Priest Rapids Fish Forum

Conference Call

Wednesday, 4 February 2026
9:00 a.m. – 11:30 a.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
Scott, Hopkins, Chelan PUD
Bill Towey, Chelan PUD
Laura Heironimus, WDFW
Ralph Lampman, YN
Nate Patterson, YN
Jason McLellan, CTCR
Monica Blanchard, WDFW
Todd Miller, WDFW
Tim Taylor, Grant PUD
Mariah Mayfield, Douglas PUD
Lance Keller, Chelan PUD
Tracy Hillman, Chair

Action Items:

- Laura Heironimus will update the White Sturgeon Spontaneous Autopolyploidy Guidance document based on recently published literature.
- Melissa Peterson will share some slides or a weblink with the PRFF that describe the WQAP evaluation criteria.

- 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.
- Ralph Lampman will update the juvenile lamprey source table.
- Ralph Lampman will share language from the Fish Passage Center memo regarding juvenile lamprey studies.
- All members will review the YN presentation and the slides from Ryan Harnish.
- Members will review the draft 2025 Pacific Lamprey Annual Report and provide comments to Mike Clement by 14 February 2026.
- Members will review the draft 2025 White Sturgeon Management Plan Report and provide comments to Mike Clement by 5 March 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 February agenda.

III. Approve January Meeting Notes

The PRFF reviewed and approved the 7 January 2026 meeting minutes.

IV. Review Action Items

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

- Laura Heironimus will update the White Sturgeon Spontaneous Autopolyploidy Guidance document based on recently published literature. **Ongoing.**
- Melissa Peterson will share some slides or a weblink with the PRFF that describe the WQAP evaluation criteria. **Ongoing.**
- Mike Clement will check with Gabriella Brill (ODFW) to see whether she is able to present her White Sturgeon telemetry results to the PRFF in March. **Complete. Gabriella will present her results during the March meeting.**
- Ralph Lampman will contact Ryan Harnish (PNNL) and see if Ryan can provide more information on his power analysis for estimating sample sizes for a juvenile Pacific Lamprey study at the dam (assuming a ViRDCt model and different standard errors). **Complete. Ryan provided slides that provided information on sample size and standard error.**
- Tracy Hillman will coordinate with the RRFF to see if the RRFF can meet with the PRFF in February to discuss juvenile lamprey survival studies. **Complete.**

V. Water Quality

Columbia River Water Temperature TMDL – Tim Taylor reported that they (Grant PUD) are on track to meet the schedule for completing the Water Quality Attainment Plan (WQAP). Tim noted that they have identified project concepts and developed evaluation criteria. In December, Grant PUD sent a draft document that identifies their evaluation criteria to Ecology. Ecology reviewed the document and provided comments on the report. Grant PUD is coordinating a meeting with Ecology to discuss some of the comments. Tim said they intend to present the process, concept ideas, and evaluation criteria to the PRFF during the March meeting. Melissa Peterson added that Grant PUD is on schedule and will have some good information to discuss during the March meeting.

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

VI. White Sturgeon

White Sturgeon Hatching and Rearing – Tygh Schuster provided an update on the status of juvenile White Sturgeon at the Yakama Nation Sturgeon Facility. He said the fish are looking good and they continue to grow. Based on sampling fish on 30 January, the current tank counts and average fish weights are as follows:

- Tank 1: 413 fish at 33.86 grams/fish
- Tank 2: 418 fish at 42.12 grams/fish
- Tank 3: 34 fish at 40.86 grams/fish
- Tank 4: 955 fish at 28.11 grams/fish
- Tank 5: 227 fish at 32.18 grams/fish
- Tank 6: 237 fish at 32.13 grams/fish

Other White Sturgeon Items – Laura Heironimus reported that she and Andrea Carpenter (ODFW) are cohosting a sturgeon symposium (Sturgeon Spotlight: Modern Perspectives for Ancient Fish) at the joint Oregon Chapter and Western Division American Fisheries Society meeting. The joint meeting will be held in Portland, Oregon, from 4-7 May 2026. She said the deadline for submitting abstracts is 14 February. Please let Andrea and Laura know if you are planning to present (email is fine) so they can track who needs to submit abstracts. Laura added that this will be a great opportunity to get sturgeon folks together in person this spring. Please let Laura know if you have any questions and share the information with others who may be interested.

VII. Pacific Lamprey

Juvenile Pacific Lamprey Survival Studies (joint meeting with the Rocky Reach Fish Forum) – Tracy Hillman reminded members that they had an action item from last month: members will consider the size of the survival standard error for a valid juvenile Pacific Lamprey survival study and identify appropriate sample sizes. Tracy also reminded members that last month members supported survival studies at the dams and the use of the Virtual Release/Dead-Fish Correction (ViRDCt) model. Tracy added that Ryan Harnish (PNNL) also provided some additional information on sample size and standard error (SE), which will be discussed later today. Because Ralph Lampman prepared a presentation, which has bearing on the standard error and sample size discussion, Tracy asked Ralph to lead off the discussion with his presentation. The presentation was sent to members yesterday (3 February).

Ralph gave a presentation titled "Considerations for the Juvenile Lamprey Passage Study" (see Attachment 1). Ralph began the presentation by identifying four key questions to consider: (1) what difference in survival rates would change mitigation response? (2) why is salmonid-level SE needed when the license does not require multi-year averaging or compliance testing? (3) what happens if salmonid-level SE is not achievable? and (4) what are appropriate and reasonable methodologies in the context of lamprey biology and feasibility? Ralph worked his way through each of these questions. The notes here capture the high points; details are provided in the attachment.

Ralph provided five possible reasons why salmonid-level precision without a multi-year design is scientifically unsound for a juvenile lamprey survival study. Ralph touched on the effects of high inter-annual variability in juvenile survival (result of environmental and biological variability) and the fact that precision and replication are inseparable. In sum, a single-year survival study even with high precision may not represent "average" conditions experienced by migrating juvenile lamprey. This is why several years of study are included in salmonid survival studies.

Ralph then provided an overview of what is required in the Priest Rapids Pacific Lamprey Management Plan (PLMP) and what it does not require (e.g., no juvenile survival standard, no compliance determination, and no required SE). Ralph believes juvenile lamprey studies are intended to reduce uncertainty and inform future criteria. He added that Grant PUD's license relies on several assumptions that have not been empirically validated in the Priest Rapids project area. Ralph believes that a juvenile lamprey study is needed to validate the assumptions in the agreement.

Ralph talked about why salmonid-level precision (SE = 2.5%) is not the right benchmark for juvenile lamprey. For example, salmonid survival studies are designed for compliance but there is no compliance standard for juvenile lamprey. In addition, the Priest Rapids Coordinating Committee acknowledged that strict SE requirements are not always necessary with salmonid survival studies. Ralph added that there is no numeric survival standard, no compliance test, and no required SE for juvenile lamprey. Rather, results from juvenile lamprey studies are intended to reduce uncertainty, validate or correct assumptions, support future passage criteria development, and identify mitigation if necessary. In short, applying a salmonid compliance-based strategy (SE = 2.5%) for juvenile lamprey is inappropriate. Juvenile lamprey survival studies are about learning and criteria development, not compliance testing.

Ralph stated that a survival estimate is important, because it informs the scale of mitigation. Trying to achieve a salmonid compliance level of precision is not needed to distinguish the magnitude of impact. Placing a high level of precision on juvenile lamprey survival studies risks delaying the study, leaving license assumptions untested, and postponing mitigation decisions. Ralph said the key point is effect size determines how much mitigation is needed, not precision. Ralph indicated that rather than focusing on a single SE target, we should advocate for a "fit-for-purpose" phased approach, which begins with assumption testing, then criteria development (if warranted), and finally mitigation (only if standards are established).

Ralph then transitioned to the requirements in the Rocky Reach PLMP. As with the Priest Rapids PLMP, the Rocky Reach PLMP does not establish numeric juvenile lamprey survival standards, define a compliance threshold, specify a required SE, require replication across multiple years, or require the study to support a pass/fail determination. Rather, it emphasizes type and magnitude of impacts and appropriate and reasonable methodologies. Ralph said the YN interpretation of the Rocky Reach PLMP is framed around measuring the type and magnitude of impacts using reasonable methods. It is not about meeting salmonid compliance standards. In addition, YN believes precision should be scaled to the management decisions being supported and paired with an appropriate study design, and that applying salmonid SE targets without replication requirements are inconsistent with both the PLMP language and sound study design.

Ralph then spoke to what "appropriate and reasonable methodologies" implies. He said "appropriate and reasonable" means the methods are suited to the species biology, life stage, expected abundance, and study feasibility. The methods should produce informative results within cost and logistical constraints and should not increase barriers to study implementation. He does not believe adopting salmonid-based SEs without replication is reasonable for juvenile lamprey studies and to require salmonid-based criteria on a juvenile lamprey study risks no study being feasible, which is not reasonable.

Regarding how survival estimates inform mitigation under the Rocky Reach PLMP, Ralph said that effect size, not precision, drives the magnitude of mitigation. Salmonid-level precision is only necessary if very small differences in survival would materially change mitigation decisions. A "fit-for-purpose" approach for the Rocky Reach project area could consist of three phases. Phase 1 would characterize impacts and develop methods, phase 2 would include refinement, if necessary (e.g., if there are substantial losses of juveniles), and phase 3 would focus on no net impact (NNI) mitigation.

Ralph identified possible mitigation measures for both the Priest Rapids and Rocky Reach project areas. He said these are only possibilities and would be discussed following a juvenile survival study. Possible mitigation measures include adult trap-and-haul, artificial propagation, a lamprey fund, and Tumwater Dam and Dryden Dam passage improvements. Ralph also identified some possible pre-study actions, including juvenile lamprey collections at dams, fyke net studies, bypass release testing, PIT-tag release detections, and Dryden Canal juvenile lamprey collection. Ralph ended his presentation by circling back to the four key questions and asked whether anyone had questions. No one had questions.

Given that no one had any questions for Ralph, Tracy and Ralph walked through the slides provided by Ryan Harnish (see Attachment 2). Tracy reminded members that last month they asked Ryan to provide more information on the relationship between SE and sample size. Ryan also provided information on how far upstream from a dam tagged juvenile lamprey should be released to maximize detections and survival. Survival from the point of release to the virtual array ranged from 0.454 to 0.921 and appeared to be a function of distance and timing of release. These data are useful because they inform the number of fish to be tagged and released.

Ryan also provided figures showing the relationship between sample size (i.e., number of juveniles tagged) and precision of route-specific survival rates. Slide #12 displays ½ 90% and ½ 95% confidence intervals versus virtual release group size (i.e., number of tagged fish detected passing the target dam). Because some fish will die between release and the target dam, these virtual release group sizes (V1) would need to be divided by the expected release-to-dam survival to get the number of fish that would need to be released. Precision also varies as a function of the number of dead tagged fish released (D_1), dam passage survival probability (S_D), the joint probability of survival and detection from the tailrace to tailwater array (λ), the proportion of dead released fish that are detected at the tailrace array (ϕ), and the detection probability of the tailrace array (p). Slides 13-15 provide examples of the effect of S_D, ϕ, and p on precision. Slide 16 displays the virtual release group sample sizes (V1 or V2), S_D, and associated SEs that Ryan's group obtained during the 2022-2024 juvenile lamprey studies.

Michael Lucid asked how dam passage survival probability was estimated. Ralph responded that it is based on the number of virtual fish that are detected at the first tailrace array and corrected for the detection of dead fish at the first tailrace array. Ralph said this is all based on the ViRDCt model. Mariah Mayfield added that the tagged fish officially become part of the study once they interact with the V1 array (array just upstream from the dam). These "virtual" fish move through the dam; some die and others survive. Because some virtual fish that die may be detected at the first tailrace array, tagged dead fish are released upstream from the dam to correct for detected virtual fish that die and are detected at

the first tailrace array. The assumption is that no dead fish will be detected at the second array, which is located several kilometers downstream from the first tailrace array.

Mariah asked whether Ryan or others have calculated the loss of fish between the release point (R1) and the virtual array (V1). Ralph noted that Ryan's Slide 11 shows the survival rates from release to V1. As noted earlier, survival rate appears to be a function of distance upstream from V1 and the time of year. Mariah said this is useful, because this informs the number of fish that need to be collected and tagged and helps determine the cost of the study. Following Mariah's question, Tim Taylor noted that the survival rate between R1 and V1 is most likely the result of predation. Tim asked whether loss due to predation from the first tailrace array to the second array can be estimated. Mariah responded that based on the current design, there does not appear to be a way to tease out losses due to predation between the downstream arrays. Tracy, referring back to comments made by Jason McLellan during previous meetings, suggested using predation tags if they are not a burden on juvenile lamprey, or adding a paired release in the tailrace. Tim noted that a paired release would include losses due to predation and handling effects. Jason suggested using predation tags in the dead fish release group. The tag burden should not be an issue for dead fish. Members identified the following questions for Ryan:

- Did PNNL estimate juvenile lamprey losses due to predation downstream from a dam. If so, how did 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?
- Does Ryan have thoughts on using predation tags inserted into the dead fish to estimate losses due to predation downstream from a dam.

As a final point, Ralph wanted members to understand that he is not opposed to a juvenile survival study with high precision, he just does not want the desire for high precision to preclude a survival study that does not require a high level of precision. A study that ends with 5% precision will still be useful and informative.

Laura asked about the timeline for completing a study plan to conduct a valid juvenile lamprey survival study in, say, 2027. Tracy noted that during past meetings, the PUDs indicated that they would need to have an approved study plan and budget by June or July. The PUDs establish their budgets in June or July for work to be conducted in the following year. Both Mike Clement and Scott Hopkins agreed that they would need to have a final cost estimate by June.

Ralph reported that he had a discussion with the Fish Passage Center (FPC) regarding juvenile lamprey survival studies. He reminded members that many years ago (2014) the FPC put together a memo indicating that juvenile lamprey used in survival studies should not be collected from downstream locations to evaluate survival at upstream dams. More recently, they provided a new memo that in part clarifies their position. Ralph said he will provide a summary of the contents within the memo that are related to juvenile studies.

Members will study the presentation by Ralph and review Ryan's slides and be prepared to discuss them during the next meeting. Ralph will update the source-fish spreadsheet, which will also be a topic of discussion next month.

Other Pacific Lamprey Items – No additional Pacific Lamprey items were discussed.

VIII. Administration

Mike Clement reported that Grant PUD sent out the draft 2025 Pacific Lamprey Annual Report to the PRFF on 14 January. Comments are due to Mike on 14 February. He also noted that Grant PUD sent the draft 2025 White Sturgeon Management Plan Annual Report to the PRFF on 3 February. Comments are due to Mike by 5 March.

IX. Adjourn

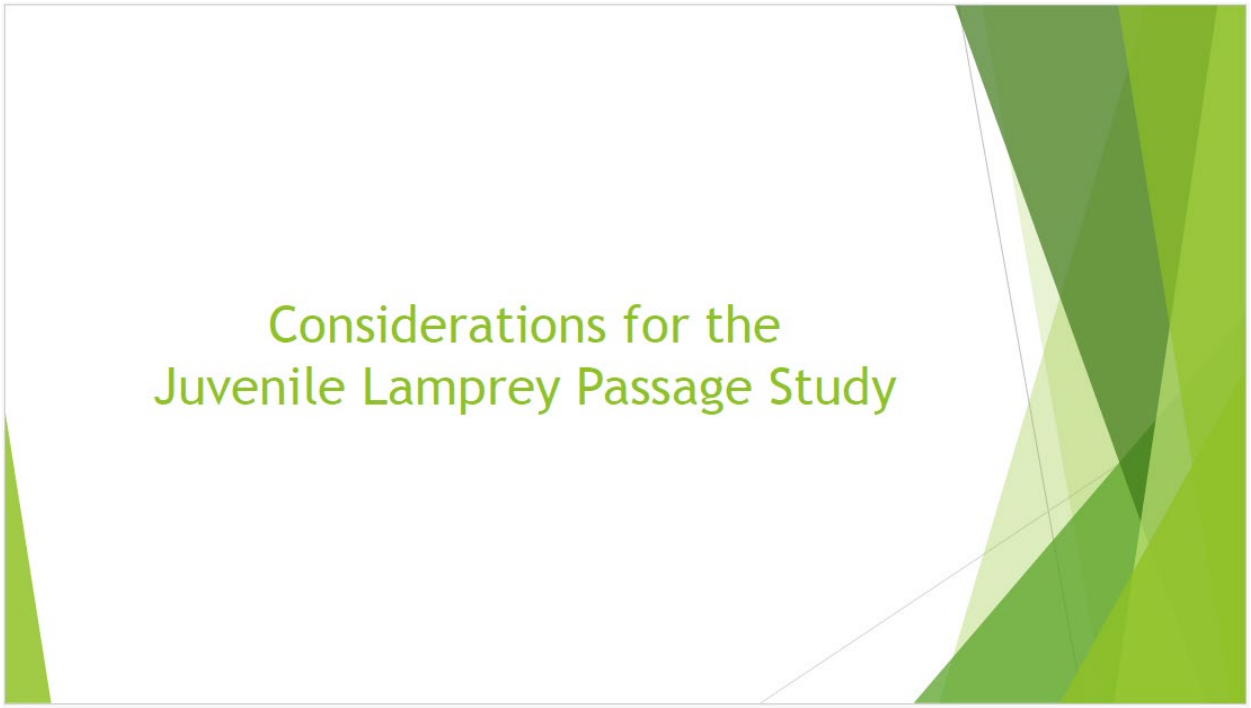
With no additional business to discuss, Tracy Hillman adjourned the meeting at 11:30 am.

X. Next Meeting

The next meeting of the PRFF will be on Wednesday, 4 March 2026.

Attachment 1

Presentation by Ralph Lampman on Juvenile Pacific Lamprey Survival Studies



Key Questions to Consider

1. What difference in survival rates would actually change mitigation response? (1%? 5%? 10%?)
2. Why is salmon level SE needed when the license does not require multi-year averaging or compliance testing?
3. What happens if salmon level SE is not achievable? Is no study preferable to a study that provides an overview of survival and impacts?
4. What are **appropriate and reasonable methodologies** in the context of lamprey biology and feasibility?

Key Questions to Consider

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Why Salmon-level Precision Without Multi-Year Design is Scientifically Unsound (#1)

Even if salmon-level SE were theoretical achievable:

- Inter-annual variability in juvenile lamprey survival (flow, temperature, etc) will likely:
  - Exceed statistical error in any single year.
- A single high precision estimate
  - Cannot represent the "type and magnitude" of impacts across all conditions.
  - Risks over- or under-estimating true project effects.

Why Salmon-level Precision Without Multi-Year Design is Scientifically Unsound (#2)

This is why:

- salmon programs rely on multi year averaging, not single-year precision.
- **Precision and replication are inseparable**
  - Survival is not a fixed parameter – it varies from year to year and is influenced by environmental conditions.
  - A single year study, no matter how precise:
    - Represent one outcome of many possible conditions
    - Does not represent the long-term Project effect by itself

Why Salmon-level Precision Without Multi-Year Design is Scientifically Unsound (#3)

Salmon requirements have never treated a single year as definitive. Multi year averaging integrates across different environmental conditions, reduces the influence of anomalous years and produces a central tendency that better reflects long-term performance.

- Why a single-year precision cannot substitute replication

  -> High precision in a single year shrinks the confidence interval around that year's estimate, but does nothing to address whether that year was:
  1) Hydrologically typical, 2) operationally represented, 3) biologically average

Why Salmon-level Precision Without Multi-Year Design is Scientifically Unsound (#4)

- What happens when precision is required without replication?

Requiring salmon level SE for a single lamprey study:

- Treats one year as if it represents long-term conditions
- Overweighs statistical certainty relative to biological variability
- Creates false confidence in a potentially unrepresentative year.

This is not how salmon survival studies have ever operated in practice.

Why Salmon-level Precision Without Multi-Year Design is Scientifically Unsound (#5)

PUDs had decades of experience studying salmonid passage behavior and survival (tagging [RT, balloon tags, PIT tags]) & approach behavior (hydroacoustic and fyke net studies) before they embarked on compliance tests with the currently established precision requirements.

- Many steps involved in increasing precision

What Grant PUD's RR PLMP Requires for Juvenile Lamprey

- Identify and mitigate project effects on juvenile Pacific Lamprey within 10 years of license issuance.
- Develop juvenile lamprey passage criteria

The license does not:

- Establish a numeric juvenile lamprey survival standard
- Require a compliance determination
- Specify any required standard error (SE) or confidence interval.

Lamprey studies are intended to reduce uncertainty and inform future criteria, not to pass or fail against an existing standard.

The License Relies on Unverified Assumptions that Need Testing

Grant's license relies on several assumptions that have not been empirically validated at Wanapum or Priest Rapids, including:

- Juvenile lamprey migrate low in the water column
- Existing salmon-oriented downstream passage measures (e.g. future unit bypass) will result in negligible harm
- Unscreened turbine intakes do not pose substantial risk

Why this matters: These assumptions are derived largely from other projects and limited dated datasets. A juvenile lamprey study is needed first and foremost to test whether these assumptions hold under project-specific conditions.

Why Salmon-Level Precision (SE<2.5%) is Not the Right Benchmark (#1)

Salmon studies are designed for compliance

For juvenile salmon, precision targets exist because survival estimates are used to:

- Evaluate compliance with numeric survival standards under the Priest Rapids Salmon and Steelhead Settlement Agreement

SE thresholds therefore serve as a **regulatory compliance function**

Why Salmon-Level Precision (SE<2.5%) is Not the Right Benchmark (#2)

Grant has already recognized limits to rigid SE requirements
The Settlement Agreement required Grant to average three years of studies at a time and used the average of the three studies to determine compliance.

This practice reflects the understanding that:

The inter-annual variability in survival, driven by environmental factors (water year, temp, etc.) is often greater than the standard error of a single study.

Additionally:

- At Grant's request, the PRCC evaluated whether SE requirements should be relaxed
- In a 2017 SOA (#2017-2), the PRCC agreed that strict SE requirements are not always necessary, allowing up to 3.5% by committee consensus

Why Applying Salmon SE Targets to Lamprey is Not Appropriate (#1)

For juvenile lamprey:

- There are no numeric survival standards
- There is no compliance test
- The license does not require a specific SE or confidence interval

Data collected are intended to:

- Reduce uncertainty
- Validate or correct license assumptions
- Support future passage criteria development, and
- Mitigation necessary

Why Applying Salmon SE Targets to Lamprey is Not Appropriate (#2)

Applying a salmon compliance-based SE target (e.g. 2.5%) to lamprey:

- Is not supported by the license language
- Is inconsistent with Grant's own approach to variability and precision
- Risks preventing a lamprey study altogether due to feasibility constraints
- Sets a higher bar for lamprey than even Grant has required in practice for salmon.

Key Statement

Grant's juvenile lamprey study obligations are about learning and criteria development, not compliance testing.

Precision requirements should be tied to the decision being supported; Testing license assumptions and identifying risk, not borrowed from salmon studies that were designed for a regulatory compliance.

This approach creates a defensible adaptive pathway from uncertainty to criteria and potential standards.

How Survival Estimate's Should Inform Mitigation Scaling

We agree that the survival value itself matters, because it informs the scale of mitigation:

- A survival value estimate near 98% implies mitigation is scaled to a relatively small loss
- A survival estimate near 70% implies mitigation will be scaled to a much larger loss

However, salmon compliance level precision is not needed to distinguish magnitude of impact.

Requiring extremely high precision up front risks:

- Delaying the study,
- Leaving license assumptions untested, and
- Postponing mitigation decisions entirely

How Survival Estimate's Should Inform Mitigation Scaling

A feasibility study with reasonable precision can:

- Identify the order-of-magnitude of loss,
- Support appropriately scaled mitigation, and
- Be refined through follow-up studies if finer distinctions are needed.

Key Point: **Effect size determines how much mitigation is needed not precision.**

Recommended Framing for Study Design and Precision (#1)

Rather than a single rigid SE target we should advocate for a fit-for-purpose phased approach:

Phase 1 – Assumptions testing

Objectives:

- Characterize passage routes (turbine vs non-turbine)
- Assess survival through Wanapum and Priest Rapids dams
- Evaluate whether "negligible harm" assumptions are valid

Recommended Framing for Study Design and Precision (#2)

Phase 2 – Criteria Development (if warranted)

Use Phase 1 results to:

- Refine study design,
- Improve precision where it matters for management decisions
- Support development of juvenile lamprey passage criteria

Phase 3- Mitigation (only if standards are established)

Salmon-like precision targets would only become relevant if and when numeric lamprey standards exist.

What Chelan PUD's RR PLMP Requires for Juvenile Lamprey (Section 4.2.3)

- **Measure the type and magnitude of ongoing Project impacts** on juvenile lamprey downstream passage
- Address:
  - Juvenile lamprey **migration timing**
  - Juvenile lamprey **passage survival through the Project**
- Use **"appropriate and reasonable methodologies"**
- Consult with the RRFF to:
  - Develop the means to provide sufficient numbers of juvenile lamprey for evaluation
- Initiate and conduct **preliminary evaluations** within the first five years of the new license.
- Optionally: Contribute to regional or local lamprey investigations to gain efficiencies in method development.

What Chelan's License Does Not Require

- Establish numeric juvenile lamprey survival standards
- Define a compliance threshold
- Specify a required standard error or confidence interval
- Require replication across multiple years
- Require the study to support a pass/fail determination

The license instead emphasizes:

- **Type and magnitude of impacts**, and
- **Appropriate and reasonable methodologies**.

Key Statement

- The RR PLMP language is calling for an early-stage impact characterization framework, not a compliance monitoring framework.

- Chelan's obligation is framed around **measurement** & **characterization of impacts**, not compliance with pre-defined standards.

Our YN Interpretation

- Chelan's juvenile lamprey requirement is fundamentally about measuring the **type** and **magnitude** of impacts using **reasonable methods** (not meeting salmon compliance standards).
- Precision should be scaled to the management decisions being supported and paired with an appropriate study structure.
- Applying salmon SE targets without salmon replication requirements is inconsistent with both the license language and sound study design.

What "Appropriate and Reasonable Methodologies" Actually Implies

Chelan's RR PLMP gives both flexibility & direction

"**Appropriate and Reasonable**" means:

- Methods suited to:
  - 1) Species biology, 2) Life stage, 3) Expected abundance, and 4) Study feasibility
- Methods that:
  - Produce informative results within cost and logistical constraints,
  - Do not increase de facto barriers to study implementation

Key Statement

A requirement that:

- Adopts salmon SE standards,
- Without salmon replication requirements
- And risks no study being feasible

Is **not reasonable**, even if well intentioned.

How Survival Estimate's Should Inform Mitigation Under Chelan's License

Chelan's RR PLMP requires:

- Measuring type and magnitude of impacts

"Effect Size," not precision drives the magnitude of mitigation. Salmon level precision is only necessary if very small differences in survival would materially change mitigation decisions.

A "Fit-For-Purpose" Approach that Aligns with Chelan's RR PLMP

A defensible Chelan-specific framing:

Phase 1 – Impact Characterization and Method Development

- Objectives
  - Identify dominant passage routes,
  - Estimate order-of-magnitude survival
  - Characterize migration timing
- Precision:
  - Sufficient to distinguish large vs small impacts
  - Not salmon-compliance SE

A "Fit-For-Purpose" Approach that Aligns with Chelan's RR PLMP

Phase 2 – Refinement (if needed)

- Triggered if Phase 1 indicates:
  - Substantial losses
  - Turbine-dominated passage
  - Or uncertainty that materially affects mitigation design or decisions
- Precision increases only where it changes decision making.

Phase 3 – NNI Mitigation

Potential Mitigation?

Grant PUD?

1. Adult Trap & Haul (Priest Rapid, Wanapum dams?)
2. Artificial Propagation
3. Lamprey Fund
4. …
5. …

Chelan PUD?

1. Adult Trap & Haul (Chelan Dams?)
2. Artificial Propagation
3. Tumwater Dam
4. Dryden Canal
5. Lamprey Fund

Potential Pre-Study Actions?

Grant PUD?

1. Collection at dams?
2. Fyke net studies?
3. …
4. …
5. …

Chelan PUD?

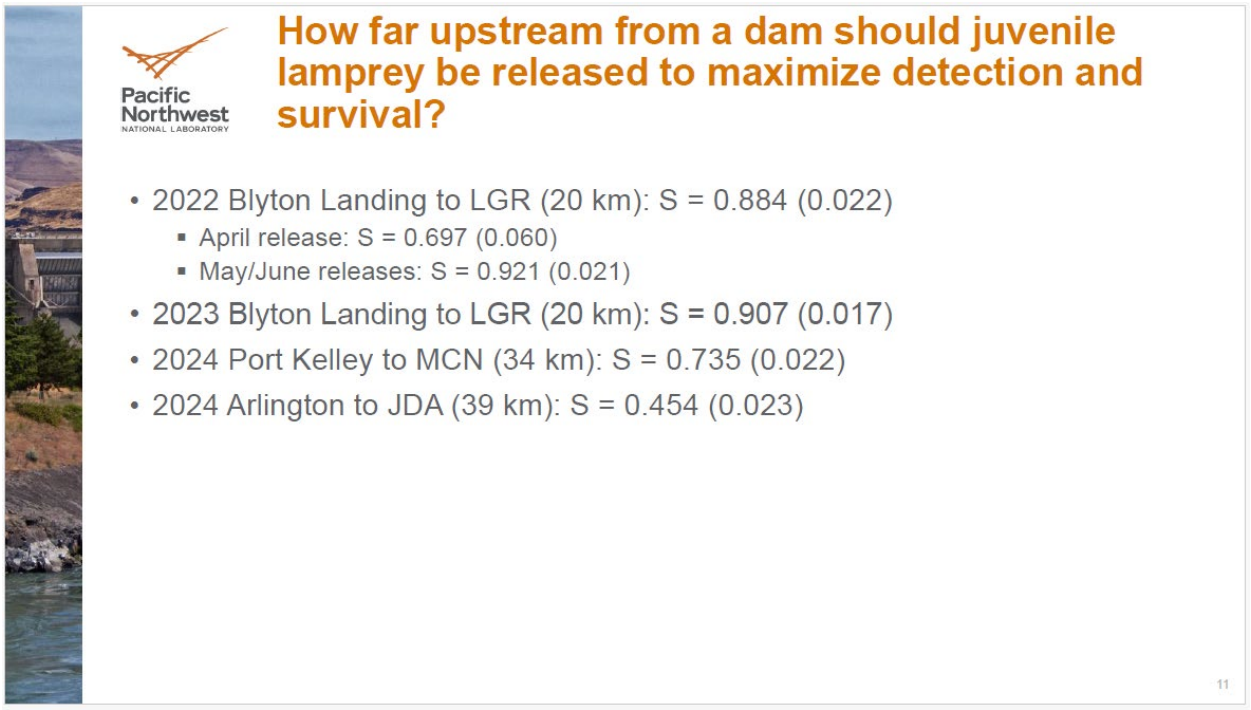
1. Bypass release testing
2. Fyke net studies?
3. PIT tag release detections
4. Dryden Canal juvenile collection
5. …

Key Questions to Consider

1. What difference in survival rates would actually change mitigation response? (1%? 5%? 10%?)
2. Why is salmon level SE needed when the license does not require multi-year averaging or compliance testing?
3. What happens if salmon level SE is not achievable? Is no study preferable to a study that provides an overview of survival and impacts?
4. What are **appropriate and reasonable methodologies** in the context of lamprey biology and feasibility?

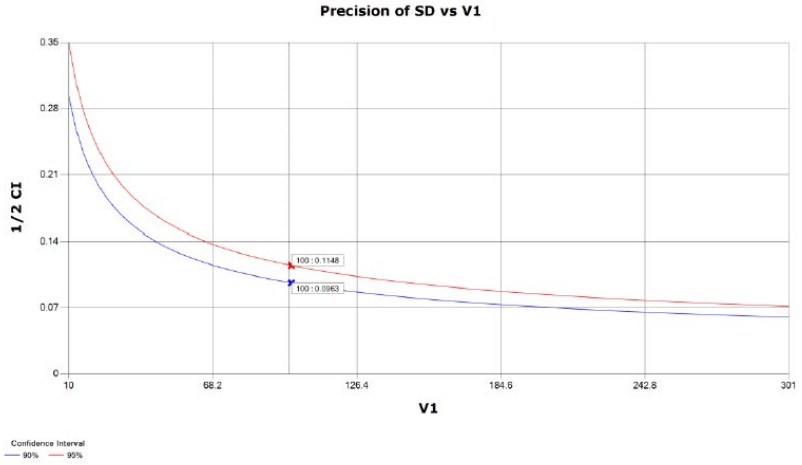
Attachment 2

Juvenile Pacific Lamprey Power Analysis Slide Provided by Ryan Harnish



What is the relationship between sample size (i.e., number of juveniles tagged) and precision of route-specific survival rates?

- Assumptions: ViRDCt; D_1 = 100; S_D = 0.75; λ = 0.7; ϕ = 0.3; p = 0.98



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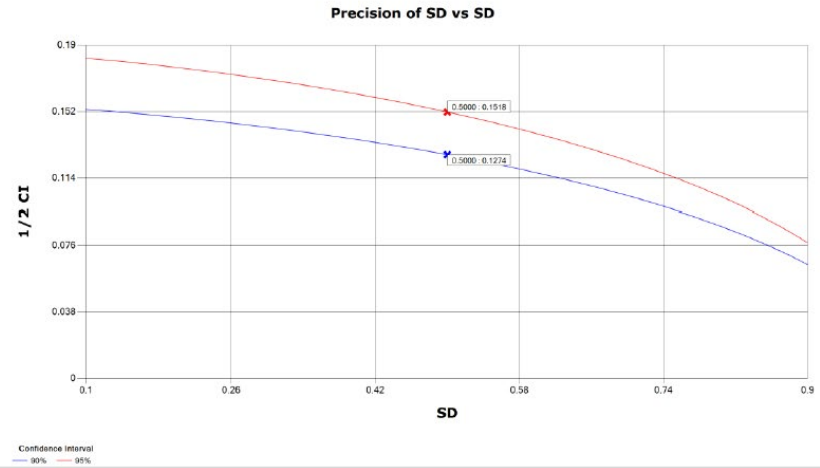
What is the relationship between survival and precision of route-specific survival rates?

- Assumptions: ViRDCt; D_1 = 100; V_1 = 100; λ = 0.7; ϕ = 0.3; p = 0.98



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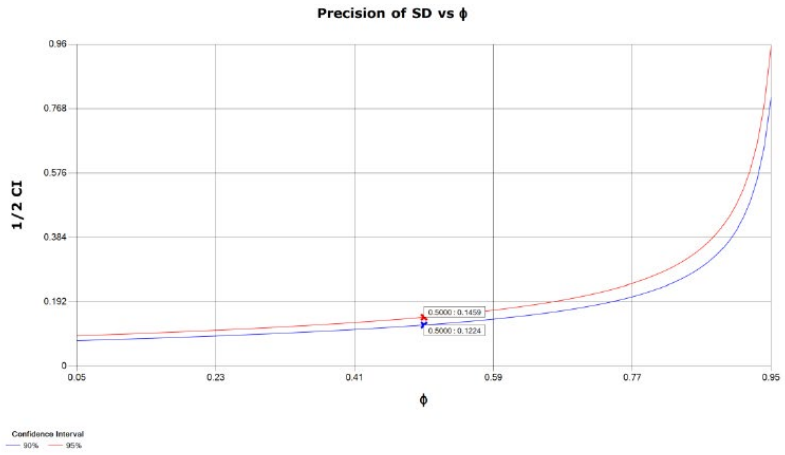
What is the relationship between dead fish detection rate and precision of route-specific survival rates?

- Assumptions: ViRDCt; $D_1 = 100$; $V_1 = 100$; $S_D = 0.75$; $\lambda = 0.7$; $p = 0.98$



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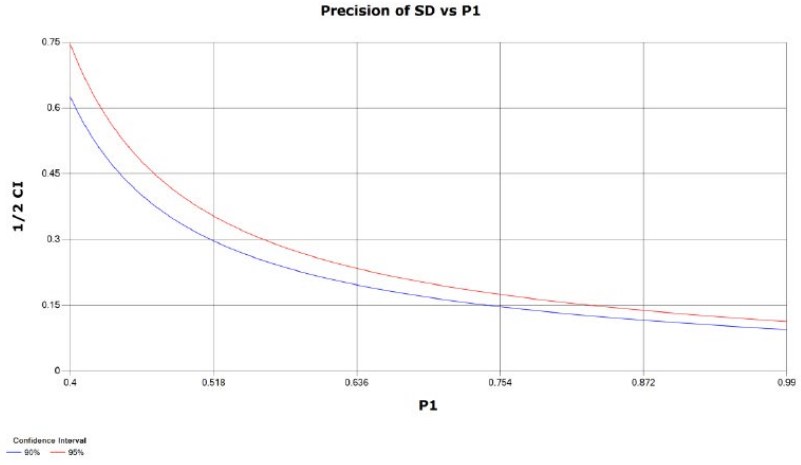
What is the relationship between detection probability and precision of route-specific survival rates?

- Assumptions: ViRDCt; $D_1 = 100$; $V_1 = 100$; $S_D = 0.75$; $\lambda = 0.7$; $\phi = 0.3$



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What level of precision can be expected in survival estimates?

- 2022 LGR: V_1 = 270; S_D = 0.911; SE = 0.029
- 2023 LGR: V_1 = 312; S_D = 0.815; SE = 0.044
- 2023 LMN: V_2 = 178; S_D = 0.867; SE = 0.059
- 2024 MCN: V_1 = 306; S_D = 0.739; SE = 0.044
- 2024 JDA: V_2 = 232; S_D = 0.714; SE = 0.032

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