Pacific Lamprey 2021 Regional Implementation Plan *for the*

Snake River Region: Lower Snake, Clearwater and Salmon Regional Management Units

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Regional Implementation Plans are written annually to document activities benefiting lamprey that were done in the previous year, activities that will occur in the current year, and to present project proposals seeking funding. They also highlight any changes in status or threats and activities related to those documented in the Pacific Lamprey *Entosphenus tridentatus* Assessment, 2018 (USFWS 2018).

Projects that are proposed and discussed within this Regional Implementation Plan are in accordance with direction provided within the *Conservation Agreement for Pacific Lamprey in the States of Alaska, Washington, Idaho, Oregon and California, 2012.* Cooperative efforts through the Agreement intend to: a) develop regional implementation plans derived from existing information and plans; b) implement conservation actions; c) promote scientific research; and d) monitor and evaluate the effectiveness of those actions.

Projects identified in this Regional Implementation Plan do not imply or intend a funding obligation or any related activity from any of the government agencies, tribes or non-governmental entities discussed within this document.

I. Status and Distribution of Pacific Lamprey in the RMU

A. General Description of the RMU

The Snake River Region includes the Snake River and all waters draining into it downstream of Hells Canyon Dam (river km 397) to its confluence with the Columbia River (Figure 1). There are three Regional Management Units (RMUs): the Lower Snake Basin, the Clearwater River Basin, and the Salmon River Basin (Figure 1) with five major tributaries: Imnaha, Salmon, Grande Ronde, Clearwater, and Tucannon rivers. Within these RMUs there are 23 Hydrologic Unit Code (HUC) watersheds in 4 subbasins. The watersheds within this region that are still accessible to Pacific Lamprey range in size from 552-6,242 km^2.

The HUC 4 subbasins are: Lower Clearwater (17060306), Middle Fork Clearwater (17060304), South Fork Clearwater (17060305), Lochsa (17060303), Lower Selway (17060302), Upper Selway (17060301), Lower Salmon (17060209), Little Salmon (17060210), South Fork Salmon (17060208). Middle Salmon-Chamberlain (17060207), Lower Middle Fork Salmon (17060206), Upper Middle Fork Salmon (17060205), Middle Salmon-Panther (17060203), Lemhi (17060204), Pahsimeroi (17060202), Upper Salmon (17060201); Lower Snake-Asotin (17060103), Lower Grande Ronde (17060105), Upper Grande Ronde (17060104), Wallowa (17060105), Mainstem Snake Hells Canyon (17060101), and Lower Snake Tucannon (17060107).

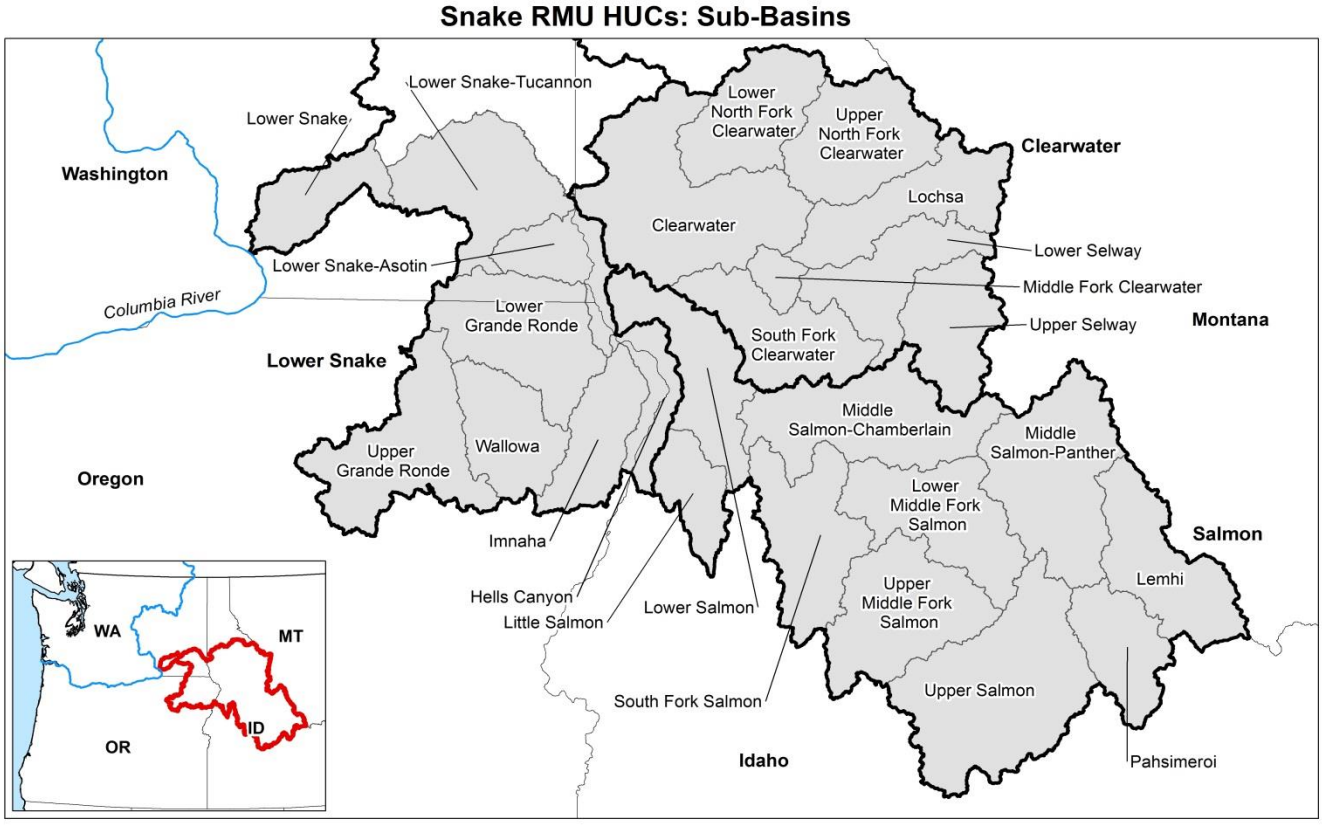

Figure 1. Map of 4th Code watersheds within the Snake River Region.

B. Status of Species

Conservation Assessment and New Updates

Historic occupancy of Pacific Lamprey is believed to have been extensive in all watersheds depicted in Figure 2 as well as the Snake River up to Shoshone Falls, and all major tributaries between the Hells Canyon Dam Complex and Shoshone Falls (Weiser, Payette, Bruneau River, Owyhee, Malheur, Burnt, Powder rivers). Current population size is still unknown in most areas of historic occupancy, but the current distribution is reduced from historic ranges (Luzier et al. 2011; USFWS 2018). The knowledge of current lamprey distribution has come from an increase in recent sampling efforts, releases of artificially propagated larval lamprey, and an active adult supplementation program ongoing by the Nez Perce Tribe (NPT) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) whereby adult lamprey collected from locations downstream in the Columbia River are released into Snake basin tributaries. Current information describing known occurrences of Pacific Lamprey is displayed in Figure 2 (a product of the U.S. Fish and Wildlife Service (USFWS) data Clearinghouse https://www.sciencebase.gov/catalog/item/53ad8d9de4b0729c15418232).

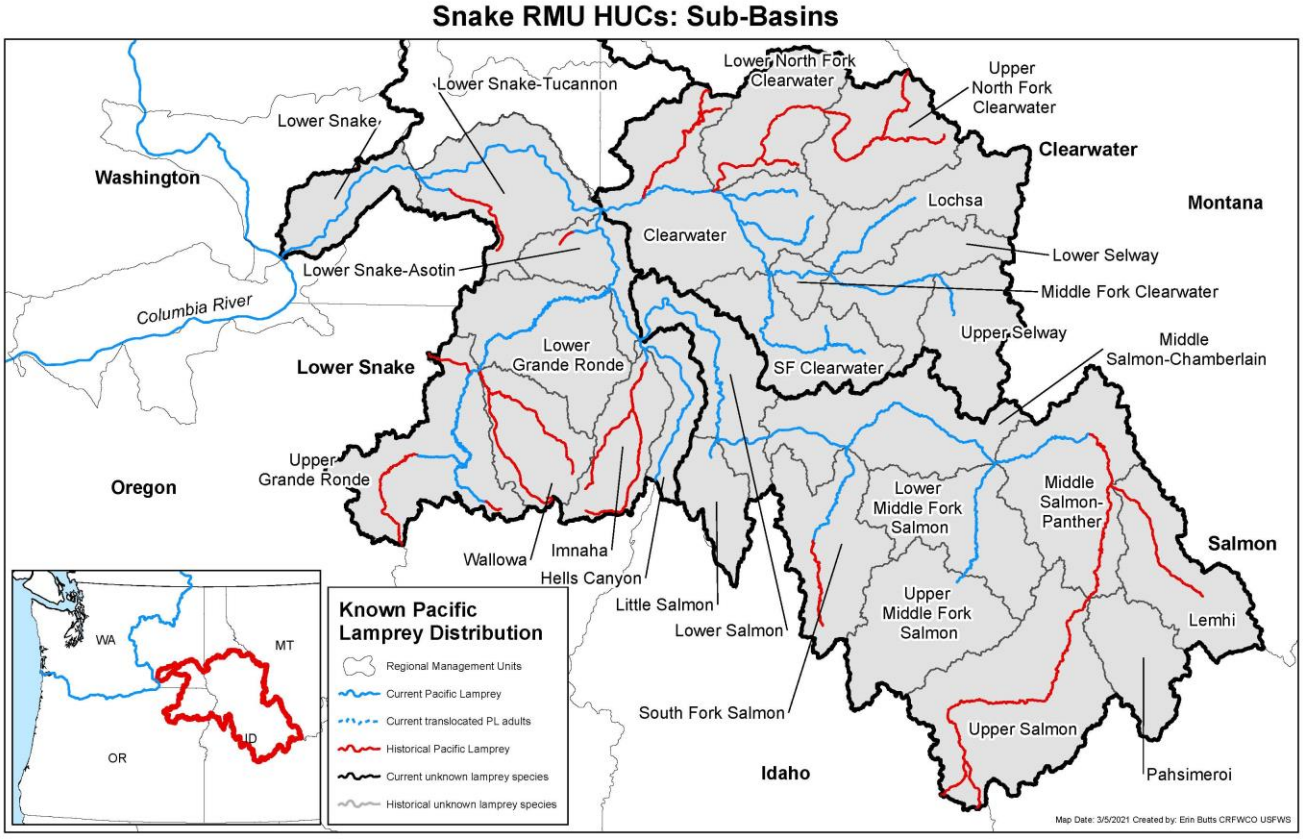

Figure 2. Current and historic known distribution for Pacific Lamprey in the Snake Regional Management Units: Lower Snake, Clearwater and Salmon (USFWS Data Clearinghouse 2018). Not depicted is historic distribution in the Snake River and tributaries above the Hells Canyon Dam Complex to Shoshone Falls.

Distribution and Connectivity

Upstream passage to the Snake River Region is restricted by four Federal Columbia River Power System (FCRPS) dams in the Columbia River (Bonneville, Dalles, John Day and McNary). Within the Snake River Region another four FCRPS dams on the Snake River (Ice Harbor, Lower Monumental, Little Goose and Lower Granite) impede upstream passage in the lower portion of the basin. The Hells Canyon Complex (Brownlee, Oxbow and Hells Canyon dams) on the Snake River as well as Dworshak Dam on the North Fork Clearwater River completely block upstream access for all native aquatic species. Culverts, irrigation diversions and smaller dams are widespread throughout the watersheds of the Snake River Region.

The combined impacts from this series of passage impediments are the most significant threat on the natural distribution and connectivity for Pacific Lampreys in most of the HUCs. Total annual counts (daytime and nighttime) of adult Pacific Lamprey at Lower Granite Dam have been declining since 2017, where a peak of only 2,894 adults passed (Figure 3). The 2020 counts (93 Total) were the lowest since 2009 (79 Total).

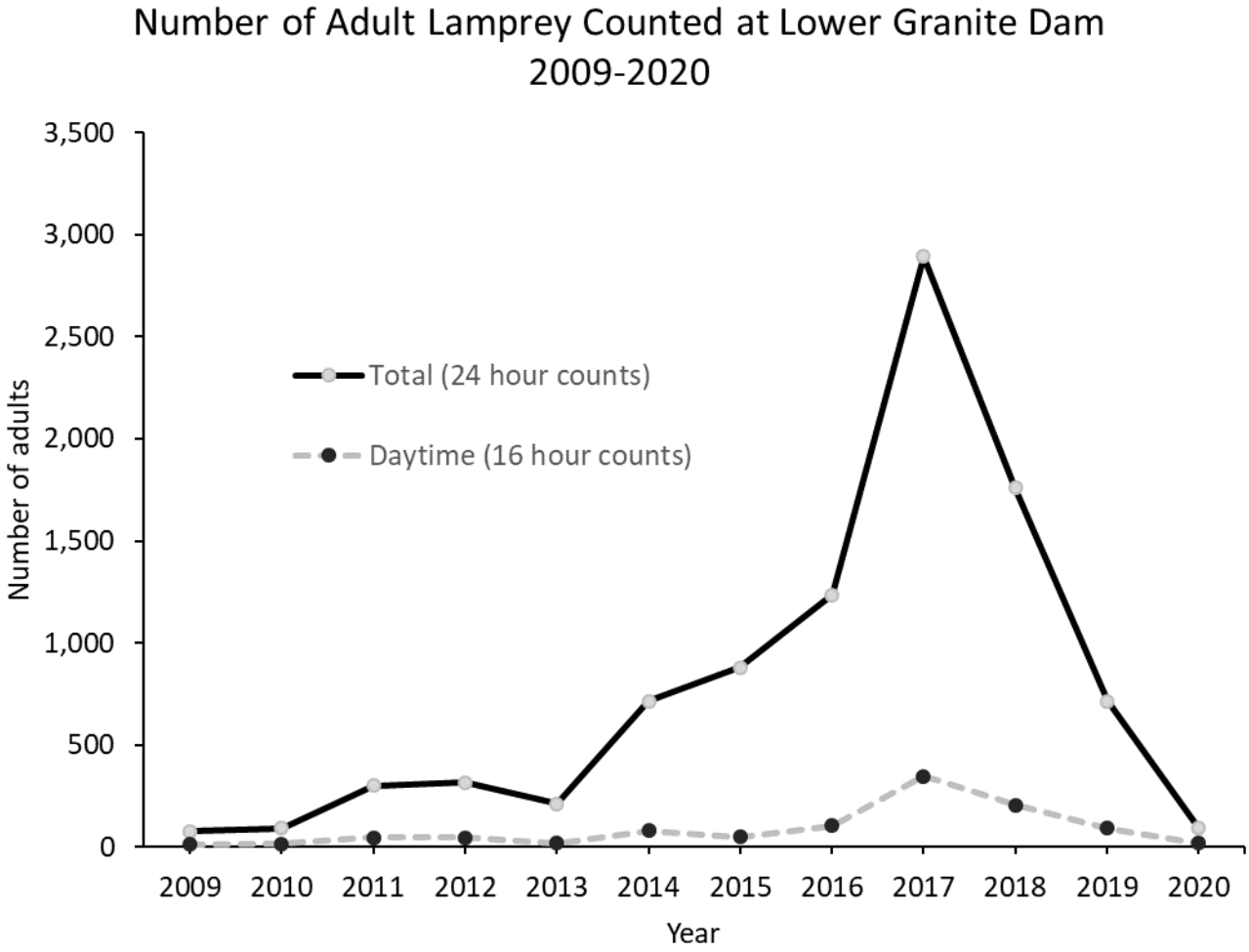

Figure 3. Number of adult Pacific Lamprey counted at Lower Granite Dam, 2009-2020. Data obtained from http://fpc.org on June 24, 2021.

Since 2000, surveys for larval Pacific Lamprey have been conducted in the Clearwater, Salmon, Selway and Lochsa subbasins of Idaho. Recent (2015-2019) surveys have confirmed the continued presence of larvae in the Mainstem, Middle and South Forks of the Clearwater River, the Lochsa and Selway rivers (Figure 2). In 2019, larval lamprey were detected in a few locations near the edge of their current distribution where they have not been recently documented. Idaho Power collected larval lamprey about 10 km's below Hells Canyon Dam and IDFG documented larval lamprey in the mainstem Salmon River near Salmon, ID.

Beginning in 2007, the NPT began releasing adult Pacific Lamprey, collected from downstream areas in the Columbia River, into tributaries of the Snake River as a means to supplement natural production (Table 1; see Ward et al. 2012). Subsequent stream surveys confirmed the presence of larvae in locations that received adult lamprey but had previously not contained larvae in recent years. The adult supplementation program has expanded throughout the years to include more tributaries throughout the basins (Table 1). CTUIR began supplementing adults in the Grande Ronde River Basin in 2015. The adult supplementation program has successfully reintroduced lamprey into extirpated tributaries and sustained these populations through annual releases. In 2021, CTUIR began releasing artificially propagated larval lamprey into the Toucannon River.

C. Threats

Summary of Major Treats

The highest priority threat in the Snake River Region is the Federal Columbia River Power System dams on the mainstem Snake and Columbia rivers, which results in small effective population size in each of the watersheds still accessible to Pacific Lamprey (USFWS 2018). Table 2 summarizes the known key threats that ranked Medium and High within the Snake River Region tributaries. The Supplement to the Mainstem Lower Columbia River and Columbia River Estuary Subbasin Plan (NPCC 2004) recommends improving dam passage for Pacific Lamprey. Translocation is now called Supplementation, to better represent the range of actions that occur when Pacific Lamprey are moved from one place to another.

Table 1. Releases of adult Pacific Lamprey into the Clearwater, Salmon, Grande Ronde and Asotin subbasins, 2007-2018, as part of the Nez Perce Tribe (NPT) and Confederated Tribes of the Umatilla Reservation (CTUIR) supplementation program. Asterisk denotes CTUIR releases. Data supplied by the Nez Perce Tribe and The Confederated Tribes of the Umatilla Reservation.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2019 summer	2020	2020 summer	Total
Clearwater River (ID)																	
Lolo Cr.	50	28	30	24	0	40	31	10	50	57	65	90	89	50	50[b]	0	614
Newsom Cr.	50	26	45	23	0	40	30	10	50	56	61	95	80	0	20	0	586
Orofino Cr.	49	25	30	22	0	40	24	0	51	56	0	90	80	0	30	0	497
Little Canyon Cr.	0	0	0	0	0	17	12	0	32	41	0	0	13	0	0	0	115
Red R.	0	0	0	0	0	0	0	0	0	0	0	91	81	0	30	0	202
East Fork Potlatch R.	0	0	0	0	0	0	0	0	0	0	0	0	0	50	50[b]	0	50
Lochsa River	0	0	0	0	0	0	0	0	0	0	0	0	15[a]	0	0	0	0
Clearwater mainstem	0	0	0	0	0	0	0	0	0	0	0	212	14[a]	9[a]	3	394[b]	215
Subbasin Total	149	79	105	69	0	137	97	20	183	210	126	578	372	109	183	394	2811
Salmon River (ID)																	
South Fork Salmon R.	0	0	0	0	0	40	30	11	50	56	62	90	81	0	30	40	490
Johnson Cr.	0	0	0	0	0	0	0	0	51	48	60	89	80	0	30	40	398
Secesh R.	0	0	0	0	0	0	0	0	0	50	65	90	92	0	32	40	369
Subbasin Total	0	0	0	0	0	40	30	11	101	154	187	269	253	0	92	120	1257
Lower Snake (WA)																	0
Asotin Cr.	28	27	35	22	29	40	30	10	43	56	61	90	80	50	50[b]	0	601
Grande Ronde River (OR)																	
Minam R.	0	0	0	0	0	0	0	0	25	55	35	90	77	0	30	0	312
Wallowa R.	0	0	0	0	0	40	30	10	25	55	30	90	80	0	30	0	390
Chesnimnus (Joeseph Cr.)	0	0	0	0	0	0	0	0	0	56	64	90	78	0	30	0	318
[c]Catherine Cr.	0	0	0	0	0	0	0	0	0	167	250	212	233	0	253	0	1115
[c]Upper Grande Ronde R.	0	0	0	0	0	0	0	0	0	400	201	527	539	0	178	0	1845
[c]Lookingglass Cr.	0	0	0	0	0	0	0	0	0	175	150	151	300	0	250	0	1026
[c]Little Lookingglass Cr.	0	0	0	0	0	0	0	0	0	0	150	0	0	0	0	0	150
[c]Indian Cr.	0	0	0	0	0	0	0	0	0	0	0	92	123	0	0	0	215
[c]Meadow Cr.	0	0	0	0	0	0	0	0	0	0	0	82	135	0	0	0	217
[c]Sheep Cr.	0	0	0	0	0	0	0	0	0	0	0	82	209	0	0	0	291
[c]Five Points Creek	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	100
[c]Wenaha River	0	0	0	0	0	0	0	0	0	0	0	0	109	0	143	0	252
*Subbasin Total	0	0	0	0	0	40	30	10	50	908	880	1416	1983	0	914	0	6231

[a]Released for FWS telemetry study, [b]Released with a portion PIT tagged, [c]Denotes CTUIR Releases

Table 2. Summary of the identified key threats of the Snake River Region, by RMU and Watershed, 2018. Harvest, Predation, Supplementation (formerly Translocation), Disease, Lack of Awareness and Climate Change were assessed and ranked Low or Insignificant in most HUC's (USFWS 2018). H – High, M – Medium, L – Low, I – Insignificant.

RMU/Watershed	Mainstem Passage	Small Population Size	Tributary Passage	Dewatering and Flow Management	Stream and Floodplain Degradation	Water Quality	Lack of Awareness	Climate Change	Predation
Lower Snake RMU	**H**	**H**	**M**	**L**	**M**	**L**	**H**	**M**	**L**
Lower Snake-Asotin	H	H	L	L	M	M	H	H	M
Lower Grande Ronde	H	H	L	I	L	L	H	H	L
Upper Grande Ronde	H	H	M	M	H	M	H	M	L
Imnaha	H	H	M	M	H	M	H	M	L
Wallowa	H	H	M	M	M	M	H	M	M
Lower Snake-Hells Canyon	H	H	M	M	L	L	M	M	M
Lower Snake-Tucannon	H	H	M	L	M	M	H	M	L
Clearwater RMU	**H**	**H**	**L**	**I**	**L**	**L**	**L**	**L**	**I**
Lower Clearwater	H	H	L	L	M	M	M	M	L
Middle Fork Clearwater	H	H	L	L	L	L	M	L	L
South Fork Clearwater	H	H	L	L	M	L	M	L	L
Lochsa	H	H	L	I	L	I	L	I	I
Lower Selway	H	H	I	I	I	I	L	L	I
Upper Selway	H	H	I	I	I	I	L	I	I
Salmon RMU	**H**	**H**	**L**	**L**	**L**	**L**	**M**	**L**	**L**
Lower Salmon	H	H	L	L	L	L	M	L	L
Little Salmon	H	H	L	L	L	M	M	L	L
South Fork Salmon	H	H	L	I	L	L	M	L	L
Middle Salmon-Chamberlain	H	H	I	I	L	L	M	L	L
Lower Middle Fork Salmon	H	H	I	I	I	I	L	I	I
Upper Middle Fork Salmon	H	H	I	I	I	I	L	I	I
Middle Salmon-Panther	H	H	M	M	M	L	H	L	I
Lemhi	H	H	M	M	M	M	H	L	I
Pahsimeroi	H	H	M	M	M	L	H	I	I
Upper Salmon	H	H	L	L	M	L	H	I	I

D. Restoration Actions

Idaho Department of Fish and Game (IDFG)

Idaho Department of Fish and Game does not have a dedicated Pacific Lamprey monitoring program but does target juvenile lamprey via electrofishing on wilderness float trips, and encounters Pacific Lamprey incidentally in screw traps and occasionally in stream electrofishing surveys. The majority of IDFG sampling occurs somewhat regularly on wilderness float trips in the Selway River and Middle Fork Salmon River. Scheduled wilderness float trips were cancelled in 2020 so no lamprey electrofishing surveys occurred.

Pacific Lamprey are also encountered by IDFG in rotary screw traps operated primarily to monitor Chinook Salmon and steelhead emigrant abundance. Trap operators collected genetic samples from a subset of encountered lamprey and sent them to the genetics lab at the Columbia River Inter-Tribal Fish Commission (CRITFIC). In 2020 crews observed 1,245 juvenile lamprey in the South Fork Salmon River screw trap. This is likely a result of Nez Perce Tribe (NPT) translocations of adult lamprey into the South Fork Salmon River. Additionally, crews observed 80 juvenile lamprey in the Lochsa River screw trap.

U.S. Fish and Wildlife Service Idaho Fish and Wildlife Conservation Office (IFWCO)

Due to COVID protocols, effort by the Idaho Fish and Wildlife Conservation Office in support of the PLCI and Conservation Agreement were minimal in 2020. Annual sampling of larval Pacific Lamprey with the Nez Perce Tribe and for distribution surveys did not occur. The IFWCO was able to complete field work for an adult Pacific lamprey radio telemetry study which began in 2019. This study assessed the migration patterns and behavior of translocated lamprey released into the mainstem Clearwater River and was in cooperation with the Nez Perce Tribe. The IFWCO continued analysis of telemetry data. IFWCO staff also participated in meetings to discuss development of a lamprey plan for the Hells Canyon Complex to file with FERC.

Oregon Department of Fish and Wildlife (ODFW)

ODFW personnel published 3 peer-reviewed articles (listed below) and completed a lamprey brochure (https://www.dfw.state.or.us/fish/species/lampreys.asp) on the native lampreys of Oregon. ODFW also participated in meetings to discuss development of a lamprey plan for the Hells Canyon Complex to file with FERC.

Clemens, B. J., & C. Wang. 2021. Dispelling misperceptions of native lampreys (*Entosphenus* and *Lampetra* spp.) in the Pacific Northwest (USA). Conservation Science and Practice. 3: e402.

Clemens, B. J., & C. B. Schreck. 2021. Microhabitat use by pre-spawning Pacific lamprey *Entosphenus tridentatus* differs by year, river segment, and availability in a large, regulated mainstem river. Environmental Biology of Fishes. 104: 325 – 340.

Clemens, B. J., H. Arakawa, C. Baker, S. Coghlan, A. Kucheryavyy, R. Lampman, M. J. Lança, C. Mateus, H. Nazari, G. Pequeño, T. Sutton, & S. Yanai. 2020. Management of anadromous lampreys: common challenges, different approaches. Journal of Great Lakes Research. https://doi.org/10.1016/j.jglr.2020.09.005

Nez Perce Tribe (NPT)

During 2020, NPT Lamprey Translocation Initiative Program continued its spring releases in all the usual targeted tributaries including Orofino Creek, Newsome Creek and Red River, as well as Lolo Creek, and in the Wallowa River, Minam River and Joseph Creek drainages of northeast Oregon, and in Asotin Creek in southeast Washington. An alternative direct release strategy, in which adults are released directly back into the river after transport past all eight dams (eliminating the conventional over-wintering period) was initiated the summer of 2020. These releases were into the mainstem Clearwater River. In the fall of 2020 additional migrant lamprey were released in the South Fork Salmon River, the Secesh River, and Johnson Creek drainages in central Idaho, with the use of this alternate strategy due to springtime access issues caused by deep snow. See Table 1 for a summary of releases through 2020. The NPT Lamprey Program also successfully proposed work via the PLCI proposal process for a collaborative multi-agency larval sampling effort in the Hells Canyon reach of the Snake River during October of 2021 and September of 2022. Associated with this funding is a "legacy" internship which helps support research and cultural ties with lamprey for the NPT.

Columbia River Inter-Tribal Fish Commission (CRITFC)

The CRITFC Hagerman Genetics Laboratory is the primary processor of lamprey genetic samples collected in the Columbia Basin. They conduct genotyping of all life stages of lamprey collected for monitoring supplementation within the Snake River basin, which includes larvae and juveniles sampled within and outside of supplementation areas and samples collected at mainstem dam juvenile collection facilities. They are finishing up 2020 Snake River Basin genotyping, and are starting analysis for 2020.

Confederated Tribes of the Umatilla Indian Reservation (CTUIR)

The Confederated Tribes of the Umatilla Indian Reservation continued adult supplementation in the Snake River Basin during 2020. 824 adult lamprey, captured at Columbia River Dams, were released into 4 locations in the Grand Ronde River Drainage. See Table 1 for a summary of releases through 2020. CTUIR began releasing propagated larval lamprey in the Toucannon River for the first time in the spring of 2021. About 200,000 prolarvae were released on May 21st and about 300,000 on June 8th.

University of Idaho

The University of Idaho's Department of Fish and Wildlife Sciences has been involved with several facets of research and evaluation of adult Pacific Lamprey migration and behavior at mainstem Columbia River and Snake River dams. Although no lamprey specific research in the Snake River RMU was conducted during 2020, University of Idaho personnel worked with collaborators to publish 5 peer-reviewed journal articles on Pacific Lamprey.

Syms, J.C.*, M.A. Kirk*, C.C. Caudill, and D. Tonina. 2020. A biologically based measure of turbulence intensity for predicting Pacific lamprey passage behaviors. Journal of Ecohydraulics. DOI: 10.1080/24705357.2020.1856007

Hess, J. S. Jeramiah, N. Timoshevskaya, C. Baker, C.C. Caudill, D. Graves, M.L. Keefer, M. Moser, L. Porter, G. Silver, S. Whitlock, and S. Narum. 2020. Genomic islands of

divergence infer a phenotypic landscape in Pacific lamprey. Molecular Ecology. **29** (20): 3841-3856. https://doi.org/10.1111/mec.15605

Zobott, H.*, R. Budwig, C.C. Caudill, M.L. Keefer, and W. Basham. 2020. Pacific Lamprey drag force modeling to optimize fishway design. Journal of Ecohydraulics. https://doi.org/10.1080/24705357.2020.1768911

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Keefer, M.L., C.J. Noyes*, T.S. Clabough, D.C. Joosten, and C.C. Caudill. 2020. Rapid migration and high survival of adult Pacific Lamprey in reservoirs. North American Journal of Fisheries Management **40**: 354-367. DOI: 10.1002/nafm.10413

United States Forest Service (USFS)

The USFS works with tribal and agency partners as needed to facilitate supplementation efforts as well as eDNA sampling.

The Rocky Mountain Research Station, through the eDNA Basinwide Lamprey Inventory and Monitoring Project (eBLIMP) (https://www.researchgate.net/project/eBLIMP-The-eDNA-Basinwide-Lamprey-Inventory-Monitoring-Project) has developed an eDNA marker for Pacific Lamprey and a preliminary set of rangewide occurrence probability maps to assist with future surveys. They have been actively collecting eDNA samples throughout Idaho and the Pacific Northwest to detect presence of lamprey species and map their distribution. Figure 6 shows sampling locations and areas with positive results in Idaho, Washington and Oregon for all samples collected since December 2019. Figure 7 shows the Snake River RMU in more detail.

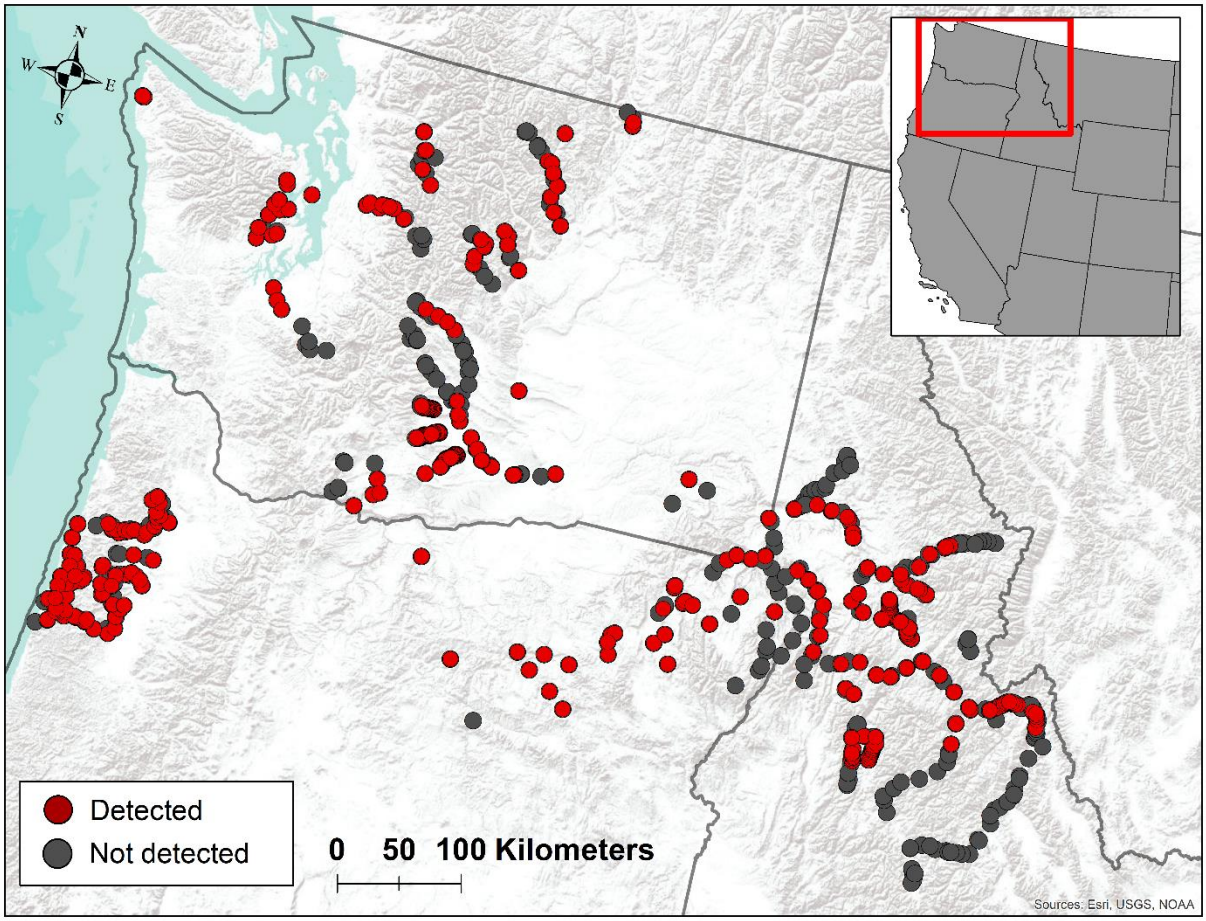

Figure 6. Environmental DNA detections of Pacific Lamprey in Idaho, Washington and Oregon. All samples were collected as a part of the analyzed by the eDNA Basinwide Lamprey Inventory and Monitoring Project and were analyzed at the National Genomics Center for Wildlife and Fish Conservation in Missoula, MT.

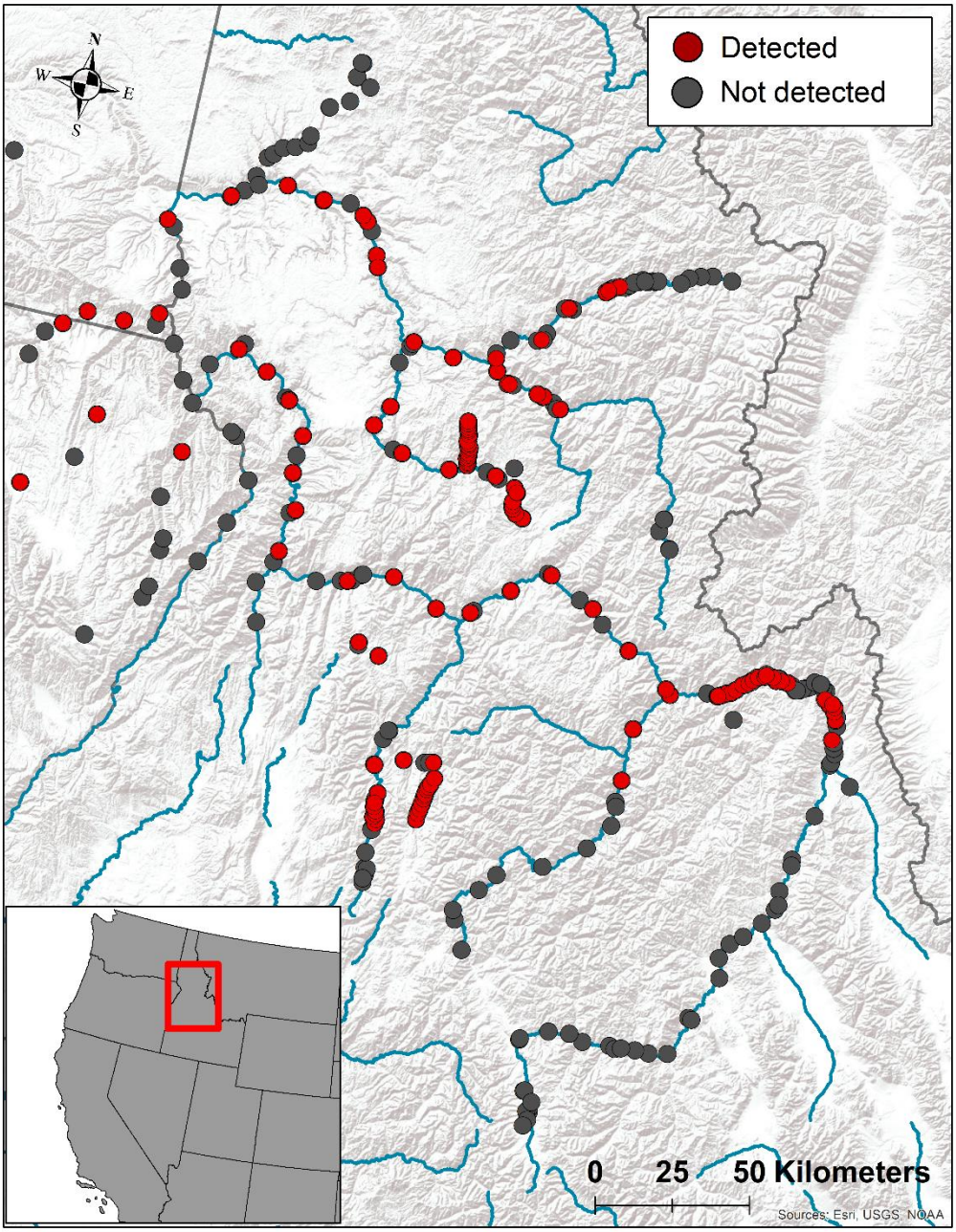

Figure 7. Environmental DNA detections of Pacific Lamprey in the Snake River Regional Management Unit. All samples were collected as a part of the eDNA Basinwide Lamprey Inventory and Monitoring Project and were analyzed at the National Genomics Center for Wildlife and Fish Conservation in Missoula, MT.

U.S. Army Corp of Engineers (COE)

Lamprey passage research and improvements have been ongoing by the COE on mainstem Columbia and Snake River dams, and activities are captured in the Columbia and Snake River Regional Management Unit Regional Implementation Plan. Lamprey specific improvements, including attachment plates at orifices, flow diffusers, lamprey orifices on weir walls and removal of right angles and hanging structures are being made at several facilities. Changes at the juvenile

salmonid bypass facilities are being implemented to facilitate juvenile lamprey return to the river, rather than into barges. Planning and coordination has begun on conducting a juvenile lamprey passage and survival study using acoustic telemetry at Lower Granite Dam.

E. High Priority Proposed Project Information

Participating members of the SRMU met in May 2021 to discuss ongoing conservation actions and identify research needed to address threats and uncertainties within the unit. No priority projects were proposed at this time.

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