FINAL Pacific Lamprey 2022/2023

Regional Implementation Plan

for the

Willamette Sub-Unit *of the*

Lower Columbia/Willamette

Regional Management Unit

Submitted to the Willamette RMU Team in June 2023

Primary Authors		Primary Editors
Jen Poirier	USFWS	
Ann Gray	USFWS	
Ben Clemens	ODFW	

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I. Introduction

This is the annual Regional Implementation Plan (RIP) report developed for the Willamette Sub-Unit of the Lower Columbia River/Willamette Regional Management Unit (Willamette RMU). RIPs for the Willamette RMU are updated each year as warranted, primarily based on new information provided by the Willamette RMU Team (Team). This Willamette RIP is not intended to be comprehensive in the information provided, but provide an overview of the RMU, and the status of Pacific lamprey within the RMU, including the primary threats and significant restoration actions that affect this species. This report and earlier versions are available on the Pacific Lamprey Technical Workgroup webpage (www.pacificlamprey.org/ltwg/). The 2022 Annual meeting notes are appended to this plan (Appendix A).

II. Status and Distribution of Pacific Lamprey in the RMU

A. General Description of the Willamette River Sub-Unit

The Willamette Sub-Unit of the Lower Columbia River/Willamette Regional Management Unit is comprised of twelve 4th field HUCs that are situated within three Environmental Protection Agency (EPA) Level III Ecoregions: Coast Range, Willamette Valley and Cascades (Figure 1, Table 1).

Table 1. Drainage Size and Level III Ecoregions of the 4th Field Hydrologic Unit Code (HUC) Watersheds located within the Willamette Sub-Unit.

Watershed	HUC Number	Drainage Size (km2)	Level III Ecoregion(s)
Middle Fork	17090001	3,540	Willamette Valley
Coast Fork Willamette	17090002	1,726	Coast Range
Upper Willamette	17090003	4,850	Willamette Valley
McKenzie	17090004	3,468	Willamette Valley, Cascades
North Santiam	17090005	1,979	Willamette Valley, Cascades
South Santiam	17090006	2,696	Willamette Valley, Cascades
Middle Willamette	17090007	1,841	Willamette Valley
Yamhill	17090008	1,999	Coast Range
Molalla-Pudding	17090009	2,267	Willamette Valley, Cascades
Tualatin	17090010	1,836	Coast Range, Willamette Valley
Clackamas	17090011	2,442	Willamette Valley, Cascades
Lower Willamette	17090012	1,668	Willamette Valley

Figure 1. Map of watersheds within the Lower Columbia River/Willamette Regional Management Unit.

B. Status of Species

Abundance

Historical run estimates of Pacific lampreys within the Willamette Basin are not available; however, the annual commercial harvest of lampreys from 1943 to 1951 was estimated to be between 100,000 and 500,000 thousand individuals (Kostow 2002). To be clear, these numbers do not reflect lamprey that escaped harvest to spawn. Because of this abundance relative to adult lamprey counts at Bonneville Dam, Kostow (2002) suggested the Willamette Basin was likely the most important production area for Pacific Lamprey in the Columbia River Basin.

From 2010 to 2019, the Confederated Tribes of Warm Springs Reservation of Oregon have collected information to estimate the abundance of Pacific Lamprey adults at Willamette Falls (Falls) and the number passing the Falls through the fishways. Average estimates are 185,825 adults (abundance at the Falls) and 60,044 adults (passing above the Falls; Table 2). Commercial harvest of lamprey no longer occurs at Willamette Falls, but several tribes continue to harvest lampreys in the summer each year.

Distribution and Connectivity

Historical occupancy of Pacific Lamprey was extensive throughout the Lower Columbia/Willamette RMU. From the previous threats assessment, Luzier et al. (2011) estimated that the current distribution was reduced 50-70% from historical ranges. Current distribution of lamprey in the Willamette Sub-Unit is strongly related to physical migration barriers (Figure 2). Twenty large dams are present within the Willamette Sub-Unit; 13 are owned and operated by the U.S. Army Corps of Engineers' (Corps or USACE) and collectively referred to as the Willamette Valley Project. At this time, no USACE dam provides upstream lamprey passage. Other large dams are for either non-federal hydropower production or water supply. See "Passage" for more discussion on dam passage.

Of the estimated 371 dams present in the Willamette Basin, approximately 148 are privately owned and used primarily for the purposes of irrigation. The greatest concentration of dams can be found in the Tualatin (82) and Yamhill (65) watersheds (Hulse et al. 2002). Culverts are also widespread throughout the watersheds of the Willamette Sub-Region and impact Pacific Lamprey distribution to an unknown extent.

Recent information collected for the 2023 Threats Assessment during the 2022 RMU meetings was used to update the percentage of historical distribution still currently occupied. Intrinsic potential for Winter Steelhead (or Spring Chinook where Winter Steelhead were not historically present) was used as a surrogate estimate for historical Pacific Lamprey distribution.

Population Structure

Previous studies have suggested a lack of genetic population structure (e.g., Goodman et al. 2008; Spice et al. 2012). However, these studies have focused on large geographical areas and have not controlled for time. Recently, two independent studies on adult Pacific Lamprey, conducted in different years and using different genetic tools have reported evidence for some genetic differentiation among a relatively small body size, early migrating run, and a larger, later migrating run of adult Pacific Lamprey at Willamette Falls (Hess et al. 2015; Clemens et al. 2017a). Moderate genetic differentiation of adult Pacific Lamprey also occurred across years in

the Willamette River Basin (Clemens et al. 2017a). Other genetic studies of Pacific Lamprey have suggested regional genetic differentiation among populations from California to Alaska (Hess et al. 2013, 2020).

Table 2. Estimated Pacific Lamprey adult abundance, and numbers at Willamette Falls 2010-2019, the percent of total that were harvested and percent of total numbers that passed above and remained below Willamette Falls (Baker and McVay 2018 (data through 2017), L. Collamer (Confederated Tribes of the Warm Springs, pers. comm.; data for 2018 and 2019).

Year	Total Abundance At Willamette Falls	Percent Harvested	Numbers Passing Willamette Falls	Percentage Passing	Numbers below Falls
2010	64,388	2.5%	27,043	42%	37,345
2011	107,383	4.0%	46,819	44%	60,564
2012	243,048	2.7%	111,559	46%	131,489
2013	173,821	4.3%	49,365	28%	124,456
2014	336,305	1.1%	125,778	37%	210,527
2015	168,398	1.3%	32,112	19%	136,286
2016	115,682	2.3%	32,148	28%	83,534
2017	277,577	2.3%	80,848	29%	196,729
2018	--	--	36,931	--	--
2019	--	--	57,838	--	--
Average	**185,825**	**2.6%**	**60,044**	**34%**	**122,616**
Median	**171,110**	**2.4%**	**48,092**	**33%**	**127,973**

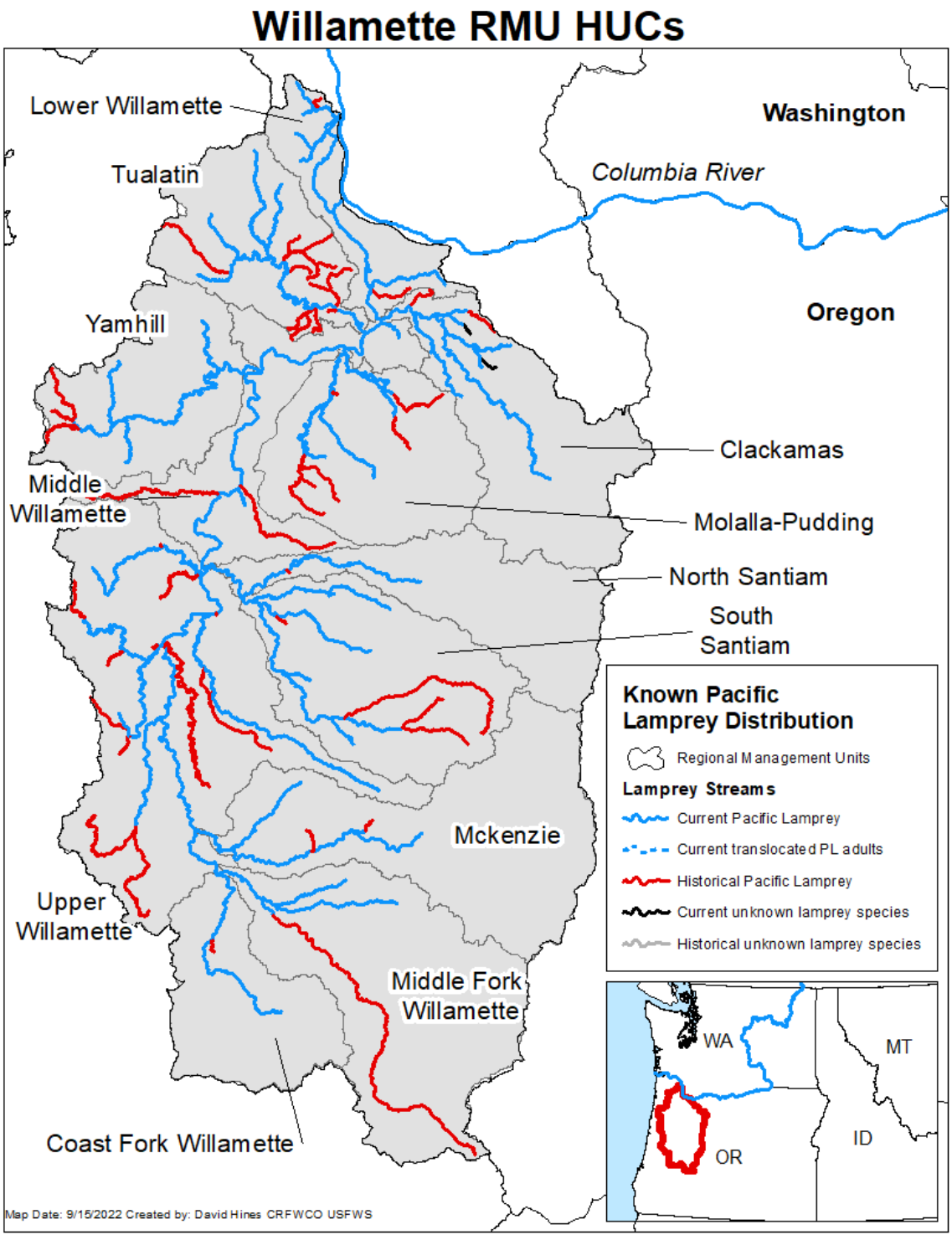

Figure 2. Current and historical distribution for Pacific Lamprey (based on known observation data) for the Willamette Regional Management Unit (USFWS Data Clearinghouse 2022).

C. Pacific Lamprey Assessment and Updates

Every five years the Pacific Lamprey Conservation Initiative (PLCI), through the information gathered from each RMU Team, revises the Pacific Lamprey Assessment (USFWS 2019). The Assessment uses local stakeholder knowledge and expertise to evaluate Pacific Lamprey distribution, population demographics and threats at the 4th field HUC watershed level. This information is used to inform NatureServe, a diagnostic tool that characterizes the conservation risk of Pacific Lamprey across their historical range. Information about current Pacific lamprey distribution, population size, trends, and watershed threats were collected from stakeholders in the Willamette sub-region through an online Assessment questionnaire and virtual meeting held on April 22, 2022. The following is a brief summary of key findings that will feed into the 2023 Pacific Lamprey Assessment.

The median from the abundance estimates from Confederated Tribes of Warm Springs Reservation (Table 2) and distribution of tagged upstream migrants (proportion) from a migration study by Clemens et al. (2017a) were used to roughly estimate the current number of adult lamprey in each of the Willamette watersheds above Willamette Falls (HUCs; Table 3). These estimates were then used to assign the appropriate bin ranking (A through F) for the current population input to the NatureServe Model. No information was available on distribution below Willamette Falls, and a 50/50 split was assumed between the Clackamas and the Lower Willamette watersheds to determine the appropriate bin ranking.

Increased attention on Pacific Lamprey has increased our understanding of this species in the Willamette Basin. Monitoring efforts, in which lamprey are either the target species or information is collected during other species' monitoring, have expanded the amount of information available and the quality of this information. While the scope and severity of several threats increased due to increased information and understanding, and distribution of lampreys within watersheds changed in some instances, overall the NatureServe conservation status ranks remained the same for all Willamette HUCs in 2022 (Table 4) relative to those from 2017.

The Willamette RMU team agreed there has been a substantial decline in lamprey populations that likely occurred in the in the 1960s and 1970s as a result of dam construction, channel straightening/simplification and other factors. Insufficient data were available to assess short-term population trends for many of the watersheds within the Willamette. However, the team thought sufficient information or condition in the habitat within 3 HUCs suggested the short-term population trends were relatively stable (Table 4).

Table 3. Estimated adult Pacific Lamprey abundance by watershed, based on available population estimates (rounded to the nearest 100) at Willamette Falls (see Table 2) and percent distribution of radio-tagged upstream migrant adult lamprey for watersheds above Willamette Falls (Clemens et al. 2017a). Distribution below Willamette Falls is unknown, so the numbers of lamprey that did not pass Willamette Falls were equally divided between the Lower Willamette and Clackamas HUCs.

	Distribution Above Willamette Falls	**Estimated Adult Population by Watershed**	**Resulting Bin for use in NatureServe Model 2022**
Middle Fk Willamette	0.3%	145	50-250 **B**
Coast Fk Willamette	1.2%	580	250–1,000 **C**
Upper Willamette	44.1%	21,172	10K-100K **F**
McKenzie	1.5%	725	250–1,000 **C**
N. Santiam	2.1%	1,015	1000-2500 **D**
S. Santiam	2.1%	1,015	1000-2500 **D**
Middle Willamette	39.3%	18,852	10K-100K **F**
Yamhill	3.9%	1,885	1000-2500 **D**
Molalla-Pudding	4.8%	2,320	1000-2500 **D**
Tualatin	0.6%	290	250–1,000 **C**
TOTAL	**100%**	**48,000**	
BELOW FALLS:			
Clackamas	50%	64,000	10K-100K **F**
Lower Willamette	50%	64,000	10K-100K **F**
TOTAL	**100%**	**128,000**	

Table 4. Population demographic and conservation status ranks of the 4th Field HUC watersheds located within the Willamette sub-region. Note – steelhead or chinook intrinsic potential was used as a surrogate estimate of historical lamprey range extent in areas where historical occupancy information was not available. Conservation Status Ranks did not change from the 2018 Assessment, and as defined as follows:

S1 = Critically imperiled in the jurisdiction because of extreme rarity or because of some factors such as very steep declines making it especially vulnerable to extirpation;

S2 = Imperiled in the jurisdiction because of rarity due to very restricted range, very few occurrences, steep declines, or other factors making it vulnerable steep declines making it especially very vulnerable to extirpation;

S3 = Vulnerable in the jurisdiction due to restricted range, relatively few occurrences, recent and widespread declines, or other factors making it vulnerable to extirpation.

Watershed	Conservation Status Rank	Historical Occupancy (km^2)	Current Occupancy (km^2)	Population Size (adults)	Short-Term Trend (% decline)
Middle Fork	S1	1,000-5,000	100-500	50-250	Unknown
Coast Fork Willamette	S1	250-1,000	20-100	250-1,000	Unknown
Upper Willamette	S1	1,000-5,000	500-2,000	10,000-100,000	Unknown
McKenzie	S2	1,000-5,000	100-500	250-1,000	Stable
North Santiam	S1	250-1,000	100-500	1,000-2,500	Unknown
South Santiam	S1	1,000-5,000	100-500	1,000-2,500	Unknown
Middle Willamette	S1	1,000-5,000	100-500	10,000-100,000	Unknown
Yamhill	S1	1,000-5,000	100-500	1,000-2,500	Unknown
Molalla-Pudding	S1	1,000-5,000	100-500	1,000-2,500	Unknown
Tualatin	S1	1,000-5,000	100-500	250-1,000	Unknown
Clackamas	S3	1,000-5,000	100-500	10,000-100,000	Stable
Lower Willamette	S1	250-1,000	100-500	10,000-100,000	Stable

D. Summary of Major Threats

The key threats within the Willamette Sub-Unit were identified by RMU participants during the 2022 Assessment revision meeting in April 2022 (Table 5), to update the 2017 Risk Assessment. Key threats are defined as those threats in which the average scope and severity across all HUCs was greater than 2.5 on a scale from 1- 4 (>3.5 = High, 2.5- 3.49 =Moderate, 1.5- 2.49=Low and <1.5= Insignificant; U=Unknown). The first Risk Assessment (Luzier et al. 2011) was updated in 2017 (USFWS 2019) and will again be updated in 2023. The discussions that follow reflect the 2022 information that will be included in the 2023 revision. Risk Assessments are revised approximately every 5 years.

Climate change, stream and floodplain degradation, water quality and dewatering and flow management are the highest ranking threats in the Willamette Sub-Unit, followed closely by passage (Table 5). The biggest shift in the threat ranking was for Climate change, which went from an "unknown" magnitude of threat in the Willamette to a high threat across all watersheds. This trend occurred not just within the Willamette rankings, but for all RMUs in Oregon. The potential impacts of Climate change highlight the importance to address other ongoing high priority threats, such as passage, stream and floodplain degradation, water quality and predation. Addressing these threats will help ameliorate climate change impacts, increase the quantity and quality of native fish habitats, and increase lamprey population resilience to a changing climate.

Previously, the 2017 rank assessment split several of the threats into “dam-related” threats and “non-dam related” threats, given the prevalence of large dams in the Willamette Basin. Dams affect multiple parameters (passage, water quality, seasonal baseflows and flood flows (timing, magnitude and duration), floodplain dynamics, habitat (e.g. inundation of habitat, loss of coarse sediment supply), and species composition (e.g. habitat suitability, predator/prey dynamics). In 2017, the Willamette RMU Team made this distinction to better identify the cause of the threats and ensure some threats were not masked by the presence of the dams. However, this split was not done in the 2022 threats ranking, as it is more time consuming, inconsistent with all other RMUs’ ranking approach, and ultimately did not affect the NatureServe model results.

Climate Change

Climate change was the highest ranking threat across all watersheds within the Willamette Basin (Table 5). Increased fires throughout the Willamette Basin in recent years along with continued drought-like conditions and the resulting impacts to rivers and fisheries were of great concern. Climate change is happening faster and more intensely than anticipated and the combined effects of climate change (e.g., changes to ambient temperature, precipitation, and streamflow patterns) and predicted rise in human population and water demand will likely exacerbate other threats within the sub-region. Climate change is likely to alter the amount, timing, and type of precipitation with decreases in snowpack, earlier snow melt, and more winter precipitation falling as rain, all of which will contribute to earlier peak stream flows and lower summer baseflows. Warmer ambient temperatures and low summer flows may increase water temperatures to the detriment of Pacific Lamprey. Low water levels may restrict lamprey habitat availability, hinder adult migration, reduce reproductive capability, or contribute to increased mortality if incubating eggs, burrowing larvae or migrating juveniles are exposed to warm temperatures (>20°C) for an extended duration (Clemens et al. 2016). Warm water temperatures

can increase vulnerability to pathogens and predation and may shift or expand the range of nonnative predatory fish, putting further stress on larval and adult lamprey (Lawrence et al. 2014).

Climate change is identified as a critical threat across the range of Pacific Lamprey, but the feasibility of making tangible changes will be challenging and require large scale institutional changes. While directly impacting climate change via PLCI funds is unlikely given limited funding, the impacts of climate change highlight the importance to address other ongoing high priority threats. Focusing stream restoration efforts on actions that improve instream complexity and floodplain connectivity, remove unneeded impoundments, or revegetate riparian areas, can provide multiple benefits to the aquatic ecosystem (e.g., improve water quality, reduce flooding, increase channel stability, etc.) and can help make systems more resilient to climate change in the future (Justice et al. 2017). Addressing lamprey passage into the mid- and upper portions of the tributary watersheds within the Willamette to allow upstream migrants access to cooler waters and forested lands will increase the quantity of accessible quality native fish habitats, and thus increase lamprey population resilience to a changing climate.

Although climate change was the highest ranking threat across the Willamette Basin, ultimately we did not include this threat in the NatureServe Model for the following reasons: 1) climate change influenced the increase of several other threat scores; and 2) it did not significantly change the results of the NatureServe model vulnerability analysis. The only Conservation Status rank that would have changed would have been the Clackamas River Basin (from "Vulnerable" to "Imperiled"); however, the Clackamas basin is relatively in good shape for the following reasons:

- There are no major barriers between the mouth of the Clackamas and the Pacific ocean;
- Adult lamprey are accessing the upper basin via volitional and trap and haul efforts; and
- PGE's requirement and commitment to provide lamprey passage at their project ensures lampreys have access to the upper Clackamas Basin, which is largely on USFS lands and in relatively good condition;
- Access to the upper basin increases the quality and quantity of available habitat and provides resilience to climate change.

Stream and Floodplain Degradation

Nearly 70 percent of Oregon's population resides in and around the Willamette Basin. Human settlement and development has greatly altered the physical habitat and hydrology of the Sub-Unit. In upland areas, forestry is the predominant land use. Fire suppression and timber harvest practices have altered the diversity and age/size composition of riparian vegetation. Many watersheds in the Willamette Sub-Unit are lacking mature conifers that play a pivotal role in bank stability, water quality protection, thermal cover, and the provision of large woody debris. In the valley, extensive agriculture and urban development have reduced the quality and complexity of aquatic and riparian habitats. Efforts to reduce flooding (dikes, levees, riprap, dams) and improve navigation (dredging, large wood clearing), have straightened and scoured streambeds, eliminated side channels and cut off flood plains. Cultivation, riparian clearing and conversion of land for crops, pastures, vineyards and development have filled and/or drained wetlands, increased soil erosion and sedimentation, and promoted the establishment and spread

of invasive plant species. Simplification of the river channel and flow regulation and simplification of the mainstem Willamette have been hypothesized to be a cause of the decreased numbers of adult Pacific Lamprey harvested by Tribal members at Willamette Falls (Clemens et al. 2017b).

Water Quality

Elevated water temperature, low dissolved oxygen, bacteria, and toxic pollutants such as herbicides, pesticides, heavy metals and flame retardants, are some of the water quality concerns in the Willamette Sub-Unit. These threats may be attributable to a number of human activities including riparian clearing, water withdrawals, failing septic systems, sewer overflow, and urban and agricultural run-off. Warm summertime temperatures (greater than or equal to 20ºC) during July-August may prevent adult Pacific Lamprey from surviving, reproducing, or migrating far up into the Willamette Basin (Clemens 2017a; Clemens et al. 2016; Clemens et al. 2012a; Clemens et al. 2009). These summertime temperatures have resulted in large die-offs, skewed sex ratios, documented testicular atresia (damaged testes) in males, and faster maturation rates. Toxins may be particularly harmful to Pacific Lamprey because larvae burrow and feed in mud and fine substrates where toxins accumulate (Nilsen et al. 2015; Clemens et al. 2017b).

Dewatering and Flow Management

Dewatering and flow management were ranked as a High key threat. Low flow conditions occur naturally in many watersheds of the Willamette Basin during summer months. These conditions may be aggravated by water withdrawals for municipal, industrial, commercial and agricultural use. In several tributaries, the large storage dams augment seasonal low flows, and some alter natural temperature and flow regimes. Water releases from thermally stratified reservoirs generally result in cooler water temperatures downstream of the dam in summer and warmer water temperatures in fall and winter. Abnormal seasonal temperature fluctuations may impact the behavior, development, and fitness of adult and juvenile lamprey. In 2005, the USACE completed a water temperature control tower at Cougar Dam on the South Fork McKenzie River, which has alleviated much of the dam-induced seasonal abnormalities in the McKenzie River. Such temperature control structures are still needed elsewhere in the Willamette Basin to return to more normative temperature regimes (e.g. North Santiam River, the Middle Fork Willamette).

Water diversions and impoundments alter the quantity and timing of flow events, which may impact adult and juvenile lamprey migration cues, decrease spawning habitat availability, prevent access to backwater or side channel habitats, create low water barriers, and contribute to mortality if incubating eggs or burrowing larvae are dewatered and stranded, or exposed to a high temperature or low oxygen environment (Clemens et al. 2017b). Some improvements to flow regimes have occurred in the Willamette Basin. Since 2002, the USACE has largely operated their Willamette Valley Project dams according to minimum flows and ramping rates that were formalized under the Willamette Project Biological Opinion issued by the National Marine Fisheries Service (NMFS 2008) for the protection of anadromous salmonids. Further, through the Willamette Valley Sustainable River Project, The Nature Conservancy and the USACE and numerous other agencies and organizations are working to ensure that Willamette River flows are managed to benefit fish and wildlife habitats as well as local communities (See http://www.cooperativeconservation.org/viewproject.aspx?id=789)

Table 5. Summary of the assessment results for the main threats of the Willamette Sub-Unit in 2022. Key Threats are those that rank Moderate or High (2.5 or greater).

Watershed	Climate Change		Stream & Floodplain Degradation		Water Quality		Dewatering & Flow Management	
	Scope	Severity	Scope	Severity	Scope	Severity	Scope	Severity
Willamette Sub-Unit								
Middle Fork	4	4	4	4	4	4	4	4
Coast Fork Willamette	4	4	4	4	4	4	4	4
Upper Willamette	4	4	4	4	4	3.5	4	4
McKenzie	4	4	3	2.5	3	3	3	3
North Santiam	4	4	4	4	3	3	4	4
South Santiam	4	4	4	4	4	4	4	4
Middle Willamette	4	4	4	4	3.5	4	4	4
Yamhill	4	4	4	4	4	4	3	3
Molalla-Pudding	4	4	3	3	4	4	4	4
Tualatin	4	4	4	4	4	4	3	3
Clackamas	4	4	3	3	3	3	1	2
Lower Willamette	4	4	4	4	4	4	3	3
Average Scope/Severity	4.0	4.0	3.8	3.7	3.7	3.7	3.4	3.5
Rank	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
Combined Mean	4.0		3.7		3.7		3.5	
Overall Threat Rank	**H**		**H**		**H**		**H**	

Table 5 (continued). Summary of the assessment results for the main threats of the Willamette Sub-Unit in 2022. Key Threats are those that rank Moderate or High (2.5 or greater).

Watershed	Passage		Predation		Lack of Awareness	
	Scope	Severity	Scope	Severity	Scope	Severity
Willamette Sub-Unit						
Middle Fork	4	4	3	3	3	3
Coast Fork Willamette	4	4	2.5	2.5	3	3
Upper Willamette	2	3	3	3	2	2
McKenzie	3	3	2	2	2	2
North Santiam	4	4	1.5	3	2.5	2.5
South Santiam	4	4	2	4	2.5	2.5
Middle Willamette	3	4	3	3	2.5	2.5
Yamhill	3	3	3	3	2	2
Molalla-Pudding	2.5	2.5	3	3	2	3
Tualatin	3	3	3	3	2.5	2.5
Clackamas	3	2.5	3	U	2	2
Lower Willamette	1.5	2	4	4	2	2
Average Scope/Severity	3.1	3.3	2.8	3.0	2.3	2.4
Rank	**M**	**M**	**M**	**M**	**L**	**L**
Combined Mean	3.2		2.9		2.4	
Overall Threat Rank	**M**		**M**		**L**	

Passage

The current distribution of Pacific Lamprey is largely determined by the many large dams throughout the Willamette Basin that do not provide passage (Clemens et al. 2012b; Schultz et al. 2014; Table 6). The USACE Willamette Valley Project dams were primarily built to reduce flood risks, but also generate electricity and provide water storage for irrigation, recreation and drinking water. The structures range in size from 49 feet (Fern Ridge) to 519 feet (Cougar) tall and do not provide volitional fish passage at any of the dams. Upstream fish passage is currently provided for anadromous salmonids via trap and haul facilities at several USACE dams, but none of these trap and haul facilities are designed to transport adult Pacific lamprey. Largely constructed in the early 1960s, the USACE dams block hundreds of miles of historical, anadromous spawning and rearing habitat and have adversely affected native fish populations in the basin. Consequently, the Willamette Valley Project Biological Opinion, issued by the National Marine Fisheries Service (NMFS 2008), requires the Corps to improve adult and juvenile salmonid passage at several high priority dams on the South Fork McKenzie River, North Santiam, South Santiam and Middle Fork Willamette, including Fall Creek. All of these basins historically supported Pacific lamprey.

USACE's adult fish trap and haul facilities are designed for anadromous salmonids, which are trapped and transported by truck and released upstream of the dams. Some of the recent upgrades include features (e.g. rounded walls at fishway entrances and orifices) that may increase the ability to capture and haul adult lamprey if additional infrastructure (such as ramps and collection boxes) was added. Recent improvements (or design plans) to trap and haul facilities have occurred at Cougar, Detroit (Minto), Foster, Dexter and Fall Creek Dams to improve trap and haul conditions for salmonids (i.e., improved attractant flows, larger holding areas, less direct handling of fish). At this time, Fall Creek Dam has the only experimental ramps for upstream lamprey passage at these USACE dams and no other upstream passage for lamprey has been planned in the near-term. Because Pacific lamprey are not listed under the ESA, the USACE considers Pacific lamprey a secondary species of concern and does not provide Pacific lamprey with the same considerations as listed salmonids. A recent draft Fish and Wildlife Coordination Act report on the Willamette Valley Project prepared for the USACE recommended USACE implement targeted trap and haul efforts for adult Pacific lamprey at Fall Creek Dam to maintain the reintroduced population of lamprey, as well as develop and implement a strategic plan for lamprey passage across all of its dams in coordination with the USFWS and other partners in the Basin.

Downstream fish passage solutions for salmonids at the USACE dams are still under evaluation. No permanent downstream fish passage collection facilities for any of the USACE dams have been completed. Juvenile fish (all species) must pass through turbines, spillway gates, or other routes of water passage as they migrate downstream. USACE has tested a small, experimental, floating surface collector at Cougar Dam for downstream passage of salmonids. Other studies to determine downstream passage solutions at Detroit and Lookout Point Dams continue. It is unclear if passage improvement measures will ultimately restore access to the habitat above these dams for Pacific Lamprey.

Although most passage projects in the Willamette Sub-Unit are focused on improving conditions for ESA-threatened spring Chinook salmon and winter steelhead, some projects are providing passage for Pacific Lamprey. In conjunction with Federal Energy Regulatory Commission relicensing, Portland General Electric (PGE) has installed three lamprey passage structures and completed several improvements to the traditional fishway at Willamette Falls Hydroelectric Project (Lower Willamette River; the latter in conjunction with ODFW), rebuilt the existing fish ladder at River Mill Dam (Clackamas River) and made modifications and improved maintenance to the fishway that traverses the Faraday and North Fork Dams (Clackamas River) to improve upstream passage of adult Pacific Lamprey. PGE is also monitoring the downstream migration of juvenile lamprey with two, surface collectors at River Mill and North Fork Dams. These facilities are collecting and enumerating lamprey outmigrants. The collection efficiencies of the downstream passage structures are unknown, but thousands of larval and juvenile lamprey outmigrants have been collected each year since their construction. PGE is also trapping and hauling adult Pacific Lamprey into the Clackamas above North Fork Dam to increase larval production (and the pheromones they produce) in the upper basin in an effort to increase adult attraction to this area through 2025. PGE continues to evaluate migration and passage success of adult Pacific Lamprey through the fish ladder at North Fork Dam to determine ladder modifications to increase volitional passage of lamprey to the upper Clackamas Basin.

Table 6. Passage conditions at most large dams located in the Willamette Sub-Unit.

Dam / ***Ownership***	**River**	**Passage Conditions for Pacific Lamprey**
Dexter, Lookout Point, and Hills Creek *USACE*	Middle Fork Willamette	A trap and haul facility for anadromous salmonids occurs below Dexter Dam, the lower-most dam on the Middle Fork Willamette. Future upgrades may increase the ability to capture and haul adult lamprey upstream of these dams if additional infrastructure was added. Permanent downstream passage facilities are not present.
Fall Creek Dam *USACE*	Tributary to Middle Fork Willamette below Dexter Dam	A trap and haul facility for anadromous salmonids occurs below Fall Creek Dam. Future upgrades may increase the ability to capture and haul adult lamprey upstream of these dams if additional infrastructure was added. Downstream passage facilities are not present; "passage" for downstream migrant salmonids is provided by annual drawdown of the reservoir.
Leaburg Dam *EWEB*	McKenzie River	Two upstream fishways are located at Leaburg Dam (~10 feet tall). Lamprey passage efficiency is unknown, but Pacific Lamprey are found above this dam. EWEB's diversions are screened to NMFS criteria, which are adequate for larger outmigrants, but may allow the smallest larvae to pass through the screen, and intermediate sized larvae may become impinged or wedged in the gaps of the screen material. Since October, 2018, EWEB has not diverted water for power generation due to instability of the canal walls and EWEB is proposing the removal of Leaburg Dam within the next 10 years.
Cougar Dam *USACE*	South Fork McKenzie River	A trap and haul facility for anadromous salmonids occurs below Cougar Dam; recent upgrades may increase the ability to capture and haul adult lamprey upstream if additional infrastructure was added.
Blue River Dam *USACE*	Blue River (tributary to McKenzie River)	No fish passage facilities are present or planned at this dam.
Trail Bridge Dam *EWEB*	McKenzie River	No fish passage facilities are present at this dam. Recent larval lamprey surveys by the USFS indicate that Pacific lamprey are not in the vicinity of this project. If Pacific lamprey were to increase their distribution upstream, EWEB would modify its trap and haul facility to accommodate Pacific Lamprey. Downstream passage will be provided by spill, which will occur year-round.

Table 6 continued. Passage conditions at most large dams located in the Willamette Sub-Unit.

Dam / ***Ownership***	**River**	**Passage Conditions for Pacific Lamprey**
Minto, Big Cliff and Detroit Dams *USACE*	North Santiam	A trap and haul facility for anadromous salmonids occurs below Big Cliff Dam, the lower-most dam, at Minto. Recent upgrades may increase the ability to capture and haul adult lamprey upstream if additional infrastructure was added. Permanent downstream passage facilities are not present.
Foster and Green Peter Dams *USACE*	South Santiam	A trap and haul facility for anadromous salmonids occurs below Foster Dam, the lower-most dam. Recent upgrades may increase the ability to capture and haul adult lamprey upstream if additional infrastructure was added. Permanent downstream passage facilities are not present.
Dorena Dam *USACE*	Row River-Tributary to Coast Fork	No fish passage facilities are present or planned at this dam.
Cottage Grove Dam *USACE*	Coast Fork Willamette River	No fish passage facilities are present or planned at this dam.
Fern Ridge Dam *USACE*	Long Tom River	No fish passage facilities are present or planned at this dam.
Scoggins Dam *BOR*	Tualatin River	No fish passage facilities are present or planned at this dam.
River Mill, Faraday, and North Fork Dams *PGE*	Clackamas River	A new fishway at the lower-most River Mill Dam was constructed in 2006 and provides 90% passage efficiency for Pacific Lamprey (Ackerman 2016). PGE has recently modified the North Fork Fishway, which traverses both Faraday and North Fork dams, and is currently conducting a trap and haul effort while they evaluate passage. Permanent downstream passage facilities at North Fork and River Mill dams are collecting and enumerating lamprey outmigrants. The collection efficiency is unknown, but thousands of larval and juvenile lampreys have been collected each year.
Willamette Falls Dam *ODFW*	Willamette River	Modifications to the existing fishway to improve lamprey passage have been completed. Additionally, seasonal lamprey ramps are installed annually to provide upstream egress for lamprey upstream passage. Modifications to improve downstream salmonid passage have been completed, including improved spill conditions, which are likely to improve passage conditions for lamprey.

Predation

Predation was ranked as a moderate threat to lamprey. Predation on lamprey likely occurs throughout the Willamette Basin: sea lion and white sturgeon activity is commonly seen immediately below Willamette Falls, and many warm-water predatory fish species are common throughout the basin in the large reservoirs and lower tributaries of the Willamette. These non-native fish are able to overwinter and survive in the basin largely because of large reservoirs or other modified habitats. At this time, there is very little direct study of predation in the Willamette Basin; thus, while there may be many potential predators of lamprey present, in many areas it is uncertain what the severity of such predation is to the lamprey population. Climate change will likely increase stream and reservoir temperatures and improve conditions for non-native predators.

Other

Predicted trends in human population growth and increased development will increase use of our natural resources (increased demand for consumptive water use, tree harvest, gravel mining, etc.) and likely compound existing threats to Pacific Lamprey throughout the Willamette Sub-Unit.

E. Conservation and Restoration Actions

The following work was recently completed or is actively occurring in the Willamette Sub-Unit. This list is not intended to be exhaustive, and we regret any omissions and are quite willing to add additional items (Contact ann_e_gray@fws.gov).

- State-wide
    - Ben Clemens (ODFW) completed the Final Coastal, Columbia, and Snake Conservation Plan for Lampreys in Oregon, which covers 4 species (Western River, Western Brook, Pacific and Pacific Brook lamprey) in February 2020. The status and limiting factors rankings in this plan are consistent with the PLCI.

- Little North Fork Santiam Restoration Activities
    - In 2022, BLM collaborated with The Freshwater Trust (TFT) to rebuild large wood jams that were burned during the 2020 fires within the Little North Fork Santiam River near the community of Elkhorn. Two large wood jams were re-created, and adjacent side channels received additional fire-killed trees to increase large wood presence and channel roughness. The BLM plans to again partner with TFT in 2023 to continue to add large wood to Little North Fork side channels and to rebuild fire-burned large wood jams and add large wood to the side channels of lower Elkhorn Creek.

- Clackamas Watershed
    - Two new surface collectors for downstream fish passage have been completed by PGE at the River Mill and North Fork Dams over the past few years. Both are collecting many juvenile lamprey outmigrants; however, the collection efficiency of these facilities for lamprey is unknown. For the 2021 out-migrant run year (Oct'21-Sept'22) PGE collected over 106,000 juvenile Pacific lamprey (both juvenile and larval life stages combined) through the bypass systems. Approximately 43,000 of these juvenile Pacific lamprey were collected through

the North Fork bypass system. PGE is taking genetics on a subset of fish passing through the bypass systems and sends them to CRITFC.

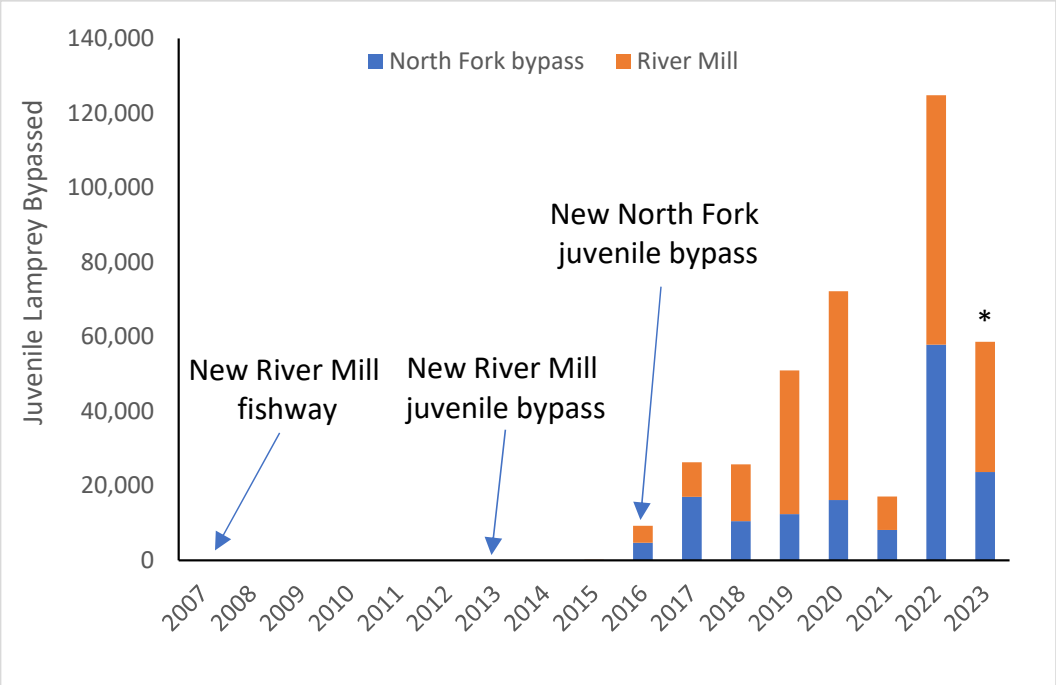

Chart above represents the number of juvenile and larval lamprey that passed through PGE's Clackamas Hydroelectric Project juvenile bypass systems. 2023 count is partial annual count through April 30, 2023. Run year ends September 30..

- PGE began annual trap-and-haul efforts to transfer adult lamprey above North Fork Dam in 2017. Lamprey are collected at River Mill Dam and are transported above North Fork Dam/Reservoir (250 to 400 fish). The trap-and-haul program will continue through 2025.
- Multiple habitat restoration efforts have been implemented in the Clackamas Basin by Metro, the Clackamas River Basin Council, PGE, and others).

- McKenzie Watershed
  - Multiple large scale restoration actions to restore floodplain connectivity and function have occurred or are planned in the McKenzie River Watershed
    - *South Fork Stage 0 restoration* will restore over 700 acres of historical alluvial delta at the confluence of the South Fork McKenzie River. Project will remove 40 acres of levees and augment sediment (over 200,000 cubic yards) and large wood (12,000 pieces) on 4.5 miles of the South Fork below Cougar Dam, resulting in 5-10 miles of secondary channel reconnection (up to 400% increase), and improving spawning and rearing habitats for Pacific Lamprey. Implementation of Phases I and II was

partially funded through the RIP process with PLCI/BPA funds. Phases I II include restoration of the lower 1.2 miles of the project area (200 acres of floodplain). Phase III implementation is slated for 2025/2026, which will restore an additional 350 acres. USFWS, ODFW, and USFWS have been conducting a larval lamprey occupancy and habitat study in 2021-2022 and hope to continue this work. Project leads: USFS (Kate Meyer), McKenzie Watershed Council (Jared Weybright).

- Finn Rock Reach Stage 8 Restoration Phase I was completed on the mainstem McKenzie River. Phase II will be implemented in 2023, completing the project and restoring 118 acres. Implementation of Phase I was partially funded through PLCI/BPA funds. Project contact: McKenzie RiverTrust (Eli Tome), USFS (Kate Meyer); McKenzie Watershed Council (Jared Weybright).
- Quartz Creek State 0 Restoration will be implemented in 2024, restoring 166 acres, just downstream from Finn Rock Reach. USFWS, ODFW and USFS have initiated a larval lamprey occupancy and habitat study and pre-project data collection will being in May. Project contacts: McKenzie Watershed Council (Jared Weybright); USFS (Kate Meyer).
- Restoration for Ennis Creek is in design planning.

- Long Tom Watershed
  - Long Tom Watershed Council and Siletz Indian Tribe received funding from the USACE to explore fish passage options at Monroe Dam on the Long Tom River. Intent of the project is to restore passage for all species of fish, including lampreys, while maintaining water withdrawal for the City of Monroe.
- Tualatin Watershed
  - During the summer of 2022, the Tualatin River Watershed Council (TRWC) implemented a pilot use of awautic qPCR eDNA technology at 40 stream sites across the Tualatin basin, Water samples at these sites were analyzed for the DNA of steelhead, coho, Pacific lamprey, and coastal cutthroat trout. Pacific lamprey eDNA was deterected in 21 of the 40 samplease and showed a high sensitivity to passage barriers, such as the Balm Grove dam that was removed after the samples were taken. In 2023 the TRWC will sample 8 sites above the former Balm Grove dam site to track post-dam removal re-colonization of Pacific lamprey.

F. Recent Publications

The following list provides links to several recently completed sciendtific papers that may be of interest to you. This list is not intended to be exhaustive, and we regret any omissions and are quite willing to add additional items (Contact ann_e_gray@fws.gov)

Clemens, B. J. 2022. Warm water temperatures (≥ 20oC) as a threat to adult Pacific lamprey: Implications of climate change. Journal of Fish and Wildlife Management 13:1–8. https://doi.org/10.3996/JFWM-21-087.

Clemens, B. J., & J. Wade. 2023. Conservation biology of the Lampetra species complex of western North America, with a focus on western brook lamprey (L. richardsoni). Canadian Manuscript Report of Fisheries and Aquatic Sciences 3258: vi + 26 p. https://waves-vagues.dfo-mpo.gc.ca/librarybibliotheque/41093732.pdf.

Clemens, B. J., & P. Edwards. 2022. A citizen science project to assess lamprey distribution and raise awareness of the cultural and ecological importance of lampreys. Final project report from the Oregon Department of Fish and Wildlife to the Bonneville Power Administration, July 16, 2020 to July 15, 2022.

Clemens, B. J., J. A. Harris, S. Starcevich, T. Evans, J. Skalicky, F. Neave, R. T. Lampman. 2022. Sampling methods and survey designs for larval lampreys. North American Journal of Fisheries Management 42:455–474. https://doi.org/10.1002/nafm.10762.

Clemens, B. J., J. D. Romer, J. S. Ziller, & M. Jones. 2023. More flow in a regulated river correlates with more and earlier adult lamprey passage, but peak passage occurs at annual low flows. Ecology of Freshwater Fish. https://doi.org/10.1111/eff.12703.

Clemens, B. J., T. A. Friesen, S. V. Gregory, & C. L. Zambory. In press. The case for basin-wide passage and habitat restoration for Pacific Lamprey in the Willamette River Basin (Oregon, USA). North American Journal of Fisheries Management. https://doi.org/10.1002/nafm.10891.

Lamprey Technical Workgroup. 2022. Practical guidelines for incorporating adult Pacific Lamprey passage at fishways, Version 2.0. Available: https://www.pacificlamprey.org/ltwg/.

Lamprey Technical Workgroup. 2022. Review of factors affecting larval and juvenile lamprey entrainment and impingement at fish screen facilities. Original version 1.0, June 2022. Available: https://www.pacificlamprey.org/ltwg/.

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Clemens, B. J., L. Wyss, R. McCoun, I. Courter, L. Schwabe, C. Peery, C. B. Schreck, E. K. Spice, and M. F. Docker. 2017a. Temporal genetic population structure and interannual variation in migration behavior of Pacific Lamprey *Entosphenus tridentatus*. Hydrobiologia. 794: 223-240.

Clemens, B. J., R. J. Beamish, K. C. Coates, M. F. Docker, J. B. Dunham, A. E. Gray, J. E. Hess, J. C. Jolley, R. T. Lampman, B. J. McIlraith, M. L. Moser, J. G. Murauskas, D. L. G. Noakes, H. A. Schaller, C. B. Schreck, S. J. Starcevich, B. Streif, S. J. van de Wetering, J. Wade, L. A. Weitkamp, and L. A. Wyss. 2017b. Conservation Challenges and Research Needs for Pacific Lamprey in the Columbia River Basin. Fisheries 42:268–280.

Clemens, B., C. Schreck, S. van de Wetering, and S. Sower. 2016. The potential roles of river environments in selecting for stream- and ocean-maturing Pacific Lamprey, *Entosphenus tridentatus* (Gairdner, 1836). pp. 299 – 322. In: A. Orlov, & R. J. Beamish (eds.) Jawless Fishes of the World. Cambridge Scholars.

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Clemens, B. J., M. G. Mesa, R. J. Magie, D. A. Young, and C. B. Schreck. 2012b. Pre-spawning migration of adult Pacific lamprey, *Entosphenus tridentatus*, in the Willamette River, Oregon (USA). Environmental Biology of Fishes. 93: 245 – 254.

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IV. APPENDIX A. 2022 MEETING NOTES

WILLAMETTE RMU- Pacific Lamprey Threats Assessment and RIP Annual Meeting

Annual Pacific Lamprey Meeting for the Willamette RMU
April 22, 2022
Co-chairs: Ann Gray & Jen Poirier (USFWS)

Virtual meeting attendees:

BLM: Anthony Spitzack
City of Portland: Melissa Brown
Confederated Tribes of Grand Ronde: Brandon Weems, Lawrence Schwabe
Confederated Tribes of Warm Springs: Lindy Collamer
Columbia River Inter-Tribal Fish Commission: Greg Silver, Laurie Porter
Greater Oregon City Watershed Council: Tom Gasgill
Mckenzie River Trust: Christer LaBrecque, Eli Tome
McKenzie Watershed Council: Jared Weybright
Molalla River Watch: Asako Yamamuro
North Clackamas Watershed Council: Amy Van Riessen
ODFW: Ben Clemens, Karen Hans, Jeremy Romer, Jeff Ziller,
Pacific Lamprey Conservation Initiative Coordinator: Alicia Marrs
USACOE: Greg Taylor
USFWS: Ann Gray, David Hines, Jen Poirier, Joe Skalicky, Mike Hudson
USFS: Barb Adams

GENERAL MEETING NOTES

2022 Events:

Lamprey Information Exchange monthly webinar series – upcoming talks:

- *May 10th – Supplementation & Disease*

Webinar registration links and list of speakers:

- *https://indd.adobe.com/view/90c66388-e0ae-4786-9e37-ae5b3d9c77ca*
- ***Recordings of previous webinars:*** *www.gotostage.com/channel/plci*

6th Annual Lamprey Information Exchange –planning

- Targeting an in-person event in early December (2022) with some webinar capabilities

The Pacific Lamprey Conservation Initiative (PLCI) has a NEW WEBSITE!!

https://www.pacificlamprey.org/

Lamprey project funding

- There are 2 primary sources of lamprey-specific funds:
  - **BPA PLCI Columbia River Basin Umbrella Project** (~300K for projects within Columbia River Basin)
  - **National Fish Habitat Partnership Funding** (~200-300K for projects across the range of Pacific Lamprey)
- There will be a webinar in June 2022 explaining funding, criteria, and timelines to help those who may be considering submitting a project proposal
  - Hosted by Alicia Marrs, our PLCI Coordinator: **Alicia@pacificlamprey.org** – details forthcoming to all RMUs

New Lamprey Distribution or eDNA Information?
If you collect any **NEW** Pacific Lamprey distribution or eDNA data, we would love to hear from you!

1. Please look at our updated distribution maps on Databasin.org to see if we already have distribution information for your survey area.
   - https://databasin.org/datasets/a243fb1346ca4258b6388c5f7a90aee4/
   - Our lamprey distribution database manager David Hines (USFWS) is creating a separate GIS layer for eDNA information and it has not been added to the map yet.
2. If you don't see any current Pacific Lamprey distribution information in your survey area on the Databasin map, please contact David Hines (David_Hines@fws.gov) to share your data.
3. Please include a GPS coordinate of your sample location if possible!
4. If you collect information on other native lamprey species (e.g., Western brook) we would love that information too!
5. David can also help with data collection on Android or Apple mobile devices if requested, using Survey123 https://www.esri.com/en-us/arcgis/products/arcgis-survey123/overview?rsource=%2Fen-us%2Farcgis%2Fproducts%2Fsurvey123%2Foverview

FYI: Recent Publications by Lamprey Technical Workgroup

- Monitoring and Minimizing Effects of Dredging on Lampreys Living Document, Original Version 1.0. March 2021. https://www.pacificlamprey.org/wp-content/uploads/2022/02/Dredging_-and_Lampreys_03.19.21.pdf

FYI: Recent Publications on Lamprey

- Sampling methods and survey designs for larval lampreys. (Clemens, Weeber, Lewis, Jones 2022 North American Journal of Fisheries Management).
- Microhabitat use by pre-spawning Pacific lamprey *Entosphenus tridentatus* in a large, regulated river differs by year, river segment, and availability (Clemens and Schreck 2021)
- Native Lampreys of Oregon (Brochure published by ODFW)
- Dispelling misperceptions of native lampreys (*Entosphenus* and *Lampetra* spp.) in the Pacific northwest (USA) (Clemens and Wang 2021)
- Abundance Trends for Adult Pacific Lamprey in Western Oregon: Historic Declines, Recent Increases, and Relative Contributions from Coastal Rivers" (Clemens, Weeber, Lewis and Jones 2021- Transactions of the American Fisheries Society).
  For more lamprey publications, check out the Data Clearinghouse literature site on USGS Science Base
  https://www.sciencebase.gov/catalog/item/53ad8d9de4b0729c15418232

Background: Pacific Lamprey Conservation Initiative

- The Willamette Regional Management Unit group is part of Pacific Lamprey Conservation Initiative (PLCI).
- The PLCI is a collaborative effort developed to promote the coordination and implementation of conservation efforts across the range of lamprey.
  The PLCI is organized into four groups: Policy Committee (i.e., high-level managers, tribal council members), Conservation Team (signatories of Conservation Agreement), Lamprey Technical Workgroup and Regional Management Unit groups.

Background: Regional Management Unit (RMU) groups

- There are 18 RMU groups across range of Pacific Lamprey.
- RMU partners include project leads, field biologists, restoration practitioners, natural resource managers and stakeholders familiar with watersheds in the region.
- Partners provide information for the Pacific Lamprey Assessment (see below).
- Assist with development of Regional Implementation Plan (see below).
- Support the development and implementation of high priority lamprey projects.

Background: Pacific Lamprey Assessment

- Every 5 years we collect information on Pacific Lamprey distribution, abundance, population trends and local threats to characterize the conservation risk of Pacific Lamprey across their range.
- The tool that we use to conduct the Assessment is a NatureServe risk model

- The NatureServe model was originally selected (back in 2009) because it's species specific, it's ideal for 'data poor' species, and it included a threats component.
- More information about the NatureServe model and Assessment methods can be found here https://www.fws.gov/pacificlamprey/Documents/PacificLamprey_2018Assessment_final_02282019.pdf

Why do we conduct the Assessment?

- This Assessment characterizes the conservation risk of PCL at a high level
- NatureServe Risk Rankings also help identify high level threats within the watersheds
- Threats information is used to guide the identification and prioritization of conservation measures in the RMU – which can potentially be funded through the RIP proposal process (below).
- Revising the Assessment every 5 years helps us to monitor progress and change in the region.

Background: Regional Implementation Plans (RIPs)

- The RIPs summarize the status, distribution and local threats to lamprey, and include on the ground projects (submitted by RMU partners) that address the identified threats to lamprey and their habitats in the region.
- The purpose of the RIP process is to facilitate the funding of high priority lamprey research and conservation actions.
- Completed RIPs for all RMUs are on Pacific Lamprey Conservation Initiative web page.

2022 ASSESSMENT QUESTIONNAIRE RANKINGS Discussion:

The attached ***2022.04.21 Willamette Ranks DRAFT*** document includes our proposed 2022 Pacific Lamprey Assessment ranks which are based on responses to the Willamette Pacific Lamprey Assessment questionnaire and discussion and input received from RMU partners during the Willamette RMU Meeting on April 22nd.

RMU Partner Project Updates & Announcements

If you have something to share with this group, please send a brief paragraph or bullet points to Ann and they will be included in these notes, once finalized.

Greg Taylor (USACOE): The COE is operating dams differently than in the past due to recent litigation. The COE has set up an injunction website https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/. Implementation plans are being worked out now (i.e., operation scenarios such as sill operations, drawdown

operations, etc.). These operational changes will have ramifications for passage, water quality, etc. both good and bad. Contact Greg Taylor directly for more information.

Karen Hans (ODFW):

- Highlighted two positive eDNA detections in Ferguson and Bear Creeks above the Monroe and Stroda drop structures (on Long Tom River) which demonstrate that Pacific Lamprey can get over the structures. Future passage improvements will make passage even better.
- Karen recently took a group of students out to Pringle Creek (Middle Fork). Although the reach looked poor, it was loaded with Pacific and western brook lamprey!
- The district recently purchased a lamprey e-fisher and hopes to go out and do more lamprey surveys. Would also like to go back to eDNA locations on Ferguson and Bear Creeks to check for Pacific Lamprey.
- If you need to conduct lamprey surveys in the Mid-Upper Willamette, get in touch with ODFW (Ben? – Karen is moving on to a new position) to borrow the e-fisher.

Ben Clemens (ODFW): As the statewide lamprey coordinator for ODFW, Ben is available if you need information or assistance (ben.clemens@oregonstate.edu). Ben also shared the following links during the meeting:
Oregon lampreys: https://www.dfw.state.or.us/fish/species/lampreys.asp
and paper reference:
Clemens, B. J., J. E. Harris, S. J. Starcevich, T. M. Evans, J. J. Skalicky, F. Neave, R. T. Lampman. 2022. Sampling Methods and Survey Designs for Larval Lampreys. North American Journal of Fisheries Management 42(2):455-474. doi:10.1002/nafm.10762.

Ben Clemens (ODFW/PLCI Conservation Team co-chair): This is the year for parties to sign or to re-commit to the PLCI Conservation Agreement https://www.pacificlamprey.org/conservation-agreement/. If you have interest or questions, please reach out to Ben (Ben.Clemens@oregonstate.edu; 541-757-5113), Ann Gray, or Jen Poirier.

Jared Weybright (Mckenzie Watershed Council): McKenzie partners (USFS, BLM, EWEB, McKenzie River Trust, McKenzie Watershed Council) are collaboratively planning and developing a series of large scale floodplain projects in the "middle McKenzie" (Quartz Creek - Horse Creek). The plan is for Finn Rock Reach Phase 2 in 2023, Quartz Creek in 2023/24, South Fork Phase 3 in 2024. All projects are expected to benefit lamprey and will follow methods previously used on SF and FRR.

Ann Gray (USFWS): Would be great to implement another collaborative (CTGR, USFWS, ODFW, EWEB) dewatering project like the Leaburg Dam dewatering project (https://www.researchgate.net/publication/344405929_Effects_of_dewatering_on_behavior_distribution_and_abundance_of_larval_lampreys). Would like the opportunity to collaborate on something like this again (e.g., Fall Creek Dam). Greg is very open to the idea and would be happy to help drive something like this. Get in touch with Ann if you have an interest in participating in a future project at Fall Creek.

Next Steps and Willamette RMU Review Timelines

- Notes and draft Assessment ranks out in early May for your final review/input.
- Once reviewed, USFWS will run the NatureServe model and update the RIP and provide that for your review in summer (please review when you get it!!).
- Pacific Lamprey Conservation Initiative project proposal funding webinar in June (Alicia Marrs). Date TBD

Contacts for Willamette RMU:

Ann Gray – USFWS ann_e_gray@fws.gov 503-231-6909

Jen Poirier – USFWS Jennifer_Poirier@fws.gov 360-604-2539

David Hines – GIS Specialist David_Hines@fws.gov 360 604-2509

Alicia Marrs – PLCI Coordinator Alicia@pacificlamprey.org 360-319-7916

V. APPENDIX B. NatureServe Model Parameters, Definitions and Final 2022 Ranks- Willamette Basin and Lamprey

April 22, 2022 Meeting/ Questionnaire and Discussion Notes

Introduction: the following information was consolidated based on individual responses to the Willamette Regional Management Unit questionnaire and discussion at the April 22, 2022 RMU annual meeting. The purpose of this information is to update the 2017 Rankings for Pacific Lamprey, as well as update information provided in the Annual Regional Implementation Plan for the Willamette RMU.

For each model parameter, there is a definition, description of the ranking, the ranks that went into the 2017 NatureServe Run, and the proposed 2022 NatureServe Ranks. Cells highlighted in yellow in the tables indicate the proposed 2022 rank is different from the 2017 rank. Red text indicates notes from the RMU meeting or is a result of follow-up with individuals after the meeting. Other comments (in black) were provided via the pre-meeting questionnaire.

1. WATERSHED POPULATION ABUNDANCE - The purpose of this section of the Assessment is to provide information for making a determination **of the median number of adult (reproductive) Pacific lamprey** in the watershed over **the last five years** (to account for fluctuations in annual abundance). The objective is not necessarily to develop a precise estimate, but rather to estimate a range of values within which the adult population is likely to occur and to assess the data quality with which that determination can be made, based on available data.

Population Size

X = Extinct (no occurrences, extant)
Z = Zero, no individuals believed extant
A = 1–50 individuals
B = 50–250 individuals
C = 250–1,000 individuals
D = 1,000–2,500 individuals
E = 2,500–10,000 individuals
F = 10,000–100,000 individuals

Population Data Quality

0 = no information available
1 = largely undocumented/anecdotal info
2 = best professional judgement
3 = partial adult/redd count data from <1/2 of potential habitat in watershed
4 = partial adult/redd count data from >1/2 of potential habitat in watershed
5 = comprehensive (>90%) adult/redd count

Population Abundance Comments:

Ann: To estimate adult population abundance, we used the Clemens et al. 2017 paper (Pacific Lamprey were tagged at Willamette Falls and tracked for 1 year) and applied the percentage of fish returning to each watershed to the median number of Pacific Lamprey passing the falls (i.e., 48,000 fish (available data from 2010-2019 from CTWS). These proposed percentages for 2022 are somewhat different than those for 2017, which based more so on professional opinion. For 2022, the RMU leads had previously decided to use median instead of average counts. This resulted in less lamprey (48K for the median vs ~60K for the average) to distribute among the HUC above Willamette Falls. NOTE: switching from the average to the median only changed 1 HUC: Molalla-Pudding would have been an E instead of a D- all other HUCs ranks were the same.

Ann asked meeting attendees to weigh in on this approach. Ben Clemens, Anthony Spitzack, and Brandon Weems all thought this was a reasonable approach to estimate abundance in Willamette HUCs. No one else opposed this approach or offered a preferred alternative.

Ann: The median number of Pacific Lamprey estimated at Willamette Falls that didn't pass was 130,000 fish (available data from 2010-2017 from CTWS). When equally split between the Clackamas and Lower Willamette, this would equate to an 'F' ranking for both watersheds,

Willamette HUC	**Population Size & Data Quality**				
	2017 Abundance Rank	**2017 Data Qlty**	**2022 Abundance Rank**	**2022 Data Qlty.**	**ABUNDANCE**
Middle Fk Willamette	D	2/4	**B**	3, 4	A = 1–50 adults B = 50–250 adults C = 250–1,000 adults D = 1,000–2,500 adults E = 2,500–10,000 adults F = 10,000–100,000 adults U = Unknown
Coast Fk Willamette	E	2/4	**C**	3, 4	
Upper Willamette	E	2/4	**F**	3, 4	
McKenzie	E	2/4	**C**	3, 4	
N. Santiam	F	2/4	**D**	3, 4	
S. Santiam	E	2/4	**D**	3, 4	**DATA QUALITY**
Middle Willamette	EF	2/4	**F**	3, 4	**0** = no information **1** = largely anecdotal info **2** = best professional judgement **3** = partial count data from <1/2 of potential habitat in watershed **4** = partial count data from >1/2 of potential habitat in watershed **5** = comprehensive (>90%) adult/redd count census with some estimate of error
Yamhill	D	2/4	**D**	3, 4	
Molalla-Pudding	D	2/4	**D**	3, 4	
Tualatin	D	2/4	**C**	3, 4	
Clackamas	F	2/3	**F**	2, 3	
Lower Willamette	F	2/3	**F**	2, 3	

which was the same as the 2017 ranks. Folks in the Clackamas agreed with the 'F' assessment, but were unable to attend the RMU meeting due to field work. 2017 ranks remain.

From Table 1; Clemens et al. 2017	% fish entering watershed	Number of Fish-	Watershed Assigned HUC
Middle F	0.3	1	Middle Fk
Coast F	0.5	2	Coast Fk
Row	0.5	2	Coast Fk
Calapooia	1.9	7	Upper Willamette
Luckiamute	1.3	5	Upper Willamette
Marys River	0.8	3	Upper Willamette
Long Tom	0.3	1	Upper Willamette
McKenzie	1.3	5	McKenzie
Santiam	14	52	N and S. Santiam
Mainstem	69.9	260	Middle and Upper Willamette
Yamhill	3.5	13	Yamhilll
Molalla	3.5	13	Molalla-Pudding
Pudding	0.8	3	Molalla-Pudding
Tualatin	0.5	2	Tualatin
Clackamas	0.8	3	Clackamas

HUC	HUC total Fish	% tagged lamprey entering HUC (n = 331)	Population estimate based on 48K median above Falls	RANK	Note
Middle Fork	1	0.30%	145	B	
Coast Fork	4	1.20%	580	C	
Upper Willamette	146	44.10%	21,172	F	All UW Tribs and Half of Mainstem Willamette fish
McKenzie	5	1.50%	725	C	
N. Santiam	7	2.10%	1,015	D	Split "Santiam" equally into N and S Santiam basins
S. Santiam	7	2.10%	1,015	D	
Middle Willamette	130	39.30%	18,852	F	Half of mainstem Willamette fish
Yamhill	13	3.90%	1,885	D	
Molalla-Pudding	16	4.80%	2,320	D	
Tualatin	2	0.60%	290	C	
Omitted Clackamas/ Lower Willamette from this table- those HUCs are discussed separately.					

Middle Fork Willamette: BLM has data on presence/absence but not on abundance
Coast Fork Willamette: ODFW hold the records for previous redd counts.
Upper Willamette: BLM has no data on abundance.
Karen Hans: The Calapooia has a significant number of Pacific Lamprey and should get this on people's radar. There will be a lot of work done in the future here due to steelhead and Chinook.
McKenzie: healthy population but highly variable based on radio telemetry and Leaburg Dam Passage Data (Video counts).
North Santiam:

- ODFW has video counts at the Upper and Lower Bennett Dams (N. Santiam), but this data likely only goes back ≈15 years, and the cameras may not work well for Pacific Lamprey. Thus, the group chose not to use this information for population abundance or trends.
- After extensive surveys above the Big Cliff/Detroit Dams, no individuals of any life stage were found.

South Santiam;
Middle Willamette: Recently confirmed population in Rickreall Creek; unconfirmed but likely population in Mill Creek.
Molalla-Pudding: No known lamprey surveys in the Molalla-Pudding. ODFW briefly conducted winter steelhead surveys but not for a long enough period of time to establish any population data/trends.
Tualatin: No known adult winter steelhead or lamprey surveys in the basin.
Clackamas: River Mill dam adult trap counts have not shown a decrease or increase to make a change in answer.

ODFW provided the following information from the extrapolations of lamprey information collected during their steelhead spawning surveys in the Lower Clackamas below River Mill Dam, with a resulting ***median of 451*** adults over 5 years:

	Year	Mean # Adult Lamprey
Clackamas	**2017**	**692**
Clackamas	**2018**	**451**
Clackamas	**2019**	**587**
Clackamas	**2020**	**343**
Clackamas	**2021**	**406**

Lower Willamette: Based on ODFW winter steelhead/lamprey spawning surveys, ranks provided were F,3.

2. SHORT-TERM WATERSHED POPULATION TREND -

The purpose of this section of the assessment is to provide information for determining the short-term trend (e.g., three generations ~36 -40 years) in the number of adult Pacific lamprey in the watershed. The watershed population trend should, when possible, be determined from the longest time series of available data. However, use of a shorter time series may be warranted in cases of inconsistent data quality over the time series. Ideally, quantitative information (e.g., dam and nest counts) should be used.

Short-Term Trend

A = Severely declining (decline of >70% in population, range, area occupied, and/or number or condition of occurrences)
B = Very rapidly declining (decline of 50-70%)
C = Rapidly declining (decline of 30-50%)
D = Declining (decline of 10-30%)
E = Stable (unchanged or within +/- 10% fluctuation in population, range, area occupied, and/or number or condition of occurrences)
F = Increasing (increase of >10%)

2022 Ranks highlighted in yellow indicate a change from 2017

Willamette HUC	SHORT -TERM Trends (three generations ~36 -40 years)				
	2017 Abundance Rank	2017 Data Qlty	2022 Abundance Rank	2022 Data Qlty.	
Middle Fk Willamette	B*	1	U	0	A = Severely declining (>70%) B = Rapidly declining (50-70%) C = Rapidly declining (30-50%) D = Declining (10-30%) E = Stable (within +/- 10% fluctuation) F = Increasing (increase of >10%) U= Unknown
Coast Fk Willamette	B*	1	U	0	
Upper Willamette	B*	1	U	0	
McKenzie	B*	1	E	3	
N. Santiam	B*	1	U	0	
S. Santiam	B*	1	U	0	**DATA QUALITY**
Middle Willamette	B*	1	U	0	**0** = no information **1** = largely anecdotal info **2** = best professional judgement **3** = partial count data from <1/2 of potential habitat in watershed **4** = partial count data from >1/2 of potential habitat in watershed **5** = comprehensive (>90%) adult/redd count
Yamhill	B*	1	U	0	
Molalla-Pudding	B*	1	U	0	
Tualatin	B*	1	U	0	
Clackamas	F[1]	2,3	E	3	
Lower Willamette	B*	0	E	3	

From 2017 - B* indicates that the group decided to maintain the rank from 2010, which seem to be based on limited information we have at Willamette Falls (comparing 1940s information to now) and Bonneville Dam (1960s information to now), but acknowledge that there is much lacking in terms of available information, accuracy and consistency on annual population estimates.

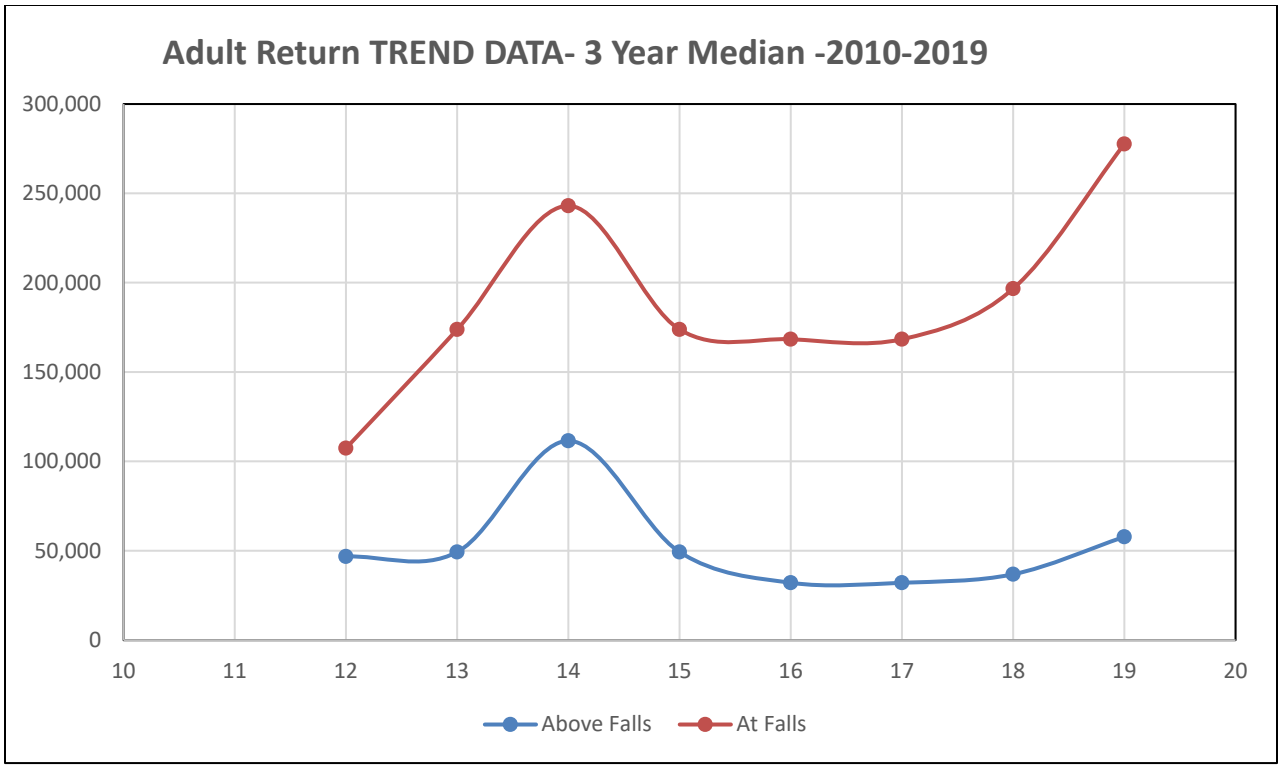
From 2017- F[1] – the increase in the Clackamas population trend may be an artifact of improved fish passage and collection facilities; the Clackamas River confluence is below and close to Willamette Falls and lower in the Willamette Basin than most of the other large tributaries.

Short-term Trend comments:

Ann: We have some trend data starting in 2010, but we do not have data that meets the 36- 40 year, 3 generation time frame as "short-term" is defined by the NatureServe model. In 2017, we ranked almost all HUCs 'B' (very rapidly declining) based on information from Willamette Falls (1940s harvest info; see above), and Bonneville Dam counts on the Columbia from 1960s/1970s. However, there is a large gap in annual counts from 1970 to 1998 at Bonneville, and only harvest information available at Willamette Falls from 1940s (~400K pounds of lamprey harvested).

Ben: ODFW has Leaburg Dam counts for the McKenzie and redd counts on the Clackamas, but no other population information in other HUCs. Ben suggested ranking the McKenzie an 'E' (stable) and all other HUCs 'Unknown'. Laurie Porter agreed with Ben.

Middle Fork Willamette: BLM does not have abundance data.
Coast Fork Willamette:
Upper Willamette: BLM has no data on abundance
McKenzie:
North Santiam: Mixed cohorts; data monitoring not designed for assessing population trends per se. Karen Hans: Upper and Lower Bennet Dams have some counts but detection of lamprey by the video counts is unknown.
South Santiam:
Middle Willamette:
Yamhill:
Molalla-Pudding:
Tualatin: Not aware of any valid population assessment data.
Clackamas: Population trends may be influenced by trends in the mainstem Willamette and from fallbacks from Willamette Falls.
Lower Willamette: Based of counts at the Willamette Falls population seems to have remained stable over the last 10 years. The overall trend however has declined.



Median based on Willamette Falls Abundance estimates from Confederated Tribes of Warm Springs (Baker and McVay 2018, and Lindy Collamer (CTWS), pers. comm. 2022)

3. WATERSHED THREATS ANALYSIS - The purpose of this section of the assessment is to provide information for determining and classifying the threats which are providing the greatest level of present and future risk to the Pacific lamprey population in a watershed. While threats may be both cumulative and synergistic, focusing on threats that currently present the highest individual severity, scope, and immediacy of challenge to Pacific lamprey within a watershed may provide the most meaningful way to compare the relative status of threats amongst watersheds.

Threats Ranking – Describe the scope and severity of each threat below using the following definitions as a reference.

Scope of Threats- What proportion of the watershed population is affected by this activity. Classify the scope of threat as high, moderate, low, or insignificant, based on the following general guidelines:

- **High (4)** – scope is impacting over 71-100% of the total Pacific lamprey population or its habitat in this watershed for an extensive period of time (multiple Pacific lamprey generations). If a threat broadly impacts spawning and rearing habitat then the scope is likely to be high.
- **Moderate (3)** – scope is impacting 31-70% of the total Pacific lamprey population or its habitat in this watershed over more than one Pacific lamprey generation.
- **Low (2)** – scope is impacting only 11-30% of the total Pacific lamprey population or its habitat in this watershed over a short period of time (less than one Pacific lamprey generation). However, if the habitat impacted is of especially high value (e.g., the only primary spawning and rearing habitat) or importance (e.g., critical wintering area) those impacts would elevate the scope to moderate or high, regardless of the extent.
- **Insignificant (1)** – scope is impacting to less than <10% of the Pacific lamprey population or habitat in this watershed only briefly.
- **Unknown (0)**

Severity of Threats- How badly and irreversibly is this watershed affected. Classify the severity of threat as high, moderate, low, or insignificant, based on the following guidelines:

- **High (4)** – severity is resulting in near-total destruction of suitable habitat and/or functional loss of Pacific lamprey from this watershed; leading to essentially irreversible decline that may require over 100 years to restore.
- **Moderate (3)** – severity is resulting in long-term degradation or reduction of suitable habitat and/or major decline of Pacific lamprey from this watershed; requiring 50-100 years to restore.
- **Low (2)** – severity is resulting in reversible degradation of or reduction of habitat and/or a measurable reduction of the watershed Pacific lamprey population, with recovery expected to be feasible within 2-3 generations
- **Insignificant (1)** – severity essentially is resulting in no measurable reduction of the Pacific lamprey population or habitat in this Watershed. A population would recover within 2 generations from any temporary fluctuation in the population. Locally sustainable levels of land management activities or angling are, by definition insignificant, as described here.
- **Unknown (0)**

Passage: ~~Natural or~~ artificial barriers that impact distribution and abundance of Pacific Lamprey by impeding upstream migrations by adult lamprey and downstream movement of larval and juvenile lamprey. Barriers may include dams, culverts, water diversions, tide gates, fishways, waterfalls, etc.

Willamette HUC	PASSAGE artificial barriers that impact distribution, abundance, migration survival				
	2017 Scope	2017 Severity	2022 Scope	2022 Severity	Def/ RANKS
Middle Fk Willamette	4	4	4	4	**SCOPE= AREA affected:** **High (4)** = >70% **Moderate (3)** = 31-70% **Low (2)** = 10-30% **Insignificant** (1) = <10% Unknown (0) **SEVERITY = Magnitude of the IMPACT:** **High (4)** = destruction requires 100+ yrs - recover **Moderate (3)** = Long term degradation requires 50-100 years **Low (2)** = reversible degradation within 30-40 yrs **Insignificant (1)** = no measurable impact. **Unknown (0)**
Coast Fk Willamette	4	4	4	4	
Upper Willamette	2.5	4	2	3	
McKenzie	3	3	3	3	
N. Santiam	4	4	4	4	
S. Santiam	4	4	4	4	
Middle Willamette	2	4	3	4	
Yamhill	3	3	3	3	
Molalla-Pudding	2.5	2.5	2.5	2.5	
Tualatin	2.5	2.5	3	3	
Clackamas	3	3	3	2.5	
Lower Willamette	1	2	1.5	2	

2022 Passage comments:

General comment from Ben: With the exception of USACEs Fall Creek Dam in Middle Fork Willamette (note: USACE is working to address, but currently not effectively collecting lamprey to pass upstream) and PGEs improvements to Rivermill Dam and the North Fork Ladder and the ongoing T&H program on the Clackamas, I'm not aware of any passage improvements for Pacific Lamprey elsewhere in the Willamette.

Middle Fork Willamette:

- High (4)- based on anecdotal evidence from the culverts that I've seen. Also see Larson et al. (2020).
- Ben Clemens: Passage is a big problem in the Middle Fork Willamette. Definitely agree with a Scope of 4, but not sure about severity.

- Greg Taylor: I would go with a 4 for Severity. Providing passage at dams is a work in progress. We aren't collecting them. It's a challenge, but something we are working on.

Coast Fork Willamette:

Upper Willamette:

- High (4) -based on agricultural uses and the culverts I've seen; this is a reasonable approximation.
- Karen Hans: No significant barriers for lamprey on the Marys, Luckiamute, and Calapooia. Still culverts and small dams in tributaries, but no large structures in the mainstem Willamette. Long Tom has three small dams below the USACE dam, but lamprey are able to pass 2 of the lower structures at least some of the time based on positive eDNA above Monroe Dam and Strouda drop structures. However, Laurie Porter found information from the Long Tom Watershed council that stated " The Monroe drop structure also stymies passage of anadromous Pacific lamprey. After the structure was built, local residents reported huge numbers of lampreys ("eels") and fluvial cutthroat trout stacked against its base."
- Anthony S indicated there is also a small dam on Greasy Creek (Major tributary to Marys) which may be an impediment or barrier to lamprey passage.
- Group agreed given all of the information to change Scope/ Severity ranking to 2/ 3.

McKenzie: Farthest upstream distribution of Pacific Lamprey unclear but have observed lamprey in the mainstem up to Blue River confluence and suspect that they would continue upstream in the South Fork McKenzie above Cougar Reservoir if given the opportunity (historically). One adult has been captured in the Cougar trap and haul facility and several were observed within 1 kilometer downstream of the dam in the South Fork during ODFW radio tagging study.

USFS has surveyed for larval lamprey and did not find Pacific lampreys upstream of the South Fork confluence, which may approximate the upstream limit of Pacific lamprey distribution in McKenzie. USFS did not find *Lampetra* spp above Horse Creek confluence. Seems like it may be temperature based as otherwise habitat looks appropriate. USACE Cougar and Blue River dams likely affect distribution, but EWEB's Trail Bridge Dam is above known distribution. Leaburg Dam is fairly passable based on recent ODFW radio telemetry data, and no one identified changes to passage within the basin. Group kept ranks the same as 2017 at 3/3.

North Santiam: Currently the USACE has no plans for lamprey passage at Big Cliff/ Detroit Dams. USACE dams are fairly low in watershed, so a Scope/Severity ranking of 4,4 seems appropriate. Ann, Ben Clemens, Greg Silver and Jeremy Romer agree.

South Santiam: Someone noted barriers on Thomas and Harrington Creeks. Group agreed to leave ranking at 4,4.

Middle Willamette: Mercer Dam on Rickreall is complete barrier and blocks at least 5 miles of habitat. Several small dams on Mill Creek likely impediments as well.

Passage limitations in Abernethy Creek restrict access to significant portions of moderately high-quality habitat (in particular, Abernethy Creek upstream of Beaver Lake). Group discussed various barriers and proposed to increase the scope to Middle Willamette a 3, and keep severity of 4. Group agreed.

Yamhill:

Molalla-Pudding: There are no known passage assessments for the basin so many potential barriers may not be identified (particularly, on private forest lands). The mainstem Molalla and Pudding do not have any barriers but lower basin tributaries (such as Milk Creek) have multiple passage barriers that impact both salmonids and lampreys. Scored 2/2.5. Group did not identify any passage improvements in the past 5 years and kept 2.5,2.5.

Tualatin: Lake Oswego/Oregon Iron & Steel diversion dam on the lower Tualatin may be a complete barrier to upstream passage of lampreys. Not aware of any assessment performed. Fish ladder present but not maintained or purposed for lampreys.

Low head barrier dam on mainstem, fairly low down.

Ben: Suggested a Scope/Severity ranking of 3,3. The Balm Grove dam is slated to come out. The low head barrier dam on the lower river is not a complete barrier because they are getting eDNA hits above the dam. Greg Silver mentioned there are Pacific Lamprey in Gales Creek too.

Clackamas: Implemented trap and haul of at least 250 adults above North Fork Dam from River Mill Dam annually since 2017.

Ann: North Fork Ladder still needs significant improvements- entrance modification will occur in 2023 and ladder maintenance specific to lampreys has been improved. Also, PGE has implemented a T&H program since 2017, moving at least 250 adults each year above North Fork Dam while studies evaluate potential impediments and improvements. Ben suggested a Scope/Severity ranking of 3, 2.5. Ann commented that downstream passage success is unknown, but reduction seems warranted based on the above information and the basin above the North Fork Dam is producing many outmigrants each year (1,000s).

Lower Willamette: Passage limitations in Kellogg Creek restrict access to significant portions of moderately high-quality habitat. Johnson Creek has many tributaries that may be accessible to salmonids but not lampreys due to high number of road crossings in the watershed.

Ben and Mike H: The removal of the Boons Ferry culvert has opened up a significant portion of habitat on Tryon Creek, though other culverts in the watershed may be barriers. Overall things haven't really changed in the Lower Willamette, we just know more. Scope/Severity ranking of 1.5, 2.

Lamprey access should also be considered at USFWS managed/maintained fish ladders in the Eagle Creek watershed...lack of maintenance could restrict access to over 10 miles of high-quality habitat. (Ann to follow up with hatchery)

Dewatering and Flow Management: Rapid fluctuations in reservoir and stream water levels from irrigation diversions, power hydropeaking operations, and instream activities (e.g., channel reconstruction, barrier removals, habitat restoration) that isolate or dewater stream habitats. Water level fluctuations can impede migration or strand larval lamprey in the substrate.

Willamette HUC	DEWATERING/FLOW MGMT Rapid fluctuations in water levels; dewater habitats/strand larvae/ impede migrations				
	2017 Scope	2017 Severity	2022 Scope	2022 Severity	RANKS
Middle Fk Willamette	4	4	4	4	**SCOPE= AREA affected:** **High (4)** = >70% **Moderate (3)** = 31-70% **Low (2)** = 10-30% **Insignificant** (1) = <10% Unknown (0) **SEVERITY = Magnitude of the IMPACT:** **High (4)** = destruction requires 100+ yrs - recover **Moderate (3)** = Long term degradation requires 50-100 years **Low (2)** = reversible degradation within 30-40 yrs **Insignificant (1)** = no measurable impact. **Unknown (0)**
Coast Fk Willamette	4	4	4	4	
Upper Willamette	4	4	4	4	
McKenzie	3	3	3	3	
N. Santiam	4	4	4	4	
S. Santiam	4	4	4	4	
Middle Willamette	4	4	4	4	
Yamhill	3	3	3	3	
Molalla-Pudding	4	4	4	4	
Tualatin	2.5	2.5	3	3	
Clackamas	1	2	1	2	
Lower Willamette	3	3	3	3	

2022 Dewatering comments:

General Comment: Ben Clemens suggests maintaining all of the 2017 Scope/Severity ranks with the exception of the Tualatin, which should be changed to 3,3. Anthony S. was good with this suggestion. No others opposed.

Middle Fork Willamette: Greg Taylor: The Middle Fork is the most regulated piece of water in the Willamette, though the flows are extraordinarily stable. Greg suggested a Scope/Severity ranking of 4,4.

Coast Fork Willamette: USACE Cottage Grove Dam is in this HUC, but it is not as regulated as the Middle Fork Willamette. Not aware of anything that has changed in the last 5 years, so suggest leaving the Scope/Severity ranking a 4,4.

Upper Willamette: Kept same 2017 score since I don't know data showing otherwise.

McKenzie: Flow in this basin is highly regulated by the following large dams: Blue River, Cougar and Trail Bridge/Smith complex. Flow management remains a concern in terms of regulation of water and dewatering habitats. Also recent developments in the Metolius have shown reduced output from natural aquifers at the Head of The Metolius, but could be a concern for the upper McKenzie. At this time, we have not looked into this potential issue on the McKenzie.

North Santiam:

South Santiam:

Middle Willamette: Rickreall Creek has Mercer dam which blocks miles of habitat and water use is often close to capacity: City of Dallas has rights to most of Rickreall Creek water at summer low-flow.

Yamhill:

Molalla-Pudding: Not aware of any flow management in the basin with exception of irrigation diversion near Feyrer Park (near the city of Molalla) that reduces Molalla mainstem flows through summer months. Flow management outside of the basin resulting from ACOE dams may impact lampreys as they migrate out of the watershed but the extent is unknown.

Tualatin:

Clackamas: Limited potential for dewatering of lamprey redds in the lower Clackamas...flow is basically "run of the river" with limited ramping. Operations of Clackamas hydro project is managed to match natural flows as closely as possible and low ramp rates.

Lower Willamette: Flow management by the ACOE at Willamette system dams impacts lower river temperature by reducing nsatural flows during summer months.

Stream and Floodplain Degradation: Habitat altering activities such as dredging, mining, floodplain development, stream channelization, road building (e.g., channel confinement, simplification, habitat fragmentation), flood reduction (e.g., channel straightening, levees), and vegetation removal (e.g., grazing, deforestation, agriculture) that have contributed to the loss of complex riverine and riparian habitats and may reduce the quality and quantity of spawning and rearing habitats.

Ranks highlighted in yellow indicate a change from 2017, an "*" indicates a rank was selected by a majority of respondents.

Willamette HUC	Stream & Floodplain Degradation Human activities that alter streamflow, channel characteristics, riparian vegetation				
	2017 Scope	2017 Severity	2022 Scope	2022 Severity	Def/ RANKS
Middle Fk Willamette	4	4	4	4	**SCOPE= AREA affected:** **High (4)** = >70% **Moderate (3)** = 31-70% **Low (2)** = 10-30% **Insignificant** (1) = <10% Unknown (0) **SEVERITY = Magnitude of the IMPACT:** **High (4)** = destruction requires 100+ yrs - recover **Moderate (3)** = Long term degradation requires 50-100 years **Low (2)** = reversible degradation within 30-40 yrs **Insignificant (1)** = no measurable impact. **Unknown (0)**
Coast Fk Willamette	4	4	4	4	
Upper Willamette	4	3.5	4	4	
McKenzie	3	3	3	2.5	
N. Santiam	4	4	4	4	
S. Santiam	4	4	4	4	
Middle Willamette	4	4	4	4	
Yamhill	4	4	4	4	
Molalla-Pudding	4	4	3	3	
Tualatin	4	4	4	4	
Clackamas	3	3	3	3	
Lower Willamette	4	4	4	4	

2022 Stream & Floodplain Degradation comments:

General Comment: Ben suggested keeping most of the Scope/Severity ranks the same for all HUCs, but lowering the Severity rank of the McKenzie based on the restoration work led by the McKenzie WC, MRT, and USFS. Several agreed but it was noted that there is still a lot to do in the McKenzie with habitat restoration in the future. Difficult to determine when and how much to change ranks.

Middle Fork Willamette:

Coast Fork Willamette:

Upper Willamette: Based on historic log drives, the streams I've seen, 4/4 is a reasonable approximation

McKenzie: I feel with recent restoration projects (since 2017) focused on reconnecting floodplains have made significant improvements in the middle and upper McKenzie that will greatly benefit lamprey spawning and rearing in the near future. Jared Weybright: There are also 3-5 more large scale floodplain projects planned for the McKenzie starting in 2023 (Finn Rock Phase 2, Quartz Creek, South Fork Phase 3 & 4).

North Santiam: Habitat above the dams is high quality and extensive but un-occupied due to passage issues.

South Santiam:

Middle Willamette: Much of the Rickreall watershed is affected by agriculture and previous splash damming and log drives have severely disconnected the stream from its floodplain.

Yamhill:

Molalla-Pudding: Based on the comments provided in the questionnaire (which were overlooked during the meeting), ranks were decreased to 3/3.

There is actually more high-quality habitat in the Molalla Basin than many know as it is located behind locked gates on private timberlands.

It is interesting that this threat ranked so high in 2017; the Molalla river is one of the most sinuous tributaries to the Willamette, which suggests one aspect of desirable river complexity. It was also entered frequently by tagged lamprey (see Clemens et al. 2017).

Tualatin: Heavily urbanized.

Clackamas:

Habitat conditions in the upper watershed are capable of supporting high productivity of lamprey populations. Lower mainstem and tributary habitat is of moderate quality but improving, particularly with respect to floodplain connectivity (resulting from largescale habitat restoration actions implemented in the last 20 years).

Habitat restoration projects; such as side channel restoration, gravel augmentation, riparian restoration; have been implemented in lower river to improve floodplain habitat but unlikely to move the ranking down below 3.

Lower Willamette:

Water Quality: Excessive water temperature (>20°C), low dissolved oxygen, pH extremes, heavy metals, sediment/turbidity, biological or chemical contaminants, etc. that can affect development, growth or survival.

Willamette HUC	Water Quality Temperature, DO, pH, contaminants, turbidity that affect growth/survival				
	2017 Scope	2017 Severity	2022 Scope	2022 Severity	Def/ RANKS
Middle Fk Willamette	4	4	4	4	**SCOPE= AREA affected:** **High (4)** = >70% **Moderate (3)** = 31-70% **Low (2)** = 10-30% **Insignificant** (1) = <10% Unknown (0) **SEVERITY = Magnitude of the IMPACT:** **High (4)** = destruction requires 100+ yrs - recover **Moderate (3)** = Long term degradation requires 50-100 years **Low (2)** = reversible degradation within 30-40 yrs **Insignificant (1)** = no measurable impact. **Unknown (0)**
Coast Fk Willamette	4	4	4	4	
Upper Willamette	4	3.5	4	3.5	
McKenzie	3	3	3	3	
N. Santiam	3	3	3	3	
S. Santiam	4	4	4	4	
Middle Willamette	3.5	4	3.5	4	
Yamhill	4	4	4	4	
Molalla-Pudding	4	4	4	4	
Tualatin	4	4	4	4	
Clackamas	3	3	3	3	
Lower Willamette	4	4	4	4	

2022 Water Quality comments:

General Comments: Ben Clemens – concerned about the mainstem Willamette, Luckiamute river mouth, and many areas from the Middle Willamette northward (downstream). Summer temperatures are commonly 20°C and above.

Anthony Spitzack: For the Upper Willamette and Middle Willamette I would agree with Ben to at least keep the ranks the same as 2017.

Middle Fork Willamette:

Coast Fork Willamette:

Upper Willamette: Kept 2017 score as it seems a reasonable approximation

McKenzie:

I feel like the McKenzie is one of the great basins in the upper Willamette. Water is spring fed, clear, and cold. However, with increasing populations, recent Holiday Farm Fire, Climate

Change and location near the highway throughout the entire length of the river, WQ is always a concern because it could change at any moment.

2017 responses seem a little high, in comparison with multiple other RMUs and their HUCs.

North Santiam: Water Quality above the dams is exceptional. Below the dams is highly variable.

Karen: suggested leaving the Scope/Severity rank at 3,3. Besides fire, no substantial changes have occurred in the HUC. Others agree.

South Santiam:

Main threat is from high water temps. Barriers block access to the coolest water.

2017 responses seem a little too high.

Karen: suggested leaving the Scope/Severity rank at 4,4.

Middle Willamette: Main threat comes from low water quantity and associated high temperatures during summer, especially in Rickreall and mainstem Willamette.

Water temperature in lower Abernethy Creek can exceed 20C in mid-summer. Dense spawning aggregation in lower mainstem Abernethy near location of ongoing temperature monitoring.

Ben Clemens, Karen Hans, and Anthony Spitzack all believe the Scope/Severity ranks should be kept the same.

Yamhill:

Molalla-Pudding:

Tualatin:

Clackamas: Lower mainstem river temps approach 20C during mid-summer but tributaries typically maintain temperature <20C (exception...Deep Creek)

Lower Willamette:

Predation: Predation by native/nonnative fish, birds or mammals (e.g. smallmouth bass, cormorants).

Willamette HUC	Predation				
	2017 Scope	2017 Severity	2022 Scope	2022 Severity	Def/ RANKS
Middle Fk Willamette	3	3	3	3	**SCOPE= AREA affected:** **High (4)** = >70% **Moderate (3)** = 31-70% **Low (2)** = 10-30% **Insignificant** (1) = <10% Unknown (0) **SEVERITY = Magnitude of the IMPACT:** **High (4)** = destruction requires 100+ yrs - recover **Moderate (3)** = Long term degradation requires 50-100 years **Low (2)** = reversible degradation within 30-40 yrs **Insignificant (1)** = no measurable impact. **Unknown (0)**
Coast Fk Willamette	2.5	2.5	2.5	2.5	
Upper Willamette	2	4	3	3	
McKenzie	2	2	2	2	
N. Santiam	1.5	3	1.5	3	
S. Santiam	2	4	2	4	
Middle Willamette	4	0	3	3	
Yamhill	3	3	3	3	
Molalla-Pudding	3	3	3	3	
Tualatin	3	3	3	3	
Clackamas	3	0	3	0	
Lower Willamette	4	4	4	4	

2022 Predation comments:

Ben: general comment: in other RMUs, ranks for predation are often tied to human induced changes that exacerbate predation by native or non-native predators. In 4 other RMUs, I've argued that in most cases, empirical or observational data are lacking, therefore, recommend the default be 0, 0. However, the group moved forward with professional opinion and local knowledge.

Middle Fork Willamette:
Lookout Point reservoir is full of warmwater, non-native piscivorous fishes (crappies, walleyes, etc.).

Coast Fork Willamette: Non-native warmwater fish predators.

Upper Willamette: Kept 2017 score, don't have data to refute and there is likely non-native predation anywhere close to the Willamette.

Karen: The scope of predation in the Upper Willamette is significant (e.g., birds, northern pikeminnow, etc.). Karen suggested a Scope/Severity ranking of 3,3. Ben agreed: Nonnative fish

in reservoirs above dams is a problem. However, there are a lot of reservoirs with nonnative fish but no Pacific Lamprey, so it's difficult to rank. Jeremy suggested that anywhere with bass should be ranked a 3,3.

McKenzie: Jeremy supported the 2017 Scope/Severity rank of 2,2. There was some discussion re: the 130,000 rainbow trout stocked annually in the McKenzie, which is a concern for juvenile Chinook and should probably be considered for lamprey. The potential for predation is there, but it hasn't been quantified. Greg thinks we should leave the scores the same, but thought this was something to remain aware of for further research (here and elsewhere potentially) to better understand if it is a problem. Jeremy R shared some data from the McKenzie (related to the Willamette BI-OP) which looked at the impact of hatchery fish predation on various species of fish in the McKenzie. Out of 2,121 hatchery trout sampled, fish remains were found in the gut contents of 10 fish. No lamprey were found.

Christer: Finn Rock, below SF McKenzie has bass but ODFW has determined the bass won't be productive once the Finn Rock gravel ponds are restored and the bass have to go into the swift and cold mainstem. Jeremy agreed that without those ponds/ or if the ponds were removed, it would be difficult for the bass to successfully reproduce in the McKenzie River.

North Santiam: Karen: The N. Santiam has no real bass issues and would agree to keep the 2017 Scope/Severity ranks.

South Santiam: Karen: The S. Fork does have a problem with bass and suggested keeping the 2017 Scope/Severity ranks. Ben noted that Mike Sinnot observed smallmouth bass moving in on Pacific Lamprey redds.

Middle Willamette: Karen: most nonnative fish are coming from downstream and would rank the Scope/Severity a 3,3.

Clackamas: Predation on lamprey within the Clackamas Basin is insignificant due to limited habitat suitable for bass or other non-native fish. The primary stronghold for bass was in the River Island area of the river that was restored and no longer provides habitat conditions suited for predation by non-native fish. Predation by native fish species (Northern pikeminnow) may be significant but something that has always naturally occurred. Predation on lamprey by sea lions in the mainstem and lower Clackamas occurs but is not likely a factor limiting lamprey production in the Clackamas. Predation by bass is likely to occur in the Clackamette Cove area (directly downstream of the spawning aggregation described below) and Willamette downstream of the Clackamas. Observation of cormorants and mergansers loafing/foraging within the Clackamas hydroproject areas have increased over the last several years.

Lower Willamette: Potentially very high. Walleyes and other warmwater fishes. No empirical data. Group agreed to leave the Lower Willamette ranks the same.

Lack of Awareness: Lack of Awareness in terms of Pacific Lamprey life history characteristics, habitat needs, physiological limitations or best management practices when conducting instream work (e.g., channel dredging, stream restoration, fish passage improvements, etc.).

Willamette HUC	LACK of AWARENESS BMP implementation during instream channel work (restoration, dredging, passage upgrade)				
	2017 Scope	2017 Severity	2022 Scope	2022 Severity	RANKS
Middle Fk Willamette	2	2	3	3	**SCOPE= AREA affected:** **High (4)** = >70% **Moderate (3)** = 31-70% **Low (2)** = 10-30% **Insignificant** (1) = <10% Unknown (0) **SEVERITY = Magnitude of the IMPACT:** **High (4)** = destruction requires 100+ yrs - recover **Moderate (3)** = Long term degradation requires 50-100 years **Low (2)** = reversible degradation within 30-40 yrs **Insignificant (1)** = no measurable impact. **Unknown (0)**
Coast Fk Willamette	2	2	3	3	
Upper Willamette	2	2	2	2	
McKenzie	2	2	2	2	
N. Santiam	2	2	2.5	2.5	
S. Santiam	2	2	2.5	2.5	
Middle Willamette	2	2	2.5	2.5	
Yamhill	2	2	2	2	
Molalla-Pudding	2	2	2	3	
Tualatin	2	2	2.5	2.5	
Clackamas	2	2	2	2	
Lower Willamette	2	2	2	2	

2022 Lack of Awareness comments:

General Comments: Ann proposed ranking LOA the same in all HUCs in 2022 as was done in 2017; however, upon review of the questionnaire responses and the meeting notes, some changes were made to individual HUCs.

Ann: I view this threat as whether or not folks doing inwater work, designing passage (fishways/culverts) and salvage are including lamprey in their plans. Currently there is nothing required (permit-wise) to address the BMPs and salvage needs for Pacific Lamprey. Are there any basins that are particularly good or bad at protecting lamprey?

Ben suggested work in the McKenzie is good with all of the restoration efforts and attention to lamprey there.

Karen has seen a significant increase in the amount of outreach (mostly to youth) and awareness of Pacific Lamprey in the Middle Willamette, but it's hard to see how this is moving the needle.

Oregon Department of Forestry includes lamprey in their passage, salvage plans, ODFW has a lot of outreach materials, ODFW sends lamprey salvage documents to consultants, etc.

Ann: BLM and the USFS include Pacific Lamprey in their work on their lands.

Middle Fork Willamette: System hydraulics and ecology managed largely by USACE dams, including the impoundments that house non-native warmwater fishes. Dam operations largely do not consider lamprey.

Coast Fork Willamette: Not clear how this system differs from Middle Fork Willamette with respect to lack of awareness.

Upper Willamette: Reasonable approximation based on anecdotal evidence. Karen: Would keep the Scope/Severity ranking a 2,2.

McKenzie: With the restoration efforts going on, outreach by the watershed councils and involving the community in ODFW lamprey radio tagging study, the local community has a better understanding of lamprey than they did back in 2017 but we need to keep chipping away with more education. It is much better than most sub-basins however.

Various organizational staffs are aware of lamprey issues and working to educate others and incorporate what has been learned.

North Santiam: USACE operates dams in the system. Dam designs and operations not designed to benefit lampreys.

Molalla-Pudding: Much of the lamprey spawning habitat in the Molalla-Pudding is located in private timberlands where if there is any focus on restoring habitat, it is for salmonids. Might be a good idea to make sure local timberland managers know the importance of their watershed to Pacific lamprey production and the habitat/life history needs of lampreys.

Clackamas: Restoration practitioners should be well aware of the needs of lampreys as they are similar to salmonids, Passage issues are certainly different and measures need to be taken to protect ammocetes during instream work (i.e. salvage and relocation if necessary).

Climate Change: Thinking specifically for this watershed, and considering the current extent of occupied Pacific lamprey habitat, do you believe climate change (e.g., a potential increase in summer maximum water temperature [1° to 3°], alterations in precipitation patterns/intensity, diminished snowpack, shifts in timing of snowmelt and peak flows, more extreme high and low flows, or an increase in the risk and extent of wildfires) would have a minimal, moderate, or profound impact on Pacific Lamprey populations? Will this watershed be especially vulnerable or especially insulated from climate change?

Willamette HUC	Climate Change				
	2017 Scope	2017 Severity	2022 Scope	2022 Severity	Def/ RANKS
Middle Fk Willamette	0	0	4	4	**SCOPE= AREA affected:** **High (4)** = >70% **Moderate (3)** = 31-70% **Low (2)** = 10-30% **Insignificant** (1) = <10% **Unknown (0)** **SEVERITY = Magnitude of the IMPACT:** **High (4)** = destruction requires 100+ yrs - recover **Moderate (3)** = Long term degradation requires 50-100 years **Low (2)** = reversible degradation within 30-40 yrs **Insignificant (1)** = no measurable impact. **Unknown (0)**
Coast Fk Willamette	0	0	4	4	
Upper Willamette	0	0	4	4	
McKenzie	0	0	4	4	
N. Santiam	0	0	4	4	
S. Santiam	0	0	4	4	
Middle Willamette	0	0	4	4	
Yamhill	0	0	4	4	
Molalla-Pudding	0	0	4	4	
Tualatin	0	0	4	4	
Clackamas	0	0	4	4	
Lower Willamette	0	0	4	4	

2022 Climate Change comments:

General Comments: Ann proposed ranking Climate Change the same in all HUCs in 2022, unless there is a specific reason why one HUC is less susceptible to climate change.

Ben: proposes a Scope/Severity ranking of 4, 4 in all HUCs. No HUC is immune to climate change. Climate change is happening faster than anticipated, and will impact all ecosystems, including cold water systems. No system is immune to climate change.

Karen Hans, Laurie Porter, Brandon Weems, Greg Silver, and Anthony Spitzack all agree, so ranks were increased to 4/4.

The following are all of the comments provided in the questionnaire on CC:

South Santiam: This basin is more susceptible to climate change impacts than North Santiam

Middle Willamette: "2" answer is based on drought like conditions expected and the conflict with water users that will likely occur in the Rickreall.

Tualatin: See Wang et al. (2020)

Clackamas: One of the densest aggregations of spawning Pacific lamprey in the Clackamas is located ~0.5 miles upstream from the confluence with the Willamette River. The location of this particular spawning location makes the resulting offspring more likely to be susceptible to high temperature that may exceed 20C (no data to confirm). PGE staff are seeing changes in snowpack, earlier runoff patterns, and consequences of the 2020 riverside fire in the Clackamas Basin, but unsure how this is impacting lamprey.

APPENDIX C. 2023 MEETING NOTES

WILLAMETTE RMU- Pacific Lamprey Threats Assessment and RIP Annual Meeting

Annual Pacific Lamprey Meeting for the Willamette RMU
May 2, 2023
Co-chairs: Ann Gray & Jen Poirier (USFWS)

Virtual meeting attendees:

BLM: Anthony Spitzack
City of Portland: Melissa Brown
Coast Fork Willamette Watershed Council: Reilly Newman
Confederated Tribes of Warm Springs: Thomas Hafen
Columbia River Inter-Tribal Fish Commission: Laurie Porter
Eugene Water & Electric Board: Andrew Janos
Long Tom WC: Jed Kaul
NRCS: Les Bachelor
North Clackamas Urban Watershed Council: Amy Van Riessen
ODFW: Ben Clemens, Jeremy Romer
PGE: Nick Ackerman Maggie David, Carson McVay,
Polk SWCD: Beth Thiel
Pudding Watershed Council: Anna Rankin
USACE: Jessica Borden, Doug Garletts, Chad Helms, Nathan McClain
USFWS: Ann Gray, Jen Poirier, Joe Skalicky,
USFS: Olivia Guthrie, Doug Larson, Kari McClellan,
Yamhill SWCD: Jordan Anderson, Keith Nasman

AGENDA

- Introductions
- 2023 PLCI updates
- 2022 Pacific Lamprey Assessment results
- 2022 RIP review
- Lamprey funding opportunities
- Partner updates
- PLCI calendar review
- Adjourn

Background: Pacific Lamprey Conservation Initiative

- The Willamette Regional Management Unit group is part of Pacific Lamprey Conservation Initiative (PLCI).
- The PLCI is a collaborative effort developed to promote the coordination and implementation of conservation efforts across the range of lamprey.
  The PLCI is organized into four groups: Policy Committee (i.e., high-level managers, tribal council members), Conservation Team (signatories of Conservation Agreement), Lamprey Technical Workgroup and Regional Management Unit groups.

Background: Regional Management Unit (RMU) groups

- There are 18 RMU groups across range of Pacific Lamprey.
- RMU partners include project leads, field biologists, restoration practitioners, natural resource managers and stakeholders familiar with watersheds in the region.
- Partners provide information for the Pacific Lamprey Assessment (see below).
- Assist with development of Regional Implementation Plan (see below).

GENERAL MEETING NOTES –

2023 PLCI Events-

- **7th Annual Lamprey Information Exchange**
  - Early December 2023- and In-person
  - It's a mini-AFS focused on lamprey!
  - More details to come!
- Recordings of past webinars: www.gotostage.com/channel/plci

The Pacific Lamprey Conservation Initiative (PLCI) has new coordinator:

Max Calloway- MCalloway@pacificlamprey.org
https://www.pacificlamprey.org/

PLCI Lamprey Technical Workgroup:

- Great way to hear what's going on with lamprey-
- Technical advisory committee of PLCI
- Members represent a variety of organizations across PLCI's geographic range
- Multiple subgroups studying a range of topics
- Participation in the LTWG and its subgroups is open to all lamprey enthusiasts!
- Only meets Twice each year!
- Contact the LTWG Chair, Christina Wang (USFWS) for more information (Christina_Wang@fws.gov)

Recent LTWG Publications:
Links to these reports and others at https://www.pacificlamprey.org/ltwg/

- *Comparison of Pacific Lamprey and Pacific Salmon Life Histories, Habitat and Ecology (LTWG; 2023)*

- *Review of Factors Affecting Larval and Juvenile Lamprey Entrainment and Impingement at Fish Screen Facilities* (LTWG; 2022)
- *Practical Guidelines for Incorporating Adult Pacific Lamprey Passage at Fishways, Version 2.0* (LTWG; 2022)
- *Best Management Guidelines for Native Lampreys During In-water Work* (LTWG; updated 2022)
- *Barriers to Adult Pacific Lamprey at Road Crossings: Guidelines for Evaluating and Providing Passage* (LTWG; 2020)
- *Overview of eDNA and Applications for Research and Monitoring of Lampreys* (LTWG; 2021)
- *Monitoring and Minimizing Effects of Dredging on Lampreys* (LTWG; 2021)

Recent Publications

For more lamprey publications, check out the Data Clearinghouse literature site on USGS Science Base
https://www.sciencebase.gov/catalog/item/53ad8d9de4b0729c15418232

- Clemens, B. J., T. A. Friesen, S. V. Gregory, & C. L. Zambory. In press. *The case for basin-wide passage and habitat restoration for Pacific Lamprey in the Willamette River Basin (Oregon, USA).* North American Journal of Fisheries Management. https://doi.org/10.1002/nafm.10891.
- Clemens, B. J., J. D. Romer, J. S. Ziller, & M. Jones. 2023. *More flow in a regulated river correlates with more and earlier adult lamprey passage, but peak passage occurs at annual low flows.* Ecology of Freshwater Fish. https://doi.org/10.1111/eff.12703.
- Clemens, B. J., & J. Wade. 2023. *Conservation biology of the Lampetra species complex of western North America, with a focus on western brook lamprey (L. richardsoni)*. Canadian Manuscript Report of Fisheries and Aquatic Sciences 3258: vi + 26 p. https://waves-vagues.dfo-mpo.gc.ca/librarybibliotheque/41093732.pdf.
- Clemens, B. J. 2022. *Warm water temperatures (≥ 20°C) as a threat to adult Pacific lamprey: Implications of climate change.* Journal of Fish and Wildlife Management 13:1–8. https://doi.org/10.3996/JFWM-21-087.
- Clemens, B. J., J. A. Harris, S. Starcevich, T. Evans, J. Skalicky, F. Neave, R. T. Lampman. 2022. *Sampling methods and survey designs for larval lampreys.* North American Journal of Fisheries Management 42:455–474. https://doi.org/10.1002/nafm.10762.
- Clemens, B. J., & P. Edwards. 2022. *A citizen science project to assess lamprey distribution and raise awareness of the cultural and ecological importance of lampreys.* Final project report from the Oregon Department of Fish and Wildlife to the Bonneville Power Administration, July 16, 2020 to July 15, 2022.

2022 Pacific Lamprey Assessment results &

- See attached slides to see how the 2022 NatureServe Conservation Status Ranks (CSRs) changed across the range from 2017 to 2022 (Slides 10- 14).
- Within the Willamette Basin, there was largely no change to the CSR (see Slides 14- 17).
- Previous Assessment are available on the Pacific Lamprey Conservation Initiative web page.

2022 RIP (Regional Implementation Plan)

- The RIPs summarize the status, distribution and local threats to lamprey, as well as summarize the information used in the latest NatureServe model for the Pacific Lamprey Assessment.
- The 2022 RIP has been out for your review and will be finalized in the next week or so.
- Completed RIPs for previous years and all RMUs are on Pacific Lamprey Conservation Initiative web page.

Lamprey Funding Opportunities

- There are 2 primary sources of lamprey-specific funds with separate RFP and guidelines:
  - **PLCI/BPA Funds** (~300K for projects within Columbia River Basin/ year from Bonneville Power Administration)
    - ***Next RFP: late summer 2023***
  - **National Fish Habitat Partnership (NFHP) Funding** (~200-300K for projects across the range of Pacific Lamprey each year)
    - ***Next RFP: January 2024***
  - See PLCI website for more information and applications: **https://www.pacificlamprey.org/funding/**

New Lamprey Distribution or eDNA Information?

If you collect any **NEW** Pacific Lamprey distribution or eDNA data, we would love to hear from you!

6. Please look at our updated distribution maps on Databasin.org to see if we already have distribution information for your survey area.
   - https://databasin.org/datasets/a243fb1346ca4258b6388c5f7a90aee4/
   - Our lamprey distribution database manager David Hines (USFWS) is creating a separate GIS layer for eDNA information and it has not been added to the map yet.
7. If you don't see any current Pacific Lamprey distribution information in your survey area on the Databasin map, please contact David Hines (David_Hines@fws.gov) to share your data.
8. Please include a GPS coordinate of your sample location if possible!
9. If you collect information on **other native lamprey species** (e.g., Western brook) we would love that information too!
10. David can also help with data collection on Android or Apple mobile devices if requested, using Survey123 https://www.esri.com/en-us/arcgis/products/arcgis-survey123/overview?rsource=%2Fen-us%2Farcgis%2Fproducts%2Fsurvey123%2Foverview

RMU Partner Project Updates & Announcements

Ben Clemens (ODFW): ODFW in partnership with the USFWS, USFS and watershed councils recently finished a Stage-0 larval lamprey occupancy study in the SF McKenzie River and FiveMile/Bell. A manuscript for this work is being finalized. Pre-Stage-0 surveys will take place in Quartz Creek (in the McKenzie basin) this summer, and post-surveys will occur after

restoration is complete.

Doug Garletts (USACE): Adult Pacific Lamprey passage at Fall Creek. The trap and haul portion of the ladder has been open since mid-April, but no adults have arrived yet. Doug will let Ann know about juvenile screw trap counts from previous years, as the screw trap located immediately in the tailrace of Fall Creek Dam has collected juvenile outmigrants, which are progeny from the CTGR reintroduction efforts above Fall Creek Dam. Doug will share available write ups of the trap data (e.g., counts, timing, etc.).

RE: Fall Creek, there was later group discussion about the possibility of evaluating drawdown effects to lamprey in that reservoir. However, the CTGR finished their 8 years of translocation several years ago. Given effective upstream passage is not available yet, the majority of progeny from those translocated may have largely already exited the system, so it may no longer be a good place for a dewatering/stranding study.

Ann Gray (USFWS): The Adult Passage & Engineering subgroup (Ann is the chair) is putting together guidelines for the trap and haul of lamprey. Get in touch with Ann if you are interested in joining the subgroup or assisting with the development of the guidance document. If you do not have time but are involved in a Trap and Haul efforts that could be used in a short Case Study write-up, please let Ann know.

Anna Ranking (Pudding River Watershed Council): The watershed council is looking into four upcoming barrier removal projects (e.g., seasonal pushup dams or dams no longer used) and would like to chat with lamprey folks about the projects and involve other partners. They will be doing a rapid bioassessment this summer (is there anything they can do for lamprey?) as well as conducting eDNA sampling in the future. Contact Anna at Anna@puddingriverwatershed.org to discuss these projects!

Jed Kaul (Long Tom Watershed Council): For the past ten years, the watershed council has been working towards the removal of the Monroe drop structure on the Long Tom River. Partners include the Confederated Tribes of the Siletz Indians and USACE. Initial work has primarily funded by USACE 1135 funds. The watershed council has applied for necessary remaining funding to make the project complete (have already secured funding from USACE and USFWS BIL funds). The City of Monroe is the Watershed Councils will be a primary partner for the second phase of the project. Removal may happen as early as 2025 if everything goes smoothly.

Maggie David (Portland General Electric): PGE is evaluating passage through its two fish ladders on the Clackamas River. While River Mill ladder performs well for lamprey, problems exist in the North Fork fish ladder. While working to address those issues, PGE has been trap and hauling adult lamprey from the River Mill fishway to above the North Fork Dam since 2017- these efforts will continue until 2025, when the situation will be re-assessed. In 2022 PGE moved a total of 400 adult lamprey above North Fork Dam. The North Fork Surface Collector collected over 40,000 juvenile lamprey through the bypass – this is estimated to be about 4% of the fish actually passing (based on very small sample size).

PGE has made North Fork ladder entrance modifications to improve lamprey passage, and will continue to make modifications to improve adult passage. This year they are evaluating modifications to the seiche boards (present at each pool) so they are curved and allow lamprey to suction around/over the weir and seiche board. These modifications will be evaluated with PIT tagged fish.

PGE oversees a Habitat and Mitigation Fund for restoration and mitigation projects in the Clackamas Basin as part of their hydropower license. They recently put out a RFP and received several large wood and side channel restoration work that will benefit Pacific Lamprey and other native fish.

Doug Larson (USFS) is involved in a Citizen Project to collect eDNA in partnership with McKenzie River Flyfishers. The original goal was to evaluate presence of bull trout, but USFS has contributed funds to also evaluate presence of Pacific lamprey, included samples to be collected above Lookout Point Dam (which has not had passage for lamprey since construction) where previous sampling found the presence of Pacific lamprey in recent years (See published paper at https://link.springer.com/article/10.1007/s10641-020-00958-9).

Laurie Porter (CRITFC) – CRITFC provided comments on the USACE's Draft EIS alternative for the Willamette Valley System (13 dams in all). These comments recommended that USACE incorporate a comprehensive lamprey passage and reintroduction plan for all of the WVS dams into its preferred alternative (covering the next 30-40 years), including immediate actions to translocated Pacific lamprey into historically occupied habitats and retrofit salmonid trap and haul facilities to allow for the trap and haul of Pacific lamprey. Longer term actions include the collective development of reintroduction plans, passage facilities, and Research Monitoring and Evaluation of passage and reintroduction, all in consultation with CRITFC and other interested parties in the Willamette Basin. – As background to this NEPA process- here's USACE's update from last year from Greg Taylor (USACE): The USACE is operating dams differently than in the past due to recent litigation. The USACE has set up an injunction website https://www.nwp.usace.army.mil/Locations/Willamette-Valley/Injunction/. Implementation plans are being worked out now (i.e., operation scenarios such as sill operations, drawdown operations, etc.). These operational changes will have ramifications for passage, water quality, etc. both good and bad.

Joe Skalicky (USFWS)- Mack Barr (ODFW district biologist) alerted Joe to a long low head dam that has an old, unmaintained, outdated fishway in the lower Tualatin River. Joe plans to do a site visit and assess passage. Given it's no longer in use, it may be a future opportunity for dam removal. Ben indicated it is likely an impediment but not a full barrier to lamprey as Pacific lamprey eDNA has been found above the dam.

In the Abernathy watershed, Joe will also be assessing the Manpano Dam for fish passage. It has a fishway that had difficulty passing coho, and unsure about lampreys' ability to pass. Due to Abernathy's mouth location (right below Willamette Falls), it does have a high lamprey redd density in the creek. When Joe was there last year, a few otters were near the dam- given that, it may be a good place to study predation, if anyone has time/interest.

Joe is working with USGS and others on a larval lamprey dewatering paper, which should be available sometime this year.

Andrew Janos (EWEB)- The EWEB has decided that Leaburg Dam, which has not been diverting water or generating since 2018, will be removed in the next 10 to 15 years. See https://www.youtube.com/watch?v=RYw3yeHyFME for a video presentation from EWEB and more information. The Leaburg Reservoir has accumulated a lot of fine sediment and hosts thousands of larval lamprey. Salvage of larval lamprey will be part of the removal plan. Joe Skalicky asked if there would be any opportunities to further study drawdowns at Leaburg Reservoir, as it presents a unique situation where lamprey are present in high numbers and controlled drawdown of the reservoir elevation can occur. Andrew said he would keep Ann and Joe apprised if such opportunity arose.

Tony Spitzack (BLM) [update taken from the North Coast RMU meeting notes]- Tony mentioned that the Mercer Dam on Rickreall Creek in the Willamette Basin. The City of Dallas is currently designing a new dam (10 year planning effort just starting) at Mercer Dam (~60 ft tall), and is considering providing passage above the dam via Trap and Haul, so it would be good to have information on how best to collect lamprey for trap and haul (ODFW contacts: Greg Apke) are likely reviewing the designs for ODFW. The habitat above Mercer Dam is really nice looking and passage would greatly benefit anadromous species. ODFW has identified Mercer Dam as a state priority for passage.

Next Steps and Willamette RMU Review Timelines

- Draft Notes will be shared for your review/input. Comment by June 5.
- Lower Columbia RMU meeting – May 15, 10:00 AM
- LTWG Summer meeting – June/July
- PLCI/BPA Request for Proposals – September/October
- Lamprey Information Exchange – December
- NFHP Request for Proposals – January 2024

Contacts for Willamette RMU:

Ann Gray – USFWS ann_e_gray@fws.gov 503-231-6909

Jen Poirier – USFWS Jennifer_Poirier@fws.gov 360-604-2539

David Hines – GIS Specialist David_Hines@fws.gov 360-604-2509