

# SNOHOMISH RIVER NATURAL COHO

## SALMON REBUILDING PLAN, ENVIRONMENTAL ASSESSMENT, MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ANALYSIS, REGULATORY IMPACT REVIEW, AND INITIAL REGULATORY FLEXIBILITY ANALYSIS

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**PLEASE NOTE:** THIS IS AN INTEGRATED DOCUMENT DESIGNED TO MEET THE NEEDS OF THE PACIFIC FISHERY MANAGEMENT COUNCIL'S PACIFIC SALMON FISHERY MANAGEMENT PLAN AND PROVIDE THE ENVIRONMENTAL ANALYSIS REQUIRED UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT.

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## LIST OF ACRONYMS AND ABBREVIATIONS

ABC	acceptable biological catch
ACL	annual catch limit
BY	brood year
CCE	California Current Ecosystem
CoTC	Coho Technical Committee (of the PSC)
Council	Pacific Fishery Management Council
CWT	coded-wire tag
EA	Environmental Assessment
EEZ	exclusive economic zone (3-200 miles from shore)
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	evolutionarily significant unit
$F_{ABC}$	exploitation rate associated with ABC
$F_{ACL}$	exploitation rate associated with ACL ( $= F_{ABC}$ )
FMP	fishery management plan
$F_{MSY}$	maximum sustainable yield exploitation rate
$F_{OFL}$	exploitation rate associated with the overfishing limit ( $= F_{MSY}$ , MFMT)
FONSI	Finding of No Significant Impacts
FRAM	Fishery Regulatory Assessment Model
ISBM	individual stock-based management
MFMT	maximum fishing mortality threshold
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSM	mixed stock model
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NA	not available
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPGO	North Pacific Gyre Oscillation
NSIG	National Standard 1 Guidelines
OFL	overfishing limit
OY	Optimum Yield
PDO	Pacific Decadal Oscillation
PFMC	Pacific Fishery Management Council (Council)
PSC	Pacific Salmon Commission
PST	Pacific Salmon Treaty
$S_{ABC}$	spawning escapement associated with ABC
$S_{ACL}$	spawning escapement associated with ACL ( $= S_{ABC}$ )
$S_{MSY}$	MSY spawning escapement
$S_{OFL}$	spawning escapement associated with the overfishing limit ( $= S_{MSY}$ )
STT	Salmon Technical Team
WDFW	Washington Department of Fish and Wildlife

## **1.0 EXECUTIVE SUMMARY**

Snohomish River natural coho salmon (Snohomish coho) met the criteria for overfished status in 2018 as defined in Section 3.1 of the Pacific Coast Salmon Fishery Management Plan (FMP). In response, the Pacific Fishery Management Council (Council) directed the Salmon Technical Team (STT), in coordination with relevant state and tribal co-managers, to develop a rebuilding plan for Council consideration within one year. This report represents the Snohomish coho rebuilding plan and includes requirements described in section 3.1.4.1 of the FMP, including: (1) an evaluation of the roles of fishing, marine and freshwater survival in the overfished determination, (2) any modifications to the criteria for determining when the stock has rebuilt, (3) recommendations for actions the Council could take to rebuild the stock, and (4) specification of the rebuilding period.

Section 3 describes the evaluation of potential factors that led to the overfished status. The analysis found that freshwater conditions likely were not a contributing factor, as the system has the capacity to produce large returns and smolt production was not abnormally low for the brood years that led to the overfished status. Marine survival, however, likely did contribute to the overfished classification, as it was low for all three broods that returned between 2014 and 2016 due to poor ocean conditions and a lack of prey. Fishery exploitation rates were within their preseason and postseason allowable limits in all cases over the past eight years, with the exception of postseason estimates for 2015 and 2017. In both of these cases, postseason exploitation rates were higher than predicted preseason and postseason exploitation rate limits were lower than those in the preseason due to over-forecasting of abundance that occurred.

Section 4 provides recommendations for action in this rebuilding plan, including (1) the rebuilt criterion, (2) fishery management strategies to be employed during the rebuilding period, (3) co-manager recommendations for a conservative approach to forecasting abundance and implementing fisheries within Puget Sound, and (4) an analysis of rebuilding times. Estimates of rebuilding time are three years for both fishery management strategy alternatives and for the  $T_{MIN}$  scenario which is based on no fishing. An analysis of the socio-economic impacts of management strategy alternatives is presented in Section 5. Section 6 presents an analysis of the environmental impacts of the alternative rebuilding strategies, as required under the National Environmental Policy Act (NEPA).

This rebuilding plan was adopted as draft for public review at the June 2019 Council meeting in San Diego, California. At the September 2019 meeting in Boise, Idaho the Council adopted the rebuilding plan as final, with the following decisions: (1) maintain the default criterion for achieving rebuilt status as defined in the FMP, (2) identification of Alternative II ( $S_{MSY}$  buffer) as the preferred management strategy alternative.

## **2.0 INTRODUCTION**

In 2018, Snohomish River natural coho salmon (Snohomish coho) met the criteria for overfished status as defined in section 3.1 of the Pacific Coast Salmon Fishery Management Plan (FMP; PFMC 2016). In response, the Pacific Fishery Management Council (Council) directed the Salmon Technical Team (STT) to propose a rebuilding plan for Council consideration within one year. The FMP, and the Magnuson-Stevens Fishery Management and Conservation Management Act (MSA), requires that a rebuilding plan must be developed and implemented within two years of

the formal notification from National Marine Fisheries Service (NMFS) to the Council of the overfished status. Excerpts from the FMP relevant to status determinations and rebuilding plans are provided in Appendix A.

The Council's criteria for overfished is met if the geometric mean of escapement, computed over the most recent three years, falls below the Minimum Stock Size Threshold (MSST) which is defined for applicable stocks in Table 3-1 of the FMP. For Snohomish coho, the number of adult spawners expected to produce maximum sustainable yield (MSY) is defined as 50,000 natural-area adult spawners, also known as  $S_{MSY}$ . The MSST for Snohomish coho is defined as 31,000 natural-area adult spawners, with  $MSST = 0.62 S_{MSY}$ . The geometric mean of Snohomish coho natural-area adult spawners over years 2014-2016 was 29,677, and thus in 2018 the stock met the criteria for overfished status. Table 2.0.a displays natural spawning escapement and the running three year geometric mean of escapement relative to  $S_{MSY}$  and the MSST. The FMP identifies the default criterion for achieving rebuilt status as attainment of a 3-year geometric mean of spawning escapement exceeding  $S_{MSY}$ .

Overfished status is defined by recent spawner escapement for salmon stocks, which is not necessarily the result of overfishing. Overfishing occurs when in any one year the exploitation rate on a stock exceeds the maximum fishing mortality threshold (MFMT), which for Snohomish coho is defined as the MSY fishing mortality rate ( $F_{MSY}$ ) of 0.60. It is possible that this situation could represent normal variation, as has been seen in the past for several salmon stocks. However, the occurrence of reduced stock size or spawner escapements, depending on the magnitude of the short-fall, could signal the beginning of a critical downward trend. Imposing fisheries on top of already low abundances could further jeopardize the capacity of the stock to produce MSY over the long term if appropriate actions are not taken to ensure that conservation objectives are achieved.

In this rebuilding plan, we begin by providing an overview of the Snohomish coho stock, the physical setting of the Snohomish River watershed, and fisheries management. We then review the potential factors that may have contributed to the overfished status. Recommendations regarding alternative rebuilding actions are proposed, as are recommendations for actions outside of the management of salmon fisheries. We end with a socioeconomic and environmental analysis of the impact of the recommended rebuilding alternatives.

The long-term average (1981-2017) natural escapement of Snohomish coho is 95,000 spawners. The run flourished in the first decade of the 2000s, averaging nearly 139,000 natural spawners per year. Since then (2010-2017), average natural spawner escapement has fallen to 67,300 fish, which include the two record low years of 2015 and 2017. (Table 2.0.a, Figure 2.0.a).

Table 2.0.a. Snohomish coho spawning escapements.

Return Year <sup>a/</sup>	Spawning Escapement <sup>b/</sup>		
	Hatchery	Natural	Total
<b>Snohomish</b>			
2000	31,258	94,093	125,351
2001	37,222	261,550	298,772
2002	11,798	161,441	173,239
2003	14,901	182,599	197,500
2004	13,891	252,768	266,659
2005	13,583	109,020	122,603
2006	6,136	75,630	81,766
2007	7,147	118,455	125,602
2008	3,312	35,441	38,753
2009	10,948	98,979	109,927
2010	4,822	49,100	53,922
2011	8,275	111,374	119,749
2012	13,354	130,637	143,991
2013	10,277	125,870	136,147
2014	13,641	46,244	59,885
2015	3,945	12,804	16,749
2016	9,201	44,141	53,342
2017	6,371	18,195	24,566
<b>GOAL</b>	<b>31,000-50,000</b>		

<sup>a/</sup> Years 2012-2017 are preliminary.

<sup>b/</sup> Includes estimated off-station returns and secondary wild stocks.

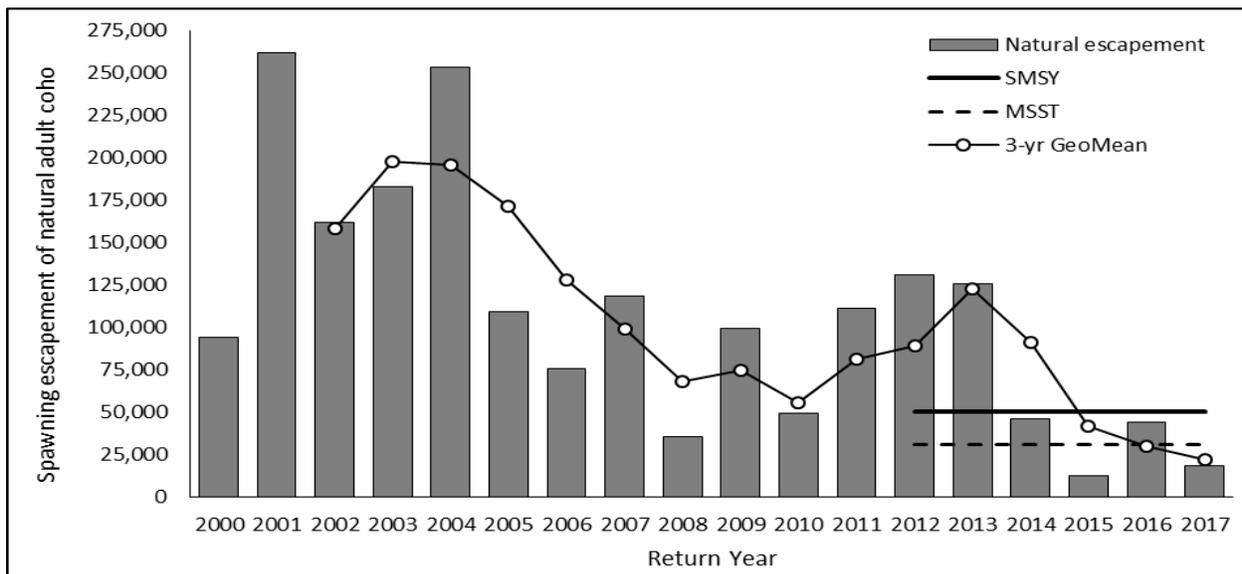


Figure 2.0.a. Spawning escapement of Snohomish River natural adult coho. Data source: PFMC 2018 Review of Ocean Fisheries, Table B-42.

## 2.1 Magnuson-Stevens Fishery Conservation and Management Act

The following is a review of NMFS' MSA National Standard 1 (NS1) guidelines regarding rebuilding plans (50 CFR 600.310(j)), and how these guidelines interface with the salmon FMP (e.g., required elements  $T_{\text{target}}$ ,  $T_{\text{min}}$ , and  $T_{\text{max}}$ ).

NMFS has developed guidelines for complying with the NS1 provisions of section 301 of the MSA (50 CFR 600.310). Under these guidelines, rebuilding plans must include the following elements; including these elements in rebuilding plan alternatives allows the Council to make an informed decision on adopting rebuilding plans.

$T_{\text{target}}$ : the target time for rebuilding the stock in as short a time as possible, taking into account the status and biology of the overfished stock, the needs of the fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem.

$T_{\text{MIN}}$ : the amount of time the stock is expected to take to rebuild to MSY biomass level in the absence of any fishing mortality ("expected" means to have at least a 50 percent probability of attaining MSY, where such probabilities can be calculated). Note that, for salmon, we use spawning escapement for biomass, so the MSY biomass level is termed  $S_{\text{MSY}}$  in salmon rebuilding plans.

$T_{\text{MAX}}$ : the maximum time for rebuilding a stock to  $B_{\text{MSY}}$  ( $S_{\text{MSY}}$  for salmon). If  $T_{\text{MIN}}$  is less than 10 years,  $T_{\text{MAX}}$  is 10 years.

To be approved, a rebuilding plan must identify  $T_{\text{target}}$  and state how the plan will accomplish rebuilding to  $S_{\text{MSY}}$  within that time (e.g., the identified harvest strategy).

To estimate  $T_{\text{MIN}}$ , an impact rate of zero is assumed, meaning all fisheries affecting the stock would cease until the stock was rebuilt. Because the Council does not have jurisdiction over tribal, in-river, and other fisheries that may impact the stock, a 'no-fishing' alternative is not a viable option for the Council to consider. Also, a 'no-fishing' alternative does not meet the purpose and need (see section 2.2.2, below) because it would restrict tribal fisheries in a manner that is inconsistent with their treaty right.

However, because  $T_{\text{MIN}}$  does serve as a bookend in the analysis of rebuilding probabilities over a ten year period when assuming an exploitation rate of zero, this ' $T_{\text{MIN}}$  scenario' fulfills the requirement of National Standard 1 in calculating the minimum time ( $T_{\text{MIN}}$ ) estimated to achieve rebuilt status. It is for this purpose only that the ' $T_{\text{MIN}}$  scenario' is included in this document (See Sections 4 and 5).

## 2.2 National Environmental Policy Act

In addition to addressing the requirements of the FMP and MSA, this rebuilding plan document integrates the environmental assessment required under the National Environmental Policy Act (NEPA). This EA was prepared using the 1978 CEQ NEPA Regulations. NEPA reviews initiated prior to the effective date of the revised CEQ regulations may be conducted using the 1978 version of the regulations. The effective date of the 2020 CEQ NEPA Regulations was September 14, 2020. This review began on September 21, 2018 and the agency has decided to proceed under the 1978 regulations.

### *2.2.1 Proposed Action*

The Proposed Action is for the Council to adopt and NMFS to approve a rebuilding plan for the Snohomish coho salmon stock, which has been determined by NMFS to be overfished under the MSA. The rebuilding plan must be consistent with the MSA and the provisions of the FMP; therefore, the plan shall include a control rule and a specified rebuilding period. The specified rebuilding period shall be as short as possible, taking into consideration the needs of fishing communities.

### *2.2.2 Purpose and Need*

The purpose of the proposed action is to develop and implement a harvest control rule that will be applied to setting annual ocean salmon fishery management measures that impact Snohomish coho. This harvest control rule will be designed to attain a three-year geometric mean spawning escapement that meets the  $S_{MSY}$  specified for that stock in the FMP in the least amount of time possible while taking into account the biology of the stock, international agreements, and the needs of fishing communities, but not to exceed 10 years. The need for the proposed action is to rebuild Snohomish coho, which the NMFS determined, in 2018, to be overfished under the MSA.

## **2.3 Stock overview**

Coho are distributed throughout all anadromous reaches of the Snohomish watershed (Figure 2.2.2.a), including the Snoqualmie and Skykomish River Basins. The majority of Snohomish adult coho return to the river as 3 year olds<sup>1</sup> between late August and late November with the peak occurring between the last week of September and first week of October<sup>2</sup>. Coho have been observed as early as July 27 at the Sunset Falls trap-and-haul site on the South Fork Skykomish River, located approximately two miles above the confluence of the South and North Forks of the Skykomish River. Spawn timing occurs primarily November through January with access to spawning reaches being highly dependent on flow conditions. Preferred spawning habitat is small tributaries with extensive associated wetlands. Juveniles rear for over a year in freshwater before out-migrating as smolt from April through June with peak outmigration occurring late April to early May<sup>3</sup>.

Coded wire tag (CWT) recovery data from Wallace Hatchery fish indicates Snohomish coho migrate out of Puget Sound and northwards to the west coast of Vancouver Island, British Columbia (Weitkamp and Neely 2002). Snohomish coho production contributes to sport and commercial fisheries in southern British Columbia, the northern Washington coast, Strait of Juan de Fuca, Puget Sound, and in-river Snohomish fisheries.

### *2.3.1 Stock composition*

All wild coho that originate from the Snohomish River Basin constitute a single management unit (MU) and are managed as a single stock. Snohomish River Coho Salmon belong to the larger Puget Sound/Strait of Georgia Coho Salmon evolutionarily significant unit (ESU) (Weitkamp et al. 1995). This ESU is currently a species of concern under the U.S. Endangered Species Act (Ford 2011). Co-managers are currently collecting genetic samples from coho in the Snohomish,

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<sup>1</sup> The Wallace Hatchery has on average less than 1 percent coho returning as 2 year old jacks. CWT data has rarely recorded a 4 year old coho in the Snohomish River.

<sup>2</sup> WDFW Snohomish River in-river sport catch record card data.

<sup>3</sup> 2000-2012 Skykomish and Snoqualmie Rivers Chinook and Coho Salmon Out-migration Study, Tulalip Tribes

Stillaguamish, and Skagit watersheds to determine genetic baselines and potentially determine within-basin population structure for these three coho stocks.

There are two hatchery programs considered to be part of the Snohomish system; WDFW's Wallace River Hatchery located at RM 4 on the Wallace River at the confluence with May Creek, and the Tulalip Tribes Bernie Kai-Kai Gobin Hatchery located at the juncture of the east and west Forks of Tulalip Creek (Figure 2.2.2.a). Eggs for both programs are collected at the Wallace Hatchery and are integrated with Snohomish wild broodstock. The Wallace Hatchery has been in operation since the early 1900s, and the Bernie Kai-Kai Gobin Hatchery since 1983.

The Bernie Kai-Kai Gobin Hatchery coho program is an isolated program and the purpose of this program is to provide coho salmon for harvest by Tulalip Tribal members in a terminal area fishery. Production from this program is also available for harvest by the non- Indian sport and commercial fisheries, and contributes to other directed and incidental harvest of coho salmon in other pre-terminal fisheries.

The Wallace River Hatchery coho program is an integrated program (broodstock is genetically integrated with the local natural population) with the goal of providing fish for harvest opportunity. Adults are collected at the following two collection facilities: 1) an in-stream trap located on May Creek; and 2) a weir placed across the Wallace River from June until October 1. Returns to this hatchery are provided in Table 2.2.1.a.

Table 2.2.1.a. Wallace Hatchery coho returns.

Return Year	Fish Returned	Males	Females	Jacks	% Female	% Jacks	Fecundity
2003	13,262	7,441	5,606	215	42%	1.6%	3,195
2004	13,880	7,259	6,576	45	47%	0.3%	3,244
2005	13,304	7,346	5,938	20	45%	0.2%	2,749
2006	6,145	3,034	3,100	11	50%	0.2%	3,054
2007	7,228	3,875	3,341	12	46%	0.2%	3,025
2008	3,316	1,813	1,490	13	45%	0.4%	3,409
2009	8,237	4,756	3,484	0	42%	0.0%	3,504
2010	4,338	2,002	2,318	20	53%	0.5%	3,424
2011	7,801	4,064	3,697	44	47%	0.6%	3,119
2012	10,475	5,202	5,240	33	50%	0.3%	2,875
2013	9,232	4,533	4,662	37	50%	0.4%	2,665
2014	7,764	4,060	3,658	46	47%	0.6%	2,706
2015	2,391	1,276	1,036	79	43%	3.3%	1,717
2016	8,384	4,161	4,147	76	49%	0.9%	2,820
2017	4,726	2,225	2,451	50	52%	1.1%	2,937
<i>Average</i>	<i>8,032</i>				<i>47%</i>	<i>0.7%</i>	<i>2,963</i>

### 2.3.2 Location and geography

The Snohomish River Basin is in Washington State and includes two major tributaries; the Skykomish and Snoqualmie Rivers.

The Snohomish River basin is 1,780 mi<sup>2</sup> [2,865 km<sup>2</sup>] in size, draining the Cascade Mountains to the east of Everett and Seattle, and entering Puget Sound at Everett. This area has extensive

moderate to high quality juvenile coho spawning and rearing habitat, due the large number of low gradient tributaries. The main tributaries directly draining the Cascades tend to have two periods of peak flow, first during winter flood events and the second during peak snow runoff in spring and early summer. The smaller tributaries are largely rain-fed, and have peak flows during the winter rain season.

A significant increase in available natural coho production habitat in the Snohomish River Basin occurred in 1958 when the Sunset Falls trap-and-haul site became operational. Fish are trapped and trucked above a series of three anadromous barrier waterfalls to provide access to additional habitat for spawning and rearing. The drainage area of the South Fork Skykomish River above Sunset Falls is approximately 362 mi<sup>2</sup> [938 km<sup>2</sup>], representing approximately 20 percent of the entire drainage area of the Snohomish River basin (Zimmerman 2014).

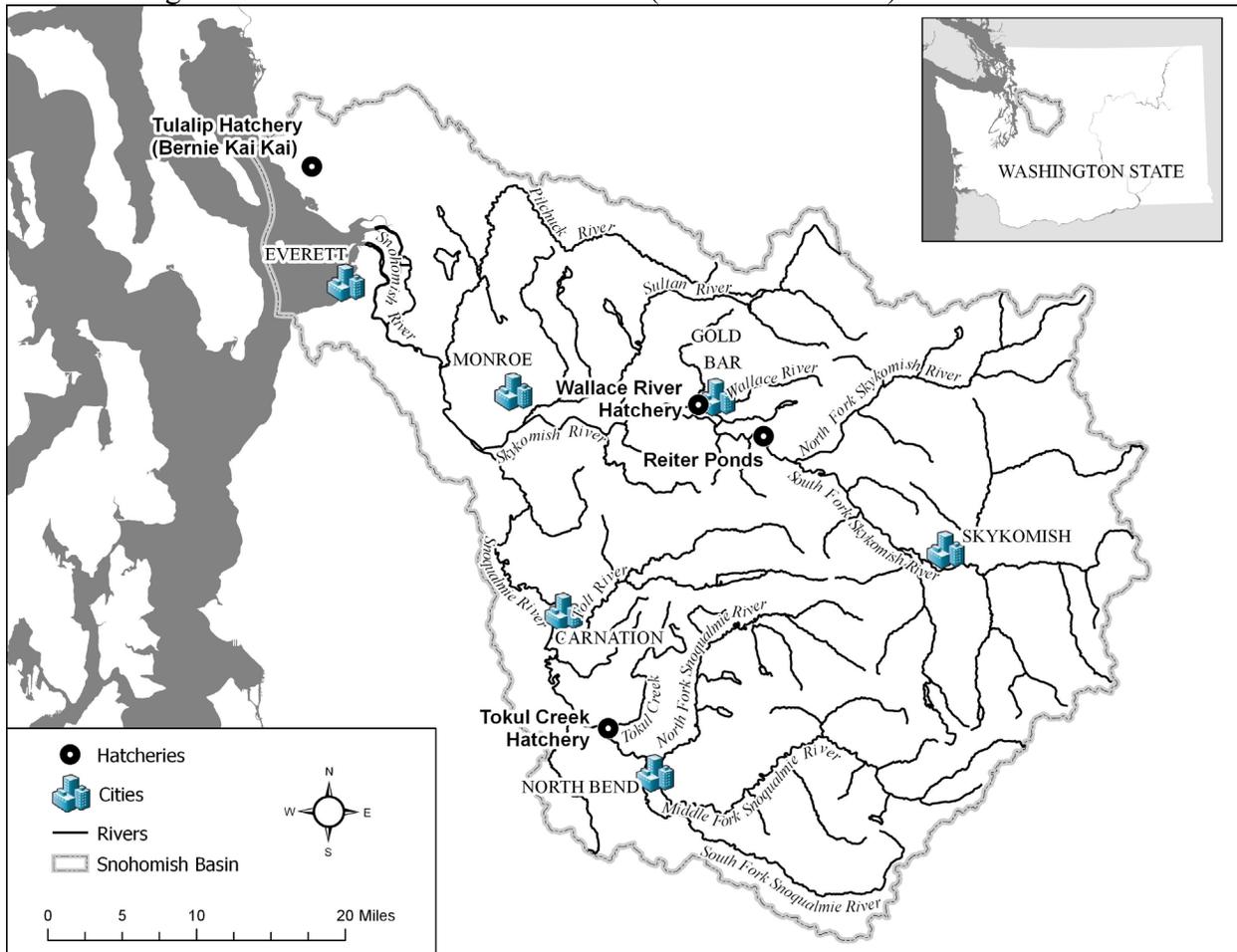


Figure 2.2.2.a. Map of the Snohomish River Basin.

## 2.4 Management overview

Snohomish natural coho are one of five Puget Sound coho management units included in the coho chapter of the Pacific Salmon Treaty (PST). Under the PST, Puget Sound management units are managed under a tiered, abundance-based management regime. Each year, the management units are classified as “low” abundance, “moderate” abundance, or “abundant” based on the forecast

ocean abundance of age-3 fish (CoTC 2013). The maximum allowable exploitation rate (ER) is determined by the abundance category (Table 2.3.a).

Table 2.3.a. Pacific Salmon Treaty-defined total exploitation rate ceilings by PSC status categories

Snohomish natural coho		
Status (PSC/Council)	Ocean Age-3 Abundance Reference Point	Total Exploitation Rate
Low	< 51,667	Up to 20%
Moderate	51,667 – 125,000	21% – 40%
Abundant	> 125,000	41% – 60%

#### 2.4.1 Conservation objectives

The abundance-based stepped harvest rates of the PST management regime were adopted as conservation objectives for Puget Sound coho MUs by the Council in November 2009 (Bowhay and Pattillo 2009), and implemented in the 2010 preseason planning process. When the Council adopted Amendment 16 in 2011, the spawning escapements associated with the ocean abundance breakpoints and allowable exploitation rates were adopted as status determination criteria (SDC). The spawning escapement associated with the Low/Moderate breakpoint and 40 percent exploitation rate allowed when the MU is classified as of moderate abundance (31,000) was adopted as MSST, and the spawning escapement associated with the moderate/abundant breakpoint, the 60 percent exploitation rate allowed when the MU is abundant (50,000) was adopted as  $S_{MSY}$ , and the maximum allowable total exploitation rate (60 percent) was adopted as the MFMT. A stock is considered to be subject to overfishing if the total fishing mortality exceeds the MFMT, and is considered to be overfished if the 3-yr geometric mean falls below the MSST. Amendment 16 to the FMP was implemented starting with the 2012 preseason planning process.

#### 2.4.2 Management strategy

The tiered harvest rates with abundance breakpoints define a control rule that limits the allowable fishery impacts on Snohomish natural coho depending on the abundance. However, fisheries impacting Snohomish coho are also constrained by impacts on other coho management units identified in the Pacific Salmon Treaty, impacts on discrete population segments listed under the U.S. Endangered Species Act, harvest sharing obligations adjudicated by the Boldt decision (under the determinations of the U.S. District Court in *U.S. v. Washington*), and impacts on other salmon stocks identified in the FMP. Each year proposed management measures are modeled using the coho Fishery Regulation Assessment Model (FRAM) parameterized with the current year's stock abundance forecasts. Final management measures adopted by the Council need to meet all the constraints on stocks and fisheries. Usually, constraints on fishery impacts to other stocks are more constraining than those on Snohomish natural coho. Postseason, when actual catch and spawning escapement data can be used to parameterize the coho FRAM, management measures are assessed to determine whether conservation objectives and status determination criteria were met.

### 3.0 REVIEW OF POTENTIAL FACTORS LEADING TO OVERFISHED STATUS

A number of factors may contribute to a stock falling below the MSST and becoming classified as overfished. Fishing mortality may be higher than was expected when management measures were

adopted, or the abundance may be less than forecast. Abundance may be less than forecast because low freshwater survival resulted in fewer smolts than expected, or because low marine survival resulted in fewer adult returns than expected. Freshwater and/or marine survival may be low enough, that even if anticipated, there will simply be too few adults produced to prevent the stock from falling below the MSST, even in the absence of fishing. The FMP specifies that the roles of freshwater survival, marine survival, and fishing should be considered in any rebuilding plan.

### **3.1 Freshwater survival**

#### *3.1.1 Review of freshwater conditions*

In the 2018 Wild Coho Forecasts for Puget Sound, Washington Coast, and Lower Columbia, Mara Zimmerman states; “In most watersheds, overall production of juvenile coho (juveniles/female \* number females) is rarely limited by spawner abundance, and the majority of variation in juvenile production is the result of environmental conditions (Bradford et al. 2000). Summer rearing flows are a key environmental variable affecting the freshwater survival and production of Puget Sound coho (Smoker 1955; Mathews and Olson 1980), although extreme flow events in the overwinter rearing period (Kinsel et al. 2009) and local habitat condition influenced by wood cover and channel complexity, fish passage, road densities, and water quality are also likely to influence smolt production (Quinn and Peterson 1996; Sharma and Hilborn 2001).”

The Snohomish watershed has been experiencing higher and more frequent fall flooding, and lower and warmer summer flows, than have been experienced historically. A cohesive temperature data set is lacking for the Snohomish, but for example in the summer of 2015, temperatures as high as 25.5 °C in the mainstem Snoqualmie River and 26.7 °C in the Raging River were observed. These temperatures are potentially lethal to salmonids (see Figures 3.1.1.a and 3.1.1.b, data from Kubo and LeDoux, 2016). “Salmonids in the Snoqualmie River watershed were subjected to both acute lethal and sub-lethal temperatures during the warm-dry summer of 2015. The impacts of these warm temperatures likely affected both juvenile salmonids rearing in the watershed over the summer as well as the adults that were holding or which returned later in the year” (Kubo, LeDoux *ibid*). This was followed by several flood stage high flows in October and November of 2015 (Figure 3.1.1.c and 3.1.1.d, USGS flow data: <https://nwis.waterdata.usgs.gov/nwis/>). Since 2015, in-river environmental conditions continue to fluctuate, but have not been as severe as those observed in 2015.

Figure 32. Mainstem Snoqualmie 7DADMAX range and WA Ecology thresholds for designated uses. State Standards after Sept. 15 specific for spawning and egg incubation.

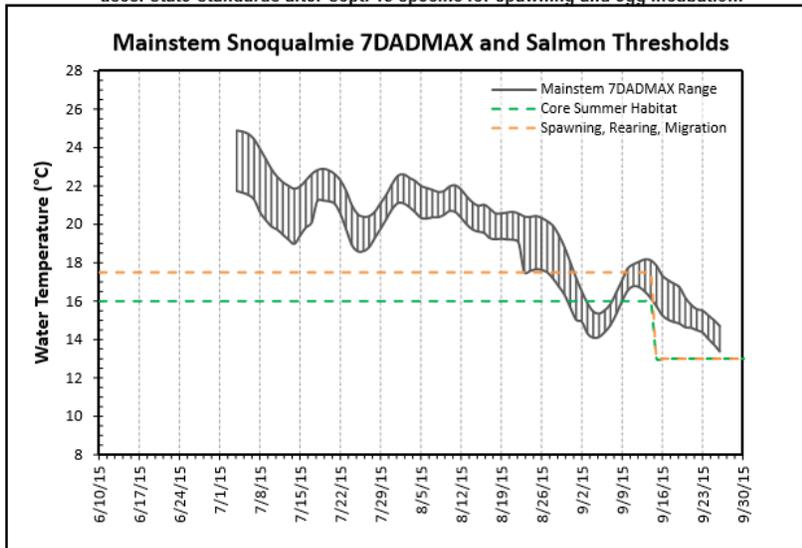


Figure 3.1.1.a. 2015 Snoqualmie River water temperatures, with thresholds for spawning and egg incubation shown.

Figure 33. Mainstem Snoqualmie 1DMAX range and WA Ecology thresholds for barrier to migration and acute lethality.

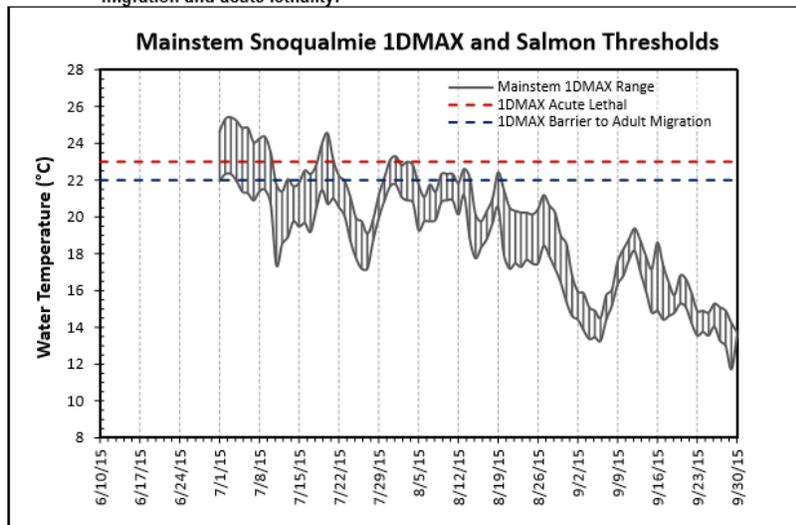


Figure 3.1.1.b. 2015 Snoqualmie River water temperatures, with thresholds for acute lethal and adult migration shown.

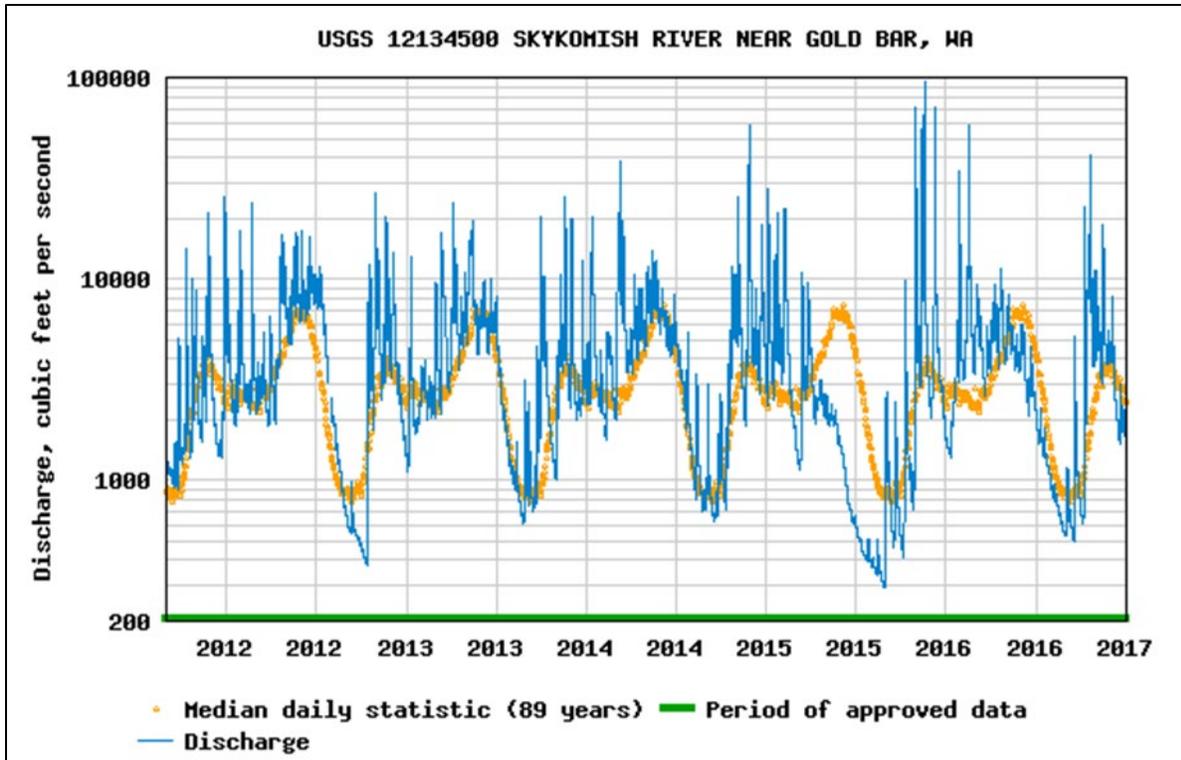


Figure 3.1.1.c. Skykomish River conditions (September 1, 2011-December 31, 2016).

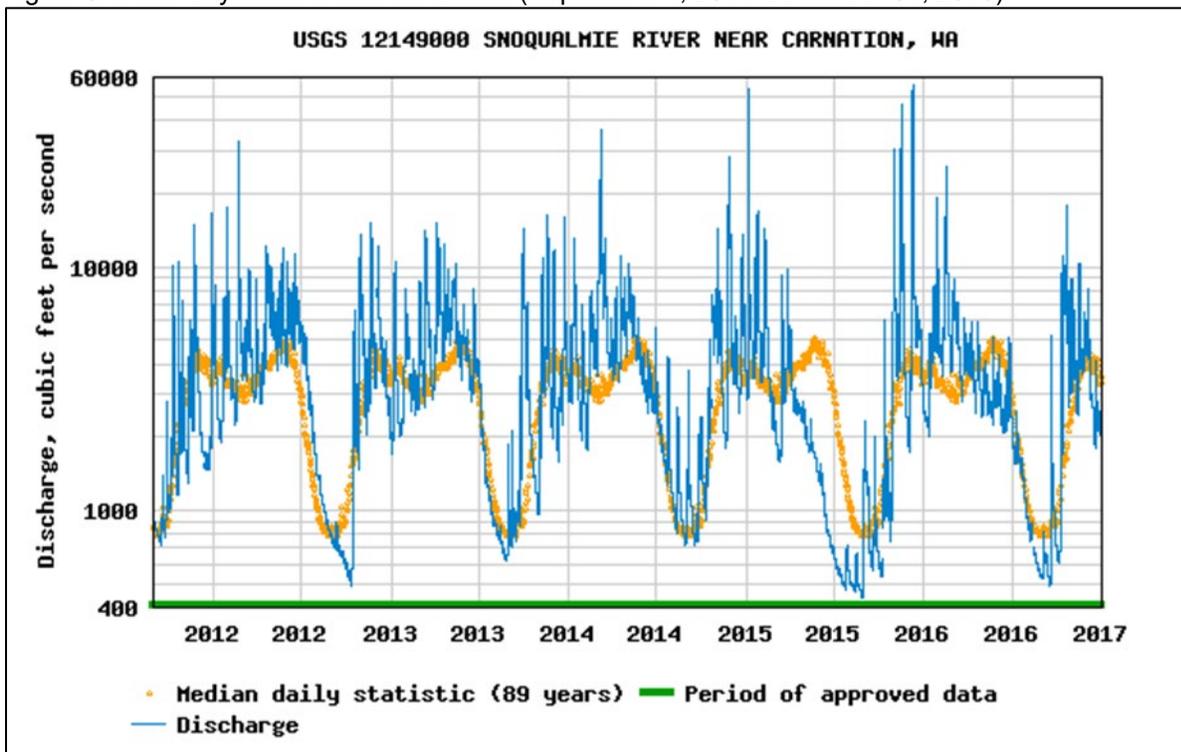


Figure 3.1.1.d. Snoqualmie River conditions (September 1, 2011-December 31, 2016).

### 3.1.2 Juvenile production estimates

Juvenile natural coho (yearlings) production estimates in the Snohomish system are based on counts of unmarked yearling coho from two rotary screw traps operating in the Skykomish River (RM 26.5 from 2008 to present; RM 23 from 2001 to 2007) and Snoqualmie River (RM 12.2 from 2002 to present; RM 16.5 in 2001). These sites were selected for their water velocities (> 3ft/sec), a constricted channel, adequate access to samplers, and in a location low enough in the watershed to capture a significant fraction of the Chinook and coho juvenile production (Kubo et al. 2013). Approximately 72 percent of the coho-producing habitat in the watershed is upstream from the traps (based on Zillges, 1977 potential rearing habitat analysis).

The sampling regime of the traps is designed to maximize effort during nighttime hours, when catch rates are considerably higher. Table 3.1.2.a shows the total hours of operation by trap and year, coho catches, and CPUE. Catch is expanded to account for the time when the trap is not fishing, the estimated efficiency of the traps (~ 1 % and 0.6% for the Skykomish and Snoqualmie respectively), and for the fraction of the coho produced in habitat not sampled (downstream) by the trap (Figure 3.1.2.c).

Table 3.1.2.a. Total effort, catch, and CPUE of unmarked smolt coho for the Skykomish and Snoqualmie traps (Data source: M. Pouley, Tulalip NRD).

Year	<u>Skykomish</u>			<u>Snoqualmie</u>		
	Effort (hours)	1+ Coho	CPUE	Effort (hours)	1+ Coho	CPUE
2001	309	5,972	19.33	509	553	1.09
2002	901	5,512	6.12	780	1,894	2.43
2003	672	8,851	13.17	946	1,305	1.38
2004	992	8,713	8.78	1,056	1,127	1.07
2005	1,071	13,949	13.02	1,018	1,187	1.17
2006	944	3,082	3.26	992	2,023	2.04
2007	1,125	6,218	5.53	510	615	1.21
2008	447	3,882	8.68	318	587	1.85
2009	687	1,410	2.05	632	754	1.19
2010	1,046	1,245	1.19	1,158	1,149	0.99
2011	667	1,798	2.70	501	1,662	3.32
2012	1,016	3,005	2.96	847	1,384	1.63
2013	1,218	4,443	3.65	1,218	1,718	1.41
2014	888	2,625	2.96	797	1,084	1.36
2015	1,079	1,596	1.48	1,017	678	0.67
2016	1,032	2,137	2.07	1,112	809	0.73
2017	843	2,154	2.56	1,155	925	0.80

Most of the coho smolts have passed the trap by week 20-21 in the Skykomish River (Figure 3.1.2.a), although in some years (e.g., 2015) migration was completed a month earlier. In the Snoqualmie River (Figure 3.1.2.b), the inter-annual variation in the timing of the outmigration is comparable to the Skykomish River (e.g., being earlier in 2015 and 2016 compared to 2013 and 2014), yet in the Snoqualmie River, the number of coho smolts migrating can increase greatly in some weeks, as estimated during week 12 and 18 in 2015 and 2013 respectively). 2017 data appears to have a more evenly-timed pattern than the previous years.

Natural productions estimates in 2017 appear to be improved over 2015 and 2016, and comparable to 2014. Aside from 2014, the magnitude of the 2017 estimates have not been seen since 2006.

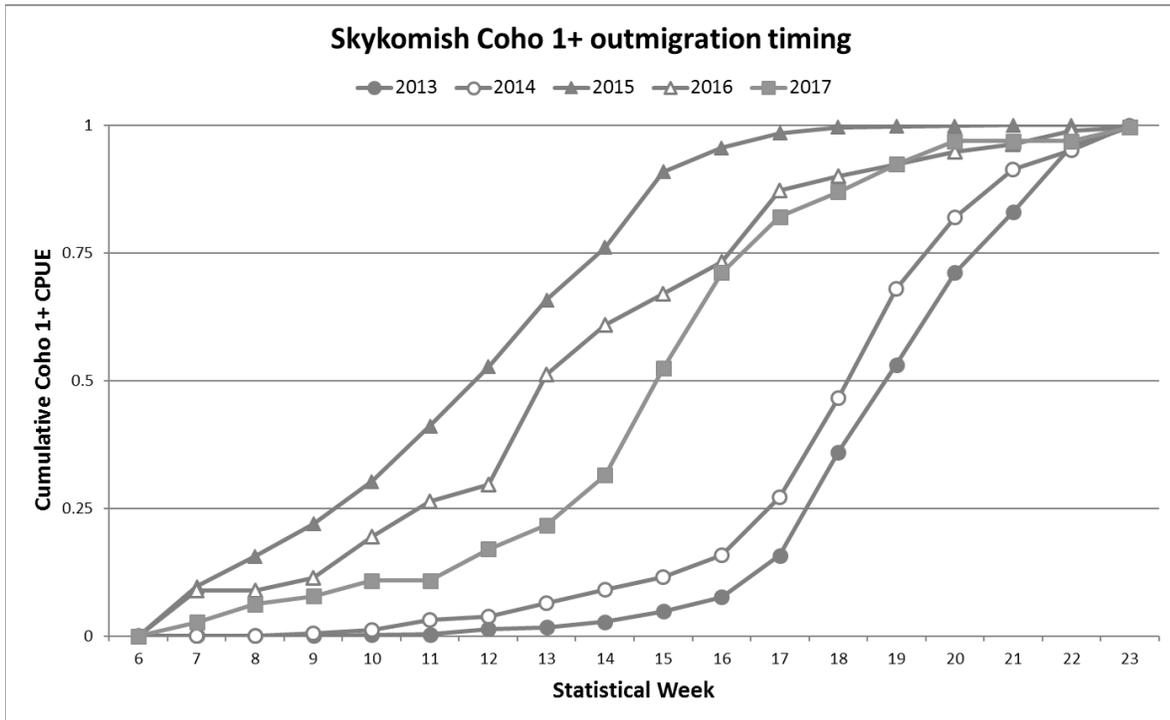


Figure 3.1.2.a. Cumulative season CPUE curves for unmarked smolt coho in the Skykomish (estimated from the trap counts). (Data source: M. Pouley, Tulalip NRD).

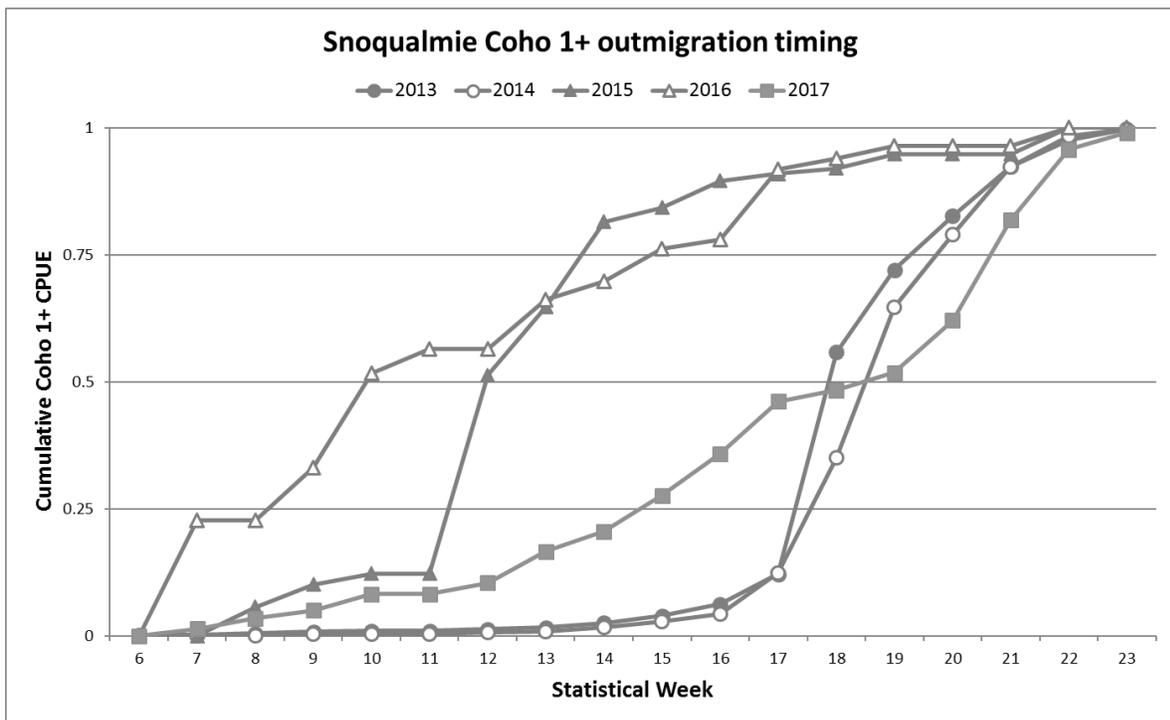


Figure 3.1.2.b. Cumulative season CPUE curves for unmarked smolt coho in the Snoqualmie estimated from the trap counts. (Data source: M. Pouley, Tulalip NRD).

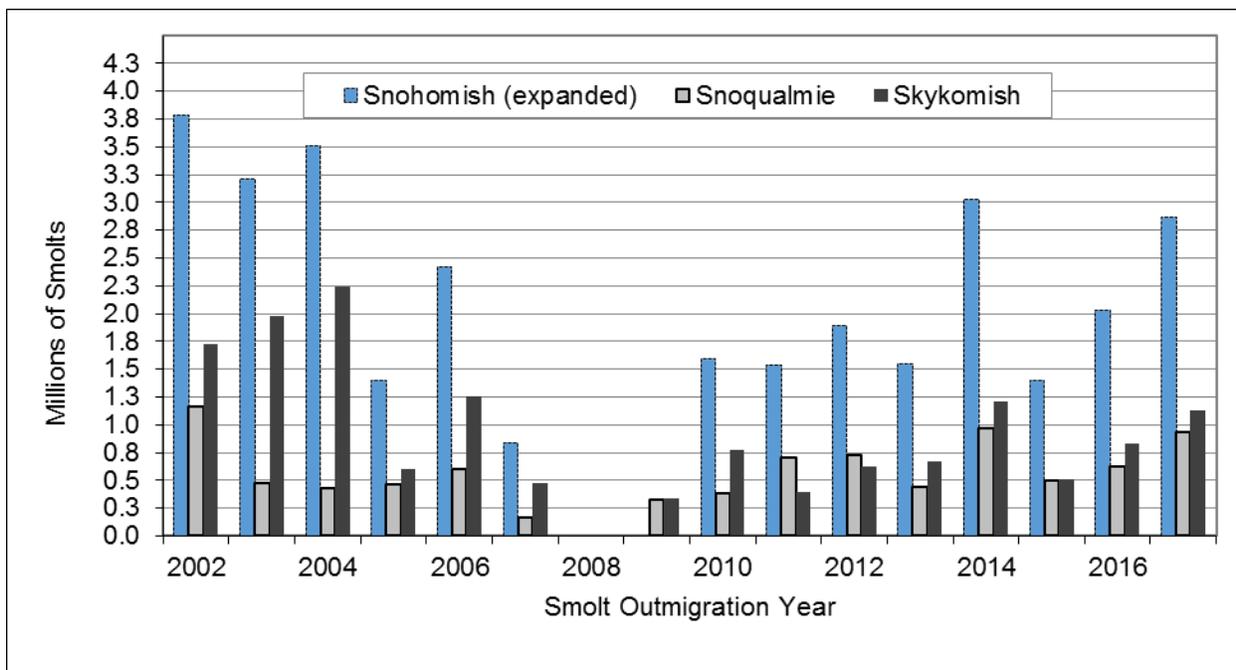


Figure 3.1.2.c. Coho smolt natural production estimates for the Snohomish Basin. Derived from data collected in area above traps on the Snoqualmie and Skykomish rivers, and expanded to whole basin production.

## 3.2 Marine survival

### 3.2.1 Review of ocean conditions

While the marine environment affects the survival of coho salmon during their entire marine residence, the most critical time period is shortly after they emigrate from fresh water as smolts.

Coho smolts from the Snohomish River enter salt water inside Puget Sound where they encounter a very different environment than those entering salt water on the open coast; however, conditions inside Puget Sound are influenced by similar basin-wide climatic processes that drive the circulation patterns in the open ocean. In addition, many of the coho salmon from inside Puget Sound migrate outside the sound and rear in the California Current Ecosystem (CCE) where they experience the same ocean conditions as coastal stocks.

Ecosystem indicators that have been associated with early marine survival of Chinook and coho salmon are displayed in Figure 3.2.1.a (Peterson et al. 2018). These indicators were selected based primarily on correlations with survival of Columbia River stocks, but are generally indicative of basin-wide marine conditions. Indicators related to the early marine survival of coho are generally related to adult coho abundance in the following year, so the years from 2013-2015 are associated with adult returns in 2014-2016. The mean ranks of indicators were generally neutral, but declining in 2013 and 2014, and have been negative since then. One noteworthy indicator is the catches of juvenile coho in September ocean surveys. These were highly correlated with coho returns in the following year, but the September surveys were discontinued in 2013, and are thus omitted from the mean ranks.

Ecosystem Indicators	Year																				
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
PDO (Sum Dec-March)	18	6	3	13	7	20	12	16	14	9	5	1	15	4	2	8	10	21	19	17	11
PDO (Sum May-Sept)	10	4	6	5	11	17	16	18	12	14	2	9	7	3	1	8	19	21	20	15	13
ONI (Average Jan-June)	20	1	1	7	14	16	15	17	9	12	3	11	18	4	6	8	10	19	21	13	5
46050 SST (°C; May-Sept)	16	9	3	4	1	8	21	15	5	17	2	10	7	11	12	13	14	20	18	6	19
Upper 20 m T (°C; Nov-Mar)	20	11	8	10	6	15	16	12	13	5	1	9	17	4	3	7	2	21	19	18	14
Upper 20 m T (°C; May-Sept)	17	12	14	4	1	3	21	19	7	8	2	5	13	10	6	18	20	9	15	11	16
Deep temperature (°C; May-Sept)	21	6	8	4	1	10	12	16	11	5	2	7	14	9	3	15	20	18	13	17	19
Deep salinity (May-Sept)	19	3	9	4	5	16	17	10	6	1	2	14	18	13	12	11	20	15	8	7	6
Copepod richness anom. (no. species; May-Sept)	19	2	1	7	6	14	13	18	15	10	8	9	17	4	5	3	11	20	21	16	12
N. copepod biomass anom. (mg C m <sup>-3</sup> ; May-Sept)	19	14	10	11	3	16	13	20	15	12	6	9	8	1	2	4	5	17	21	18	7
S. copepod biomass anom. (mg C m <sup>-3</sup> ; May-Sept)	21	2	5	4	3	14	15	20	13	10	1	7	16	9	8	6	11	18	19	17	12
Biological transition (day of year)	18	8	5	7	9	14	13	19	12	2	1	3	16	6	10	4	11	21	21	17	15
Ichthyoplankton biomass (mg C 1,000 m <sup>-3</sup> ; Jan-Mar)	21	12	3	8	10	19	18	15	17	16	2	13	5	14	11	9	20	6	7	1	4
Ichthyoplankton community index (PCO axis 1 scores; Jan-Mar)	10	13	2	7	5	11	20	18	3	12	1	14	15	8	4	6	9	19	21	17	16
Chinook salmon juvenile catches (no. km <sup>-2</sup> ; June)	19	4	5	16	8	12	17	20	11	9	1	6	7	15	3	2	10	13	18	21	14
Coho salmon juvenile catches (no. km <sup>-2</sup> ; June)	19	8	13	6	7	3	16	20	17	5	4	10	11	15	18	1	12	9	14	21	2
Mean of ranks	17.9	7.2	6.0	7.3	6.1	13.0	15.9	17.1	11.3	9.2	2.7	8.6	12.8	8.1	6.6	7.7	12.8	16.7	17.2	14.5	11.6
Rank of the mean rank	21	5	2	6	3	15	17	19	11	10	1	9	13	8	4	7	13	18	20	16	12
<i>Ecosystem Indicators not included in the mean of ranks or statistical analyses</i>																					
Physical Spring Trans. UI based (day of year)	3	7	20	17	4	13	15	21	13	1	6	2	8	11	18	9	19	10	5	16	11
Physical Spring Trans. Hydrographic (day of year)	20	3	13	8	5	12	14	21	6	9	1	9	18	3	11	2	16	7	17	19	14
Upwelling Anomaly (April-May)	10	3	17	6	9	14	13	21	10	4	7	8	15	17	15	12	19	1	2	20	5
Length of Upwelling Season UI based (days)	6	2	19	12	1	14	10	21	5	3	9	3	16	18	16	15	20	11	8	13	7
SST NH-5 (°C; May-Sept)	9	6	5	4	1	3	21	16	10	18	2	19	11	7	14	13	15	12	17	8	20
Copepod Community Index (MDS axis 1 scores)	20	3	4	8	1	13	15	18	16	10	2	6	12	9	7	5	11	19	21	17	14
Coho Juv Catches (no. fish km <sup>-2</sup> ; Sept)	11	2	1	4	3	6	12	14	8	9	7	15	13	5	10	NA	NA	NA	NA	NA	NA

Figure 3.2.1.a. Summary of marine indicators from 1998-2018. The top block is basin-wide climate indices, the second block is specific physical oceanographic indicators, and the third block is biological indicators. Numbers inside each block are rank value of that indicator across all years with one being the best and 21 the worst. Color coding is used to reflect ocean conditions for salmon growth and survival (green=good, yellow=intermediate, red=poor). The bottom block is indicators not included in the mean ranks. (Source: NWFSC).

In 2013, there were mixed ocean conditions. The climate indicators, such as Pacific Decadal Oscillation (PDO) and El Niño, were 'neutral'. However, sea surface temperatures were warmer than usual, and the majority of the upwelling occurred over a short period of time (i.e., July) with the upwelling 'season' ultimately ending much earlier than usual. The biological indicators pointed to good ocean conditions, with a high abundance of large, lipid-rich zooplankton, a moderate abundance of winter fish larvae that develop into salmon prey in the spring, and catches of juvenile spring Chinook salmon during the June survey off Washington and Oregon that were the second highest in 16 years. Overall, juvenile salmon entering the ocean in 2013 encountered average to above average ocean conditions off Oregon and Washington.

In 2014, many of the ecosystem indicators pointed towards a relatively poor year for salmon survival. The summer PDO values were strongly positive (warm), coinciding with a 'warm blob'

of water centered in the Gulf of Alaska. El Niño conditions were ‘neutral’, sea surface temperatures were warmer than usual, and the upwelling season started late and ended early. The biological indicators featured a high abundance of large, lipid-rich zooplankton, but a low abundance of winter fish larvae that develop into salmon prey in the spring, and moderate catches of juvenile spring Chinook salmon during the June survey off Washington and Oregon. Overall, juvenile salmon entering the ocean in 2014 encountered below average ocean conditions off Oregon and Washington likely leading to below average returns of adult coho salmon in 2015.

In 2015, many of the ocean ecosystem indicators suggested a relatively poor year for juvenile salmon survival. The PDO was strongly positive (warm) throughout 2015, coinciding with anomalously warm ocean conditions in the NE Pacific, called “The Blob”, that began in the fall of 2013 and persisted through 2015. El Niño conditions also turned positive in April 2015 and remained strongly positive, signaling a strong El Niño at the equator. Despite the strongest upwelling observed since 1998, sea surface and deep water temperatures off Newport, Oregon remained warmer than usual (+2°C) throughout most of 2015. During the strongest upwelling period in June, shelf waters did cool and were salty, but returned to positive temperature anomalies quickly from July onward. The zooplankton community remained in a lipid-depleted state throughout 2015, and was dominated by small tropical and sub-tropical copepods and gelatinous zooplankton that generally indicate poor feeding conditions for small fishes upon which juvenile salmon feed. Krill biomass was also among the lowest in 20 years. On the other hand, the biomass of larval fish species that are common in salmon diets in spring was above average this year, however, there were also high concentrations of larval rockfish and Northern anchovy which are generally indicators of poor feeding conditions for salmon. There were also many new copepod species encountered that had never been seen off Newport since sampling began in 1969.

In 2017, the anomalous warm ocean conditions that had persisted since September of 2014 had begun to dissipate. While ocean ecosystem indicators in 2015 and 2016 suggested some of the poorest outmigration years for juvenile salmon survival in the 20 year time series, some of the indicators in 2017 were fair. The PDO was strongly positive (warm) throughout the first half of 2017, however the index declined to more neutral levels from July through November 2017. Strong La Niña conditions at the equator persisted from August through December of 2016, and then became neutral throughout most of 2017. Prior to the onset of upwelling in 2017, ocean conditions off Newport, Oregon remained warm and fresh. However, after the onset of upwelling, sea surface temperatures were cooler than average and the near bottom water on the shelf was salty. Contrary to what occurred in 2015 and 2016, in June 2017, the copepod community transitioned to a cold water community, signaling that the marine ecosystem might be transitioning back to normal.

By 2018, the anomalous warm ocean conditions that had persisted since September of 2014 dissipated. While ocean ecosystem indicators in 2015 and 2016 remain some of the poorest outmigration years for juvenile salmon survival in the 21-year time series, the indicators in 2018 pointed towards neutral conditions. However, sea surface temperatures in the Northeast Pacific were anomalously warm with a spatial pattern similar to the “Blob” of late 2013. Further, model projections suggested warm ocean conditions of approximately +1°C in the Northeast Pacific through spring 2019.

### 3.2.2 Early life survival rates

The marine survival for the South Fork Skykomish River was directly estimated using coded-wire tags for ocean entry year 1978 through 1986. Starting in ocean entry year 1987, marine survival has been derived using the historical average smolt production above Sunset Falls (276,000 smolts), adult coho escapement at the Sunset Falls trap, and exploitation rates calculated from Wallace Hatchery coho coded-wire tag groups (CWT/non-mark since 1996). This estimate assumes that average smolt production above Sunset Falls has not changed and that harvest rates of hatchery and wild coho are comparable (Zimmerman, 2018).

For the entire Snohomish system, recent marine survival was estimated using reconstructed ocean recruit coho (postseason FRAM validation runs) and smolt trap estimates. Estimates of marine survival are available for the South Fork Skykomish River going back to 1979, and for the Snohomish River back to 2003 with the exceptions of 2009 and 2010. Recent year data (2004-2016) are shown in Figure 3.2.2.a. The broods returning in 2014-2016 experienced some of the lowest marine survival on record. Salmon from the South Fork Skykomish River have experienced low marine survival before, but not for consecutive years. The salmon returns in 2014-2016 all experienced low survival. For the Snohomish River, marine survival was low in all three years, but in 2015 survival was the lowest on record (at only 1 percent). Marine survival in 2016 was improved over 2015, and although data for 2017 and 2018 was not available at the time this document was prepared by the Council (October 17, 2019), ocean conditions in those years are assumed to be more similar to 2016 than 2015, which could suggest a positive trend.

Zimmerman (2018) compared various preseason forecast models for Snohomish coho ocean abundance and found the best model included the North Pacific Gyre Oscillation (NPGO) index May to September of ocean entry and local marine water clarity (light transmissivity) in May of ocean entry in the top 20 meters of depth (assumed to be a proxy for plankton biomass) in Port Gardner. Holmgren (pers. comm. 2018) tested a model including an index of *Pseudocalanus* diversity (derived from PCA analysis during 2003-2016 and NPGO) and it performed very similar to the model described above. This suggests that bottom up processes in Puget Sound and in the ocean can explain some of the variability in early marine survival for Snohomish coho better than other environmental variables.

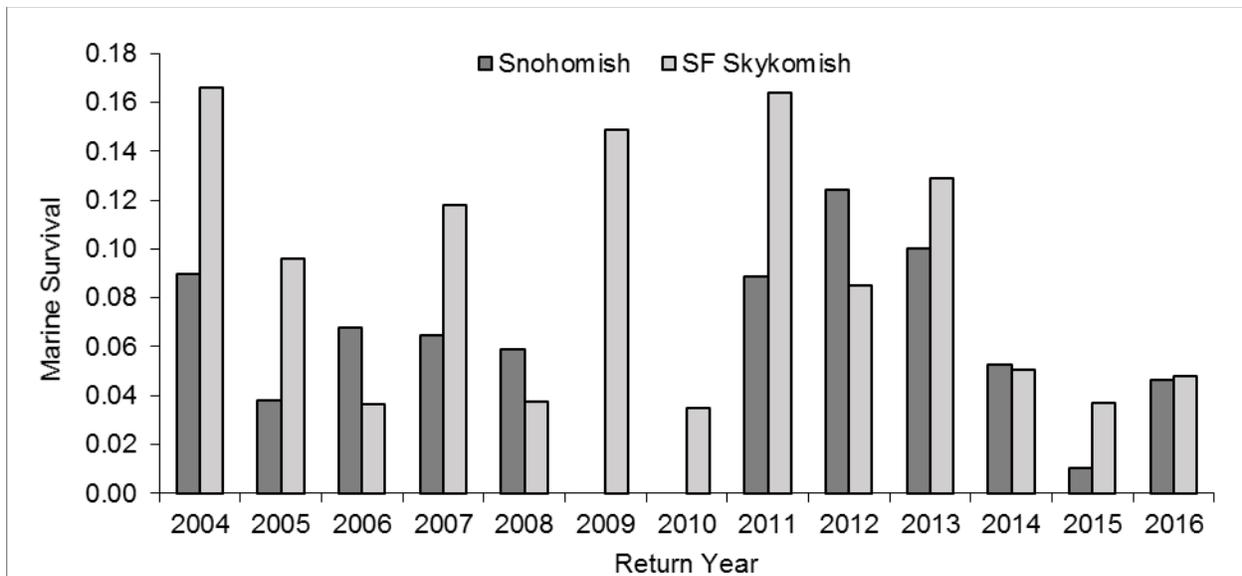


Figure 3.2.2.a. Estimated marine survival of Snohomish River and South Fork Skykomish River natural adult coho. For South Fork Skykomish wild coho (see Zimmerman 2018) and Snohomish (Pouley and Holmgren, pers. comm. 2018)

### 3.3 Harvest impacts

#### 3.3.1 Ocean fisheries

##### Fisheries descriptions

Harvest of Snohomish River natural coho occur in U.S. and Canadian marine sport and commercial fisheries in southern British Columbia, the northern Washington coast, Strait of Juan de Fuca, and Puget Sound. Terminal tribal and non-tribal drift and set net coho fisheries occur in commercial Marine Management Area (MMA) 8A (Port Susan/Possession Sound) and 8D (Tulalip Bay). These fisheries are directed at coho returning to hatchery production programs in Tulalip Bay and the Snohomish River Basin. There have been no directed commercial salmon fisheries in the Snohomish River, although there are periodically tribal ceremonial and subsistence fisheries. Moderate-sized coho sport fisheries occur in sport MMA 8.2 (Port Susan/Possession Sound), and the Snohomish River Basin. The terminal fishery co-managers are WDFW and the Tulalip Tribes.

##### Commercial ocean seasons

Council area commercial troll fisheries south of Cape Falcon typically do not allow retention of coho. North of Cape Falcon, the non-Indian and Treaty Indian troll (treaty troll) regulations typically allow coho retention from July through September. In 2014 and 2015, coho retention in the non-Indian commercial troll fishery was limited to adipose-marked coho through August; non-selective coho fisheries occurred in September. In 2016, the non-Indian commercial troll fishery was limited to 30 total fishing days in July and August; September was closed to all troll fishing. Coho retention was not allowed in the fishery in 2016. In 2017 and 2018, the troll fishery was assigned minimal coho quotas, and no non-selective coho fisheries occurred.

The Treaty Indian troll fishery was open from July through mid-September in 2014, 2015, 2017, and 2018 for all salmon species, and was limited to July and August in 2016 with no coho retention. The treaty troll fishery operates largely in ocean waters, however there is directed harvest in the

Strait of Juan de Fuca (Area 4B). Area 4B is considered an ‘ocean’ fishery during the summer treaty troll season and harvest is deducted from the allowable ocean treaty troll coho quota.

#### Recreational ocean seasons

North of Cape Falcon, the all-species recreational salmon fisheries were open from mid-June through late September in 2014 and 2015. In both years, coho retention was limited to adipose-marked coho through August, and unmarked coho retention was allowed in September. In 2016, the recreational fishery was limited to July 1 through August 27. Coho retention was not allowed north of Leadbetter Point in 2016. In 2017 and 2018, recreational salmon fisheries were assigned minimal coho quotas, and seasons were shortened relative to most recent years, ending on Labor Day. No non-selective coho fisheries occurred in 2016, 2017, or 2018.

South of Cape Falcon, coho retention was allowed from late June through early August in 2014, 2015, and 2016 with retention limited to adipose-marked coho. In 2017, mark-selective coho retention was allowed in late June and July, and in 2018, mark-selective coho retention was allowed late June through early September. Unmarked coho retention was allowed in all years in September.

#### Ocean harvest

Table 3.3.1.a shows coho quotas and catch by fishery during the period 2014 through 2018. During the three (critical) years that resulted in the overfished status, ocean harvest of coho fell well within the allowable quotas or guidelines. In 2016, the north of Cape Falcon coho harvest was severely restricted, if not prohibited, due to the low forecasted returns. In 2017 and 2018, coho harvest remained restricted relative to recent years prior to 2016. In the area North of Cape Falcon, Council-area fisheries harvested 78 percent of the 282,500 coho quota in 2014, 42 percent of the 216,770 fish quota in 2015, 85 percent of the very low quota of 18,900 in 2016, 96 percent of the 60,100 coho quota in 2017, and 91 percent of the 60,100 coho quota in 2018.

Table 3.3.1.a. Coho harvest quotas for Council managed fisheries compared with actual harvest by management area and fishery.

Fishery Governed by Quota or Guideline	2014			2015			2016		
	Quota	Catch	Catch/ Quota	Quota	Catch	Catch/ Quota	Quota	Catch	Catch/ Quota
<b>North of Cape Falcon</b>									
Treaty Indian	62,500	55,897	89%	42,500	3,983	9%	-	-	-
Commercial Troll									
Non-Indian Commercial	35,200	23,141	66%	19,200	5,059	26%	-	-	-
Troll									
Recreational	184,800	140,450	76%	155,070	82,986	54%	18,900	16,059	85%
<b>Total North of Cape Falcon</b>	<b>282,500</b>	<b>219,488</b>	<b>78%</b>	<b>216,770</b>	<b>92,028</b>	<b>42%</b>	<b>18,900</b>	<b>16,059</b>	<b>85%</b>
<b>South of Cape Falcon</b>									
Recreational									
Coho mark-selective	80,000	48,530	61%	55,000	14,896	27%	26,000	1,547	6%
Coho non-mark-selective	35,000	34,267	98%	20,700	4,445	21%	7,500	4,170	56%
<b>Total South of Cape Falcon</b>	<b>115,000</b>	<b>82,797</b>	<b>72%</b>	<b>75,700</b>	<b>19,341</b>	<b>26%</b>	<b>33,500</b>	<b>5,717</b>	<b>17%</b>
<b>Grand Total Council Area</b>	<b>397,500</b>	<b>302,285</b>	<b>76%</b>	<b>292,470</b>	<b>111,369</b>	<b>38%</b>	<b>52,400</b>	<b>21,776</b>	<b>42%</b>
Fishery Governed by Quota or Guideline	2017			2018					
	Quota	Catch	Catch/ Quota	Quota	Catch	Catch/ Quota			
<b>North of Cape Falcon</b>									
Treaty Indian	12,500	13,084	105%	12,500	11,301	90%			
Commercial Troll									
Non-Indian Commercial	2,500	1,838	74%	4,600	1,384	30%			
Troll									
Recreational	45,100	42,658	95%	43,000	41,838	97%			
<b>Total North of Cape Falcon</b>	<b>60,100</b>	<b>57,580</b>	<b>96%</b>	<b>60,100</b>	<b>54,523</b>	<b>91%</b>			
<b>South of Cape Falcon</b>									
Recreational									
Coho mark-selective	18,000	6,177	34%	35,000	11,601	33%			
Coho non-mark-selective	7,900	8,451	107%	7,600	6,898	91%			
<b>Total South of Cape Falcon</b>	<b>25,900</b>	<b>14,628</b>	<b>56%</b>	<b>42,600</b>	<b>18,499</b>	<b>43%</b>			
<b>Grand Total Council Area</b>	<b>86,000</b>	<b>72,208</b>	<b>84%</b>	<b>102,700</b>	<b>73,022</b>	<b>71%</b>			

Source: PFMC Review of Ocean Fisheries, Table I-6, Feb 2015, Feb 2016, Feb 2017, Feb 2018, Feb 2019

### 3.3.2 Puget Sound fisheries

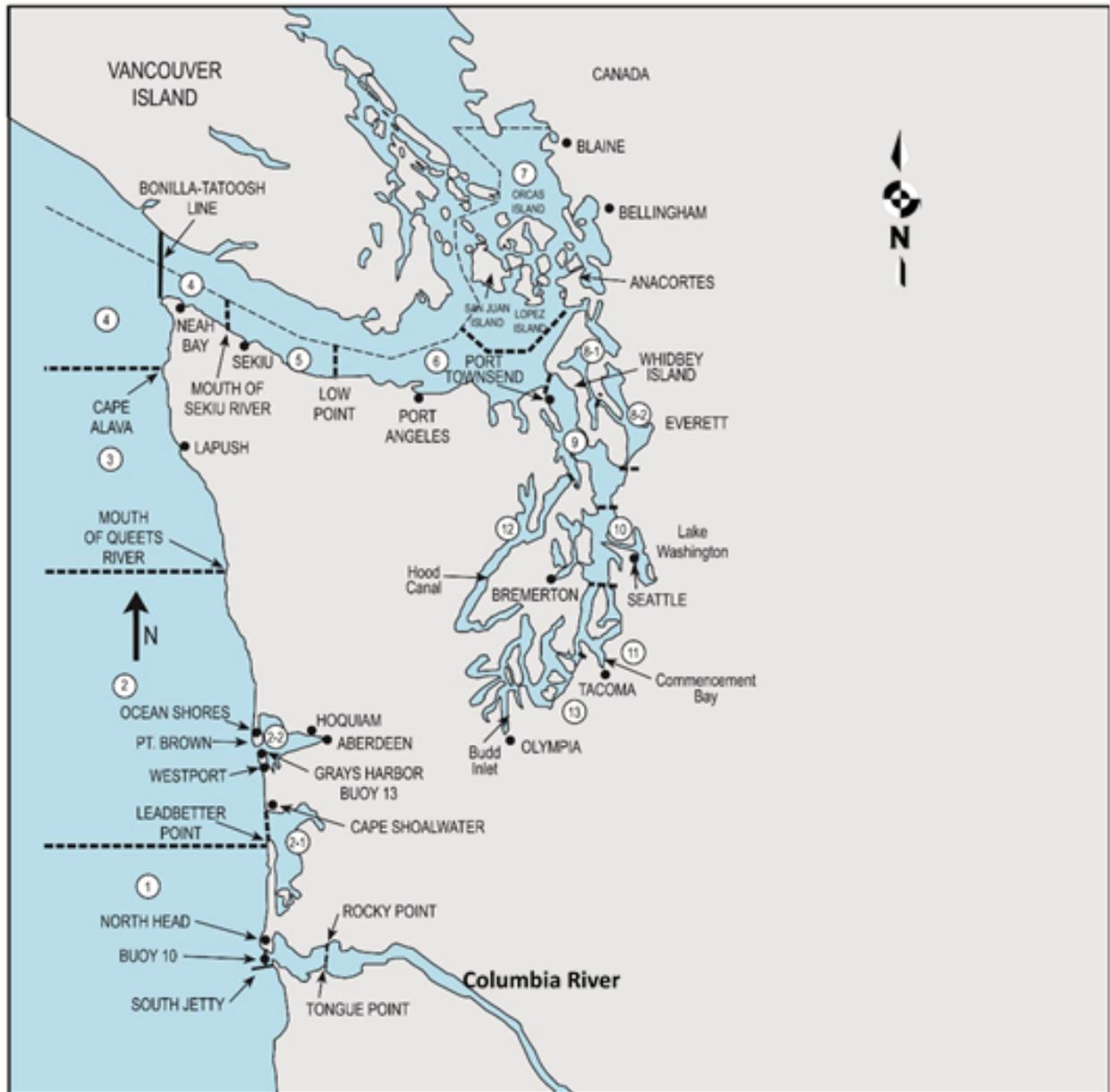


Figure 3.3.2.a. Map of Western Washington, showing the Marine Catch Areas of Puget Sound (Areas 5 through 13) and the Washington coast (Areas 1 through 4).

#### Tribal fisheries

Strait of Juan de Fuca (Area 5) is predominantly gillnet harvest during July-August, and then switches to set net harvest in October. Harvest in Areas 6 and 6C are modest.

In Central Puget Sound, harvest is largely from Area 10, in similar proportions for the month of September, October, and for gillnet and purse seine gears. Tribes have very limited fisheries in Area 9.

Harvests in terminal areas 8A and 8D (Port Susan and Tulalip Bay, respectively) are much larger in comparison to those in the Strait of Juan de Fuca and the Central Sound. During 2009-2016, total coho harvest amounted to 291,959 fish in Areas 8A and 8D (73,364 and 218,595 respectively). Most of the catch in both areas, occurs in September, by gillnet in 8A and set net in 8D. Incidental coho catches during pink salmon fisheries (odd-years; calendar weeks 33-35) are very limited, and no coho catches have occurred in recent years past the coho management period, as chum fisheries have remained closed. The 8D fisheries target Tulalip hatchery origin salmon (coho, chum and Chinook) on average the proportion of non-Tulalip Hatchery coho (~15 percent) in the tribal net coho catch is significantly less in the inside part of Tulalip Bay (where set net gear is allowed) than in the outside portion (“the Bubble”, where other gears operate) at around 30 percent.

Coho tribal fisheries catches (all stocks) in the Strait of Juan de Fuca (Areas 5, 6, and 6C), Central Sound, and Terminal areas (8A, 8D) for the period 2004-2016 are summarized in Table 3.3.2.a.

#### Non-Indian commercial seasons

The number of non-Indian commercial fisheries targeting coho within Puget Sound are limited in time and area. Within Puget Sound, non-Indian and Treaty Indian regulations typically allow coho retention from September through mid-October. In 2014 and 2015, coho retention in the non-Indian commercial gillnet, purse seine, and beach seine fisheries was limited to Quilcene Bay, Port Gamble Bay, Bellingham Bay, Dungeness Bay, Tulalip Bay and the waters through Possession Sound northward to Camano Head. In 2016, the non-Indian commercial fishery targeting coho was not planned in the Tulalip Bay and Possession Sound areas, but was offered in all other areas.

#### Recreational seasons

Recreational fishing seasons in the marine catch areas of Puget Sound (Areas 5-13; see map in Appendix B, Table B.1) allowed some coho retention in most areas during the 2014-15 and 2015-16 seasons, via non-selective (NSF) or mark-selective (MSF) coho fisheries as specified in Table B.1. The standard daily bag limit in these fisheries was generally 2 salmon – up to 2 hatchery marked (adipose fin-clipped) coho in MSFs, and up to 2 coho (either marked or unmarked) in NSFs. Additionally, in 2015, as is typical for odd-year regulations, a pink salmon bonus limit (2 pink salmon in addition to the standard 2 salmon limit) was allowed in all Puget Sound marine areas except Areas 8-1 and 8-2. In contrast, coho retention was not allowed in most Puget Sound marine areas during the 2016-17 season due to relatively low run size forecasts for most Puget Sound coho stocks, with the exception of Hood Canal (Area 12; see further detail in Appendix B).

Table 3.3.2.a. Coho harvest in Puget Sound marine fisheries<sup>a/b/</sup>

Year	Treaty Indian	Non-Indian Commercial	Recreational <sup>c/</sup>
2004	533,188	39,481	83,708
2005	287,037	19,694	58,309
2006	259,779	9,827	26,688
2007	209,137	13,435	65,306
2008	227,273	6,464	21,400
2009	259,528	20,091	75,719
2010	153,683	18,220	20,290
2011	223,800	28,821	56,775
2012	355,839	35,628	169,884
2013	298,503	29,577	115,934
2014	191,166	11,815	124,185
2015	47,118	4,777	142,669
2016	259,957	14,486	4,983
2017	191,478	11,763	40,686
2018	240,757	9,645	NA
2004-13 Ave.	280,777	22,124	69,401

a/ Data do not reflect treaty Indian allocations. Includes U.S. and Canadian-origin salmon and fish caught in test fisheries.

b/ Commercial and Treaty Indian data are preliminary. Sport data are preliminary in 2017.

c/ Recreational catches include WDFW Statistical Areas 5 through 13, which include the Strait of Juan de Fuca, San Juan Islands, and inner Puget Sound.

Source: PFMC Review of 2018 Ocean Fisheries, Tables B-39 and B-40.

### 3.3.3 Recreational fisheries in the Snohomish River system

#### Seasons

The standard freshwater sport fishery salmon regulations in the Snohomish River Basin have allowed for an even-year fishing season in the Snohomish, Skykomish, and Snoqualmie Rivers of September 1 through December 31, and in the Wallace River a season of September 16 through November 30. The standard odd-year season starts August 1 on the Snoqualmie River below Highway 9 to allow for harvest of pink salmon and opens progressively as the fish move higher in the system. Even-year limits are generally three coho only and odd-year limits are three salmon plus one additional pink, release Chinook and chum. The 2012 through 2017 preseason agreed to in-river sport seasons followed this standard with the exception of 2016 which had a forecast below escapement goals and no preseason agreed to in-river sport harvest. See Appendix C, Table C.1.

Inseason changes that deviated from the preseason agreements were implemented in 2015, 2016 and 2017. These changes reduced the in-river sport fishing season in 2015 and 2017, and provided for some opportunity in 2016. See Appendix C, Table C.2.

In 2015, the beginning of sport seasons were truncated by drought closures implemented July 17 (during gamefish seasons) and lifted between September 2 and September 30 on different sections of the rivers. A run size update on October 1, 2015, indicated a much lower than predicted run

size, and the season ended October 21 through emergency regulation. In 2016, preseason forecasts allowed for no freshwater sport coho seasons, but when inseason updates indicated a run size larger than forecasted, a limited season of October 11 through October 31 was implemented. There were also two four-day openings on the Snohomish mainstem, September 29 through October 2, and October 6 through October 9. In 2017, the Wallace River delayed opening until September 30 due to concerns about Chinook broodstock numbers, pink salmon retention closed throughout the Snohomish watershed on September 22 due to concerns over low pink returns, and the entire Snohomish watershed closed on October 28 to the retention of all salmon except hatchery coho.

### Harvest

Snohomish in-river coho catch 2012 through 2016 ranged from 1,194 fish in 2016 which had a very limited season to 16,295 in 2013 (Table 3.3.3.a.).

Table 3.3.3.a. Recreational coho catch in the Snohomish River system

	2012	2013	2014	2015	2016
Skykomish River	1,472	3,068	1,177	995	714
Snokomish River	4,823	12,555	1,277	2,607	480
Snoqualmie River	606	672	85	115	-
Wallace River				125	253
Snohomish R. System Total	6,901	16,295	2,539	3,842	1,447

### 3.3.4 Total exploitation rates

Postseason harvest and exploitation rate data for Snohomish coho were compiled from postseason model runs of the coho FRAM that are generated annually by the Coho Technical Committee (CoTC) of the Pacific Salmon Commission. Over the 14-year period from 2004 through 2017, the total exploitation rate on Snohomish coho averaged 24.4 percent and ranged from a high of 54.8 percent in 2015 to a low of 9.7 percent in 2010 (Table 3.3.4.a). Over this time period, on average approximately 5 percent of the total exploitation occurred in Alaskan and Canadian fisheries while 9 percent occurred in Council fisheries. The remaining 86 percent occurred in other preterminal and terminal fisheries within Puget Sound.

Exploitation rates on Snohomish River coho returning in 2014-2016 were high compared to other recent years. The exploitation rates in 2015 and 2014 were the highest and second highest since at least 2004. This was largely a result of anomalously high exploitation rates in Puget Sound sport fisheries (labeled as ‘Other Preterminal’ in Figure 3.3.4.a; Table 3.3.4.a). Even though abundance was much lower in 2015, the fish were very vulnerable to sport fisheries in Puget Sound. In 2016, preseason forecasts for abundance were very low, and preterminal fisheries were severely restricted. Inseason, when the run size appeared to be greater than expected, terminal fisheries were liberalized. This resulted in most of the harvest being taken in terminal fisheries. Council area fisheries have minor impacts on Snohomish coho, and the postseason estimates of total impacts of Council area fisheries in 2014-2016 were less than 2.1 percent in all years (Table 3.3.4.a)

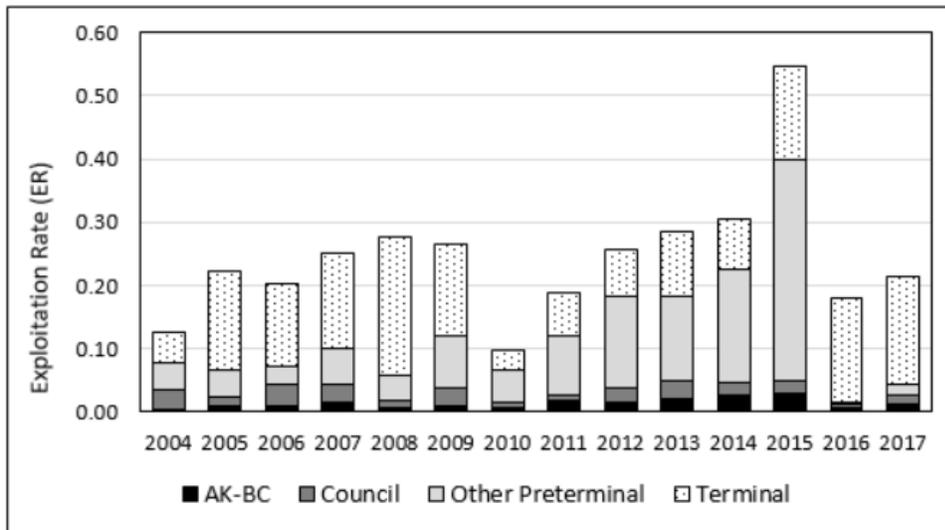


Figure 3.3.4.a. Postseason total exploitation rate by major fishery group on Snohomish natural coho from FRAM estimates generated by the PSC CoTC.

Table 3.3.4.a. Ocean age 3 abundance and escapement and exploitation rates for Snohomish natural coho from postseason FRAM estimates generated by the PSC CoTC.

Strata	2004	2005	2006	2007	2008	2009	2010 <sup>a/</sup>
Ocean Age 3 Abundance	289,505	133,924	94,754	157,393	49,412	134,407	54,363
Escapement	252,787	104,149	75,626	117,737	35,816	98,950	49,101
Alaska-Canada	0.4%	0.8%	1.0%	1.5%	0.7%	1.0%	0.5%
NOF-Treaty Troll	2.1%	1.1%	2.5%	2.1%	0.8%	2.2%	0.5%
NOF-Nontreaty Troll	0.3%	0.2%	0.3%	0.2%	0.1%	0.3%	0.3%
NOF-Sport	0.5%	0.3%	0.3%	0.4%	0.1%	0.4%	0.2%
SOF all	0.1%	0.0%	0.0%	0.1%	0.0%	0.1%	0.0%
Preterminal Other	4.3%	4.2%	3.0%	5.7%	4.0%	8.2%	5.2%
Terminal Sport	0.0%	3.5%	1.5%	3.7%	3.6%	0.1%	2.8%
Terminal Net	5.1%	12.1%	11.5%	11.5%	18.2%	14.2%	0.3%
<b>Total ER</b>	<b>12.7%</b>	<b>22.2%</b>	<b>20.2%</b>	<b>20.2%</b>	<b>27.5%</b>	<b>26.4%</b>	<b>9.7%</b>
Strata	2011 <sup>a/</sup>	2012 <sup>a/</sup>	2013 <sup>a/</sup>	2014 <sup>a/</sup>	2015 <sup>a/</sup>	2016 <sup>a/</sup>	2017 <sup>a/</sup>
Ocean Age 3 Abundance	137,351	175,524	175,727	66,561	28,314	53,876	23,129
Escapement	111,375	130,632	125,871	46,244	12,804	44,141	18,196
Alaska-Canada	1.6%	1.5%	2.0%	2.6%	2.9%	0.8%	1.2%
NOF-Treaty Troll	0.6%	1.6%	2.0%	1.5%	0.4%	0.0%	0.9%
NOF-Nontreaty Troll	0.2%	0.3%	0.4%	0.2%	0.4%	0.1%	0.1%
NOF-Sport	0.2%	0.3%	0.3%	0.3%	0.9%	0.1%	0.3%
SOF all	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%
Preterminal Other	9.3%	14.6%	13.6%	17.9%	35.1%	0.3%	1.8%
Terminal Sport	5.3%	3.8%	9.0%	3.4%	12.0%	2.0%	9.4%
Terminal Net	1.7%	3.5%	1.1%	4.6%	2.9%	14.7%	7.6%
<b>Total ER</b>	<b>18.9%</b>	<b>25.6%</b>	<b>28.4%</b>	<b>30.5%</b>	<b>54.8%</b>	<b>18.1%</b>	<b>21.3%</b>

a/ 2010-2017 results are preliminary

### 3.4 Assessment and management

#### 3.4.1 Abundance forecast errors

The age-3 ocean abundance forecast of Snohomish natural coho in each of the years from 2014-2016 was based on the estimated smolt production from the basin, multiplied by an expectation of the marine survival rate. Among the local and regional variables that may influence marine survival of wild coho salmon, two variables are particularly informative for the Snohomish MU – North Pacific Gyre Oscillation (NPGO) index May to September of ocean entry and local marine water clarity (light transmissivity) in May of ocean entry. Higher survival is associated with higher NPGO index values and higher light transmissivity (Zimmerman, 2018).

In 2014 and, especially, 2015, abundance was over-forecasted (Figures 3.4.1.a and 3.4.1.b). In 2016, abundance was substantially under-forecast, not just for the Snohomish coho, but for other coho stocks as well. Fisheries may not always be able to respond appropriately inseason to forecasting errors; this could cause ER caps to be exceeded (if over-forecast), or result in foregone opportunities for harvest (if under-forecast).

In 2016, fishery co-managers (tribal and WDFW) agreed to more conservative forecasts in response to the unexpected low returns in the previous year, and continuing observed poor ocean conditions (i.e., warmer temperatures, lower upwelling intensity, and lower prey abundance). The management response was to correlate fewer years of data (i.e., to reflect more recent conditions) in the forecast models and lower predicted marine survival.

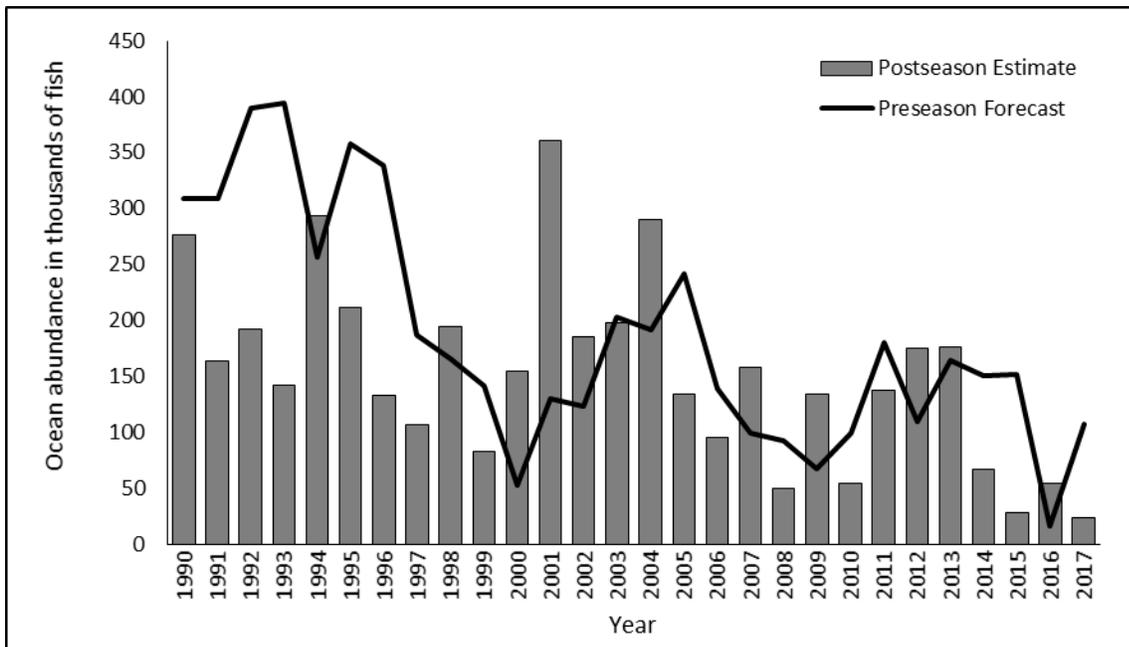


Figure 3.4.1.a. Preseason forecasts and postseason FRAM estimates of ocean age 3 abundance of Snohomish River natural coho. Preseason forecasts are generated by salmon co-managers and postseason FRAM estimates are generated by the PSC CoTC.

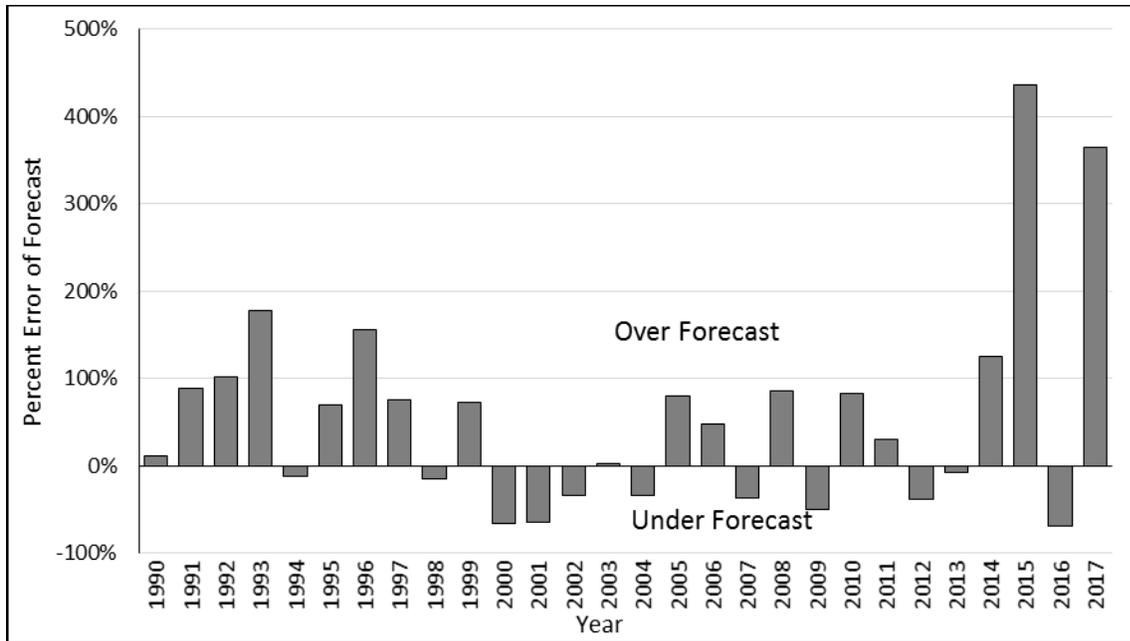


Figure 3.4.1.b. Preseason forecast error when compared to postseason estimates of ocean age 3 abundance of Snohomish River natural coho. Preseason forecasts are generated by salmon co-managers and postseason FRAM estimates are generated by the PSC CoTC

### 3.4.2 Exploitation rate forecast errors

The escapement years that contributed to the overfished determination for Snohomish coho were 2014 through 2016.

In 2014 and 2015, abundance was over-forecasted which caused the stock to be inappropriately categorized when determining the preseason maximum ER allowed, or ‘ER Cap’. The over-forecasts of 2014 and 2015 also contributed to ERs that exceeded preseason projections, particularly in 2015. The combination of higher ERs than projected and preseason ER caps that were set too high (based on postseason estimates) resulted in a postseason ER estimate that exceeded the postseason ER cap in 2015 (Table 3.4.2.a.).

In 2016, abundance was under-forecast which caused the stock to be inappropriately categorized when determining the preseason ER Cap. Inseason, information indicated actual abundance was greater than the preseason forecast. Terminal area fisheries were able to respond to the abundance updates and provide additional opportunity inseason. As a result, the postseason ER was greater than preseason projections. Postseason ER estimates were still beneath the preseason cap of 20 percent even though it increased to 40 percent based on the postseason abundance estimates (Table 3.4.2.a.).

A summary of preseason projected and postseason estimated total exploitation rates, compared to those allowed (cap) since 2010 is provided in Table 3.4.2.a. This helps illustrate the change in preseason/postseason exploitation rates, and also the change in the ER Cap. Table 3.4.2.b details the pre- and postseason fishery mortalities and resulting exploitation rates by fishery aggregate for each of the three years that led to the overfished status. For Council fisheries, the postseason ERs were less than those predicted preseason in all three years.

Table 3.4.2.a. Preseason and postseason total exploitation rates for Snohomish natural coho generated in FRAM modeling conducted by the PFMC Salmon Technical Team (preseason) and the PSC CoTC (postseason).

Return Year	Exploitation Rate			
	Preseason		Postseason	
	ER	ER cap <sup>a/</sup>	ER <sup>b/</sup>	ER cap <sup>a/</sup>
2010	0.33	0.40	0.10	0.40
2011	0.26	0.60	0.19	0.60
2012	0.28	0.40	0.26	0.60
2013	0.25	0.60	0.28	0.60
2014	0.30	0.60	0.31	0.40
2015	0.33	0.60	0.55	0.20
2016	0.07	0.20	0.18	0.40
2017	0.15	0.40	0.21	0.20
Average	0.25	0.48	0.26	0.43

a/ See CoTC 2013 for information on determination of ER caps

b/ Postseason exploitation rates are preliminary.

Table 3.4.2.b. Preseason forecast and postseason estimates of escapement, total mortality, and exploitation rate by fishery for Snohomish natural coho during years that contributed to the overfished classification (2014-16), plus data for the most recent year available (2017) . Data Sources: preseason forecasts generated by salmon co-managers, preseason exploitation rates from FRAM modeling by the PFMC STT, and postseason FRAM estimates generated by the PSC CoTC.

Fishery Component	2014		2015		2016		2017	
	Preseason	Postseason	Preseason	Postseason	Preseason	Postseason	Preseason	Postseason
Ocean Age 3 Abundance	150,477	66,561	152,091	28,314	16,772	53,876	107,384	23,129
FMP Smsy	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Escapement after all fisheries	104,765	46,244	102,363	12,804	15,666	44,141	91,065	18,196
Alaska-Canada Council North of Falcon	802	1,706	2,396	828	199	408	1,102	286
Treaty Troll	3,407	1,006	2,582	117	5	10	864	213
Nontreaty Troll	559	131	553	120	27	69	254	25
Sport	854	206	868	267	59	68	256	60
Council South of Falcon	151	55	151	20	14	17	90	13
<b>Council Subtotal</b>	<b>4,971</b>	<b>1,398</b>	<b>4,154</b>	<b>524</b>	<b>105</b>	<b>164</b>	<b>1,464</b>	<b>311</b>
Preterminal Other								
Troll	55	11	107	78	4	-	53	7
Net	15,534	3,081	14,208	740	75	113	3,559	280
Sport	8,612	8,810	10,826	9,111	60	66	546	120
Terminal Net and Sport	15,738	5,311	18,037	4,229	663	8,984	9,595	3,929
<b>Total Fishing Mortality</b>	<b>45,712</b>	<b>20,317</b>	<b>49,728</b>	<b>15,510</b>	<b>1,106</b>	<b>9,735</b>	<b>16,319</b>	<b>4,933</b>
Alaska-Canada Council North of Falcon	0.5%	2.6%	1.6%	2.9%	1.2%	0.8%	1.0%	1.2%
Treaty Troll	2.3%	1.5%	1.7%	0.4%	0.0%	0.0%	0.8%	0.9%
Nontreaty Troll	0.4%	0.2%	0.4%	0.4%	0.2%	0.1%	0.2%	0.1%
Sport	0.6%	0.3%	0.6%	0.9%	0.4%	0.1%	0.2%	0.3%
Council South of Falcon	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.1%
<b>Council Subtotal</b>	<b>3.3%</b>	<b>2.1%</b>	<b>2.7%</b>	<b>1.9%</b>	<b>0.6%</b>	<b>0.3%</b>	<b>1.4%</b>	<b>1.3%</b>
Preterminal Other								
Troll	0.0%	0.0%	0.1%	0.3%	0.0%	0.0%	0.0%	0.0%
Net	10.3%	4.6%	9.3%	2.6%	0.4%	0.2%	3.3%	1.2%
Sport	5.7%	13.2%	7.1%	32.2%	0.4%	0.1%	0.5%	0.5%
Terminal Net and Sport	10.5%	8.0%	11.9%	14.9%	4.0%	16.7%	8.9%	17.0%
<b>Total Exploitation Rate</b>	<b>30.4%</b>	<b>30.5%</b>	<b>32.7%</b>	<b>54.8%</b>	<b>6.6%</b>	<b>18.1%</b>	<b>15.2%</b>	<b>21.3%</b>

### 3.5 Summary of contributing factors

Freshwater productivity of the Snohomish River system does not appear to be a major contributing factor. The Snohomish system has produced large runs in the past, and estimated smolt production in 2013, 2014, and 2015, although less than some years, was not abnormally low.

Marine survival has fluctuated, but was low for all of the broods that returned in 2014, 2015, and 2016, especially for salmon returning in 2015. Lower marine survival in 2015 is attributed to poor ocean conditions and lack of available prey. In 2015, Snohomish coho returned in much lower numbers than forecasted pre-season. The fish were also much smaller in both weight and length than normal, resulting in less fecundity per returning adult. This had a compounding effect on the resource, resulting in both low escapement and low spawning potential for those adult salmon that did return.

Exploitation rates on Snohomish coho are typically constrained by impacts of fisheries on other stocks. In the years from 2010 to 2017, the projected pre-season ERs have averaged 52 percent of the allowable ER caps, and the post-season rates have averaged 81 percent of the allowable caps. The only years in this time frame in which the post-season estimate exceeded what should have been allowed were 2015 and 2017. This was due to a combination of forecast error and a delayed in-season reduction to the sport fisheries in terminal waters. In 2016, despite a forecast error, harvest remained within the post-season ER cap, although both the post-season estimated ER and ER cap were higher than projected pre-season.

## **4.0 RECOMMENDATIONS FOR ACTION**

### **4.1 Recommendation 1: Rebuilt criterion**

Consider the Snohomish coho stock to be rebuilt when the 3-year geometric mean of natural-area adult escapement meets or exceeds  $S_{MSY}$ . This is the default rebuilt criterion in the FMP.

### **4.2 Recommendation 2: Management strategy alternatives**

Recommend the Council adopt a management strategy (control rule) that will be used to guide management of fisheries that impact Snohomish natural coho until rebuilt status is achieved. We offer two alternative management strategies for consideration. The rebuilding time frame under each alternative is not expected to exceed the maximum rebuilding time ( $T_{MAX}$ ) of 10 years. The probability of achieving rebuilt status for year 1 (2018) through 10 are projected in Section 4.4, *Analysis of Management strategy alternatives*.

The description of alternatives may include references intended to meet NEPA or MSA criteria. Guidelines suggest that alternatives are identified as either an ‘action’ or a no-action’ alternative, and that the minimum time ( $T_{MIN}$ ) and the time estimated to achieve rebuilt status ( $T_{target}$ ) are acknowledged within the suite of alternatives. See Section 2.1 for a more complete description

Alternative I: Status Quo. During the rebuilding period continue to use the current management framework and reference points, as defined in the FMP and the PST, to set maximum allowable exploitation rates on an annual basis. Projected rebuilding time,  $T_{target}$ , is three years (see Section 4.3). This is considered a ‘no-action’ alternative

Alternative II:  $S_{MSY}$  Buffer. The Council will plan ocean fisheries to limit impacts on Snohomish natural coho consistent with escapement thresholds and exploitation rate limits identified by the Washington tribal and state co-managers, and consistent with the FMP. The co-managers will increase the MSY escapement goal of 50,000 by 10%, to 55,000, until rebuilt status is achieved and may adjust escapement thresholds and exploitation rate

limits annually, as described in the FMP, to promote rebuilding of the stock while allowing limited fisheries to occur.

The tribal and state co-managers will plan inside fisheries during the North of Falcon pre-season process that, when combined with PFMC fisheries, will meet these escapement and exploitation rate objectives. The co-managers may implement additional conservation measures, as necessary.

Under this alternative, changes to the  $S_{MSY}$  and MSST reference points defined in the salmon FMP are not proposed. Projected rebuilding time,  $T_{target}$ , is three years (see Section 4.4). This is considered an ‘action’ alternative.

For the two alternatives and the  $T_{MIN}$  scenario, year 1 for the  $T_{MIN}$  and  $T_{target}$  calculations is defined as 2018. This convention was adopted for Snohomish natural coho due to data availability, as the most recent estimates of ocean abundance and spawner escapement are from 2017. Rebuilding times projected here assume the control rules defined in the alternatives were first applied to 2018 fisheries, and each of the nine years thereafter. However, an adopted rebuilding plan will likely be first implemented in 2020.

### **4.3 Recommendation 3: Co-manager recommendations**

Successful co-management is one essential component to rebuilding Snohomish coho stocks and this should continue. Co-managers recognize that modifications to ocean fisheries alone will not be enough to achieve the recovery of Snohomish coho and are committed to making changes to fisheries in Puget Sound to rebuild Snohomish coho. In response to over forecasting of Snohomish coho ocean abundances in 2014 and 2015 co-managers adjusted the 2016, 2017, and 2018 forecasts by using conservative marine survival in the calculations of adult recruits. In addition, the smolt production estimate used in the forecast of adult recruits in 2018 was lowered substantially (lower 95% confidence interval bound), to minimize the risk of over forecasting. Co-managers have been very conservative in setting fishing schedules for the seasons 2016-2018. In 2018 for example, tribal and sport fisheries were curtailed early in the season (end of September), resulting in a more conservative fishing schedule than what in-season updates to the terminal abundance would have allowed. Co-managers are taking a cautious approach because there is uncertainty in the estimates (smolt production, marine survival, and exploitation rates), and because of the need to recover the Snohomish coho stock to escapement levels to the “moderate” category.

### **4.4 Analysis of management strategy alternatives**

The STT has developed a model to assess the probability of a stock achieving rebuilt status in the years following an overfished declaration. In this model, future abundance is based on a distribution fitted to past observed ocean age-3 abundances (2004-2017), accounting for lag-1 autocorrelation. Realistic levels of error in abundance forecasts, escapement estimates, and exploitation rate implementation contribute to the projected adult spawner escapement. Replicate simulations are performed to allow for projecting the probability of achieving rebuilt status by year. The model framework allows for evaluation of alternative rebuilding plans by specifying the rebuilding plans as alternative harvest control rules. Model structure, parameterization, and additional results are presented in Appendix D.

This model was applied to Snohomish natural coho in order to provide projected rebuilding times, with year 1 representing 2018. The projected rebuilding time is defined here as the number of years needed for the probability of achieving rebuilt status to meet or exceed 0.50. Given this condition, rebuilding times are projected to be three years for both alternatives I and II, with a  $T_{MIN}$  (based on a no fishing scenario) of three years (Table 4.4.a). The rebuilding probabilities in Table 4.4.a are displayed graphically in Figure 4.4.a. There were extremely small differences in rebuilding time probabilities between Alternatives I and II. While a probability of 0.5 has been used here to define rebuilding times, the Council has the discretion to recommend a probability greater than 0.5 to be used for this purpose.

Table 4.4.a. Projected rebuilding probabilities by year for each of the alternatives and the  $T_{MIN}$  scenario.

	Year									
	1	2	3	4	5	6	7	8	9	10
Alternative I	0.052	0.224	<b>0.599</b>	0.747	0.842	0.902	0.937	0.960	0.976	0.984
Alternative II	0.055	0.230	<b>0.616</b>	0.759	0.842	0.902	0.939	0.964	0.978	0.986
$T_{MIN}$	0.106	0.391	<b>0.776</b>	0.881	0.937	0.971	0.985	0.992	0.996	0.998

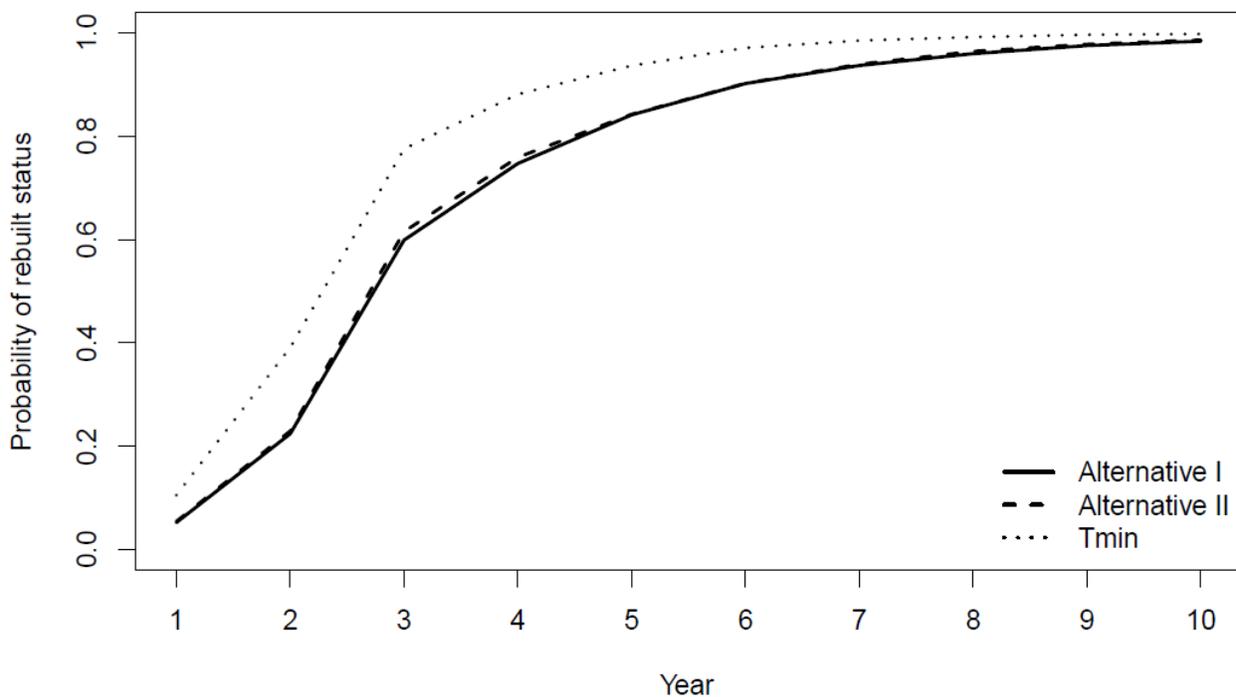


Figure 4.4.a. Projected probability of achieving rebuilt status by year under the two alternatives and the  $T_{MIN}$  scenario.

The model described here was created to allow for a quantitative assessment of rebuilding alternatives. The tool has some elements of a management strategy evaluation (MSE), but lacks an explicit biological operating model. It relies on autocorrelated draws from an abundance distribution informed by past abundance levels. As such, no explicit population dynamics are included in the model. Data limitations and the short time frame for development of rebuilding plans did not allow for constructing a more detailed operating model. The model also does not

explicitly account for mixed-stock effects, where another stock could limit access to Snohomish natural coho in ocean fisheries and prevent attainment of allowable exploitation rates.

The probability of achieving rebuilt status for alternative rebuilding plans within a 10 year window is the core result of this analysis. The results for particular alternatives may be most useful if interpreted in a relative rather than absolute sense. Actual rebuilding periods may be somewhat shorter or longer than these results suggest due to the vagaries of future production, ocean conditions, and fisheries.

## **5.0 SOCIOECONOMIC IMPACT OF MANAGEMENT STRATEGY ALTERNATIVES**

### **5.1 Approach to the socio-economic analysis and benchmark/baseline**

The approach for the analysis is to provide the best information possible on the impacts of each of the alternatives. To achieve this end the analysis includes both quantitative and qualitative information. As needed to describe potential impacts of the alternatives, the socioeconomic analysis assesses the following.

- The likelihood that the rebuilding stock will be constraining in a particular year:
  - the degree to which the stock has been a constraint historically, and
  - the differences in escapement policy between historical policies and the action alternatives for recent years.
- The potential degree of reduction in ocean fisheries:
  - the differences in escapement policy between no action and action alternatives over a range of stock abundances, and
  - the average reduction in ocean fisheries and attendant changes in personal income that might be expected, assuming the stock is constraining in every year.

It is important to assess the likelihood that a stock will be constraining because when a stock is not constraining a change in the harvest policy might have no impact. Regulations governing ocean fisheries are generally shaped by the most constraining stock (i.e., the stock for which it is most difficult to meet escapement policies because of relatively low abundance). In such cases there are usually surplus escapements (i.e., escapement levels in excess of the management goal) for non-constraining stocks. If a more conservative harvest policy is imposed for a stock that is non-constraining in a particular year, even without imposing the more conservative harvest policy, any surplus escapement of the non-constraining stock may be more than sufficient to meet the more conservative criteria, and thus the policy would have no additional impact on that stock.

Predicting whether or not a particular stock will be constraining in the future is untenable because it requires a projection of the abundance of every other potentially constraining stock in the region. Therefore to assess the likelihood that a stock may be constraining in the future, the approach used here is first to consider whether a stock has been a constraint historically, and second to look at a hindcast of how historical harvest policies would have been different if the action alternative described below had been in place at that time. The hindcast is used to indicate the degree to which the action alternative might have modified historical harvests at the time including whether a stock that was not constraining may have become so under the action alternative.

Setting aside the question of whether the stock was or would be constraining, an upper bound on the potential degree of harvest reduction in ocean fisheries is indicated first by a general comparison of the status quo and alternative harvest policies, and second by using additional results from the STT modeling of the probability of a stock achieving rebuilt status under alternative management strategies (see section 4.5). Specifically, the additional results used are the average reductions in exploitation rates derived from 10,000 replicate simulations of 10-year management cycles under each alternative strategy. Differences in average exploitation rates between the alternative simulations are used as an indicator of the magnitude of the difference in socio-economic impact, and a proportional relationship between the two is assumed (e.g., if exploitation rates are reduced by 10 percent then economic activity associated with salmon fishing will be reduced by 10 percent). The assumption of a proportional relationship is used because it is not possible to predict *a priori* how the Council might shape a particular season given the status of each stock it is managing. Each year the Council engages in an extensive public process in which it shapes seasons to optimize harvest by addressing allocation issues among various harvesting sectors and geographic areas while ensuring that the preseason expectation is that escapement objectives are met for all stocks. In particular, the Council generally optimizes fishing opportunity by shaping season structures to avoid constraining stocks. Because of this flexibility to use season shaping to mitigate negative impacts, estimates of changes in impacts based solely on proportional differences in exploitation rates should be considered as upper bounds (i.e., the degree of reduction is not likely to be as great as indicated here especially if it is unlikely that the stock will be a constraint on shaping the salmon seasons).

These average proportional changes in exploitation rates are then applied to an average annual personal income impact associated with the fishery (an economic benchmark) to provide an indicator of the change in overall economic activity derived from non-tribal commercial and recreational ocean salmon fisheries each year under a given alternative. These average annual impacts are then multiplied by the projected median number of years to rebuild under the alternative to generate an estimate of the economic effect over the entire rebuilding period.<sup>4</sup>

Personal income impacts in this case are the personal income generated as a result of direct expenditures related to fishing (recreational and commercial), processing, and support industry activities. These include personal income earned directly by those participating in fishing and processing activities (including charter vessels providing recreational trips), personal income earned by those employed in businesses that supply and service commercial fishing, recreational fishing and processing support activities (e.g., fuel and bait suppliers, mechanics, and truck drivers; also called indirect income), and the personal income generated by other businesses when those with direct and indirect income spend their money in the community (e.g., grocery stores and restaurants). On the one hand, when fishing activity is reduced, personal income impacts may not be reduced proportionally because affected individuals may increase their activity in other fisheries or take up substitute economic activity in the same community. On the other hand, with respect to alternative fishing activity a recent study indicates that substitution may be minimal and there can be short and long term effects that result in impacts that are more than proportional to the

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<sup>4</sup> The analytical approach here is basically a quantitatively informed qualitative analysis. In an approach that was able to provide a more precise quantitative estimate of the expected annual changes in impacts, discount rates would be applied to the stream of expected changes.

reduction in the salmon fishery. For example, with respect to vessels that remained active during a closure, there was only limited evidence that more diversified vessels made up for their reduced salmon fishing with increased activity elsewhere (Richerson and Holland, 2017). Furthermore, vessels that are more dependent on salmon are likely to cease all fishing activity during a salmon closure rather than increase activity in other fisheries, and a portion of those will exit the fishery permanently (*Ibid.*). Even if other vessels take up the slack as opportunity returns those vessels may be located in different ports (or some local infrastructure may have disappeared), causing geographic redistributions. Additional information on the modeling and interpretation of personal income impacts (also termed community income impacts) is provided in Chapter IV of the Review of 2017 Ocean Salmon Fisheries (PFMC 2018).

It is important to recognize, that despite similarity in terminology, personal income impacts differ from the impacts of an alternative. Personal income impacts are the income associated with a particular activity, while the impacts of an alternative are the changes from status quo that occur as a result of implementing a new policy (i.e., an action alternative). For example, suppose that the personal income impacts associated with fishing under status quo are \$10 million and those under an action alternative \$9 million. Therefore the potential impact of the action alternative, as represented by the reduction or redistribution of personal income compared with status quo, would be \$1 million.

Domestic ocean fisheries impacting the coho stock covered by this rebuilding plan occur mainly in Washington state and north of Cape Falcon, Oregon. These include ocean commercial and recreational fisheries. In addition, when a coho stock constrains ocean fisheries there may be increases in inside fishing opportunity. The focus of this analysis is impacts on ocean fisheries and related economic activity. Therefore for the economic benchmark, personal income impacts for port areas in Oregon and Washington north of Cape Falcon during 2004 to 2016 are used. There are currently five salmon rebuilding plans in development that are using the same 2004-2016 range of years for the economic analysis, including for two other Washington coho stocks and two California Chinook stocks. The year 2016 was selected for the last year of the period because it was the most recent year for which data were available when the analytical models were developed. Years prior to 2004 are not included because quality of the coho data in those years was not as strong as the more recent years, and a desire to maintain consistency across rebuilding plans. There are not strong reasons to deviate from using this same period of years across all five rebuilding plans, and this consistency is expected to simplify review and comprehension of the analyses for both decision makers and the public. These years span recent history and describe a range of escapement and harvest levels that could reasonably be expected to occur in future years, although due to ocean, climate, and other conditions, the actual distribution may tend more toward one end of this spectrum than the other, or exhibit increased variability.

Estimates of total coastal community personal income impacts during 2004-2016 in affected port areas north of Cape Falcon for the non-tribal commercial ocean troll salmon fishery averaged approximately \$3.4 million per year (in inflation-adjusted 2016 dollars), ranging from \$1.6 million in 2008 to \$5.6 million in 2015, and for the ocean recreational salmon fishery averaged approximately \$9.9 million, ranging from \$4 million in 2008 to \$16 million in 2014. Total community personal income impacts in affected areas from the combined non-tribal commercial troll and recreational salmon fisheries conducted in ocean areas averaged approximately \$13.3

million during 2004-2016, ranging from \$5.6 million in 2008 to \$21.3 million in 2014<sup>5</sup> (Figure 5.1.a and Table 5.1.a).

For the individual port areas, inflation-adjusted personal income impacts during the period from combined ocean non-tribal commercial troll and recreational salmon fisheries averaged approximately \$1.3 million in Neah Bay, ranging from \$0.4 million in 2008 to \$2.2 million in 2004; \$0.7 million in La Push, ranging from \$0.3 million in 2016 to \$1 million in 2015; \$6.7 million in Westport, ranging from \$3 million in 2008 to \$10.2 million in 2015; \$3.3 million in Ilwaco, ranging from \$1.2 million in 2008 to \$5.8 million in 2014; and \$1.5 million in Astoria, ranging from \$0.7 million in 2008 to \$3.1 million in 2014 (Figure 5.1.b and Table 5.1.a).

2008 was the lowest year for combined non-tribal ocean salmon fishery personal income impacts during the period overall and for three of the five affected port areas: Neah Bay, Westport and Ilwaco, while 2016 was the lowest year for La Push and Astoria. 2014 had the highest combined salmon fishery personal income impacts during the period overall and also for two port areas: Ilwaco and Astoria. The highest years for the remaining three port areas were 2004 for Neah Bay, and 2015 for both La Push and Westport (Figure 5.1.b and Table 5.1.a).

Although not included in these economic impact estimates, tribal commercial ocean troll salmon fisheries also occur and contribute economically to the coastal communities. In addition, Snohomish coho are also taken in commercial and tribal net fisheries and recreational fisheries in Puget Sound and its tributaries which also contribute economically to the coastal communities. During 2004-2016, commercial net harvests of adult Snohomish coho in the Puget Sound region averaged 36,253 fish, ranging from 1,419 fish in 2010 to 80,504<sup>6</sup> fish in 2004. Given that these fisheries do occur and contribute to coastal and Puget Sound communities, the economic benefit from affected salmon fisheries is likely higher and more widely distributed than reported in this document.

In summary, there are three elements to this analysis: primarily qualitative information on future conditions (related primarily to the likelihood that the stock will be a constraint and whether there will be any impact from an alternative harvest policy), a quantitative indicator of the economic magnitude of the fishery and how future conditions might change relative to a benchmark if the stock is constraining (effects of the action on personal income associated with the fishery), and qualitative caveats regarding the quantitative information (reasons the personal income impact estimates might be off in one direction or another). Information about how future conditions will change even in the absence of any action is taken into account in the cumulative impact section of

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<sup>5</sup> It is important to note that income impact estimates produced for years prior to the 2010 data year were derived using a different methodology than estimates for subsequent years. While strictly speaking, estimates produced using the two methodologies may not be directly comparable, for simplicity this limitation was overlooked for this analysis, since the change more or less equivalently affected both the commercial and recreational sectors and all port areas. A description of the transition to the current income impact methodology and comparisons of results from the earlier and current models are found in Appendix E of the Review of 2014 Ocean Salmon Fisheries (PFMC 2015).

<sup>6</sup> Puget Sound catch data from Review of 2018 Ocean Salmon Fisheries: Stock Assessment and Fishery Evaluation Document for the Pacific Coast Salmon Fishery Management Plan. Table B-42 (PFMC 2019).

this EA (see section 6.7), which take into consideration current trends as well as the impacts of reasonably foreseeable future actions.

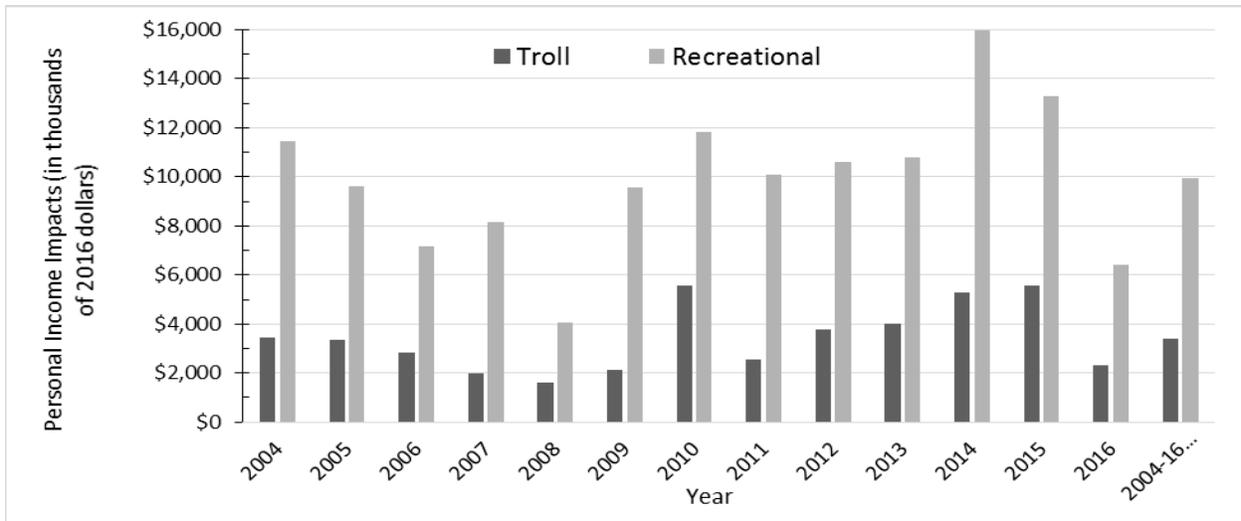


Figure 5.1.a. Estimates of total, aggregated personal income impacts in affected coastal communities in Washington and Oregon north of Cape Falcon in thousands of real (inflation adjusted, 2016) dollars for the non-tribal commercial ocean troll and ocean recreational salmon fisheries.

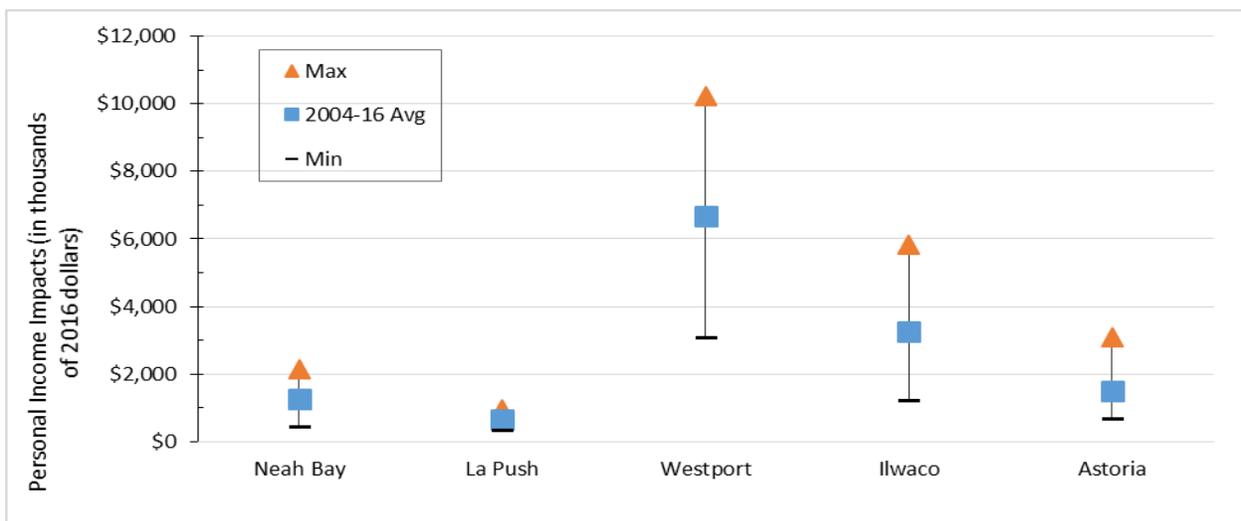


Figure 5.1.b. Estimates of personal income impacts by coastal community in thousands of real (inflation adjusted, 2016) dollars for the combined non-tribal commercial ocean troll and ocean recreational salmon fisheries in Washington and Oregon north of Cape Falcon.

Table 5.1.a. Estimates of personal income impacts by coastal community in thousands of real (inflation adjusted, 2016) dollars for the non-tribal commercial ocean troll and ocean recreational salmon fisheries for major Washington and Oregon port areas north of Cape Falcon.

<b>Ocean Troll</b>	<b>Neah Bay</b>	<b>La Push</b>	<b>Westport</b>	<b>Ilwaco</b>	<b>Astoria</b>	<b>Total</b>
2004	928	293	1,154	113	969	3,457
2005	761	454	1,170	144	803	3,333
2006	566	459	440	295	1,050	2,811
2007	250	254	1,038	129	310	1,981
2008	163	216	616	164	442	1,601
2009	331	342	1,192	83	180	2,128
2010	251	403	3,843	95	972	5,563
2011	575	228	1,407	96	244	2,551
2012	862	501	1,467	234	723	3,788
2013	485	448	2,674	74	354	4,035
2014	385	445	1,528	1,108	1,840	5,305
2015	315	641	3,021	420	1,171	5,568
2016	206	204	1,386	219	305	2,321
<b>2004-16 Avg</b>	<b>468</b>	<b>376</b>	<b>1,611</b>	<b>244</b>	<b>720</b>	<b>3,419</b>
<b>Max</b>	<b>928</b>	<b>641</b>	<b>3,843</b>	<b>1,108</b>	<b>1,840</b>	<b>5,568</b>
<b>Min</b>	<b>163</b>	<b>204</b>	<b>440</b>	<b>74</b>	<b>180</b>	<b>1,601</b>
<b>Recreational</b>	<b>Neah Bay</b>	<b>La Push</b>	<b>Westport</b>	<b>Ilwaco</b>	<b>Astoria</b>	<b>Total</b>
2004	1,228	260	5,332	3,494	1,151	11,465
2005	842	263	4,866	2,829	835	9,636
2006	552	231	3,593	2,200	600	7,176
2007	563	180	3,687	2,875	842	8,146
2008	244	108	2,425	1,024	242	4,043
2009	657	288	4,626	3,166	848	9,586
2010	777	332	6,312	3,422	976	11,819
2011	758	363	5,180	3,033	756	10,089
2012	944	343	5,848	2,853	606	10,594
2013	1,088	368	5,679	2,987	687	10,810
2014	1,190	484	8,315	4,731	1,242	15,962
2015	1,059	334	7,203	3,793	909	13,298
2016	595	112	2,746	2,604	352	6,410
<b>2004-16 Avg</b>	<b>807</b>	<b>282</b>	<b>5,062</b>	<b>3,001</b>	<b>773</b>	<b>9,926</b>
<b>Max</b>	<b>1,228</b>	<b>484</b>	<b>8,315</b>	<b>4,734</b>	<b>1,242</b>	<b>15,962</b>
<b>Min</b>	<b>244</b>	<b>108</b>	<b>2,425</b>	<b>1,024</b>	<b>242</b>	<b>4,043</b>
<b>Combined</b>	<b>Neah Bay</b>	<b>La Push</b>	<b>Westport</b>	<b>Ilwaco</b>	<b>Astoria</b>	<b>Total</b>
2004	2,156	553	6,486	3,607	2,120	14,922
2005	1,603	718	6,036	2,974	1,638	12,969
2006	1,118	690	4,033	2,495	1,649	9,986
2007	813	434	4,725	3,004	1,151	10,127
2008	407	324	3,041	1,189	683	5,644
2009	989	630	5,819	3,249	1,029	11,715
2010	1,028	735	10,155	3,517	1,948	17,382
2011	1,333	590	6,587	3,129	1,001	12,640
2012	1,806	845	7,315	3,087	1,329	14,382
2013	1,573	816	8,353	3,061	1,041	14,844
2014	1,576	928	9,842	5,839	3,082	21,268
2015	1,374	975	10,223	4,213	2,080	18,866
2016	800	316	4,132	2,824	658	8,730
<b>2004-16 Avg</b>	<b>1,275</b>	<b>658</b>	<b>6,673</b>	<b>3,245</b>	<b>1,493</b>	<b>13,344</b>
<b>Max</b>	<b>2,156</b>	<b>975</b>	<b>10,223</b>	<b>5,839</b>	<b>3,082</b>	<b>21,268</b>
<b>Min</b>	<b>407</b>	<b>316</b>	<b>3,041</b>	<b>1,189</b>	<b>658</b>	<b>5,644</b>

Income impact estimates from *Review of 2017 Ocean Salmon Fisheries: Stock Assessment and Fishery Evaluation Document for the Pacific Coast Salmon Fishery Management Plan*. Tables IV-17 and IV-18 (PFMC 2018).

## 5.2 Alternative I

Under Alternative I, the current management framework and reference points<sup>7</sup> used to set maximum allowable exploitation rates on an annual basis, would remain in place (i.e., status quo). Since Alternative I would not change harvest policy for Snohomish coho; there would be no direct or indirect economic impact relative to status quo and whether or not Snohomish coho is a constraining stock would not affect that result.

Under Alternative I, the estimated timeframe needed to achieve rebuilt status (with a probability of at least 50 percent) under status quo exploitation rates is 3 years (Figure 4.4.a and Table 4.4.a). Since harvest policy would not change, economic activity associated with Alternative I would not be expected to change from the baseline, and the general magnitude of that activity is reflected in the benchmark economic data provided in Section 5.1 (i.e., inflation-adjusted 2004-2016 average of \$13.34 million per year in income from combined non-tribal ocean commercial and recreational salmon fisheries in the affected coastal communities north of Cape Falcon). At the same time, note that actions under rebuilding plans for other salmon stocks may be associated with deviations from the baseline.

Not including differences in short term impacts (impacts during the rebuilding period), the long-term impacts of Alternative I are expected to be similar to the other alternatives in that all the alternatives are expected to achieve rebuilding in a relatively few number of years.

## 5.3 Alternative II

Under Alternative II, fishing with an exploitation rate that is on average approximately 1.1 percent reduced from status quo / Alternative I is estimated to result in rebuilding in 3 years, the same as under status quo / Alternative I. The comparative cost of this alternative is the reduced annual harvest opportunity (measured in dollars, here estimated with income impacts) times the number of years it takes to rebuild. Note that if rebuilding takes a longer or shorter period, the costs would be increased or reduced, respectively.

The current exploitation rate policy for Snohomish coho varies with ocean abundance forecasts as shown below:

Above 125,000 adults,	60%
Between 51,667 and 125,000 adults	40%
Below 51,667 adults,	20%

Additionally, there is a minimum escapement goal of 50,000 spawners. Alternative II would increase that escapement goal to 55,000 spawners. Applying the exploitation rate to abundance estimates provides a sense of the range of abundances over which the change in escapement floor would have an impact but does not take into account natural mortality that would further reduce expected spawning escapement. Figure 5.3.a shows that under current policy at an ocean abundance of 83,300 coho the exploitation rate of 40% would leave 50,000 spawners, therefore at

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<sup>7</sup> As defined in the FMP and the PST.

an abundance of 83,300 coho, harvest would have to be reduced below the 40% exploitation rate in order to achieve the 50,000 spawner escapement goal after natural mortality is taken into account. That would be true of somewhat higher abundances as well, up to the level at which a 40 percent exploitation rate would leave a number of coho sufficient to achieve the 50,000 spawner escapement goal after taking into account natural mortality. Under Alternative II, the minimum escapement goal would increase to 55,000 spawners and the ocean abundance necessary to meet that goal (before taking into account natural mortality) would be about 91,700 coho. Thus between Status Quo / Alternative I and Alternative II there is about a 10 percent difference in the ocean abundance at which the spawner escapement goal would be encountered (from an abundance of something above 91,700 adults compared to something above 83,300 adults, after natural mortality is taken into account).

The impact of the rebuilding policy in a particular year will depend first on the degree to which the new control rule constrains harvest in that year. As discussed in section 5.1, one indication of the likelihood that a stock will be a constraint is the degree to which it has been a constraint in the past. Because of the large number of considerations that affect the deliberations on each year's salmon season it is sometimes difficult to determine with certainty whether or not a given stock was a constraint in any particular year. However, historically, Snohomish coho appear to not have been a constraint on ocean fisheries. If this continues into the future, the socio-economic impacts of Alternative II would be minimal. Table 5.3.a. summarizes whether the three Washington coho stocks under rebuilding or other coho stocks of concern were constraining to ocean salmon fisheries north of Cape Falcon during the 2004-2019 seasons. The table shows that Snohomish coho were never the most constraining stock on ocean salmon fisheries north of Cape Falcon during the period. Of the three rebuilding coho stocks Queets River natural coho were constraining on ocean salmon fisheries north of Cape Falcon four years during the period: 2015-2018. Other natural coho stocks that were constraining on ocean salmon fisheries north of Cape Falcon include: Fraser River stocks during 11 of the 16 years (2004-2007 and 2009-2015), Lower Columbia River natural coho during four years (2006 and 2008-2010), Oregon coastal natural coho during one year (2008), and Grays Harbor coho during one year (2018). In the most recent year shown, 2019, fisheries north of Cape Falcon were shaped to minimize impacts on Puget Sound Chinook. Whether Snohomish coho is constraining in the future depends not only on the abundance of Snohomish coho but also the relative abundance of other stocks. While past patterns indicate minimal likelihood that Alternative II would result in a constraint on ocean fisheries, with changing conditions in the future it is possible that the frequency with which Snohomish coho is constraining will increase, making the estimates of changes in personal income impacts more relevant.

Comparing the Alternative II policy to actual expected escapements shows that there were only 2 years out of 13 in which escapement would have been below the 55,000 minimum goal such that Alternative II would have altered management. In those two years escapement would also have been below the current 50,000 minimum goal (2009 and 2016).

Thus based both on the history of constraining species for north of Cape Falcon fisheries and a hindcasts of the Alternative II policy (Alternative II escapement goal compared to actual preseason escapement projections) it appears that the frequency of years in which the Snohomish coho Alternative II would be constraining would be relatively low. However, future conditions may

change such that Snohomish coho becomes constraining and on that basis it is useful to compare the status quo and Alternative II policies and results from the modelling.

As mentioned, STT modeling of Alternative II predicts an exploitation rate that is on average 1.1 percent reduced from status quo / Alternative I. Assuming Snohomish coho are constraining for the years that the model predicts a reduction in the exploitation rate under Alternative II, and that there would be a comparable proportional reduction in the Ocean fisheries north of Cape Falcon in such years, the economic impact estimated for combined non-tribal commercial and recreational ocean fisheries in terms of associated personal income would be \$0.14 million per year, or 3 x - \$0.14 million = -\$0.432 million over the 3-year rebuilding period (in 2016 dollars). In a year in which Alternative II alters fishery management, the single year impacts would likely be higher than the 1.1 percent average reduction (which includes years of no impact). Since the rebuilding period is expected to be very short, the actual conditions are unlikely to reflect the average. As discussed in section 5.1, to the degree that this average result applies, impacts might be lower than indicated here if other economic activities are substituted for salmon fishing; higher if there is an amplification due to vessels dropping out of fishing entirely for the short or long term; or distributed differently if there is a shifting of activity as a result of season shaping or change in the location of harvesters and infrastructure over the long term. The amplification effect is probably more likely with a complete closure of the salmon fishery than under an open fishery with a reduced exploitation rate. There might also be offsetting gains in inside fisheries and escapement effects for other stocks that are not quantified here. Note that these impacts also do not include effects on tribal fisheries.

Not including differences in short term impacts (impacts during the rebuilding period), the long-term impacts of Alternative II are expected to be similar to Alternative I (no action) and the T<sub>MIN</sub> scenario in that rebuilding would be achieved in a relatively few number of years.

Table 5.3.a. Stocks that were most constraining to north of Cape Falcon ocean salmon fisheries at the time annual management measures were adopted (from each year's Preseason Report III – available at [www.pcouncil.org](http://www.pcouncil.org))

Year	Most Constraining Stock(s)	Graphic depiction of which coho stocks were most constraining (Red indicates constraining, Yellow indicates depressed but not constraining)							
		Queets R.	JDF <sup>1/</sup>	Snohomish R.	Fraser R.	LCN <sup>2/</sup>	OCN <sup>3/</sup>	GH <sup>4/</sup>	Other
2004	Fraser				Red				
2005	Fraser				Red				
2006	Fraser and LCN				Red	Red			
2007	Fraser				Red				
2008	LCN and OCN					Red	Red		
2009	Fraser and LCN				Red	Red			
2010	Fraser and LCN				Red	Red			
2011	Fraser				Red				
2012	Fraser				Red				
2013	Fraser				Red				
2014	Fraser				Red				
2015	Fraser and Queets	Red			Red				
2016	Queets	Red			Yellow				
2017	Queets	Red			Yellow				
2018	Queets and Grays Harbor	Red			Yellow			Red	

Year	Most Constraining Stock(s)	Graphic depiction of which coho stocks were most constraining (Red indicates constraining, Yellow indicates depressed but not constraining)							
		Queets R.	JDF <sup>1/</sup>	Snohomish R.	Fraser R.	LCN <sup>2/</sup>	OCN <sup>3/</sup>	GH <sup>4/</sup>	Other
2019	PS Chinook <sup>5</sup>								
16 yrs.	No. of years constraining:	4	-	-	11	4	1	1	1

1/ Strait of Juan de Fuca coho

2/ Lower Columbia River natural coho

3/ Oregon coastal natural coho

4/ Grays Harbor coho

5/ In 2019 fisheries north of Cape Falcon were shaped to minimize impacts on Puget Sound Chinook

Table 5.3.b Snohomish coho historical preseason escapement and exploitation rate projections, relevant management criteria and comparison with Alternative II policy (thousands of fish and percentages).

	Preseason Estimates				Historic Standard		Current Policy	Alt II
	Ocean Spawner Abundance	Exploitation Rate (ER)	Council Area Fisheries ER	Escapement	ER( $\leq$ )	Spawners( $\geq$ )	Spawners( $\geq$ )	Spawners( $\geq$ )
2004	192.1	35.0%	6.7%	126.2	60.0%	70.0	50.0	55.0
2005	241.6	40.0%	5.3%	147.6	60.0%	70.0	50.0	55.0
2006	139.5	39.0%	4.2%	86.1	60.0%	70.0	50.0	55.0
2007	98.9	39.0%	4.9%	60.7	40.0%	70.0	50.0	55.0
2008	92.0	34.4%	1.9%	71.1	40.0%	70.0	50.0	55.0
2009	67.0	26.4%	3.8%	49.5	40.0%	70.0	50.0	55.0
2010	99.4	32.4%	3.4%	67.5	40.0%	70.0	50.0	55.0
2011	180.0	25.8%	2.6%	133.9	60.0%		50.0	55.0
2012	109.0	28.4%	3.2%	78.2	40.0%		50.0	55.0
2013	163.8	25.1%	2.9%	123.0	60.0%		50.0	55.0
2014	150.0	30.0%	3.3%	104.8	60.0%		50.0	55.0
2015	151.5	32.7%	2.7%	102.4	60.0%		50.0	55.0
2016	20.6	7.0%	0.6%	15.7	20.0%		50.0	55.0

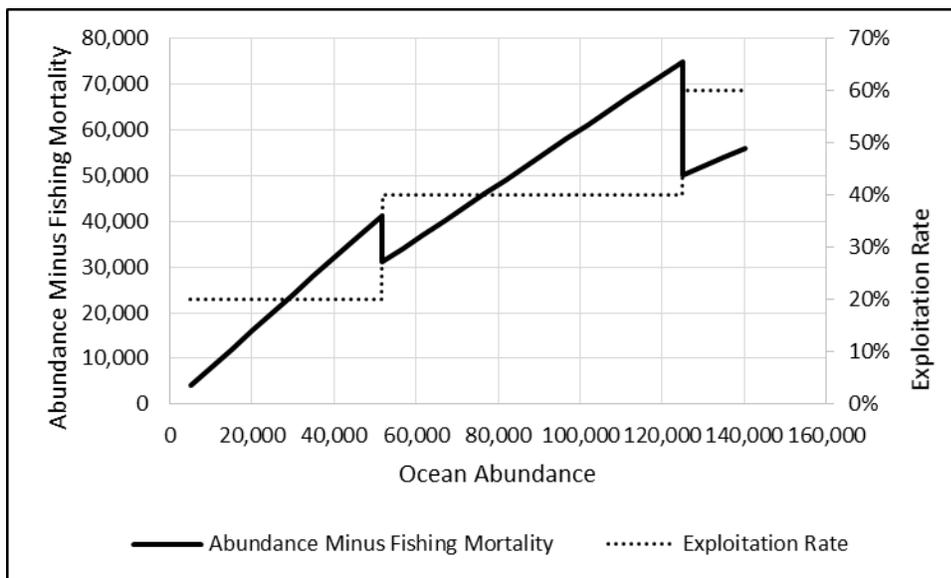


Figure 5.3.a. Relation between Snohomish ocean abundance, exploitation rate policy and escapement before taking into account natural mortality (i.e. ocean abundance minus fishing mortality).

#### 5.4 T<sub>MIN</sub> rebuilding scenario

Under the T<sub>MIN</sub> rebuilding scenario, rebuilding is estimated to occur as quickly as possible; three years assuming an exploitation rate of zero during that time. Under T<sub>MIN</sub> there would be no fishing and therefore Snohomish coho would be constraining (although it might be constraining in conjunction with Queets and JDF coho if the T<sub>MIN</sub> scenario were applied to those stocks simultaneously). The 3-year rebuilding period is the same amount of time as under Alternative I and Alternative II with at least a 50 percent probability of rebuilding during the period. Compared with the ‘no action’ or status quo management strategy of Alternative I, under the T<sub>MIN</sub> scenario the estimated upper-bound economic impact in terms of reduction in non-tribal commercial and recreational fisheries income impacts is \$13.34 million per year, or 3 x -\$13.34 million = -\$40.03 million (in 2016 dollars) over the 3-year rebuilding period. As discussed in section 5.1, impacts might be lower than this if other economic activities were substituted for salmon fishing;<sup>8</sup> higher if there is an amplification due to vessels dropping entirely out of fishing for the short or long term, or distributed differently if there is a geographic shifting of activity as a result of season shaping or changes in the location of harvesters and infrastructure over the long term. The amplification effect may be more likely with a complete closure of the salmon fishery under the T<sub>MIN</sub> scenario. There might also be offsetting gains in inside fisheries and possible escapement benefits for other stocks that are not quantified here (depending on spawner-recruit relationships, increased escapement that results in increased spawning might positively or negatively impact long-term production). Also note that these estimates do not include effects on tribal fisheries.

There is some chance that rebuilding could occur before or later than the median three years required under T<sub>MIN</sub>, thereby reducing or increasing total short term economic impacts, respectively.

Not including differences in short term impacts (impacts during the rebuilding period), the long-term impacts of the T<sub>MIN</sub> scenario are expected to be similar to Alternative I (no action) and Alternative II in that rebuilding would be achieved in a relatively few number of years.

#### 5.5 Summary of socio-economic impacts

Table 5.5.a summarizes the short-term economic trade-offs, assuming at least a 50 percent probability of rebuilding for each alternative or scenario. If rebuilding occurs more quickly (i.e., if a lower probability time to rebuilding occurs) then the impacts would be less than indicated, and if rebuilding occurs more slowly than the impacts would be greater than indicated (see the last two lines of the table). In years that Snohomish coho is not constraining, there may be no differences between Alternative I and Alternative II. Due to the difficulty of plausibly modelling multiple stocks over time, the modeling used to derive the average reductions did not take into account whether the stock would be constraining or not, possibly resulting in an over-estimate of the average reduction in exploitation rate under Alternative II. Also, since the average reductions in exploitation rate were calculated across 10,000 replicate simulations of 10-year management cycles while the rebuilding periods are predicted to be relatively short, the actual conditions

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<sup>8</sup> Recent studies have pointed to the difficulty vessels have exhibited in compensating for lost salmon opportunities by increasing activity in other West Coast fisheries, even for vessels with history of participation in those fisheries. Thus, substitute activities might tend to be non-fishing. See, e.g., Richerson, K., and Holland, D. S. 2017. Quantifying and predicting responses to a US West Coast salmon fishery closure. – ICES Journal of Marine Science, doi:10.1093/icesjms/fsx093.

encountered during the brief rebuilding period are likely to vary substantially from the modeled average. This could lead to impacts that are substantially above or below the average. These and other assumptions and caveats together with their implications are covered in Table 5.5.b.

Table 5.5.a. Summary of economic impacts of the Snohomish coho rebuilding alternatives.

	<b>Alt I</b>	<b>Alt II</b>	<b>T<sub>MIN</sub> Scenario</b>
Key Assumptions	Snohomish Coho would constrain fisheries in the North of Falcon Area  North of Falcon Fisheries would be reduced in proportion to the reduction in the exploitation rate under each alternative.		
<u>Frequency of Snohomish Coho Constraint</u>			
Preseason: 2004-2019	0 of 16 Years		
Alternative Hindcast for 2004-2016, (Relative to projected exploitation rates)	0 of 13 Yrs	2 of 13 Yrs	13 of 13 yrs (possibly co-constraining if other rebuilding coho stock are managed under the T <sub>MIN</sub> Scenario)
Rebuilding Time Based on a 50% Rebuilding Probability Threshold	3 Years	3 Years	3 Years
Rebuilding Probability for Rebuilding Time	60%	62%	78%
Reduction in Mean Exploitation Rate	0%	1.1%	100%
West Coast Ocean Area Fishery Economic Impacts Per Year	None	-\$0.14 million per year	-\$13.34 million per year
West Coast Ocean Area Fishery Total Impacts	None over 3 yrs	-0.43 million over 3 yrs	-\$40.03 million over 3 yrs
Probability of Rebuilding in One or Two Years	22%	23%	39%
Probability of Rebuilding Taking 6 or More Years	16%	16%	6%

Table 5.5.b. Assumptions/caveats used in the analysis and potential implications.

<b>Assumption/Caveats</b>	<b>Potential Implication</b>
Snohomish Coho will be constraining.	Snohomish coho are not usually the most constraining stock in the north of Cape Falcon area. To the degree that they would not be constraining for years in which there is a difference between Alternative I and Alternative II, there would not be a cost associated with Alternative II, relative to Alternative I. Queets coho would always be constraining under the T <sub>MIN</sub> Scenario.
Ocean, habitat, and other conditions will remain within historic ranges.	To the degree that environmental conditions change in coming years, Snohomish coho may become constraining (depending on the impact of those conditions on Snohomish coho relative to other stocks) or have shorter or longer rebuilding time frames with correspondingly lower or higher economic impacts.

Table 5.5.b. Assumptions/caveats used in the analysis and potential implications (continued)	
Assumption/Caveats	Potential Implication
Ocean fishing is reduced for all sectors and ocean areas north of Cape Falcon in proportion to the average reduction in exploitation rates.	The Council shapes seasons to mitigate impacts of reductions in exploitation rates. Therefore, for Alternative II actual impacts are likely to be lower than indicated here, although single year reductions in exploitation rates in certain areas may be substantially greater than the average. Given the short duration of the rebuilding periods, impacts are likely to vary substantially from the average (higher or lower), which was estimated based on 10,000 model runs.
Rebuilding times will be equal to the median.	There are reasonably large probabilities that rebuilding times are shorter or longer than the median time, and that the attendant socio-economic impacts will therefore be less or greater than indicated (see last two lines of the above table).
Tribal fishery impacts not included.	There would likely be both social and economic impacts from the disruption of Native American tribal fisheries, which are not quantitatively assessed.
Impacts to inside fisheries are not included	To the degree that ocean fisheries are constrained there may be increased activity in inside fisheries.
Impacts to abundance of other stocks are not included	Achieving escapement objectives for Snohomish coho could lead to more escapement for other stocks, which may have positive or negative impacts, depending on the spawner-recruit relationships for those stocks.
Substitute economic activities are not taken into account in personal income impact estimates.	Economic impacts may be overestimated to the degree that substitute economic activity is available. Recent studies indicate that alternative fishing activities are often not pursued to a significant degree, therefore if there are substitute activities they would likely be non-fishing related.
The possibility of amplification and geographic redistribution are not taken into account in personal income impact estimates. <sup>a/</sup>	Particularly during a complete closures, some vessels will completely stop fishing, thereby reducing overall activity more than proportionally to the reduction in salmon fishing. This reduction may continue to some degree even after the fishery reopens. Geographic redistribution due to season shaping or, during a closure, loss of vessels or infrastructure could result in greater impacts to some ports than others.

a/ A recent study (Richerson and Holland,2017) also indicates that impacts may be amplified and duration of impacts lengthened if vessels leave the fishery.”

## 6.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS OF MANAGEMENT STRATEGY ALTERNATIVES CONSIDERED

### 6.1 Introduction

This chapter will analyze the environmental impacts of the alternatives on the resources that would be more than minimally affected by the proposed action. This is a required component to adopt this integrated document as an environmental assessment under NEPA. The Proposed Action will have no impact on fish and fisheries other than salmon. In addition to targeted salmon stocks, the Proposed Action may have impacts on marine mammals, ESA-listed salmon stocks, cultural resources, and environmental justice, which are discussed in the following subsections. Several resources included in the Affected Environment are not analyzed in detail in this chapter, because they would not be more than minimally affected by the proposed action and differences among effects of the alternatives are insubstantial. These resources, and the effects of this action on them, are described below:

- Non-target fish species – Fisheries for halibut, coastal pelagic, groundfish, albacore, and invertebrates are all managed separately from salmon fisheries. Species targeted by these fisheries are rarely, if ever, encountered in the salmon fishery. Effort shift among fisheries occurs, but is driven by factors that are largely unrelated to the proposed action, e.g. market forces. Overfished species of groundfish are generally not contacted in the ocean salmon fishery, thus are not expected to be affected by this action. Therefore, we do not expect the proposed action to have more than minimal impacts on non-target fish species.
- Seabirds – Some seabirds prey on juvenile salmon, thus salmon fisheries have the potential to reduce prey available to seabirds by removing adult salmon that could otherwise spawn and produce additional juveniles. Council-area salmon fisheries are managed to meet spawning escapement and exploitation rate goals for adult salmon. It is unlikely that the proposed action would have more than a minimal, if any, effect on the availability of juvenile salmon for seabirds, as environmental effects likely limit juvenile abundance more than the proposed action.
- Ocean and coastal habitats and ecosystem function – Salmon fisheries do not disturb bottom habitat; therefore, the proposed action would not have any effect on the physical environment. The removal of adult salmon by the ocean fisheries is not considered to significantly affect the lower trophic levels or the overall marine ecosystem because salmon are not the only or primary predator in the marine environment (NMFS 2003; Appendix B). Spawning escapement goals (i.e.,  $S_{MSY}$  and MSST) for Snohomish coho are set in the FMP. Under the preferred alternative, the co-managers will manage for a buffered escapement goal of ten percent over  $S_{MSY}$  (listed in Table 3-1 of the FMP) until rebuilt status is achieved (see section 4.2, above); however, the estimated time to rebuild this stock is three years under either of the two alternatives. Therefore, in addition to having no impact on the physical habitat, the Proposed Action is not expected to impact marine nutrient transport beyond a minimal and temporary amount. Therefore, no significant impacts are expected on biodiversity or ecosystem function from the Alternatives analyzed in this EA.

The action area for the proposed action is the exclusive economic zone (EEZ), from three to 200 miles offshore of the coasts of Washington and Oregon, from the U.S./Canada border to Cape Falcon, Oregon. In this document, the action area and the analysis area are largely synonymous,

exceptions are noted below. The analysis area extends beyond the action area to include state waters, ports in these states that receive landings from these ocean salmon fisheries, communities and tribes that engage in fishing in state waters, and rivers that salmon use to migrate towards their spawning grounds (e.g., the Snohomish River Basin) in our analyses for economics (Chapter 5, above), cultural resources, and environmental justice.

The STT's recommendations to the Council are presented in Chapter 4 of this integrated document. These recommendations include actions that are required under the FMP, but which fall outside the scope of an MSA rebuilding plan and, therefore, are not part of NMFS' required action to approve a rebuilding plan under the MSA. Section 4.2 presents the alternatives considered by the Council for the MSA rebuilding plan to be recommended to NMFS for approval by the Secretary of Commerce (Secretary). Therefore, the analyses in this chapter are limited to the environmental impacts of the alternatives in section 4.2 only. Other recommendations may be acted upon at the Council's discretion, but are not considered part of the MSA rebuilding plan for Snohomish natural coho and will not be included in the approval decision by the Secretary.

## **6.2 Targeted salmon stocks**

### *6.2.1 Affected environment*

Ocean salmon fisheries in the analysis area, north of Cape Falcon, primarily target Chinook and coho salmon.

The Council manages several stocks of Chinook and coho salmon under the FMP (PFMC 2016). In the ocean, stocks of salmon comingle which results in mixed-stock fisheries. Non-target stocks, including ESA-listed stocks, will be encountered in mixed-stock fisheries. The Council's Salmon Technical Team (STT) models the degree to which target and non-target stocks are impacted by proposed fisheries, and the Council uses tools such as harvest restrictions, time and area closures, and mark-selective fisheries to limit impacts to non-target stocks (PFMC and NMFS 2017).

In the analysis area, the primary management tools are time and area closures, recreational bag limits, quotas, and mark-selective fisheries that target hatchery fish. The primary salmon stocks targeted in the analysis area are: Lower Columbia River hatchery fall-run Chinook salmon, Columbia River Spring Creek Hatchery fall-run Chinook salmon, and Columbia River late hatchery coho stocks. Coastal coho stocks also contribute to fisheries in the analysis area, but individual stock contributions are minor. Fisheries in the analysis area are managed to meet FMP conservation objectives for these stocks, and to comply with ESA consultation requirements for any ESA-listed salmon stocks that are affected by salmon fisheries in the analysis area.

Detailed information on spawning escapement and fisheries impacts on salmon stocks are reported in the Council's annual Stock Assessment and Fishery Evaluation (SAFE) document, known as the Annual Review of Ocean Salmon Fisheries. These documents are available on the Council's website ([www.pcouncil.org/salmon/stock-assessment-and-fishery-evaluation-safe-documents/](http://www.pcouncil.org/salmon/stock-assessment-and-fishery-evaluation-safe-documents/)).

### *6.2.2 Environmental Consequences of Alternatives on Target Salmon Stocks*

Impacts to targeted salmon stocks are limited by reference points in the FMP, including conservation objectives, MSST, MFMT, and annual catch limits (ACLs). Council area fisheries

north of Cape Falcon, Oregon, are managed under species-specific quotas for Chinook and coho salmon. Quotas and annual management measures are set preseason to meet these reference points for all targeted stocks.

*Alternative I (Status Quo)* – The Status Quo alternative is the NEPA No-action Alternative. Under this alternative, the Council would continue to manage fisheries according to the abundance-based stepped harvest rates of the PST management regime and the related SDC that have been in effect since they were implemented under FMP Amendment 16 in 2012 (see section 2.4.1, above; see also table 3-1 and figure 3-3 in the FMP (PFMC 2016)). Table 3.3.1.a in this EA shows coho harvests in ocean salmon fisheries for years 2014 through 2018. Table 2.0.a. shows Snohomish coho spawning escapement for years 2000 through 2017, which is highly variable from year to year. Under Alternative I, the environmental consequences on target salmon stocks from Council-area fisheries in the analysis area would be similar to what has occurred since 2012.

*Alternative II (S<sub>MSY</sub> Buffer)* – Under Alternative II, state and tribal co-managers will buffer escapement goals for Snohomish natural coho by ten percent over the S<sub>MSY</sub> specified in the FMP. This escapement, and the total exploitation rate on Snohomish natural coho, will be affected by ocean and inside fisheries. Table 4.4.a. in this EA shows that Alternative II is likely to result in rebuilding Snohomish natural coho in three years, the same as under Alternative I.

NMFS understands that there is a level of uncertainty around environmental conditions that could affect T<sub>target</sub> under any alternative. In section 3.5, we describe that poor ocean conditions led to poor marine survival and reduced fecundity for Snohomish natural coho for the period 2014-2016. Therefore, although the modeling indicates we would expect Snohomish natural coho to be rebuilt somewhat greater escapement under Alternative II, and rebuilding three years under both alternatives, environmental factors could negate those expectations. Irrespective of that uncertainty, table 4.4.a in this document shows an 80 percent, or better, probability that under either of the two alternatives, the Snohomish natural coho stock would be rebuilt by year five.

## **6.3 Marine mammals**

### *6.3.1 Affected environment*

A number of non-ESA-listed marine mammal species occur in the analysis area. The non-ESA-listed marine mammal species that are known to interact with ocean salmon fisheries are California sea lion (*Zalophus californianus*) and harbor seals (*Phoca vitulina*), both species will feed on salmon, when available, and have been documented preying on hooked salmon in commercial and recreational fisheries (e.g., Weise and Harvey 1999). Other pinnipeds, including Steller sea lions (*Eumetopias jubatus*), also occur in the area and may also interact with the ocean salmon fisheries, but there is currently no available information on such interactions. All marine mammals are protected under the Marine Mammal Protection Act (MMPA). Ocean salmon fisheries employ hook-and-line “troll” gear and are classified under NMFS’ MMPA List of Fisheries as Category III (85 FR 21079, April 16, 2020), indicating there is no record of substantive impacts to marine mammals from these fisheries (MMPA 118(c)(1)). Of the ESA-listed marine mammals that occur in the analysis area, only Southern Resident killer whales (SRKW) (a distinct population segment (DPS) of *Orcinus orca*) are likely to be affected by salmon fisheries.

Salmon fisheries conducted under the FMP may directly affect SRKW through interactions with vessels and gear, and indirectly affect them by reducing prey availability. The Council is currently considering the effects of the FMP on SRKW through an ad hoc workgroup (SRKW workgroup). The SRKW Workgroup risk assessment report, presented at the Council's March 2020 meeting, provides the most current information on SRKW and their predator-prey interaction with Pacific salmon (the report can be found online at: <https://www.pcouncil.org/documents/2020/02/e-3-a-srkw-workgroup-report-1-electronic-only.pdf/>).

NMFS completed a consultation on the effects of implementing the Council's 2020 ocean salmon management measures on SRKW and their current and proposed critical habitat. The biological opinion, dated April 29, 2020, considered interactions with vessels and gear, and effects on prey availability. The biological opinion concluded that effects from the Council's 2020 salmon fisheries are not likely to jeopardize the continued existence of the SRKW DPS or destroy or adversely modify its designated critical or proposed habitat. The 2020 salmon fisheries were consistent with the Council's proposed rebuilding plan for Snohomish coho.

The SRKW workgroup is continuing to consider a long-term approach and may make further recommendations to the Council. NMFS intends to complete a multi-year biological opinion on the effects of implementing the FMP on SRKW. The annual management measures for Council salmon fisheries are developed to be consistent with all ESA biological opinions. In any year that the terms of the biological opinion for SRKW are more constraining on the fishery than the Snohomish coho rebuilding plan, the management measures for that year would be developed to be consistent with the SRKW biological opinion and consistent with the ESA.

### *6.3.2 Environmental consequences of the alternatives on marine mammals*

*Alternative I (Status Quo)* – Under the Status Quo alternative, impacts on marine mammals would be expected to be the same as they have been in recent years and not change the amount of salmon available as prey to marine mammals. Ocean salmon hook-and-line fisheries would continue to be Category III under the MMPA and the harvest of salmon in Council-managed fisheries would continue to be guided by the existing control rules and FMP reference points. Additionally, with respect to ESA-listed marine mammals, fisheries would be managed consistent with any requirements included in current or future biological opinions.

*Alternative II (S<sub>MSY</sub> Buffer)* – Under Alternative II, ocean salmon hook-and-line fisheries would continue to be Category III under the MMPA. Alternative II would have no impact on harvest of Chinook salmon in Council-managed salmon fisheries and would have limited impact on harvest of coho salmon in Council-managed salmon fisheries during rebuilding. Rebuilding time is estimated at three years, meaning the S<sub>MSY</sub> buffer would be in effect relatively briefly before reverting to the status quo; therefore, any effect on marine mammals would be short-term. Additionally, with respect to ESA-listed marine mammals, fisheries would be managed consistent with any requirements included in current or future biological opinions. Therefore, we would expect Alternative II to be similar to Alternative I in terms of impacts on marine mammals.

## 6.4 ESA listed salmon stocks

### 6.4.1 Affected environment

Several ESUs of Pacific salmon that are ESA-listed as threatened or endangered occur in the areas where Council-managed ocean salmon fisheries occur. As stated above, the only salmon species encountered regularly in fisheries in the action area are Chinook and coho salmon. ESA-listed Chinook and coho salmon ESUs that occur within the analysis area are listed in Table 6.4.1a.

Table 6.4.1.a. ESA-listed Chinook and coho salmon ESUs that occur within the analysis area.

ESA-listed ESUs	Status	Most recent citation
<b>Chinook (<i>Oncorhynchus tshawytscha</i>)</b>		
Snake River Fall-Run	Threatened	70 FR 37160 (June 28, 2005)
Snake River Spring/Summer-run	Threatened	70 FR 37160 (June 28, 2005)
Puget Sound	Threatened	70 FR 37160 (June 28, 2005)
Lower Columbia River	Threatened	70 FR 37160 (June 28, 2005)
Upper Willamette River	Threatened	70 FR 37160 (June 28, 2005)
Upper Columbia River Spring-run	Endangered	70 FR 37160 (June 28, 2005)
<b>Coho (<i>Oncorhynchus kisutch</i>)</b>		
Oregon Coastal	Threatened	70 FR 35755 (June 20, 2011)
Lower Columbia River	Threatened	70 FR 37160 (June 28, 2005)

NMFS has issued biological opinions on the impacts of Council-managed salmon fisheries on ESA-listed salmon. Based on those biological opinions, NMFS provides guidance to the Council during the preseason planning process for setting annual management measures for ocean salmon fisheries based on the coming year's abundance projections. This guidance addresses allowable impacts on ESA-listed salmon. The Council structures fisheries to not exceed those allowable impacts.

NMFS has previously consulted on the effects of Council-area salmon fisheries on the ESA-listed salmon ESUs in the analysis area, and has produced the biological opinions listed in Table 6.4.1.b.

Table 6.4.1.b. NMFS biological opinions regarding ESA-listed salmon ESUs likely to be affected by Council-area ocean salmon fisheries in the analysis area.

Date	Duration	Citation	Species Considered
March 8, 1996	Until reinitiated	NMFS 1996	Snake River spring/summer and fall Chinook (and sockeye)
April 28, 1999	Until reinitiated	NMFS 1999	Oregon Coast coho (S. Oregon/N. California Coast coho, and Central California Coast coho)
April 30, 2001	Until reinitiated	NMFS 2001	Upper Willamette Chinook, Upper Columbia River spring-run Chinook (Lake Ozette sockeye, Columbia River chum, and 10 steelhead ESUs)
April 30, 2004	Until reinitiated	NMFS 2004	Puget Sound Chinook
April 26, 2012	Until reinitiated	NMFS 2012	Lower Columbia River Chinook
April 9, 2015	Until reinitiated	NMFS 2015	Lower Columbia River coho

### 6.4.2 Environmental consequences of the alternatives on ESA-listed salmon stocks

Salmon fisheries in the analysis area are managed consistent with the requirements of the biological opinions listed in section 6.4.1. Each biological opinion contains an incidental take

statement that describes the amount of take anticipated, as well as reasonable and prudent measures or alternatives and terms and conditions to keep authorized take within the permitted amount. In the case of Council-area salmon fisheries, take is generally synonymous with impacts from mortality (either through hooking mortality or incidental harvest). Because salmon fisheries would be managed consistent with current and future biological opinion under any rebuilding plan alternative, there would be no expected difference among the alternatives in terms of impacts on ESA-listed salmon stocks.

## 6.5 Cultural resources

### 6.5.1 *Affected environment*

Salmon are of nutritional, cultural, and economic importance to Native American tribes living in the analysis area. Salmon are harvested by tribes in commercial fisheries and for ceremonial and subsistence purposes. Tribal ceremonial and subsistence uses pertain to fish that are caught non-commercially by members of Washington Coast and Puget Sound treaty tribes for purposes of maintaining cultural viability, providing a valuable food resource, among other traditional foods, in tribal ceremonies, and meeting the nutritional needs of tribal members.

Treaty trust responsibilities require NMFS and the Council to abide by Court orders in the *U.S. v. Washington (Puget Sound)* and *Hoh v. Baldrige (Washington coast)* cases, governing allocation and management of shared salmon resources. Annual negotiations establishing allocation among the tribes, non-Indian fishing sectors, and ocean and inside interests take place in the North of Falcon process.<sup>9</sup>

As described in section 6.2, Snohomish natural coho may be harvested in a variety of mixed-stock fisheries throughout the analysis area, including fisheries conducted by several tribes; however, terminal fisheries that impact Snohomish natural coho are co-managed by WDFW and the Tulalip Tribes (see section 3.3.1).

### 6.5.2 *Environmental consequences of the alternatives on cultural resources*

*Alternative I (Status Quo)* – Under the Status Quo alternative, impacts on cultural resources would be expected to be the same as in recent years, with inter-annual variability in abundance and negotiations in the North of Falcon process affecting the amount of Snohomish natural coho available for tribal harvest.

*Alternative II (Buffered  $S_{MSY}$ )* – Under Alternative II, the tribal and state co-managers will manage to a buffered escapement goal, ten percent above  $S_{MSY}$  and until rebuilt status is achieved and may adjust escapement thresholds and exploitation rate limits annually, as described in the FMP, to promote rebuilding of the stock while allowing limited fisheries to occur. Additionally, the tribal and state co-managers will plan inside fisheries during the North of Falcon preseason process that, when combined with PFMC fisheries, will meet these escapement and exploitation rate objectives. The co-managers may implement additional conservation measures, as necessary. Under this alternative, Snohomish natural coho are expected to rebuild in three years, which is the same as

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<sup>9</sup> See <https://wdfw.wa.gov/fishing/management/north-falcon> for information on the North of Falcon process.

under Alternative I, and, of available salmon species, only coho harvest would be affected. Therefore, Alternative II would be expected to have a small, but noticeable, adverse impact on cultural resources compared with Alternative I.

## **6.6 Environmental Justice**

### *6.6.1 Affected Environment*

NMFS must determine which impacts may be adverse under any alternative, and, if so, whether such impacts may be felt disproportionately by environmental justice (EJ) populations.

*Resources:* EJ populations may be adversely affected by an action's impacts to economics and cultural resources.

*EJ Populations:* Executive Order 12898 and the Council for Environmental Quality (CEQ) guidance on Environmental Justice under NEPA (CEQ 1997) identifies EJ populations as low income, minority, or those relying on subsistence fishing or farming including Indian tribes.

While Alternative II may result in adverse economic effects, NMFS cannot identify specific communities, by census block, which may be affected by reductions in commercial or recreational fishing. Commercial and recreational fishermen may capture fish, land fish, and reside in different geographic areas. In addition, NMFS cannot distinguish, based on available data, differences in impacts between EJ and reference populations. Economic models apply the overall harvest management framework to the overall area in order to determine effects of harvest reduction. Further dividing the projections to each county would result in a proportional distribution among the counties in that region. Therefore, if the study area includes EJ communities (based on low income or minority thresholds), NMFS cannot determine whether the economic effects of any alternative result in a disproportionate effect on low-income or minority communities.

The action alternative may disproportionately adversely affect cultural resources for the Tulalip Tribes, who have a federally protected right to the fishery resource in usual and accustomed places and who are a participating tribe in the North of Falcon process.

### *6.6.2 Environmental consequences of alternatives on environmental justice populations*

*Cultural Resources:* Alternative II would reduce fishing opportunities for the Tulalip Tribes during rebuilding. Given the cultural and religious importance of salmon to Indian tribes, and given that this importance is not paralleled among other populations that may be affected by the harvest, these negative effects would be disproportionate.

*Economic Resources:* All populations (tribes and non-tribes) would be adversely affected by Alternative II in years that fisheries are constrained to meet the escapement goal for Snohomish natural coho; "usually, constraints on fishery impacts to other stocks are more constraining than those on Snohomish natural coho" (see section 2.4.2 in this document). Given the short term nature of the rebuilding plan, the effects would not likely be disproportionate.

*Environmental Justice Determination:* Alternative II would result in a disproportionate adverse effect on the Tulalip Tribes as it pertains to cultural resources.

## 6.7 Cumulative impacts

This section describes the “impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions” (40 CFR 1508.7). Salmon are subject to multiple, diverse, and far-reaching effects in both freshwater and marine environments throughout their complex life cycle, while the Council, state, and tribal fisheries take place near the end of this life cycle. Therefore, the Council and NMFS must consider a wide range of cumulative effects in making a decision on this rebuilding plan.

### 6.7.1 *Past, Present, and Reasonably Foreseeable Future Actions*

A number of past, present, and reasonably foreseeable future actions affect Snohomish natural coho. This section does not identify the individual effects of each past action. CEQ’s Guidance on Consideration of Past Actions in Cumulative Effects Analysis (Connaughton 2005) allows agencies to “conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions.”

Noting the change in status of the Snohomish natural coho, the 2018 Report to Congress on the Status of U.S. Fisheries (NMFS 2019) states that, “Many of the stocks added to the overfishing and overfished list have been impacted by environmental factors or international harvest that the United States has limited ability to control” (NMFS 2019). Section 3.5 of this document, above, summarizes the factors that cumulatively led to a change in Snohomish natural coho status, noting that poor marine survival and reduced fecundity “had a compounding effect on the resource, resulting in both low escapement and low spawning potential for those adult salmon that did return.” Lower than forecast abundance also lead to post-season exploitation rates that were higher than forecast preseason.

The temporal scope encompasses past actions that occurred since the FMP was implemented in 1984. The temporal scope of reasonably foreseeable future actions encompasses all known Council, state, and tribal fishery management actions. The dynamic nature of fishery resource management makes it very difficult to predict future decisions or actions; substantive future decisions, such as the annual salmon management measures, will be analyzed in future NEPA documents. Therefore, we do not quantify a temporal scope for the selection of reasonably foreseeable future actions.

The effects of fishery management extend into the future and are unlikely to change until the management action is changed or new management actions are introduced. Therefore, we do not quantify a temporal scope for the effects of future actions but consider the cumulative effects that last beyond the end of the one- to two-year rebuilding period.

### Fishery Management Actions

The Council recommends management measures for ocean salmon fisheries annually based on stock forecasts and in accordance with conservation objectives set in the FMP and guidance provided by NMFS for managing impacts to ESA-listed stocks. The Council’s recommended management measures must also be consistent with any applicable rebuilding measures. The Council and NMFS use these management measures to continuously shape salmon fisheries impacts on salmon stocks using an intensive preseason and inseason process, as described in chapters 9 and 10 of the FMP (PFMC 2016). Snohomish natural coho have never constrained

Council-managed fisheries, although Puget Sound coho stocks collectively constrained ocean fisheries in 2016 and 2017.

The Council also manages other non-salmon fisheries for their impacts to salmon. For example, the groundfish fishery is subject to ESA-driven salmon bycatch guidelines. Fisheries outside of the Council's jurisdiction also affect salmon spawning escapement – the metric for evaluating salmon stock status. The Council considers impacts from fisheries managed by the states and treaty Indian tribes through the North of Falcon process and Columbia River fisheries managed under U.S. v. Oregon Agreement, as well as obligations for fisheries off Alaska and Canada under the Pacific Salmon Treaty (PFMC and NMFS 2017) in setting annual management measures for salmon. These intensive management processes will continue annually as a reasonably foreseeable future action and will ensure that constraining stocks are not overharvested, and that harvest of abundant stocks can be optimized and achieve the most overall benefit to the nation.

Concurrent with developing the Snohomish natural coho rebuilding plan, the Council also developed rebuilding plans for Strait of Juan de Fuca natural coho (JdF) and Queets natural coho, which were also determined to be overfished. The Council has recommended the Status Quo alternatives for these stocks, with  $T_{\text{target}} = 6$  years for JdF and 2 years for Queets coho.

#### Non-Fishing Related Actions

Because salmon spend part of their lifecycle in fresh water, they are vulnerable to a broad range of human activities (since humans spend most of their time on land) that affect the quantity and quality of these freshwater environments. These activities are generally well known and diverse. They include physical barriers to migration (such as dams and culverts), changes in water flow and temperature (often a secondary effect of dams or water diversion projects), hatchery management, and degradation of spawning environments (such as habitat modification, changes in water quality, quantity, and hydrology, as well as effects of land use changes, forestry, farming, infrastructure, and urban development).

Non-fishing activities in the marine environment (such as transportation, run-off, aquaculture, and energy development) can introduce chemical pollutants and sewage; and result in changes in water temperature, salinity, dissolved oxygen, and suspended sediment which poses a risk to the affected resources. Human-induced non-fishing activities tend to be localized in nearshore areas and marine project areas. When these activities co-occur, they are likely to work additively or synergistically to decrease habitat quality and may indirectly constrain the sustainability of the managed resources, non-target species, and protected resources. Decreased habitat suitability tends to reduce the tolerance of affected species to the impacts of fishing effort.

The following ongoing and pending actions may further confound the effects of the rebuilding alternatives:

- Climate effects, including changes in river flows and flow variability; stream temperature, sea surface temperature, ocean acidification, and other ocean conditions; and seasonal changes in temperature and precipitation, are affecting salmon. However, our ability to predict future impacts on a specific salmon stock stemming from climate effects remains uncertain. This uncertainty is confounded by the fact that salmon occupy different habitats

over their life cycle (tributary, mainstem river, estuary, and marine). Climate effects and subsequent natural adaptation may vary across each of these habitats. For example, early migration of juvenile fish in response to changing river conditions may adversely affect their survival during the marine stage (Crozier et. al 2019).

- During its development of the Snohomish natural coho rebuilding plan, the Council received information from NOAA scientists on the poor ocean conditions that affected the California Current Ecosystem and that contributed to poor marine survival of salmon (see section 3.2). Recently, NOAA scientists have identified a new anomaly, designated the Northeast Pacific Marine Heatwave of 2019. NOAA scientists will continue to monitor these conditions and provide fisheries managers and others with information on how the unusually warm conditions could affect the marine ecosystem and fish stocks.<sup>10</sup>

### 6.7.2 *Incremental Cumulative Effects*

The following terminology is used to define the incremental effect contributed by each alternative to cumulative impacts:

- Imperceptible: The added effect contributed by the alternative to the cumulative impact is so small that it is impossible or extremely difficult to detect.
- Noticeable: The added effect contributed by the alternative, while evident and observable, is relatively small in proportion to the cumulative impact.
- Substantial: The added effect contributed by the alternative is evident and observable and constitutes a large portion of the cumulative impact.

#### Biological Resources (target fish, marine mammals, and ESA-listed salmon)

The analysis area for biological resources is the same as the analysis area defined in Section 6.1. Considering past and present actions and environmental conditions, the Snohomish natural coho stock is currently in an overfished condition.

As noted in Section 3.5, fishing impacts have generally fallen below the allowable exploitation rate for Snohomish natural coho; however, in 2015 and 2017 the postseason total exploitation rate was higher than anticipated preseason due to a combination of forecast error and a delayed in-season reduction to the sport fisheries in terminal waters. Irrespective of fishing or the selected alternatives, when accounting for reasonably foreseeable future actions, coupled with environmental conditions and normal variations in abundance, the stock is expected to rebuild in three years.

Because the stock is expected to rebuild under any of the fishing alternatives, and the difference between the alternatives is negligible, the alternatives have an imperceptible incremental contribution to future cumulative effects.

While Alternative II may have a positive short-term effect (three years) on marine mammals (see Section 6.3.2), the alternatives would have an imperceptible incremental contribution to long-term

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<sup>10</sup> <https://www.fisheries.noaa.gov/feature-story/new-marine-heatwave-emerges-west-coast-resembles-blob>

effects on marine mammals or ESA-listed salmon stocks when accounting for all past, present, and reasonably foreseeable future actions in the analysis area.

### Economics

The analysis area for economic resources is the same as the analysis area defined in Section 5, i.e., the economically affected area (north of Cape Falcon, Oregon, to the U.S./Canada border).

As noted in Section 5, quantifying the change in the baseline from historic conditions (the net cumulative effect) is not practical because of the numerous factors that interact to determine future fishing conditions. These conditions are described in Sections 3 and 5 and include variable abundance of Snohomish natural coho, fishery closures, trends of other salmon stocks (constraining stocks), shifts to other fisheries, actual time to rebuild, rebuilding of other overfished coho stocks, and a Council season setting process during which various biological, economic, and social factors are balanced in shaping each season and determining fishing opportunities. Therefore, this cumulative effect section, like Section 5, will focus on the differences in the incremental cumulative impacts between the alternatives.

At the scale of the entire west coast, both alternatives have an imperceptible incremental contribution to cumulative economic effects because the projected rebuilding time under both alternatives is three years. As shown in table 3.3.4.a, Snohomish natural coho historically contribute little to Council-area fisheries, most of these fish are caught in terminal and preterminal fisheries (figure 6.7.1). Localized, short-term cumulative impacts (at the port, tribe, community, family, or individual levels) are difficult to project, as the fisheries north of Cape Falcon, the analysis area, are usually constrained by stocks other than Snohomish natural coho (see chapter 5). NMFS cannot predict these localized cumulative effects, which depend on other local and macroeconomic conditions as well as personal choices that fishermen and local businesses may make.

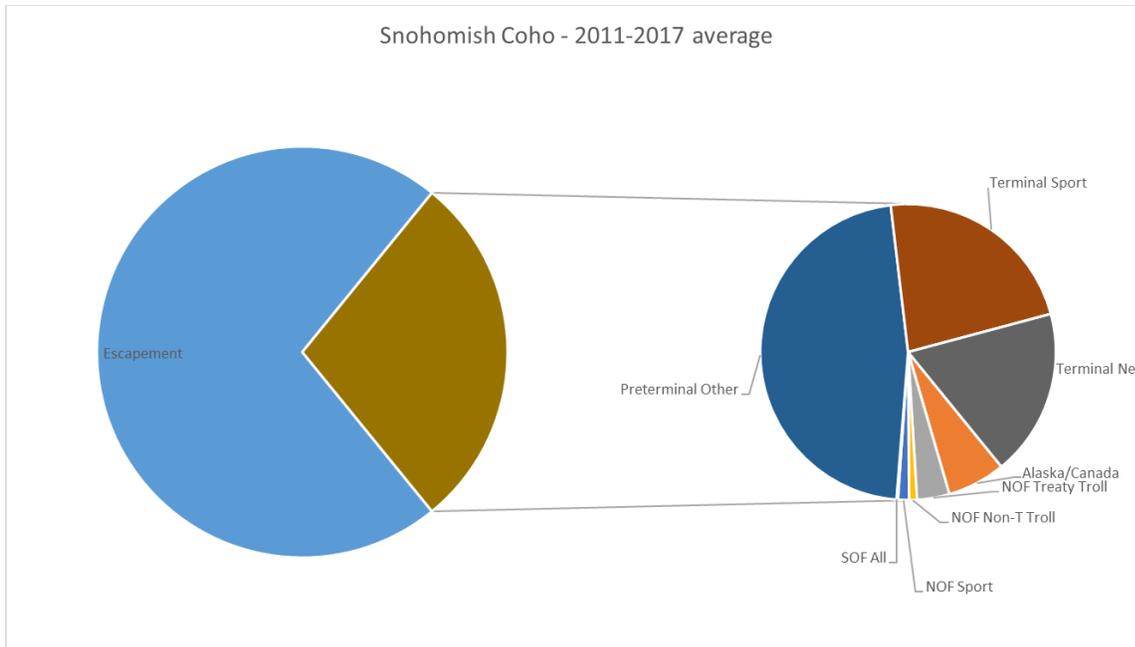


Figure 6.7.2. Snohomish natural coho contribution to escapement and various fisheries, 2011-2017 average, data from table 3.3.4.a. Council area fisheries are north of Cape Falcon (NOF) and south of Cape Falcon (SOF) only.

### Cultural Resources

Past, present, and reasonably foreseeable future actions that have adversely affected salmon stocks have also eroded an important cultural resource. The magnitude of this adverse cumulative effect cannot be quantified. Under both alternatives, the Snohomish natural coho stock is expected to rebuild in three years. Alternative I would have an imperceptible incremental contribution to this cumulative adverse effect on cultural resources. Alternative II, with a proposed buffered escapement goal, could result in a small, but noticeable contribution to the cumulative adverse effect by further constraining tribal fisheries in years that Snohomish natural coho abundance constrains fisheries.

### Environmental Justice

The expected effects of the alternatives on environmental justice communities, described in Section 6.6, found that Alternatives II would not result in a disproportionate adverse effect on Cultural Resources for Indian tribes during the rebuilding period. Given that cultural harvest over the rebuilding period will be largely dependent on salmon abundance, non-fishing related actions, or climate change, the alternatives would likely have an imperceptible contribution to cumulative adverse environmental justice effects.

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## APPENDIX A. STATUS DETERMINATION CRITERIA

The following is an excerpt from the Salmon Fishery Management Plan

### 3.1 STATUS DETERMINATION CRITERIA

*“Overfished. A stock or stock complex is considered “overfished” when its biomass has declined below a level that jeopardizes the capacity of the stock or stock complex to produce MSY on a continuing basis.”*

*NSIGs (600.310 (e)(2)(i)(E))*

In establishing criteria by which to determine the status of salmon stocks, the Council must consider the uncertainty and theoretical aspects of MSY as well as the complexity and variability unique to naturally producing salmon populations. These unique aspects include the interaction of a short-lived species with frequent, sometimes protracted, and often major variations in both the freshwater and marine environments. These variations may act in unison or in opposition to affect salmon productivity in both positive and negative ways. In addition, variations in natural populations may sometimes be difficult to measure due to masking by hatchery produced salmon.

#### 3.1.1 General Application to Salmon Fisheries

In establishing criteria from which to judge the conservation status of salmon stocks, the unique life history of salmon must be considered. Chinook, coho, and pink salmon are short-lived species (generally two to six years) that reproduce only once shortly before dying. Spawning escapements of coho and pink salmon are dominated by a single year-class and Chinook spawning escapements may be dominated by no more than one or two year-classes. The abundance of year-classes can fluctuate dramatically with combinations of natural and human-caused environmental variation. Therefore, it is not unusual for a healthy and relatively abundant salmon stock to produce occasional spawning escapements which, even with little or no fishing impacts, may be significantly below the long-term average associated with the production of MSY.

Numerous West Coast salmon stocks have suffered, and continue to suffer, from nonfishing activities that severely reduce natural survival by such actions as the elimination or degradation of freshwater spawning and rearing habitat. The consequence of this man-caused, habitat-based variation is twofold. First, these habitat changes increase large scale variations in stock productivity and associated stock abundances, which in turn complicate the overall determination of MSY and the specific assessment of whether a stock is producing at or below that level. Second, as the productivity of the freshwater habitat is diminished, the benefit of further reductions in fishing mortality to improve stock abundance decreases. Clearly, the failure of several stocks managed under this FMP to produce at an historical or consistent MSY level has little to do with current fishing impacts and often cannot be rectified with the cessation of all fishing.

To address the requirements of the MSA, the Council has established criteria based on biological reference points associated with MSY exploitation rate and MSY spawning escapement. The criteria are based on the unique life history of salmon and the large variations in annual stock abundance due to numerous environmental variables. They also take into account the uncertainty and imprecision surrounding the estimates of MSY, fishery impacts, and spawner escapements. In recognition of the unique salmon life history, the criteria differ somewhat from the general guidance in the NS1 Guidelines (§600.310).

### 3.1.4 Overfished

*“For a fishery that is overfished, any fishery management plan, amendment, or proposed regulations... for such fishery shall (A) specify a time period for ending overfishing and rebuilding the fishery that shall:(i) be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of the fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock within the marine ecosystem; and (ii) not exceed 10 years, except in cases where the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in which the United States participates dictate otherwise....”*

*Magnuson-Stevens Act, §304(e)(4)*

A stock will be considered overfished if the 3-year geometric mean of annual spawning escapements falls below the MSST, where MSST is generally defined as  $0.5 \cdot S_{MSY}$  or  $0.75 \cdot S_{MSY}$ , although there are some exceptions (Table 3-1). Overfished determinations will be made annually using the three most recently available postseason estimates of spawning escapement.

#### 3.1.4.1 Council Action

When the overfished status determination criteria set forth in this FMP have been triggered, the Council shall:

- 1) notify the NMFS NWR administrator of this situation;
- 2) notify pertinent management entities;
- 3) structure Council area fisheries to reduce the likelihood of the stock remaining overfished and to mitigate the effects on stock status;
- 4) direct the STT to propose a rebuilding plan for Council consideration within one year.

Upon formal notification from NMFS to the Council of the overfished status of a stock, a rebuilding plan must be developed and implemented within two years.

The STT’s proposed rebuilding plan shall include:

- 1) an evaluation of the roles of fishing, marine and freshwater survival in the overfished determination;
- 2) any modifications to the criteria set forth in section 3.1.6 below for determining when the stock has rebuilt,
- 3) recommendations for actions the Council could take to rebuild the stock to  $S_{MSY}$ , including modification of control rules if appropriate, and;
- 4) a specified rebuilding period.

In addition, the STT may consider and make recommendations to the Council or other management entities for reevaluating the current estimate of  $S_{MSY}$ , modifying methods used to forecast stock abundance or fishing impacts, improving sampling and monitoring programs, or changing hatchery practices.

Based on the results of the STT’s recommended rebuilding plan, the Council will adopt a rebuilding plan for recommendation to the Secretary. Adoption of a rebuilding plan will require implementation either through an FMP amendment or notice and comment rule-making process. Subject to Secretarial approval, the Council will implement the rebuilding plan with appropriate actions to ensure the stock is rebuilt in as short a time as possible based on the biology of the stock but not to exceed ten years, while taking into consideration the needs of the commercial,

recreational and tribal fishing interests and coastal communities. The existing control rules provide a default rebuilding plan that targets spawning escapement at or above MSY, provided sufficient recruits are available, and targets a rebuilding period of one generation (two years for pink salmon, three years for coho, and five years for Chinook). If sufficient recruits are not available to achieve spawning escapement at or above MSY in a particular year, the control rules provide for the potential use of *de minimis* exploitation rates that allow continued participation of fishing communities while minimizing risk of overfishing. However, the Council should consider the specific circumstances surrounding an overfished determination and ensure that the adopted rebuilding plan addresses all relevant issues.

Even if fishing is not the primary factor in the depression of the stock, the Council must act to limit the exploitation rate of fisheries within its jurisdiction so as not to limit rebuilding of the stock or fisheries. In cases where no action within Council authority can be identified which has a reasonable expectation of contributing to the rebuilding of the stock in question, the Council will identify the actions required by other entities to recover the depressed stock. Due to a lack of data for some stocks, environmental variation, economic and social impacts, and habitat losses or problems beyond the control or management authority of the Council, it is possible that rebuilding of depressed stocks in some cases could take much longer than ten years. The Council may change analytical or procedural methodologies to improve the accuracy of estimates for abundance, harvest impacts, and MSY escapement levels, and/or reduce ocean harvest impacts when it may be effective in stock recovery. For those causes beyond Council control or expertise, the Council may make recommendations to those entities which have the authority and expertise to change preseason prediction methodology, improve habitat, modify enhancement activities, and re-evaluate management and conservation objectives for potential modification through the appropriate Council process.

In addition to the STT assessment, the Council may direct its Habitat Committee (HC) to work with federal, state, local, and tribal habitat experts to review the status of the essential fish habitat affecting the overfished stock and, as appropriate, provide recommendations to the Council for restoration and enhancement measures within a suitable time frame. However, this action would be a priority only if the STT evaluation concluded that freshwater survival was a significant factor leading to the overfished determination. Upon review of the report from the HC, the Council will consider appropriate actions to promote any solutions to the identified habitat problems.

### **3.1.5 Not Overfished-Rebuilding**

After an overfished status determination has been triggered, once the stock's 3-year geometric mean of spawning escapement exceeds the MSST, but remains below  $S_{MSY}$ , or other identified rebuilding criteria, the stock status will be recognized as "not overfished-rebuilding". This status level requires no Council action, but rather is used to indicate that stock's status has improved from the overfished level but the stock has not yet rebuilt.

### **3.1.6 Rebuilt**

The default criterion for determining that an overfished stock is rebuilt is when the 3-year geometric mean spawning escapement exceeds  $S_{MSY}$ ; the Council may consider additional criteria for rebuilt status when developing a rebuilding plan and recommend such criteria, to be implemented subject to Secretarial approval.

Because abundance of salmon populations can be highly variable, it is possible for a stock to rebuild from an overfished condition to the default rebuilding criterion in as little as one year, before a proposed rebuilding plan could be brought before the Council.

In some cases it may be important to consider other factors in determining rebuilt status, such as population structure within the stock designation. The Council may also want to specify particular strategies or priorities to achieve rebuilding objectives. Specific objectives, priorities, and implementation strategies should be detailed in the rebuilding plan.

#### *3.1.6.1 Council Action*

When a stock is determined to be rebuilt, the Council shall:

- 1) notify the NMFS NWR administrator of its finding, and;
- 2) notify pertinent management entities.

#### **3.1.7 Changes or Additions to Status Determination Criteria**

Status determination criteria are defined in terms of quantifiable, biologically-based reference points, or population parameters, specifically,  $S_{MSY}$ ,  $MFMT (F_{MSY})$ , and  $MSST$ . These reference points are generally regarded as fixed quantities and are also the basis for the harvest control rules, which provide the operative guidance for the annual preseason planning process used to establish salmon fishing seasons that achieve OY and are used for status determinations as described above. Changes to how these status determination criteria are defined, such as  $MSST = 0.50 * S_{MSY}$ , must be made through a plan amendment. However, if a comprehensive technical review of the best scientific information available provides evidence that, in the view of the STT, SSC, and the Council, justifies a modification of the estimated values of these reference points, changes to the values may be made without a plan amendment. Insofar as possible, proposed reference point changes for natural stocks will only be reviewed and approved within the schedule established for salmon methodology reviews and completed at the November meeting prior to the year in which the proposed changes would be effective and apart from the preseason planning process. SDC reference points that may be changed without an FMP amendment include: reference point objectives for hatchery stocks upon the recommendation of the pertinent federal, state, and tribal management entities; and Federal court-ordered changes. All modifications would be documented through the salmon methodology review process, and/or the Council's preseason planning process.

## APPENDIX B. PUGET SOUND RECREATIONAL FISHERY REGULATIONS

### Puget Sound recreational fisheries

Provided below are descriptions of recreational fishing seasons for coho as planned preseason during the state-tribal North of Falcon process, for each of the Puget Sound marine areas during the 2014-15, 2015-16, and 2016-17 seasons (the period from July 1, 2014 through June 30, 2017). Recreational fisheries were implemented as planned preseason unless specified otherwise via footnotes in Table B.1.

#### Areas 5 and 6

In the Strait of Juan de Fuca, both Area 5 (Sekiu and Pillar Point) and Area 6 (East Juan de Fuca Strait) were open to mark-selective coho fishing during the summer of 2014 and 2015 from July 1-September 30. In Area 5 only, non-selective coho fishing was allowed from September 19-25 during 2014, and on the specific dates of September 12-14, 19-21, and 26-27 in 2015. Additionally, Area 5 was open during October 1-31 for mark-selective coho fishing in 2014 and for non-selective coho fishing in 2015. In Area 6, non-selective coho fishing was open in the month of October in both 2014 and 2015. During the winter and spring seasons, Area 5 was open for non-selective coho fishing from February 16 - April 10 in 2015, and from February 16 - April 30 in 2016. During the 2016-17 season, there were no fisheries allowing coho salmon retention in Areas 5 and 6.

#### Area 7

In Area 7 (San Juan Islands area north to Point Roberts), non-selective coho fishing was open from July 1-31 in both the 2014 and 2015 summer seasons. Additionally, mark-selective coho fishing was open from August 1 – October 31 in 2014, and from August 1 – September 30 in 2015. The month of October in 2015 was open to non-selective coho fishing in Area 7. During the winter-spring of 2014-15 and 2015-16, Area 7 was open for non-selective fishing from December 1 through April 30. However, during the 2016-17 season, there were no fisheries allowing coho salmon retention in Area 7.

#### Areas 8-1 and 8-2

In Area 8-1 (Deception Pass, Hope Island, and Skagit Bay) and Area 8-2 (Port Susan and Port Gardner), non-selective coho fishing was open from August 1 through April 30 during both the 2014-15 and 2015-16 seasons; otherwise these areas were closed to salmon fishing. During the 2016-17 season, there were no fisheries allowing coho salmon retention in Areas 8-1 and 8-2, with the exception of the Tulalip Bay terminal area in which non-selective coho fishing was allowed from September 10-25 on Saturdays and Sundays only.

#### Area 9

In Area 9 (Admiralty Inlet), non-selective coho fishing was open from July 1 through November 30, and again from January 16 through April 15, in both the 2014-15 and 2015-16 seasons. In contrast, during the 2016-17 season, there were no fisheries allowing coho salmon retention in Area 9.

#### Area 10

In Area 10 (Seattle/Bremerton area), non-selective coho fishing was open from July 1 through January 31 in both the 2014-15 and 2015-16 seasons. In contrast, during the 2016-17 season, there were no fisheries allowing coho salmon retention in Area 10. The Elliott Bay terminal area near

Seattle was closed for all salmon retention during summer 2014 and 2016 but open in 2015 for non-selective coho and pink salmon fishing from August 14-31 (Fridays through Sundays only) in 2015.

#### Area 11

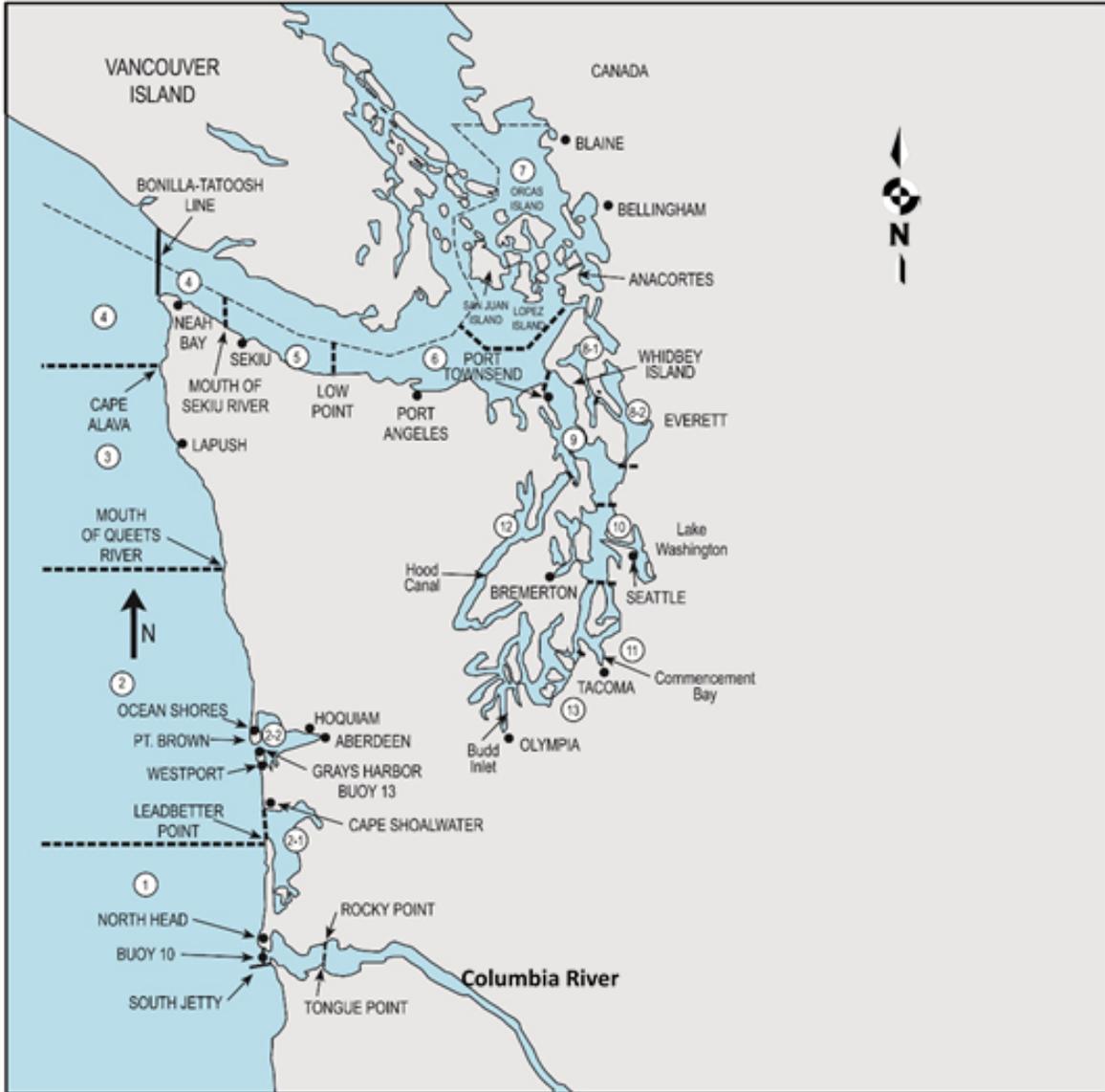
In Area 11 (Tacoma – Vashon Island), non-selective coho fishing was open from June 1 through December 31, and again from February 1 through April 30, in both the 2014-15 and 2015-16 seasons. In contrast, during the 2016-17 season, there were no fisheries allowing coho salmon retention in Area 11.

#### Area 12

Area 12 (Hood Canal) was open for non-selective coho fishing from July 1 through December 31 in both 2014 and 2015. However, the portion of Area 12 North of Point Ayock opened two months later (on September 1) during 2014. The whole area was open for non-selective coho fishing from February 1 through April 30 in the spring seasons of 2015 and 2016. During summer 2016, the area South of Point Ayock was open for non-selective coho fishing from July 1 – September 30, whereas the area North of Point Ayock opened starting 1 ½ months later, with a season from August 16 – September 30. All of Area 12 was open for non-selective coho fishing from October 1, 2016 through April 30, 2017.

#### Area 13

In Area 13 (South Puget Sound), mark-selective coho fishing was open from July 1 through October 31 during the summer seasons of 2014 and 2015. During the winter-spring period, non-selective coho fishing was open from November 1 through June 30 during both the 2014-15 and 2015-16 seasons. In contrast, during the 2016-17 season, there were no fisheries allowing coho salmon retention in Area 13.



Map of Western Washington, showing the Marine Catch Areas of Puget Sound (Areas 5 through 13) and the Washington coast (Areas 1 through 4).

Appendix Table B.1. Recreational Coho Fishing Seasons in Puget Sound Marine Areas 5 through 13 during the period from July 1, 2014 through June 30, 2017. Recreational fisheries were implemented as planned preseason unless noted otherwise below via footnotes (a/ through l/).

Area	Fishery Type <sup>1/</sup>	Dates of Season, by Fishery Year (July 1 - June 30)		
		2014-15	2015-16	2016-17
5	NR	n/a	n/a	July 1-Aug 15; Feb 16-Apr 30
	NSF	Sept 19-25; Feb 16-Apr 10	Sept 12-14, 19-21, 26-27; Oct 1-31; Feb 16-Apr 30	n/a
	MSF	July 1-Sept 18; Sept 26-30; Oct 1-31	July 1-Sept 11; Sept 15-18, 22-25, 28-30	n/a
	Closed	Nov 1-Feb 15; Apr 11-June 30	Nov 1 - Feb 15; May 1-June 30	Aug 16-Feb 15; May 1-June 30
6	NR	n/a	n/a	July 1-Aug 15; Dec 1-Apr 30
	NSF	Oct 1-31; Dec 1-Apr 10	Oct 1-31; Dec 1-Apr 10 <sup>d/</sup>	n/a
	MSF	July 1-Sept 30	July 1-Sept 30	n/a
	Closed	Nov 1-30; Apr 11-June 30	Nov 1-30; Apr 11-June 30	Aug 16-Nov 30; May 1-June 30
7	NR	n/a	n/a	July 1-Oct 31; Dec 1-Apr 30 <sup>k/</sup>
	NSF	July 1-31; Dec 1-Apr 30 <sup>e/</sup>	July 1-31; Oct 1-31; Dec 1-Apr 30 <sup>e/</sup>	n/a
	MSF	Aug 1 - Oct 31	Aug 1 -Sept 30	n/a
	Closed	Nov 1-30; May 1-June 30	Nov 1-30; May 1-June 30	Nov 1-30; May 1-June 30
8-1	NR	n/a	n/a	Nov 1 - Apr 30
	NSF	Aug 1-Apr 30	Aug 1-Apr 30 <sup>f/</sup>	n/a
	MSF	n/a	n/a	n/a
	Closed	July 1-31; May 1-June 30	July 1-31; May 1-June 30	July 1-Oct 31; May 1-June 30
8-2	NR	n/a	n/a	Nov 1 - Apr 30
	NSF	Aug 1-Apr 30	Aug 1-Apr 30 <sup>f/</sup>	n/a
	MSF	n/a	n/a	n/a
	Closed	July 1-31; May 1-June 30	July 1-31; May 1-June 30	July 1-Oct 31; May 1-June 30
Tulalip Bay	NR	n/a	n/a	July 1-Sept 5; May 26-June 30 (Fri-Mon only); otherwise same as Area 8-2
	NSF	May 29-June 29 (Fri-Mon only); Sept 6-21 (open Sat, Sun only); otherwise same as Area 8-2	July 1-Sept 7; May 27-June 30 <sup>h/</sup> (Fri-Mon only); Sept 12-27 (open Sat, Sun only); otherwise same as Area 8-2	Sept 10-25 (open Sat, Sun only); otherwise same as Area 8-2
	MSF	n/a	n/a	n/a
	Closed	Same as Area 8-2	Same as Area 8-2	Same as Area 8-2
9	NR	n/a	n/a	July 1-Aug 15; Nov 1-30; Jan 16-Apr 15
	NSF	July 1-Nov 30; Jan 16-Apr 15	July 1-Nov 30 <sup>b/</sup> ; Jan 16-Apr 15 <sup>g/</sup>	n/a
	MSF	n/a	n/a	n/a
	Closed	Dec 1-Jan 15; April 16-June 30	Dec 1-Jan 15; April 16-June 30	Aug 16-Oct 31; Dec 1-Jan 15; May 1-June 30

Area	Fishery Type <sup>1/</sup>	Dates of Season, by Fishery Year (July 1 - June 30)		
		2014-15	2015-16	2016-17
10	NR	June 1-30	June 1-30	July 1-Aug 15; Nov 1-Feb 28 <sup>1/</sup> ; June 1-30
	NSF	July 1 - Jan 31	July 1 - Jan 31 <sup>cl</sup>	n/a
	MSF	n/a	n/a	n/a
	Closed	Feb 1 - May 31	Feb 1 - May 31	Aug 16-Oct 31; Mar 1-May 30
Elliott Bay	NR	n/a	n/a	n/a
	NSF	n/a	Aug 14-31 (Fri-Sun only)	n/a
	MSF	n/a	n/a	n/a
	Closed	July 1-Aug 31, otherwise same as Area 10	July 1-Aug 31, except as above for NSF; otherwise same as Area 10	July 1-Aug 31, otherwise same as Area 10
11	NR	n/a	June 1-30 <sup>h/</sup>	July 1 - Aug 31 <sup>1/</sup> ; Feb 1-Apr 30
	NSF	June 1, 2014-Dec 31; Feb 1-Apr 30, 2015; June 1-30, 2015	July 1-Dec 31; Feb 1-Apr 30	n/a
	MSF	n/a	n/a	n/a
	Closed	Jan 1-31; May 1-31	Jan 1-31; May 1-31	Sept 1-Jan 31; May 1-31
12	NR	n/a	n/a	n/a
	NSF	<u>So. of Ayock</u> : July 1-Dec 31; <u>N. of Ayock</u> : Sept 1-Dec 31; <u>whole area</u> : Feb 1-Apr 30	<u>whole area</u> : July 1-Dec 31; Feb 1-Apr 30	<u>So. of Ayock</u> : July 1-Sept 30; <u>N. of Ayock</u> : Aug 16-Sept 30; <u>whole area</u> : Oct 1 - Apr 30
	MSF	n/a	n/a	n/a
	Closed	<u>whole area</u> : Jan 1-31; May 1-June 30; <u>N. of Ayock</u> : July 1-Aug 31	<u>whole area</u> : Jan 1-31; May 1-June 30	<u>So. of Ayock</u> : May 1-June 30; <u>N. of Ayock</u> : July 1-Aug 15; May 1-June 30
13	NR	n/a	n/a	July 1-Aug 31; Oct 1 <sup>1/</sup> -June 30
	NSF	Nov 1-June 30	Nov 1-June 30 <sup>h/</sup>	n/a
	MSF	July 1-Oct 31	July 1-Oct 31	n/a
	Closed	n/a	n/a	Sept 1-30

<sup>1/</sup> Definitions of fishery types:

NR= Non-retention regulation for coho salmon. Anglers may fish for other salmon or bottomfish species, but may not retain coho salmon.

NSF = Non-selective fishery for coho salmon. Anglers may keep either hatchery marked (adipose fin-clipped) or unmarked (adipose fin intact) coho. Daily bag limit is typically 2 salmon (at most 2 coho).

MSF = Mark-selective fishery for coho salmon. Anglers may keep hatchery marked (adipose fin-clipped) coho but must release unmarked (adipose fin intact) coho. Daily bag limit is typically 2 hatchery coho.

Closed = Closed for coho and all other salmon species.

**Inseason changes:**

<sup>a/</sup> Area 7, winter-spring 2015:

Effective January 12 through April 30, 2015, the daily limit for salmon was reduced from 2 to 1 (anglers required to release unmarked Chinook). Starting January 29, Area 7 was closed for salmon fishing except on Fridays, Saturdays, and Sundays. Effective February 16 through April 30, 2015, Area 7 was closed to salmon fishing. Reason for these inseason changes: to ensure compliance with conservation objectives and agreed-to management plans for the Area 7 Chinook mark-selective fishery.

b/ Area 9, summer 2015:

Effective August 6, 2015, the sub-area in northern Hood Canal (from south and west of a line from Foulweather Bluff to Olele Point to the Hood Canal Bridge) was closed to salmon fishing, except angling for salmon from shore was permissible, from the Hood Canal Bridge to the northern boundary of Salsbury Point Park. Daily limit was 2 salmon plus 2 additional pink salmon. Reason for inseason change: to protect mid-Hood Canal Chinook per state-tribal management plans agreed to during the North of Falcon preseason process.

Effective November 1 through November 30, 2015, Area 9 closed for Chinook and coho salmon retention. Reason for inseason change: Area 9 winter mark-selective Chinook fishery had higher than expected sublegal-size Chinook encounters. Puget Sound coho run sizes were below preseason forecasts; therefore, non-retention of coho was required beginning November 1, 2015.

c/ Area 10, winter 2015-16:

Effective October 19, 2015, Area 10 closed for salmon fishing. Area 10 opened again on October 28 for chum salmon retention only -- coho and Chinook still had to be released. Effective December 1, 2015 through January 31, 2016, Area 10 closed again for salmon fishing. Reason for inseason changes: Chinook encounters in the Area 10 winter Chinook MSF had reached preseason expectations; needed to ensure compliance with conservation objectives and agreed-to management plans.

d/ Area 6, spring 2016:

Area 6 closed for salmon fishing effective February 22 through April 10, 2016 to slow down the number of Chinook encounters in the Area 6 Chinook MSF and comply with agreed-to management plans. From March 12 through March 18, however, the area opened again for a short time with a daily limit of 2 salmon, no more than 1 hatchery Chinook (release wild Chinook) for limited fishing opportunity.

e/ Area 7, spring 2016:

Area 7 closed to salmon fishing effective March 14 through April 30. Reason for inseason change: encounters of Chinook in the Area 7 Chinook MSF had reached preseason expectations; needed to ensure compliance with conservation objectives and agreed-to management plans.

f/ Areas 8-1 & 8-2, spring 2016:

Areas 8-1 and 8-2 closed to salmon fishing effective April 4 through April 30, 2016. Reason for inseason change: encounters of Chinook in the Area 8-1 and 8-2 Chinook MSFs had reached preseason expectations; needed to ensure compliance with conservation objectives and agreed-to management plans.

g/ Area 9, spring 2016:

Area 9 closed to salmon fishing effective April 11 through April 15, 2016. Reason for inseason change: encounters of Chinook in the Area 9 Chinook MSF had reached preseason expectations; needed to ensure compliance with conservation objectives and agreed-to management plans.

h/ Multiple Areas, spring 2016

Effective May 1 through June 24, 2016, the following areas were closed to salmon fishing (changed from coho non-retention to closed): Marine Area 8-2 (including Tulalip Terminal Area Fishery), Marine Area 11, Marine Area 13, and year-round piers (Marine Areas 9, 10, 11, and 13). Reason for change: State-tribal co-managers were delayed in coming to agreement during the 2016 North of Falcon process. Endangered Species Act (ESA) coverage for Chinook and steelhead impacts expired April 30, 2016; therefore, starting May 1, 2016, scheduled fisheries did not have the needed federal ESA permit and could not be implemented. Effective June 24, 2016, these areas opened to salmon fishing per permanent rules due to receiving the federal ESA permit.

i/ Area 11, summer 2016:

Area 11 closed to salmon fishing effective August 20, 2016 (except for piers) – changed from coho non-retention to closed for all salmon. Reason for inseason change: legal-sized encounters of Chinook in the Area 11 Chinook MSF had reached preseason expectations; needed to ensure compliance with conservation objectives and agreed-to management plans.

j/ Area 13, fall 2016:

A portion of Area 13 opened for hatchery coho salmon starting on October 1, 2016, and then the whole area opened for hatchery coho retention effective October 22, 2016. The daily bag limit was 2 salmon (release wild Chinook and wild coho). Reason for inseason change: the state-tribal co-managers agreed there were sufficient numbers of coho returning to southern Puget Sound to allow the retention of hatchery coho.

<sup>k/</sup> Area 7, winter-spring 2017:

Closed to salmon fishing effective February 11 through March 24, 2017. Re-opened March 25 with a daily limit of 2 salmon, no more than 1 hatchery Chinook (release coho and wild Chinook). The Area 7 Chinook MSF was closed again on April 22 through April 30, 2017. Reasons for inseason changes: modified the Area 7 Chinook MSF to stay within the preseason agreed-to number of Chinook encounters and increase the possibility of providing season-long angling opportunity. The April 22 closure was needed due to encounters of Chinook reaching preseason expectations; needed to ensure compliance with conservation objectives and agreed-to management plans.

<sup>l/</sup> Area 10, winter-spring 2017:

Area 10 closed to salmon fishing effective January 23, 2017 through February, 28, 2017 (changed from coho non-retention to closed), except for year-round piers. Reason for inseason change: encounters of Chinook reached preseason expectations in the Area 10 Chinook MSF; needed to ensure compliance with conservation objectives and agreed-to management plans.

APPENDIX C. RECREATIONAL SEASONS IN THE SNOHOMISH RIVER SYSTEM

Table C.1. Preseason agreed to freshwater sport coho fishing seasons in the Snohomish system

River	Area	Preseason Agreed-to Season Dates					
		2012	2013	2014	2015	2016	2017
Snohomish R.	Mouth to Hwy 9 bridge	Sept 1-Dec 31	Aug 1-Dec 31	Sept 1-Dec 31	Aug 1-Dec 31	Closed	Aug 1-Dec 31
Snohomish R.	Hwy 9 bridge to forks	Sept 1-Dec 31	Aug 1-Dec 31	Sept 1-Dec 31	Aug 16-Dec 31	Closed	Aug 16-Dec 31
Skykomish R.	Mouth to Lewis St. bridge	Sept 1-Dec 31	Aug 1-Dec 31	Sept 1-Dec 31	Aug 16-Dec 31	Closed	Aug 16-Dec 31
Skykomish R.	Lewis St. bridge to confluence with NF and SF	Sept 1-Dec 31	Sept 1-Dec 31	Sept 1-Dec 31	Sept 1-Dec 31	Closed	Sept 1-Dec 31
Snoqualmie R.	Mouth to falls	Sept 1-Dec 31	Sept 1-Dec 31	Sept 1-Dec 31	Sept 1-Dec 31	Closed	Sept 1-Dec 31
Wallace R.	Mouth to hatchery intake	Sept 16-Nov 30	Sept 16-Nov 30	Sept 16-Nov 30	Sept 16-Nov 30	Closed	Sept 16-Nov 30
All other river and creeks		Closed	Closed	Closed	Closed	Closed	Closed
Daily limit (release Chinook and chum)		3	3 + 1 pink	3	3 + 1 pink	0	3

Table C.2. Actual freshwater sport coho fishing seasons with inseason management in the Snohomish system.

River	Area	Actual Season Dates		
		2015	2016	2017
Snohomish R.	Mouth to Hwy 9 bridge	Aug 1-Oct 21	Sept 29-Oct 2, Oct 6-9, 11-31	Aug 1-Oct 28
Snohomish R.	Hwy 9 bridge to forks	Aug 16-Oct 21	Sept 29-Oct 2, Oct 6-9, 11-31	Aug 16-Oct 28
Skykomish R.	Mouth to Lewis St. bridge	Sept 2-Oct 21	Oct 11-31	Aug 16-Oct 28
Skykomish R.	Lewis St. bridge to confluence with NF and SF	Sept 2-Oct 21	Oct 11-31	Sept 1-Oct 28
Skykomish R.	Mouth of Sultan to mouth of Wallace	Sept 2-Oct 21	Oct 11-31	Sept 1-Oct 28
Skykomish R.	Mouth of Wallace to confluence of NF and SF	Sept 11-Oct 21	Closed	Sept 1-Oct 28
Snoqualmie R.	Mouth to falls	Sept 1-Oct 21	Closed	Sept 1-Oct 28
Wallace R.	Mouth to hatchery intake	Sept 30-Oct 21	Oct 11-31	Sept 1-Oct 28
All other river and creeks		Closed	Closed	Closed

## APPENDIX D. MODEL DESCRIPTION

### Introduction

Salmon rebuilding plans must include, among other requirements, a specified rebuilding period. In addition, the National Environmental Policy Act (NEPA) analysis of rebuilding plans requires the development of rebuilding plan alternatives. In past assessments, the rebuilding period and alternative rebuilding plans were developed using expert knowledge, with no particular quantitative assessment. Beginning in 2018, the Salmon Technical Team (STT) developed a simple tool to assess the probability of a stock achieving rebuilt status in each year following an overfished declaration. Here we describe this model and provide additional results for the Snohomish natural coho salmon stock.

### Methods

The methods described here are for a single replicate simulation.

For Snohomish natural coho, there is evidence for positive lag-1 autocorrelation in log-transformed values of the pre-fishery ocean abundance, with autocorrelation coefficient  $\rho = 0.234$ . To account for this, model log-scale abundance,  $\log(N_t)$ , is characterized by lag-1 autocorrelated draws from a Normal distribution with parameters estimated from the abundance series. Simulated abundance  $\log(N_t)$  is thus a function of  $\log(N_{t-1})$ ,  $\rho$ , and the distribution of past abundance on the log scale,

$$\log(N_t) = \rho[\log(N_{t-1})] + (1 - \rho)Y_t, \quad (1)$$

with  $Y_t$  a random draw from the distribution

$$Y_t \sim \text{Normal} \left[ \log(\bar{S}) - 0.5\sigma_{\log(S)}^2, \sqrt{\frac{(1 - \rho^2)\sigma_{\log(S)}^2}{(1 - \rho)^2}} \right] \quad (2)$$

and where  $\bar{S}$  is the arithmetic mean of the observed Snohomish natural coho ocean abundance time series and  $\sigma_{\log(S)}^2$  is the variance of the log-transformed abundance time series. The standard deviation term in Equation 2 is derived from the expression for the standard deviation of a sum of two random variables. Simulated log-scale abundance in year  $t$  is then back-transformed to the arithmetic scale,  $N_t = \exp[\log(N_t)]$ .

The forecast abundance  $\hat{N}_t$  is drawn from a lognormal distribution,

$$\hat{N}_t \sim \text{Lognormal}[\log(N_t) - 0.5\sigma_{\log(\hat{N})}^2, \sigma_{\log(\hat{N})}] \quad (3)$$

with the bias corrected mean and standard deviation specified on the log scale. The log-scale standard deviation was defined as

$$\sigma_{\log(\hat{N})} = \sqrt{\log(1 + CV_{\hat{N}}^2)} \quad (4)$$

with  $CV_{\hat{N}}$  representing the coefficient of variation for the abundance forecast.  $CV_{\hat{N}}$  is a model parameter that defines the degree of abundance forecast error.

The forecast abundance  $\hat{N}_t$  is applied to a harvest control rule to determine the allowable exploitation rate,  $\hat{F}_t$ . However, for Snohomish natural coho, where the abundance or status of other stocks in the fishery can determine the exploitation rate in many fisheries, including Council-area fisheries, the use of an abundance-based control rule would poorly describe the degree of exploitation on this stock. As a result,  $\hat{F}_t$  was specified for Alternative I using the following approach. A random draw was taken from the set of postseason estimates of Snohomish natural coho exploitation rates from 2004-2017. If that randomly drawn exploitation rate coupled with the forecast abundance resulted in a projected escapement greater than or equal to 50,000, the randomly drawn exploitation rate was assumed for  $\hat{F}_t$ . If that exploitation rate resulted in a projected escapement of less than 50,000,  $\hat{F}_t$  was set at the higher of (1) the exploitation rate resulting in a projected escapement of 50,000 or (2) an exploitation rate of 0.20.  $\hat{F}_t$  was specified for Alternative II in the same manner as Alternative I, with the exception that 55,000, rather than 50,000, was used as the escapement goal. The hat notation for  $\hat{F}$  indicates that this exploitation rate is a target exploitation rate, not the realized exploitation rate experienced by the stock.

Adult spawner escapement  $E_t$  is thus

$$E_t = N_t \times (1 - F_t) \quad (5)$$

where  $N_t$  is the “true” abundance and  $F_t$  is the realized exploitation rate. The realized exploitation rate is a random draw from the beta distribution

$$F \sim \text{Beta}(\alpha, \beta) \quad (6)$$

with parameters

$$\alpha = \frac{1 - \hat{F}_t(1 + CV_F^2)}{CV_F^2} \quad (7)$$

and

$$\beta = \frac{\frac{1}{\hat{F}_t} - 2 + \hat{F}_t + (\hat{F}_t - 1)CV_F^2}{CV_F^2}. \quad (8)$$

The coefficient of variation for the exploitation rate implementation error,  $CV_F$ , is a model parameter that determines the degree of error between the target and realized exploitation rates.

Because escapement is estimated with error, escapement estimates  $\hat{E}_t$  are drawn from a lognormal distribution,

$$\hat{E}_t \sim \text{Lognormal}[\log(E_t) - 0.5\sigma_{\log(\hat{E})}^2, \sigma_{\log(\hat{E})}] \quad (9)$$

where the bias corrected mean and standard deviation are specified on the log scale. The log-scale standard deviation was computed in the same manner as Equation 4.

The procedure described above is repeated for each year (year 1 [2018] through 10), and each replicate. Simulations are initiated with the 2017 estimated abundance; simulated abundance in  $t = 1$  (2018) is therefore a function of the 2017 abundance, the autocorrelation coefficient, and a draw from the abundance distribution (Equation 1).

A stock is assumed to be rebuilt when the geometric mean of  $\hat{E}$  computed over the previous three years exceeds the maximum sustainable yield spawner escapement,  $S_{MSY}$ . The probability of achieving rebuilt status in year  $t$  is the cumulative probability of achieving a 3-year geometric mean greater than or equal to  $S_{MSY}$  by year  $t$ .

## Results

Results for Snohomish natural coho presented here are the product of 10,000 replicate simulations of 10 years. The probability of being rebuilt in year  $t = 1$  is the proportion of the 10,000 simulations that resulted in the geometric mean of the estimated escapement in  $t = -1$  (44,141: the 2016 natural escapement), the estimated escapement in  $t = 0$  (18,195: the 2017 natural adult escapement), and the simulated escapement estimate in year  $t = 1$  (2018) exceeding  $S_{MSY} = 50,000$ . For  $t = 2$ , the probability of being rebuilt is the probability that the stock was rebuilt in either  $t = 1$  or  $t = 2$ .

Table 4.4.a and Figure 4.4.a in the body of the report display the probabilities of achieving rebuilt status under two rebuilding alternatives: (I) status quo and (II) under an increased escapement goal. A no-fishing scenario was also evaluated to establish  $T_{MIN}$ . For these simulations the following parameter values were assumed:  $CV_{\hat{N}} = 0.2$ ,  $CV_{\hat{E}} = 0.2$ , and  $CV_F = 0.1$ . The parameter values were chosen because they produce plausible levels of abundance forecast error, escapement estimation error, and implementation error for realized exploitation rates.

Rebuilding probabilities were also computed for the status quo control rule under an increased CV of the abundance forecast error ( $CV_{\hat{N}} = 0.6$ ), the escapement estimation error CV ( $CV_{\hat{E}} = 0.5$ ), and the CV of the exploitation rate implementation error ( $CV_F = 0.2$ ). Figure 1 displays distributions depicting the levels of abundance forecast error, escapement estimation error, and exploitation rate implementation error given the base case CVs and the CVs used for the alternative scenarios. Figure 2 displays results for these alternative scenarios under the status quo control rule. Overall, the probability of achieving rebuilt status by year is relatively insensitive to increased values of these parameters.

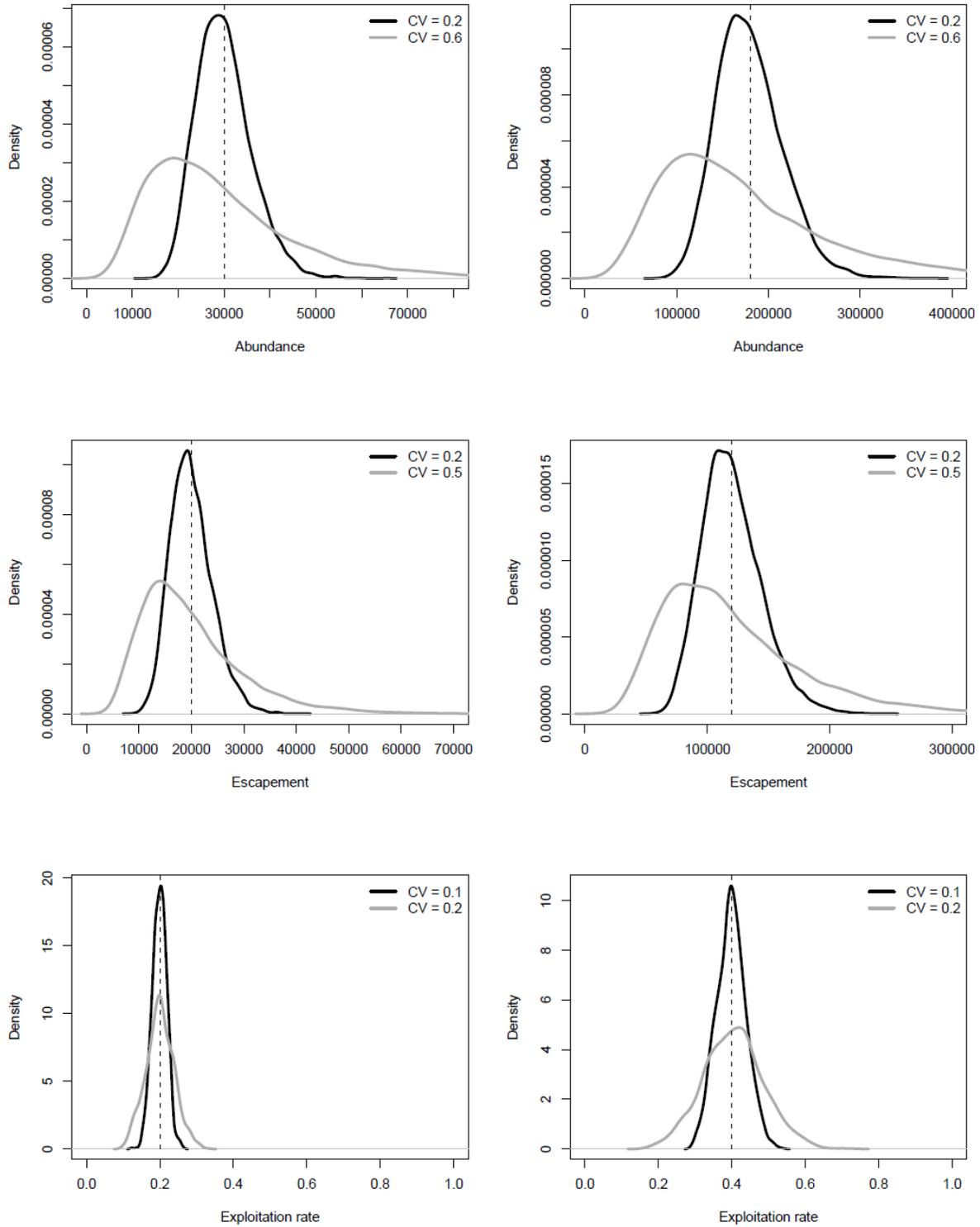


Figure 1. Distributions of the forecast abundance (top row), estimated escapement (middle row), and realized exploitation rate (bottom row) under different levels of known abundance, known escapement, and predicted exploitation rate. Known values are indicated by vertical dashed lines.

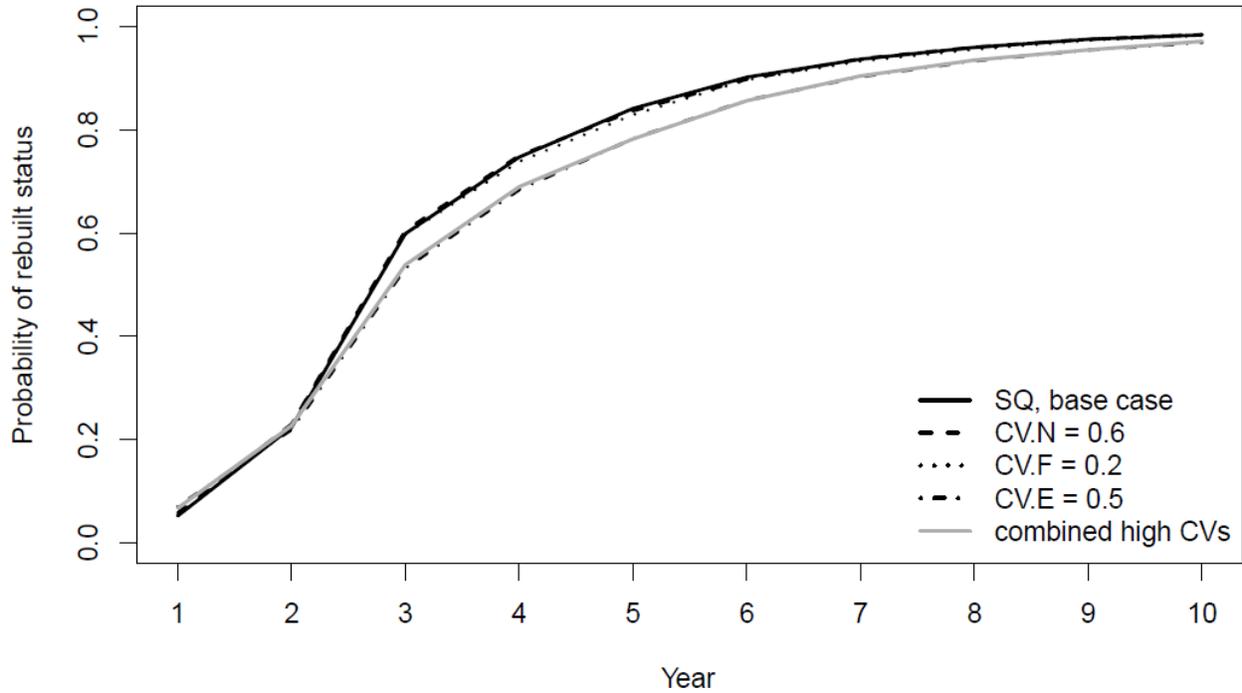


Figure 2. Probability of achieving rebuilt status in years 1 through 10 for the status quo control rule (Alternative I), given different parameter values for abundance forecast error (CV.N), exploitation rate implementation error (CV.F), and escapement estimation error (CV.E).

## APPENDIX E. LIST OF AGENCIES AND PERSONS CONSULTED

The following public meetings were held as part of the salmon management process (Council-sponsored meetings in bold):

<b>March 2018</b>	<b>Rohnert Park, CA</b>
<b>April 2018</b>	<b>Portland, OR</b>
May 2018	Public Webinar
June 2018	Public Meeting in Olympia, WA
August 2018	Public Webinar
September 2018	Public Webinar
<b>September 2018</b>	<b>Seattle, WA</b>
<b>November 2018</b>	<b>San Diego, CA</b>
<b>March 2019</b>	<b>Vancouver, WA</b>
<b>April 2019</b>	<b>Rohnert Park, CA</b>
<b>June 2019</b>	<b>San Diego, CA</b>
<b>September 2019</b>	<b>Boise, ID</b>

The following organizations were consulted and/or participated in preparation of supporting documents:

Northwest Indian Fisheries Commission  
Columbia River Intertribal Fish Commission  
West Coast Indian Tribes

California Department of Fish and Wildlife  
Oregon Department of Fish and Wildlife  
Washington Department of Fish and Wildlife

National Marine Fisheries Service, West Coast Region, Sustainable Fisheries Division  
National Marine Fisheries Service, Northwest Fisheries Science Center  
National Marine Fisheries Service, Southwest Fisheries Science Center  
U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office  
United States Coast Guard

## APPENDIX F. REGULATORY IMPACT REVIEW

As applicable, rulemakings must comply with Executive Order (E.O.) 12866 and the Regulatory Flexibility Act (RFA). To satisfy the requirements of E.O. 12866, the National Marine Fisheries Service (NMFS) undertakes a regulatory impact review (RIR). To satisfy the requirements of the RFA, NMFS prepares an initial regulatory flexibility analysis (IRFA) and final regulatory flexibility analysis (FRFA), or a certification.

The NMFS Economic Guidelines that describe the RFA and E.O. 12866 can be found at: <http://www.nmfs.noaa.gov/op/pds/documents/01/111/01-111-05.pdf>

The RFA, 5 U.S.C. § 601 *et seq.*, can be found at: [http://www.nmfs.noaa.gov/sfa/laws\\_policies/economic\\_social/rfa\\_revised\\_through\\_2010\\_jobs\\_act.pdf](http://www.nmfs.noaa.gov/sfa/laws_policies/economic_social/rfa_revised_through_2010_jobs_act.pdf)

Executive Order 12866 can be found at: [http://www.nmfs.noaa.gov/sfa/laws\\_policies/economic\\_social/eo12866.pdf](http://www.nmfs.noaa.gov/sfa/laws_policies/economic_social/eo12866.pdf)

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### REGULATORY IMPACT REVIEW

The President of the United States signed E.O. 12866, “Regulatory Planning and Review,” on September 30, 1993. This order established guidelines for promulgating new regulations and reviewing existing regulations. The E.O. covers a variety of regulatory policy considerations and establishes procedural requirements for analysis of the benefits and costs of regulatory actions. The E.O. stresses that in deciding whether and how to regulate, agencies should assess all of the costs and benefits of available regulatory alternatives. Based on this analysis, they should choose those approaches that maximize net benefits to the Nation, unless a statute requires another regulatory approach.

NMFS satisfies the requirements of E.O. 12866 through the preparation of an RIR. The RIR provides a review of the potential economic effects of a proposed regulatory action in order to gauge the net benefits to the Nation associated with the proposed action. The analysis also provides a review of the problem and policy objectives prompting the regulatory proposal and an evaluation of the available alternatives that could be used to solve the problem.

The RIR provides an assessment that can be used by the Office of Management and Budget to determine whether the proposed action could be considered a significant regulatory action under E.O. 12866. E.O. 12866 defines what qualifies as a “significant regulatory action” and requires agencies to provide analyses of the costs and benefits of such action and of potentially effective and reasonably feasible alternatives. An action may be considered significant if it is expected to: (1) Have an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the

rights and obligations of recipients thereof; or (4) Raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in the EO.

*Statement of the Problem*

See Purpose and Need statement in this document (Section 2.2.2).

*Description of the fishery and other affected entities*

See Ocean, Puget Sound, and in-river fishery descriptions in this document (Section 3.3).

*Description of the management goals and objectives*

See conservation objectives and management strategy in this document (Section 2.4.1 and Section 2.4.2).

*Description of the Alternatives*

See management strategy alternatives, analysis, and additional information in this document (Section 4.2 and Section 4.4)

*An Economic Analysis of the Expected Effects of Each Selected Alternative Relative to the No Action Alternative*

See socioeconomic impact of management strategy alternatives considered in this document (Section 5.0).

*RIR-Determination of Significant Impact*

As noted above, under E.O. 12866, a regulation is a “significant regulatory action” if it is likely to: (1) have an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President’s priorities, or the principles set forth in this Executive Order. Pursuant to the procedures established to implement section 6 of E.O. 12866, the Office of Management and Budget has determined that this action is not significant.

## **APPENDIX G. REGULATORY FLEXIBILITY ANALYSIS**

For any rule subject to notice and comment rulemaking, the RFA requires Federal agencies to prepare, and make available for public comment, both an initial and final regulatory flexibility analysis, unless the agency can certify that the proposed and/or final rule would not have a “significant economic impact on a substantial number of small entities”. This determination can be made at either the proposed or final rule stage. If the agency can certify a rule, it need not prepare an IRFA, a FRFA, a “Small Entity Compliance Guide,” or undertake a subsequent periodic review of the rule under Section 610 of the RFA. The NMFS Regional Administrator/Office Director, using analyses and rationale provided by the Council or NMFS, prepares a memorandum from the Chief Counsel for Regulation (CC/Regs) of the DOC to the Chief Counsel for Advocacy certifying and setting forth the factual basis for the certification.

The CC/Regs will sign and transmit the certification to SBA at the time the notice of proposed rulemaking or final rulemaking is published in the FR, along with a statement providing the factual basis for such certification.

### **Request for comment on proposed rules**

In addition to comments on the analysis below, the agency requests comments on the decision to certify this rule.

### **Description of the reasons why action by the agency is being considered**

The reasons why agency action is being considered are explained in Section 2.2 of the respective rebuilding plans (Pacific Fishery Management Council. 2019. Salmon Rebuilding Plan for Queets River Natural Coho; Salmon Rebuilding Plan for Snohomish River Natural Coho; Salmon Rebuilding Plan for Strait of Juan de Fuca Natural Coho).

### **Statement of the objectives of, and legal basis for, the proposed rule**

The reasons why agency action is being considered are explained in Section 2 of the rebuilding plans cited above.

### **Reporting and recordkeeping requirements**

There are no applicable reporting and recordkeeping requirements associated with this rulemaking.

### **A description and, where feasible, estimate of the number of small entities to which the proposed rule will apply**

Part 121 of Title 13, Code of Federal Regulations (CFR), sets forth, by North American Industry Classification System (NAICS) categories, the maximum number of employees or average annual gross receipts a business may have to be considered a small entity for RFAA purposes. See 13 C.F.R. § 121.201. Under this provision, the U.S. Small Business Administration established criteria for businesses in the fishery sector to qualify as small entities. Standards are expressed either in number of employees, or annual receipts in millions of dollars. The number of employees or annual receipts indicates the maximum allowed for a concern and its affiliates to be considered small (13 C.F.R. § 121.201).

The SBA size standard for Subsector 487, “Scenic and Sightseeing Transportation”, which includes charter fishing, is \$7.5 million in gross receipts (13 CFR § 121.201).

Provision is made under SBA’s regulations for an agency to develop its own industry-specific size standards after consultation with Advocacy and an opportunity for public comment (see 13 CFR 121.903(c)). NMFS has established a small business size standard for businesses, including their affiliates, whose primary industry is commercial fishing (80 FR 81194, December 29, 2015). This standard is only for use by NMFS and only for the purpose of conducting an analysis of economic effects in fulfillment of the agency’s obligations under the RFA.

NMFS' small business size standard for businesses, including their affiliates, whose primary industry is commercial fishing is \$11 million in annual gross receipts. This standard applies to all businesses classified under North American Industry Classification System (NAICS) code 11411 for commercial fishing, including all businesses classified as commercial finfish fishing (NAICS 114111), commercial shellfish fishing (NAICS 114112), and other commercial marine fishing (NAICS 114119) businesses. (50 C.F.R. § 200.2; 13 C.F.R. § 121.201).

According to the PacFIN database (discussed in greater detail in the assumptions discussion below); 357 distinct vessels caught salmon in the North of Cape Falcon or Puget Sound areas in 2018. All of these vessels had revenue less than the threshold for small entities defined above, and because no data on affiliation are available, each of these is assumed to be a small entity. From the recreational effort database (RecFIN), in 2018 during the peak months of July and August there were a maximum of 189 boat trips a day in the ocean recreational fishery. Assuming each boat trip is one vessel, it is assumed that 189 ocean recreational businesses will be directly regulated under this rule. There are no data available about the size of these entities so all are considered small. RecFIN does not provide effort estimates for recreational fisheries in Puget Sound that would also be impacted by this rule, so the true number of recreational entities is assumed to be higher than the 189 vessels in the ocean fisheries.

#### **Description and estimate of economic effects on entities, by entity size and industry.**

A detailed description and estimate of the economic effects of the proposed rule is available in Section 5.3 of the rebuilding plans cited above. To summarize, there are no expected economic effects of the Juan de Fuca and Queets coho rebuilding plans as the Council selected the No Action alternative. The impacts in the Snohomish rebuilding plan are expected to be relatively minor (~\$140,000 per year) for a total of \$430,000 over three years (with a 23 percent chance of rebuilding before three years).

#### **An explanation of the criteria used to evaluate whether the rule would impose “significant” economic effects.**

Because all directly regulated entities are small, these regulations are not expected to place small entities at a significant disadvantage to large entities. Without detailed data available to inform a distributional analysis, it is assumed that the 357 commercial vessels and 189 (plus unknown number of Puget Sound charter vessel) would all be impacted equally. The 2004-2016 average community income contribution of commercial and recreational salmon fisheries is \$13.3 million. As discussed above, the estimated impacts from the Alternative II Snohomish rebuilding plan and

No Action Queets and Juan de Fuca rebuilding plans is \$0.14 million, or about 1 percent of the total coastwide community income. Thus while there are short-run negative impacts associated with this rule, these are not expected to be “significant” relative to the size of the fishery. There may be localized impacts that are greater or lower than the regional average.

**An explanation of the criteria used to evaluate whether the rule would impose effects on “a substantial number” of small entities.**

This rule would impact the salmon fishery north of Cape Falcon, which as described above included 171 distinct commercial entities and at least 189 recreational entities, which is a substantial number of small entities.

**A description of, and an explanation of the basis for, assumptions used.**

Data used to inform this analysis come primarily from PacFIN, which includes data provided by the states of Oregon, California, and Washington on commercial fishing trips and landings; in addition to the West Coast Region permit database and the recreational fisheries database (RecFIN). The number of entities predicted to be impacted is generally based on the level of participation in the previous year (2018). However, it is possible that environmental or management conditions change in other fisheries that would impact the level of participation in the salmon fishery beyond what is predicted here. For a detailed description of assumptions made in the economic analysis, see Sections 5.1 and 5.5 cited above.

**Relevant Federal rules that may duplicate, overlap or conflict with the proposed rule.**

There are no relevant Federal rules that may duplicate, overlap, or conflict with this action.

**Certification statement by the head of the agency**

The agency finds per 5 U.S.C. § 605 (the RFA) that “the proposed rule, if promulgated, will not have a significant economic impact on a substantial number of small entities.”

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Reviewed by West Coast Regional Economist Abigail Harley

## APPENDIX H - CONSISTENCY WITH OTHER APPLICABLE LAWS ANALYSIS

### *Magnuson Stevens Fishery Conservation and Management Act (MSA)*

The MSA provides parameters and guidance for Federal fisheries management. Overarching principles for fisheries management are found in the MSA's National Standards, which articulate a broad set of policies governing fisheries management. In crafting fisheries management regimes, the Councils and NMFS must balance their recommendations to meet these different national standards.

**National Standard 1** requires that, upon notification that a stock or stock complex is overfished or approaching an overfished condition, a Council must prepare and implement an FMP, FMP amendment, or proposed regulations (i.e., rebuilding plan) within two years of notification, consistent with the requirements of section 304(e)(3) of the MSA. The Council's rebuilding plan must specify a time period for rebuilding the stock or stock complex based on factors specified in MSA 304(e)(4). This target time for rebuilding ( $T_{\text{target}}$ ) shall be as short as possible, taking into account: the status and biology of any overfished stock, the needs of fishing communities, recommendations by international organizations in which the U.S. participates, and interaction of the stock within the marine ecosystem. In addition, the time period shall not exceed 10 years, except where biology of the stock, other environmental conditions, or management measures under an international agreement to which the U.S. participates, dictate otherwise. The rebuilding plan will specify the minimum time for rebuilding the overfished stock ( $T_{\text{min}}$ ), the maximum time for rebuilding ( $T_{\text{max}}$ ).

The alternatives in section 4.2 of this document were developed to be consistent with the requirements of the MSA. Rebuilding time ( $T_{\text{target}}$ ) under the two alternatives is 3 years. The preferred alternative (Alternative II – Buffered  $S_{\text{MSY}}$ ) has a  $T_{\text{target}}$  of 3 years and was supported by the state and tribal co-managers in Washington State. A “no fishing” scenario, which would not be feasible because the Council does not have jurisdiction over tribal and in-river recreational fisheries, provides an estimate for  $T_{\text{min}}$  of 3 years. When  $T_{\text{min}}$  is 10 years or less, NS1 states that  $T_{\text{max}}$  is 10 years. Therefore, the alternatives are consistent with NS1. Year 1 for the Snohomish natural coho analysis is 2018:

- $T_{\text{target}}$ 
  - Alternative I – 3 years (2020)
  - Alternative II – 3 years (2020)
- $T_{\text{min}}$  – 3 year (2020)
- $T_{\text{max}}$  – 10 years (2027)

**National Standard 2** requires the use of the best available scientific information. The Council's Scientific and Statistical Committee (SSC) reviewed and recommended the methods used to develop alternatives for the Snohomish natural coho rebuilding plan and the analyses used to estimate  $T_{\text{target}}$  and  $T_{\text{min}}$ . The alternatives were crafted based on up to date scientific information regarding abundance and the methods approved by the SSC.

**National Standard 3** requires individual stocks of fish to be managed as a unit throughout their ranges and interrelated stocks of fish to be managed as a unit. The conservation objectives

and ACLs are established for individual stocks in the Salmon FMP and are based on either escapement or on total fishery exploitation rate, both of which account for impacts to stocks from fisheries throughout their range. All salmon stocks are managed as a unit in Council-area fisheries to ensure all conservation objectives are met. The alternatives were developed to be consistent with, or more conservative than, the conservation objectives and ACLs in the FMP in order to rebuild the overfished stock.

**National Standard 4** requires that “Conservation and management measures shall not discriminate between residents of different States.” And that “allocation shall be: (A) fair and equitable...; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no...entity acquires an excessive share.” The alternatives do not affect the allocation guidelines in the FMP, which were in turn developed to meet National Standard 4.

**National Standard 5** requires efficiency, where practicable, in the utilization of fishery resources. All alternatives in this EA are expected to have no significant effects on the efficiency in the utilization of fishery resources.

**National Standard 6** requires conservation objectives and management measures to take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches. The FMP allows for inseason management of Council-area salmon fisheries to meet conservation objectives and preseason management objectives. None of the alternatives would affect that.

**National Standard 7** requires that conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication. All alternatives in this EA meet this standard.

**National Standard 8** requires that conservation and management measures shall, consistent with the conservation requirements of the MSA, take into account the importance of fishery resources to fishing communities in order to “(A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.” The alternatives represent a range of management measures with various economic impacts. The Final Preferred Alternative (Alternative II) was developed to provide the optimum balance between the short-term needs of the communities and the long-term needs of the communities, needs which rely on long-term health of the salmon stocks.

**National Standard 9** requires the reduction, to the extent practicable, of bycatch or bycatch mortality. All alternatives in this EA are expected to have no significant effects due to bycatch mortality on non-target species.

**National Standard 10** requires, to the extent practicable, conservation and management measures to promote the safety of human life at sea. The Alternatives in this EA are not expected to impact risks to salmon fishermen.

### ***Coastal Zone Management Act (CZMA)***

Section 307(c)(1) of the CZMA of 1972 requires all Federal activities that directly affect the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. The proposed action was developed to rebuild the overfished Snohomish natural coho stock and was determined by NMFS to be consistent to the maximum extent practicable with the approved coastal zone management programs of the affected states (i.e., Washington and Oregon). This determination was sent to the responsible state agencies in Washington, on November 22, 2019, and Oregon, on November 26, 2019, for review under section 307(c)(1) of the CZMA. The State of Washington has concurred with NMFS' finding. The State of Oregon has not responded; therefore, concurrence is assumed.

### ***Endangered Species Act (ESA)***

Ocean salmon fisheries conducted under the FMP do affect ESA-listed salmon species. The alternatives analyzed in this EA do not superseded conservation measures required to protect ESA-listed species. Implementation of the proposed action will be consistent biological opinions issued by NMFS.

Of the ESA-listed marine mammals described below (see MMPA section), Council-managed salmon fisheries only impact listed Southern Resident Killer Whales. NMFS consulted on the effects of the ocean salmon fisheries on the ESA-listed Southern Resident killer whale (SRKW) distinct population segment in 2009. As discussed below, NMFS has reinitiated consultation to consider new information. Consultations on ocean salmon fisheries effects on ESA-listed Puget Sound yelloweye rockfish, bocaccio, Pacific eulachon, and North American green sturgeon concluded no effect from Council-managed ocean salmon fisheries on these species.

The following biological opinions and Section 4(d) determinations have been prepared for West Coast stocks by NMFS.

Table H-1. NMFS ESA Biological Opinions regarding Evolutionarily Significant Units (ESUs) and Distinct Population Segments (DPSs) affected by PFMC Fisheries.

<b>Date</b>	<b>Duration</b>	<b>Species Considered</b>
<b>Salmonid Species</b>		
March 8, 1996	until reinitiated	Snake River spring/summer and fall Chinook Snake River sockeye
April 28, 1999	until reinitiated	S. Oregon/N. California Coastal coho Central California Coast coho Oregon Coast natural coho
April 28, 2000	until reinitiated	Central Valley Spring-run Chinook California Coastal Chinook
April 27, 2001	until withdrawn	Hood Canal summer-run chum
April 30, 2001	until reinitiated	Upper Willamette River Chinook Columbia River chum Ozette Lake sockeye Upper Columbia River spring-run Chinook Ten listed steelhead DPSs
June 13, 2005	until reinitiated	California Coastal Chinook
April 4, 2015	until reinitiated	Lower Columbia River coho
March 3, 2018	until reinitiated	Sacramento River winter-run Chinook
April 29, 2004	until reinitiated	Puget Sound Chinook
April 26, 2012	until reinitiated	Lower Columbia River Chinook
<b>Non-Salmonid Species</b>		
May 5, 2009	Reinitiated in 2019	Southern Resident Killer Whales

### ***Marine Mammal Protection Act (MMPA)***

The MMPA of 1972 is the principle Federal legislation that guides marine mammal species protection and conservation policy in the United States. Under the MMPA, NMFS is responsible for the management and conservation of 153 stocks of whales, dolphins, porpoise, as well as seals, sea lions, and fur seals; while the US Fish and Wildlife Service is responsible for walrus, sea otters, and the West Indian manatee.

Off the west coast, the Southern Resident Puget Sound killer whale stock (SRKW) is listed as endangered under the Endangered Species Act (ESA); Guadalupe fur seal, and Southern sea otter California stock are listed as threatened under the ESA. The sperm whale (WA, OR, CA stock), humpback whale (WA, OR, CA, Mexico stock), blue whale eastern north Pacific stock, and Fin whale (WA, OR, CA stock) are listed as endangered under the Endangered Species Act (ESA). Any marine mammal species listed as endangered or threatened under the ESA is automatically considered depleted under the MMPA.

The commercial salmon troll fisheries off the west coast are classified as Category III fisheries, indicating a remote or no likelihood of causing incidental mortality or serious injury to marine mammals (85 FR 21079, April 16, 2020). Recreational salmon fisheries are assumed to have similar impacts as they use similar gear and techniques.

### ***Migratory Bird Treaty Act (MBTA)***

The MBTA of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished populations of many native bird species. The act states it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and is a shared agreement between the United States, Canada, Japan, Mexico, and Russia to protect a common migratory bird resource. The Migratory Bird Treaty Act prohibits the directed take of seabirds, but the incidental take of seabirds does occur. None of the alternatives directly affect any seabirds protected by the Migratory Bird Treaty Act.

### ***Paperwork Reduction Act (PRA)***

The purposes of the PRA are to minimize the burden of information collection by the Federal Government on the public; maximize the utility of any information thus collected; improve the quality of information used in Federal decision making, minimize the cost of collection, use and dissemination of such information; and improve accountability. The PRA requires Federal agencies to obtain clearance from the Office of Management and Budget before collecting information. This clearance requirement is triggered if certain conditions are met. “Collection of information” is defined broadly. In summary it means obtaining information from third parties or the public by or for an agency through a standardized method imposed on 10 or more persons. Collection of information need not be mandatory to meet the trigger definition. Even information collected by a third party, if at the behest of a Federal agency, may trigger the clearance requirement. Within NMFS, the Office of the Chief Information Officer is responsible for PRA compliance. Obtaining clearance can take up to 9 months and is one aspect of NMFS review and approval of Council decisions.

The proposed action does not include a collection-of-information requirement and, therefore, authorization under the PRA is not required.

### ***Executive Order 12898 Environmental Justice***

Executive Order 12898 obligates Federal agencies to identify and address “disproportionately high adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations in the United States” as part of any overall environmental analysis associated with an action. NOAA guidance, NAO 216-6, at 7.02, states that “consideration of Executive Order 12898 should be specifically included in the NEPA documentation for decision making purposes.” Agencies should also encourage public participation “especially by affected communities” as part of a broader strategy to address environmental justice issues.

The environmental justice analysis must first identify minority and low-income groups that live in the project area and may be affected by the action. Typically, census data are used to document the occurrence and distribution of these groups. Agencies should be cognizant of distinct cultural, social, economic or occupational factor that could amplify the adverse effects of the proposed action. (For example, if a particular kind of fish is an important dietary component, fishery management actions affecting the availability or price of that fish could have a disproportionate effect.) In the case of Indian tribes, pertinent treaty or other special rights should be considered. Once communities have been identified and characterized, and

potential adverse impacts of the alternatives are identified, the analysis must determine whether these impacts are disproportionate. Because of the context in which environmental justice developed, health effects are usually considered and three factors may be used in an evaluation: whether the effects are deemed significant, as the term is employed by NEPA; whether the rate or risk of exposure to the effect appreciably exceeds the rate for the general population or some other comparison group; and whether the group in question may be affected by cumulative or multiple sources of exposure. If disproportionately high adverse effects are identified, mitigation measures should be proposed. Community input into appropriate mitigation is encouraged.

This EA includes an environmental justice analysis (see section 6.6, above) that determined that the Preferred Alternative (Alternative II) would have a disproportionate impact on the Tulalip Tribes' cultural resources compared with the No-action Alternative (Alternative I). The determination also found that economic impacts among the alternatives would be short-term and not expected to disproportionately affect minority and low-income communities. West Coast Indian tribes are part of the Council's decision-making process on salmon management issues, and tribes with treaty rights to salmon, groundfish, or halibut have a seat on the Council. Additionally, the Tulalip Tribes contributed substantially to this document.

#### ***Executive Order 13132 Federalism***

Executive Order 13132 enumerates eight "fundamental federalism principles." The first of these principles states "Federalism is rooted in the belief that issues that are not national in scope or significance are most appropriately addressed by the level of government closest to the people." In this spirit, the Executive Order directs agencies to consider the implications of policies that may limit the scope of or preempt states' legal authority. Preemptive action having such "federalism implications" is subject to a consultation process with the states; such actions should not create unfunded mandates for the states; and any final rule published must be accompanied by a "federalism summary impact statement."

The Council process offers many opportunities for states and Indian tribes (through their agencies, Council appointees, consultations, and meetings) to participate in the formulation of management frameworks and management measures implementing the framework. This process encourages states and tribes to institute complementary measures to manage fisheries under their jurisdiction that may affect federally managed stocks.

The proposed action would not have federalism implications subject to Executive Order 13132.

#### ***Executive Order 13175 Consultation and Coordination with Indian Tribal Governments***

Executive Order 13175 is intended to ensure regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes.

The Secretary recognizes the sovereign status and co-manager role of Indian tribes over shared Federal and tribal fishery resources. At Section 302(b)(5), the MSA reserves a seat on the

Council for a representative of an Indian tribe with Federally-recognized fishing rights from California, Oregon, Washington, or Idaho.

Tribes with Federally-recognized fishing rights that may be impacted by the proposed action are the Tulalip Tribes of the Washington state. The proposed action and the other alternative have been developed through the Council process. Through the tribal representative on the Council and tribal comments submitted to NMFS and the Council, the Tribes have had a role in the developing the proposed action and analyzing the effects of the alternatives; therefore, the proposed action is consistent with EO 13175.

***Executive Order 13771 Reducing Regulation and Controlling Regulatory Costs***

Executive Order 13771 requires federal agencies to remove two regulations for every new regulation for rulemakings that are determined to be “significant” by the Office of Management and Budget (OMB). As the proposed action has not been determined to be significant by OMB, there is no applicability of this executive order.

## **APPENDIX I. FINDING OF NO SIGNIFICANT IMPACT**

## Background

### Proposed Action:

The proposed action is for the Pacific Fishery Management Council (Council) to adopt and the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service (NMFS) to approve a rebuilding plan for the Snohomish River natural coho salmon stock (Snohomish coho), which has been determined by NMFS to be overfished under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Details can be found in the Environmental Assessment (EA).

### Alternatives Evaluated in the Environmental Assessment:

Alternative I. Status quo control rule. This is considered the 'no-action' alternative and is the preferred alternative.

Alternative II.  $S_{MSY}$  Buffer. The Council will plan ocean fisheries to limit impacts on Snohomish natural coho consistent with escapement thresholds and exploitation rate limits identified by the Washington tribal and state co-managers, and consistent with the Fishery Management Plan (FMP).

### Selected Alternative:

Alternative II.  $S_{MSY}$  Buffer.

### Related Consultations:

There are no consultations specific to the proposed action; however, there are several Endangered Species Act (ESA) section 7 consultations on the ocean salmon fisheries impacts on ESA-listed evolutionarily significant units (ESUs) of salmon. Table 6.4.1.b below, reproduced from the EA, lists the current applicable ESA section 7 biological opinions relative to ESA-listed salmon ESUs.

Table 6.4.1.b. NMFS biological opinions regarding ESA-listed salmon ESUs likely to be affected by Council-area ocean salmon fisheries in the analysis area.

Date	Duration	Citation	Species Considered
8-Mar-96	Until reinitiated	NMFS 1996	Snake River spring/summer and fall Chinook (and sockeye)
28-Apr-99	Until reinitiated	NMFS 1999	Oregon Coast coho (S. Oregon/N. California Coast coho, and Central California Coast coho)
30-Apr-01	Until reinitiated	NMFS 2001	Upper Willamette Chinook, Upper Columbia River spring-run Chinook (Lake Ozette sockeye, Columbia River chum, and 10 steelhead ESUs)
30-Apr-04	Until reinitiated	NMFS 2004	Puget Sound Chinook
26-Apr-12	Until reinitiated	NMFS 2012	Lower Columbia River Chinook
9-Apr-15	Until reinitiated	NMFS 2015	Lower Columbia River coho

In addition to ESA-listed salmon, NMFS has consulted on the effects of the ocean salmon fisheries on ESA-listed Southern Resident killer whales (SRKW). As stated in section 6.3.1 of the EA, NMFS completed a consultation on the effects of implementing the Council's 2020



ocean salmon management measures on SRKW and intends to complete an opinion analyzing operation of the fishery under the Pacific Coast Salmon Fishery Management Plan (FMP), including this rebuilding plan, prior to the 2021 ocean salmon fishing season.

## **Significance Review**

The Council on Environmental Quality (CEQ) Regulations state that the determination of significance using an analysis of effects requires examination of both context and intensity, and lists ten criteria for intensity (40 C.F.R. § 1508.27 (1978)). In addition, the Companion Manual for National Oceanic and Atmospheric Administration Administrative Order 216-6A provides sixteen criteria, the same ten as the CEQ Regulations and six additional, for determining whether the impacts of a proposed action are significant. Each criterion is discussed below with respect to the proposed action and considered individually as well as in combination with the others.

***1. Can the proposed action reasonably be expected to cause both beneficial and adverse impacts that overall may result in a significant effect, even if the effect will be beneficial?***

The proposed action is expected to have the beneficial impact of rebuilding the overfished Snohomish coho salmon stock.

***2. Can the proposed action reasonably be expected to significantly affect public health or safety?***

No, there are no effects on public health or safety from the proposed action. The proposed action implements a harvest control rule to be used in setting annual ocean salmon fishery management measures while the Snohomish coho salmon stock is rebuilding.

***3. Can the proposed action reasonably be expected to result in significant impacts to unique characteristics of the geographic area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?***

No, the proposed action has no physical action. The proposed action implements a harvest control rule to be used in setting annual fishery management measures while the Snohomish coho salmon stock is rebuilding.

***4. Are the proposed action's effects on the quality of the human environment likely to be highly controversial?***

No, the proposed action is not likely to be highly controversial. The proposed action was developed through a series of public meetings and with the involvement of stakeholders and co-managers. NMFS received no comments on the draft EA.

***5. Are the proposed action's effects on the human environment likely to be highly uncertain or involve unique or unknown risks?***

No, the proposed action's effects are not likely to be highly uncertain as they are based on well-documented methodologies.

**6. *Can the proposed action reasonably be expected to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?***

No, rebuilding plans are developed on a case-by-case basis with the unique circumstances of each instance taken into consideration.

**7. *Is the proposed action related to other actions that when considered together will have individually insignificant but cumulatively significant impacts?***

No, the proposed action will inform the setting of annual management measures for ocean salmon fisheries. These annual management measures are analyzed in a National Environmental Policy Act (NEPA) document. The annual management measures are developed to meet the cumulative conservation objectives and other requirements for all MSA-managed salmon stocks on the West Coast.

**8. *Can the proposed action reasonably be expected to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources?***

No, the proposed action has no physical action. The proposed action establishes a harvest control rule to be used in setting annual fishery management measures while the Snohomish coho salmon stock is rebuilding.

**9. *Can the proposed action reasonably be expected to have a significant impact on endangered or threatened species, or their critical habitat as defined under the Endangered Species Act of 1973?***

No, annual management measures for ocean salmon fisheries are developed to be consistent with biological opinions on the impact of the ocean salmon fisheries on ESA-listed species.

**10. *Can the proposed action reasonably be expected to threaten a violation of Federal, state, or local law or requirements imposed for environmental protection?***

No, the proposed action was prepared with consideration of MSA, NEPA, and other applicable laws.

**11. *Can the proposed action reasonably be expected to significantly adversely affect stocks of marine mammals as defined in the Marine Mammal Protection Act (MMPA)?***

No, the proposed action will not have any significant impact on marine mammals. The MMPA is one of the applicable laws that were considered in the development of the proposed action.

***12. Can the proposed action reasonably be expected to significantly adversely affect managed fish species?***

No, as described in chapter 6 of the EA, non-salmonid managed fish species are managed under their other West Coast fishery management plans and are uncommonly encountered in the salmon fishery; therefore, the proposed action will not have any effect on those managed fish species. The proposed action will not adversely affect any managed salmon species, and is specifically designed to rebuild a managed stock of salmon.

***13. Can the proposed action reasonably be expected to significantly adversely affect essential fish habitat as defined under the Magnuson-Stevens Fishery Conservation and Management Act?***

No, there are no adverse effects to essential fish habitat from the proposed action. The proposed action implements a harvest control rule to be used in setting annual ocean salmon fishery management measures while the Snohomish coho salmon stock is rebuilding.

***14. Can the proposed action reasonably be expected to significantly adversely affect vulnerable marine or coastal ecosystems, including but not limited to, deep coral ecosystems?***

No, the proposed action will not adversely affect vulnerable marine or coastal ecosystems. The proposed action implements a harvest control rule to be used in setting annual ocean salmon fishery management measures in a sustainable manner while the Snohomish coho salmon stock is rebuilding.

***15. Can the proposed action reasonably be expected to significantly adversely affect biodiversity or ecosystem functioning (e.g., benthic productivity, predator-prey relationships, etc.)?***

No, the proposed action will not adversely affect biodiversity or ecosystem functioning. The proposed action implements a harvest control rule to be used in setting annual ocean salmon fishery management measures in a sustainable manner while the Snohomish coho salmon stock is rebuilding.

***16. Can the proposed action reasonably be expected to result in the introduction or spread of a nonindigenous species?***

No, the proposed action does not affect the introduction or spread of nonindigenous species. The West Coast states have regulations in place for vessel inspections to address this issue.

## Determination

In view of the information presented in this document and the analysis contained in the supporting Environmental Assessment prepared for the Snohomish coho salmon Rebuilding Plan, it is hereby determined that the Snohomish coho salmon Rebuilding Plan will not significantly impact the quality of the human environment as described above and in the supporting Environmental Assessment. In addition, all beneficial and adverse impacts of the proposed action have been addressed to reach the conclusion of no significant impacts. Accordingly, preparation of an environmental impact statement for this action is not necessary.



REGIONAL ADMINISTRATOR  
West Coast Region  
National Marine Fisheries Service

December 14, 2020

Date