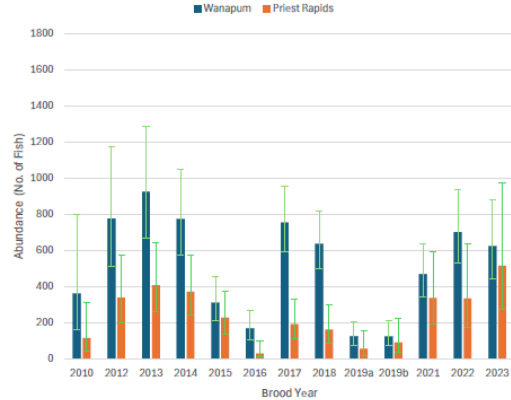


Abundance by Brood Year

2024 Multi State Model
– full dataset analyzed



2025 Multi State Model
– full dataset analyzed



Estimates of older brood years more variable due to low catch number with juvenile gear, sensitive to recaptures

Growth and Evidence of Density Dependence



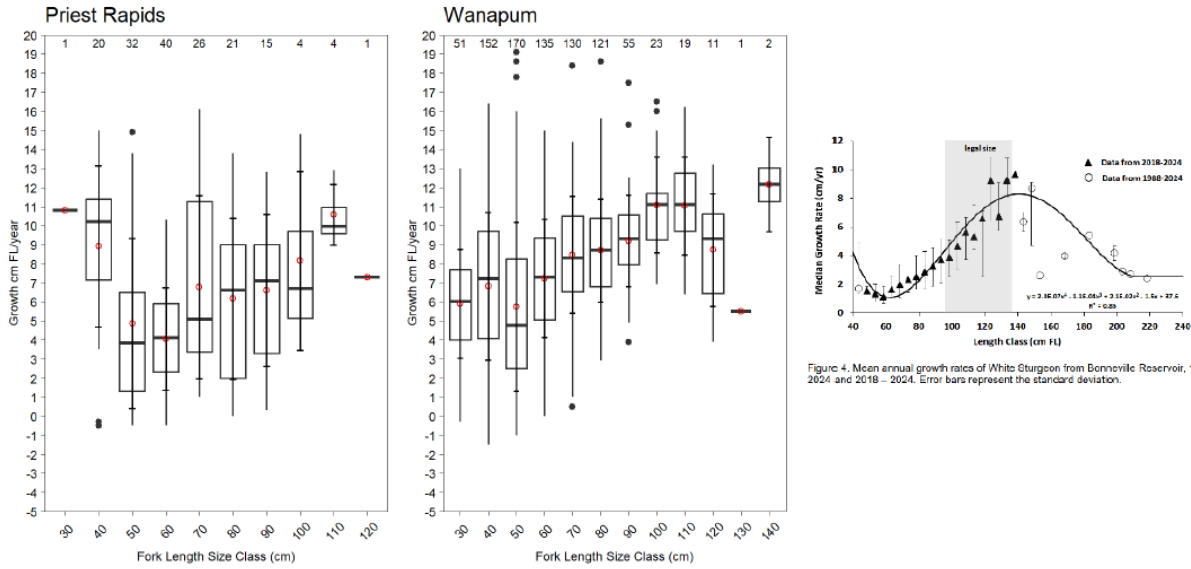
Questions:

- 1) How does growth (change in FL/Relative Wt) differ by reservoir/reservoir section, age, and size of fish?**
- 2) Are we seeing density dependent growth within the White Sturgeon population in either Priest Rapids or Wanapum reservoirs?**

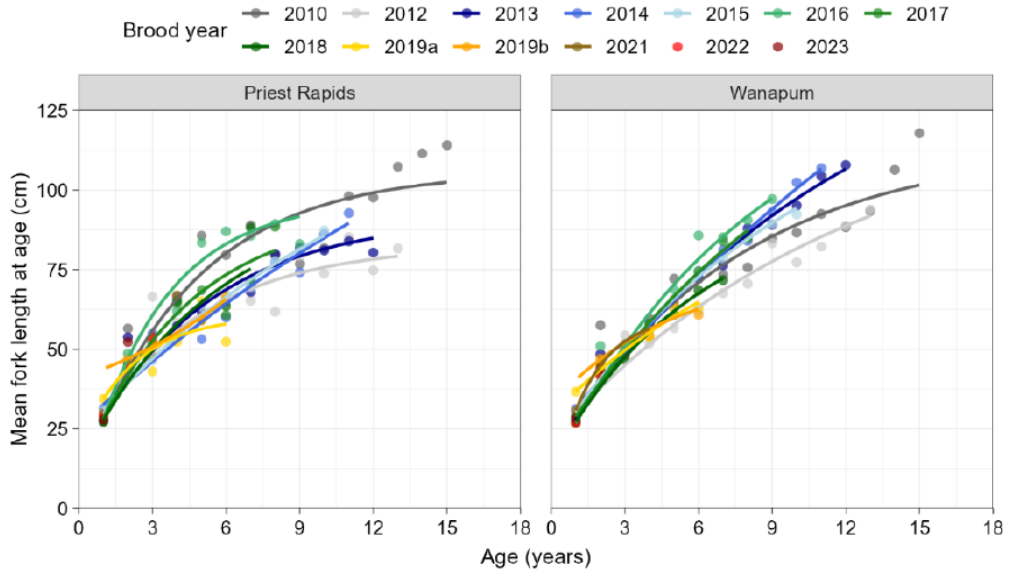
BY Condition by Reservoir/Reservoir Section



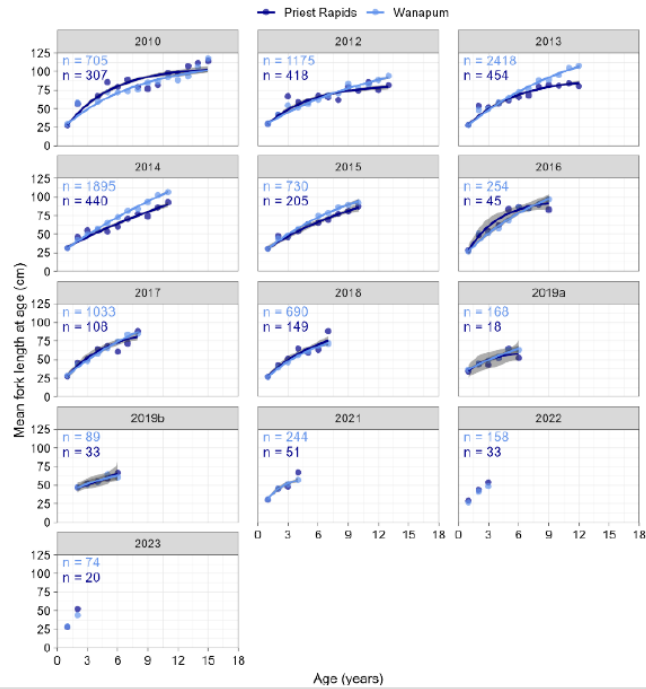
Growth cm FL/Year by FL size Class (1-2yr recap data)



Growth by Reservoir

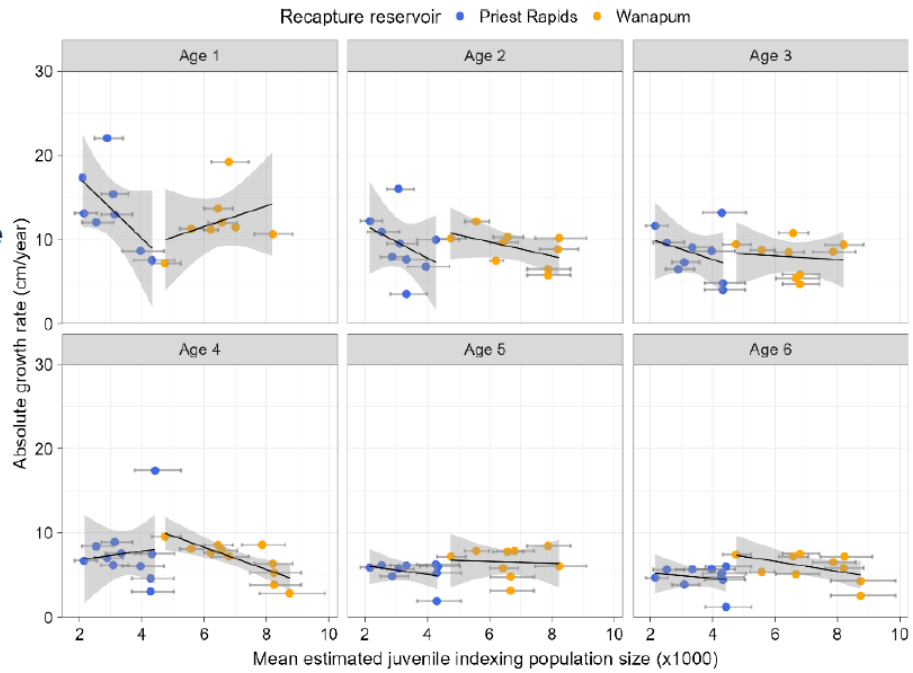


Growth by Age and Brood Year



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Growth by Age vs Population Abundance



49



Summary

- 2024BY release successful; low fin deformity;
Good size
- 2025 Brood stock 2025BY
6x6 spawning matrix; 36 genetic families, but mortality during rear
reduce release numbers
- 2025 Natural Spawn Monitoring
Spawning detected!
- 2025 Juvenile Population Modeling
Lower catch in Priest Rapid upper reservoir of older brood years
Overall increase in population in both reservoir, large contribution of younger brood years
- Growth Modeling and Density Dependence
Size at age data (von Bertalanffy) indicate plateauing growth in PR compared to Wanapum
Growth rates based on recapture data; Wanapum greater than Priest Rapids, but growth relatively high compared
to LCR populations
Weak evidence of density dependent growth in younger brood years in Priest Rapids. Little or no evidence of
density dependent growth in Wanapum



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Attachment 2

Presentation by Dave Robichaud on Estimating Sample Size for a ViRDCT-based Juvenile Lamprey Survival Study

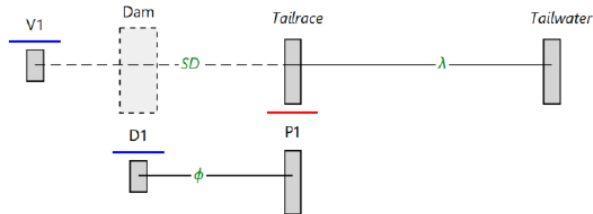
**Sample Sizes for a ViRDCT-based Juvenile
Lamprey Survival Study at PR Project**

Background

6 parameters for the reduced ViRDCT Model

- Size (number of fish) in the Virtual Release group (V1)
- Size (number of fish) in the Dead Release group (D1)
- Dam survival (S_D)
- Detection of virtual release on the tailrace array (P)
- Detection of dead release on the tailrace array (ϕ)
- Survival to and detection of V1 at the far downstream array (λ)

ViRDCT Reduced Model



Background

“Sample Size” - a simulation tool developed by Lockhart et al. at Columbia Basin Research

The screenshot shows the ViRDCT Reduced Model simulation tool interface. The main window displays the diagram from the previous slide. On the right, there is an 'Inputs' panel with three sections: 'Release Sizes', 'Survival/Drift Probabilities', and 'Capture Probabilities'. Each section contains a table with columns for the parameter name, Minimum, and Maximum.

Release	Minimum	Maximum
V1	0	0
D1	0	0

Survival	Minimum	Maximum
S_D	0	0
λ	0	0
ϕ	0	0

Capture	Minimum	Maximum
P1	0	0

Background

VIRDCT Reduced Model

Diagram parameters:
 $V1 = 1000-2000$
 $D1 = 500$
 $SD = 0.9$
 $\lambda = 0.9$
 $P1 = 0.9$

Inputs

Release Sizes

Release	Minimum	Maximum
V1	1000	2000
D1	500	

Survival/Drift Probabilities

Survival	Minimum	Maximum
SD	0.9	
λ	0.9	
ϕ	0.3	

Capture Probabilities

Capture	Minimum	Maximum
P1	0.9	

Buttons: Print, Save as PNG, Run Analysis

Background

VIRDCT Reduced Model

Input:

Live Virtual Release (V1): 1000-2000
 Dead Release (D1): 500
 Live release to tailrace (SD): 0.90
 Live release tailrace to tailwater (λ): 0.90
 Dead release to tailrace (ϕ): 0.30
 Live release tailrace detection (P1): 0.90

Results:

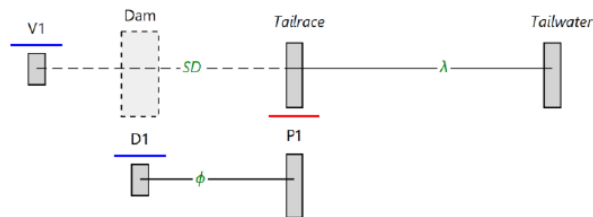
V1	SD s.e.	SD 1/2 95% CI	SD 1/2 90% CI
1000	0.0136	0.0267	0.0224
1010	0.0135	0.0265	0.0223
1020	0.0135	0.0264	0.0222
1030	0.0134	0.0263	0.0221
1040	0.0134	0.0262	0.0220
1050	0.0133	0.0261	0.0219
1060	0.0132	0.0259	0.0218
1070	0.0132	0.0258	0.0217
1080	0.0131	0.0257	0.0216
1090	0.0131	0.0256	0.0215
1100	0.0130	0.0255	0.0214
1110	0.0130	0.0254	0.0213
1120	0.0129	0.0253	0.0212
1130	0.0128	0.0252	0.0211
1140	0.0128	0.0251	0.0210
1150	0.0127	0.0250	0.0210
1160	0.0127	0.0249	0.0209
1170	0.0126	0.0248	0.0208

Background

6 parameters for the reduced ViRDCT Model

- Size (number of fish) in the Virtual Release group (V1)
- Size (number of fish) in the Dead Release group (D1)
- Dam survival (S_D)
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- Survival to and detection of V1 at the far downstream array (λ)

ViRDCT Reduced Model

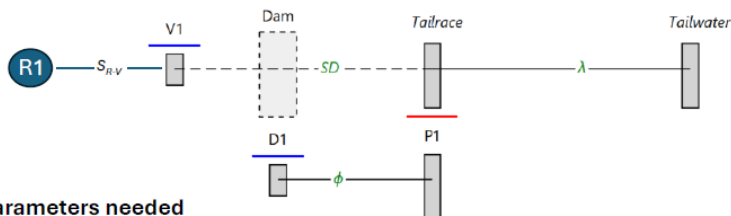


Background

6 parameters for the reduced ViRDCT Model

- Size (number of fish) in the Virtual Release group (V1)
- Size (number of fish) in the Dead Release group (D1)
- Dam survival (S_D)
- Detection of virtual release on the tailrace array (P)
- Detection of dead release on the tailrace array (ϕ)
- Survival to and detection of V1 at the far downstream array (λ)

ViRDCT Reduced Model



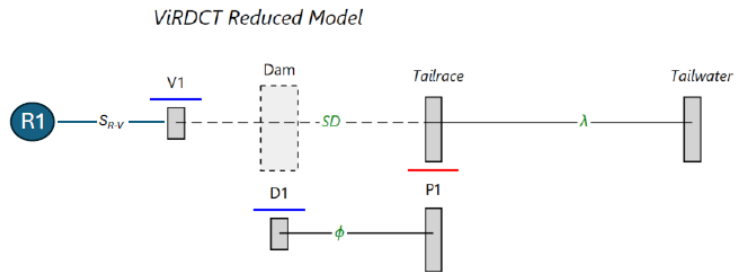
2 more parameters needed

- Size (number of fish) in the Live Release group (R1)
- Proportion of live release (R1) that become part of Virtual Release (S_{R-V})

Background

8 parameters for the reduced ViRDCT Model

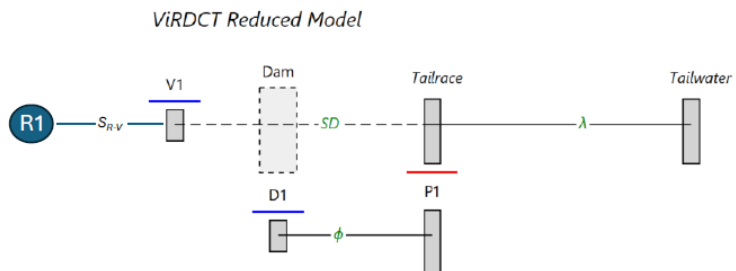
- Size (number of fish) in the Live Release group (R1)
- Proportion of live release (R1) that become part of Virtual Release (S_{R-v})
- Size (number of fish) in the Virtual Release group (V1)
- Size (number of fish) in the Dead Release group (D1)
- Dam survival (S_D)
- Detection of virtual release on the tailrace array (P)
- Detection of dead release on the tailrace array (ϕ)
- Survival to and detection of V1 at the far downstream array (λ)



Background

8 parameters for the reduced ViRDCT Model

- Size (number of fish) in the Live Release group (R1)
- Proportion of live release (R1) that become part of Virtual Release (S_{R-v})
- ~~Size (number of fish) in the Virtual Release group (V1)~~ — Calculated (from R1 and S_{R-v})
- Size (number of fish) in the Dead Release group (D1)
- Dam survival (S_D)
- Detection of virtual release on the tailrace array (P)
- Detection of dead release on the tailrace array (ϕ)
- Survival to and detection of V1 at the far downstream array (λ)

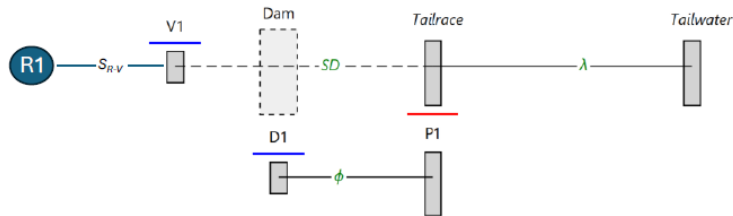


Background

7 parameters for the reduced ViRDCT Model

- Size (number of fish) in the Live Release group (R1)
- Proportion of live release (R1) that become part of Virtual Release (S_{R-V})
- Size (number of fish) in the Dead Release group (D1)
- Dam survival (S_D)
- Detection of virtual release on the tailrace array (P)
- Detection of dead release on the tailrace array (ϕ)
- Survival to and detection of V1 at the far downstream array (λ)

ViRDCT Reduced Model



Background

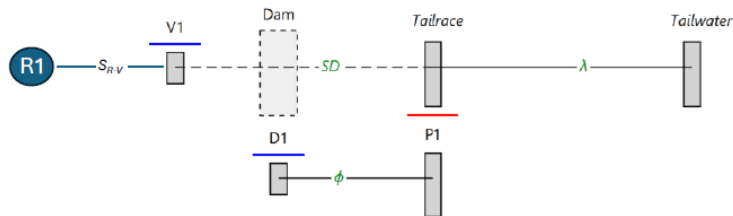
2 "USER CONTROLLED" parameters – SAMPLE SIZES

- Size (number of fish) in the Live Release group (R1)
- Size (number of fish) in the Dead Release group (D1)

5 "Biological/Physical" RESULTS to be estimated by the model

- Proportion of live release (R1) that become part of Virtual Release (S_{R-V})
- Dam survival (S_D)
- Detection of virtual release on the tailrace array (P)
- Detection of dead release on the tailrace array (ϕ)
- Survival to and detection of V1 at the far downstream array (λ)

ViRDCT Reduced Model



Methods

5 “Biological/Physical” RESULTS to be estimated by the model

- Proportion of live release (R1) that become part of Virtual Release (S_{R-V})
- Dam survival (S_D)
- Detection of virtual release on the tailrace array (P)
- Detection of dead release on the tailrace array (ϕ)
- Survival to and detection of V1 at the far downstream array (λ)

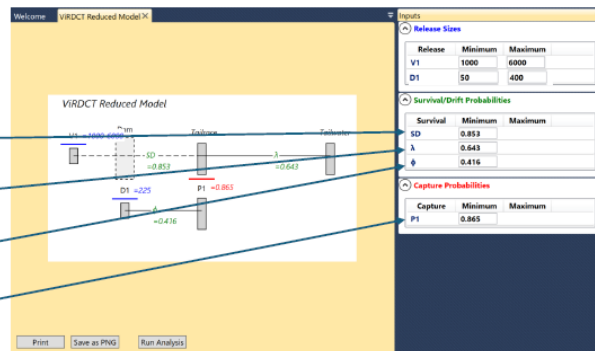
Sources for possible values?

- Deng et al. (2023) – lamprey at LGR 2022 – was the only source we could find that presented results in terms of these parameters
- “Bad Case Scenario”, assumed Deng (2023) values, worsened by 2 x their SEs

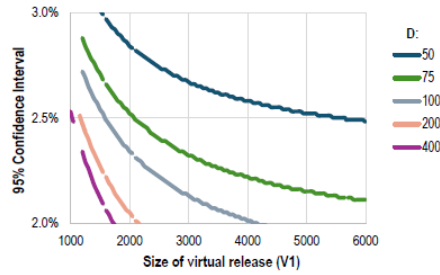
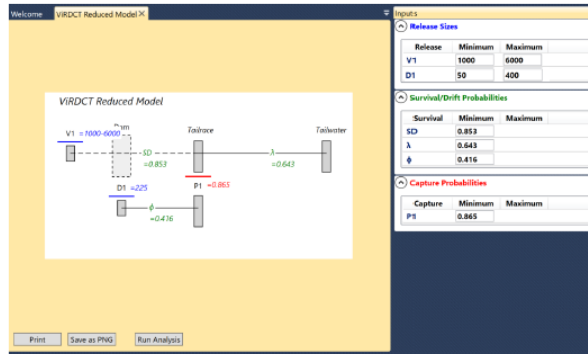
Parameter	LGR 2022	Simulation
S_{R-V}	0.849 (SE = 0.020)	0.809
S_D	0.911 (SE = 0.029)	0.853
λ	0.711 (SE = 0.034)	0.643
ϕ	0.270 (SE = 0.073)	0.416
P	0.909 (SE = 0.022)	0.865

Methods

Parameter	LGR 2022	Simulation
S_{R-V}	0.849 (SE = 0.020)	0.809
S_D	0.911 (SE = 0.029)	0.853
λ	0.711 (SE = 0.034)	0.643
ϕ	0.270 (SE = 0.073)	0.416
P	0.909 (SE = 0.022)	0.865



Results



Results

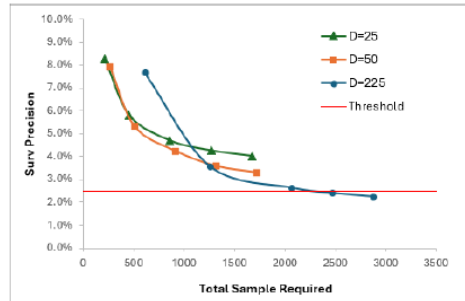
		Number of Fish in Dead Release Group (D)								
		50	75	100	175	200	225	250	275	400
V	Virtual Release (at 2.5%)	5669	2096	1594	1218	1172	1139	1113	1093	1035
WANAPUM										
R _{WA}	Live Release (V / S _{li,V})	7009	2592	1971	1506	1449	1409	1376	1352	1280
N _{WA}	TOTAL (R _{WA} + D)	7059	2667	2071	1681	1649	1634	1626	1627	1680
PRIEST RAPIDS										
V _{US}	From Upstream (V * S _D * S _{li,V})	3911	1446	1099	840	808	785	767	754	714
V _{PR}	More needed (V - V _{US})	1758	650	495	378	364	354	346	339	321
R _{PR}	Additional Live (V _{PR} / S _{li,V})	2174	804	612	468	450	438	428	420	397
V	Total Virtual Release (V _{US} + V _{PR})	5669	2096	1594	1218	1172	1139	1113	1093	1035
N2	TOTAL TO BE ADDED (R _{PR} + D)	2224	879	712	643	650	663	678	695	797
TOTAL (N1 + N2)		9283	3546	2783	2324	2299	2297	2304	2322	2477

Results

The requirement of 2,300 fish is based on a few assumptions:

- 1) that only studies that adhere to 2.5% precision thresholds would be acceptable; and
- 2) that the fish and array would experience what we thought of as 'bad-case' scenarios for fish survival and detection probability

With respect to assumption 1, you *could* carry out the study with fewer fish. This would likely result in survival estimates that are less precise than the traditional threshold. For example:



Results

The requirement of 2,300 fish is based on a few assumptions:

- 1) that only studies that adhere to 2.5% precision thresholds would be acceptable; and
- 2) that the fish and array would experience what we thought of as 'bad-case' scenarios for fish survival and detection probability

With respect to assumption 2, if detection rates or survival rates at WA and PR are markedly better than the assumed 'bad case' values, the resulting precision would improve.

If the true values are worse than the ones were used, the resulting precision would go down.

Conclusions

- If we just want to find out what survival *might* be, pick a sample size and go with it.
- If we want values that are precise enough to be the basis for decision-making, then higher sample sizes would be warranted