Pacific Lamprey

2021 Regional Implementation Plan

for the

Washington Coast/Puget Sound Regional Management Units

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I. Status and Distribution of Pacific lamprey in the RMUs

A. General Description of the RMUs

The Puget Sound/Strait of Juan de Fuca Region is bordered by the Strait of Juan de Fuca to the west, the Cascade Range to the east, Puget Sound systems to the south, and the U.S.–Canada border to the north (Figure 1). The Puget Sound/Strait of Juan de Fuca Region includes all Washington river basins flowing into the Puget Sound, Hood Canal, and Strait of Juan de Fuca. The major river basins in the Puget Sound initiate from the Cascade Range and flow west, discharging into Puget Sound, with the exception of the Fraser River system, which flows northwest into British Columbia. All of the major river basins in Hood Canal and the Strait of Juan de Fuca originate in the Olympic Mountains. This region is comprised of 20 4th field HUCs ranging in size from 435-6,604 km^2 (Table 1).

The Washington Coast Region is bordered by the Pacific Ocean to the West, Cape Flattery to the North, Olympic Mountain Range and Willapa Hills to the East, and the Columbia River to the South (Figure 2). This region includes all Washington river basins flowing directly into the Pacific Ocean. The Washington Coast Region includes the Hoh-Quillayute, Queets-Quinault, Upper and Lower Chehalis, Grays Harbor, and Willapa Bay sub-regions, or 4th field HUCs, ranging in size from 1,471-3,393 km^2 (Table 2).

Figure 1. Map of watersheds within the Puget Sound/Strait of Juan de Fuca RMU.

Table 1. Drainage Size and Level III Ecoregions of the 4th Field Hydrologic Unit Code (HUC) Watersheds located within the Puget Sound/Strait of Juan de Fuca Region.

Watershed	HUC Number	Drainage Size (km^2)	Level III Ecoregion(s)
Fraser	17110001	645	Puget Lowland, North Cascades
Strait of Georgia	17110002	2,473	Puget Lowland, North Cascades
San Juan Islands	17110003	1,621	Puget Lowland
Nooksack	17110004	1,282	Puget Lowland, North Cascades
Upper Skagit	17110005	4,222	North Cascades
Sauk	17110006	1,919	North Cascades
Lower Skagit	17110007	1,158	Puget Lowland, North Cascades
Stillaguamish	17110008	1,823	Puget Lowland, North Cascades
Skykomish	17110009	2,209	Puget Lowland, North Cascades
Snoqualmie	17110010	1,795	Puget Lowland, Cascades, North Cascades
Snohomish	17110011	720	Puget Lowland, North Cascades
Lake Washington	17110012	1,603	Puget Lowland, Cascades, North Cascades
Duwamish	17110013	1,261	Puget Lowland, Cascades, North Cascades
Puyallup	17110014	2,580	Puget Lowland, Cascades
Nisqually	17110015	1,880	Puget Lowland, Cascades
Deschutes	17110016	435	Puget Lowland, Cascades
Skokomish	17110017	642	Coast Range, Puget Lowland, North Cascades
Hood Canal	17110018	2,479	Coast Range, Puget Lowland, North Cascades
Puget Sound	17110019	6,604	Coast Range, Puget Lowland
Dungeness-Elwha	17110020	3,289	Coast Range, Puget Lowland, North Cascades
Crescent-Hoko	17110021	2,005	Coast Range, Puget Lowland

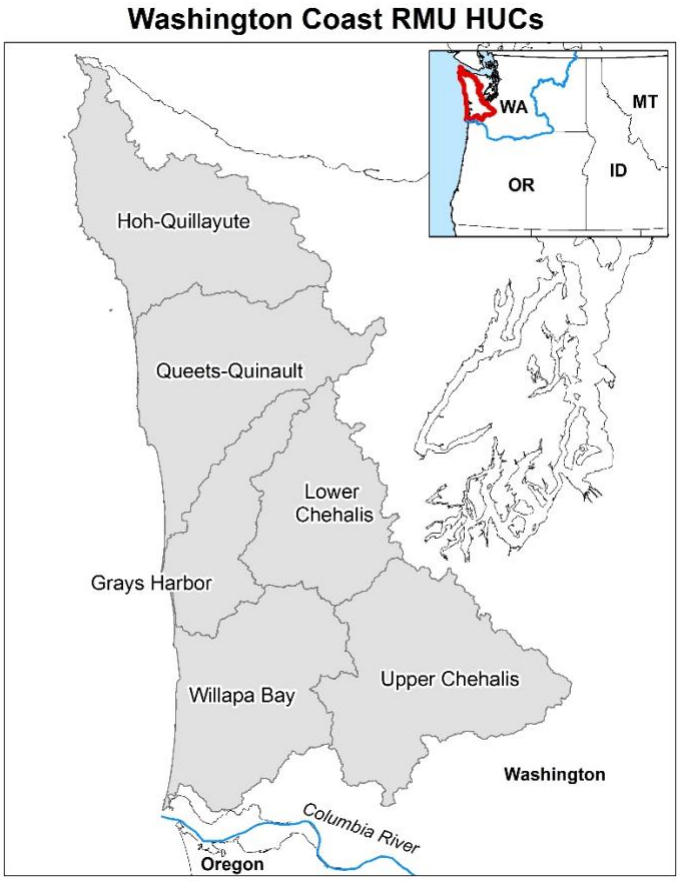

Figure 2. Map of watersheds within the Washington Coast RMU.

Table 2. Drainage Size and Level III Ecoregions of the 4th Field Hydrologic Unit Code (HUC) Watersheds located within the Washington Coast Region.

Watershed	HUC Number	Drainage Size (km^2)	Level III Ecoregion(s)
Hoh-Quillayute	17100101	3,186	Coast Range, North Cascades
Queets-Quinault	17100102	3,082	Coast Range, North Cascades
Upper Chehalis	17100103	3,393	Coast Range, Puget Lowland, Cascades
Lower Chehalis	17100104	2,170	Coast Range, Puget Lowland
Grays Harbor	17100105	1,471	Coast Range
Willapa Bay	17100106	2,849	Coast Range

B. Status of Species

Conservation Assessment and New Updates

Pacific Lamprey has not been a management priority for federal or state agencies on the Washington Coast or Puget Sound. However, in 2020 there were steps towards a more focused and collaborative approach to collecting targeted Pacific Lamprey data and incorporating lamprey into management activities in both RMUs. The Washington Coast RMU and Puget Sound/Strait of Juan de Fuca RMU both held inaugural annual meetings to discuss and coordinate on lamprey conservation needs. Both RMU meetings had participants from tribes, local, state, and federal agencies, non-profits, and universities. Additionally, staff from the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), and Washington Department of Fish and Wildlife (WDFW) met three times to discuss collaborative management of rare aquatic species that are not managed under the Endangered Species Act, and Pacific Lamprey was a particular focus of these meetings. Highlighted across these multi-organizational meeting was the need for more targeted lamprey data collection, lamprey identification and trainings for biologists and managers, sharing of best management guide resources, and continued collaboration. A focused effort by partners to collate information regarding Pacific Lamprey distributions, population trends, and local threats will be a priority in the coming year to facilitate identifying or updating the conservation status rank of Pacific Lamprey in all HUCs across these two RMUs.

Lamprey distribution information is currently being gathered (e.g. environmental DNA (eDNA) sampling, occupancy sampling and networking with partner agencies to fill data gaps) in western Washington tributaries. In 2019, water samples were collected in four HUCs, Sauk River, Skykomish River, Nisqually River, and Hood Canal, to help determine presence of Pacific Lamprey using eDNA techniques. Existing lamprey distribution and occupancy information is largely based upon anecdotal observations, or has been collected incidentally while monitoring salmonid species. In three of the four HUCs sampled, positive detections were found outside the current delineated distribution range for Pacific Lamprey. In some case, positive detections were found in new waterways that were previously unidentified as potential Pacific Lamprey habitat and in other cases, positive detections were found upstream of current or historic distribution boundaries. The results of the 2019 sampling season were encouraging and supported the utility of implementing broader eDNA sampling across the region to gain much needed distribution information on Pacific Lamprey. In 2021, this sampling effort is being expanded to eight HUCs in the North Puget Sound through a collaboration with the USFS Rocky Mountain Research Station. Additionally, the USFWS is conducting larval lamprey surveys and eDNA sampling on the Washington Coast to evaluate the efficacy of both methods for detecting lamprey, and ultimately to develop an occupancy model for Pacific Lamprey in Western Washington. These targeted lamprey sampling efforts will help guide and inform future project planning and fill distribution data gaps.

For the Washington Coast, conservation status ranks were calculated for two of six HUCs in 2017. An increase in available data from the Pacific Lamprey distribution database and updates to the calculated range extent were used to rank current occupancy and calculate ratio ranks for all six HUCs in the

region. However, four of these HUCs did not meet the minimum required parameters to calculate a conservation status rank were, and as a result do not have a conservation status rank (Table 3). The historical and current occupancy for the four HUCs without a conservation status rank still need to be finalized by the RMU work group. The Upper Chehalis and Lower Chehalis HUCs now have enough information from partners to be assigned a conservation status rank. Information provided allowed population size, short term trend, and threats to be ranked for these two HUCs. A compilation of all known larval and adult Pacific Lamprey occurrences in the Washington Coast RMU (as of 2017) are displayed in Figure 3, which is a product of the USFWS Data Clearinghouse.

Table 3. Population demographics of the 4th Field Hydrologic Unit Code (HUC) watersheds located within the Washington Coast Region, 2017. S1 = Critically Imperiled. S2 = Imperiled.

Watershed	HUC Number	Conservation Status Rank	Occupancy (km^2)		Current Population Size (Adults)	Short Term Trend
			Historical	Current		
Hoh-Quillayute	17100101		1,000−5,000	100-500	No rank	No rank
Queets-Quinault	17100102		1,000−5,000	100-500	No rank	Declining?
Upper Chehalis	17100103	S2?	1,000−5,000	100-500	250−2,500	Stable
Lower Chehalis	17100104	S3	1,000−5,000	100-500	1,000−2,500	Stable
Grays Harbor	17100105		1,000−5,000	Zero	No rank	No rank
Willapa Bay	17100106		1,000−5,000	100-500	No rank	No rank

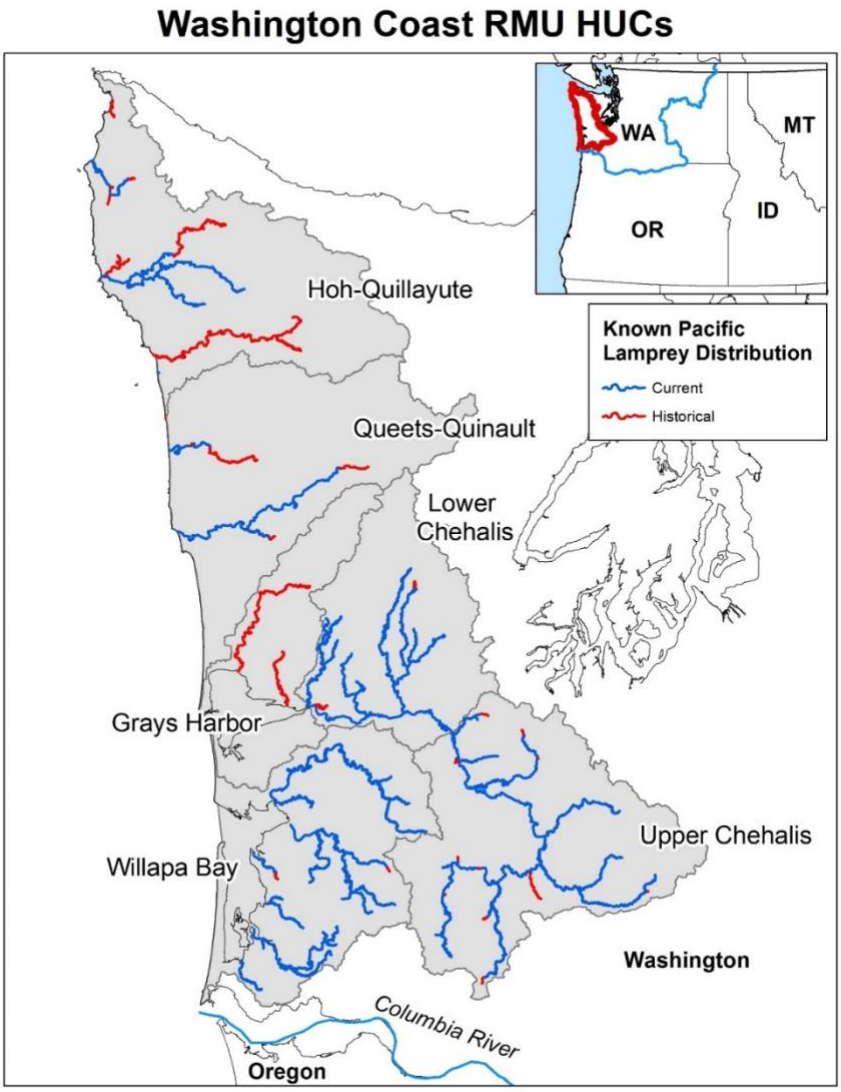

Figure 3. Current Pacific Lamprey distribution and location of 6 4th Field HUCs in the Washington Coast RMU (USFWS Data Clearinghouse 2017).

For the Puget Sound/Strait of Juan de Fuca, conservation status ranks were calculated in four of twenty HUCs in 2017 (Table 4). With limited data, all status ranks were S1 (Critically Imperiled) in the Nooksack, Puyallup, Dungeness-Elwha, and Crescent-Hoko. Much is still unknown about the watersheds in this region. Final Conservation Status Ranks changed in three HUCs. All three HUCs with Pacific Lamprey occupancy were categorized as Critically Imperiled (S1). Information availability and data quality were highest in the Elwha. The status of Pacific Lamprey in the Sumas River, Strait of Georgia, San Juan Islands, Upper Skagit, Sauk, Lower Skagit, Stillaguamish, Skykomish, Snoqualmie, Snohomish, Lake Washington, Duwamish, Nisqually, Deschutes, Skokomish, Hood Canal, Puyallup and Puget Sound HUCs are still unknown, however, with increased distribution data historical and current occupancy were calculated for these HUCs. These calculations should be considered preliminary until reviewed, reevaluated, and approved by the RMU work group during the 2022 assessment process.

Table 4. Population demographic and Conservation Status Ranks of the 4th Field HUC watersheds in the Puget Sound/Strait of Juan de Fuca Region. S1 = Critically Imperiled. Ranks highlighted in yellow indicate a change in 2017 when all HUCs were unranked.

Watershed	HUC Number	Conservation Status Rank	Historical Occupancy (km2)	Current Occupancy (km2)	Current Population Size (adults)	Short-term Trend (% decline)
Sumas River	17110001		250-1,000	Zero		
Strait of Georgia	17110002		250-1,000	Zero		
San Juan Islands	17110003					
Nooksack	17110004	S1	1,000-5,000	20-100	1,000-10,000	-Stable
Upper Skagit	17110005		1,000-5,000	Zero		
Sauk	17110006		1,000-5,000	Zero		
Lower Skagit	17110007		250-1,000	20-100		
Stillaguamish	17110008		1,000-5,000	100-500		
Skykomish	17110009		1,000-5,000	20-100		
Snoqualmie	17110010		1,000-5,000	20-100		
Snohomish	17110011		250-1,000	20-100		
Lake Washington	17110012		250-1,000	Zero		
Duwamish	17110013		250-1,000	20-100		
Puyallup	17110014	S1	1,000-5,000	20-100	Unknown	
Nisqually	17110015		1,000-5,000	20-100		
Deschutes	17110016		250-1,000	Zero		
Skokomish	17110017		250-1,000	4-20		
Hood Canal	17110018		1,000-5,000	20-100		
Puget Sound	17110019		1,000-5,000	20-100		
Dungeness-Elwha	17110020	S1	1,000-5,000	20-100	Unknown	Increasing
Crescent-Hoko	17110021	S1	250-1,000	20-100	Unknown	

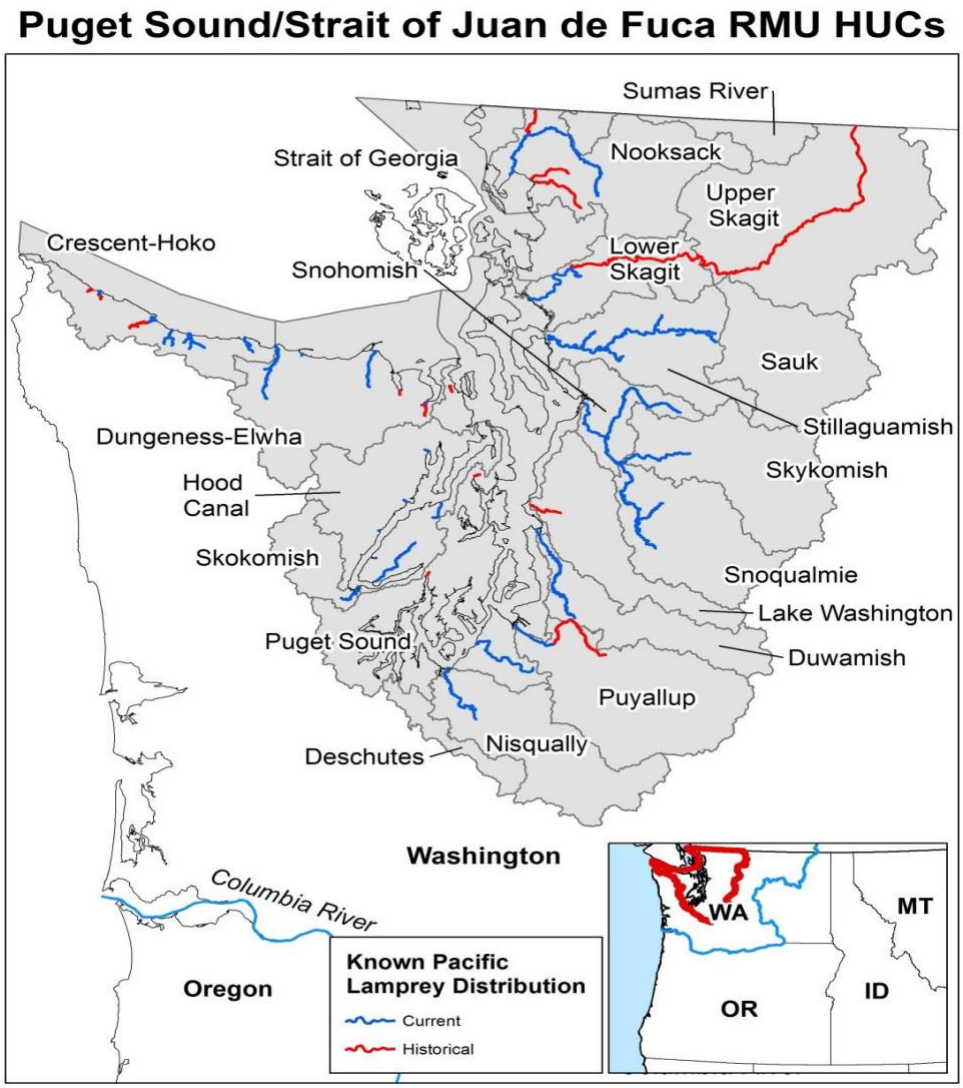

Figure 4. Current Pacific Lamprey distribution and location of 20 4th Field HUCs in the Puget Sound/Strait of Juan de Fuca RMU (USFWS Data Clearinghouse 2017).

Distribution, Connectivity, and Threats

Lack of awareness, stream and floodplain degradation, dewatering and flow management, and climate change were identified as threats to Pacific Lamprey in the four HUCs ranked in the Puget Sound/Strait of Juan de Fuca RMU in 2017. These most likely account for Washington Coast threats as well. Lack of awareness ranked as the greatest threat with moderate scope and severity. Stream and floodplain degradation were moderate threats with moderate scope and severity. Dewatering and flow management were moderate threats with low scope and moderate severity. Finally, climate change was identified as a low threat in the Dungeness-Elwha HUC with low scope and low severity. Recent research into direct climate change impacts to Pacific Lamprey could be used to assist in evaluating scope and severity for this threat more broadly across Western Washington. Using multiple projected climate change scenarios to predicted risk categories for Pacific Lamprey in west coast watersheds, Wang et al. (2020) calculated the Chehalis River to be moderately vulnerable and the Skagit River would be highly vulnerable to future climate change impacts. Changes in stream temperature and hydrologic timing were projected across all scenarios and locations and highlight the need to evaluate the threat of climate change in both RMUs. Passage was identified as a threat in the Puyallup River but was not ranked in severity or scope. More information from all HUCs need to be collected and analyzed before threats are ranked and prioritized.

Road crossing culverts are prevalent in the Washington Coast RMU. 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; Stillwater Sciences 2014; Crandall and Wittenbach 2015). Many impassable culverts occur low in watersheds (near tributary outlets), preventing access to miles of potential habitat. An extensive effort is underway to inventory and prioritize problem culverts for removal, replacement or repair.

Restoration and Research Actions

To date, the primary lamprey restoration activities that have occurred or are occurring within these RMUs are being performed by organizations focused on salmon and steelhead recovery in both western Washington RMUs. Many instream and floodplain habitat restoration activities have been identified in watershed management plans (e.g., Puget Sound Salmon Recovery Plan (2007)). The vast majority of these actions have been funded and designed for salmon recovery, but work may improve habitat conditions for lamprey as well. The following lamprey research and restoration actions were initiated by RMU partners in the Washington Coast and Puget Sound/Strait of Juan de Fuca RMUs.

Table 5. Conservation actions implemented that specifically target or impact Pacific Lamprey in the Washington Coast and/or Puget Sound/Strait of Juan de Fuca RMUs.

HUC	Threat	Action Description	Type	Status

RMU	Population	Conducted first annual RMU meeting for WA Coast and Puget Sound/Strait of Juan de Fuca RMUs	Coordination	Complete
RMU	Population	Environmental DNA sampling to better understand lamprey distribution.	Survey	Ongoing
RMU	Lack of Awareness	Consideration of lamprey when planning and implementing instream habitat restoration work	Coordination	Ongoing
Snoqualmie, Snohomish, Skykomish	Lack of Awareness	Multiple presentations to stakeholders about incorporating lamprey into assessments, salvage, and restoration projects	Coordination	Ongoing
RMU	Population	Spawning ground surveys, smolt trap monitoring, and fish distribution surveys	Survey	Ongoing
WA Coast	Population	Meeting to discuss spawning survey methods. Collaboration on developing spawning survey protocol	Survey	Ongoing
WA Coast	Population	DNA sample and photo collection at smolt traps for ongoing genetics work (CRITFC)	Survey	Ongoing
RMU	Population	eDNA sample analysis on Federal Land in partnership with USFS. Extended spawning survey pilot to be implemented in 2-3 subbasins to evaluate Pacific Lamprey spawning outside of steelhead timeframe	Survey	Proposed
RMU	Population	State and Federal agency collaboration on rare aquatic species management, focusing on	Coordination	Ongoing

		Pacific Lamprey		
Sauk, Upper Skagit	Population Lack of Awareness	eDNA sampling with Glacier Peak Institute students	Survey	Underway
RMU	Populations	USFS and Trout Unlimited are developing a multi-species eDNA assay that would detect nine salmonid species and Pacific Lamprey	Survey	Underway
Washington Coast	Passage	Initial planning, assessment, sampling for potential lamprey passage at fish hatchery.	Coordination, Survey, Analysis	Underway

II. Selection of Priority Actions

High Priority Proposed Project Information and RMU Meeting Participants

Table 6: Project submitted by RMU partners for the Puget Sound/Strait of Juan de Fuca and Washington Coast RMUs in 2021.

Project Name	**Project Proponent and Organization**	**Project Types(s)**	**Funding Request**	**Brief Description**

Lamprey ID & Integrating Lamprey into Restoration Workshop Series for Washington and Alaska*	PLCI Restoration Subgroup	Assessment & Outreach	Phase 1: $35,000 Phase 2: $85,000	Develop and implement a series of 10 in-person restoration/ID workshops in WA & AK that will target stakeholders in the following RMUs:
				• Phase 1: Upper Columbia (3 workshops)
				• Phase 2:
				  • Coastal Washington (2)
				  • Puget Sound/Strait of Juan de Fuca (2)
				  • Alaska (3)

Table 7: Participants at the Washington Coast RMU meeting on May 19, 2021

The Confederated Tribes of the Chehalis Reservation - Hope Rieden	Wild Salmon Center - Jess Helsey, Betsy Krier	Pacific Lamprey Conservation Initiative – Alicia Marrs
Quileute Indian Tribe - Caroline Walls	University of Washington - Rich Osborne	Washington Department of Fish and Wildlife - Lauren Bauernschmidt, Kim Figlar-Barnes, Curt Holt, Lyle Jennings, James Losee, Jody Pope, Mike Scharpf, Doris Small, Pad Smith, Marlene Wagner, Jenni Whitney, Marie Winkowski
Quinault Indian Nation – Bill Armstrong	Department of Natural Resources - Kyle Martens	
Northwest Indian Fisheries Commission – John Hagan	US Forest Service - Jessie Huggins, Marc McHenry	
Trout Unlimited – Alex Gustafson, Luke Kelly	US Fish and Wildlife Service – Monica Blanchard, Erin Butts, Miranda Plumb, Will Ritchie, Joe Skalicky, Christina Wang	

Table 8: Participants at the Puget Sound/Strait of Juan de Fuca RMU meeting on May 21, 2021

Jamestown S'kallam Tribe - Aaron Brooks	King County – Kollin Higgins, Andrea Mojzak	Whatcom Conservation District – Alan Chapman
Lower Elwha Klallam Tribe - Rebecca Paradis	National Marine and Atmospheric Administration – Kinsey Frick, Mary Moser	Western Washington University – Leo Bodensteiner
Nooksack Indian Tribe – Ned Currence	North Olympic Salmon Coalition – Rebecca Benjamin	US Forest Service (USFS) – Joshua (JD) Jones, Richard Vacirca
Point No Point Treaty Council - Scott Bass	Skagit Fisheries Enhancement Group – Erin Matthews, Kristin Murray	US Fish and Wildlife Service – Monica Blanchard, Erin Butts, Miranda Plumb, Christina Wang
Puyallup Tribe of Indians - Andrew Berger	Snoqualmie Valley Watershed Improvement District – Lisa Kysar	Washington Department of Fish and Wildlife - Joe Boucher, Riley Freeman, Tara Liveingoog-Schott, Gabe Madel, Katrina Simmons, Kathryn Sutton, Bob Vadas, Peter Verhey, Jenni Whitney, Marie Winkowski, Michael Young
Tulalip Tribes - Matt Pouley	South Puget Sound Salmon Enhancement Group - Kristin Williamson	
Snoqualmie Indian Tribe - Alex Harwell	Trout Unlimited – Steve Kopp	Pacific Lamprey Conservation Initiative – Alicia Marrs
Skagit River System Cooperative- Catherine Austin	Wild Fish Conservancy – Mary Lou White	USFS National Genomic Center - Kellie Carim

III. Literature Cited

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