Pacific Lamprey

2021 Regional Implementation Plan

for the

Lower Columbia/Willamette

Regional Management Unit

Lower Columbia Sub-Unit

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I. Status and Distribution of Pacific lamprey in the RMU

A. General Description of the RMU

The Lower Columbia River sub-unit within the Lower Columbia River/Willamette Regional Management Unit includes watersheds that drain into the Columbia River mainstem from Bonneville Dam at Rkm 235, west to confluence of the Columbia River with the Pacific Ocean. It is comprised of six 4th field HUCs ranging in size from 1,753−3,756 km^2 (Table 1). Watersheds within the Lower Columbia River sub-unit include the Lower Columbia-Sandy, Lewis, Upper and Lower Cowlitz, Lower Columbia-Clatskanie, and Lower Columbia River (Figure 1).

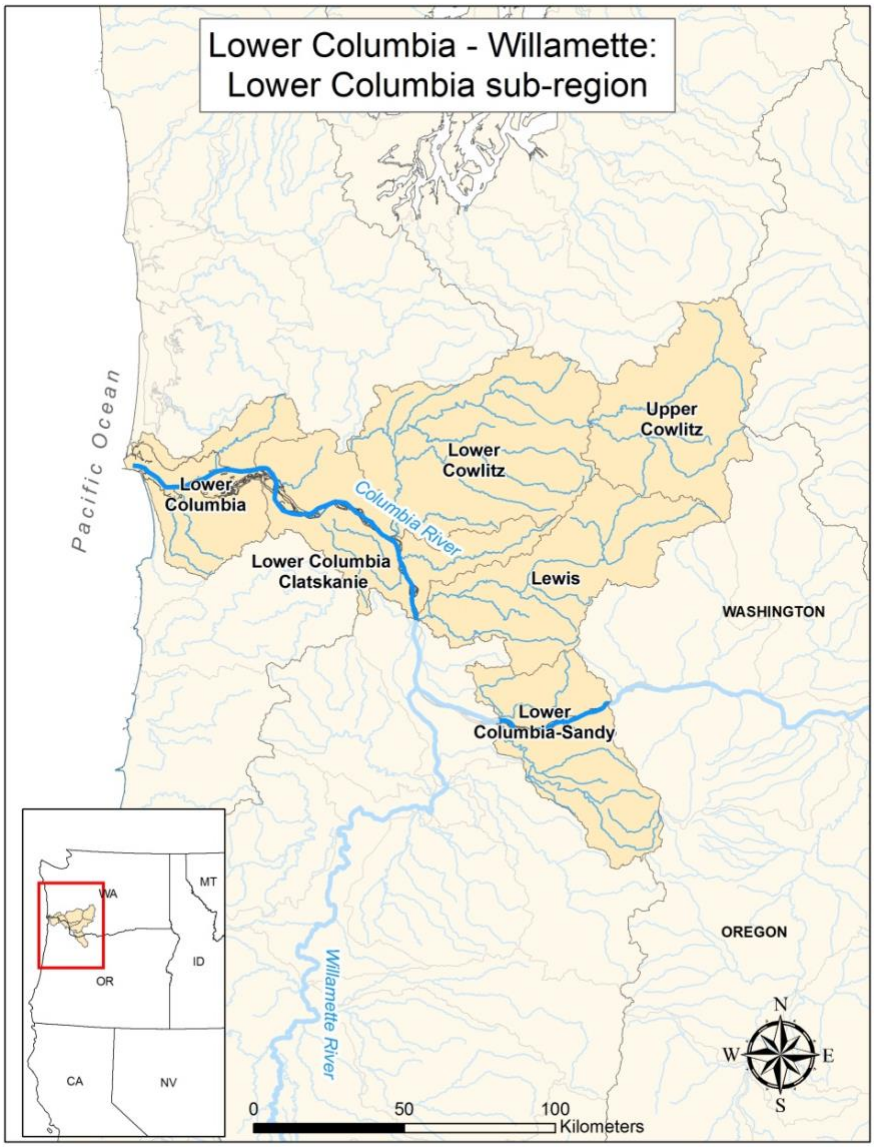

Figure 1. Map of watersheds within the Lower Columbia/Willamette RMU, Lower Columbia sub-unit.

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

Watershed	HUC Number	Drainage Size (km^2)	Level III Ecoregion(s)
Lower Columbia-Sandy	17080001	2,263	Willamette Valley, Cascades
Lewis	17080002	2,719	Puget Lowland, Willamette Valley, Cascades
Upper Cowlitz	17080004	2,654	Puget Lowland
Lower Cowlitz	17080005	3,756	Puget Lowland, Cascades
Lower Columbia-Clatskanie	17080003	2,349	Coast Range, Willamette Valley
Lower Columbia	17080006	1,753	Coast Range

B. Status of Species

Conservation Assessment and New Updates

Current Pacific Lamprey distribution in the Lower Columbia sub-unit is greatly reduced from historical range (Table 2). The revised Pacific Lamprey Assessment ranking of current distribution was reduced in all HUCs in 2017. The decline in these areas is a result of more accurately calculating the numeric area of occupancy (versus using a visual estimate), rather than a decline in Pacific Lamprey range (USFWS 2018). Overall, understanding of Pacific Lamprey distribution has expanded considerably in both Oregon and Washington State tributaries due to increased awareness and sampling effort (e.g., smolt trapping, redd surveys, occupancy sampling, fish salvages). Washington Department of Fish and Wildlife (WDFW) recently compiled a summary of adult and juvenile lamprey data collected incidentally during various WDFW monitoring programs and projects over the years. This information helped to expand known Pacific Lamprey distribution in several southwest Washington tributaries in 2020. A compilation of all known larval and adult Pacific Lamprey occurrences in the Lower Columbia sub-unit are displayed in Figure 2, which is a product of the USFWS Data Clearinghouse.

Pacific Lamprey population abundance was updated in the Lower Columbia-Sandy, Lower Columbia-Clatskanie, and Lower Columbia River HUCs using new information from Oregon Department of Fish and Wildlife (ODFW) to estimate a range of abundance using available redd counts. As part of the monitoring for winter steelhead spawning populations, the Oregon Adult Salmonid Inventory and Sampling (OASIS) field crews record data on lamprey spawners and redds. These estimates are considered minimum population numbers, as the surveys are focused on steelhead, and end before the completion of Pacific Lamprey spawning (see Jacobsen et al. 2014; Jacobsen et al. 2015; Brown et al. 2017). Abundance estimates were calculated for four lower Columbia River tributaries in multiple run years: the Sandy River (2010, 2012-2016), Clatskanie River (2012-2013, 2015-2016), Youngs Bay and Big Creek (2012-2013). Average abundance of adults ranged from 2-293 fish in the Sandy Basin (avg. of avg. 97 fish), 157-782 fish in the Clatskanie River (avg. of avg. 408 fish), and 25-980 fish in Youngs Bay and Big Creek Combined (avg. of avg. 354 fish). Adult Pacific Lamprey abundance is currently unknown in the Lewis and Lower Cowlitz HUCs, and Pacific Lamprey are believed to

be extirpated from the Upper Cowlitz River. The Cowlitz Salmon Hatchery Barrier Dam and Mayfield Dam effectively block access to the upper portion of the Lower Cowlitz River (above RM 49.6) and upper Cowlitz basin.

Short-term population trend (defined as the degree of change in population size over 3 lamprey generations or 27 years), was ranked as unknown in all HUCs of the Lower Columbia sub-unit (Table 2). Mainstem dam counts provide one of the only long term records of adult Pacific Lamprey numbers in the Columbia River basin. Despite data gaps and monitoring inconsistencies, counts of adult Pacific Lamprey at Bonneville Dam indicate a significant downward trend in abundance over time. Counts of adult Pacific Lamprey prior to 1970 averaged over 100,000 fish (1939-1969), while the recent 10-year average is just over 35,000 fish (Columbia River DART 2021) . Historical harvest records at Willamette Falls also suggest a decline in adult Pacific Lamprey abundance. Harvest estimates have ranged from a peak of ~400,000 pounds of fish in 1946 to less than 12,000 pounds since 2001 (Ward 2001). This reduction may be attributable to reduced fishing effort, more stringent regulations, different harvest methods, or a decline in lamprey abundance (Kostow 2002). Unfortunately no long term counts of Pacific Lamprey exist in tributary or mainstem areas of the Lower Columbia sub-unit. Populations are believed to be declined (from historical levels), but adequate information does not exist to estimate the magnitude of the decline. Oregon Department of Fish and Wildlife OASIS estimates provide 2-6 years of good abundance information in select lower Columbia tributaries (i.e., Sandy, Clatskanie, Youngs Bay and Big Creek), but this data set is not long enough to infer population trends.

Table 2. Population demographic and conservation status ranks (see Appendix 1) of the 4th Field HUC watersheds located within the Lower Columbia sub-unit. Note – steelhead intrinsic potential was used as a surrogate estimate of historical lamprey range extent in areas where historical occupancy information was not available. Ranks highlighted in yellow indicate a change from the 2011 Assessment.

Watershed	HUC Number	Conservation Status Rank	Historical Occupancy (km^2)	Current Occupancy (km^2)	Population Size (adults)	Short-Term Trend (% decline)
Lower Columbia-Sandy	17080001	S2	1000-5000	100-500	50-1000	Unknown
Lewis	17080002	S1↓	250-1000	100-500	Unknown	Unknown
Upper Cowlitz	17080004	SH	1000-5000	Zero	Zero	Unknown
Lower Cowlitz	17080005	S2	1000-5000	100-500	Unknown	Unknown
Lower Columbia-Clatskanie	17080003	S1S2↓	1000-5000	100-500	250-2500	Unknown
Lower Columbia	17080006	S2	1000-5000	100-500	250-2500	Unknown

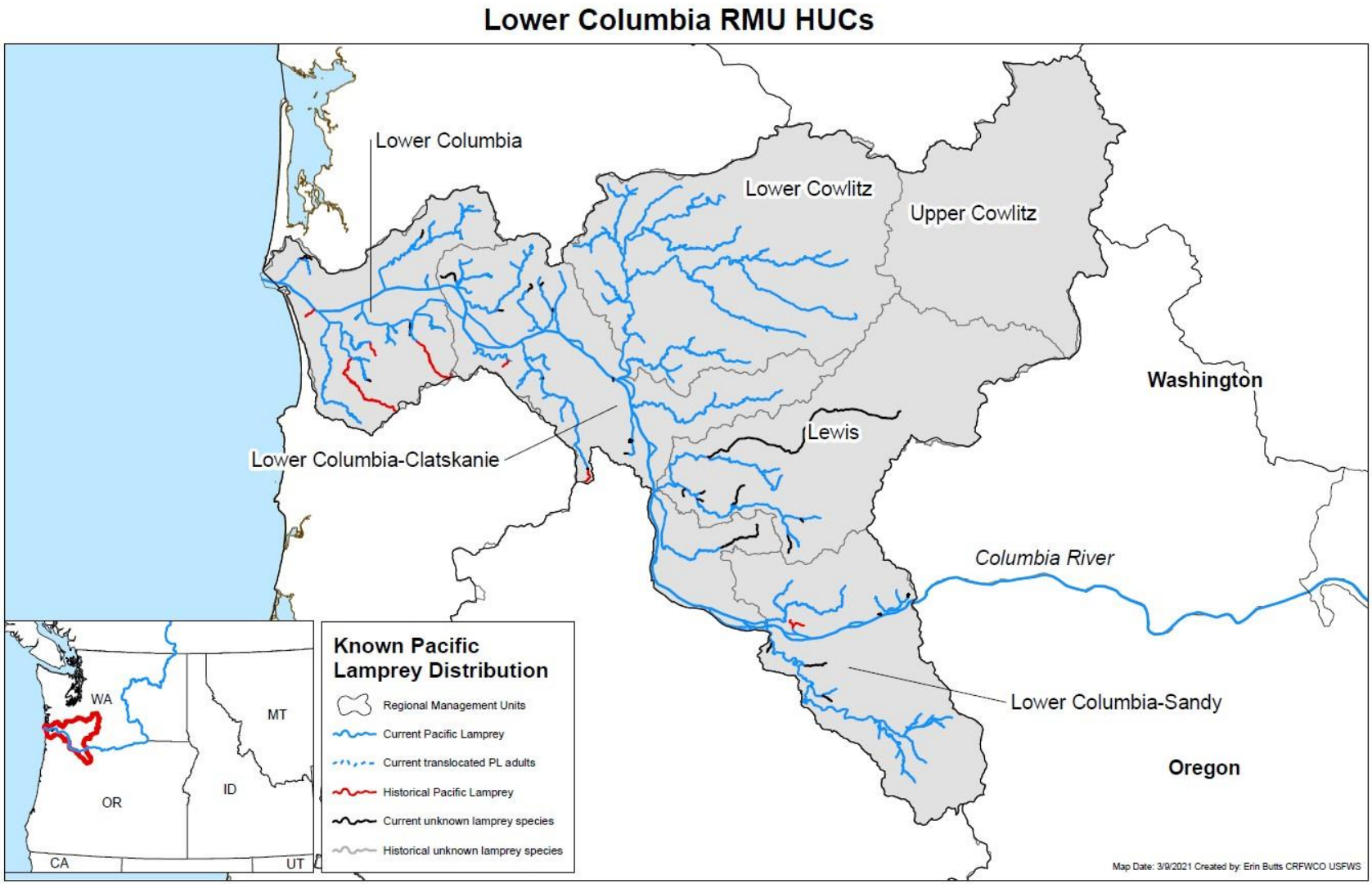

Figure 2. Current and historical known distribution for Pacific Lamprey: Lower Columbia/Willamette Regional Management Unit, Lower Columbia sub-unit (USFWS Data Clearinghouse 2021). Historical Pacific Lamprey distribution depicted in map was obtained from published literature, tribal accounts and state and federal agency records.

Distribution and Connectivity

Threats to passage were considered moderate in the Lower Columbia sub-unit (Table 3). While adult passage is not impeded by dams of the Federal Columbia River Power System (FCRPS), lamprey in these HUCs are affected by other large hydroelectric dam including Merwin, Swift, and Yale Dams in the Lewis Basin, and Mayfield, Mossy Rock and Cowlitz Falls in the Lower and Upper Cowlitz Basins. These dams were built without fish passage and completely block upstream migration and access to important spawning and rearing habitat. To compensate for loss of passage, salmon and steelhead are diverted into a collection facility where they are sorted, hauled by truck and released above dams. Downstream passage for juveniles is accomplished using floating surface collectors. It is unknown whether Pacific Lamprey have ever been collected at Cowlitz Salmon Hatchery or Merwin adult fish collection facilities. No trap-and-haul of lamprey currently takes place above these dams. Other significant passage barriers in the Lower Columbia sub-unit include the multi-dam complex on the Bull Run River in the Sandy basin, and Sediment Retention Structure on the North Fork Toutle River. Culverts, tide gates, and small dams/weirs are also a concern throughout the RMU.

Road crossing culverts are prevalent in the Lower Columbia sub-unit. Poorly designed or installed culverts may fragment aquatic habitat and impede the migration of fish. Culverts with excessive water velocity (>0.86 m/s), inadequate attachment points, perched outlets, or added features with abrupt 90 degree angles (e.g., baffles, fish ladder steps, outlet aprons), may obstruct passage of adult lamprey (Moser et al. 2002; Mesa et al. 2003; Keefer et al. 2003; Stillwater Sciences 2014; Crandall and Wittenbach 2015; LTW 2020a). Many impassable culverts occur low in watersheds (near tributary outlets), preventing access to miles of potential habitat. Barrier removal projects are on-going throughout the Lower Columbia sub-unit, but more effort is needed to address the passage needs of adult Pacific Lamprey and other native fish species (see LTW 2020a). There are still a number of basins within the lower Columbia with no barrier assessments.

Tide gates are broadly distributed in tidally influenced tributaries of the Lower Columbia sub-unit. Estuarine wetlands and floodplains were historically constrained by dikes and gated culverts to prevent flooding and drain land for agriculture, livestock grazing, and/or residential development. Traditional top-hinge tide gates do not allow tidal backflow and thus provide few (if any) passage opportunities for fish. Furthermore, many of the older wood and cast iron tide gates have become damaged or corroded over time and need maintenance. Stakeholder groups, like the Oregon Tide Gate Partnership, are actively working to facilitate the removal, repair or replacement of failing structures throughout the Oregon Coast and Lower Columbia. The Nature Conservancy recently funded a tide gate inventory of the lower Columbia that will be implemented in summer 2020.

Fish hatcheries in the lower Columbia River basin often utilize barrier dams and fish ladders to divert adult salmon into the hatchery during brood collection, or to regulate fish passage above the hatchery. Many of these structures are suspected passage barriers to adult Pacific Lamprey. The USFWS in partnership with ODFW recently completed an evaluation of adult Pacific Lamprey passage efficacy at seven different fishways and barrier dams associated with three salmon hatcheries in Oregon. A similar assessment was completed at 12 fish hatcheries in SW Washington in 2020.

C. Threats

Summary of Major Threats

The following table summarizes the known key threats (i.e., score ≥2.50) within the Lower Columbia sub-unit tributaries as identified by RMU participants during the Risk Assessment revision meeting in May 2017. The highest priority threat in the Lower Columbia watersheds is Dewatering and Flow Management followed by, Passage, Stream and Floodplain Degradation, and Water Quality.

Table 2. Key threats to Pacific Lamprey and their habitats within the Lower Columbia River sub-unit, 2017. High = 4; Moderate/High = 3.5; Moderate = 3; Low/Moderate = 2.5; Low = 2; Unknown = no value

Watershed	Passage		Dewatering and Flow Management		Stream and Floodplain Degradation		Water Quality	
	Scope	Severity	Scope	Severity	Scope	Severity	Scope	Severity
Sandy	2.5	3	3.5*	2	2.5	3	3*	3*
Lewis	3	3	4	4	3	3	3	3
Upper Cowlitz	4	4	4	4	3	3	1	1
Lower Cowlitz	3	3	3	4	3	3	1	2
Clatskanie	3.5	4	3*	3*	4	3	3.5*	3.5*
Lower Columbia	2	2.5	2.5	2	3.5	3	3	4
Mean	3.00	3.25	3.33	3.17	3.16	3.00	2.42	2.75
Rank	**M**	**H**	**M**	**M**	**M**	**M**	**L**	**M**
Mean Scope & Severity	3.13		3.25		3.08		2.59	
Drainage Rank	**M**		**M**		**M**		**M**	

"*****" indicates areas that were ranked higher because of the mainstem Columbia River

Current Threats

Dewatering & flow management

Dewatering and Flow Management was ranked a moderate threat in the Lower Columbia sub-unit. Low seasonal streamflow and Bonneville Dam flow regulation were identified as key issues in the region. Low flow conditions occur naturally in many watersheds during summer months (e.g., Grays River), but land use practices and consumptive water use may exacerbate conditions further. Water withdrawals for irrigation, livestock, municipal, or industrial purposes leave many watersheds in the Lower Columbia sub-unit dewatered or with inadequate flow during summer and fall months (e.g., Sandy River, Washougal River, East Fork Lewis River, Kalama River, Clatskanie River, Lewis and Clark River, Youngs River, Big Creek, and the South Fork Klaskanine River). Low flows can impact fish by reducing spawning and rearing habitat availability, creating low water passage barriers, or impairing water quality. The projected rise in human population and anticipated effects of climate change (i.e., elevated ambient temperatures, decreased surface water availability, altered flow regimes), may increase the frequency, duration and intensity of low flow conditions the future.

The mainstem Columbia River downstream from Bonneville Dam is susceptible to frequent fluctuations in discharge and water level resulting from the operation of Bonneville Dam for hydropower production and flood control. Flow regulation has significantly altered the natural flow patterns of the Columbia River (see Lower Columbia Fish Recovery Board (LCFRB) 2010). These changes can negatively impact aquatic species that rely on environmental cues (i.e., temperature, photoperiod, flow) to trigger important developmental or behavioral events such as emergence, growth, maturation or migration. In the Columbia River basin, the spring freshet takes place an average of two weeks earlier and flow volume is reduced from historical levels (LCFRB 2010; Naik and Jay 2011). Diminished spring flows may increase the duration of fish migration, potentially increasing exposure to predators and other threats. Additionally, the shift of peak flows to earlier in the spring could result in even longer periods of low flow and warm water temperatures during summer and fall months (Naik and Jay 2011). Rapid water level fluctuations below Bonneville Dam (i.e., hydropeaking) repeatedly inundate and dewater shallow water areas, directly impacting the quantity, accessibility and suitability of spawning and rearing habitat. Lamprey larvae are especially vulnerable to stranding as they rear in fine sediments along river margins and delta regions, but impacts related to hydropeaking below Bonneville Dam are unknown (Jolley et al. 2012; Mueller et al. 2015).

Stream & floodplain degradation

Stream and Floodplain Degradation was also ranked a moderate threat. Channel confinement, channel manipulation, and floodplain development are the primary concerns in the sub-unit. Human settlement and land development have greatly altered the physical habitat of tributaries in the region. In upland areas, stream cleaning, forest fires (e.g., Yacolt Burn), and historical timber harvest practices have completely deforested or altered the diversity and age structure of riparian vegetation and trees. Many watersheds are lacking mature trees that play a pivotal role in bank stability, water quality protection, thermal cover, and input of wood into channels. Large wood can benefit streams by influencing the structural complexity of the channel (i.e., creating pools or

undercut banks), increasing the deposition of fine substrate and organic matter, thereby providing important rearing habitat for juvenile salmonids and larval lamprey (Gonzalez et al. 2017). Within lowland areas, river channels have been straightened, diked and armored to protect property against flooding and erosion. Channel simplification and conversion of land for agriculture, grazing, and development (rural, urban, commercial, industrial) has reduced or eliminated a substantial amount of side channel and wetland habitat.

The Columbia River mainstem below Bonneville Dam has been straightened and confined by major railroad and transportation corridors that run parallel to the river. Much of the shoreline is armored with riprap and connection to tributaries occurs through culverts and bridges. In the Lower Columbia River and estuary, dikes and levees have disconnected the mainstem from floodplain and estuary habitat (e.g., tidal swamp, marsh, wetlands), reducing the river to a single channel. Efforts to maintain the shipping channel (e.g., jetties, pile dikes) have altered flow patterns and increased sediment accumulation that requires periodic dredging to remove. The impacts of channel maintenance dredging on larval lamprey in the Lower Columbia River have not been thoroughly documented. Dredging may displace, injure or kill burrowing larvae, disturb or destroy potential rearing habitat, or re-suspend contaminated sediments into the river (Maitland et al. 2015; Clemens et al. 2017). Preliminary deep water larval sampling in the Lower Columbia River downstream from the City of Skamakawa (RM 33.5) did not detect larval lamprey in the 15 quadrats surveyed (Jolley et al. 2011a). Multiple size class and species of lamprey have been observed in other areas within the Columbia River mainstem (Jolley et al. 2011b; Jolley et al. 2012), but habitat use and distribution within the estuary is still unknown.

Water quality

Elevated water temperature is the primary water quality concern in Lower Columbia tributaries. Excessive temperatures generally occur during summer months and may be attributed to increased air temperature, lack of riparian cover, reduced instream flows associated with water withdrawal, and warm irrigation water returns. The impacts of relatively warm water temperatures (e.g., ≥20°C) on Pacific Lamprey embryonic development, physiology, adult migrations, reproductive capability and evolutionary pressures can be multitudinous and substantial (Clemens et al. 2016). Other water quality concerns in tributaries include low dissolved oxygen, pH extremes, and presence of bacteria (e.g., fecal coliform, e coli), that may be associated with elevated water temperatures and agricultural or urban runoff.

Major water quality concerns in the Lower Columbia mainstem include elevated water temperature, low dissolved oxygen, gas supersaturation, and biological and chemical contaminants. Average water temperature below Bonneville Dam often exceeds 19°C in late June to early September (Bragg and Johnston 2016). High water temperatures are likely a result of warmer ambient temperatures and cumulative effects of water withdrawal and land use activities in tributary and mainstem areas. Dissolved gas supersaturation resulting from spill from Bonneville Dam can exceed the EPA mandated limit of 110% saturation for several months during normal and low water years (Schneider and Barko 2006). These levels may extend throughout the entire lower Columbia River. Short-term exposure to gas levels <120% has minimal ill effects for juvenile salmonids. However, long term or repeated exposure to sublethal levels (<110%) may increase susceptibility to predation, disease, toxins, or other environmental stressors (McGrath et al. 2006). Furthermore, aquatic organisms inhabiting shallow water

habitats or exposed during vulnerable life stages (e.g., incubating embryos, sac fry, or larvae) may be more sensitive to sublethal effects. The vulnerability of Pacific Lamprey to gas bubble disease or potential sensitivity at different life stages is unknown. Industrial discharge and surface water runoff from farms, roads and urban areas are the primary source of contaminants entering the Columbia River mainstem. Toxic contaminants such as DDE, PCBs, and heavy metals settle out and accumulate in fine sediments, reaching concentrations that may be harmful to aquatic and terrestrial organisms. Toxins and heavy metals may be a particular concern for Pacific Lamprey because direct exposure in water or sediment during larval and adult life stages can result in high concentrations of contaminants accumulating in fatty tissues that may compromise fish health and development (Nilsen et al. 2015; Clemens et al. 2017). Monitoring and restoration efforts to improve and protect water quality for fish, wildlife, and human health are ongoing in the Lower Columbia sub-unit.

Predation

Although not ranked a 'key threat', predation of adult and juvenile lamprey by native and non-native fish, birds, and marine mammals is known to occur in the Columbia River Basin (Close et al. 1995; Zorich et al. 2011; Madson et al. 2017). Pacific Lamprey encounter many of the same predators as salmonids during migration, but the severity of the threat is not well understood. Dams and other human changes to the environment can increase habitat suitability for predator species and may contribute to the decline of lamprey by delaying/slowing migration or exposing fish to increased mortality in areas where piscivorous predators may congregate (e.g. Bonneville Dam tailrace, Sand Island, etc.). In addition, temperature increases predicted with climate change models may expand the territory of warmwater predators into tributaries, putting further stress on native fish communities (Lawrence et al. 2014).

Restoration and Research Actions

To date, the primary lamprey restoration activities that have occurred or are occurring within this RMU are being performed by organizations focused on salmon and steelhead recovery on both the Oregon and Washington side of the river. Many instream and floodplain habitat restoration activities have been identified in subbasin and watershed management plans (e.g., Oregon Lower Columbia River Conservation and Recovery Plan (2010), Washington Lower Columbia Salmon Recovery and Fish and Wildlife Subbasin Plan (2010), Lower Columbia River Recovery Plan for Salmon and Steelhead (2013)). The vast majority of these actions have been funded and designed for salmon recovery, but work may improve habitat conditions for lamprey as well. Current Pacific Lamprey research has focused on gaining a better understanding of distribution and habitat use within the Columbia River mainstem and tributaries. The following lamprey research and restoration actions were initiated or recently completed by RMU partners in the Lower Columbia sub-unit from 2012-2020.

HUC	Threat	Action Description	Type	Status
RMU	Population	Environmental DNA, spawning ground surveys, smolt trapping and occupancy sampling to better understand lamprey distribution.	Survey	Ongoing
RMU	Stream Degradation	Implementation of instream and floodplain habitat restoration activities and culvert removal/replacement projects where lamprey salvage efforts occurred.	Instream	Ongoing
RMU	Passage	Evaluation of adult Pacific Lamprey passage efficacy at fishways and barrier dams associated with salmon hatcheries.	Assessment	Complete
RMU	Population	Distribution surveys in mainstem and principal tributaries	Survey	Ongoing
RMU	Population	Use of eDNA to monitor effectiveness of large wood placement projects and recolonization of larval lamprey following restoration	Assessment	Proposed/ Underway
RMU	Lack of Awareness	Consideration of lamprey when planning and implementing instream habitat restoration work (see LTW 2020b)	Coordination	Ongoing
RMU	Lack of Awareness	Compilation of lamprey data from SW Washington tributaries	Assessment	Complete
RMU	Passage	Map, assess and prioritize passage barriers in tributaries and evaluate available lamprey habitat upstream	Assessment	Underway
RMU	Population	Adult/Juvenile Pacific Lamprey data summary for Southwest Washington tributaries	Assessment	Complete
RMU	Population	Oregon Department of Fish and Wildlife Conservation Plan for Lampreys in Oregon *https://www.dfw.state.or.us/fish/CRP/coastal_columbia_snake_lamprey_plan.asp*	Other	Complete
RMU	Population	Ongoing lamprey genetics work (CRITFC)	Assessment	Ongoing
Sandy	Stream Degradation	Sandy River floodplain reconnection, gravel augmentation in Bull Run River.	Instream	Complete
Sandy	Stream Degradation	Large wood augmentation, side channel reconnection in upper Sandy River.	Instream	Complete
Sandy	Stream Degradation	Evaluation of new and past restoration projects to determine if projects benefit Pacific Lamprey or may be a barrier (e.g., log weirs)	Instream	Underway
Sandy	Water	Water quality monitoring and larval lamprey	Survey	Proposed

	Quality	sampling in Sandy R. Delta to understand the importance of this area as cold water refuge for salmon, steelhead and lamprey		
Sandy	Passage	Removal of Kwoneesum Dam – will restore connectivity to 3 miles of habitat on Wildboy Cr. (trib. Of WF Washougal River)	Instream	Underway
Clatskanie	Population	Conduct adult spawning ground surveys to monitor Pacific Lamprey distribution, timing, and number of redds to develop relative abundance indexes.	Survey	Ongoing
Clatskanie	Population	Deep water sampling to document distribution and habitat use of larval lamprey in Columbia River mainstem.	Assessment	Complete
Clatskanie	Passage	Tide gate and culvert modification and removal projects to restore access to spawning and rearing habitat.	Instream	Ongoing
Clatskanie	Passage	Removal of 3 passage barriers that will restore 200-300 acres and increase habitat connectivity for native fish	Instream	Underway
Clatskanie	Stream Degradation	Assessment of larval lamprey use in areas of salmonid restoration vs no restoration (Abernathy Creek).	Survey	Underway
Lower Columbia	Stream Degradation	Floodplain reconnection on Lewis and Clark & junctions of Big and Little Creeks	Instream	Upcoming
Lower Columbia	Stream Degradation	Whole habitat watershed restoration initiative on Grays R. will incorporate habitat needs for lamprey and other native fish	Instream	Upcoming
Lower Columbia	Passage	Pilot test of acoustic telemetry array to monitor movement of juvenile lamprey	Instream	Proposed
Lower Columbia	Passage	Lamprey friendly passage improvements at 3 dams at North Fork Klaskanine Hatchery. The smallest dam was completely removed in 2020	Instream	Underway
Lower Columbia	Passage	Evaluation of passage constraints for lamprey at fish hatcheries in Washington State	Instream	Complete
Lower Columbia	Population	Conduct adult spawning ground surveys to monitor Pacific Lamprey distribution, timing, and number of redds to develop relative abundance indexes.	Survey	Ongoing
Lower Columbia	Population	Study looking at effects of dredging on larval lamprey occupancy and abundance at 4 different locations in lower Columbia R.	Survey	Upcoming
Lower Columbia	Passage	Tide gate and culvert modification and removal projects to restore access to spawning and rearing habitat.	Instream	Ongoing

Lower Columbia	Population	Investigation of salinity tolerance and larval lamprey occurrence in tidally influenced estuarine stream.	Assessment	Complete
Lower Columbia	Population	UC Santa Barbara Master's group looking at juvenile Pacific Lamprey use of Columbia River estuary and how changes in environmental conditions effect habitat for Pacific Lamprey	Assessment	Underway
Lower Columbia	Passage	Formation of Oregon Tide Gate Partnership Group	Coordination	Ongoing
Lower Columbia	Passage	Tide gate inventory in lower Columbia River	Survey	Underway
Lower Cowlitz	Stream Degradation	Restoration work implemented in Coweeman (7 miles) and SF Toutle (14 miles) watersheds have shown great results at aggrading channels and retaining both fine and coarse sediments, likely benefiting resident and anadromous lamprey.	Instream	Ongoing
Lower Cowlitz	Stream Degradation	Study to look at effects of installing beaver dam analogs on larval lamprey presence and distribution	Instream	Underway

II. Selection of Priority Actions

A. Prioritization Process

Participating members of the Lower Columbia sub-unit had a virtual meeting on April 23rd, 2020 to discuss completed and ongoing conservation actions and identify specific projects and research needed to address threats and uncertainties within the region. The following project proposal was submitted by RMU partners for the Lower Columbia sub-unit Regional Implementation Plan in 2021:

Project Name	Project Proponent and Organization	Project Type(s)	Funding Requested	Brief Description
North North Fork Klaskanine Fish Passage Project	Graham Klag North Coast Watershed Association	Habitat Restoration	$53,955	The project will build a ~260 feet roughened channel to backwater a 6 feet tall diversion dam at Klaskanine Fish Hatchery. The constructed riffle will provide full fish passage over the dam and restore access to 4.7 miles of habitat on the North North Fork Klaskanine.

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Appendix 1

The following are the definitions for interpreting the NatureServe conservation status ranks in Table 2.

SX Presumed Extirpated.—Species or ecosystem is believed to be extirpated from the jurisdiction (i.e., nation, or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered. (= "Regionally Extinct" in IUCN Red List terminology).

SH Possibly Extirpated.—Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty. Examples of such evidence include: (1) that a species has not been documented in approximately 20–40 years despite some searching or some evidence of significant habitat loss or degradation; or (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in the jurisdiction.

SU Unrankable. .—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

S1 Critically Imperiled.—Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.

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

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

S4 Apparently Secure.—Uncommon but not rare; some cause for long-term concern due to declines or other factors.

S5 Secure.—Common, widespread, and abundant in the jurisdiction.