Agenda Item F.2
Attachment 3 **(Electronic Only)**
September 2019

# *DRAFT 13*
# SNOHOMISH RIVER NATURAL COHO

*(AUGUST, 2019)*

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

**PLEASE NOTE**: COMMENTS AND REVIEW SHOULD BE CONCENTRATED ON THE PORTION OF THIS DOCUMENT THAT IS FOCUSED ON THE SALMON REBUILDING PLAN, WHICH ARE MAINLY SECTIONS 1-5, AND ANY APPENDICES NOTED IN THOSE SECTIONS. ALL DATA IS CONSIDERED PRELIMINARY, AND SOME ANALYSIS IS INCOMPLETE.

THIS IS AN INTEGRATED DOCUMENT AND SOME PORTIONS OF THE DOCUMENT [INDICATED BY AN ASTERISK (*)] CANNOT BE COMPLETED AT THIS TIME. THE 'PENDING DATA' OUTSIDE OF SECTIONS 1-5 WILL BE DEVELOPED AT A LATER DATE BY NMFS, AND MADE AVAILABLE FOR PUBLIC COMMENT THROUGH THE NOTICE-AND-COMMENT RULEMAKING PROCESS.

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| | |
|---|---|
| ABC | acceptable biological catch |
| ACL | annual catch limit |
| BY | brood year |
| 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 |
| NS1G | 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 comanagers, 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) comanager 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 X (XX control rule) 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 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[a/] | Spawning Escapement[b/] | | |
|---|---|---|---|
| | Hatchery | Natural | Total |
| | **Snohomish** | | |
| 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 | 8,375 | 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 |
| GOAL | | 31,000-50,000 | |

[a/]Years 2012-2017 are prliminary.

[b/]Includes estimated off-station returns and secondary wild stocks.

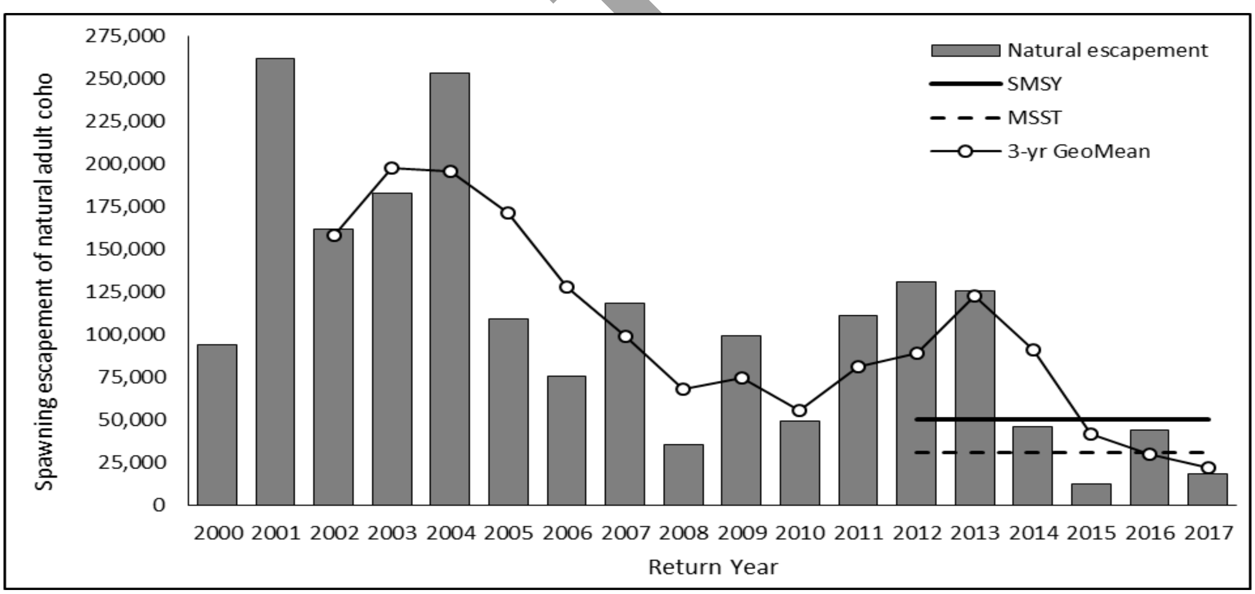


Figure 2.0.a. Spawning escapement of Snohomish River natural adult coho. Data source: PFMC 2018 Review of Ocean Fisheries, Table B-42.

## 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 $T_{target}$, $T_{min}$, and $T_{max}$).

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.

$T_{target}$: 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.

$T_{MIN}$: 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 $S_{MSY}$ in salmon rebuilding plans.

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

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

To estimate $T_{MIN}$, 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 because it would restrict tribal fisheries in a manner that is inconsistent with their treaty right.

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

### *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 the commercial, recreational and tribal fishing interests and coastal 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[1] between late August and late November with the peak occurring between the last week of September and first week of October[2]. 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[3].

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 (NOAA Fisheries 2009). Co-managers are currently collecting genetic samples from coho in the Snohomish, 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

[1] 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.

[2] WDFW Snohomish River in-river sport catch record card data.

[3] 2000-2012 Skykomish and Snoqualmie Rivers Chinook and Coho Salmon Out-migration Study, Tulalip Tribes

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 |
| *Average* | *8,032* | | | | *47%* | *0.7%* | *2,963* |

### *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$^2$ [2,865 km$^2$] 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 $mi^2$ [938 $km^2$], representing approximately 20 percent of the entire drainage area of the Snohomish River basin (Zimmerman 2014).

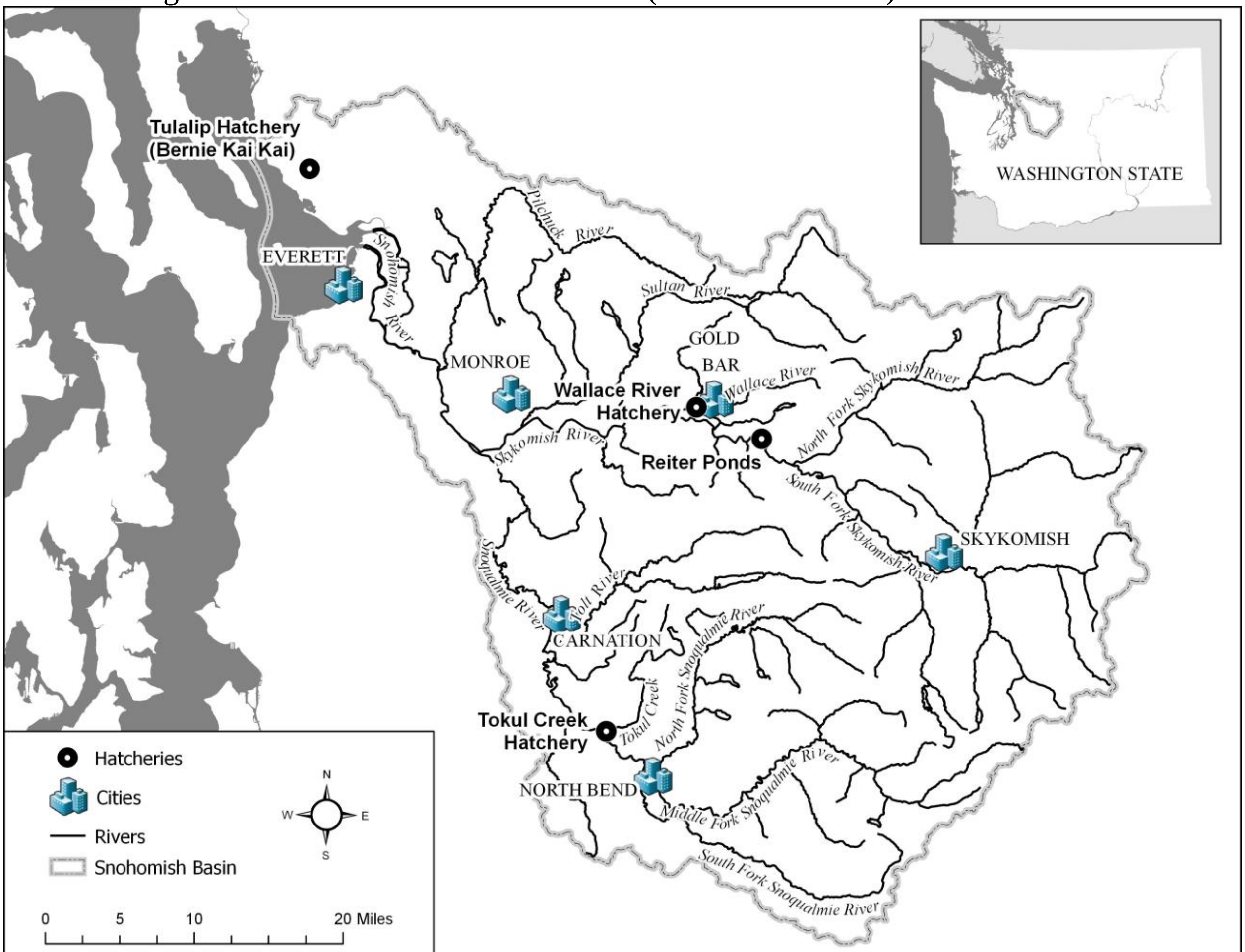


Figure 2.2.2.a. Map of the Snohomish River Basin.

## 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 $^{o}$C in the mainstem Snoqualmie River and 26.7 $^{o}$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.**

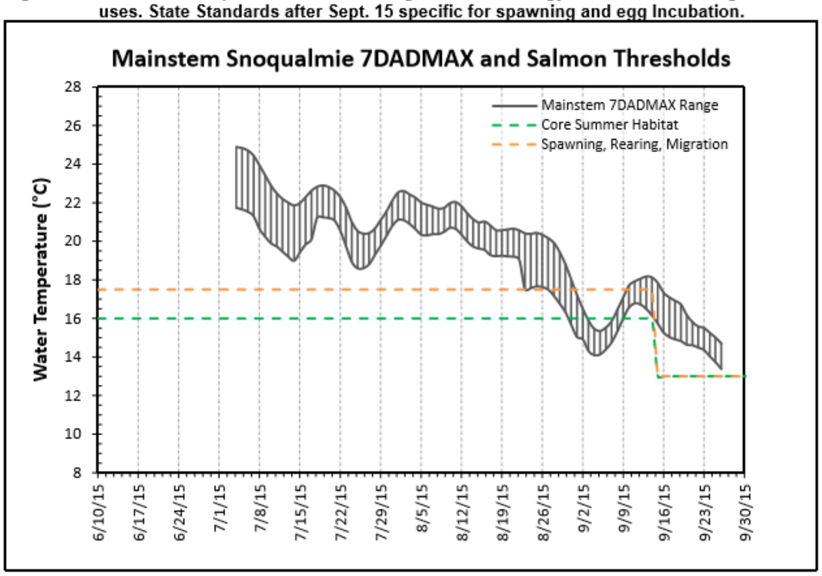


Figure 3.1.1.a. 2015 Snoqualmie River water temperatures, with thresholds for spawning and egg incubation shown.

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

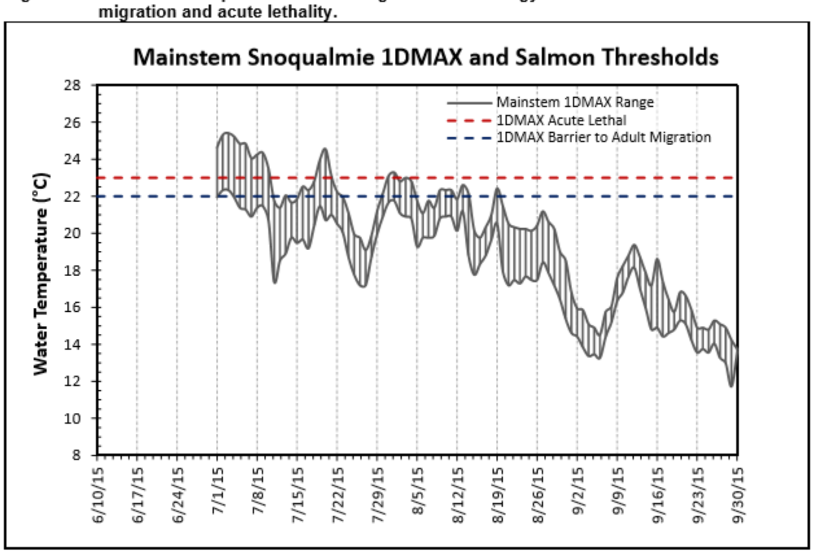


Figure 3.1.1.b. 2015 Snoqualmie River water temperatures, with thresholds for acute lethal and adult migration shown.

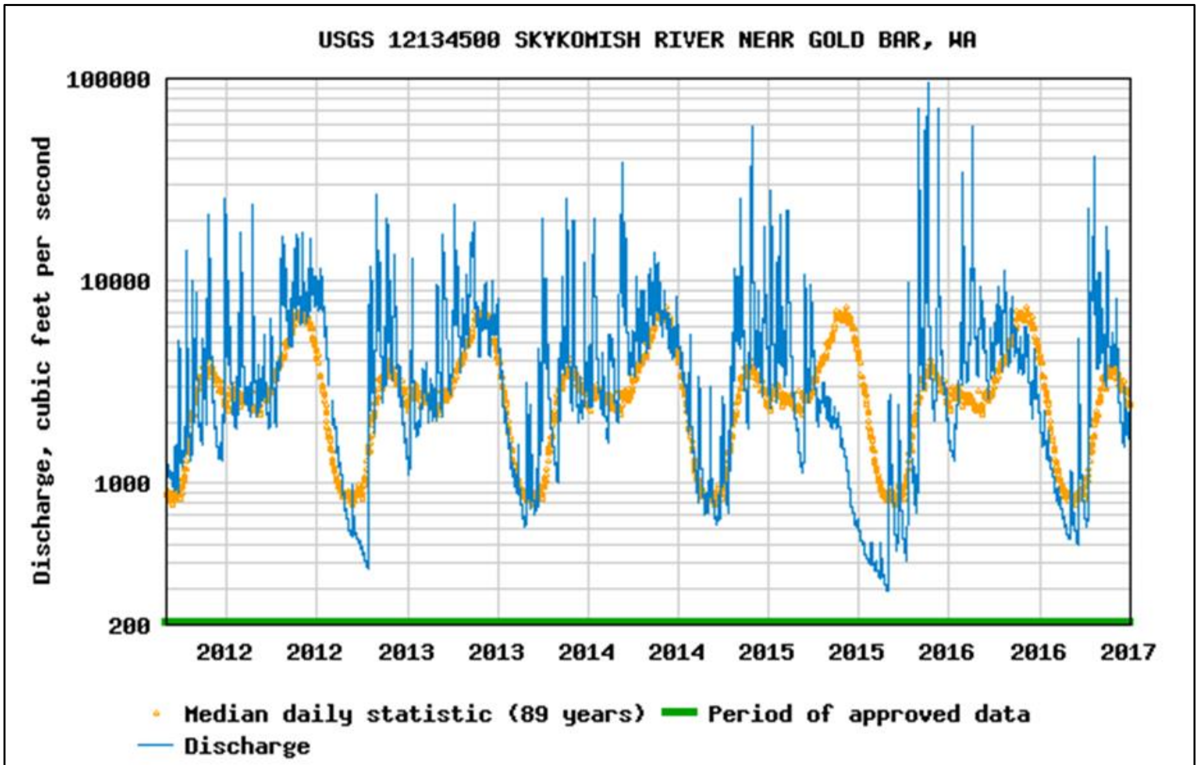

Figure 3.1.1.c. Skykomish River conditions (September 1, 2011-December 31, 2016).

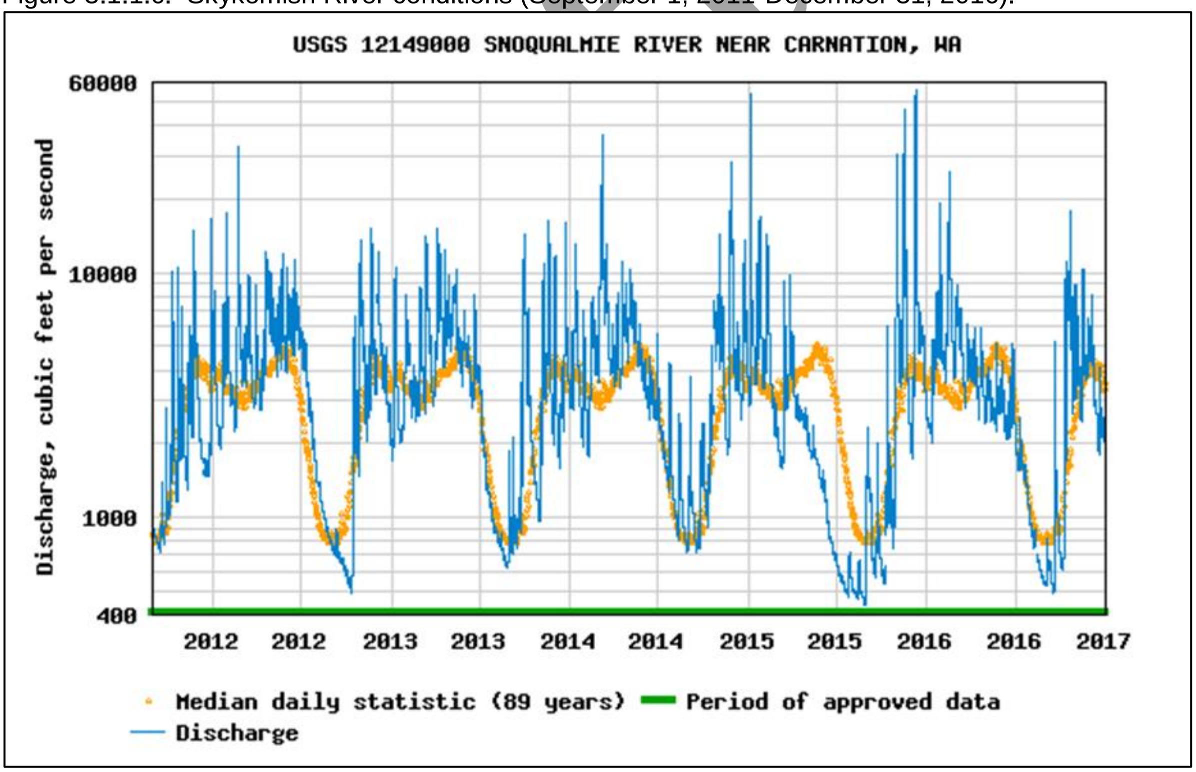

Figure 3.1.1.d. Snoqualmie River conditions (September 1, 2011-December 31, 2016).

### *3.1.2 Juvenile production estimates*

Juvenile natural coho (yearlings) production in the Snohomish system is 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. 2012). 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).

| | **Skykomish** | | | **Snoqualmie** | | |
|---|---|---|---|---|---|---|
| Year | 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 smolt 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.

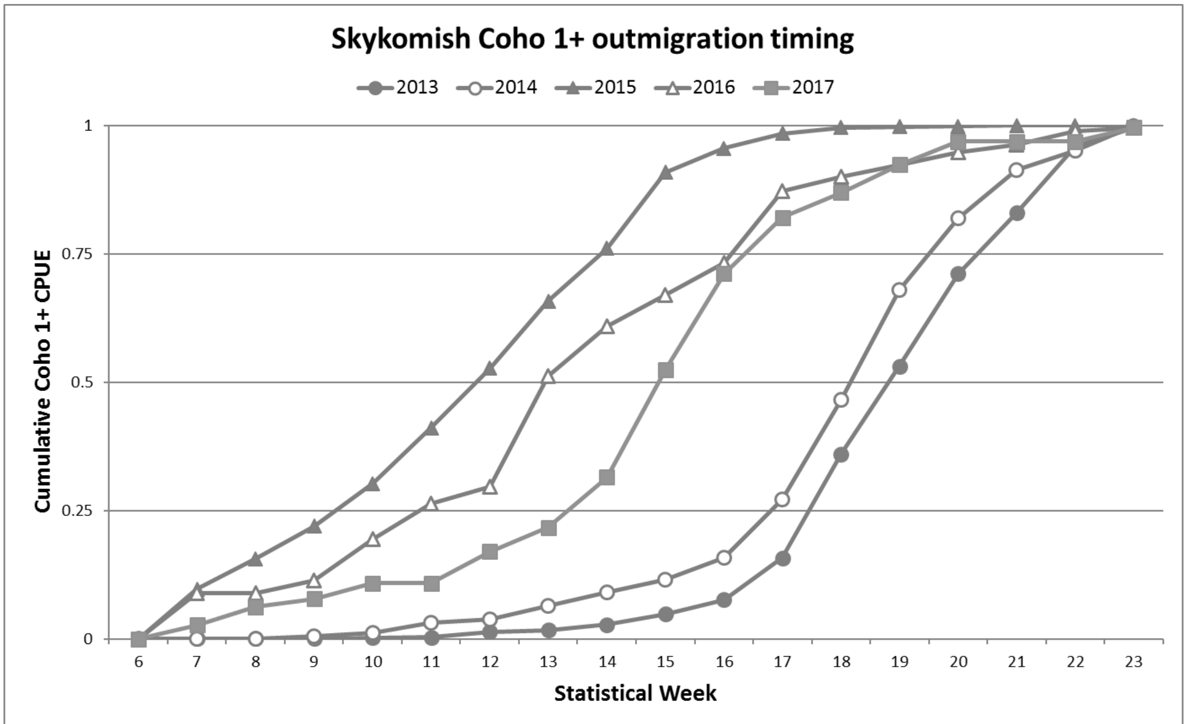


Figure 3.1.2.a. Cumulative season CPUE curves for unmarked smolt coho in the Skykomish (estimated from the trap counts. (Data source: M. Pouley, Tulalip NRD).

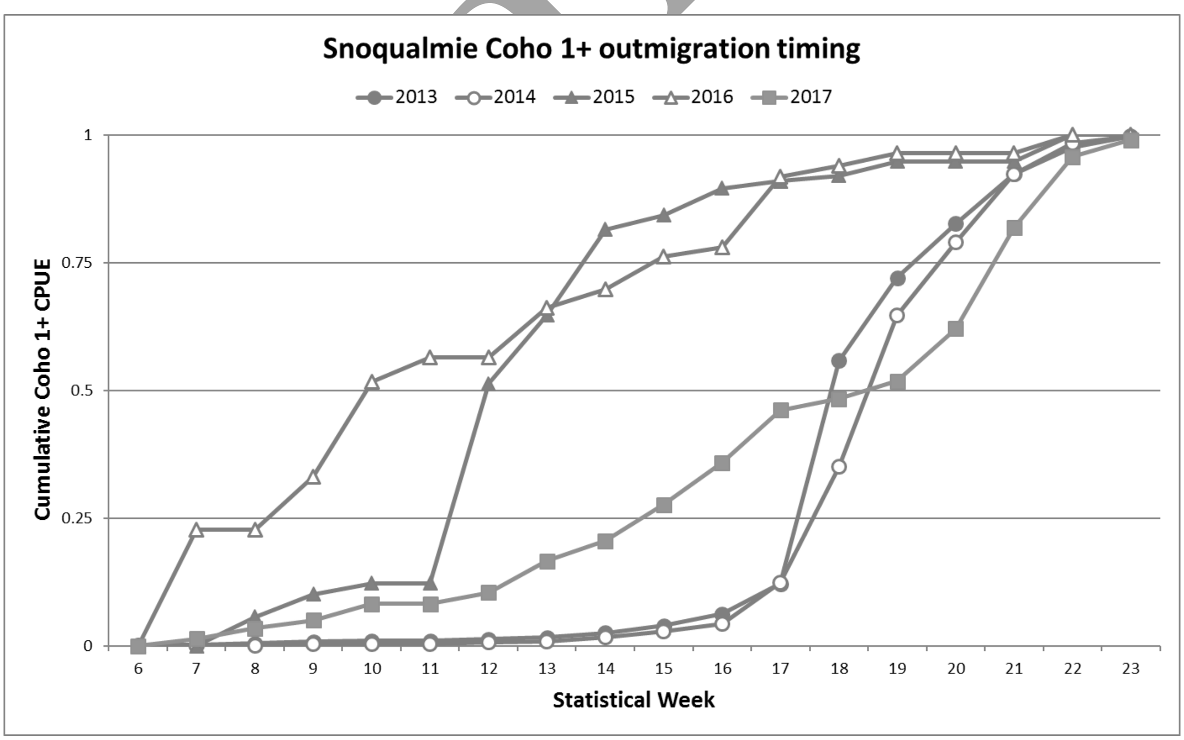


Figure 3.1.2.b. Cumulative season CPUE curves for unmarked smolt coho in the Snoqualmie estimated from the trap counts. (Data source: M. Pouley, Tulalip NRD).

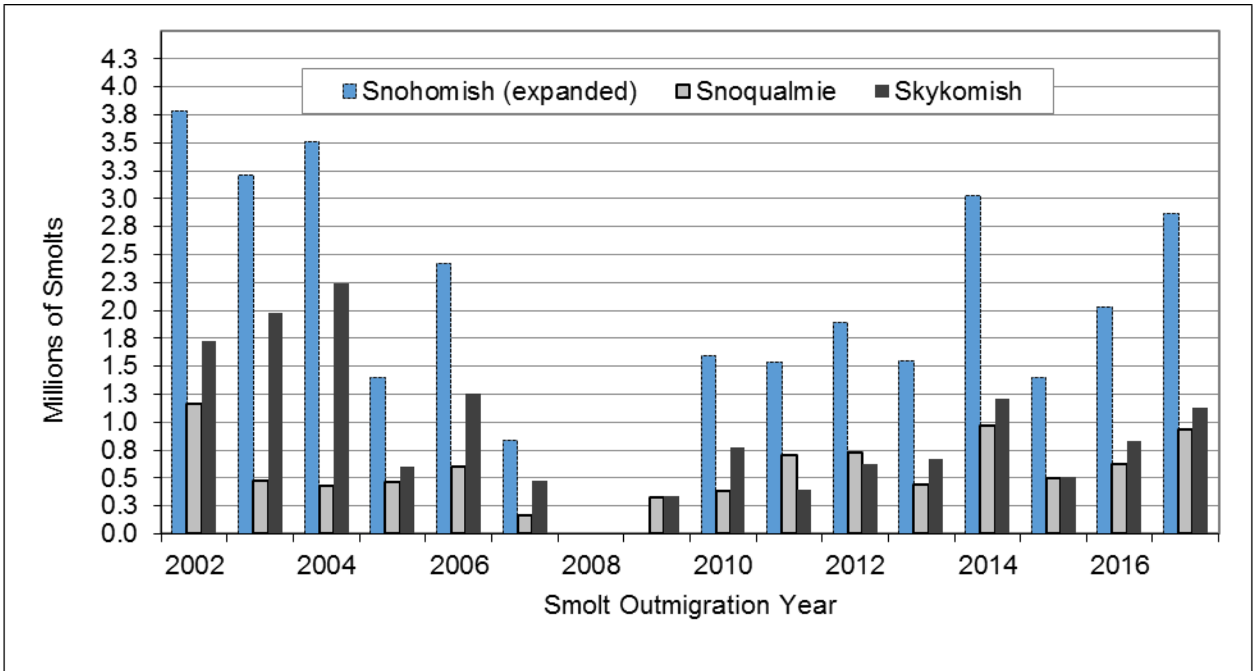


Figure 3.1.2.c. Coho smolt natural production estimates for the Snohomish Basin. Derived from data collected in area above traps on the Snoqualmie and Skykomish rivers, and expanded to whole basin production.

## 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 saltwater inside Puget Sound where they encounter a very different environment than those entering saltwater 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 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 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 oceans 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.

| | Year | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ecosystem Indicators* | *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 $m^{-3}$; 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 $m^{-3}$; 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 $m^{-3}$; 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. $km^{-1}$; 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. $km^{-1}$; 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 |
| *Ecosystem Indicators not included in the mean of ranks or statistical analyses* | | | | | | | | | | | | | | | | | | | | | |
| 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 $km^{-1}$; 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 were 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 (unmarked hatchery coho since 1996 (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 is not yet available, 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.

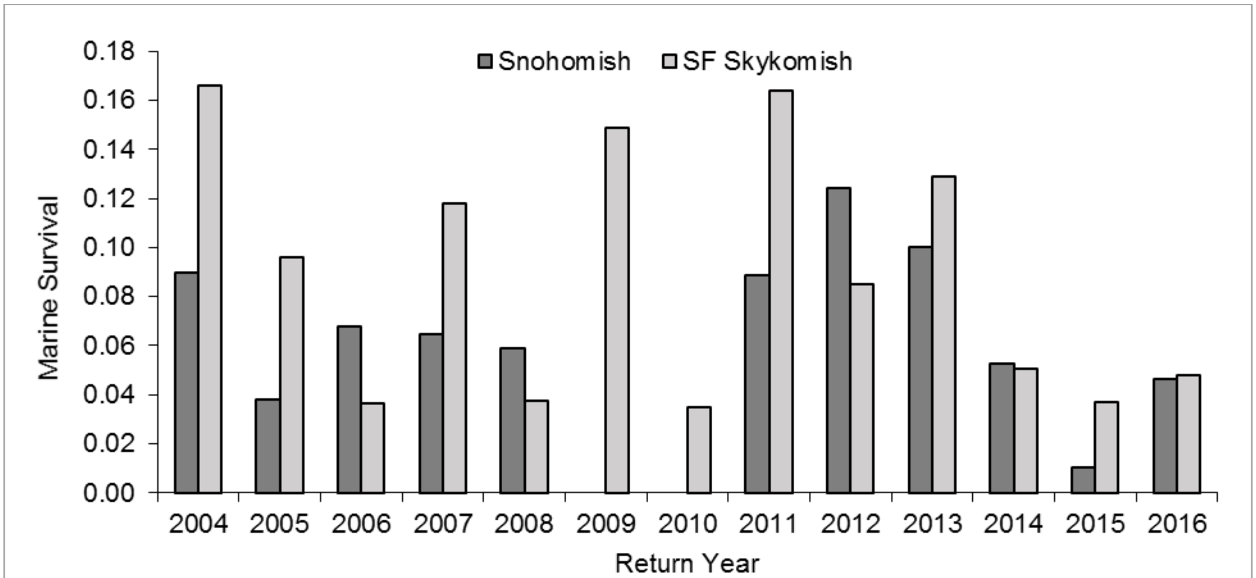

Figure 3.2.2.a. Estimated marine survival of Snohomish River and South Fork Skykomish River natural adult coho. For South Fork Skykomish wild coho (see Zimmerman 2018) and Snohomish (Pouley and Holmgren, pers. comm. 2018)

## 3.3 Harvest impacts

### *3.3.1 Ocean fisheries*

Season 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.

| | 2014 | | | 2015 | | | 2016 | | |
|---|---|---|---|---|---|---|---|---|---|
| Fishery Governed by Quota or Guideline | Quota | Catch | Catch/ Quota | Quota | Catch | Catch/ Quota | Quota | Catch | Catch/ Quota |
| **NORTH OF CAPE FALCON** | | | | | | | | | |
| TREATY INDIAN COMMERCIAL TROLL | 62,500 | 55,897 | 89% | 42,500 | 3,983 | 9% | - | - | - |
| NON-INDIAN COMMERCIAL TROLL | 35,200 | 23,141 | 66% | 19,200 | 5,059 | 26% | - | - | - |
| RECREATIONAL | 184,800 | 140,450 | 76% | 155,070 | 82,986 | 54% | 18,900 | 16,059 | 85% |
| **TOTAL NORTH OF CAPE FALCON** | **282,500** | **219,488** | **78%** | **216,770** | **92,028** | **42%** | **18,900** | **16,059** | **85%** |
| **SOUTH OF CAPE FALCON** | | | | | | | | | |
| 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% |
| **TOTAL SOUTH OF CAPE FALCON** | **115,000** | **82,797** | 72% | **75,700** | **19,341** | 26% | **33,500** | **5,717** | 17% |
| **GRAND TOTAL COUNCIL AREA** | **397,500** | **302,285** | **76%** | **292,470** | **111,369** | **38%** | **52,400** | **21,776** | **42%** |

| | 2017 | | | 2018 | | |
|---|---|---|---|---|---|---|
| Fishery Governed by Quota or Guideline | Quota | Catch | Catch/ Quota | Quota | Catch | Catch/ Quota |
| **NORTH OF CAPE FALCON** | | | | | | |
| TREATY INDIAN COMMERCIAL TROLL | 12,500 | 13,084 | 105% | 12,500 | 11,301 | 90% |
| NON-INDIAN COMMERCIAL TROLL | 2,500 | 1,838 | 74% | 4,600 | 1,384 | 30% |
| RECREATIONAL | 45,100 | 42,658 | 95% | 43,000 | 41,838 | 97% |
| **TOTAL NORTH OF CAPE FALCON** | **60,100** | **57,580** | **96%** | **60,100** | **54,523** | **91%** |
| **SOUTH OF CAPE FALCON** | | | | | | |
| 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% |
| **TOTAL SOUTH OF CAPE FALCON** | **25,900** | **14,628** | 56% | **42,600** | **18,499** | 43% |
| **GRAND TOTAL COUNCIL AREA** | **86,000** | **72,208** | **84%** | **102,700** | **73,022** | **71%** |

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*

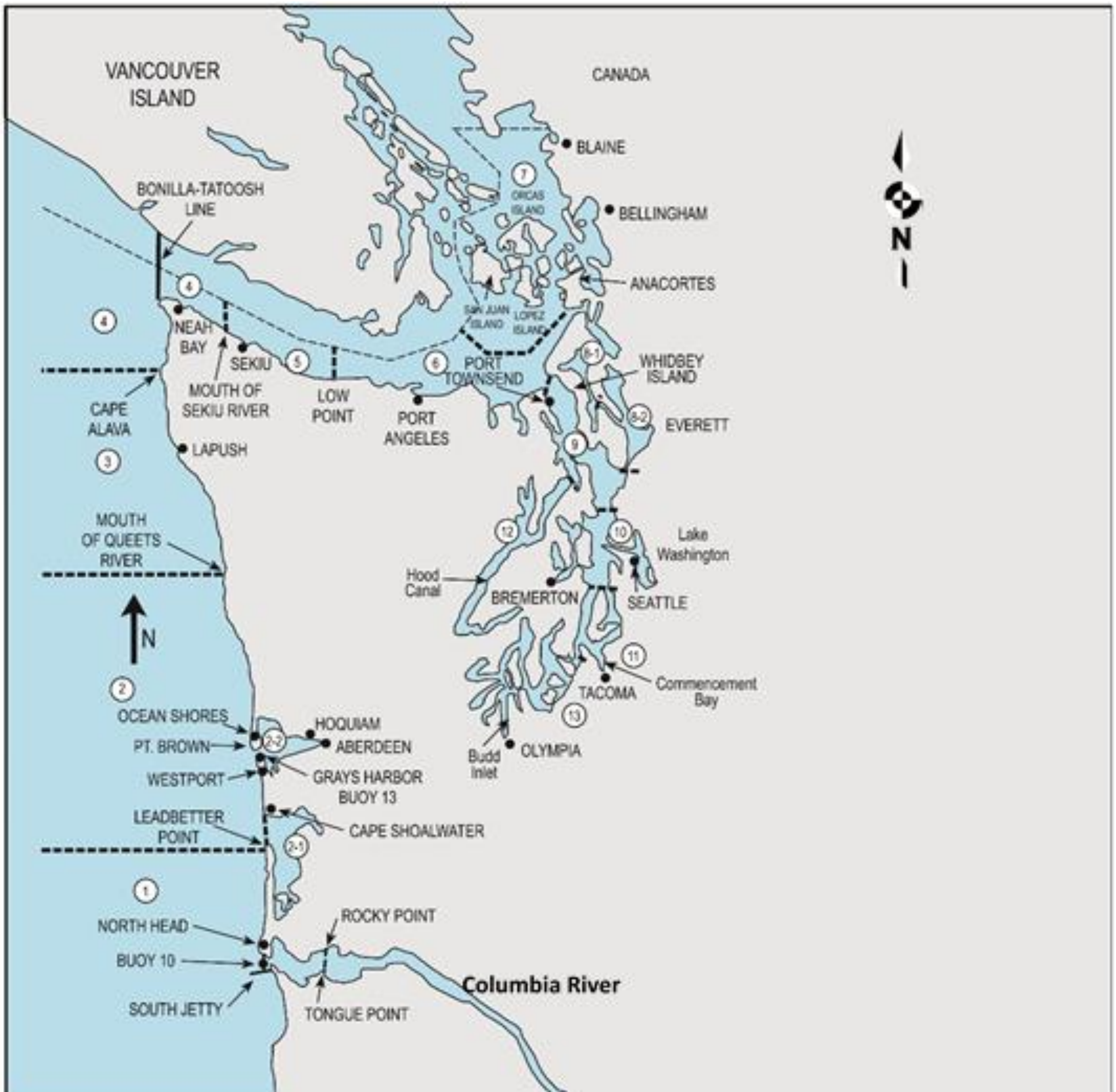


Figure 3.3.2.a. Map of Western Washington, showing the Marine Catch Areas of Puget Sound (Areas 5 through 13) and the Washington coast (Areas 1 through 4).

<u>Tribal fisheries</u>

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.

Harvest in terminal areas 8A and 8D 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, occur 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).

Puget Sound marine area harvest

Table 3.3.2.a. Coho harvest in Puget Sound marine fisheries[a/b/]

| Year | Treaty Indian | Non-Indian Commercial | Recreational[c/] |
|---|---|---|---|
| 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 has 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 3 coho only and odd-year limits are 3 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 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 4-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)

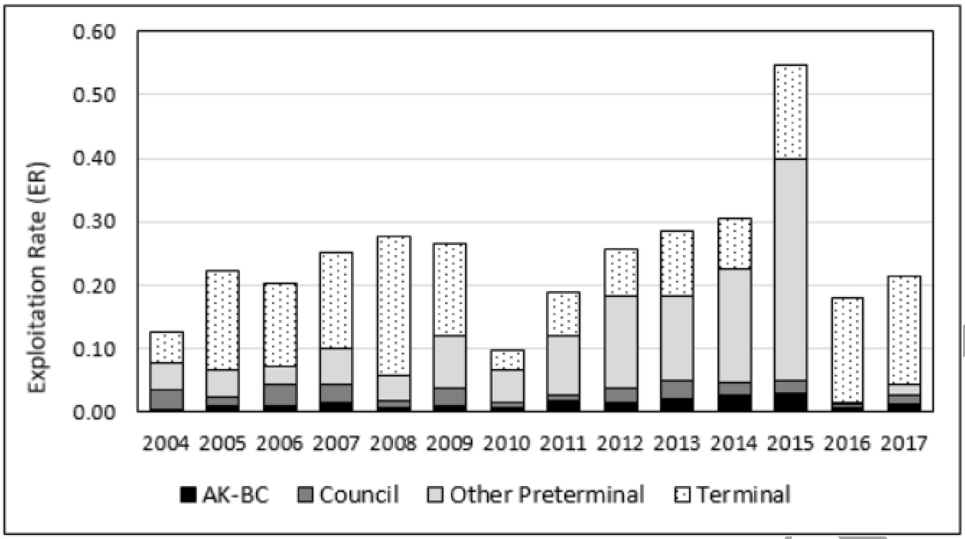


Figure 3.3.4.a. Postseason total exploitation rate by major fishery group on Snohomish natural coho from FRAM estimates generated by the PSC CoTC.

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[a/] |
|---|---|---|---|---|---|---|---|
| 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% |
| Total ER | 12.7% | 22.2% | 20.2% | 25.2% | 27.5% | 26.4% | 9.7% |
| Strata | 2011[a/] | 2012[a/] | 2013[a/] | 2014[a/] | 2015[a/] | 2016[a/] | 2017[a/] |
| 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% |
| Total ER | 18.9% | 25.6% | 28.4% | 30.5% | 54.8% | 18.1% | 21.3% |

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.

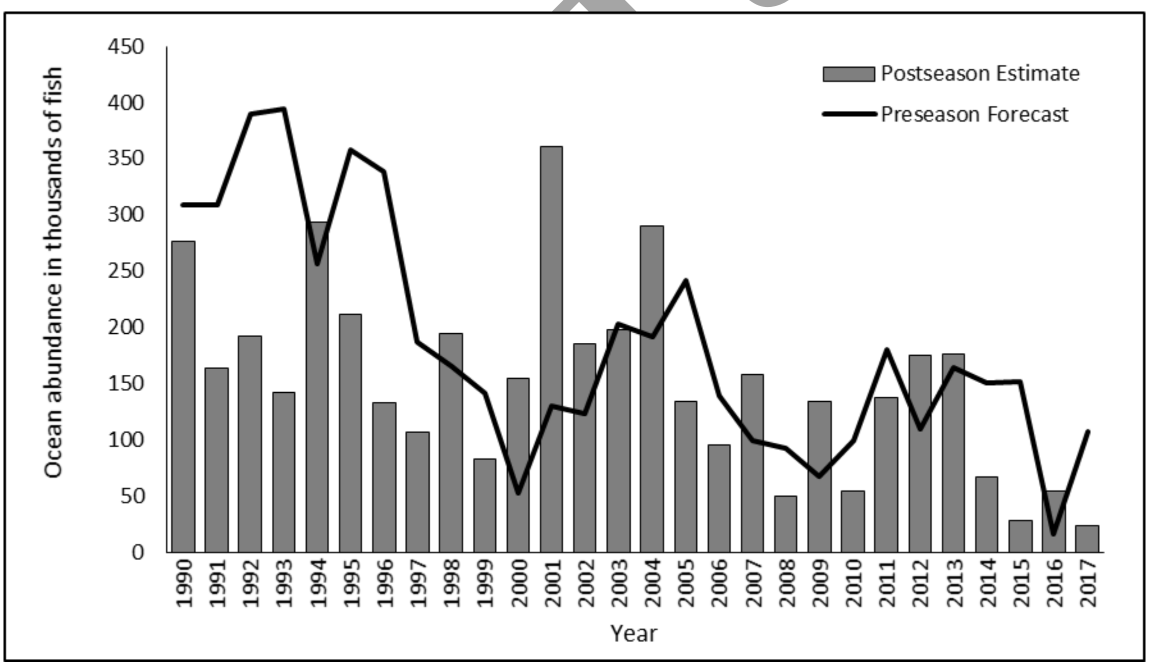


Figure 3.4.1.a. Preseason forecasts and postseason FRAM estimates of ocean age 3 abundance of Snohomish River natural coho. Preseason forecasts are generated by salmon co-managers and postseason FRAM estimates are generated by the PSC CoTC.

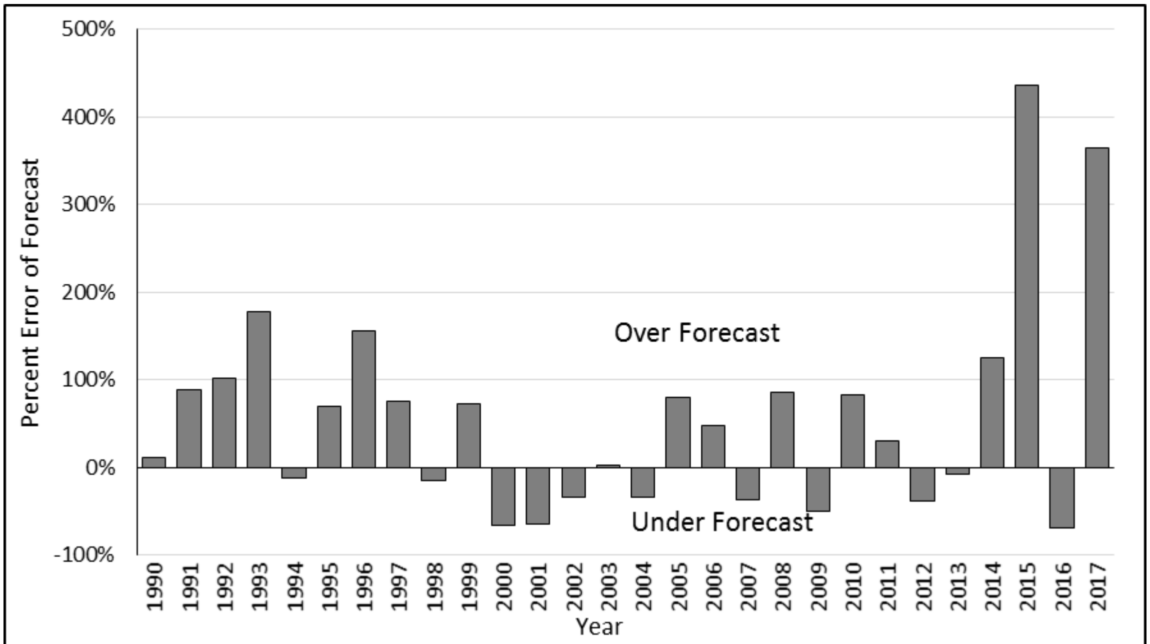

Figure 3.4.1.b. Preseason forecast error when compared to postseason estimates of ocean age 3 abundance of Snohomish River natural coho. Preseason forecasts are generated by salmon co-managers and postseason FRAM estimates are generated by the PSC CoTC

### *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[a/] | ER[b/] | ER cap[a/] |
| 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.

| | 2014 | | 2015 | | 2016 | | 2017 | |
|---|---|---|---|---|---|---|---|---|
| **FISHERY COMPONENT** | **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 | 802 | 1,706 | 2,396 | 828 | 199 | 408 | 1,102 | 286 |
| Council North of Falcon | | | | | | | | |
| 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 |
| **Council Subtotal** | **4,971** | **1,398** | **4,154** | **524** | **105** | **164** | **1,464** | **311** |
| 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 |
| **Total Fishing Mortality** | **45,712** | **20,317** | **49,728** | **15,510** | **1,106** | **9,735** | **16,319** | **4,933** |
| Alaska-Canada | 0.5% | 2.6% | 1.6% | 2.9% | 1.2% | 0.8% | 1.0% | 1.2% |
| Council North of Falcon | | | | | | | | |
| 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% |
| **Council Subtotal** | **3.3%** | **2.1%** | **2.7%** | **1.9%** | **0.6%** | **0.3%** | **1.4%** | **1.3%** |
| 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% |
| **Total Exploitation Rate** | **30.4%** | **30.5%** | **32.7%** | **54.8%** | **6.6%** | **18.1%** | **15.2%** | **21.3%** |

## 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 preseason. 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 preseason ERs have averaged 52 percent of the allowable ER caps, and the postseason rates have averaged 81 percent of the allowable caps. The only years in this time frame in which the postseason 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 postseason ER cap, although both the postseason estimated ER and ER cap were higher than projected preseason.

# 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 comanagers, 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 comanagers 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, 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: Comanager recommendations

Successful comanagement is one essential component to rebuilding Snohomish coho stocks and this should continue. Comanagers 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 comanagers 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. Comanagers 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 inseason updates to the terminal abundance would have allowed. Comanagers 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 | **0.599** | 0.747 | 0.842 | 0.902 | 0.937 | 0.960 | 0.976 | 0.984 |
| Alternative II | 0.055 | 0.230 | **0.616** | 0.759 | 0.842 | 0.902 | 0.939 | 0.964 | 0.978 | 0.986 |
| $T_{MIN}$ | 0.106 | 0.391 | **0.776** | 0.881 | 0.937 | 0.971 | 0.985 | 0.992 | 0.996 | 0.998 |

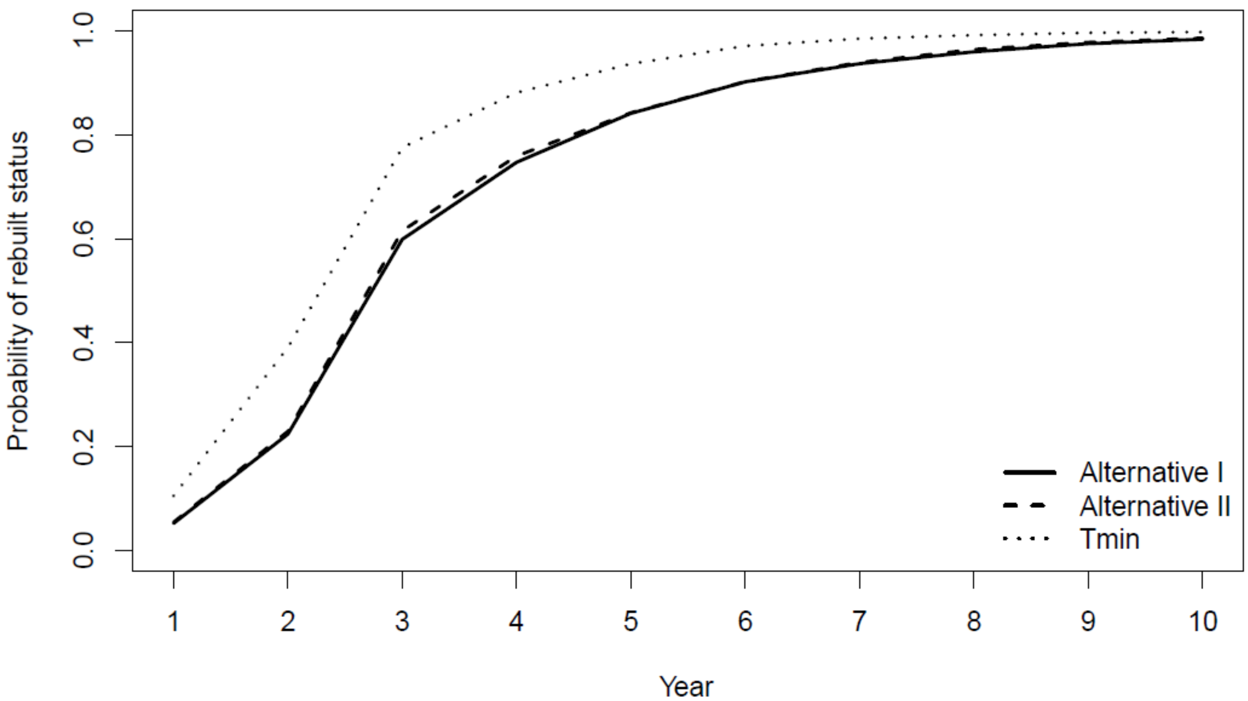


Figure 4.4.a. Projected probability of achieving rebuilt status by year under the two alternatives and the $T_{MIN}$ scenario.

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 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. [4]

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 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 most recent annual salmon review (PFMC 2018b).

[4] 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.

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[5] (Figure 5.1.a and Table 5.1.a).



[5] 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.

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 non-tribal economic impact estimates, tribal commercial ocean troll salmon fisheries also occur and contribute economically to coastal communities. In addition, JDF coho are also taken in commercial and tribal net fisheries and recreational fisheries in Puget Sound and its tributaries. During 2004-2016, commercial net harvests of adult JDF coho in the Puget Sound region averaged 3,369 fish, ranging from 332 fish in 2015 to 6,877 fish in 2009.[6] 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 is indicated by the economic benchmark used 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 relevant NEPA documents, which take into consideration current trends as well as the impacts of reasonably foreseeable future actions.



[6] 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.

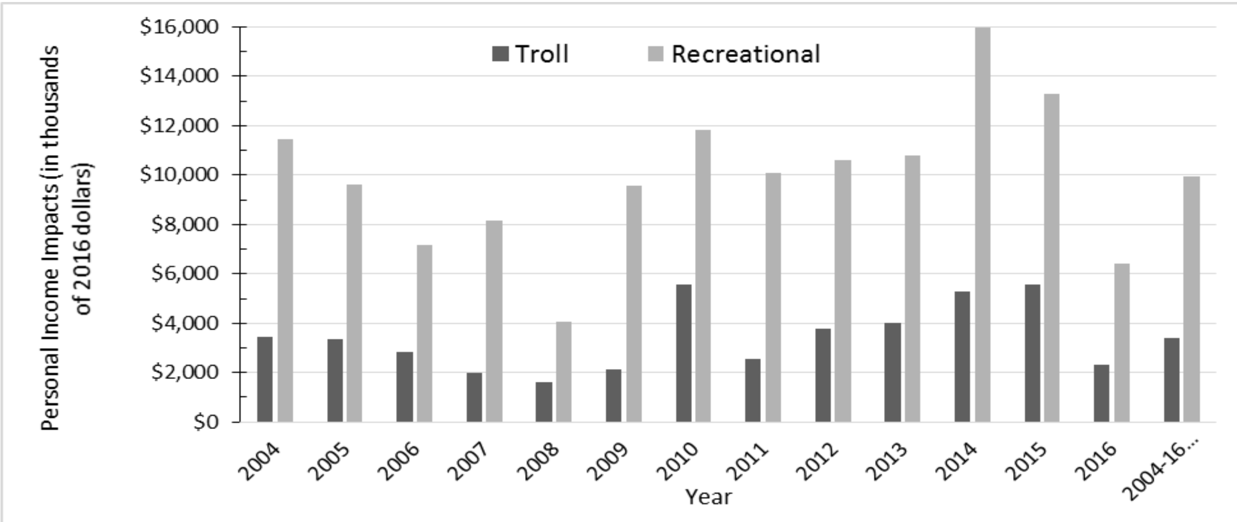


Figure 5.1.a. Estimates of total, aggregated personal income impacts in affected coastal communities in Washington and Oregon north of Cape Falcon in thousands of real (inflation adjusted, 2016) dollars for the non-tribal commercial ocean troll and ocean recreational salmon fisheries.

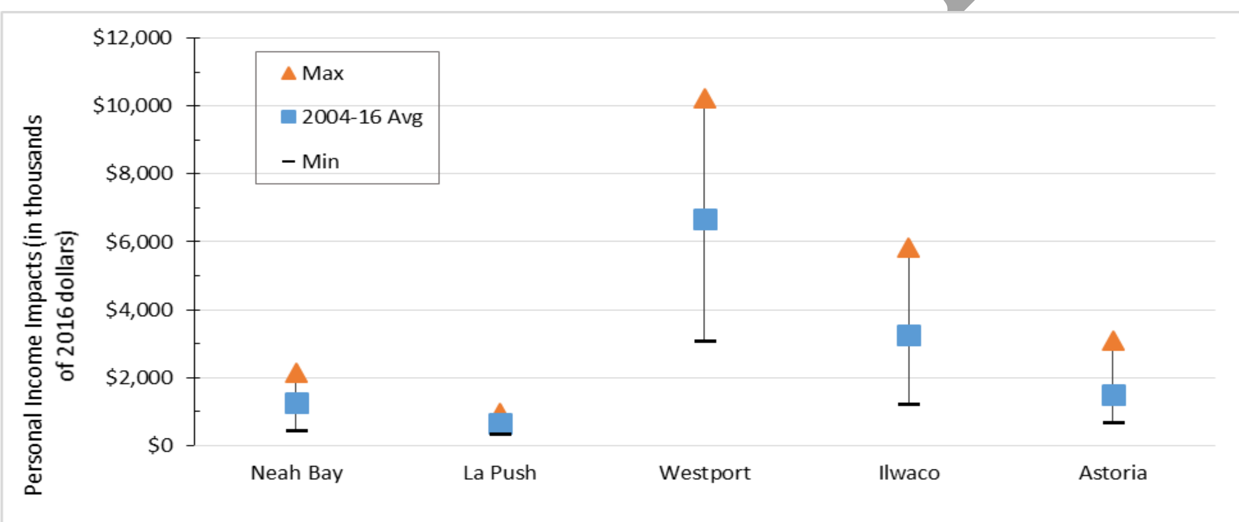


Figure 5.1.b. Estimates of personal income impacts by coastal community in thousands of real (inflation adjusted, 2016) dollars for the combined non-tribal commercial ocean troll and ocean recreational salmon fisheries in Washington and Oregon north of Cape Falcon.

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.

| OCEAN TROLL | Neah Bay | La Push | Westport | Ilwaco | Astoria | Total |
|---|---|---|---|---|---|---|
| 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 |
| **2004-16 Avg** | **468** | **376** | **1,611** | **244** | **720** | **3,419** |
| **Max** | **928** | **641** | **3,843** | **1,108** | **1,840** | **5,568** |
| **Min** | **163** | **204** | **440** | **74** | **180** | **1,601** |
| **RECREATIONAL** | **Neah Bay** | **La Push** | **Westport** | **Ilwaco** | **Astoria** | **Total** |
| 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 |
| **2004-16 Avg** | **807** | **282** | **5,062** | **3,001** | **773** | **9,926** |
| **Max** | **1,228** | **484** | **8,315** | **4,731** | **1,242** | **15,962** |
| **Min** | **244** | **108** | **2,425** | **1,024** | **242** | **4,043** |
| **Combined** | **Neah Bay** | **La Push** | **Westport** | **Ilwaco** | **Astoria** | **Total** |
| 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 |
| **2004-16 Avg** | **1,275** | **658** | **6,673** | **3,245** | **1,493** | **13,344** |
| **Max** | **2,156** | **975** | **10,223** | **5,839** | **3,082** | **21,268** |
| **Min** | **407** | **316** | **3,041** | **1,189** | **658** | **5,644** |

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

## 5.2 Alternative I

Under Alternative I, the current management framework and reference points[7] 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**Error! Reference source not found.** 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 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

[7] As defined in the FMP and the PST.

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 spanner 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 constrain 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 $T_{MIN}$ 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)

| | | Graphic depiction of which coho stocks were most constraining (Red indicates constraining, Yellow indicates depressed but not constraining) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Most Constraining Stock(s) | Queets R. | JDF[1/] | Snohomish R. | Fraser R. | LCN[2/] | OCN[3/] | GH[4/] | Other |
| 2004 | Fraser | | | | | | | | |
| 2005 | Fraser | | | | | | | | |
| 2006 | Fraser and LCN | | | | | | | | |
| 2007 | Fraser | | | | | | | | |
| 2008 | LCN and OCN | | | | | | | | |
| 2009 | Fraser and LCN | | | | | | | | |
| 2010 | Fraser and LCN | | | | | | | | |
| 2011 | Fraser | | | | | | | | |
| 2012 | Fraser | | | | | | | | |
| 2013 | Fraser | | | | | | | | |
| 2014 | Fraser | | | | | | | | |
| 2015 | Fraser and Queets | | | | | | | | |
| 2016 | Queets | | | | | | | | |
| 2017 | Queets | | | | | | | | |
| 2018 | Queets and Grays Harbor | | | | | | | | |
| 2019 | PS Chinook[5] | | | | | | | | |
| 16 yrs | No. of years constraining: | 4 | - | - | 11 | 4 | 1 | 1 | 1 |

1/ Strait 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 (≤) | Spawners (≥) | Spawners (≥) | Spawners (≥) |
| **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 |

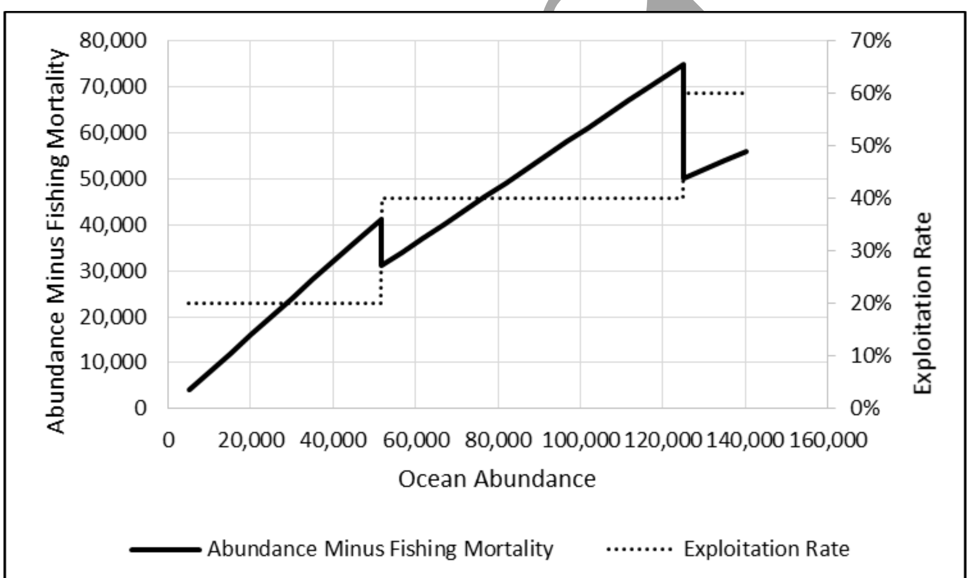


Figure 5.3.a. Relation between Snohomish ocean abundance, exploitation rate policy and escapement before taking into account natural mortality (i.e. ocean abundance minus fishing mortality).

## 5.4 $T_{MIN}$ rebuilding scenario

Under the $T_{MIN}$ rebuilding scenario, rebuilding is estimated to occur as quickly as possible; three years assuming an exploitation rate of zero during that time. Under $T_{MIN}$ 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 $T_{MIN}$ 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 $T_{MIN}$ 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;[8] 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 $T_{MIN}$ 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 $T_{MIN}$, 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 $T_{MIN}$ 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 reductions were calculated across 10,000 replicate simulations of 10-year management cycles while the rebuilding periods are predicted to be relatively short, the actual

[8] Recent studies have pointed to the difficultly 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.

conditions 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.

| | **Alt I** | **Alt II** | **$T_{MIN}$ Scenario** |
|---|---|---|---|
| Key Assumptions | Snohomish Coho would constrain fisheries in the North of Falcon Area<br><br>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 $T_{MIN}$ 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 Taking 6 or More Years | 16% | 16% | 6% |

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

| **Assumption/Caveats** | **Potential Implication** |
|---|---|
| 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 $T_{MIN}$ Scenario. |
| Ocean, habitat, and other conditions will remain with 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. |

| | |
|---|---|
| Ocean fishing is reduce for all sectors and areas 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. |

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

| Assumption/Caveats | Potential Implication |
|---|---|
| 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.[a/] | 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. |

# 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 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.

## 6.2 Target salmon stocks

### *6.2.1 Affected environment*

Ocean salmon fisheries in the analysis area target Chinook and coho salmon.

The Council manages several stocks of Chinook salmon under the FMP (PFMC 2016a). 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 and recreational bag limits; some fisheries also have quotas. The primary salmon stocks targeted in the analysis area are: Lower Columbia River hatchery fall-run Chinook salmon, Columbia River Spring Creek Hatchery fall-fun 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/).

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

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

## 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). 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 (83 FR 5349, February 7, 2018), 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 (a distinct population segment of *Orcinus orca*) are likely to be affected by salmon fisheries.

Salmon fisheries affect Southern Resident killer whales by removing Chinook salmon, an important prey species for the whales (NMFS 2009). NMFS issued a biological opinion evaluating the effects of the Pacific Coast salmon fisheries on Southern Resident killer whales in 2009 (NMFS 2009; Appendix B); this opinion concluded that the proposed ocean salmon fisheries were not likely to jeopardize the continued existence of the Southern Resident killer whales or adversely modify their critical habitat. NMFS completed a five-year review of the Southern Resident killer whale ESA listing in September 2016. There is new information regarding status, diet, and potentially the effects of fisheries on Southern Resident killer whale population trends. NMFS is reassessing the effects of salmon fisheries in light of this new information, and has reinitiated consultation on the effects of Council salmon fisheries (memorandum from Ryan Wulff, NMFS, to Chris Yates, NMFS, dated April 12, 2019).

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

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

## 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 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 |
|---|---|---|
| **Chinook (*Oncorhynchus tshawytscha*)** | | |
| 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) |
| **Coho (*Oncorhynchus kisutch*)** | | |
| Oregon Coastal | Threatened | 76 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 |
|---|---|---|---|
| 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 |

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

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

## 6.5 Non-target fish species

### *6.5.1 Affected environment*

Pacific halibut, and Pacific halibut fisheries, occur north of Point Arena, California. Halibut allocations are established annually in the International Pacific Halibut Commission's (IPHC) regulations and the PFMC's Area 2A Catch Sharing Plan (e.g., 82 FR 18581, April 20, 2017). Allocation of halibut quota to fisheries in the analysis area would not be affected by the Proposed Action, as the IPHC's halibut quota for the U.S. West Coast and the sub-area allocations set forth in the Catch Sharing Plan are set annually under separate processes from setting the annual salmon management measures.

Fisheries for coastal pelagic species (e.g., northern anchovy, market squid, Pacific sardine, Pacific mackerel, and jack mackerel), Dungeness crab, shrimp/prawns, and sea cucumbers occur in the analysis area and are managed by either NMFS and the PFMC (coastal pelagics) or the states (crab, shrimp/prawns, and sea cucumbers). The species targeted in these fisheries are not encountered in ocean salmon fisheries. It is possible that reductions in salmon fishing opportunities could result in a shift of effort toward these other species; however, we could not find any documentation to support this.

Fishermen that participate in salmon fisheries, both commercial and recreational, may also fish for groundfish (i.e., species such as rockfish and flatfish that live on or near the bottom of the ocean).

Groundfish fisheries are managed under the Council's Groundfish FMP. Commercial salmon trollers that retain groundfish are considered to be participating in the open access groundfish fishery with non-trawl gear; therefore, they must comply with the regulations for the open access groundfish fishery. Likewise, recreational fishers that retain groundfish, must comply with recreational groundfish regulations. As fishery impacts to groundfish are managed under the Groundfish FMP and regulations, there would be no measurable effect on these species from the proposed action.

Albacore (*Thunnus alalunga*) is harvested on the West Coast, including the analysis area, by many of the same commercial and recreational fishermen that fish for salmon. Fishery impacts to albacore are managed under the Council's Highly Migratory Species FMP. Commercial and recreational fishers shift effort between salmon and albacore in response to available fishing opportunities, catch limits, angler demand (recreational fisheries), and changing prices for the species being harvested (commercial fisheries). As fishery impacts to albacore are managed under the Highly Migratory Species FMP and regulations, there would be no measurable effect on these species from the proposed action.

#### *6.5.2 Environmental consequences of the alternatives on non-target fish species*

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

### 6.6 Seabirds

#### *6.6.1 Affected environment*

Numerous seabird species, as well as raptors, are protected under the Migratory Bird Treaty Act, including several species that are present in areas coincident with Pacific salmon. These seabirds include grebes, loons, petrels, albatrosses, pelicans, double-crested cormorants, gulls, terns, auks, and auklets (PFMC 2013c). ESA-listed seabird species include short-tailed albatross (endangered) and marbled murrelet (threatened). Interactions with the Pacific salmon fishery typically occur in two ways: when seabirds feed on outmigrating juvenile salmon, and when seabirds are entangled or otherwise interact with fishing gear or activities. Predation on juvenile salmon by seabirds is known to occur in estuarine environments, such as the lower Columbia River, as salmon smolts migrate downstream and into marine waters. We do not know the extent to which seabirds in the analysis area depend upon juvenile salmonids as prey. Council-managed ocean salmon fisheries are limited to hook-and-line tackle. Interactions with seabirds are uncommon in these fisheries.

#### *6.6.2 Environmental consequences of the alternatives on seabirds*

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

### 6.7 Ocean and coastal habitats and ecosystem function

#### *6.7.1 Affected environment*

Salmon FMP stocks interact with a number of ecosystems along the Pacific Coast, including the California Current Ecosystem (CCE), numerous estuary and freshwater areas and associated riparian habitats. Salmon contribute to ecosystem function as predators on lower trophic level species, as prey for higher trophic level species, and as nutrient transportation from marine ecosystems to inland ecosystems. Because of their wide distribution in both the freshwater and marine environments, Pacific salmon interact with a great variety of habitats and other species of fish, mammals, and birds. The analysis area for the Proposed Action is dominated by the CCE. An extensive description of the CCE can be found in chapter three of the Council's Pacific Coast Fishery Ecosystem Plan (PFMC 2013c). Council managed salmon fisheries use hook and line gear, exclusively. This gear does not touch the ocean floor and does not disturb any habitat features. Therefore, salmon fisheries have no physical impact on habitat.

#### *6.7.2 Environmental consequences of the alternatives on habitat and ecosystem function*

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

### **6.8 Cultural resources**

#### *6.8.1 Affected environment*

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

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

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

### **6.9 Cumulative impacts**

*{Section to be completed by NMFS after Council adopts a rebuilding plan}*

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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."*

*NS1Gs (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*$S_{MSY}$ or 0.75*$S_{MSY}$, 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

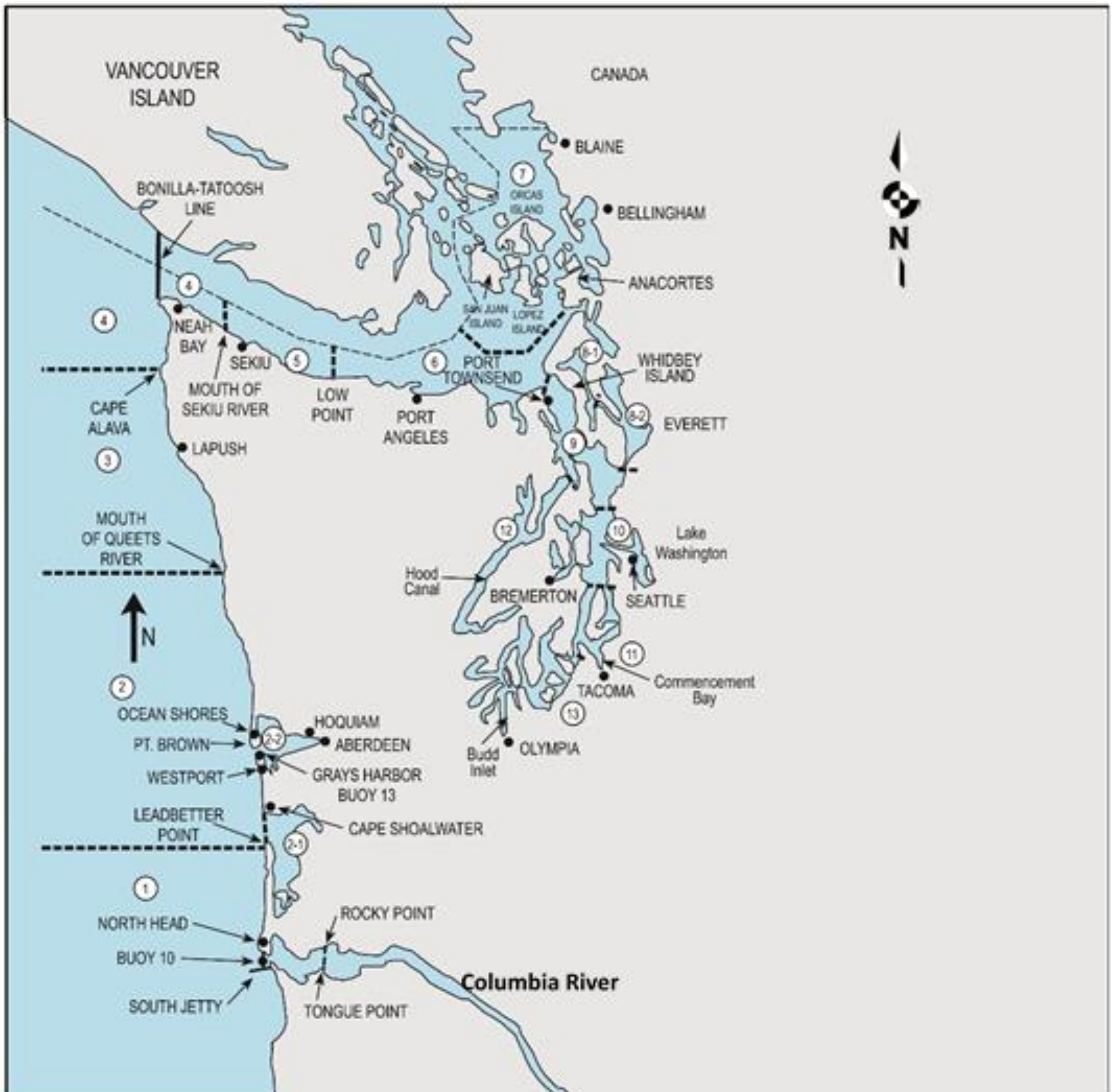
In Area 11 (Tacoma – Vashon Island), non-selective coho fishing was open from June 1 through December 31, and again from February 1 through April 30, in both the 2014-15 and 2015-16 seasons. In contrast, during the 2016-17 season, there were no fisheries allowing coho salmon retention in Area 11.

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 [1/] | 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 [d/] | 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 [k/] |
| | NSF | July 1-31; Dec 1-Apr 30 [a/] | July 1-31; Oct 1-31; Dec 1-Apr 30 [e/] | 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 [f/] | 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 [f/] | 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 [h/] (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 [b/], Jan 16-Apr 15 [g/] | 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 [1/] | 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 [l/]; June 1-30 |
| | NSF | July 1 - Jan 31 | July 1 - Jan 31 [c/] | 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 [h/] | July 1 - Aug 31 [i/]; 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 | So. of Ayock: July 1-Dec 31; N. of Ayock: Sept 1-Dec 31; whole area: Feb 1-Apr 30 | whole area: July 1-Dec 31; Feb 1-Apr 30 | So. of Ayock: July 1-Sept 30 ; N. of Ayock: Aug 16-Sept 30 ; whole area: Oct 1 - Apr 30 |
| | MSF | n/a | n/a | n/a |
| | Closed | whole area: Jan 1-31; May 1-June 30; N. of Ayock: July 1-Aug 31 | whole area: Jan 1-31; May 1-June 30 | So. of Ayock: May 1-June 30; N. of Ayock: July 1-Aug 15; May 1-June 30 |
| 13 | NR | n/a | n/a | July 1-Aug 31; Oct 1 [j/] -June 30 |
| | NSF | Nov 1-June 30 | Nov 1-June 30 [h/] | n/a |
| | MSF | July 1-Oct 31 | July 1-Oct 31 | n/a |
| | Closed | n/a | n/a | Sept 1-30 |

[1/] 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:**

[a/] 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.

k/ 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.

l/ 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

| | | Preseason Agreed-to Season Dates | | | | | |
|---|---|---|---|---|---|---|---|
| River | Area | 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 16-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 16-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.

| | | Actual Season Dates | | |
|---|---|---|---|---|
| River | Area | 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 mouth of Sultan | 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 | |
| Skykomish R. | Mouth of Wallace to confluence with 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

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

and where $\bar{S}$ is the arithmetic mean of the observed Snohomish natural coho ocean abundance time series and $\sigma^2_{\log(S)}$ 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 $\widehat{N}_t$ is drawn from a lognormal distribution,

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

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

$$\sigma_{\log(\widehat{N})} = \sqrt{\log\left(1 + \text{CV}^2_{\widehat{N}}\right)} \quad (4)$$

with $\mathrm{CV}_{\hat{N}}$ representing the coefficient of variation for the abundance forecast. $\mathrm{CV}_{\hat{N}}$ 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

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

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

$$F \sim \mathrm{Beta}(\alpha, \beta) \qquad (6)$$

with parameters

$$\alpha = \frac{1 - \hat{F}_t(1 + \mathrm{CV}_F^2)}{\mathrm{CV}_F^2} \qquad (7)$$

and

$$\beta = \frac{\frac{1}{\hat{F}_t} - 2 + \hat{F}_t + (\hat{F}_t - 1)\mathrm{CV}_F^2}{\mathrm{CV}_F^2}. \qquad (8)$$

The coefficient of variation for the exploitation rate implementation error, $\mathrm{CV}_F$, 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,

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

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, $S_{\text{MSY}}$. 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 $S_{\text{MSY}}$ 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 $S_{\text{MSY}} = 50{,}000$. 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 $T_{\text{MIN}}$. For these simulations the following parameter values were assumed: $\text{CV}_{\hat{N}} = 0.2$, $\text{CV}_{\hat{E}} = 0.2$, and $\text{CV}_F = 0.1$. 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 ($\text{CV}_{\hat{N}} = 0.6$), the escapement estimation error CV ($\text{CV}_{\hat{E}} = 0.5$), and the CV of the exploitation rate implementation error ($\text{CV}_F$ = 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.

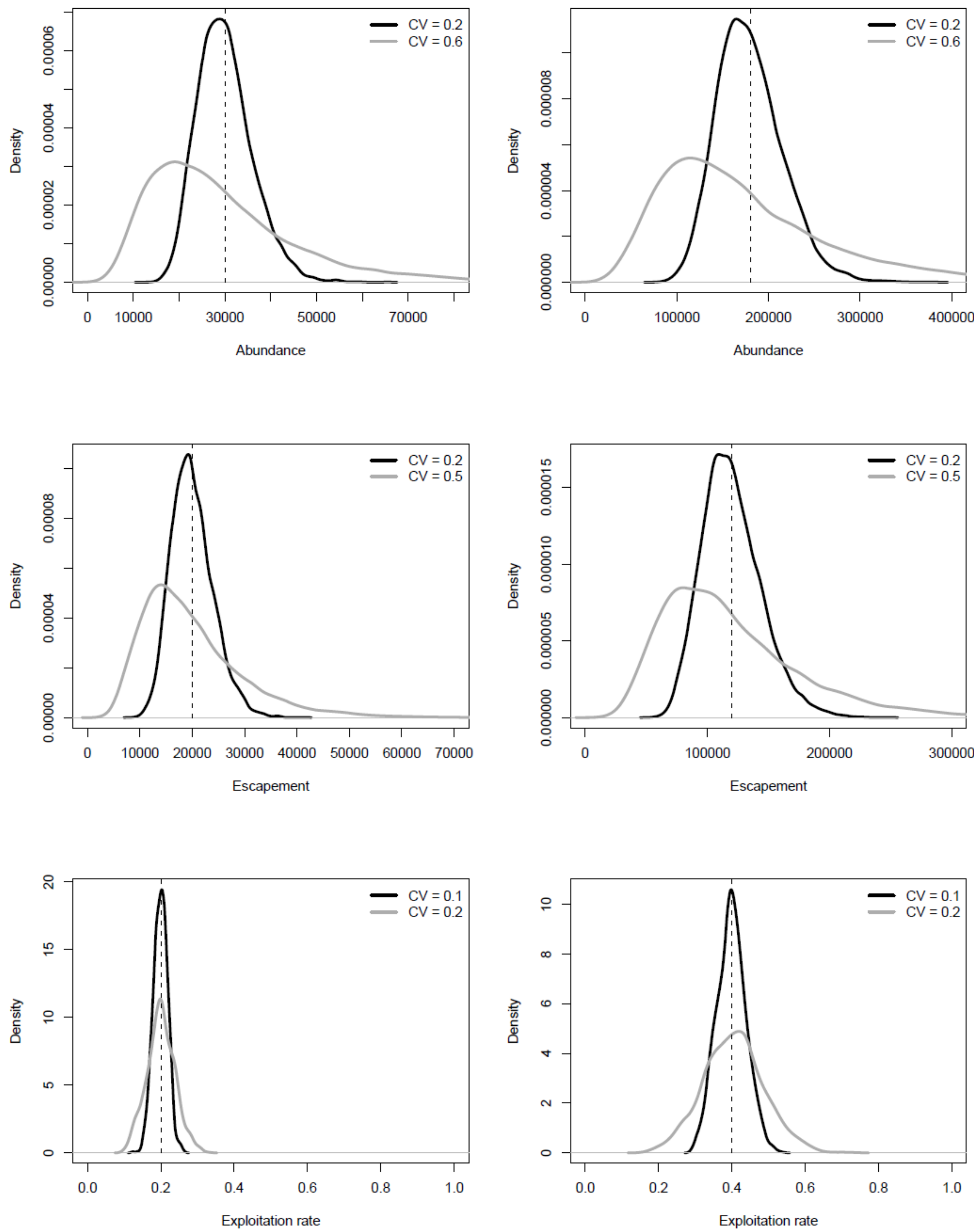



Figure 1. Distributions of the forecast abundance (top row), estimated escapement (middle row), and realized exploitation rate (bottom row) under different levels of known abundance, known escapement, and predicted exploitation rate. Known values are indicated by vertical dashed lines.

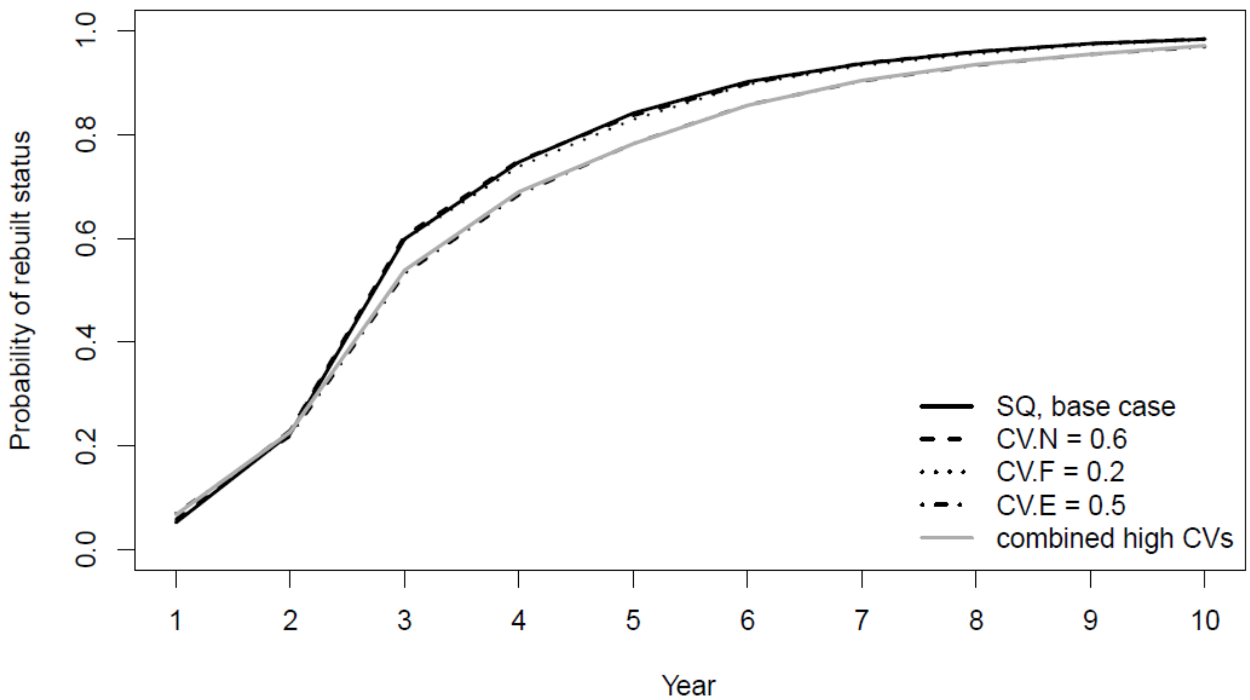



Figure 2. Probability of achieving rebuilt status in years 1 through 10 for the status quo control rule (Alternative I), given different parameter values for abundance forecast error (CV.N), exploitation rate implementation error (CV.F), and escapement estimation error (CV.E).

APPENDIX E. DRAFT FINDING OF NO SIGNIFICANT IMPACT

{Section to be completed by NMFS after Council adopts a rebuilding plan}

APPENDIX F. PAST, PRESENT AND REASONABLY FORESEEABLE FUTURE IMPACTS

{Section to be completed by NMFS after Council adopts a rebuilding plan}

APPENDIX G. LIST OF AGENGIES AND PERSONS CONSULTED

{Section to be completed by NMFS after Council adopts a rebuilding plan}

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

| | |
|---|---|
| **March 2018** | **Rohnert Park, CA** |
| **April 2018** | **Portland, OR** |
| May 2018 | Public Webinar |
| June 2018 | Public Meeting in Olympia, WA |
| August 2018 | Public Webinar |
| September 2018 | Public Webinar |
| **September 2018** | **Seattle, WA** |
| **November 2018** | **San Diego, CA** |
| **March 2019** | **Vancouver, WA** |
| **April 2019** | **Rohnert Park, CA** |
| **June 2019** | **San Diego, CA** |
| **September 2019** | **Boise, ID** |

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 H.  REGULATORY IMPACT REVIEW

{Section to be completed by NMFS after Council adopts a rebuilding plan}

Regulatory Impact Review and Initial Regulatory Flexibility Analysis for the
[*Insert Rule Name and RIN #*]

National Marine Fisheries Service, West Coast Region
[*Insert date*]

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
>
> Executive Order 12866 can be found at: http://www.nmfs.noaa.gov/sfa/laws_policies/economic_social/eo12866.pdf

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 Snohomish River fishery descriptions in this document (Section 3.3.1, Section 3.3.2, and Section 3.3.3).

*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, Section 4.4, and Appendix D).

*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 XXX.

## APPENDIX I. INITIAL REGULATORY FLEXIBILITY ANALYSIS

{Section to be completed by NMFS after Council adopts a rebuilding plan}

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". These analyses describe the impact on small businesses, non-profit enterprises, local governments, and other small entities as defined by the RFA (5 U.S.C. § 603). This analysis is to inform the agency and the public of the expected economic effects of the alternatives, and aid the agency in considering any significant regulatory alternatives that would accomplish the applicable objectives and minimize the economic impact on affected small entities. The RFA does not require the alternative with the least cost or with the least adverse effect on small entities be chosen as the preferred alternative. The IRFA must only address the effects of a proposed rule on entities subject to the regulation (i.e., entities to which the rule will directly apply) rather than all entities affected by the regulation, which would include entities to which the rule will indirectly 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).

- A fish and seafood merchant wholesaler (NAICS 424460) primarily engaged in servicing the fishing industry is a small business if it employs 100 or fewer persons on a full time, part time, temporary, or other basis, at all its affiliated operations worldwide.

- A business primarily engaged in Seafood Product Preparation and Packaging (NAICS 311710) is a small business if it employs 750 or fewer persons on a full time, part time, temporary, or other basis (13 CFR § 121.106), at all its affiliated operations.[9]

In addition to small businesses, the RFA recognizes and defines two other kinds of small entities: small governmental jurisdictions and small organizations. A small governmental jurisdiction is any government or district with a population of less than 50,000 persons. A small organization is any not-for-profit enterprise that is independently owned and operated and not dominant in its field, while. (5 U.S.C. § 601). There is no available guidance beyond this statutory language regarding how to determine if non-profit organizations are "small" for RFA purposes. The Small Business Administration (SBA) does have provisions for determining whether a business is "small" for RFA purposes and whether it is "dominant in its field," and those provisions can inform how NMFS classifies non-profit organizations for the purposes of RFA analyses in rulemaking. After consultation with the SBA, NOAA Fisheries has decided to use SBA's size standards for non-profit organizations to determine whether a non-profit organization is "small" and, in turn, whether it is "dominant in its field," to apply the statutory definition of a "small organization" in practice:
A nonprofit organization is determined to be "not dominant in its field" if it is considered "small" under SBA size standards:

- Environmental, conservation, or professional organizations (NAICS 813312, 813920): Combined annual receipts of $15 million or less.
- Other organizations (NAICS 813319, 813410, 813910, 813930, 813940, 813990): Combined annual receipts of $7.5 million or less.

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).

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

[99] For purposes of rulemaking, NMFS West Coast Region is applying the seafood processor standard to catcher processors (C/Ps) and mothership processor ships, which earn the majority of their revenue from selling processed Pacific whiting seafood product.

The reasons why agency action is being considered are explained in the "Statement of the Problem" section in the RIR above (Appendix H).

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

The reasons why agency action is being considered are explained in the "Description of the Management Goals and Objectives" section in the RIR above (Appendix H). The legal basis for the proposed rule is…

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

*Reporting and recordkeeping requirements*

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

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

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

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

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

*A description of any significant alternatives to the proposed rule that accomplish the stated objectives of applicable statutes and that minimize any significant economic impact of the proposed rule on small entities*

APPENDIX J. NATIONAL STANDARDS ANALYSIS

{Section to be completed by NMFS after Council adopts a rebuilding plan}

APPENDIX K. CONSISTENCY WITH OTHER APPLICABLE LAWS ANALYSIS

{Section to be completed by NMFS after Council adopts a rebuilding plan}

- MSA
- CZMA
- ESA
- MMPA
- MBTA
- PRA
- EO 12898 Environmental Justice
- EO 13132 Federalism
- EO 13175 Tribal Consultation and Coordination
- Regulatory Flexibility Act
- EO 12866 Regulatory Planning and Review

- EO 13771 Reducing Regulation and Controlling Regulatory Costs