MEMORANDUM

TO: Council Members
FROM: Mark Fritsch
SUBJECT: Update on Pacific lamprey runs in the Columbia River Basin and translocation successes

BACKGROUND:

Presenter: Laurie Porter and Jon Hess from the Columbia River Inter-Tribal Fish Commission (CRITFC)

Summary: Laurie will provide a summary on the current run of Pacific lamprey in the Columbia River Basin, and a brief overview of activities associated with the tribal projects being implemented through the Program. Jon will provide an overview of successful Pacific Lamprey translocation efforts in the Snake River that have increased overall abundance and productivity. Recent results have shown that adult offspring are returning in increasing numbers to Bonneville Dam as a direct result of the translocation programs of the Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes and Bands of the Yakama Nation, and Nez Perce Tribe.

The summary and overview are a complement to the presentation at the May Council meeting that provided a review of the status of Pacific Lamprey conservation and restoration efforts throughout the U.S. range with an emphasis on the Program’s support for the Pacific Lamprey Conservation Initiative activities in the Columbia River Basin.
Relevance: The Fish and Wildlife Program (Program) recognizes Pacific Lamprey as not only an ecologically important species, but also a key cultural species in the Columbia Basin. This report addresses the 2014 Program’s Emerging Priority #5\(^1\). In addition, the Program also addresses several specific measures in the Program’s Lamprey strategy regarding lamprey passage and monitoring.

Workplan: Fish and Wildlife Division work plan 2022; Program Implementation and performance.

Background: Pacific Lamprey, *Entosphenus tridentatus* (formerly *Lampetra tridentata*), have inhabited the Pacific for millions of years. Historic runs of Pacific Lamprey in the Columbia River Basin numbered in the hundreds of thousands, but their distribution and abundance have decreased and currently they return in drastically smaller numbers. They migrate from the mouth of the Columbia River to Chief Joseph and Hells Canyon dams, in the mainstem Columbia and Snake rivers, respectively. Threats to Pacific Lamprey occur throughout the entire range of the species and include but are not limited to: restricted mainstem and tributary passage, reduced flows and dewatering of streams, stream and floodplain degradation, degraded water quality, predation and changing marine and climate conditions.

In 1994, the Council approved the first lamprey project in the Fish and Wildlife Program. The project (Project #1994-026-00, *Pacific Lamprey Research and Restoration Project*) proposed by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) called for research and restoration of Pacific Lamprey throughout tribal ceded lands. This was followed by additional projects in 2002, 2007, 2008 and 2018 (see Table 1). Currently, there are six active projects that focus on Pacific Lamprey funded through the F&W Program. These projects have a variety of goals and objectives, but generally aim at establishing population status and trends, documenting distribution, identifying limiting factors, and develop reintroduction and supplementation actions.

<table>
<thead>
<tr>
<th>Project #</th>
<th>Project Title</th>
<th>Sponsors</th>
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<tbody>
<tr>
<td>1994-026-00</td>
<td>Pacific Lamprey Research and Restoration Project</td>
<td>Confederated Tribes of the Umatilla Indian Reservation, NOAA</td>
</tr>
<tr>
<td>2008-308-00</td>
<td>Willamette Falls Lamprey Escapement Estimate</td>
<td>Confederated Tribes of the Warm Springs</td>
</tr>
</tbody>
</table>

\(^1\) Emerging priority #5 – Implement additional sturgeon and lamprey measures (passage and research).
Prior to and concurrent with the work above, the Lamprey Technical Workgroup (LTWG), active since 1995, assisted the region in providing guidance and recommendations to the Anadromous Fish Committee of the Columbia Basin Fish and Wildlife Authority. In 2011, the *Tribal Restoration Plan for the Columbia River Basin* (TPLRP) was completed which outlined objectives to halt the decline of Pacific Lamprey and restore them throughout their historical range for ecological health and tribal cultural use. With the development of the *Pacific Lamprey Assessment (Assessment)* and Template for Conservation Measures by USFWS in 2011 (and revised by PLCI partners in 2018) which noted and built upon the needs and actions identified in the TPLRP, there was a need to solidify regional commitments for lamprey actions and in response a *Conservation Agreement for Pacific Lamprey* (Agreement) was signed in 2012 by tribal, state and federal partners in the region to collaborate on efforts that reduce or eliminate threats to Pacific Lamprey. The goal of the Agreement is to achieve long-term persistence of the species.

In addition, an aspect of Project #2008-524-00, *Implement Tribal Pacific Lamprey Restoration Plan*, which is managed by the Columbia River Inter-Tribal Fish Commission working with the USACE, targeted development of a Passage Improvement Plan as part of the Agreement. The goal of this 10-year plan was to improve adult and juvenile passage and survival through the Federal Columbia River Power System with emphasis on improvements at Bonneville, John Day, and McNary dams.

To demonstrate and reaffirm the importance of Pacific Lamprey to the ecological needs of the Basin and to respect the importance to the Tribal sovereigns, the Council recognized, and supported the TPLRP and Agreement in the 2014 Fish and Wildlife Program (see page 94). This was also confirmed by the need to integrate and take the necessary steps to implement additional lamprey measures into the Program².

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² Emerging priority #5, page 116: Implement additional sturgeon and lamprey measures (passage and research).
On March 14, 2018 the Council approved Project #2017-005-00, *Pacific Lamprey Conservation Initiative* as one of the most recent projects to be approved for the direct Program. The Oregon Department of Fish and Wildlife codified their *Conservation Plan for Lampreys*, which includes Pacific Lamprey in 2019.
Update on Pacific Lamprey runs and translocation successes in the Columbia River Basin

NWPCC
Laurie Porter  Columbia River Inter-Tribal Fish Commission
Jon Hess      Columbia River Inter-Tribal Fish Commission
"Here are my friends"

The late Elmer Crow, Nez Perce, who dedicated the final years of his life to helping restore his “eels.” Here, he is showing a net full of Pacific lamprey at the Nez Perce Tribal Hatchery awaiting out planting into the wild streams and rivers in Idaho.
Plan Vision: Pacific lamprey are widely distributed within the Columbia River basin in numbers that fully provide for ecological, tribal cultural and harvest values.

Plan Goal: Immediately halt population declines and prevent additional extirpation in tributaries. Reestablish lamprey as a fundamental component of the ecosystem. Restore Pacific lamprey to sustainable, harvestable levels throughout the historical range and in all tribal usual and accustomed areas.

Numeric Goals: Columbia River Basin

• 2012 - Halt decline
• 2020 - 200,000 adults (based on 2002–2003 Bonneville Dam counts)
• 2035 - 1,000,000 adults (from 1950s–1960s Bonneville Dam counts)
• 2050 - Restore lamprey to sustainable, harvestable levels throughout their historic range
In the absence of quantitative goals and objectives based in hydropower loss assessments, contribute to achieving the following adult abundance and other population targets for Pacific lamprey:

• **L1** - Adult Pacific lamprey abundance target of a three-year rolling average of 200,000 at Bonneville Dam by 2025, progressing toward 1,000,000 by 2035.

• **L2** - Reduce the risk of extirpation and improve adult abundance toward sustainable harvestable levels across the historic distribution and range of Pacific lamprey in the Columbia basin, including across all six Pacific Lamprey Regional Management Units (RMU), measured every five years.

• **L3** - Improve passage efficiency for adult Pacific Lamprey to an interim standard of at least 80 percent at each dam on the mainstem Columbia and Snake rivers.

• **L4** - For juvenile lamprey, improve passage efficiency and survival progressing toward standards used to measure juvenile salmonid survival.
Return and Spawn
Adults return to freshwater, possibly attracted by pheromones produced by lamprey larvae living in the stream. Depending on their maturity, they will spawn immediately or wait up to three years after returning. Females can produce over a quarter million eggs.

Larval Stage
After a 19-day incubation, eyeless lamprey larvae (ammocoetes) emerge and burrow into stream bottoms and filter feed. 4-10 years

Metamorphosis
Develop eyes and sucking disc with teeth and a rasping tongue to become macrophthalmia (smolts) and migrate to the ocean.

Ocean Stage
Adult lampreys prey on hake, walleye, pollock, salmon, and other fish in the ocean. They may travel long distances attached to their prey. 1-7 years
Buckaroo Dam
Bruneau River, Idaho
early 1900’s
Adult Pacific Lamprey Dam Counts
IH, LoMo, LGS, LGR

[Bar chart showing dam counts for IH, LoMo, LGS, and LGR from 1999 to 2021]
Escapement past dams: HD PIT

- Slightly above average passage: BON, TDD, JDD
- Slightly below average passage: MCN, IHD, PRD

Keefer et al., 2019
Eels at Willamette Falls. 7-15-13
Bonneville Dam counts and Willamette Falls escapement estimates for Pacific Lamprey
Confederated Tribes of the Umatilla Indian Reservation Translocation
Nez Perce Tribe Translocation

NPT Translocation Totals

[Chart showing translocation numbers from 2006 to 2021 for different categories: BOU, TDA, JDA, CTUIR, YIN, Total]
Yakama Nation Translocation
Outline

● the dataset of the published study
● larval and juvenile boost
● Snake River juvenile abundance
● Snake River natal-origin adults at BON?
● ocean residence time?
● Juvenile-to-Adult-Return (JAR) model
● Snake River translocation adults at BON?
● yeah, your model says so, but really?!
● preference of migration route? Willamette vs BON

DOI: 10.1002/tafs.10359263
the dataset of the published study

Translocation program
Primary goal- Interim abundance of larvae

Secondary goal- direct & indirect boost abundance of all life stages

Ultimate goal- restore ecosystem services & sustainable harvest

Genetic monitoring
Measure direct success

Direct success = larval, juvenile, and adult offspring
the dataset of the published study

N = 25,856
Parent = 6,899
Larvae from Tran. Sites = 3,481
SNPs = 260
Natal origins from Parentage & Sibship

- Putative volitional
- Translocation
larval and juvenile boost

Direct boost for larval and juvenile abundance?

Presence of translocation larval offspring confirmed!
1,982 parent assignments, 89% in translocation areas
Snake River juvenile abundance

Larval/Juvenile Abundance LGR 2011

Estimated abundance

Larval/Juvenile Abundance LGR 2012

Estimated abundance

Larval/Juvenile Abundance LGR 2013

Estimated abundance

Larval/Juvenile Abundance LGR 2014

Estimated abundance

Larval/Juvenile Abundance LGR 2015

Estimated abundance

Larval/Juvenile Abundance LGR 2016

Estimated abundance

Larval/Juvenile Abundance LGR 2017

Estimated abundance

Larval/Juvenile Abundance LGR 2018

Estimated abundance

Snake River juvenile abundance
Snake River natal-origin adults at BON?

Estimated abundance of adults at Bonneville Dam

Estimated abundance of larvae and juveniles at Lower Granite Dam

Collection year

Lower Granite Dam Juvenile Cohort 2011

Juveniles at Lower Granite Dam

Adults at Bonneville Dam
ocean residence time?

5.5 ocean years

Lower Granite Dam Juvenile Cohort 2011

Estimated abundance of adults at Bonneville Dam

Estimated abundance of larvae and juveniles at Lower Granite Dam

Collection year

Juveniles at Lower Granite Dam

Adults at Bonneville Dam
Juvenile-to-Adult-Return (JAR) model

Lower Granite Dam Juvenile Cohort 2011

Estimated abundance of larvae and juveniles at Lower Granite Dam

Collection year

Estimated abundance of adults at Bonneville Dam

Juvenile-to-Adult-Return (JAR) = 10,585 / 6,693 = 1.58
Snake River translocation adults at BON?

Estimated abundance of larvae and juveniles at Lower Granite Dam

Collection year
- 2011: 2.4%
- 2012: 1.3%
- 2013: 19.1%
- 2014: 19.1%
- 2015: 5.4%
- 2016: 15.3%
- 2017: 11.2%
- 2018: Volitional offspring
- 2019: Translocation offspring
Estimated abundance of larvae and juveniles at Lower Granite Dam

Projected # of adults from Snake River translocations

Migration Year at Bonneville Dam

LGR2013
LGR2014
LGR2015
LGR2016
LGR2017
LGR2018

total_TL

Snake River translocation adults at BON?
Snake River translocation adults at BON?
Newsome Creek

2007

yeah, but really?!

Bonneville Dam Pacific Lamprey Adult Migration Year 2021

Snake_TL, 371, 0.5%

Umatilla_TL, 102, 0.1%

Yakima_TL, 561, 0.7%

Snake, 8,806, 10.8%

Umatilla, 1,173, 1.4%

Yakima, 285, 0.3%

MidC, 2,549, 3.1%

Fifteenmile, 586, 0.7%

Olympic, 25, 0.0%

Clackamas, 76, 0.1%

Unknown, 67,031, 82.2%

Translocation = 1,034 adults

Run size: 81,566

MY21

Projected # of adults from Snake River Run

Migration Year at Bonneville Dam
preference of migration route?

Willamette Falls
Willamette River

Bonneville Dam
Columbia River

water?...check.
passage?...check
friends?...
Cohort 2011

Bonneville = 3,014 (97%)

Willamette = 78 (3%)

Total = 3,092

Preference of migration route?
Conclusions

- Snake River natal-origins adults at BON? Yes they return!
- Ocean residence time? 5+ years!
- Juvenile-to-Adult-Return (JAR) model 1.6 larvae/juveniles to 1 adult return
- Snake River translocation adults at BON? 700+ could return by 2023
- Yeah, your model says so, but really?! 300+ Snake River adults in 2021!
- Preference of migration route? 97% return to BON compared to WIL

Photo credit: Jeremy FiveCrows
Acknowledgments

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