Lower Columbia
Conservation & Sustainable Fisheries Plan
2021 Progress Report

Prepared by

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This is document is a working draft. Data and information may change.

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The Washington Lower Columbia River Fish Recovery Board

The Lower Columbia Fish Recovery Board (LCFRB) is the State of Washington's Regional Recovery Organization for salmon recovery in the Southwest Washington Region. This region extends from the mouth of the Columbia River upstream to, and including, the Little White Salmon River.

The LCFRB is one of seven Regional Recovery Organizations established by law to develop and facilitate implementation of salmon and Steelhead recovery sustainability plans, monitor implementation, and track and report on accomplishments. The Boards are governed by committees of local citizens and dedicated staff, assisted by technical experts.

As a regional recovery organization, the LCFRB led the collaborative development of the Lower Columbia Salmon Recovery and Fish & Wildlife Subbasin Plan for Endangered Species Act (ESA) listed Columbia River Chum and Lower Columbia River Chinook, Steelhead and Coho.

INTRODUCTION & APPROACH

The *Recovery Plan for Lower Columbia River Salmon and Steelhead* identifies a comprehensive suite of targets, strategies and actions for reducing the impact of factors responsible for the long-term decline and subsequent listing in 1998-2005 of these species under the U. S. Endangered Species Act. These factors include freshwater and estuary habitat, hydropower, ecological interactions, hatcheries, and fisheries.

A comprehensive implementation plan for hatchery and fishery actions was completed in 2017 by the Washington Department of Fish and Wildlife (WDFW) and the Lower Columbia Fish Recovery Board (LCFRB). This Conservation and Sustainable Fisheries (CSF) Plan sets forth strategies, actions, and management practices for Washington Lower Columbia fisheries and hatcheries consistent with efforts to return natural origin lower Columbia salmon and Steelhead to healthy, harvestable levels while sustaining Tribal, commercial and recreational fisheries. The CSF Plan addresses Recovery Plan actions for hatchery and fishery threats that are within WDFW's authority. WDFW also addresses actions in other impact categories, such as ecological interactions and hydro-operations. Where WDFW does not have the sole authority to implement a given action, the agency works through other processes to achieve the desired result. The CSF Plan also describes monitoring of population responses to fishery and hatchery actions, program refinements based on fish responses, and reporting of hatchery and fishery reform implementation and progress toward recovery targets.

This report reviews progress in implementation and the responses to hatchery and fishery strategies developed to aid in the conservation and recovery of natural origin salmon and steelhead in Southwest Washington. The report describes: 1) the current species and population status in the region relative to recovery goals; 2) a review of hatchery reforms and benefits; and 3) a review of fishery management protections and effects. Information is summarized for each salmon and steelhead species and run, and presented within an All-H recovery framework. Additional hatchery and fishery actions expected to be implemented are identified.

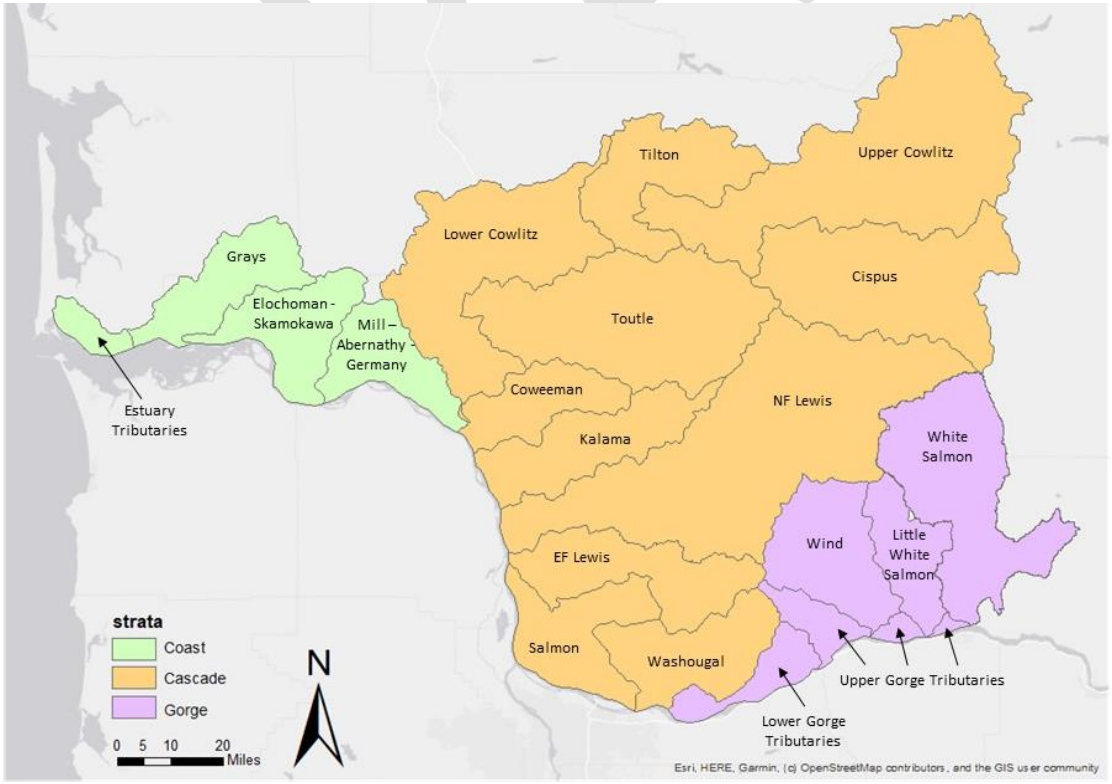

Figure 1. The Lower Columbia River region. Each subbasin is labeled and color coded by strata.

STATUS ASSESSMENT

This report reviews salmon and steelhead species and population status in the Washington Lower Columbia region relative to goals identified in the Recovery Plan (LCFRB 2010a; NMFS 2013). Three Evolutionary Significant Units (ESU) of salmon (Chinook, Coho, Chum) and one Distinct Population Segment (DPS) of Steelhead are listed under ESA in the Lower Columbia River region. Each listing unit can also include multiple run types (Spring, Fall and Late Fall Chinook; Winter and Summer Steelhead) These species are supported by seventy-two populations distributed across three strata (Coast, Cascade, Gorge), including winter Steelhead in the Coast strata which are a part of the unlisted Southwest Washington Steelhead DPS.

Recovery goals are defined in terms of species and population viability, which is the ability to persist over an extended period of time.[1] Recovery criteria call for at least two populations achieving High or Very High viability in each of three geographic strata, and an average viability of Moderate across all populations in each stratum. The Recovery Plan also includes a recovery scenario designating populations for different levels of viability contribution to recovery goals (Primary, Contributing, Stabilizing). Viability in salmon is a function of four population parameters[2]: abundance, diversity, productivity and spatial structure). Extensive descriptions of recovery definitions, criteria, and goals may be found in the Recovery Plan (LCFRB 2010a; NMFS 2013).

Viability of each Washington Lower Columbia population was re-assessed in this report based on recent abundance and related information on spatial structure, productivity, and diversity. Current viability is based on abundance relative to abundance benchmarks defined in the Recovery Plan for different viability levels for each individual population (see Appendix E in LCFRB 2010a). Viability levels defined by current abundance were downgraded where spawning was narrowly distributed or where hatchery fish comprised a substantial portion of natural-origin spawners with the potential to reduce natural productivity and diversity. Details of viability assignments are documented in population descriptions later in this report.

Abundance is estimated by WDFW with a variety of methods appropriate to the species and population. These can include dam and weir counts where fish enter a trap or are counted as they pass a window. Many populations are counted in spawning ground surveys where observers count fish or redds from shore or by snorkeling. Hatchery-origin fish are typically distinguished from natural-origin fish by the absence of adipose fins which are removed at the hatcheries prior to release as juveniles. LCFRB worked with WDFW to access the most up to date data and information for this report. Some information is publicly available via online databases including WDFW's Salmon Conservation and Reporting Engine (SCoRE, https://fortress.wa.gov/dfw/score/) and the Pacific States Marine Fisheries Commission fisheries data project StreamNet (https://www.streamnet.org). Other metrics and data sets were calculated, determined, and/or centralized internally by WDFW staff specifically for this report. Metrics and data format should align with updated hatchery metrics output funded through the 2020 SRFB Monitoring project (Lower Columbia Population Performance Reporting, Grant #20-1165).

Data availability was categorized for each population: 1 = good (annual statistical stream survey, dam or weir count), 2= fair (periodic surveys, index counts), 3= poor (lacking annual or periodic surveys, expert

[1] *NOAA's Lower Columbia River Technical Recovery Team and the Recovery Plan define "long-term" risks based on a 100-year time frame.*

[2] *For the purposes of the viability reassessment, abundance is expressed as the recent 12-year geometric mean value consistent with guidance in the Recovery Plan.*

judgement, habitat model inference). Of the 72 populations in the region, 55 (76%) have annual monitoring data sets sufficient to support "good" estimates current abundance (Table 1). Two additional populations have fair monitoring data sets and data is poor for 15 populations.

"Current" abundance is summarized in this report based on recent twelve- and four-year geometric means[3] as per direction in the Recovery Plan (LCFRB 2010a; NMFS 2013) and the related and comprehensive Research, Monitoring and Evaluation program identified by the LCFRB (2010b). A 12-year geometric mean was selected to represent an interval of sustained abundance across multiple generational cycles. Viability assignments were based on 12-year geometric means. A 4-year geometric mean describes status of the latest fish generation. "Current" estimates included the most recent years available for each population which was typically 2008-2019 (12-year) and 2016-2019 (4-year). When current abundance estimates were unavailable for a population, baseline abundance estimates from the Recovery Plan were used in viability summaries. Full abundance data sets are included in Appendix B.

Table 1. Summary of population status data availability for lower Columbia River salmon and Steelhead.

	No. of populations	Good	Fair	Poor
Spring Chinook	7	4	1	2
Fall Chinook	14	13	0	1
Late Fall Chinook	1	1	0	0
Coho	17	17	0	0
Chum	11	4	1	6
Winter Steelhead	17	12	0	5
Summer Steelhead	5	4	0	1
Totals	*72*	*55*	*2*	*15*

[1]*Quality/type of recent abundance data: good (annual statistical stream survey, dam or weir count), fair (periodic surveys, index counts), poor (expert judgement, habitat model inference).*

In cases, where all twelve or four years were not available, the geometric mean included years where data were available within the prescribed period. Many populations do not have very long-term datasets for natural origin spawner estimates. For instance, comprehensive surveys of Chinook and Coho were conducted by WDFW beginning only in 2010. Prior to 2010, Chinook surveys often did not estimate abundance separately for natural and hatchery origin spawners. Coho surveys were very limited prior to 2010. Chum abundance data is limited by low returns in many years such that quantitative estimates are available for only a few years in some populations. In cases where no current stock assessment data were available, current abundance was assumed to similar to that reported in the Recovery Plan for the time of listing. In most cases, populations without current stock assessments are at Very Low abundance and viability.

The incidence of hatchery-origin spawners was also a key consideration in assessing the viability of each population. Hatchery fish on the spawning have been widely documented to reduce productivity and diversity of natural spawners. Therefore, viability of a population was assumed to be lower for a given population abundance when hatchery fish comprised a substantial proportion of total spawners. Hatchery contributions to natural spawning are discussed in documented in greater detail in the hatcheries section of this report.

[3] *Means are geometric means defined as the nth root of n products. Geometric means are considered to be a better measure of central tendency for data such as fish abundance which is typically highly skewed. The geometric mean smooths the contribution of periodic large run sizes which otherwise inflate simple averages relative to typical population values.*

This assessment estimates that just 13% of the 72 populations are currently at High or Very High viability (Table 2). In contrast, 71% of populations are at Low or Very Low viability. Late Fall Chinook are in the best shape based on a single population at Very High viability. Summer Steelhead viability averages Moderate across five populations. Average viability is Low to Very Low for all other species and run types (Table 2).

However, this assessment estimated that viability of 21 of 72 total populations is currently greater than reported in the Recovery Plan at the time of ESA listing. Many of these changes are attributable to the implementation of a more comprehensive statistical assessment program of population status. For instance, new spawning ground surveys have documented substantially more natural-origin Coho spawning in streams than was previously known. Many species and populations are also likely to have benefited by conservation and recovery measures including fishery reductions, hatchery reforms, reintroduction programs and habitat restoration. At this time, it is difficult to distinguish trends in actual improvement from the effects of better stocks assessment due to the lack of consistent long-term data for most natural-origin populations.

Table 2. Population viability level at listing and at present based on current information. Viability levels are separated by a "/" where current level has changed relative to the level identified in the Recovery Plan: Baseline Viability/Current Viability. Color codes highlight current viability: VH = blue, H = green, M = yellow, L = red, VL = gray.

		Chinook			Chum		Steelhead		Coho
		Fall	L Fall	Spring	Fall	Sum	Winter	Sum	
Coast	Grays/Chinook	VL	--	--	M/VH	--	M	--	VL
	Eloch./Skam.	VL	--	--	VL/L	--	M	--	VL
	Mill/Aber./Ger.	VL	--	--	VL	--	M	--	VL
Cascade	Lower Cowlitz	VL/M	--	--	VL	VL	L	--	VL/H
	Coweeman	VL/L	--	--			L/M	--	VL/H
	SF Toutle	VL	--	VL			M	--	VL/M
	NF Toutle		--				VL/M	--	VL/L
	Upper Cowlitz	VL/L	--	VL	--		VL	--	VL
	Cispus		--	VL	--		VL	--	VL
	Tilton		--	VL	--	--	VL	--	VL/L
	Kalama	VL	--	VL	VL	--	L/H+	M	VL
	NF Lewis	VL/M	VH	VL	VL	--	VL	VL	VL/L
	EF Lewis		--	--		--	M	VL/M	VL/L
	Salmon	VL	--	--	VL	--	VL	--	VL/M
	Washougal	VL/L	--	--	VL/H	--	L	M/H	VL
Gorge	Lower Gorge	VL	--	--	H	--	L	--	VL
	Upper Gorge	VL	--	--	VL	--	L	H	VL
	White Salmon	VL	--	VL		--		--	
No. @ Very High		0	1	0	1	0	0	0	0
No. @ High		0	0	0	2	0	1	2	2
No. @ Moderate		2	0	0	0	0	7	2	2
No. @ Low		3	0	0	1	0	4	0	4
No. @ Very Low		9	0	7	6	1	5	1	9
Average Viability		L-	VH	VL	L+	VL	L+	M	L

Viability: VL = Very Low, L = Low, M = Moderate, H = High, VH = Very High. Intermediate viability levels are denoted by '+' and '-'.

Spring Chinook

Spring Chinook historically returned to cool, snowmelt-driven Cascade strata streams but much of the spawning range was blocked by dams in the Cowlitz, Lewis and White Salmon rivers (Figure 2). The Condit Dam in the White Salmon River was removed between 2011 and 2012, and reintroduction programs are being implemented in the Cowlitz and Lewis watersheds. Natural production remains at very low levels in all of these watersheds. Large mitigation hatchery programs were developed, and lower Columbia Spring Chinook returns to natural spawning areas are currently dominated by hatchery-origin fish.

Where the lower Columbia was historically thought to produce 100,000 Spring Chinook per year, the natural-origin run to lower Columbia tributaries in Washington and Oregon now averages just 2,000 per year (MAFAC 2020). At the time of ESA listing in 1999, all seven Washington populations were estimated to be at Very Low levels of viability (Table 3). Two additional populations occur in Oregon (Sandy at Moderate viability and Hood at Very Low viability). Very Low viability was associated with low abundance, poor productivity, limited distribution and a loss of historical diversity.

Recent data shows no significant improvements in the abundance of natural-origin Spring Chinook (Table 3, Figure 4). Abundance remains substantially less than ESA delisting goals and viability is Very Low in all Washington populations (Figure 2, Table 3). Details are discussed for key population in the following pages.

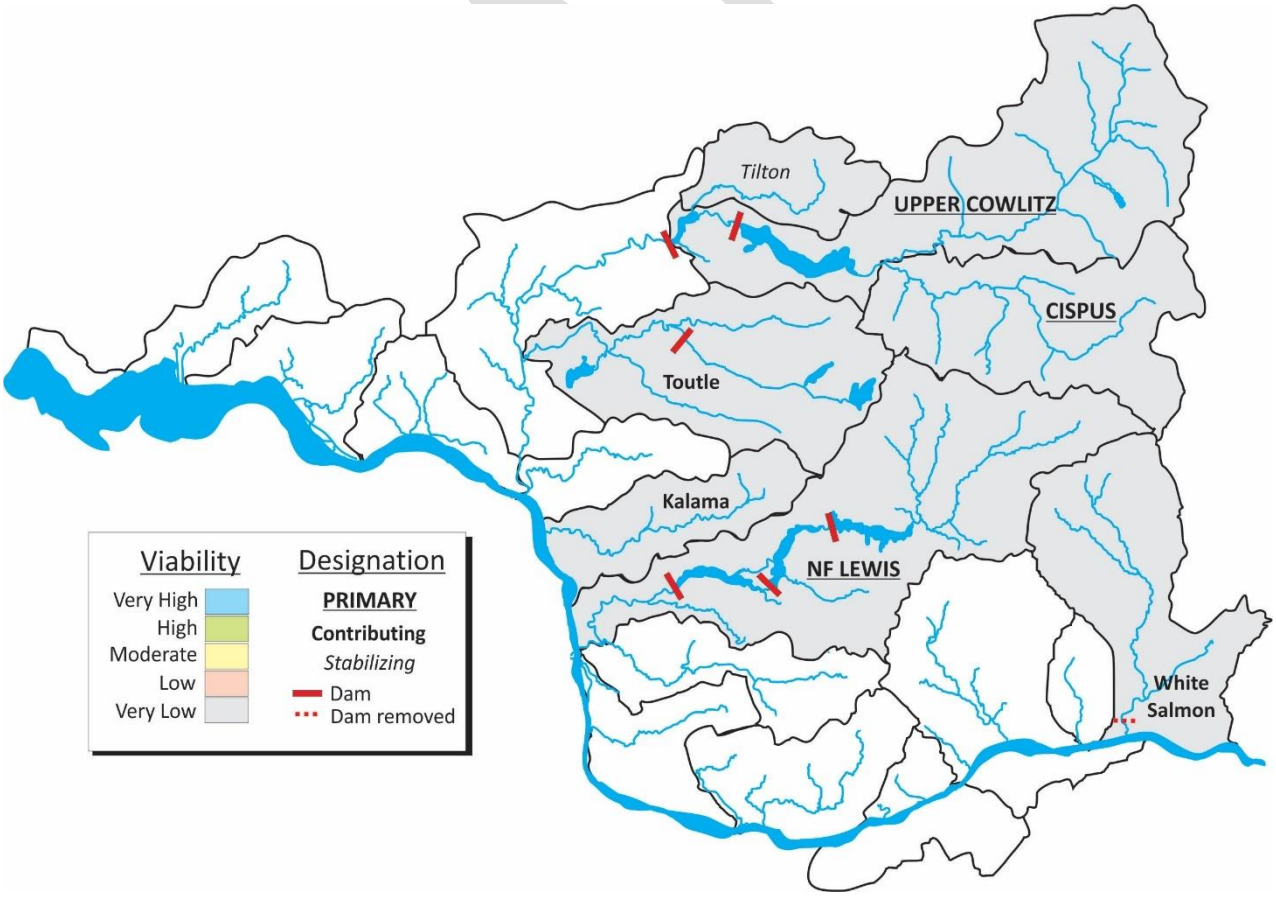

Figure 2. Current status (approximate) and Recovery Plan designations of Lower Columbia River populations of Spring Chinook Salmon in Washington.

Table 3. Viability and abundance relative to recovery objectives for Lower Columbia River populations of Spring Chinook Salmon in Washington.

Strata	Population	Desig.[1]	Viability[2]			Abundance[3]						% of	Yrs goal met[10]		Data[11]
			@list[4]	Goal[5]	Now[6]	Historical	@list[4]	Goal[5]	@High[7]	12-yr[8]	4-yr[8]	Goal[12]	12-yr	4-yr	
Cascade	U Cowlitz[13]	P	VL	H+	VL	22,000	300	1,800	1,500	194	126	5%	0%	0%	1
	Cispus[13]	P	VL	H+	VL	7,800	150	1,800	1,500						
	Tilton	S	VL	VL	VL	5,400	<100	--	1,500	0	0		--	--	3
	Toutle	C	VL	M	VL	3,100	100	1,100	1,500	100	--		--	--	3
	Kalama	C	VL	L	VL	4,900	100	300	1,500	68	53		0%	0%	1
	Lewis N Fk	P	VL	H	VL	15,700	300	1,500	1,500	244	245		0%	0%	2
Gorge	White Salmon	C	VL	L+	VL	n/a	<50	500	1,500	10	6	2%	0%	0%	1

[1] Priority designation identified in Recovery Plan (LCFRB 2010a; NMFS 2013): P=Primary, C=Contributing, S=Stabilizing.

[2] Viability identified based on abundance, productivity, spatial structure and diversity at listing. VH=Very High, H=High, M=Moderate, L=Low, VL = Very Low.

[3] Abundance of natural-origin spawners (geometric means).

[4] Status in the 1990s at the time of first listing.

[5] Recovery targets based on scenario identified in the Recovery Plan.

[6] Approximate viability level identified for the purposes of this exercise based on current status and improvements since listing. Changes are highlighted with bold underlines.

[7] Abundance at High viability (approximate value identified in Recovery Plan).

[8] Recent 12-year averages (2008-2019) based on the best available information. Where recent survey data is not available, values were assumed to be those reported in the Recovery Plan.

[9] Recent 4-year averages (2016-2019) based on the best available information.

[10] Percentage of years for available data where recovery goal was met.

[11] Quality/type of recent abundance data reported in this assessment: 1 = good (annual statistical stream survey, dam or weir count), 2= fair (periodic surveys, index counts), 3= poor (expert judgement, habitat model inference).

[12] Based on 12-year geomeans.

[13] U Cowlitz and Cispus Spring Chinook populations are managed and monitored as one, combined population. Abundances are combined, although recovery goals remain independent.

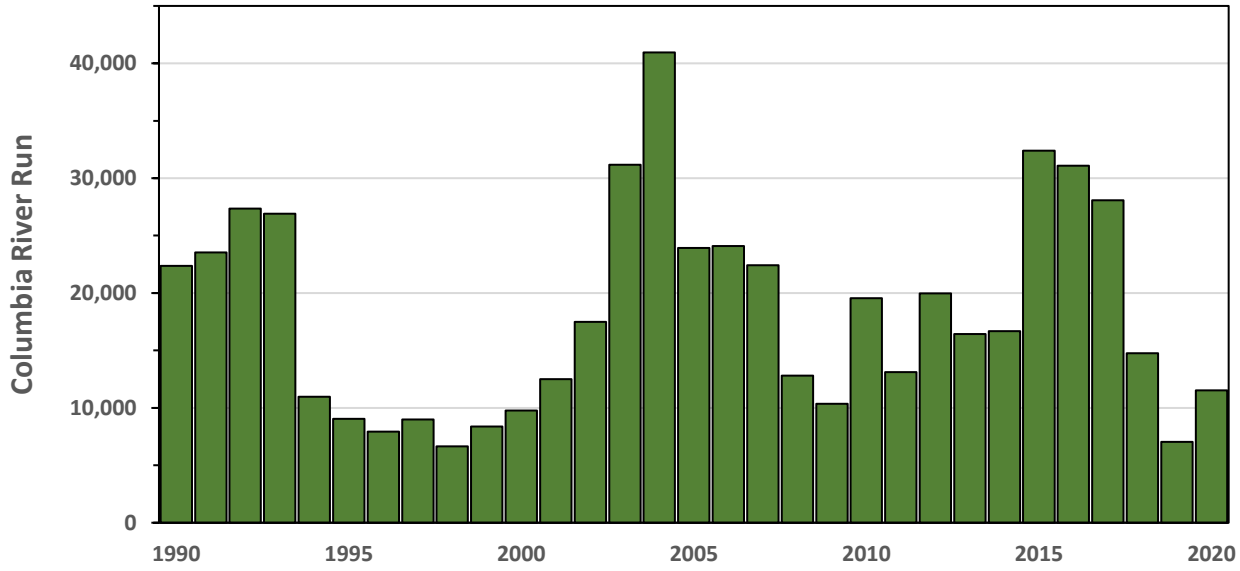

Figure 3. Annual Columbia River mouth run size of Lower Columbia River Spring Chinook (Cowlitz, Kalama, Lewis and Sandy Rivers) including hatchery and natural origin totals (ODFW and WDFW 2021).

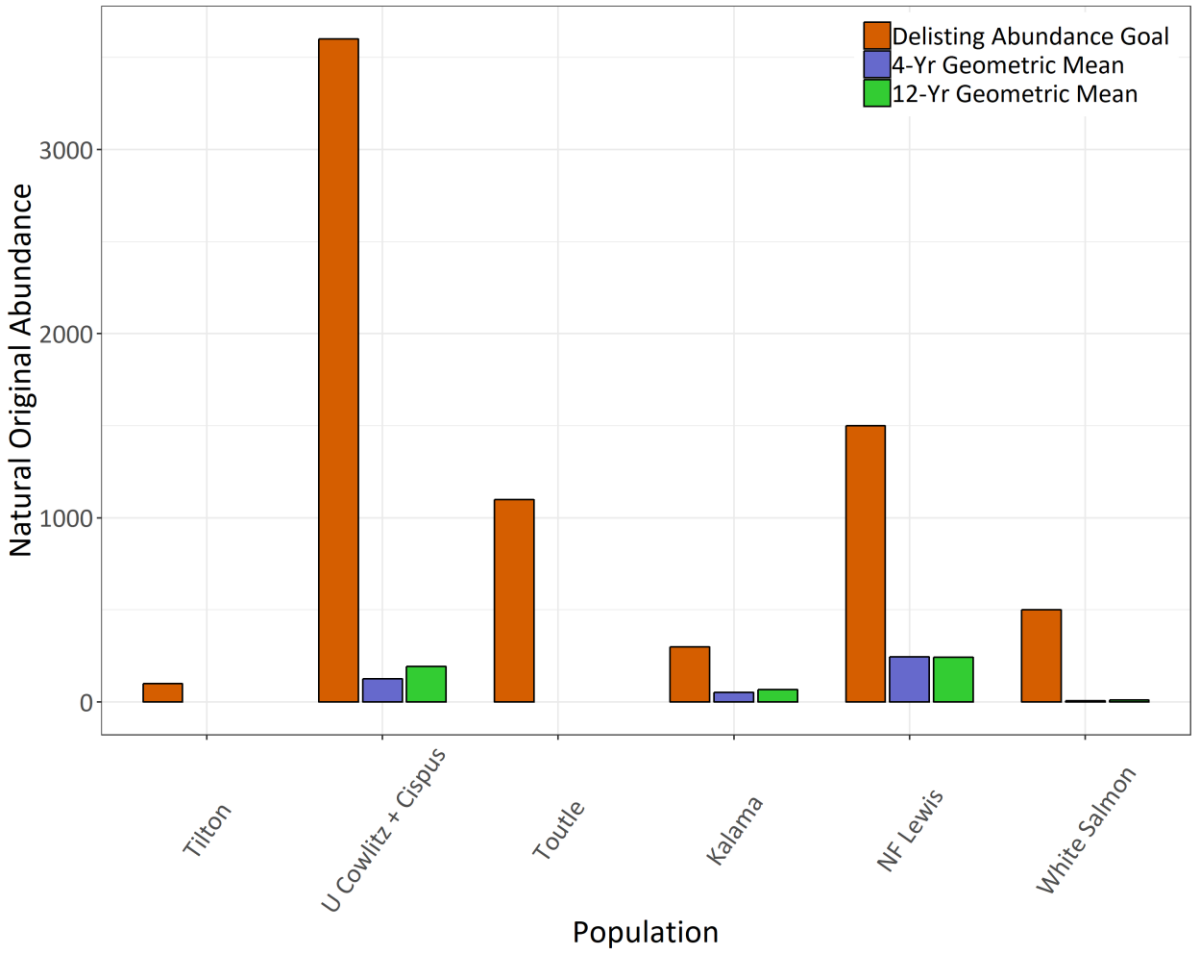

Figure 4. Recent natural origin (NOR) 4-year and 12-year geometric mean abundance estimates for Spring Chinook populations relative to delisting abundance goals.

Future prospects for recovery of Spring Chinook remain uncertain and depend on the success of reintroduction programs which are currently in their early stages. Habitat upstream of the Cowlitz and Lewis hydropower systems is considered to be of relatively high quality. Most of these watersheds are managed as public lands by the U.S. Forest Service, resulting in limited developed and restoration of watershed processes through implementation of the Northwest Forest Plan. Habitat restoration in these watersheds is also funded through dedicated hydropower programs by Tacoma Power Utilities and PacifiCorp, providing additional support for reduced freshwater habitat impacts to Spring Chinook in the long-term.

Cowlitz & Cispus Spring Chinook[4] - All Spring Chinook in this system historically spawned in the upper basin, particularly in the mainstem Cowlitz above Packwood and in the Cispus River. Completion of Mayfield Dam at River Mile 52 blocked upstream migration in 1962. Adult passage and transport efforts were discontinued in 1980. Currently, some natural spawning occurs downstream from Mayfield Dam but the return is dominated by hatchery-origin fish. Successful reintroduction into habitat upstream of the Cowlitz hydropower system is a top priority for Spring Chinook recovery. Reintroduction efforts have been underway above Cowlitz River dams since 1994. Program success relies on effective collection and fish passage survival of downstream migrating juveniles at Cowlitz Falls Dam. Initial juvenile collection efforts proved challenging but collection efficiencies have significantly improved since a new collection facility was completed at Cowlitz Falls Dam in 2017. Collection efficiency of juvenile Spring Chinook averaged approximately 60% in 2017-2020, still below the program target of 95%. There is no adult trap efficiency targets or tracking at the Barrier Dam. Thus, we represent the current tributary hydro impact as reduced from baseline estimates of 90% (Upper Cowlitz) and 100% (Cispus) to 40% today.

Toutle Spring Chinook - No estimates of abundance are available for this population. Current abundance is assumed to be similar to that reported in the Recovery Plan and the number is fall short of the recovery goal. The mainstem and North Fork Toutle are still recovering from the effects of the Mt. St. Helens eruption in 1980, and habitat appears quite limited for Spring Chinook production in South and North Fork tributaries. In addition, the U.S. Army Corps of Engineers Sediment Retention Structure (SRS) in the North Fork Toutle River has blocked access to the upper basin since 1989, and trap and haul operations utilizing the fish collection facility are not targeting spring Chinook. Releasing hatchery-origin Chinook salmon upstream of the SRS could support recolonization and establishment of a Toutle population if paired with operation of the SRS collection facility year round to capture migrating fish.[5]

Kalama Spring Chinook - Only a small remnant population currently exists. Only natural-origin fish are passed upstream from Kalama Falls (RM 10.5) hatchery where the majority spawning habitat for Spring Chinook is located. Hatchery fish comprise the large majority of the run, although their spawning is limited to habitat downstream of Kalama Falls hatchery. Kalama Spring Chinook have not met delisting abundance goals in any years of reported data.

Lewis Spring Chinook - Almost all Spring Chinook in this system historically spawned in the upper basin which was blocked by Merwin Dam in 1931. Currently, natural spawning occurs in four miles of the North Fork mainstem downstream from Merwin Dam. However, natural production is not significant and the run is dominated by hatchery-origin fish. A FERC relicensing settlement agreement for Lewis River hydroelectric projects calls for taking significant steps to achieve a genetically viable, self-sustaining

[4] *Although they are recognized by NOAA Fisheries as distinct populations, Upper Cowlitz and Cispus populations are combined as one for the purposes of this analysis because monitoring and management efforts for these population do not currently separate fish from these two subbasins.*

[5] *Reintroduction effort is not currently planned or initiated.*

natural population in the upper North Fork. Reintroduction efforts began in 2013, with the release of adult Chinook salmon into the upper basin and the operation of a juvenile collection facility in Swift Reservoir. Successful reintroduction upstream of the Lewis hydropower system is critical to spring Chinook recovery. Success relies on effective collection of upstream migrating spawners and downstream migrating juveniles. Collection efficiency targets identified in the Settlement Agreement are not being met today. The Settlement Agreement identifies an adult trap efficiency goal of 98%. A trap efficiency assessment was conducted 2015 through 2019, but was abandoned because of insufficient spring Chinook returns. Juvenile collection efficiency improved from 11.3% (2017) to 51% (2019), but still remains below the 95% collection efficiency target for the program. However, full implementation of passage requirements of the Lewis River hydro license agreement is currently delayed by legal challenges.

White Salmon Spring Chinook - This population was extirpated when Condit Dam blocked upstream fish migration following construction at River Mile 3 in 1913. Spring Chinook have begun to recolonize the White Salmon River following removal of Condit Dam in 2011, although numbers are very low: one of the four spawning spring Chinook detected in 2019 was observed upstream of the Condit Dam site (Olk and Dammerman 2020).

Fall Chinook

Two types of Fall Chinook return to lower Columbia rivers and streams. Virtually all subbasins produce the predominate tule stock of Fall Chinook (Figure 5). A late Fall bright stock returns to the North Fork Lewis River as well as the Sandy River in Oregon. Where the lower Columbia was historically thought to produce 170,000 Fall Chinook per year, the natural-origin run to lower Columbia tributaries in Washington and Oregon now averages about 12,000 per year (MAFAC 2020).

At the time of ESA listing in 1999, twelve of twelve Washington populations, five of seven Oregon populations, and two of two shared populations of tule Fall Chinook were estimated to be at Very Low levels of viability (Table 4). Very Low viability was associated with low abundance, poor productivity, limited distribution and a loss of historical diversity. The Lewis Late Fall Chinook population is the rare example of a healthy highly viable salmon population.

Fall Chinook have been a long-standing focus of WDFW spawning ground surveys, primarily to support management of Columbia River mainstem sport and commercial fisheries. In 2010, WDFW began implementation of an expanded monitoring program for Chinook salmon populations in the Lower Columbia region in order to gather data on Viable Salmonid Population (VSP) parameters – spawner abundance, including proportion of hatchery origin spawners, spatial distribution, diversity, and productivity.

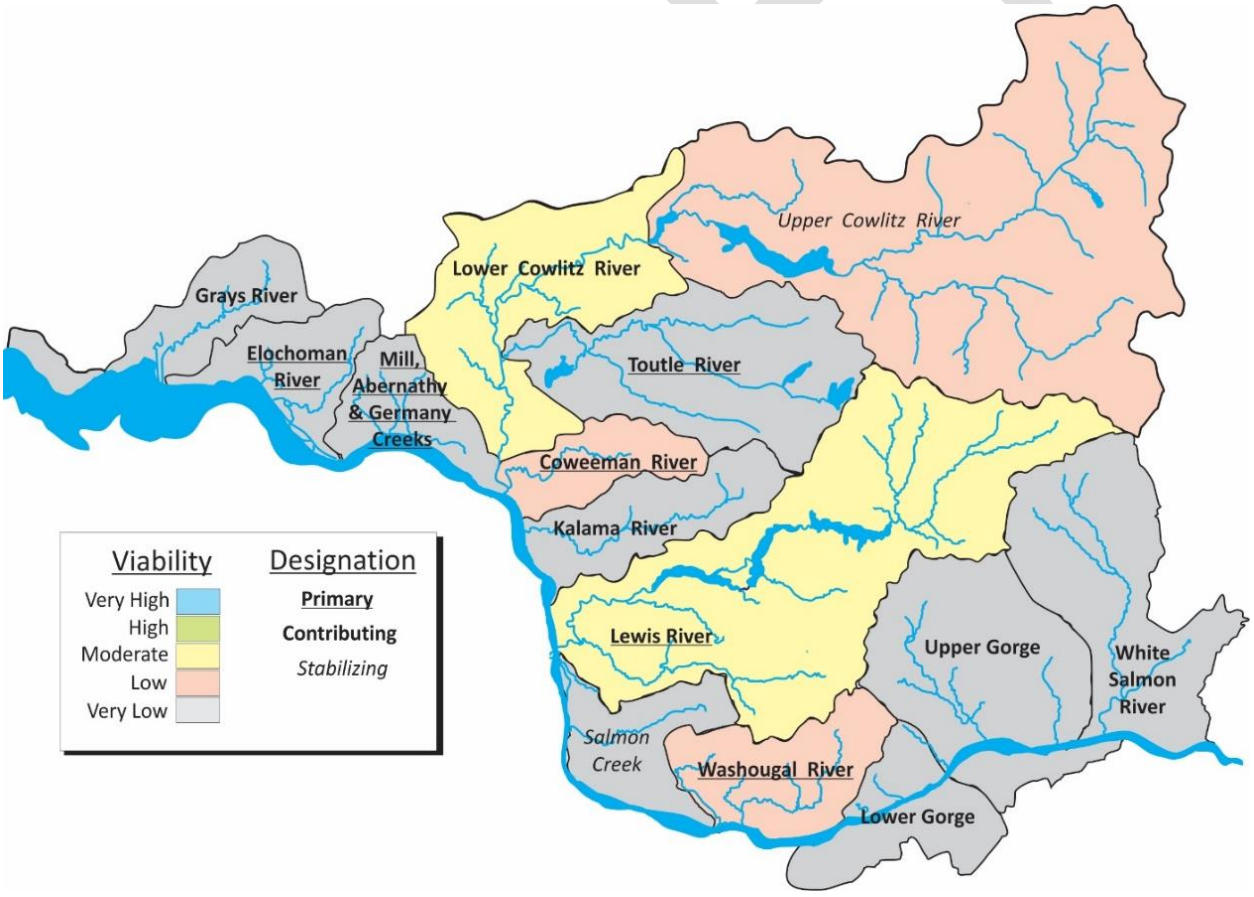

Figure 5. Current status (approximate) and Recovery Plan designations of Lower Columbia River populations of tule Fall Chinook Salmon in Washington. (Late-run Fall Chinook population in the North Fork Lewis River is not shown but is at Very High viability.)

Table 4. Viability and abundance relative to recovery objectives for Lower Columbia River populations of Fall Chinook Salmon in Washington.

Strata	Population	Desig.[1]	Viability[2]			Abundance[3]						Yrs goals met[10]		Data[11]
			@list[4]	Goal[5]	Now[6]	Historical	@list[4]	Goal[5]	@High[7]	12-yr[8]	4-yr[9]	12-yr[8]	4-yr[9]	
Coast	Grays/Chinook	C	VL	M+	VL	800	<50	1,000	1,100	128	254	0%	0%	1
	Eloch/Skam	P	VL	H	VL	3,000	<50	1,500	1,500	80	52	0%	0%	1
	Mill/Ab/Germ	P	VL	H	VL	2,500	50	900	900	40	18	0%	0%	1
Cascade	L Cowlitz	C	VL	M+	**M**	24,000	500	3,000	3,600	2,966	3,268	40%	50%	1
	U Cowlitz	S	VL	VL	**L**	28,000	0	--	1,100	2,207	1,417	--	--	1
	Toutle	P	VL	H+	VL	11,000	<50	4,000	3,400	277	207	0%	0%	1
	Coweeman	P	VL	H+	**L**	3,500	100	900	1,100	571	368	20%	0%	1
	Kalama	C	VL	M	VL	2,700	<50	500	1,100	1,034	1,806	80%	100%	1
	Lewis	P	VL	H+	**M**	2,600	<50	1,500	1,100	2,045	1,766	80%	75%	1
	Salmon	S	VL	VL	VL	n/a	<50	--	1,100	50	--	--	--	3
	Washougal	P	VL	H+	**L**	2,600	<50	1,200	1,100	789	952	20%	25%	1
	Lewis NF (late Fall)	P	VH	VH	VH	23,000	7,300	7,300	2,400	9,459	7,793	67%	50%	1
Gorge	Lower (WA/OR)	C	VL	M	**M**	3,200	<50	1,200	1,100	2,188	7,090	60%	100%	1
	Upper (WA/OR)	C	VL	M	VL	3,400	<50	1,200	1,100	554	441	10%	0%	1
	White Salmon	C	VL	M	VL	1,000	<50	500	1,100	477	284	50%	0%	1

[1] Priority designation identified in Recovery Plan: P=Primary, C=Contributing, S=Stabilizing.

[2] Viability based on abundance, productivity, spatial structure and diversity at listing. VH=Very High, H=High, M=Moderate, L=Low, VL = Very Low.

[3] Abundance of natural-origin spawners (geometric means).

[4] Status in the 1990s at the time of first listing.

[5] Recovery targets based on scenario identified in the Recovery Plan.

[6] Approximate viability level identified for the purposes of this exercise based on current status and improvements since listing. Changes are highlighted with bold underlines.

[7] Abundance at High viability (approximate value identified in Recovery Plan). Values may vary depending on productivity.

[8] Recent 12-year averages (2008-2019) based on the best available information. Data are not available prior to 2010 for many populations.

[9] Recent 4-year averages (2016-2019) based on the best available information.

[10] Percentage of years for available data where recovery goal was met.

[11] Quality/type of recent abundance data reported in this assessment: 1 = good (annual statistical stream survey, dam or weir count), 2= fair (periodic surveys, index counts), 3= poor (expert judgement, habitat model inference).

[12] Based on 12-year geomeans.

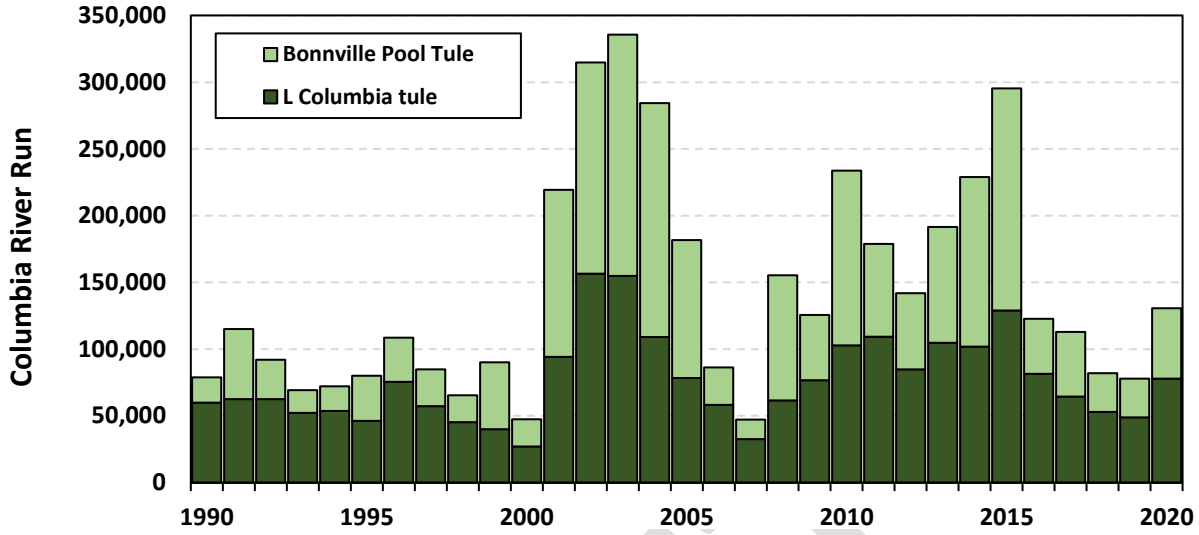

Figure 6. Annual Columbia River mouth run size of Lower Columbia River tule Fall Chinook including hatchery and natural origin totals.

Based on current information, the viability status of several populations is re-evaluated in this report. Recent data shows that four of twelve Washington tule Fall Chinook populations are larger than believed at listing. Abundance of tule Fall Chinook has generally increased since listing although numbers vary considerably from year to year (Figure 6). Differences likely reflect a recent period of relatively favorable ocean conditions for lower Columbia River Fall Chinook, benefits of fishery reductions since listing and improved stock-assessments of the natural-origin share of spawning escapements. Data on natural spawning escapements are generally not adequate to distinguish long term trends from the effects of annual variability in environmental conditions.

No tule Fall Chinook population has met their delisting abundance goal or achieved High or Very High viability (Figure 5). Nine of the 14 populations occurring entirely or in part in Washington remain at Very Low levels of viability. These include every Coast and Gorge Stratum population. Fall Chinook are faring slightly better in the Cascade strata, where delisting abundance goals are occasionally reached in some years. Details are discussed for key populations in the pages following.

Modest improvements have been seen in Fall Chinook numbers in a few areas but many populations continue to be at Very Low viability. Many populations are likely to have benefited from hatchery and fishery measures but significant improvements in conditions in the lower tributary mainstems where Fall Chinook spawn have been difficult to achieve because they generally require large scale watershed improvements.

Grays/Chinook, Elochoman/Skamakowa, Mill/Abernathy Germany (Tule) Fall Chinook - Coast strata Fall Chinook abundances are below delisting goals for return years with available data. Viability remains Very Low. Improvements in abundance over time are not evident for the period of data available, with the potential exception of the Grays/Chinook population.

Lower Cowlitz (Tule) Fall Chinook - This was likely the most significant historical Fall Chinook population in the region. Spawning currently occurs over about 45 miles of the mainstem Cowlitz between Kelso Bridge and the Cowlitz Salmon Hatchery with a concentration between river miles 51-52. The Recovery Plan identified this as a Contributing population targeted for a Moderate level of viability. However, subsequent assessments have found this population to be several times more abundant than previously documented and among the largest for this species in the region. Mean natural-origin spawning over the

last 12 years (2,966) is six times greater than estimated at listing and near the delisting abundance goal of 3,000. There is a large hatchery program but few out of basin hatchery transfers have occurred. However, the natural population is largely self-sustaining as hatchery-origin spawners comprise just 25% of the total which is much less than was believed at the time of listing. We estimate that this population could be upgraded from Very Low viability at listing to Moderate viability now.

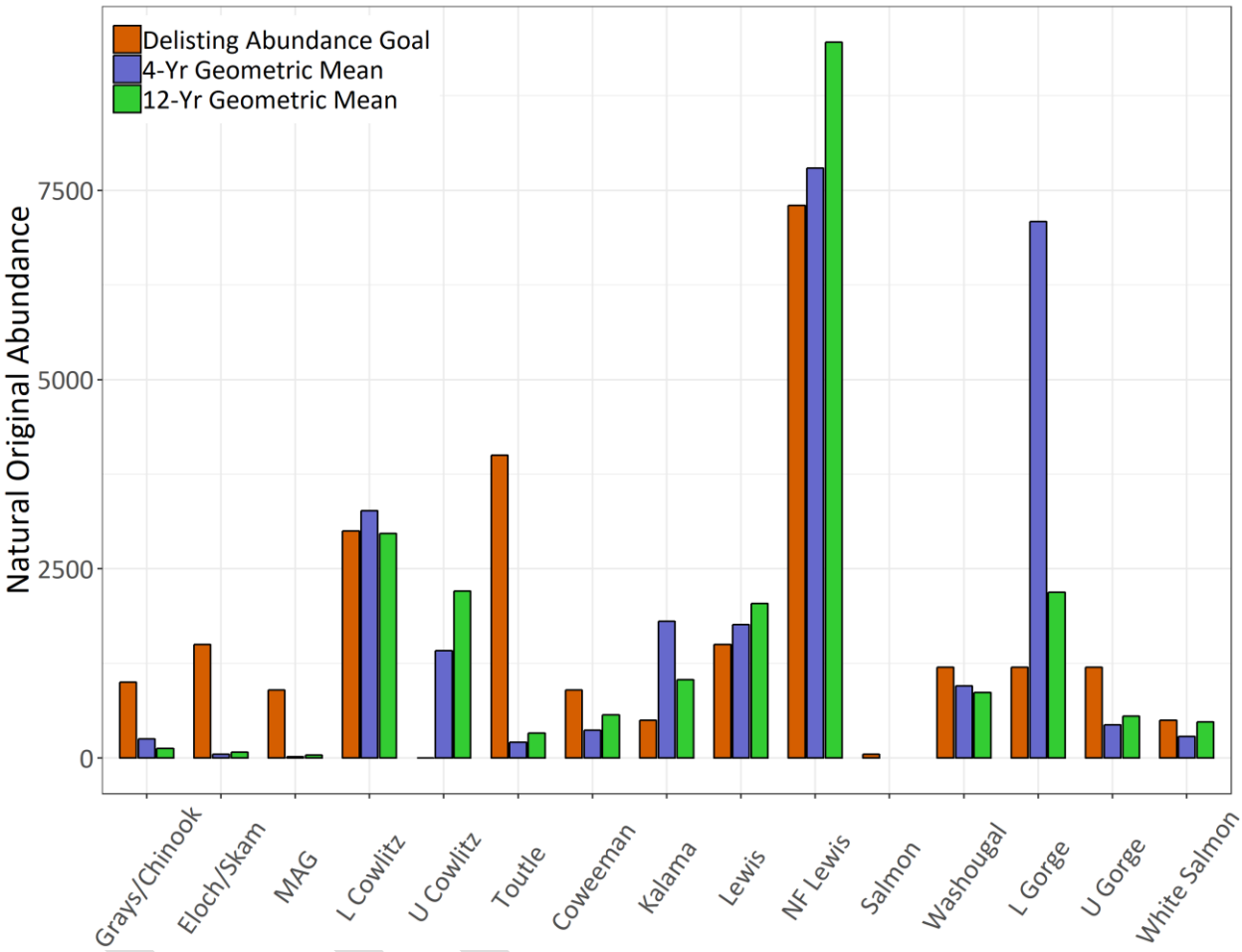

Figure 7. Recent natural origin (NOR) 4- and 12-year geometric mean abundance estimate for Tule and Late Fall Chinook populations relative to delisting abundance goals.

U Cowlitz (Tule) Fall Chinook - At the time of listing, this population was extinct. This population was designated as Stabilizing in the Recovery Plan due to uncertain prospects for reintroduction upstream from Cowlitz Dams. In the interim, a natural spawning population has been re-established in the Tilton by transporting and releasing hatchery adults into upstream areas which still contain large areas of suitable habitat. Juvenile Fall Chinook are collected at Cowlitz Falls Dam and trucked around dams for release downstream. Mean natural-origin spawning over the last 12 years (2,207) now exceeds the abundance level identified for High viability (1,100). Since 2017 the return has been over 90% natural-origin fish as transport and release of hatchery adults has been curtailed. The Tilton River in particular appears to have the potential to support a viable population. We estimate that the Upper Cowlitz population could be upgraded from Very Low viability at listing to Low viability now. This upgrade is contingent on Chinook salmon recolonization of habitat in the Upper Cowlitz and Cispus watersheds, assuming the reintroduction program supports continuation of a fall-run life history in addition to the formal program focus on spring-run fish. It remains to be seen whether this population will continue to sustain similar numbers of fish in the years following elimination of the hatchery subsidy as well as limiting distribution to the Tilton while

spring Chinook recovery is prioritized in the Upper Cowlitz and Cispus watersheds. The ultimate success of the reintroduction effort will depend on juvenile collection efficiency.

Coweeman (Tule) Fall Chinook - This Primary population was targeted by the Recovery Plan for improvement from Very Low to High viability. Spawning occurs in the mainstem, primarily in a six-mile section from Mulholland Creek to the Jeep Creek Bridge. This population is one of only two without a history of significant hatchery influence, and was identified as a historical legacy population by the Technical Recovery Team. Mean natural-origin spawning over the last 12 years (571) is substantially greater than estimated at listing (100) and greater than the recovery benchmark for Moderate viability (500). The population is largely self-sustaining as hatchery-origin spawners comprise just 15%. We estimate that this population could be upgraded from Very Low viability at listing to Low or higher viability now.

Toutle (Tule) Fall Chinook - This population is not faring well: they have not met ESA delisting abundance goals in any reported years. However, there is potential to increase habitat capacity in both forks of the Toutle River. This was historically a large fall Chinook population and has been designated as a core and Primary population in the Recovery Plan. Prior to the eruption of Mt. St. Helens in 1980, most fall Chinook spawned in the lower 5 miles of the mainstem Toutle and in the lower NF Toutle, but also occurred as far upstream as Coldwater Creek on the NF Toutle River (46 mi from the river mouth). The eruption devastated much of the spawning area in the mainstem and NF Toutle. Current spawning primarily occurs in the lower Green below the North Toutle Hatchery (~0.6 mi), and in the lower SF Toutle from the 4700 Bridge to the confluence with the mainstem Toutle River (~2.6 mi). Fall Chinook are not currently being passed into the North Fork Toutle, above the SRS. Releasing hatchery-origin Chinook salmon upstream of the SRS could support recolonization and establishment of a Toutle population if paired with operation of the SRS collection facility year-round to capture migrating fish.[6] Hatchery releases of fall Chinook have occurred in the Toutle River basin since 1951. The North Toutle Hatchery (formerly called the Green River Hatchery) located on the lower Green River near the confluence with the NF Toutle River was destroyed in the 1980 eruption of Mt. St. Helens. Rearing ponds near the original hatchery site were developed after the eruption and began operation in 1985. The North Toutle Hatchery was rebuilt in 1990 and continues to produce fall Chinook salmon. Although hatchery-origin spawners comprise 43% of this population since 2014, hatchery production is being reduced in this basin and a weir is installed in the North Fork Toutle to reduce hatchery-origin fish competition on spawning grounds.

Kalama (Tule) Fall Chinook - Spawning primarily occurs in the mainstem between Kalama Falls Hatchery and the I-5 Bridge (11 miles). Lower Kalama Falls (RM 10.5) is a natural barrier to upstream migration. Hatchery releases of fall Chinook in the Kalama began in 1895 with the completion of the Lower Kalama (Fallert Creek) Hatchery (RM 4.8) (the oldest hatchery in the Columbia basin). This Contributing populations regularly exceeds its Moderate delisting abundance goal for natural origin spawners but the return is subsidized by a large number of hatchery fish. Related uncertainty in population diversity continues to place this population in the Very Low viability category.

Lewis (Bright) Fall Chinook - This is one of the healthiest salmon populations in the entire Columbia Basin. Spawning occurs primarily in a four-mile reach between Merwin Dam at River Mile 19 and the Lewis River Salmon Hatchery. Hatchery releases of bright fall Chinook were discontinued in 1986 to eliminate interactions with the highly viable wild population. This population is meeting its abundance goal for High viability. Protection of mainstem spawning and rearing areas will be key to their continuing High viability.

[6] Reintroduction effort is not currently planned or initiated.

Lewis (Tule) Fall Chinook - Tule Fall Chinook occur in both the north and east forks but the east fork supports most of the production. Spawning occurs primarily in a six-mile reach from Lewisville Park downstream to Daybreak Feeders. This Primary population was targeted by the Recovery Plan for a High level of viability, and was identified as a historical legacy population by the Technical Review Team. At listing, the best available information suggested that the spawning population was predominately of hatchery origin and that an average of fewer than 50 natural origin spawners were present. However, improved stock assessments now estimate a recent 12-year mean of about 2,000 natural-origin spawners per year. This number exceeds the recovery goal for abundance at High viability of 1,500. Hatchery-origin spawners comprise approximately 40% of the total return but most of those occur in the North Fork. A weir was placed in Cedar Creek in the Lewis River in 2019 to reduce hatchery-origin straying on to natural-origin spawning grounds. No hatchery Fall Chinook have been released into the East Fork where most spawning occurs and hatchery contributions to that population component are quite low. We estimate that this population could be upgraded from Very Low viability at listing to Moderate or higher viability now.

Washougal (Tule) Fall Chinook - We estimate that the population could be upgraded from Very Low viability at listing to Low viability now. At listing, the best available information suggested that the spawning population was predominately of hatchery origin and that an average of fewer than 50 natural origin spawners were present. However, improved stock assessments now estimate a current average of about 800 natural-origin spawners per year. This number is approaching the threshold for high abundance identified in the Recovery Plan (1,100). The continuing significance of hatchery-origin fish in natural production areas (~50%) precludes upgrading of current viability beyond the Low level today, but reductions in hatchery program size and weir installation may support viability improvements over time.

Lower Gorge (Tule) Fall Chinook - The lower Gorge subbasin includes small Oregon and Washington streams between Washougal River and Bonneville Dam. On the Washington side, these include Hamilton, Hardy, and Duncan Creeks. Fall Chinook historically spawned in the lower reaches of these small streams and in the Columbia River mainstem. Spawning currently occurs in the Columbia River mainstem from the upper end of Pierce Island to the lower end of Ives Island, along the Washington shore in Hamilton Slough between the mouths of Duncan and Hardy Creeks, and in the lower reaches of Hardy and Hamilton Creeks. The recent 12-year average escapement (2,100) exceeds the Recovery Plan abundance target for Very High viability (1,900) although annual numbers are highly variable. Natural spawners are comprised almost entirely of natural-origin fish. We estimate that this population could be upgraded from Very Low viability at listing to Moderate or higher viability now.

Upper Gorge (Tule) Fall Chinook - This is a shared population with Oregon but most of the habitat exists in Washington. Historically, fall Chinook were limited to the lower reaches of the Wind River, Little Wind River, and Little White Salmon River. Completion of Bonneville Dam (1938) inundated primary fall Chinook spawning areas in these rivers. A ladder was constructed in the Wind River at Shipherd Falls (RM 2) in 1956, providing fish access to the upper basin. Fall Chinook have been observed up to the Carson National Fish Hatchery (RM 18), but the majority of spawning occurs in the lower two miles of the mainstem. Spawning may also occur in the Little Wind River (RM 1) and in the Little White Salmon River in a ¼ mile stretch of river downstream from the Little White Salmon Hatchery and upstream of Drano Lake. This population is not close to consistently meeting its delisting abundance goals and is heavily influenced by hatchery-origin spawners.

White Salmon (Tule) Fall Chinook - The historical fall Chinook population in the White Salmon was significant. The construction of Condit Dam (RM 3) in 1913 blocked access to most of the historical spawning habitat, about 14 stream miles. Since dam removal in 2011, Tule and bright Fall Chinook salmon

spawn in significant numbers downstream of the dam site but limited spawning has been documented upstream.[7] This population is not close to consistently meeting its delisting abundance goals.

[7] https://www.cbbulletin.com/post-dam-removal-though-spring-chinook-spawning-above-old-condit-dam-site-fall-chinook-still-prefer-lower-river-miles/

Coho

Coho historically returned to practically all lower Columbia subbasins (Figure 8, Table 5). Spawning and rearing habitat was widely distributed in small to medium sized streams and rivers at low to moderate elevations. Development and land use has degraded Coho streams particularly hard. Where the lower Columbia was historically thought to produce 300,000 Coho per year, now the natural-origin Coho run averages just 30,000 per year (MAFAC 2020).

At the time of ESA listing in 2005, all 17 Coho populations occurring in whole or part in Washington were estimated to be at Very Low levels of viability (Table 5). Very Low viability was associated with low abundance, poor productivity, limited distribution and a loss of historical diversity.

Stock assessments of natural-origin Coho in Washington were historically lacking as management was focused on hatchery fish released in large numbers for fishery mitigation purposes. In 2010, WDFW began implementation of an expanded monitoring program of Coho natural-origin spawner abundance, hatchery-origin spawners, spatial distribution, diversity, and productivity. Sixteen of the seventeen Washington populations are now monitored each year.

Abundance data for Washington Coho populations are generally available from only since 2010 (Figure 9). Total numbers generally varied between ten and twenty thousand except for 2014 when abundance exceeded 60,000. The peaks in 2014 was apparently the product of good ocean conditions.

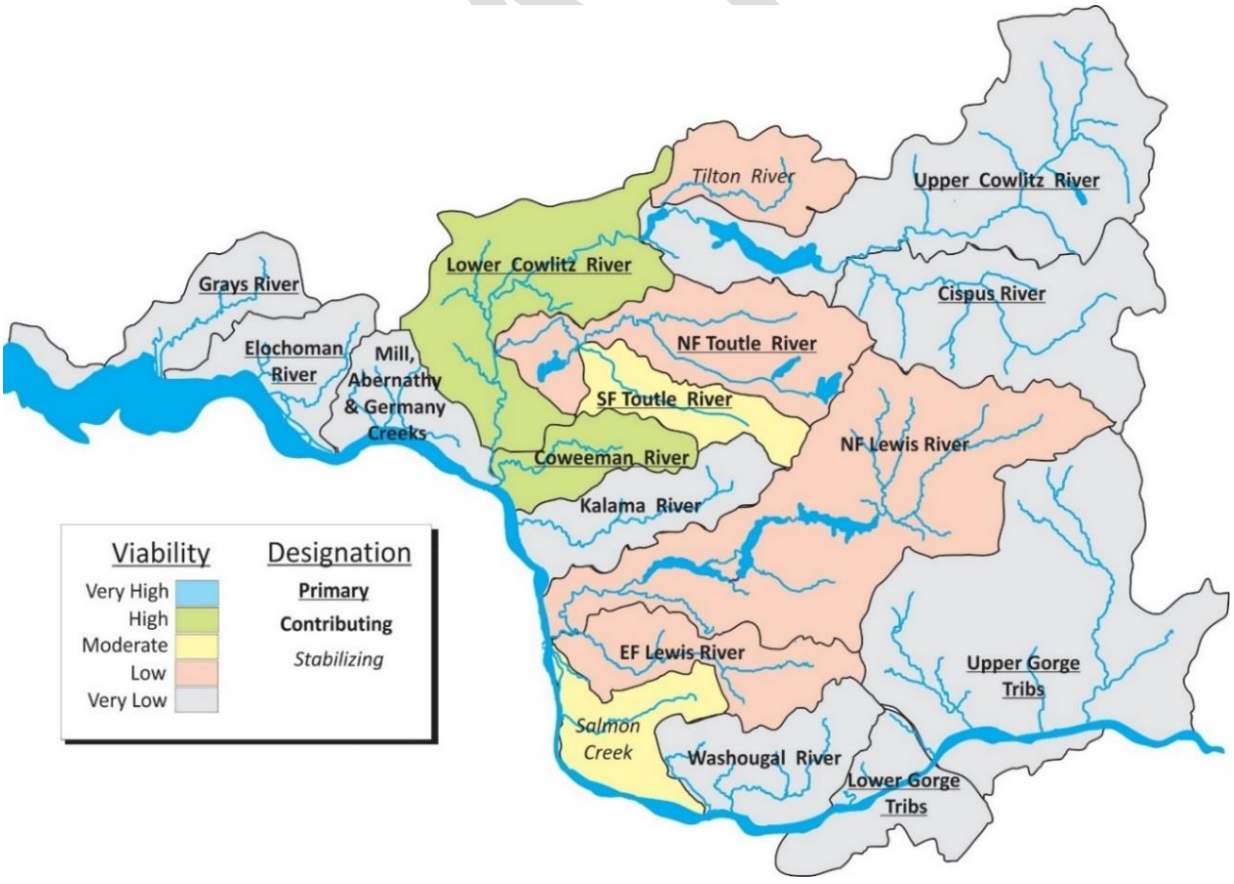

Figure 8. Current status (approximate) and Recovery Plan designations of Lower Columbia River populations of Coho Salmon in Washington.

Table 5. Viability and abundance relative to recovery objectives for Lower Columbia River populations of Coho Salmon in Washington.

Strata	Population	Desig.[1]	Viability[2]			Abundance[3]						% of	Yrs goal met[10]		Data[11]
			@list[4]	Goal[5]	Now[6]	Historical	@list[4]	Goal[5]	@High[7]	12-yr[8]	4-yr[8]	Goal[12]	12-yr	4-yr	
Coast	Grays/Chinook	P	VL	H	VL	3,800	<50	2,400	2,400	306	242	13%	11%	0%	1
	Eloch/Skam	P	VL	H	VL	6,500	<50	2,400	2,400	640	757	27%	11%	0%	1
	Mill/Ab/Germ	C	VL	M	VL	2,800	<50	1,800	2,000	674	760	37%	11%	0%	1
Cascade	Lower Cowlitz	P	VL	H	**H**	18,000	500	3,700	3,700	3,738	2,885	101%	44%	33%	1
	Upper Cowlitz	P	VL	H	VL	18,000	<50	2,000	2,000	1,220	738	31%	36%	0%	1
	Cispus	P	VL	H	VL	8,000	<50	2,000	2,000						
	Tilton	S	VL	VL	**L**	5,600	<50	--	2,000	1,908	2,154	--	--	--	1
	S.F. Toutle	P	VL	H	**M**	27,000	<50	1,900	2,000	1,566	1,116	82%	33%	33%	1
	N.F. Toutle	P	VL	H	**L**		<50	1,900	2,000	1,082	871	57%	22%	0%	1
	Coweeman	P	VL	H	**H**	5,000	<50	1,200	1,200	2,544	2,590	212%	89%	100%	1
	Kalama	C	VL	L	VL	800	<50	500	2,000	23	65	5%	0%	0%	1
	N.F. Lewis	C	VL	L	**L**	40,000	200	500	2,000	1,570	1,836	314%	89%	100%	1
	E.F. Lewis	P	VL	H	**L**	3,000	<50	2,000	2,000	1,170	833	59%	22%	0%	1
	Salmon	S	VL	VL	**M**	5,300	<50	--	2,000	1,533	1,908	--	--	--	1
	Washougal	C	VL	M+	VL	3,000	<50	1,500	2,000	301	197	20%	0%	0%	1
Gorge	Lower (WA/OR)	P	VL	H	VL	4,700	<50	1,900	2,000	393	358	22%	0%	0%	1
	Upper (WA/OR)	P	VL	H	VL	950	<50	1,900	2,000	44	44	2%	0%	0%	1

[1] Priority designation identified in Recovery Plan: P=Primary, C=Contributing, S=Stabilizing.

[2] Viability based on abundance, productivity, spatial structure and diversity at listing. VH=Very High, H=High, M=Moderate, L=Low, VL = Very Low.

[3] Abundance of natural-origin spawners (geometric means).

[4] Status in the 1990s at the time of first listing.

[5] Recovery targets based on scenario identified in the Recovery Plan.

[6] Approximate viability level identified for the purposes of this exercise based on current status and improvements since listing. Changes are highlighted with bold underlines.

[7] Abundance at High viability (approximate value identified in Recovery Plan).

[8] Recent 12-year averages (2008-2019) based on the best available information. Data are not available prior to 2010 for many populations.

[9] Recent 4-year averages (2016-2019) based on the best available information.

[10] Percentage of years for available data where recovery goal was met.

[11] Quality/type of recent abundance data reported in this assessment: 1 = good (annual statistical stream survey, dam or weir count), 2= fair (periodic surveys, index counts), 3= poor (expert judgement, habitat model inference).

[12] Based on 12-year geomeans.

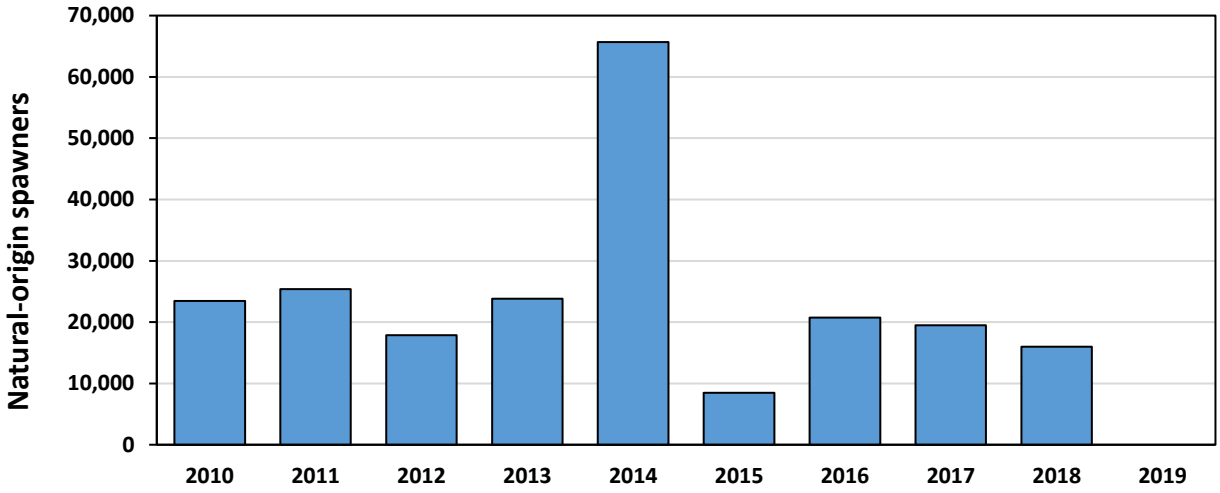

Figure 9. Annual abundance of natural-origin Coho Salmon in the Washington Lower Columbia River (total of all populations surveyed).

Our review identified several changes in viability status based on nominal population improvements since ESA listing over 20 years ago and more comprehensive stock assessments completed in the interim. Recent data shows that abundance of natural-origin Coho in Washington is substantially greater than believed at listing. Three of the 17 populations actually exceed recovery goals for abundance (Figure 10). Abundance of five additional populations is substantially greater than believed at listing. Currently-significant populations are all located in the Cascade stratum. Coast and Gorge strata populations all remain at Very Low viability.

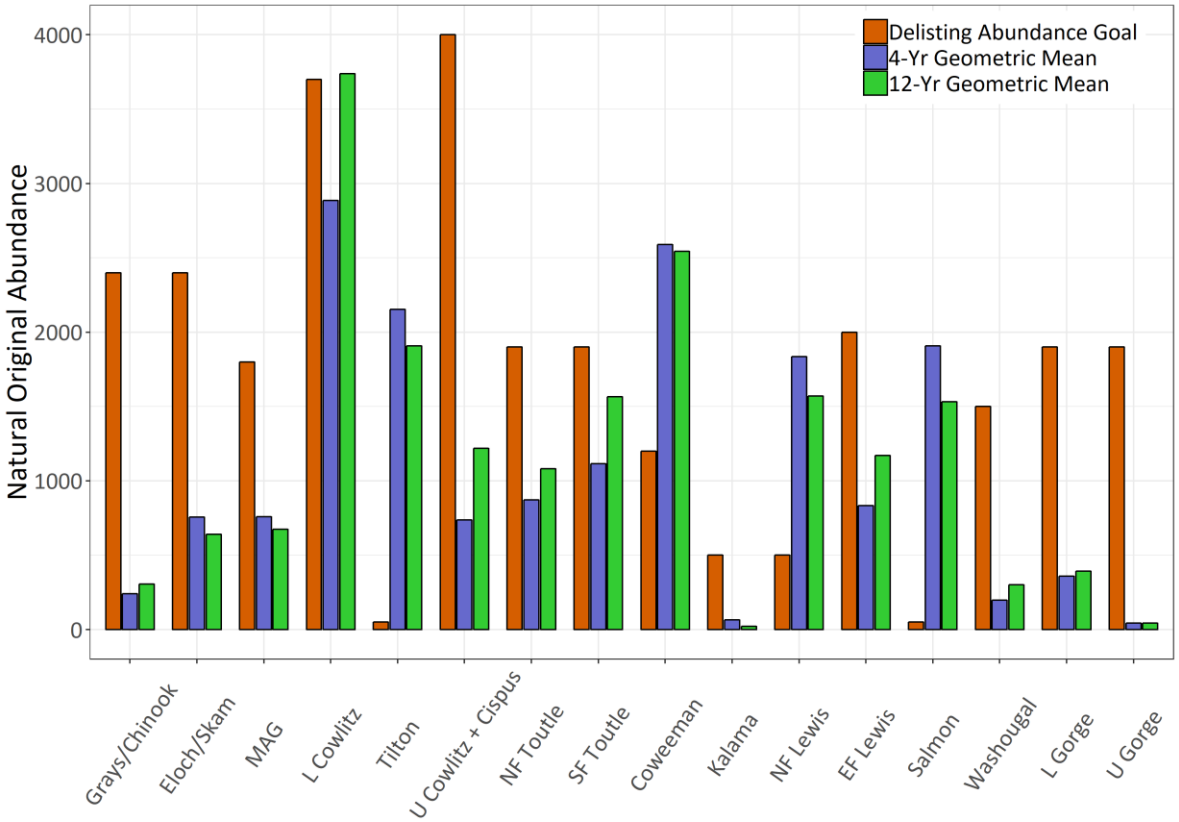

Figure 10. Recent natural origin (NOR) 4-year geometric mean abundance estimates for Coho populations relative to delisting abundance goals.

Coho salmon have been a focus of significant recovery efforts which have included substantial reductions in harvest rates, region-wide hatchery reforms, habitat improvements and implementation of a comprehensive assessments of status relative to goals. Efforts to date have likely contributed to viability improvements although long-term data are not available by which any improvements can be measured directly. The majority of restoration and conservation habitat project funding has directly addressed Coho freshwater habitat: 56% of completed Salmon Recovery Funding Board projects in the region target stream reaches where Coho are presumed to be present. This could be because Coho and winter Steelhead typically rely on smaller tributary and headwater habitat for rearing and spawning, and these habitat types may fall disproportionately within industrial timber and public lands. Habitat projects may be more feasible to complete in these areas because parcel sizes are typically larger and there is less infrastructure than larger river and lower watershed areas where development is more common. On top of this, the focus of the Lower Columbia Intensively Monitored Watershed (IMW) program is Coho abundance and productivity responses to freshwater habitat restoration. Preliminary results from this program emphasize the importance of providing complex summer and winter rearing habitat. Applying these lessons to restoration efforts across the region could potentially increase the effectiveness of restoration actions design to target Coho habitat needs.

Grays/Chinook Coho - Natural spawning occurs primarily in upper mainstem and large tributaries throughout the basin. Habitat degradation has been extensive and large numbers of hatchery fish were also historically released in this subbasin. Recent 12-year mean abundance is only 13% of the Recovery goal.

Elochoman/Skamakowa Coho - Natural spawning in the Elochoman is thought to occur in most areas accessible to coho with the majority of the spawning area in the upper watershed, in particular the West Fork. In Skamokawa Creek, important spawning areas include the mainstem and major tributaries. Habitat degradation has been extensive and large numbers of hatchery fish were also historically released in this subbasin. Recent 12-year mean abundance is only 27% of the Recovery goal.

Mill/Abernathy Germany Coho - Natural spawning is thought to occur in most areas accessible to coho in Mill, Abernathy (including Cameron Creek), Germany, and Coal Creeks. There are no production hatcheries located on these creeks, although out-of-basin early stock coho have been planted in past years. Recent 12-year mean abundance is only 37% of the Recovery goal.

Lower Cowlitz Coho - This population was likely one of the largest historical populations in the lower Columbia with production occurring in many tributary streams. Significant natural production occurs in most tributaries accessible to Coho including Olequa, Lacamas, Brights, Ostrander, Blue, Otter, Mill, Arkansa, Foster, Stillwater, Campbell and Hill Creeks. This Primary population was prioritized by the Recovery Plan for restoration from a Very Low to High level of viability. More comprehensive spawning surveys since 2010 have found this population to be substantially larger than previously estimated. This is now the largest natural Coho population in the Washington lower Columbia with annual numbers ranging from 1,700 to 18,200 since 2010. Mean natural-origin spawning escapement over the last 12 years (3,738) is seven times abundance estimated at listing (500) and exceeds the delisting abundance goal (3,700) consistent with High viability. Based on this information, we estimate that the Lower Cowlitz Coho population could be upgraded from Very Low viability at listing to High viability now. The population is self-sustaining as hatchery contributions to this population are less than 15% on average. Hatcheries currently release 2.4 million per Coho year into the Cowlitz and Toutle rivers but straying into significant natural production areas is relatively low.

U Cowlitz & Cispus Coho – Two Primary Coho populations in the Cascade strata rely on habitat upstream of the Cowlitz hydropower system. Mayfield Dam at River Mile 52 blocked upstream migration in 1962. Adult passage and transport efforts were discontinued in 1980. Successful reintroduction into habitat upstream of the Cowlitz hydropower system is a top priority for Coho recovery. Reintroduction efforts were initiated in 1994 with releases of hatchery-origin fish into the upper basin. The reintroduction program has a juvenile collection efficiency target of 95%. Initial juvenile collection efforts proved challenging, but collection efficiencies have significantly improved since a new collection facility was completed at Cowlitz Falls Dam in 2017. Collection efficiency of juvenile Coho averaged approximately 70% in 2017-2020. Thus, we represent the current tributary hydro impact as approximately 30%.

Coweeman Coho - Most spawning takes place in the mainstem Coweeman River and in tributaries such as Goble, Baird and Mulholland creeks. This Primary population was prioritized by the Recovery Plan for restoration to a High level of viability. More comprehensive spawning surveys have found abundance of natural-origin fish to be substantially greater than previously believed. Average natural-origin abundance (2,544) is substantially higher than was identified in the Recovery Plan (<50). This far exceeds the 1,200 Coho abundance recovery target for High viability identified in the Recovery Plan. We estimate that this population can be upgraded from Very Low viability at listing to High viability now. The natural population appears productive and self-sustaining as hatchery fish comprise just 10% of the total return. Historical hatchery production included widespread transfers from other populations, but transfers were eliminated by the early 1990s. Hatchery off-station planting of juvenile Coho was historically commonplace throughout lower Columbia tributaries. However, no hatchery Coho are currently released into the Coweeman River.

SF Toutle Coho - Spawning occurs in most areas accessible to Coho including the mainstem and tributaries. The 1980 Mount St. Helens eruption had minor effects on the South Fork compared to the mainstem and North Fork Toutle. This Primary population was prioritized by the Recovery Plan for restoration to a High level of viability. Improved stock assessments indicate that average abundance (1,566) is substantially higher that believed at the time of listing (<50). This exceeds the 1,100 Coho abundance benchmark for Moderate viability identified in the Recovery Plan, but not the ESA delisting goal of 1,900 fish. The natural population appears productive and self-sustaining as hatchery fish comprise a low (18%) proportion of the total return. We estimate that this population can be upgraded from Very Low viability at listing to Moderate viability now.

NF Toutle Coho - This river system likely provided the most productive habitat in the Lower Columbia River basin in the 1960s and 1970s. Natural spawning was thought to occur in most accessible areas including tributaries. Productivity in much of the North Fork was greatly reduced after the 1980 Mount St. Helens Eruption. However, the Green River and many other tributaries were relatively unaffected. Significant production areas include Hoffstadt, Johnson, Alder, Devils, and Herrington creeks. This Primary population was prioritized by the Recovery Plan for restoration to a Very Low to High level of viability. More comprehensive spawning surveys since 2010 have found mean abundance of natural-origin fish (1,082) to be substantially higher than believed at the time of listing (<50). Numbers are approaching the 1,100 Coho abundance benchmark for Moderate viability identified in the Recovery Plan, although they still fall short of the ESA delisting goal of 1,900 fish. The natural population appears self-sustaining as hatchery fish comprise a Moderate (36%) proportion of the total return. The North Fork Toutle Hatchery is located on the Green River less than a mile upstream from the confluence with the North Fork Toutle. Annual releases have been progressively reduced from over 750,000 through 2008 to about 150,000 through 2018 to just 90,000 planned for 2022. With this change, numbers of hatchery fish on the spawning grounds

are expected to decline further in the coming years. We estimate that this population can be upgraded from Very Low viability at listing to Low viability now.

Tilton Coho - We estimate that this population could be upgraded from Very Low viability at listing to Low viability now. Since listing, this population has been reintroduced with releases of hatchery fish in natural spawning areas. Over time these efforts have produced a significant natural-origin return to this stream. The 12-year average of 1,908 is close to the 2,000 Coho abundance benchmark for High viability identified in the Recovery Plan. However, hatchery-origin fish continue to account for a High proportion of the total return (~60%) and therefore the productivity and diversity of the natural population remain uncertain. This population was classified as Stabilizing in the Recovery Plan but given the progress of the reintroduction effort, could be considered for a Contributing or even Primary designation.

North Fork Lewis Coho - We estimate that this population could be upgraded from Very Low viability at listing to Low viability now. Improved stock assessments indicate that average abundance (1,570) is substantially higher that believed at the time of listing (200). This far exceeds the 500 fish ESA delisting goal and 1,200 Coho abundance recovery target for High viability identified in the Recovery Plan. However, hatchery fish continue to comprise a substantial percentage of total spawners (~60%) which precludes a higher viability rating. A portion of this Coho population also historically spawned in the upper basin which was blocked by Merwin Dam in 1931. A FERC relicensing settlement agreement for Lewis River hydroelectric projects calls for taking significant steps to achieve a genetically viable, self-sustaining natural population in the upper North Fork. Exploratory efforts released adult Winter Steelhead, Coho and Spring Chinook into the upper basin and operated a juvenile collection facility in Swift Reservoir beginning in 2013. Low adult coho returns from 2015 – 2019 led to incomplete adult trap efficiency assessments, but juvenile collection efficiency increased from 11.8% in 2015 to 63.5% in 2019. However, full implementation of passage requirements of the Lewis River hydro license agreement is currently delayed by legal challenges.

East Fork Lewis Coho - Natural spawning currently occurs downstream of Lucia Falls at River Mile 21 and in Lockwood, Mason and Rock creeks. This Primary population was prioritized by the Recovery Plan for restoration to a High level of viability. More comprehensive spawning surveys indicate that average abundance (1,170) is substantially higher that believed at the time of listing (<50). This exceeds the 1,100 Coho abundance benchmark for Moderate viability identified in the Recovery Plan, although is less than the ESA delisting goal of 2,000 fish. There are no hatcheries in this river although Coho fry were periodically released in past years. Hatchery-origin spawners comprise just 21% of total spawners in natural production areas. We estimate that this population could be upgraded from Very Low viability at listing to Low or higher viability now.

Salmon Creek Coho - Natural spawning can occur throughout the basin, but principally in the upper mainstem and Morgan, Rock, Mill and Whipple creeks. Potential for Coho spawning also exists in nearby streams, including Burnt Bridge and Whipple Creek. Salmon Creek has been heavily impacted by urban development. The Recovery Plan classified this population as Stabilizing due to presumed low viability and habitat challenges posed by the urbanization of the stream and its watershed. However, subsequent spawning ground surveys indicate that average abundance (1,533) is substantially higher that believed at the time of listing (<50). This exceeds the 1,200 Coho abundance recovery target for Moderate viability identified in the Recovery Plan and the ESA delisting goal of baseline abundance (i.e., <50 fish). The natural population appears productive and self-sustaining as hatchery fish comprise just 4% of the total return. We estimate that this population could be upgraded from Very Low viability at listing to Moderate viability now. Based on this new information, the Recovery Priority for this populations warrants reconsideration.

Lower Gorge Coho - This is a shared population with Oregon. Most of the available habitat is in Washington streams including Duncan, Hardy and Hamilton creeks. The population in Hardy and Hamilton creeks may be one of the more productive remaining in the Washington lower Columbia region. Other potential coho spawning tributaries include: Gibbons Creek, Lawton Creek, St. Cloud Creek, Woodward Creek, and Greenleaf Creek (a tributary of Hamilton Creek). There are no hatcheries on Duncan, Hardy, or Hamilton Creeks. However, Washougal Hatchery late coho were planted in Duncan and Greenleaf Creeks in 1983. Oregon operates a very large hatchery program in the lower gorge downstream from Bonneville Dam. Coho have not met abundance goals in any reported years, and mean numbers are just 21% of the delisting goal, respectively. Hatchery fish comprise 15% of total returns. This is particularly concerning because this is a Primary population.

Upper Gorge Coho - This is a shared population with Oregon but most of the habitat occurs in Washington. Early run coho salmon spawn in accessible sections of Rock Creek, Spring Creek, Wind River, and Little White Salmon River. The lower reaches of these tributaries were flooded after the construction of Bonneville Dam in 1938. Little is known about historical coho salmon runs in the Big White Salmon although they were believed to migrate up to Trout Lake (RM 28) prior to the construction Condit Dam (RM 3) in 1913. Data are currently available for natural-origin spawners only for the Wind River. Small numbers also currently spawn in the Big White Salmon River. Coho in the Upper Gorge are also struggling to meet goals: Upper Gorge Coho have not met abundance goals in any reported years, and mean numbers are just 2% of delisting goals. Hatchery fish comprise 26% of total returns. This is particularly concerning because this is a Primary population.

Chum

Annual returns of Chum Salmon to the Columbia River have declined from hundreds of thousands in the 1930s to fewer than 20,000 today (MAFAC 2020). Chum are extirpated or nearly so throughout most of their historical range. Only three lower Columbia populations continue to support significant numbers of spawners (Grays/Chinook, Washougal, and Lower Gorge). At the time of ESA listing in 1999, eight of nine Washington populations, six of six Oregon populations, and one of two shared populations were estimated to be at Very Low levels of viability (Table 6). Very Low viability was associated with low abundance, poor productivity, limited distribution and a loss of historical diversity.

Stock assessments for Chum Salmon were historically conducted primarily for the Grays River population which continues to be the strongest of the remaining populations. In 2002, WDFW undertook a more comprehensive assessment of Chum numbers throughout the lower Columbia River. Oregon also conducted additional surveys on their side of the river. This work identified significant populations in the Washougal and the Lower Columbia River gorge tributaries subbasins. The Elochoman/Skamakowa population was also determined to be larger than believed at listing. Small numbers of Chum salmon were documented in other tributaries. Since 2002, Chum numbers in these populations have been variable from year to year with no clear trend (Figure 12).

Based on this new information, the viability status of several populations is re-evaluated in this report. We estimate that each stratum currently includes one population of High to Very High viability occurring in whole or in part in Washington (Figure 11, Table 6). Details are discussed for key population in the pages following.

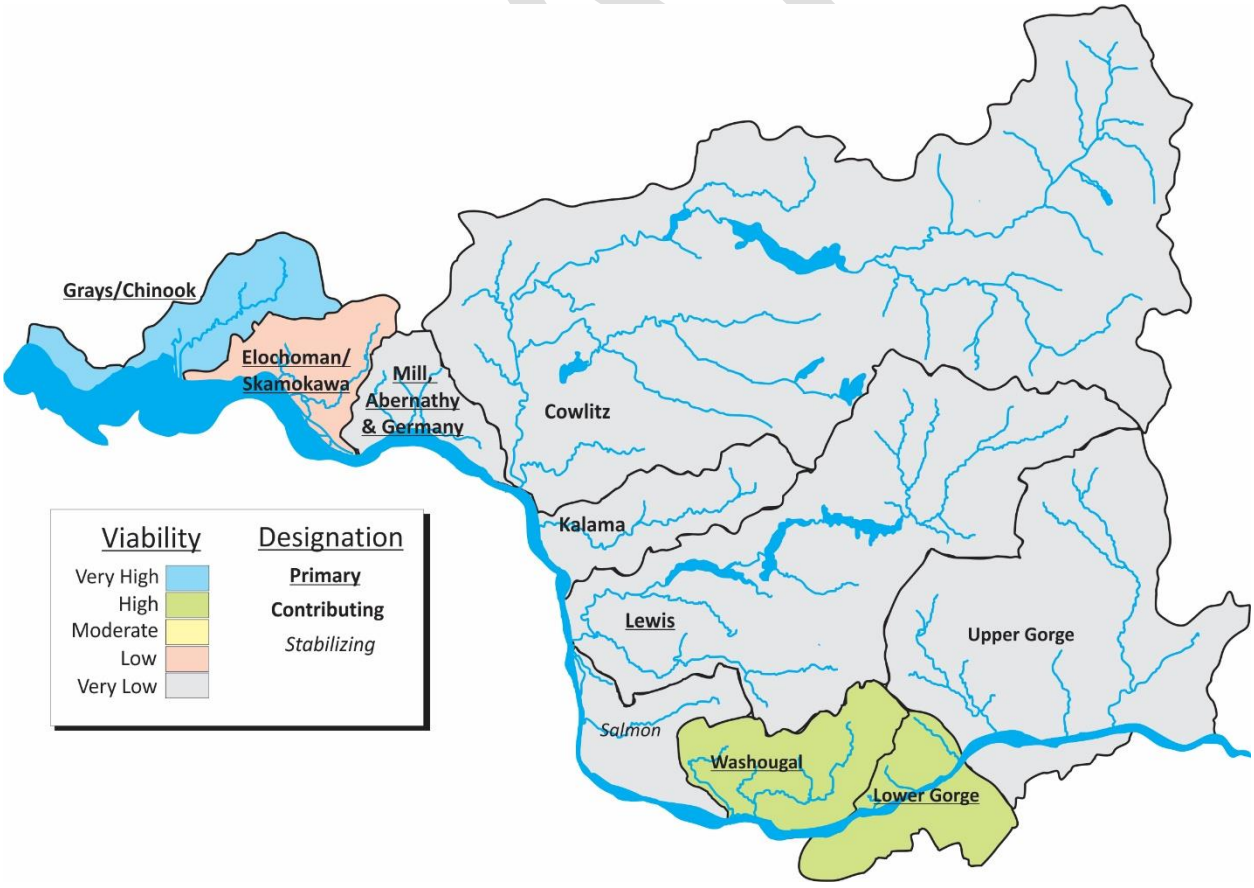

Figure 11. Current status and Recovery Plan designations of Lower Columbia River populations of Chum Salmon in Washington.

Table 6. Viability and abundance relative to recovery objectives for Lower Columbia River populations of Chum Salmon in Washington.

Strata	Population	Desig.[1]	Viability[2]			Abundance[3]						% of goal	Yrs goal met[10]		Data[11]
			@list[4]	Goal[5]	Now[6]	Historical	@list[4]	Goal[5]	@High[7]	12-yr[8]	4-yr[9]		12-yr[8]	4-yr[9]	
Coast	Grays/Chinook	P	M	VH	**VH**	10,000	1,600	1,600	1,300	6,523	9,560	408%	100%	100%	1
	Eloch/Skam	P	VL	H	**L**	16,000	<200	1,300	1,300	916	920	70%	8%	25%	2
	Mill/Ab/Germ	P	VL	H	VL	7,000	<100	1,300	1,300	100	100	--	--	--	3
Cascade	Cowlitz[13]	C	VL	M	VL	195,000	<300	900	1,300	300	--	--	--	--	3
	Kalama	C	VL	M	VL	20,000	<100	900	1,300	100	--	--	--	--	3
	Lewis [C]	P	VL	H	VL	125,000	<100	1,300	1,300	100	--	--	--	--	3
	Salmon	S	VL	VL	VL	4,000	<100	100	1,300	100	--	--	--	--	3
	Washougal	P	VL	H+	**H**	18,000	<100	1,300	1,300	2,009	2,260	155%	83%	100%	1
Gorge	Lower (WA/OR)	P	H	VH	**H**	6,000	2,000	2,000	1,300	2,333	3,970	117%	58%	75%	1
	Upper (WA/OR)	C	VL	M	VL	11,000	<50	900	1,300	97	87	11%	0%	0%	1

[1] Priority designation identified in Recovery Plan: P=Primary, C=Contributing, S=Stabilizing.

[2] Viability based on abundance, productivity, spatial structure and diversity at listing. VH=Very High, H=High, M=Moderate, L=Low, VL = Very Low.

[3] Abundance of natural-origin spawners (geomeans).

[4] Status in the 1990s at the time of first listing.

[5] Recovery targets based on scenario identified in the Recovery Plan.

[6] Viability level recommended by this report based on current status and improvements since listing. Changes from Recovery Plan are highlighted with bold underlines.

[7] Abundance at High viability (approximate value identified in Recovery Plan).

[8] Recent 12-year geomeans (2008-2019) based on the best available information. Where recent survey data is not available, values were assumed to be those reported in the Recovery Plan.

[9] Recent 4-year geomeans (2016-2019) based on the best available information.

[10] Percentage of years for available data where recovery goal was met.

[11] Quality/type of recent abundance data reported in this assessment: 1 = good (annual statistical stream survey, dam or weir count), 2= fair (periodic surveys, index counts), 3= poor (expert judgement, habitat model inference).

[12] Based on 12-year geomeans.

[13] Recovery Plan reported that the Cowlitz historically supported fall and summer Chum populations.

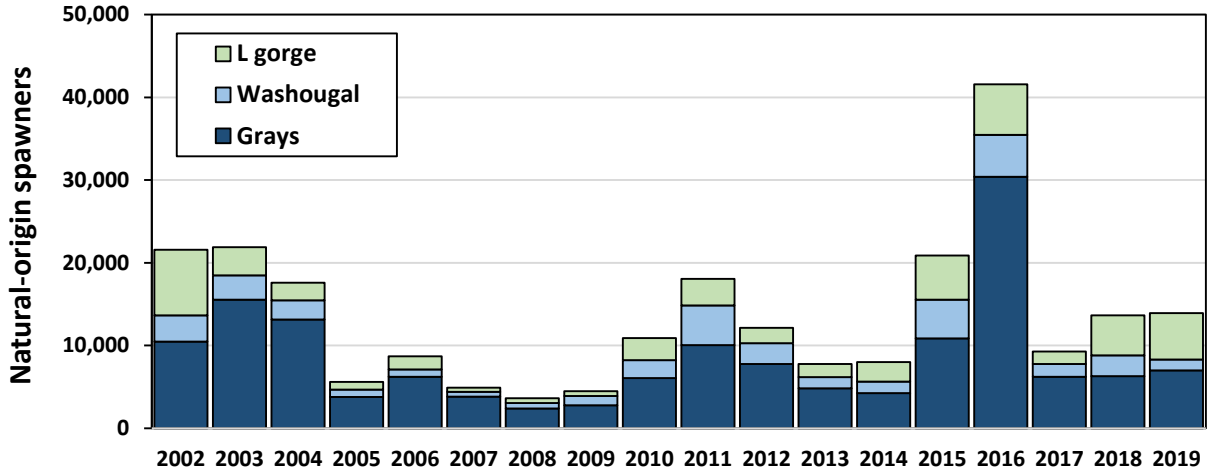

Figure 12. Annual estimates of natural-origin abundance of Chum salmon in key populations, 2002-2019.

A variety of actions have been undertaken for the benefit of Chum salmon and these actions have been instrumental in preserving and in some cases beginning to rebuild severely-depleted populations. Fishery impacts have been reduced to *de minimis* levels (<5%) by prohibiting sport and commercial retention and limiting commercial seasons in late fall when Chum Salmon are present since 1993. Hatchery influence is limited to small scale supplementation and reintroduction programs to support greater spatial distribution of Chum across the region. Further details on fisheries and hatcheries may be found on following chapters in this report. Spawning channels have been constructed in Skamokawa Creek, Duncan Creek, and the Lewis River to provide critically limiting habitat and increase spatial distribution. Estuary habitat protection and restoration will likely have significant benefits for Chum Salmon during a critical life history stage. Chum salmon are also expected to benefit from other stream, floodplain and watershed habitat protection and restoration efforts across the region although there is limited effort at this time in lower watershed areas favored by this species. Long-term success of Chum Salmon recovery efforts will depend on critical habitat restoration needed to expand spatial distribution beyond a few limited production areas.

Grays-Chinook Chum - This Primary population is the largest remaining for this species in the Columbia Basin. Recent twelve and four-year mean abundances substantially exceed the abundance goal identified in the Recovery Plan for Very High viability of this population (Table 6, Figure 13). Mean natural-origin spawning escapement over the last 12 years is four times the delisting abundance goal. The goal has been exceeded in each of the last 19 years. Numbers have been varied from year to year but the trend has been stable over this period. Spawners are well distributed among the mainstem Grays River from RM 9.5-13.0, the lower 1.4 miles of the West Fork of the Grays River, the lower 0.5 miles of Crazy Johnson Creek, and in Gorley Creek at RM 12 of the Grays River with mean abundance of 1,400 or more in each of three major spawning areas.[8] Habitat for Chum has been enhanced by construction of a spawning channel. Hatchery influence is very low as hatchery-origin spawners comprise just 6% of natural spawners in the Grays River. Based on high abundance, spawning distribution among multiple areas, and limited hatchery influence, we estimate that the Grays-Chinook Chum population can be upgraded from Moderate viability at listing to Very High viability now. The population could benefit from further increases in spawning habitat distribution to reduce risks of catastrophic losses due to watershed conditions. Sedimentation and unstable channel conditions are a primary concern.

[8] https://fortress.wa.gov/dfw/score/score/species/population_details.jsp?stockId=2748

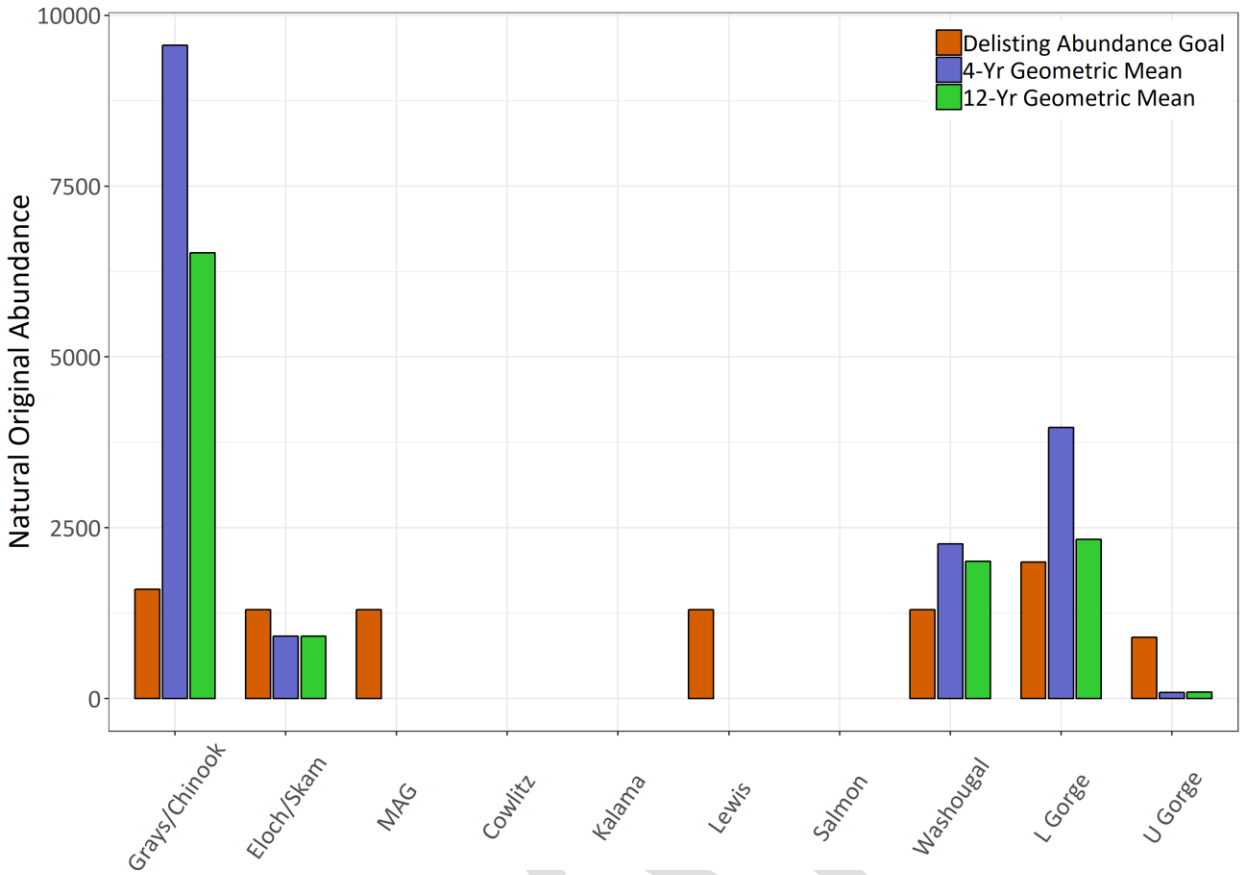

Figure 13. Recent natural origin (NOR) 4-year and 12-year geometric mean abundance estimates for Chum populations relative to delisting abundance goals.

Elochoman/Skamakowa Chum - This system appears to support more Chum than previously assumed. The Recovery Plan reported very low numbers and viability for this population. We estimate that the Elochoman/Skamokawa Chum population could be upgraded from Very Low to Low based on current survey data. New survey data estimated 4,000 spawners in 2016. Surveys are not conducted in every year and counts in other years have ranged from 34 to 209. Counts are likely under-estimates due to the difficulty of observing fish as stream flows and turbidity increase in the fall. Recent mean abundances continue to fall well short of abundance goals identified in the Recovery Plan for Very High viability of this population (Table 6, Figure 13). Spawning occurs primarily in the lower mainstem Elochoman between tidewater and the Elochoman Hatchery, and in Skamokawa Creek between tidewater and Standard and McDonald creeks. Harlow's Creek, which flows directly into the Columbia downstream of Skamokawa Creek, is also an important Chum spawning area. Numbers appear to have benefited from construction of two spawning channels along Skamokawa Creek. WDFW is waiting on capital funding to conduct additional Chum restoration at the old hatchery site.

Cowlitz & Lower Tributaries Chum- This system historically supported the largest Chum numbers in the basin including fall and possibly summer run populations. Spawning occurred in the mainstem Cowlitz, Toutle, and Coweeman Rivers. Natural spawning primarily occurs in the lower Cowlitz, lower mainstem Toutle, Ostrander Creek, and the lower Coweeman. Some chum historically migrated into areas upstream from Mayfield Dam. Critical habitat in the lower river has been significantly reduced by diking in the Longview/Kelso area. Chum Salmon are currently present in the Lower Cowlitz but numbers and viability are Very Low. Natural spawning now occurs primarily in the lower Cowlitz, lower mainstem Toutle,

Ostrander Creek, and the lower Coweeman. Little restoration work has been conducted to date for Cowlitz Chum Salmon.

Lewis River Chum - The Lewis River has been identified as a Primary population but numbers remain very low. Historically-productive areas included the lower Lewis River and Cedar Creek. Chum salmon currently spawn in the lower reaches of the mainstem North Fork and East Fork Lewis River. Hatchery-origin fry are being released to help jump start this population. A spawning channel was constructed in the East Fork Lewis but it has not been successful to date. A spawning channel was also planned for the North Fork Lewis near Eagle Island but funds for construction have not been identified.

Washougal Chum- The Recovery Plan reported very low numbers and viability of this Primary population. However, more recent spawning ground surveys have identified significant numbers of Chum salmon spawning in the mainstem Columbia River near the mouth of the Washougal. These fish are spawning in upwelling areas near the Washington shoreline upstream from the I-205 bridge. Spawning also occurs in the lower reaches of the mainstem Washougal, Little Washougal, and Lacamas Creek. Recent twelve and four-year mean abundances substantially exceed the abundance goal identified in the Recovery Plan for High viability of this population (Table 6, Figure 13). Mean natural-origin spawning escapement over the last 12 years is over 50% greater than the delisting abundance goal. The goal has been exceeded in 10 of the last 12 years (83%). Numbers have been varied from year to year but the trend has been stable over this period. Hatchery influence is negligible as hatchery-origin spawners comprise <1% of natural spawners. We estimate that the Washougal Chum population can be upgraded from Very Low to High based on the new survey data. This is the sole Cascade stratum population where viability is not Very Low. Population improvements might be possible in Washougal proper, but a baseline study has not been conducted and additional scoping needs to be completed first.

Lower Gorge Chum - The Recovery Plan reported significant numbers and High viability for this population and current status is the same. This population spawns in the lower mile of Hardy and Hamilton Creeks, Hamilton Slough, Duncan Creek, and in the mainstem Columbia at Ives and Pierce Islands as well as scattered sites on the Oregon side. Habitat work in Hamilton, Hardy, and Duncan Creeks and artificial spawning channels in Hardy Creek and Hamilton Spring have increased the spatial distribution of this population. Recent twelve and four-year mean abundances meet or exceed abundance goals identified in the Recovery Plan for Very High viability of this population (Table 6, Figure 13). Abundance of this population is currently fluctuating around the goal which has been met in seven of the last 12 years. Hatchery influence is negligible as hatchery-origin spawners comprise <1% of natural spawners. Abundance generally appears to have increased since 2010. We estimate that this population is at High viability or greater based on current numbers. This population is a High priority for continued protection which is currently provided by conservation ownership in headwater areas of Hamilton Creek; conservation management of spawning areas in Duncan Creek; and Federal management of Ives Island habitats. Gaps in conservation management include private lands along Highway 14, which may pose risk to hydrological and water quality processes that help sustain groundwater fed-spawning habitats.

Upper Gorge Chum - This is a shared population with Oregon but most of the habitat exists in Washington. The majority of the historical chum spawning habitat was flooded after the construction of Bonneville Dam in 1938. Spawning is limited to the lower reaches of Rock Creek, the Wind River below Shipperd Falls, Little White Salmon and Big White Salmon Rivers. Natural spawning chum in these tributaries are all naturally produced as no hatchery chum are released in the area. This population have not met delisting abundance goals to date, nor are they on a positive trajectory.

Steelhead

Steelhead in the Lower Columbia region are grouped by NOAA Fisheries into two distinct population segments (DSP). Steelhead populations in the Coast strata are part of the Southwest Washington DPS which is not listed under ESA, but are part of the Steelhead recovery strategy in the Recovery Plan. The Lower Columbia Steelhead DPS is listed as threatened under the ESA. Winter Steelhead are the predominate run type in the Lower Columbia and populations are present in practically all subbasins. Summer Steelhead are also produced in a few areas, typically in streams where falls or cascades were partial barriers to Steelhead passage during portions of the year.

Stock assessment data is available for most Columbia River Steelhead populations in Washington since 2000. Numbers of both summer and winter Steelhead have been variable over the last 20 years with no significant increasing or decreasing trend (Figure 14). Long-term data is not available for a comparison of numbers before and after listing although the Recovery Plan estimated pre-listing abundance based on the best information available at that time.

At the time of ESA listing in 1999, Washington Steelhead populations included eight at Very Low, six at Low, seven at Moderate and one at High Viability (Table 7). In contrast, six of eight populations occurring only in Oregon were at Moderate to Very High viability.

Our review identified several changes in viability status based on nominal population improvements since ESA listing over 20 years ago and stock assessments completed in the interim (Figure 15, Table 7). Recent data shows that 10 of 22 Washington populations meet or exceed delisting abundance targets (Figure 16, Figure 17). Nine populations meet or exceed average abundance levels consistent with High viability although several of these continue to be limited by hatchery effects on diversity.

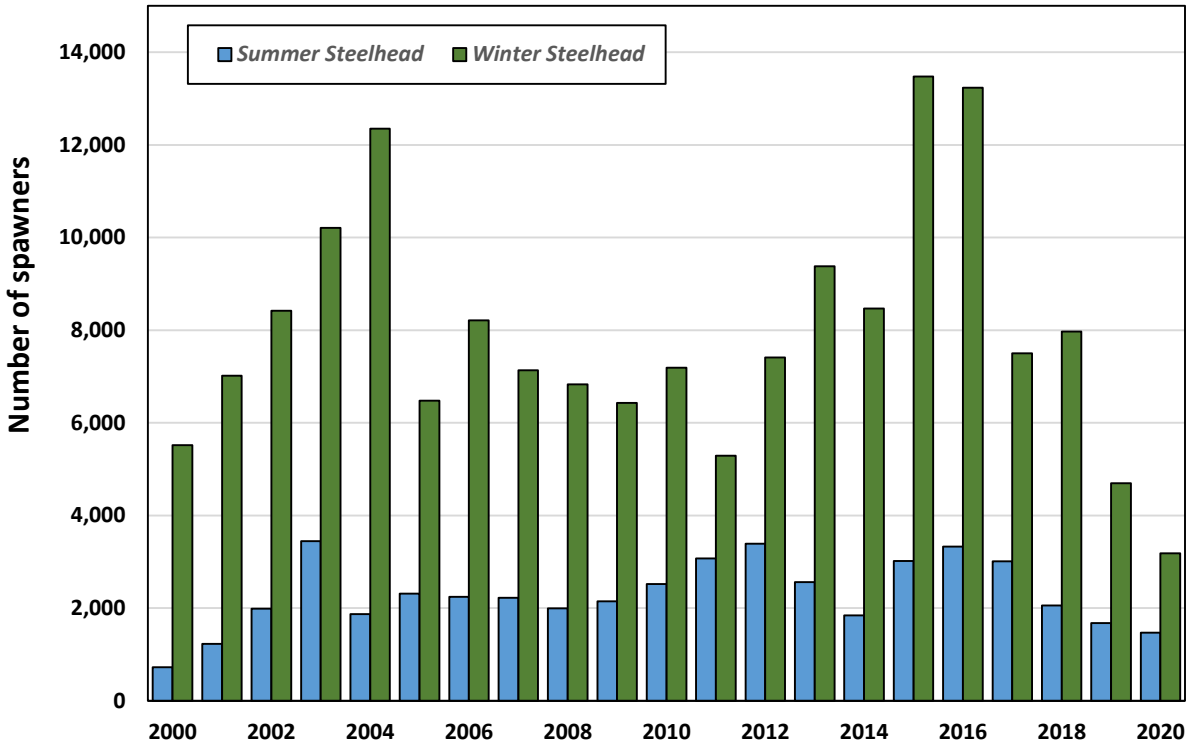

Figure 14. Annual abundance of natural-origin Steelhead in the Washington Lower Columbia River (total of all populations surveyed).

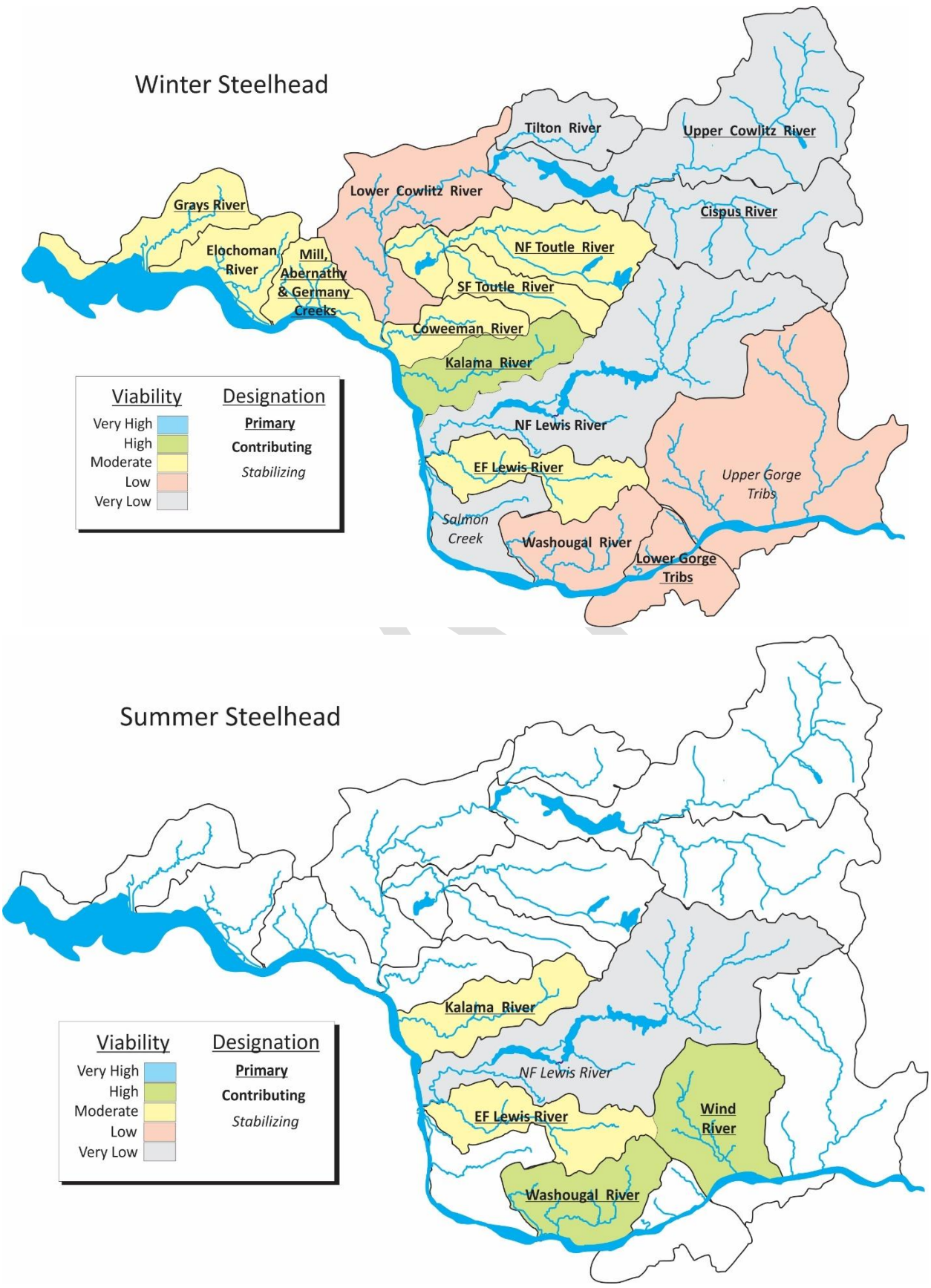

Figure 15. Current status (approximate) and Recovery Plan designations of Lower Columbia River populations of Steelhead in Washington.

Table 7. Viability and abundance relative to recovery objectives for Lower Columbia River populations of Steelhead in Washington.

	Strata	Population	Desig.[1]	Viability[2]			Abundance[3]						% of	Yrs goal met[10]		Data[11]
				@list[4]	Goal[5]	Now[6]	Historical	@list[4]	Goal[5]	@High[7]	12-yr[8]	4-yr[8]	Goal[12]	12-yr	4-yr	
Winter run	Coast	Grays/Chinook	P	M	H	M	1,600	800	800	500	593	684	74%	25%	25%	1
		Eloch/Skam	C	M	M+	M	1,100	600	600	500	544	567	91%	33%	25%	1
		Mill/Ab/Germ	P	M	H	M	900	500	500	500	321	244	64%	17%	0%	1
	Cascade	Lower Cowlitz	C	L	M	L	1,400	350	400	500	350	--	--	--	--	3
		Upper Cowlitz	P	VL	H	VL	1,400	<50	500	500	259	187	26%	0%	0%	1
		Cispus	P	VL	H	VL	1,500	<50	500	500						
		Tilton	C	VL	L	VL	1,700	<50	200	500	214	206	107%	50%	25%	1
		S.F. Toutle	P	M	H+	M	3,600	350	600	500	519	553	87%	42%	50%	1
		N.F. Toutle	P	VL	H	**M**		120	600	500	576	492	96%	42%	50%	1
		Coweeman	P	L	H	**M**	900	350	500	500	509	457	102%	50%	25%	1
		Kalama	P	L	H+	**H+**	800	300	600	500	755	523	126%	83%	50%	1
		N.F. Lewis	C	VL	M	VL	8,300	150	400	500	150	--	--	--	--	3
		E.F. Lewis	P	M	H	M	900	350	500	500	489	597	98%	50%	75%	1
		Salmon	S	VL	VL	VL	500	<50	--	500	50	--	--	--	--	3
		Washougal	C	L	M	L	800	300	350	500	399	384	114%	67%	75%	1
	Gorge	Lower (WA/OR)	P	L	H	L	2,100	200	300	500	200	--	--	--	--	3
		Upper (WA/OR)	S	L	L	L	600	200	--	500	200	12	9	0%	0%	3
Summer un	Cascade	Kalama	P	M	H	M	1,000	500	500	500	481	511	96%	50%	50%	1
		N.F. Lewis	S	VL	VL	VL	6,500	150	--	500	150	--	--	--	--	3
		E.F. Lewis	P	VL	H	**M**	600	<50	500	500	704	609	141%	83%	75%	1
		Washougal	P	M	H	**H**	2,200	400	500	500	648	613	130%	80%	75%	1
	Gorge	Wind	P	H	VH	H	5,000	1,000	1,000	500	650	594	65%	25%	50%	1

[1] Priority designation identified in Recovery Plan: P=Primary, C=Contributing, S=Stabilizing.

[2] Viability based on abundance, productivity, spatial structure and diversity at listing. VH=Very High, H=High, M=Moderate, L=Low, VL = Very Low.

[3] Abundance of natural-origin spawners (geometric means).

[4] Status in the 1990s at the time of first listing.

[5] Recovery targets based on scenario identified in the Recovery Plan.

[6] Approximate viability level identified for the purposes of this exercise based on current status and improvements since listing. Changes are highlighted with bold underlines.

[7] Abundance at High viability (approximate value identified in Recovery Plan).

[8] Recent 12-year averages (2008-2019) based on the best available information. Where recent survey data is not available, values were assumed to be those reported in the Recovery Plan.

[9] Recent 4-year averages (2016-2019) based on the best available information.

[10] Percentage of years for available data where recovery goal was met.

[11] Quality/type of recent abundance data reported in this assessment: 1 = good (annual statistical stream survey, dam or weir count), 2= fair (periodic surveys, index counts), 3= poor (expert judgement, habitat model inference).

[12] Based on 12-year geomeans.

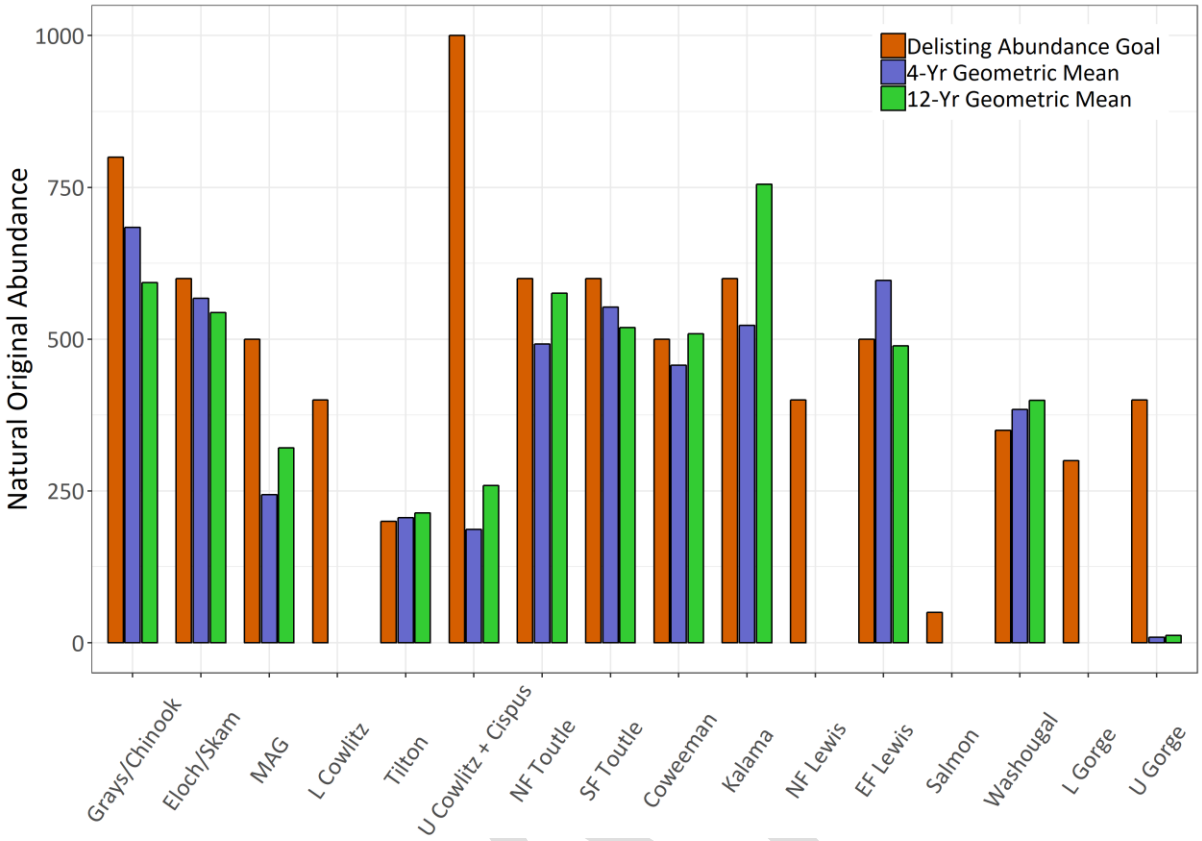

Figure 16. Recent natural origin (NOR) 4-year and 12-year geometric mean abundance estimates for Winter Steelhead populations relative to delisting abundance goals.

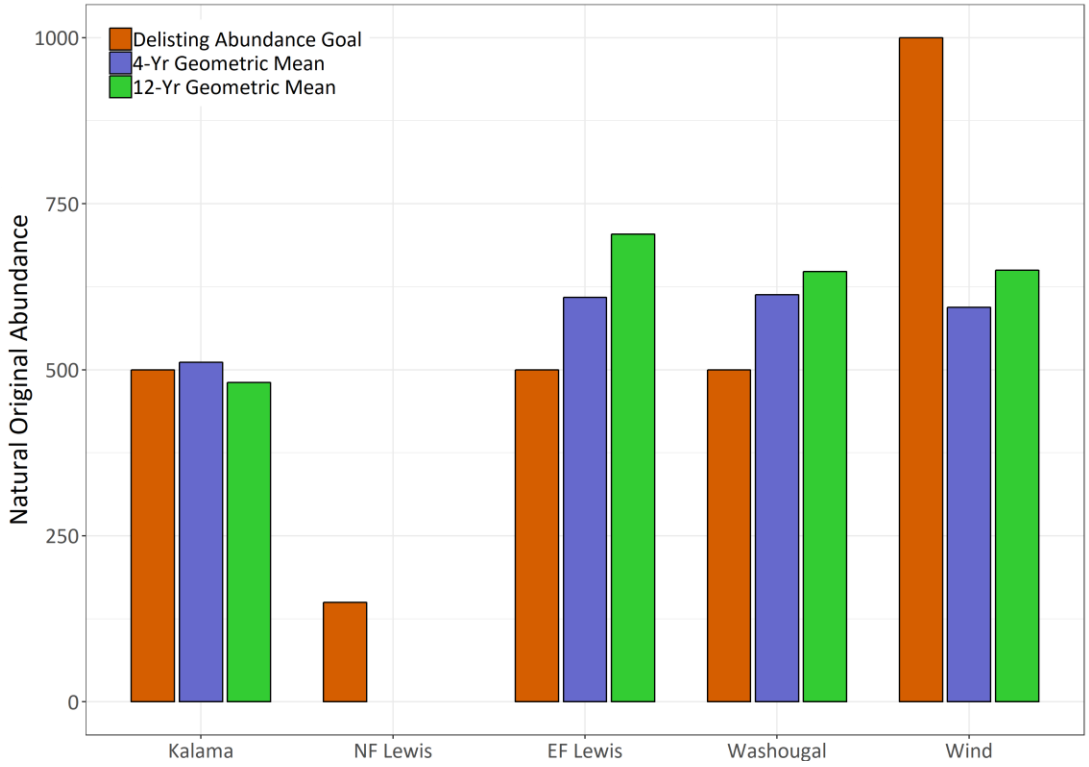

Figure 17. Recent natural origin (NOR) 4-year and 12-year geometric mean abundance estimates for Summer Steelhead populations relative to delisting abundance goals.

Steelhead appear to be making recovery progress from a delisting abundance perspective, with a wide distribution of populations across the region achieving goals with the exception of the gorge stratum. The majority of restoration and conservation habitat project funding has directly addressed winter Steelhead freshwater habitat: 56% of completed Salmon Recovery Funding Board projects in the region target stream reaches where winter Steelhead are presumed to be present. This could be because winter Steelhead typically rely on smaller tributary and headwater habitat for rearing and spawning, and these habitat types may fall disproportionately within industrial timber and public lands. Habitat projects may be more feasible to complete in these areas because parcel sizes are typically larger and there is less infrastructure than larger river and lower watershed areas where development is more common.

Winter Steelhead

Grays/Chinook Winter Steelhead - This Primary population was prioritized by the Recovery Plan for restoration to a High level of Viability. Current viability is Moderate. Winter Steelhead are distributed throughout the mainstem above tidal influence and throughout the East, West, and South Forks. In 1957, Grays River Falls (RM 13) was lowered with explosives, providing easier upstream migration; during the 1950s numerous other natural and man-made barriers above Grays Falls were cleared to improve Steelhead access to the upper watershed. Abundance appears to be generally similar to that at listing as identified in the Recovery Plan. Mean 12-year abundance is about 74% of the goal for High viability and the goal has reached in about 25% of these years. The Statewide Steelhead Management Plan established this population as a wild gene bank to support natural origin Steelhead recovery (WDFW 2008). Hatchery produced winter Steelhead from Elochoman and Cowlitz Rivers and Chambers Creek stocks were historically planted in the Grays River basin beginning in 1957. Steelhead hatchery production ended in 2016. Improvements in productivity and diversity are expected in response to reforms in the hatchery program.

Elochoman/Skamakowa Winter Steelhead - This Contributing population was prioritized by the Recovery Plan for restoration to a Moderate-plus level of Viability. Current viability is Moderate. Abundance appears to be generally similar to that at listing as identified in the Recovery Plan. Mean 12-year abundance is about 91% of the goal for High viability and the goal has reached in about 33% of these years.

Mill/Abernathy/Germany Winter Steelhead - This Primary population was prioritized by the Recovery Plan for restoration to a High level of Viability. Current viability is Moderate. Abundance appears to be generally similar to that at listing as identified in the Recovery Plan. Mean 12-year abundance is about 64% of the goal for High viability and the goal has reached in about 17% of these years. Winter Steelhead are widely distributed throughout the mainstem and major tributaries. Spawning in Mill Creek occurs in the mainstem, North Fork and unnamed tributaries. Spawning in Abernathy Creek occurs in the mainstem, Slide Creek, and Cameron Creek. Spawning in Germany Creek occurs in the mainstem, Loper Creek, and John Creek. Hatchery Steelhead were planted annually from 1961 to 2000 but these fish contributed little to natural production because natural fish spawned later than the hatchery stocks. No hatchery Steelhead are currently released into this population and the incidence of hatchery strays is negligible.

Lower Cowlitz Winter Steelhead - The lower Cowlitz winter steelhead historical population may have been one of the largest in the lower Columbia Basin. Winter steelhead are distributed throughout the mainstem Cowlitz below Mayfield Dam; natural spawning occurs in Olequa, Ostrander, Salmon, Arkansas, Delameter, Stillwater and Whittle Creeks. Hatchery winter steelhead have been planted in the Cowlitz River basin since 1957 using broodstock from Cowlitz River and Chambers Creek. The Cowlitz Trout

Hatchery, located on the mainstem Cowlitz at RM 42 currently produces winter steelhead. Hatchery fish account for the majority of the winter steelhead run to the Cowlitz River basin.

Coweeman Winter Steelhead - Winter Steelhead are distributed throughout the mainstem Coweeman, Goble Creek, and the lower reaches of Mulholland and Baird Creeks. This Primary population was prioritized by the Recovery Plan for restoration to a High level of Viability. We estimate that this population could be upgraded from Low viability at listing to Moderate viability now. Current stock assessments indicate that average abundance (509) is substantially higher that believed at the time of listing (350). This meets the 500 Steelhead Recovery Goal for this population for Moderate viability identified in the Recovery Plan as the goal for this population. However, a higher viability level is precluded at this time pending some assessment of the effectiveness of the integrated hatchery program on natural population productivity and diversity. Hatchery winter Steelhead have been planted in the Coweeman River basin since 1957 using broodstock from the Elochoman and Cowlitz Rivers and Chambers Creek. The hatchery program shifted from out-of-stratum to in-basin stocks beginning in 2017 to reduce hatchery influences on productivity and diversity.

Toutle South Fork Winter Steelhead - This Primary population was prioritized by the Recovery Plan for restoration to a High level of Viability. Current viability is Moderate. Abundance appears to be greater than at listing as identified in the Recovery Plan. Mean 12-year abundance is about 87% of the goal for High viability and the goal has reached in about 42% of these years. Spawning occurs in the mainstem SF Toutle and Studebaker, Johnson, and Bear Creeks. Aside from several small fry plants after the 1980 eruption of Mount St. Helens, hatchery winter Steelhead have not been stocked into the South Fork Toutle River (WDFW SCoRE).

Toutle North Fork Winter Steelhead - Winter Steelhead spawn primarily in the NF Toutle River mainstem, Alder and Deer Creeks. In the Green River they spawn in the mainstem and Devils, Elk, and Shultz Creeks. The 1980 eruption of Mt. St. Helens greatly altered the habitat within the Toutle River Basin; the NF Toutle sustained the most significant habitat degradation. Wild Steelhead are trapped and passed over the NF Toutle sediment retention structure to allow access to tributaries upstream. This Primary population was designated as a historical core population and prioritized by the Recovery Plan for restoration to a High level of Viability. We estimate that this population could be upgraded from Very Low viability at listing to Moderate viability now. Current stock assessments indicate that average abundance (576) is substantially higher that believed at the time of listing (120). This exceeds the 500 Steelhead benchmark for High viability identified in the Recovery Plan. The Statewide Steelhead Management Plan established this population as a wild gene bank to support natural origin Steelhead recovery (WDFW 2008). Hatchery winter Steelhead were historically planted in the NF Toutle River basin since 1953 using Elochoman and Cowlitz Rivers and Chambers Creek broodstock. However, these fish contributed little to natural production due to run timing. Steelhead hatchery releases were discontinued in 2014 to reduce hatchery influences on productivity and diversity. The natural population appears productive and self-sustaining as hatchery fish are now believed to comprise a very low (<5%) proportion of the total return. A higher viability level is precluded at this time out of concern for potential legacy effects of historical hatchery production on natural productivity and diversity.

Tilton Winter Steelhead – The historical Tilton River Winter Steelhead return size is estimated to be 1,700 spawners prior to the construction of Mayfield Dam in 1963, which blocked access to the upper watershed. Current natural spawning returns are part of a steelhead reintroduction program initiated in 1994. Adults are captured at Cowlitz hatcheries and transported to the Tilton River for release. In addition, late stock winter steelhead are planted into the Tilton River. Smolts are captured at the Cowlitz Falls Dam collection facility, acclimated at Cowlitz Salmon Hatchery and released into the lower Cowlitz. These

efforts have established a small natural-origin population in the Tilton River. However, long term viability of this population is uncertain and depends on the continuation of reintroduction efforts.

Upper Cowlitz & Cispus Winter Steelhead - Two Primary populations in the Cascade strata rely on habitat upstream of the Cowlitz hydropower system. Mayfield Dam at River Mile 52 blocked upstream migration in 1962. Adult passage and transport efforts were discontinued in 1980. Successful reintroduction into habitat upstream of the Cowlitz hydropower system is a top priority for recovery. Reintroduction efforts were initiated in 1994 with releases of hatchery-origin fish into the upper basin. A significant natural-origin population has been re-established although numbers remain substantially below the goal for High viability. The reintroduction program has a juvenile collection efficiency target of 95% (PacifiCorp 2019)). Initial juvenile collection efforts proved challenging but collection efficiencies have significantly improved since a new collection facility was completed at Cowlitz Falls Dam in 2017. Collection efficiency of juvenile Steelhead averaged approximately 70% in 2017-2020.

Kalama Winter Steelhead - Winter Steelhead spawn in the mainstem Kalama River up to a 35 foot barrier falls (RM 36.8) and in Gobar, Elk, and Fossil Creeks. This Primary population was prioritized by the Recovery Plan for restoration to a High level of Viability. We estimate that this population could be upgraded from Low viability at listing to High plus viability now. This is currently one of the largest natural populations of winter Steelhead in the region. Current stock assessments indicate that average abundance (755) is more than double that estimated at the time of listing (300). This exceeds the 700 Steelhead benchmark for Very High viability identified in the Recovery Plan. The natural population appears to be self-sustaining. However, a Very High viability level is precluded at this time pending some assessment of the effectiveness of the integrated hatchery program on natural population productivity and diversity. The Steelhead hatchery program shifted from out-of-stratum to in-basin stocks beginning in 2017 to reduce hatchery influences. Productivity and diversity are expected to continue to improve in response to reforms in the hatchery program.

Lewis North Fork Winter Steelhead - The historical population was one of the largest in the lower Columbia basin and was predominately produced in the upper Lewis watershed above Swift Dam. Construction of Merwin Dam in 1932 blocked access to approximately 80% of the spawning and rearing habitat in the NF Lewis. A dam located on Cedar Creek was removed in 1946, restoring access to habitat throughout this tributary. Currently, spawning occurs in the NF Lewis River downstream of Merwin Dam and in Cedar Creek and other accessible tributaries. Habitat for wild winter steelhead in the lower North Fork Lewis is limited. Exploratory efforts released adult Winter Steelhead into the upper basin and operated a juvenile collection facility in Swift Reservoir beginning in 2013. However, full implementation of passage requirements of the Lewis River hydro license agreement is currently delayed by legal challenges.

Lewis East Fork Winter Steelhead - Winter Steelhead spawn in the mainstem as well as Rock Creek and other tributaries; rearing habitat is available throughout most of the basin. Upstream migration was improved in 1982 by “notching” Sunset Falls which lowered the falls from 13.5 to 8 feet. This Primary population was targeted by the Recovery Plan for a High level of viability. Current viability is Moderate. Current stock assessments indicate that average abundance (489) is greater that estimated at the time of listing (350) and approaching the abundance goal (500) identified in the Recovery Plan. Numbers have exceeded the goal in about 50% of the last 12 years. The Statewide Steelhead Management Plan established this population as a wild gene bank to support natural origin Steelhead recovery (WDFW 2008). There are no hatcheries in the system. However, Skamania Hatchery winter Steelhead smolts were previously released into the lower river for harvest opportunity. Steelhead hatchery releases ended in 2014 to reduce hatchery influences on productivity and diversity.

Lower Gorge Winter Steelhead - This Primary population is shared with Oregon but most of the habitat exists in Washington. Winter Steelhead spawn primarily in the lower two miles of Hamilton Creek. The population was prioritized by the Recovery Plan for restoration to a High level of viability. At listing, viability was estimated to be low and current data is not available. This population has benefited from significant habitat work in Hamilton, Hardy, and Duncan Creeks. Hatchery winter Steelhead were planted in the basin beginning in 1958 but no hatchery Steelhead are currently released into this population and the incidence of hatchery strays is negligible.

Upper Gorge Winter Steelhead - This is a shared population with Oregon but most of the habitat exists in Washington. Winter steelhead currently spawn in streams throughout the area including the Wind River and White Salmon River below Condit Dam (RM 3). Shipperd Falls (40 ft cascade) was a block to Wind River winter steelhead until a fish ladder was constructed in 1956. Winter Steelhead are currently distributed throughout the lower mainstem Wind River (~11 mi) and Trout Creek (RM 10.8). High drop-offs and waterfalls exist throughout the basin; some have been modified to promote fish passage while others remain as impediments to upstream steelhead migration. Construction of Bonneville Dam inundated the lower one mile of the Wind River, flooding spawning and rearing habitat. Hatchery releases of Chambers Creek and Skamania winter Steelhead stock occurred in the Wind River Basin between 1951 and 1963. Because of concern with wild Steelhead interactions, releases of catchable-size rainbow trout were discontinued in 1994 and hatchery Steelhead releases were discontinued in 1997. No anadromous fish except unmarked (wild) steelhead are allowed past Hemlock Dam on Trout Creek. This population remains far short of their delisting goals.

Summer Steelhead

Kalama Summer Steelhead - Summer Steelhead spawn above Lower Kalama Falls in the mainstem and NF Kalama River and throughout many tributaries, including Gobar, Elk, Fossil, and Wild Horse Creeks. This Primary population was prioritized by the Recovery Plan for restoration from Moderate to High level viability, and was identified as a historical core population by the Technical Review Team. Current stock assessments indicate that average abundance (481) is similar to that estimated at the time of listing (350) and approaching the abundance goal (500) identified in the Recovery Plan. Numbers have exceeded the goal in about 50% of the last 12 years. Current viability remains Moderate pending expected improvements in diversity from hatchery reforms. The Steelhead hatchery program shifted from out-of-stratum to in-basin stocks beginning in 2017 to reduce hatchery influences on productivity and diversity.

Lewis East Fork Summer Steelhead - Summer Steelhead spawn throughout the basin, extending to the mainstem East Fork Lewis and tributaries upstream of Moulton Falls. This Primary population was prioritized by the Recovery Plan for restoration to a High level of viability, and was identified as a historical legacy population for Steelhead by the Technical Review Team. We estimate that this population could be upgraded from Very Low viability at listing to Moderate viability now. Current stock assessments indicate that average abundance (704) is substantially higher that believed at the time of listing (<50). This equals the 700 Steelhead benchmark for Very High viability identified in the Recovery Plan. The delisting abundance goal of 500 is also exceeded. A higher viability level is precluded at this time out of concern for potential legacy effects of historical hatchery production on natural productivity and diversity. The Statewide Steelhead Management Plan established this population as a wild gene bank to support natural origin Steelhead recovery (WDFW 2008). Steelhead hatchery production ended in 2014 to reduce hatchery influences on productivity and diversity.

Washougal Summer Steelhead - Summer Steelhead spawn throughout the Washougal Basin, including the mainstem Washougal and tributaries upstream of Dougan Falls, the Little Washougal, and the North Fork

Washougal. This Primary population was prioritized by the Recovery Plan for restoration from Moderate to High viability, and was identified as both a historical core and legacy population by the Technical Review Team. Mean 12-year abundance (648) appears to be greater than that at listing as identified in the Recovery Plan (400) and exceeds the goal for High viability (500). This goal has been reached in about 80% of these years. Based on recent stock assessment information, we estimate that the goal for High viability of this population is currently being achieved. A segregated hatchery program currently releases Steelhead in the Washougal but interactions with natural origin spawners are limited by a weir operated at the Skamania Hatchery, which is intended to reduce natural-hatchery origin fish interactions.

Wind Summer Steelhead - Summer Steelhead spawn throughout the Wind Basin including the mainstem Wind, the Little Wind, and Panther, Bear, Trout, Trapper, Dry, and Paradise creeks. High gradients and waterfalls exist throughout the basin; some have been modified to promote fish passage while others remain as impediments to upstream Steelhead migration. This Primary population was prioritized by the Recovery Plan for restoration from High to Very High viability. Current abundance (650) appears less than estimated at listing by the Recovery Plan (1,000). The Statewide Steelhead Management Plan established this population as a wild gene bank to support natural origin Steelhead recovery (WDFW 2008). Hatchery Steelhead releases were discontinued in 1997 and hatchery influence is currently estimated to be negligible. Habitat gains for summer Steelhead are expected to continue in the Wind River: a substantial portion of this watershed falls within Gifford Pinchot National Forest, which is managed through the Northwest Forest Plan, and a restoration strategy led by the LCFRB was developed in 2017 identifying High priority habitat restoration projects to support Steelhead recovery. WDFW estimated that approximately 35% of Wind River Steelhead that passed Bonneville Dam do not survive the 13 miles to the Shipherd Falls ladder. Likely cited mortality sources include natural mortality, increased mortality due to temperature, and unaccounted fishery mortality. If loss was reduced to zero, the population in the Wind would immediately increase by 33% (personal communication, D. Rawding, 10/27/2020).

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