Science, Service, Stewardship

2022 5-Year Review: Summary & Evaluation of **Oregon Coast Coho Salmon**

National Marine Fisheries Service
West Coast Region

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5-Year Review: Oregon Coast Coho Salmon

Species Reviewed	Evolutionarily Significant Unit or Distinct Population Segment
Coho Salmon (*Oncorhynchus kisutch*)	*Oregon Coast Coho Salmon*

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1. General Information

1.1 Introduction

Many West Coast salmon and steelhead (*Oncorhynchus* spp.) stocks have declined substantially from their historic numbers and now are at a fraction of their previous abundance. Several factors contributed to these declines including overfishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices. These factors collectively led to the National Marine Fisheries Service's (NMFS) listing of 28 salmon and steelhead stocks in California, Idaho, Oregon, and Washington under the Federal Endangered Species Act (ESA).

The ESA, under section 4(c)(2), directs the Secretary of Commerce to review the listing classification of threatened and endangered species at least once every five years. A 5-year review is a periodic analysis of a species' status conducted to ensure that the listing classification of a species as threatened or endangered on the List of Endangered and Threatened Wildlife and Plants (List) (50 CFR 17.11 – 17.12; 50 CFR 223.102, 224.101) is accurate (USFWS and NMFS 2006; NMFS 2020a). After completing this review, the Secretary must determine if any species should: (1) be removed from the list; (2) have its status changed from endangered to threatened; or (3) have its status changed from threatened to endangered. The most recent 5-year review analysis for West Coast salmon and steelhead occurred in 2016. This document describes the results of the 2022 5-year review for ESA-listed Oregon Coast (OC) coho salmon.

A 5-year review is:

- A summary and analysis of available information on a given species
- The tracking of a species' progress toward recovery
- The recording of the deliberative process used to make a recommendation on whether or not to reclassify a species
- A recommendation on whether reclassification of the species is indicated

A 5-year review is not:

- A re-listing or justification of the original (or any subsequent) listing action
- A process that requires acceleration of ongoing or planned surveys, research, or modeling
- A petition process
- A rulemaking

1.1.1 Background on salmonid listing determinations

The ESA defines species to include subspecies and distinct population segments (DPSs) of vertebrate species. A species may be listed as threatened or endangered. To identify taxonomically recognized species of Pacific salmon we apply the "Policy on Applying the Definition of Species under the ESA to Pacific Salmon" (56 FR 58612). Under this policy, we identify population groups that are "evolutionarily significant units" (ESUs) within taxonomically recognized species. We consider a group of populations to be an ESU if it is substantially reproductively isolated from other populations within the taxonomically recognized species and represents an important component in the evolutionary legacy of the species. We consider an ESU as constituting a DPS and, therefore, a "species" under the ESA.

Artificial propagation programs (hatcheries) are common throughout the range of ESA-listed West Coast salmon and steelhead. Before 2005, our policy was to include in the listed ESU or DPS only those hatchery fish deemed "essential for conservation" of the species. We revised that approach in response to a court decision. On June 28, 2005, we announced a final policy addressing the role of artificially propagated Pacific salmon and steelhead in listing determinations under the ESA (70 FR 37204) (Hatchery Listing Policy). This policy establishes criteria for including hatchery stocks in ESUs and DPSs. In addition, it (1) provides direction for considering hatchery fish in extinction risk assessments of ESUs and DPSs; (2) requires that hatchery fish determined to be part of an ESU or DPS be included in any listing of the ESU or DPS; (3) affirms our commitment to conserving natural salmon and steelhead populations and the ecosystems upon which they depend; and (4) affirms our commitment to fulfilling trust and treaty obligations with regard to the harvest of some Pacific salmon and steelhead populations, consistent with the conservation and recovery of listed salmon ESUs and steelhead DPSs.

To determine whether a hatchery program is part of an ESU or DPS, and therefore must be included in the listing, we consider the origins of the hatchery stock, where the hatchery fish are released, and the extent to which the hatchery stock has diverged genetically from the donor stock. We include within the ESU or DPS (and therefore within the listing) hatchery fish that are no more than moderately diverged from the local population.

Because the new Hatchery Listing Policy changed the way we considered hatchery fish in ESA listing determinations, we completed new status reviews and ESA listing determinations for West Coast salmon ESUs on June 28, 2005 (70 FR 37159), and for steelhead DPSs on January 5, 2006 (71 FR 834). On June 20, 2011, we confirmed the threatened status of OC coho salmon ESU following several federal court cases, biological reviews, and listing determinations (76 FR 35755; Stout et al. 2012). On August 15, 2011, we published our 5-year reviews and listing determinations for 11 ESUs of Pacific salmon and 6 DPSs of steelhead from the Pacific Northwest (76 FR 50448). On May 26, 2016, we published our 5-year reviews and listing determinations for 17 ESUs of Pacific salmon, 10 DPSs of steelhead, and the southern DPS of eulachon (*Thaleichthys pacificus)* (81 FR 33468).

1.2 Methodology Used to Complete the Review

On October 4, 2019, we announced the initiation of 5-year reviews for 17 ESUs of salmon and 11 DPSs of steelhead in Oregon, California, Idaho, and Washington (84 FR 53117). We requested that the public submit new information on these species that had become available since our 2016 5-year reviews. In response to our request, we received information from federal and state agencies, Native American Tribes, conservation groups, fishing groups, and individuals. We considered this information, as well as information routinely collected by our agency, to complete these 5-year reviews.

To complete the reviews, we first asked scientists from our Northwest and Southwest Fisheries Science Centers to collect and analyze new information about ESU and DPS viability. To evaluate viability, our scientists used the Viable Salmonid Population (VSP) concept developed by McElhany et al. (2000). The VSP concept evaluates four criteria – abundance, productivity, spatial structure, and diversity – to assess species viability. By applying this concept, scientists with the Northwest Fisheries Science Center considered new information for a given ESU or DPS relative to the four salmon and steelhead population viability criteria. They also considered new information on ESU and DPS composition. At the end of this process, the science team prepared reports detailing the results of their analyses (Ford 2022).

To further inform the reviews, we also asked biologists from our West Coast Region familiar with hatchery programs to consider new information available since the previous listing determinations. Among other things, they considered hatchery programs that have ended, new hatchery programs that have started, changes in the operation of existing programs, and scientific data relevant to the degree of divergence of hatchery fish from naturally spawning fish in the same area. Finally, we consulted salmon management biologists from the West Coast Region who are familiar with habitat conditions, hydropower operations, and harvest management. In a series of structured meetings, by geographic area, these biologists identified relevant information and provided insight on the degree to which circumstances had changed for each listed entity.

In preparing this report, we considered the best available scientific information, including the work of the Northwest Fisheries Science Center (Ford 2022); the OC coho salmon recovery plan (NMFS 2016a); technical reports prepared in support of recovery plans for the species in question; the listing record (including designation of critical habitat and adoption of protective regulations); the recent biological opinions issued for OC coho salmon; information submitted by the public and other government agencies; results from numerous habitat restoration projects completed in the species domain; and the information and views provided by the geographically based management teams. The present report describes the agency’s findings based on all of the information considered.

1.3 Background – Summary of Previous Reviews, Statutory and Regulatory Actions, and Recovery Planning

1.3.1 Federal Register Notice Announcing Initiation of this Review

84 FR 53117; October 4, 2019

1.3.2 Listing History

In 1998, NMFS listed OC coho salmon under the ESA as a threatened species (Table 1). In 2001, in *Alsea Valley Alliance v. Evans*, a United States (U.S.) District Court decision set aside the ESA listing. NMFS continued to include the OC coho salmon in its status reviews and proposed the ESU for threatened status in 2004. In 2006, NMFS decided that listing OC coho salmon was not warranted. In 2008, NMFS listed the OC coho salmon as threatened after its decision to not list the ESU was invalidated by a U.S. District Court in *Trout Unlimited v. Lohn*. In 2011, the ESU retained threatened status.

Table 1. Summary of the listing history under the Endangered Species Act for the Oregon Coast coho salmon ESU.

Salmonid Species	ESU/DPS Name	Original Listing	Revised Listing(s)
Coho Salmon (*O. kisutch*)	Oregon Coast coho salmon	**FR Notice:** 63 FR 42587 **Date:** 8/10/1998 **Classification:** Threatened	**FR Notice:** 69 FR 33102 **Date:** 6/14/2004 **Classification:** Proposed Listing **FR Notice:** 71 FR 3033 **Date:** 1/19/2006 **Classification:** Not warranted **FR Notice:** 73 FR 7816 **Date:** 2/11/2008 **Classification:** Threatened **FR Notice:** 76 FR 35755 **Date:** 6/20/2011 **Classification:** Threatened

1.3.3 Associated Rulemakings

The ESA requires NMFS to designate critical habitat, to the maximum extent prudent and determinable, for species it lists under the ESA. Critical habitat is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, that contain physical or biological features essential to conservation, that may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species at the time of listing that are essential for the conservation of the species. We designated critical habitat for OC coho salmon in 2008 (Table 2).

Section 9 of the ESA prohibits the take of species listed as endangered. The ESA defines take to mean harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. For threatened species, the ESA does not automatically prohibit take, but instead authorizes the agency to adopt regulations it deems necessary and advisable for species conservation and to apply the take prohibitions of Section 9(a)(1) through ESA section 4(d). In 2000, NMFS adopted 4(d) regulations for threatened salmonids that prohibit take except in specific circumstances. In 2005, we revised our 4(d) regulations for consistency between ESUs and DPSs throughout the West Coast Region, and finalized our Hatchery Listing Policy. These 4(d) regulations went into effect in 2008 when OC coho salmon were listed again as a threatened species.

Table 2. Summary of rulemaking for 4(d) protective regulations and critical habitat for the Oregon Coast coho salmon ESU.

Salmonid Species	ESU Name	4(d) Protective Regulations	Critical Habitat Designations
Coho Salmon (*O. kisutch*)	Oregon Coast coho salmon	**FR notice:** 65 FR 42422 **Date:** 7/10/2000 **Revised:** 6/28/2005 (70 FR 37159)	**FR Notice:** 65 FR 7764 **Date:** 2/16/2000 **Type:** Final **FR Notice:** 73 FR 7816 **Date:** 2/11/2008 **Type:** Final

1.3.4 Review History

Table 3 lists the numerous scientific assessments of the status of OC coho salmon. These assessments include status reviews conducted by our Northwest Fisheries Science Center and technical reports prepared to support recovery planning for this species.

Table 3. Summary of previous scientific assessments for the Oregon Coast coho salmon ESU.

Salmonid Species	ESU Name	Document Citation
Coho Salmon (*O. kisutch*)	Oregon Coast coho salmon	Ford 2022 NMFS 2016a NWFSC 2015 Stout et al. 2012 Wainwright et al. 2008 Lawson et al. 2007 Good et al. 2005 NMFS 1997 Weitkamp et al. 1995

1.3.5 Recovery Plan and Species' Recovery Priority Number at Start of 5-Year Review Process

On April 30, 2019, NMFS issued new guidelines (84 FR 18243) for assigning listing and recovery priorities. For determining a recovery priority for recovery plan development and implementation, we assess demographic risk (based on the listing status and species' condition in terms of its productivity, spatial distribution, diversity, abundance, and trends) and recovery potential (major threats understood, management actions exist under United States (U.S.) authority or influence to abate major threats, and certainty that actions will be effective) to assign a Recovery Priority number from 1 (high) to 11 (low). Additionally, if the listed species is in conflict with construction or other development projects or other forms of economic activity, then they are assigned a 'C' and are given a higher priority over those species that are not in conflict. Table 4 lists the recovery priority number for the OC coho salmon ESU that was in effect at the time this 5-year review began (NMFS 2019a). In January 2022, NMFS issued a new report with updated recovery priority numbers. The number for OC coho salmon ESU remained unchanged (NMFS 2022).

1.3.6 Recovery Plan or Outline

Table 4. Recovery Priority Number (NMFS 2019a) and Endangered Species Act Recovery Plan for the Oregon Coast coho salmon ESU.

Salmonid Species	ESU Name	Recovery Priority Number	Recovery Plans/Outline
Coho Salmon (*O. kisutch*)	Oregon Coast coho salmon	**5C**	**Title:** Final ESA Recovery Plan for Oregon Coast Coho Salmon (*Oncorhynchus kisutch*) Available at: http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/recovery_planning_and_implementation/oregon_coast/oregon_coast_recovery_plan.html **FR Notice:** 81 FR 90780 **Date:** 12/15/2016 **Type:** Notice, Final Recovery Plan

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2. Review Analysis

In this section, we review new information to determine whether species' delineations remain appropriate.

2.1 Delineation of Species under the Endangered Species Act

Is the species under review a vertebrate?

ESU Name	YES	NO
Oregon Coast Coho Salmon	X	

Is the species under review listed as an ESU/DPS?

ESU Name	YES	NO
Oregon Coast Coho Salmon	X	

Was the ESU/DPS listed prior to 1996?

ESU Name	YES	NO	Date Listed if Prior to 1996
Oregon Coast Coho Salmon		X	N/A

Prior to this 5-year review, was the ESU/DPS classification reviewed to ensure it meets the 1996 DPS policy standards?

In 1991, NMFS issued a policy explaining how the agency would apply the definition of "species" in evaluating Pacific salmon stocks for listing consideration under the ESA (56 FR 58612). Under this policy a group of Pacific salmon populations is considered a "species" under the ESA if it represents an "evolutionarily significant unit" (ESU) which meets the two criteria of being substantially reproductively isolated from other con-specific populations, and it represents an important component in the evolutionary legacy of the biological species. The 1996 joint NMFS-Fish and Wildlife Service (FWS) "distinct population segment" (DPS) policy (61 FR 4722) affirmed that a stock (or stocks) of Pacific salmon is considered a DPS if it represents an ESU of a biological species.

2.1.1 Summary of Relevant New Information Regarding the Delineation of the Oregon Coast Coho Salmon ESU.

ESU Delineation

This section provides a summary of information presented in Ford (2022): Biological viability assessment update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest.

We found no new information that would justify a change in the delineation of the OC coho salmon ESU (Ford 2022).

Membership of Hatchery Programs

For West Coast salmon and steelhead, many of the ESU and DPS descriptions include fish originating from specific artificial propagation programs (*e.g.,* hatcheries) that, along with their naturally produced counterparts, are included as part of the listed species. NMFS' Policy on the Consideration of Hatchery-Origin Fish in Endangered Species Act Listing Determinations for Pacific Salmon and Steelhead (Hatchery Listing Policy) (70 FR 37204, June 28, 2005) guides our analysis of whether individual hatchery programs should be included as part of the listed species. The Hatchery Listing Policy states that hatchery programs will be considered part of an ESU/DPS if they exhibit a level of genetic divergence relative to the local natural population(s) that is not more than what occurs within the ESU/DPS.

In preparing this report, our hatchery management biologists reviewed the best available information regarding the hatchery membership of this ESU and DPS. They considered changes in hatchery programs that occurred since the last 5-year review (e.g., some have been terminated while others are new) and made recommendations about the inclusion or exclusion of specific programs. They also noted any errors and omissions in the existing descriptions of hatchery program membership. NMFS intends to address any needed changes and corrections via separate rulemaking subsequent to the completion of the 5-year review process before effecting any official change in hatchery membership.

In the 2016 5-year review, the OC coho salmon ESU was defined as including all naturally spawned coho salmon originating from coastal rivers south of the Columbia River and north of Cape Blanco and includes hatchery fish from one artificial propagation program: the Cow Creek Hatchery Program [Oregon Department of Fish and Wildlife (ODFW) Stock #18] (76 FR 35755, June 20, 2011). Since 2016, we updated the name of the Cow Creek Hatchery Program by removing the ODFW stock number from the name of the hatchery program (85 FR 81822, December 17, 2020).

2.2 Recovery Criteria

The ESA requires recovery plans be developed for each listed species unless the Secretary finds a recovery plan would not promote the conservation of the species. Recovery plans must contain, to the maximum extent practicable, objective measurable criteria for delisting the species, site-specific management actions necessary to recover the species, and time and cost estimates for implementing the recovery plan.

2.2.1 Approved Recovery Plan with Objective, Measurable Criteria

Does the species have a final, approved recovery plan containing objective, measurable criteria?

ESU/DPS Name	YES	NO
Oregon Coast Coho Salmon	X	

2.2.2 Adequacy of Recovery Criteria

Based on new information considered during this review, are the recovery criteria still appropriate?

ESU/DPS Name	YES	NO
Oregon Coast Coho Salmon	X	

Are all of the listing factors that are relevant to the species addressed in the recovery criteria?

ESU/DPS Name	YES	NO
Oregon Coast Coho Salmon	X	

2.2.3 Biological Recovery Criteria as They Appear in the Recovery Plan

Salmon and steelhead typically exhibit a metapopulation structure (Schtickzelle and Quinn 2007; McElhany et al. 2000). Rather than interbreeding as one large aggregation, ESUs and DPSs function as a group of demographically independent populations separated by areas of unsuitable spawning habitat. For conservation and management purposes, it is important to identify the independent populations that make up an ESU or DPS.

McElhany et al. (2000) defined an independent population as: "…a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other group spawning in a different place or in the same place at a different season." For our purposes, not interbreeding to a "substantial degree" means that two groups are considered to be independent populations if they are isolated to such an extent that exchanges of individuals among the populations do not substantially affect the population dynamics or extinction risk of the independent populations over a 100-year time frame. Independent populations exhibit different population attributes that influence their abundance, productivity, spatial structure and diversity. Independent populations are the units that are combined to form alternative recovery scenarios for multiple similar population groupings and ESU viability.

The OC coho salmon ESU includes all naturally spawned coho salmon originating from coastal rivers south of the Columbia River and north of Cape Blanco. It also includes coho salmon from one artificial propagation program: the Cow Creek Hatchery Program (76 FR 35755, June 20, 2011; 85 FR 81822, December 17, 2020) (See Figure 2 below).

For recovery planning and development of recovery criteria for the OC coho salmon ESU, NMFS appointed the Oregon and Northern California Coasts Technical Recovery Team (ONCC TRT). All of the Pacific salmon TRTs used the same biological principles for developing their ESU/DPS and population viability criteria. These principles are described below and in more depth in the NMFS 2000 Technical Memorandum NOAA NMFS-NWFSC-42, *Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units* (hereafter referred to as McElhany et al. 2000). The viable salmonid population (VSP) concept (McElhany et al. 2000) is based on the biological parameters of abundance, productivity, spatial structure, and diversity for an independent salmonid population to have a negligible risk of extinction over a 100-year time frame. While the ESU is the listed entity under the ESA, the ESU-level viability criteria are based on the collective viability of the individual populations that make up the ESU—their characteristics and their distribution throughout the ESU's geographic range.

The NMFS-appointed ONCC TRT developed viability criteria metrics based on the McElhany et al. (2000) and McElhany et al. (2007) VSP concepts (NMFS 2008). The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) adopted the 2008 ONCC TRT viability criteria as recovery criteria for the threatened OC coho salmon ESU.

The VSP concept identifies the attributes, provides guidance for determining the conservation status of populations and larger-scale groupings of Pacific salmonids, and describes a general framework for how many and which populations within an ESU/DPS should be at a particular status for the ESU/DPS to have an acceptably low risk of extinction. McElhany et al. (2000) developed combined VSP criteria metrics that described the probability that a population would persist after 100 years. The higher the combined VSP parameter score for the probability of population persistence in 100 years (i.e., 95-99% population persistence), the lower the probability of population extinction (i.e., 1-5%) in 100 years. A population with <5% risk of extinction in 100 years is considered to be at low extinction risk and a viable salmonid population (Figure 1). NMFS color coded the extinction risk assessment categories to assist the readers more easily distinguish the various risk categories.

Table 5. Viable Salmonid Population (VSP) criteria metrics and corresponding risk levels

<table>
<tr><td colspan="2" rowspan="3"></td><td colspan="4">VSP Criteria Metrics</td></tr>
<tr><td colspan="4">Spatial Structure/Diversity Risk</td></tr>
<tr><td>Very Low</td><td>Low</td><td>Moderate</td><td>High</td></tr>
<tr><td rowspan="4">Abundance/ Productivity Risk</td><td>Very Low (<1%)</td><td>Very Low Risk (Highly Viable)</td><td>Very Low Risk (Highly Viable)</td><td>Low Risk (Viable)</td><td>Moderate Risk</td></tr>
<tr><td>Low (<5%)</td><td>Low Risk (Viable)</td><td>Low Risk (Viable)</td><td>Low Risk (Viable)</td><td>Moderate Risk</td></tr>
<tr><td>Moderate (<25%)</td><td>Moderate Risk</td><td>Moderate Risk</td><td>Moderate Risk</td><td>High Risk</td></tr>
<tr><td>High (>25%)</td><td>High Risk</td><td>High Risk</td><td>High Risk</td><td>High Risk</td></tr>
</table>

For recovery planning and development of recovery criteria, the ONCC TRT identified five groupings of similar populations, termed “biogeographic strata.” Overall, the ESU is composed of twenty-one independent populations distributed among five biogeographic strata: North Coast (four populations), Mid-Coast (six populations), Mid-South Coast (four populations), Lakes (three populations), and Umpqua (four populations).

The ONCC TRT biological recovery criteria (also called viability criteria) are hierarchical in nature, with ESU-level criteria being based on the status of natural-origin salmon assessed at the population level. A detailed description of the ONCC TRT viability criteria and their derivation is outlined in Wainwright et al. (2008). Recovery strategies outlined in the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) are targeted on achieving, at a minimum, the ONCC TRT biological recovery criteria for each biogeographic stratum to have all five biogeographic strata “sustainable” with representation of all the major life history strategies present historically, and with the abundance, productivity spatial structure, and diversity attributes required for long-term persistence and sustainability (NMFS 2016a).

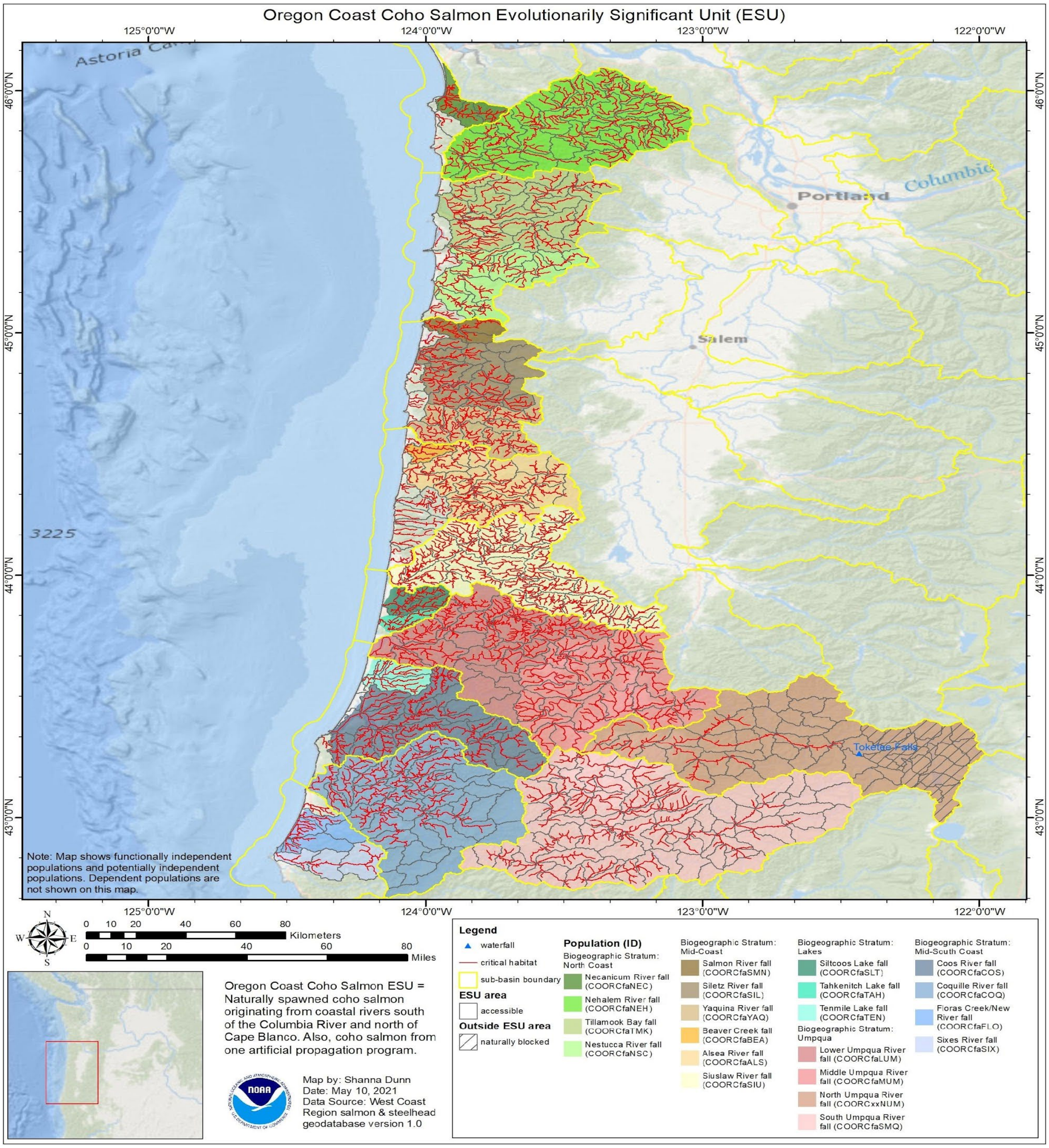


Figure 1. Oregon Coast coho salmon ESU population structure and critical habitat.[1]

[1] The map above generally shows the accessible areas for the Oregon Coast coho salmon ESU. The area displayed is consistent with the regulatory description of the composition of the Oregon Coast coho salmon ESU found at 50 CFR17.11 and 223.102. Actions outside the areas shown can affect this ESU. Therefore, these areas do not delimit the entire area that could warrant consideration in recovery planning or determining if an action may affect this ESU for the purposes of the ESA.

The ONCC TRT developed two principal elements within the biological recovery criteria that describe a sustainable stratum and ESU: (1) most (more than half) of the independent populations in each biogeographic stratum must be considered sustainable and (2) all five biogeographic strata should be sustainable for the whole ESU to be viable (Wainwright et al. 2008). The plan recognizes that, at the biogeographic stratum level, there may be several specific combinations of populations that could satisfy the ONCC TRT criteria. The biological recovery criteria for OC coho salmon are "that there is at least a moderate certainty that the ESU is sustainable."

The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) identifies the minimum number of independent populations within stratums to meet the ONCC TRT recommendations for the ESU to be sustainable. For the OC coho salmon ESU to be sustainable, all five strata in the ESU need to be sustainable. NMFS' overall recovery direction for OC coho salmon centers on restoring degraded habitats and the ecosystem processes and functions that affect those habitats and protecting habitats that are currently functioning through effective regulatory backstops. The primary focus is to protect and restore freshwater and estuarine rearing habitats upon which egg-to-smolt survival, and overall productivity, depends, so the highest priorities are for the strategies and actions related to rearing habitats (NMFS 2016a).

The ONCC TRT developed a knowledge-based Decision Support System (DSS) for the OC coho salmon ESU (Wainwright et al. 2008). The DSS was designed to evaluate the biological sustainability of the entire ESU, where 'biological sustainability' implies that "a population is able to survive prolonged periods of adverse environmental conditions, while maintaining its genetic legacy and long-term adaptive potential" (Wainwright et al. 2008). The DSS consists of a suite of biological recovery criteria that contribute to ESU sustainability. The biological recovery criteria evaluate two general conditions that imply different levels and types of risk:

- *Persistence*. The persistence analysis evaluates the ability of the ESU to persist over a 100-year period without artificial support, including the ability to survive prolonged periods of adverse environmental conditions. It is based on population productivity, probability of persistence, and abundance relative to critically low thresholds (McElhany et al. 2000; Stout et al. 2012).
- *Sustainability*. The sustainability analysis evaluates the ability of the ESU to maintain its genetic legacy and long-term adaptive potential for the foreseeable future. The ONCC TRT explained that sustainability implies stability of habitat availability and other conditions necessary for the full expression of the population's (or ESU's) life history diversity into the foreseeable future. Criteria used to evaluate population sustainability are objective measures of spawner abundance, artificial influence, spawner and juvenile distribution, and habitat capacity. They also include ESU-level measures of genetic diversity, phenotypic and habitat diversity, and small populations (NWFSC 2015).

The terms persistent and sustainable are both part of the more generic term "viable" as used in the viable salmonid populations report (McElhany et al. 2000). The two terms are used to distinguish distinct types and levels of risk. Persistence relates to the simple risk (or danger) of extinction, which is the primary determinant of endangered status under the ESA. Sustainability goes beyond this, requiring that population diversity (genetic and ecological) be sustained so that risk of extinction will not increase in the foreseeable future, thus relating to threatened status under the ESA (Wainwright et al. 2008).

The ONCC TRT integrated the concept of uncertainty into the DSS (see Wainwright et al. 2008 for a full explanation). Through its construction, it allows the degree of uncertainty to be evaluated and expressed in an outcome, ranging from certainly false through uncertain to certainly true. For example, if more than half the populations in every stratum meet the biological recovery criteria that would suggest high ‘certainty’ that the biological recovery criteria are met.

The 2008 ONCC TRT document provides a detailed discussion that includes 29 separate biological criteria as components of the Decision Support System. In brief, these criteria look at watershed- and population-level spawner and juvenile occupancy and distributions, population-specific productivity, probability of persistence (from population viability models), spawner abundance, artificial influence, and ESU-wide genetic and phenotypic diversity (Wainwright et al. 2008). NMFS considers this ONCC TRT report describing the DSS, and the NOAA Fisheries Biological Review Team (BRT) and NWFSC status updates, as the principal components of ‘best available science’ on the subject of OC coho salmon biological recovery criteria. We used these reports as the basis for our delisting criteria, which are described below. The ONCC TRT and BRT documents provide full technical discussions of the biological recovery criteria and DSS approach (Wainwright et al. 2008; Stout et al. 2012; NWFSC 2015; NMFS 2016a; Ford 2022). Currently, ongoing maintenance and implementation of the DSS is done by ODFW staff. NMFS may update details of the biological recovery criteria over time as new information becomes available; however, a formal revision to the recovery plan will be required if substantial changes are warranted.

Under the DSS approach, as presently employed, the information collected for the biological criteria is used to evaluate six measures of biological status for OC coho salmon viability that form the basis of our assessment of population, stratum, and ESU health. The six measures are:

1. Spawner abundance,
2. Spawner distribution,
3. Juvenile distribution,
4. Critical abundance,
5. Population productivity, and
6. Artificial influence.

The results of the assessment of these six measures are then used to develop a series of ‘scores,’ expressed in terms of levels of certainty, that indicate how well the populations, strata, and ESU are doing (their biological status) for the abundance, productivity, spatial structure, and diversity attributes. The Ford (2022) review developed the DSS scores for 2012, 2015, and 2020 data (see Table 64 from Ford 2022). Table 6 shows the rating score relationship for risk assessment of the

DSS tables. Scores less than zero (negative values) are not listed in the table because they represent the lowest probabilities in meeting the specified DSS criteria.

Table 6. Decision Support System scores and descriptions of certainty of ESU Persistence or Sustainability scores.

Decision Support System (DSS) Score	Confidence in Meeting Persistence or Sustainability Criteria
0.1 to 0.29	Low to Moderate Certainty
0.3 to 0.59	Moderate to High Certainty
0.6 to 1.0	High to Very High Certainty

At the ESU level, the 2020 DSS tables showed the ESU Persistence (EP) score for OC coho salmon was 0.60, demonstrating a high confidence that the ESU is able to persist (not go extinct) (Table 64, Ford 2022; ODFW 2020b). This is down from the 2015 EP score of 0.73, but higher than the 2012 EP score of 0.44. The ESU Sustainability (ES) score for 2020 is 0.24, demonstrating a low to moderate confidence that the ESU meets the criteria for being sustainable. The 2020 ES score is down from 2015 where the ES score was 0.29, but higher than the 2012 ES score of 0.23 (Table 7).

Table 7. Decision Support System-ESU persistence and sustainability scores for 2012, 2015, and 2020 (ODFW 2020b; Ford 2022).

Year	ESU Persistence	ESU Sustainability
2012	0.44	0.23
2015	0.73	0.29
2020	0.60	0.24

The Stratum Persistence (SP) scores for the ESU ranges from 0.47 (Umpqua) to 0.73 (Mid Coast) (Table 8) (ODFW 2020b; Ford 2022). Thus, the Umpqua Stratum is currently demonstrating a moderate confidence for SP (0.47). The North Coast, Mid Coast, Lakes, and Mid-South Coast stratums all have a high confidence that they meet the persistence criteria (not go extinct) with SP scores of 0.63, 0.73, 0.72 and 0.70 respectively.

The Stratum Sustainability (SS) for the ESU ranges from 0.26 for the Umpqua to 0.66 for the south coast (Table 8). The Umpqua stratum exhibited the greatest decline in status over the last five years.

Table 8. Decision Support System Stratum Persistence (SP) and Stratum Sustainability (SS) scores for 2012, 2015, and 2020 (ODFW 2020b; Ford 2022). See Table 6 for color scores.

Stratum	SP 2012	SP 2015	SP 2020		SS 2012	SS 2015	SS 2020
N Coast	0.56	0.65	0.63		0.39	0.47	0.46
Mid Coast	0.37	0.82	0.73		0.42	0.61	0.61
Lakes	0.92	0.90	0.72		0.66	0.70	0.64
Umpqua	0.60	0.68	0.47		0.32	0.49	0.26
Mid-S Coast	0.27	0.66	0.70		0.32	0.66	0.66

North Coast Biogeographic Stratum

Independent Populations: Necanicum, Nehalem, Tillamook, and Nestucca
Current Stratum Status: Moderate to High level of certainty that the North Coast Biogeographic Stratum is persistent/sustainable (viable, moderate to low risk) (ODFW 2020b; Ford 2022) (Table 8).

Biological Recovery Criteria: For North Coast Biogeographic Stratum persistence/sustainability (viability), at least three of the four independent populations (Necanicum, Nehalem, Tillamook Bay, and Nestucca) comprising the North Coast Biogeographic Stratum should reach *Viable* (moderate to low risk) status (NMFS 2016a).

Independent Population Status: The Necanicum population has the lowest confidence in being a viable population (Table 9). The Nehalem, Tillamook, and Nestucca have moderate to high confidence of meeting persistence and sustainability criteria (Table 9).

Table 9. Decision Support System scores for North Coast Biogeographic Stratum Population Persistence (PP) and Population Sustainability (PS) 20 (ODFW 2020b; Ford 2022). See Table 6 for color scores.

Stratum	Population	PP 2012	PP 2015	PP 2020		PS 2012	PS 2015	PS2020
N Coast	Necanicum	-0.24	-0.21	-0.26		-0.14	-0.10	-0.16
N Coast	Nehalem	0.84	0.91	0.76		0.67	0.78	0.63
N Coast	Tillamook	0.55	0.68	0.65		0.35	0.50	0.51
N Coast	Nestucca	0.57	0.63	0.61		0.44	0.45	0.41

Mid-Coast Biogeographic Stratum

Independent Populations: Salmon, Siletz, Yaquina, Beaver, Alsea, and Siuslaw
Current Status: Moderate to High level of certainty that the Mid-Coast Biogeographic Stratum is persistent/sustainable (viable) (ODFW 2020b; Ford 2022) (Table 8).

Biological Recovery Criteria: For Mid-Coast Biogeographic Stratum persistence/sustainability (viability), at least four of the six independent populations (Salmon, Siletz, Yaquina, Beaver, Alsea, and Siuslaw) comprising the Mid-Coast Coast Biogeographic Stratum should reach *Viable* (moderate to low risk) status (NMFS 2016a).

Independent Population Status: The Salmon and the Beaver populations are not viable (Table 10). The Siletz, Yaquina, Alsea, and Siuslaw populations are viable (moderate to low risk status).

Table 10. Decision Support System scores for Mid-Coast Biogeographic Stratum Population Persistence (PP) and Population Sustainability (PS) (ODFW 2020b; Ford 2022). See Table 5 for color scores.

Stratum	Population	PP 2012	PP 2015	PP 2020		PS 2012	PS 2015	PS 2020
Mid-Coast	Salmon	-1.0	-1.0	-1.0		-1.0	-1.0	-1.0
Mid-Coast	Siletz	0.36	0.81	0.76		0.35	0.58	0.58
Mid-Coast	Yaquina	0.65	0.85	0.87		0.60	0.73	0.74
Mid-Coast	Beaver	0.80	0.82	0.17		0.53	0.56	0.24
Mid-Coast	Alsea	0.28	0.81	0.76		0.33	0.64	0.64
Mid-Coast	Siuslaw	0.38	0.85	0.71		0.49	0.85	0.80

Lakes Biogeographic Stratum

Independent Populations: Siltcoos, Tahkenitch, and Tenmile
Current Status: Moderate to High level of certainty that the Lakes Coast Biogeographic Stratum is persistent/sustainable (viable) (ODFW 2020b; Ford 2022) (Table 8).

Biological Recovery Criteria: For Lakes Biogeographic Stratum persistence/sustainability (viability), at least two of the three independent populations (Tenmile, Siltcoos, and Takenitch) comprising the Lakes Biogeographic Stratum should reach *Viable* (moderate to low risk) status (NMFS 2016a).

Independent Population Status: The Siltcoos, Tahkenitch, and Tenmile are viable (moderate to low risk status).

Table 11. Decision Support System scores for Lakes Biogeographic Stratum Population Persistence (PP) and Population Sustainability (PS) for 2012, 2015, and 2020 (ODFW 2020b; Ford 2022) (see Table 5 for color scores).

Stratum	Population	PP 2012	PP 2015	PP 2020		PS 2012	PS 2015	PS 2020
Lakes	Siltcoos	0.92	0.95	0.42		0.83	0.85	0.53
Lakes	Tahkenitch	0.78	0.82	0.72		0.66	0.70	0.64
Lakes	Tenmile	0.98	0.90	0.93		0.20	0.34	0.87

Umpqua Biogeographic Stratum

Independent Populations: Lower Umpqua, Middle Umpqua, North Umpqua and South Umpqua
Current Status: Moderate level of certainty that the Umpqua Biogeographic Stratum is persistent/sustainable (viable) (ODFW 2020b; Ford 2022).

Biological Recovery Criteria: For Umpqua Biogeographic Stratum persistence/sustainability (viability), at least three of the four independent populations (Lower Umpqua, Middle Umpqua, North Umpqua, and South Umpqua) comprising the Umpqua Biogeographic Stratum should reach *Viable* (moderate to low risk) status (NMFS 2016a).

Independent Population Status: The North and South Umpqua populations have low confidence of meeting persistence criteria. The Middle Umpqua population has a moderate certainty of being persistent and the Lower Umpqua population has a high confidence in being persistent (not go extinct).

Table 12. Decision Support System scores for Umpqua Biogeographic Stratum Population Persistence (PP) and Population Sustainability (PS) (ODFW 2020b; Ford 2022). See Table 5 for color scores.

Stratum	Population	PP 2012	PP 2015	PP 2020		PS 2012	PS 2015	PS 2020
Umpqua	Lower	0.74	0.81	0.85		0.65	0.84	0.87
Umpqua	Middle	0.45	0.61	0.43		0.31	0.53	0.38
Umpqua	North	-0.95	-0.30	0.52		-0.95	-0.57	-0.41
Umpqua	South	0.80	0.75	0.26		0.33	0.45	0.14

<u>Mid-South Coast Biogeographic Stratum</u>
Independent Populations: Coos, Coquille, Floras/New, and Sixes
Current Status: Moderate to High level of certainty that the Mid-South Coast Biogeographic Stratum is persistent/sustainable (viable) (ODFW 2020b; Ford 2022) (Table 8).

Biological Recovery Criteria: For Mid-South Coast Biogeographic Stratum persistence/sustainability (viability), at least three of the four independent populations (Coos, Coquille, Floras, and Sixes) comprising the Mid-South Coast Biogeographic Stratum should reach *Viable* (moderate to low risk) status (NMFS 2016a).

Independent Population Status: The Sixes population is not persistent (Table 13). The Coos, Coquille, and Floras/New have a high degree of certainty in being persistent (not go extinct).

Table 13. Decision Support System scores for Mid-South Coast Biogeographic Stratum Population Persistence (PP) and Population Sustainability (PS) (ODFW 2020b; Ford 2022). See Table 5 for color scores.

Stratum	Population	PP 2012	PP 2015	PP 2020		PS 2012	PS 2015	PS 2020
Mid-South	Coos	0.75	0.89	0.80		0.80	0.87	0.82
Mid-South	Coquille	0.91	0.93	0.80		0.87	0.91	0.80
Mid-South	Floras/New	-0.21	0.43	0.61		-0.10	0.45	0.52
Mid-South	Sixes	-1.0	-1.0	-1.0		-1.0	-1.0	-1.0

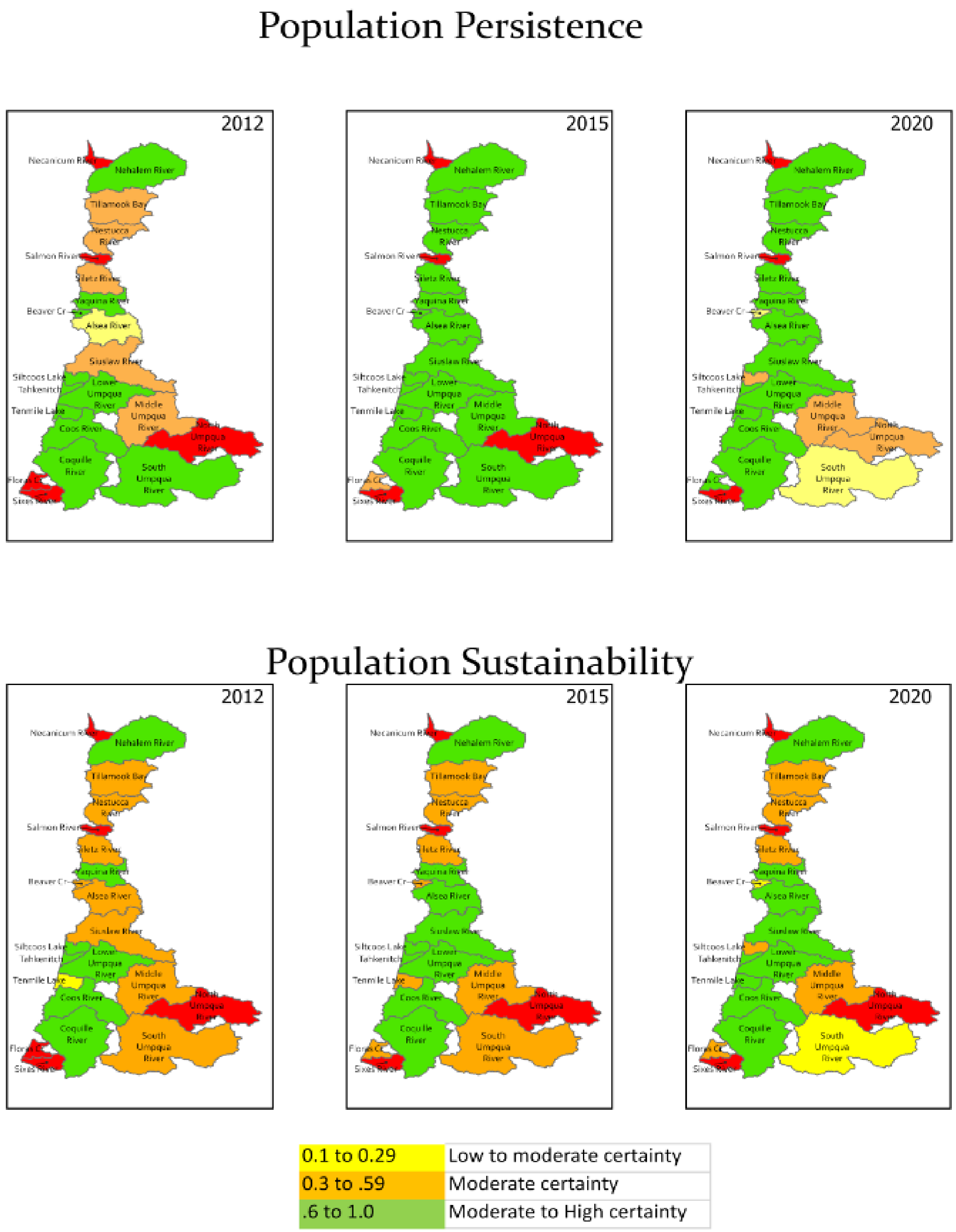


Figure 2. Population Persistence (PP) and Population Sustainability (PS) scores for 2012, 2015, and 2020.

2.3 Updated Information and Current Species' Status

In addition to recommending biological recovery criteria, the ONCC TRT also assessed the current status of each population of the OC coho salmon ESU (NMFS 2008). In 2021, the NWFSC evaluated each population with the biological criteria identified in the DSS and assigned a current viability rating for the ESU as a whole (Ford 2022).

2.3.1 Analysis of Viable Salmonid Population (VSP) Status

Information provided in this section is summarized from Ford (2022): Viability assessment update for Pacific salmon and steelhead listed under the Endangered Species Act: Pacific Northwest.

Updated Biological Risk Summary

The ODFW's 12-year assessment of the Oregon Coast Coho Conservation Plan (ODFW 2021) highlights favorable improvements for OC coho salmon overall, consistent with the Ford (2022) assessment. It notes the strong role that ocean conditions play on adult returns to the ESU, including recent low abundances associated with strong marine heat waves.

The latest ESU scores for persistence (high certainty of ESU persistence) and sustainability (low to moderate certainty of ESU sustainability) also demonstrate that the biological status of the ESU has decreased slightly since the 2016 review (high certainty of persistence, moderate certainty of sustainability), which covered a period of favorable ocean conditions and high marine survival rates. However, current ESU scores have improved relative to the 2012 assessment (moderate certainty of persistence, low to moderate certainty of sustainability). This improvement occurred despite similar or better abundances and marine survival rates during the earlier period, suggesting continued benefits due to management decisions to reduce both harvest and hatchery releases.

Despite these somewhat optimistic results for OC coho salmon, it is unclear what the future will bring. A recent assessment of the vulnerability of ESA-listed salmonid species to climate change indicated that OC coho salmon had high overall vulnerability, high biological sensitivity and climate exposure, but only moderate adaptive capacity (Crozier et al. 2019). Because young coho spend a full year in freshwater before ocean entry, the juvenile freshwater stage was considered to be highly vulnerable. The ESU also scored high in sensitivity at the marine stage due to expected changes due to ocean acidification. These results are consistent with the climate change assessment by Wainwright and Weitkamp (2013), which indicated OC coho salmon will likely be negatively affected by climate change at all stages of the life cycle. Overall, the OC coho salmon ESU is at moderate-to-low risk of extinction, with viability largely unchanged from the prior review.

2.3.2 ESA Listing Factor Analysis

Section 4(a)(1) of the ESA directs us to determine whether any species is threatened or endangered because of any of the following factors: (A) the present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or man-made factors affecting its continued existence. Section 4(b)(1)(A) requires us to make listing determinations after conducting a review of the status of the species and taking into account efforts to protect such species. Below we discuss new information relating to each of the five factors as well as efforts being made to protect the species.

Listing Factor A: Present or threatened destruction, modification or curtailment of its habitat or range

Current Status and Trends in Habitat

Below, we summarize information on the current status and trends in habitat conditions since our last 5-year review (NMFS 2016b) by the five biogeographic strata comprising the OC coho salmon ESU (North Coast, Mid-Coast, Umpqua, Mid-South Coast, and Lakes). We specifically address: (1) the key emergent or ongoing habitat concerns (threats or limiting factors) focusing on the top concerns that potentially have the biggest impact on independent population viability; (2) the population-specific geographic areas (e.g., independent population major/minor spawning areas) where key emergent or ongoing concerns about this habitat condition remain; (3) population-specific key protective measures and major restoration actions taken since the 2016 5-year review toward achieving the recovery plan viability criteria established by the Oregon and Northern California Coast Technical Recovery Team (NMFS 2008) and adopted by NMFS in the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) as efforts that substantially address a key concern noted in above #1 and # 2, or, that represent a noteworthy conservation strategy; (4) key regulatory measures that are either adequate, or, inadequate and contributing substantially to the key concerns summarized above; (5) recommended future recovery actions over the next five years toward achieving population viability, including: key near-term restoration actions that would address the key concerns summarized above; projects to address monitoring and research gaps; fixes or initiatives to address inadequate regulatory mechanisms, and addressing priority habitat areas when sequencing priority habitat restoration actions.

An emerging habitat concern range-wide is climate change, which poses future changes in fresh, estuarine, and marine habitat conditions, and the increasing threat of wildfire and wildfire responses in uplands. These are described more fully in the section on Listing Factor E, later in this document.

North Coast Biogeographic Stratum

1) Population-Specific Key Emergent or Ongoing Habitat Concerns Since the 2016 5-Year Review

Habitat concerns continue to affect the four independent populations (Necanicum, Nehalem, Tillamook and Nestucca) comprising the North Coast Biogeographic Stratum. Although many partners have successfully carried out habitat restoration projects, the ongoing primary habitat concerns as reported in the previous 2016 5-year review (NMFS 2016b) continue to be:

- Insufficient stream juvenile rearing habitat complexity, including lack of large wood debris, pools, and connections to floodplains and off-channel areas, especially overwintering habitat (all populations).
- Poor water quality, such as high summer temperatures and agricultural runoff (Nehalem and Tillamook populations).
- Loss of beaver pond habitat due to removal of beavers and beaver dams (all populations).

2) Population-Specific Geographic Areas of Habitat Concern Since the 2016 5-Year Review

- Floodplain habitat conversion to low gradient valley agricultural uses (all populations).
- Inadequate riparian conditions on forest timber lands particularly private lands upstream of the estuaries (all populations).
- Degradation of upper estuarine- and freshwater juvenile rearing habitat areas (all populations).

3) Population-Specific Key Protective Measures and Major Restoration Actions Taken Since the 2016 5-Year Review

Numerous restoration efforts associated with the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and implementation of the Oregon Plan for Salmon and Watersheds and the Oregon Coast Coho Conservation Plan (OCCCP) (ODFW 2007) have been funded by the Pacific Coast Salmon Restoration Fund (PCSRF)/Oregon Watershed Enhancement Board (OWEB), the National Oceanic and Atmospheric Administration (NOAA) Restoration Center, Federal Emergency Management Agency (FEMA), United State Forest Service (USFS), Bureau of Land Management (BLM), and others for all North Coast biogeographic stratum populations. Key protective actions and major restoration actions since the 2016 5-year review include:

- NOAA’s Restoration Center and the Wild Salmon Center collaborative efforts with the Nehalem Watershed Council for the development of the Strategic Action Plan (SAP). The SAP is targeting the Nehalem Watershed for restoration of cool water habitats, riparian plantings, enhancement of beaver habitats, and continued large wood placement projects (Nehalem population).
- Restoration of 443 acres of tidal wetlands and reopening of nearly 14 miles of historical tributaries through implementation of the Southern Flow Corridor flood reduction project in Tillamook Bay. ODFW estimates that this multi-partnership project will annually produce an average of 4,873 to 7,531 adult OC coho salmon (Tillamook population).
- Continued implementation of the strategic work plan for the Salmon SuperHwy, public-private partnership to remove barriers to historic habitats and improve connectivity throughout six major river systems that drain into Tillamook and Nestucca bays. (Tillamook, Nestucca populations).
- Implementation of the recently funded 2020 Pacific Marine and Estuarine Fish Habitat Partnership Neskowin Fish Passage Improvement Project to increase access to 250 acres of riverine estuary, tidal scrub/shrub and tidal forest wetland rearing habitat and 5 miles of spawning habitat for OC coho salmon (Neskowin dependent population).

4) Key Regulatory Measures Since the 2016 5-Year Review

The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and the previous 2016 5-year review (NMFS 2016b) identified agriculture, forestry, beaver management, and water quality regulatory mechanisms as priority issues affecting salmon recovery for the watersheds within the North Coast Biogeographic Stratum. Various federal, state, county and tribal regulatory mechanisms are in place to minimize or avoid habitat degradation caused by human use and development. Although many of these mechanisms have been improved and updated in the past five years, the implementation and effectiveness of these land use regulations remain a concern. See Listing Factor D: Inadequacy of Regulatory Mechanisms in this document for details.

5) Recommended Future Actions Over the Next Five Years Toward Achieving Population Viability

- Implement the remaining fish passage improvement projects identified in the work plan for the Salmon Superhwy for Tillamook and Nestucca populations. Approximately half of the identified barriers still need to be fixed over the next five years to achieve identified population viability goals.
- Finalize and implement the Habitat Conservation Plans (HCP) for Western Oregon state forests to provide additional protection and restoration of habitat for the Necanicum, Nehalem, and Tillamook populations.
- Implement the Strategic Action Plan (SAP) for the Nehalem population that focus on an anchor habitat strategy that seeks to identify, protect, and restore stream reaches most capable of supporting coho across the full spectrum of their freshwater residency. These features meet the seasonal habitat needs for coho from egg to smolt outmigration and are characterized by a low gradient, high potential for channel-floodplain interaction, and accumulation of spawning gravels.
- Finalize and implement the Oregon Private Forest Accords to achieve improvements to forest practices (all populations).
- Systematically review and quantitatively analyze the amount of habitat addressed versus the priority watershed reaches targeted for protection and restoration activities in the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) in order to track progress against plan objectives (All populations).
- Increase the amount and quality of winter rearing habitat by improving stream and estuarine habitat complexity—increase amounts of large wood and pool habitat, and connect side channels, wetlands, and other off-channel areas (All populations).
- Improve water quality, especially by reducing summer water temperatures and agricultural runoff (Tillamook population).
- On state and private timberlands, increase protection of riparian forests with no-touch buffer widths (All populations)
- Continue to support the agriculture community through tide gate replacement/enhancement projects to enhance fish passage and create winter rearing habitats for rearing juvenile OC coho salmon. (Tillamook and Nehalem populations).
- Work with ODFW and others to increase beaver pond habitat by promoting beaver protection on state and privately-owned lands (All populations).

- Collaborate with public and private organizations and others to identify and implement approaches to avoid, reduce and mitigate the impact of future floodplain development on OC coho salmon (All populations).

Mid-Coast Biogeographic Stratum

1) Population-Specific Key Emergent or Ongoing Habitat Concerns Since the 2016 5-Year Review

For the six independent populations (Salmon, Siletz, Yaquina, Beaver, Alsea, and Siuslaw) comprising the Mid-Coast Biogeographic Stratum, the primary habitat concerns as reported in the previous 2016 5-year review (NMFS 2016b) continue to be:

- Insufficient stream complexity including lack of large wood debris and off-channel overwintering habitat (Salmon, Siletz, Yaquina, Alsea, Siuslaw, and Beaver populations)
- Inadequate spawning gravel (Beaver population)
- Poor water quality, such as high water temperatures during the summer (Salmon, Siletz, Yaquina, Alsea, and Siuslaw populations)
- Loss of beaver pond habitat due to removal of beavers and beaver dams (All populations)
- Lack of fish passage and access in the Yaquina, Alsea, and Siuslaw rivers and Beaver Creek estuaries (All populations)

2) Population-Specific Geographic Areas of Habitat Concern Since the 2016 5-Year Review

- Insufficient riparian buffers on private and federal timber lands (All populations)
- Conversion of floodplain habitat to low gradient valley agricultural uses (All populations)
- Loss of estuarine habitat – in the Salmon, Siletz, Yaquina, Alsea, and Siuslaw watersheds.

3) Population-Specific Key Protective Measures and Major Restoration Actions Taken Since the 2016 5-Year Review

Numerous restoration efforts associated with the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and implementation of the Oregon Plan for Salmon and Watersheds, and Oregon Coast Coho Conservation Plan (ODFW 2007) have been funded by the Pacific Coast Salmon Restoration Fund/Oregon Watershed Enhancement Board, the NOAA Restoration Center, Federal Emergency Management Agency, USFS, BLM, and others for all Mid-Coast biogeographic stratum populations. Key protective actions and major restoration actions since the 2016 5-year review include:

- Siuslaw Coho Partnership, a coalition of local, state, and federal partners, completed the 2019 joint SAP that targets the Siuslaw watershed population for restoration of cool water habitats, riparian plantings, enhancement of beaver habitats, and continued large wood placement projects.
- Ongoing development of the NOAA Restoration Center and Wild Salmon Center joint SAP that targets the Siletz watershed population for restoration of cool water habitats, riparian plantings, enhancement of beaver habitats, and continued large wood placement projects.

4) Key Regulatory Measures Since the 2016 5-Year Review

The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and the previous 2016 5-year review (NMFS 2016b) identified agriculture, forestry, beaver management, and water quality regulatory mechanisms as priority issues affecting salmon recovery for the watersheds within the Mid-Coast Biogeographic Stratum. Various federal, state, county and tribal regulatory mechanisms are in place to minimize or avoid habitat degradation caused by human use and development. Although many of these mechanisms have been improved and updated in the past five years, the implementation and effectiveness of these land use regulations remain a concern. See Listing Factor D: Inadequacy of Regulatory Mechanisms in this document for details.

5) Recommended Future Actions Over the Next Five Years Toward Achieving Population Viability

- Systematically review and quantitatively analyze the amount of habitat addressed versus the priority watershed reaches targeted for protection and restoration activities in the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) in order to track progress against plan objectives (All populations).
- Finalize and implement the Oregon Private Forest Accords to achieve improvements to forest practices (All populations).
- Increase access to lowland habitats (i.e., side-channels, alcoves, and floodplains) to improve high flow refugia, estuarine productivity, and life-history diversity in the Beaver Creek population.
- Work with ODFW and others to increase beaver pond habitat by promoting beaver protection on state and privately-owned lands (All populations).
- Continue to support the agriculture community through tide gate replacement/enhancement projects to enhance fish passage and create winter rearing habitats for rearing juvenile OC coho salmon while protecting land use activities (All populations).

Umpqua Biogeographic Stratum

1) Population-Specific Key Emergent or Ongoing Habitat Concerns since the 2016 5-Year Review

For the four independent populations (Lower Umpqua, Middle Umpqua, North Umpqua, and South Umpqua) comprising the Umpqua Biogeographic Stratum, the primary habitat concerns reported in the previous 2016 5-year review (NMFS 2016b) continue to be:

- Insufficient stream habitat complexity, including lack of large wood debris and off-channel overwintering habitat (All Populations).
- Water quantity during summer low flow periods (Middle Umpqua, and South Umpqua populations).
- Water quality, especially high water temperature during the summer (Middle, South and Lower Umpqua populations).
- Loss of beaver pond habitat through removal of beavers and beaver dams (South Umpqua, Middle, and Lower Umpqua populations).
- Lack of fish passage (tide gates) and access in the Lower Umpqua River and Smith River estuary (Lower Umpqua population).

2) Population-Specific Geographic Areas of Concern since the 2016 5-Year Review

- Habitat degradation associated with large wildfires (salvage logging, increased water temperatures, debris flows, reduction in stream complexity) in the South Umpqua and North Umpqua populations.
- Reduced survival of juvenile coho salmon in all freshwater areas, but particularly the South Umpqua population, due to drought, extremely low summer flows, increased stream temperatures, and increased predation by smallmouth bass.
- Inadequate riparian buffers on private timberlands (Lower Umpqua, Middle Umpqua, and South Umpqua populations).

3) Population-Specific Key Protective Measures and Major Restoration Actions Taken since the 2016 5-Year Review

Numerous restoration efforts associated with the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and implementation of the Oregon Plan for Salmon and Watersheds, and the Oregon Coast Coho Conservation Plan (ODFW 2007) have been funded by the Pacific Coast Salmon Restoration Fund (PCSRF)/Oregon Watershed Enhancement Board (OWEB), the NOAA Restoration Center, Federal Emergency Management Agency (FEMA), USFS, BLM, and others for all Umpqua biogeographic stratum populations. Key protective actions and major restoration actions since the 2016 5-year review include:

- Prioritization of 56 tide gates for improvement or repair in the Smith and Lower Umpqua rivers with the Lower Umpqua Tide Gate Partnership with Glover’s tide gate targeted for implementation in the summer of 2021 creating an additional 32 acres of flooded wetlands for winter rearing OC coho salmon (Lower Umpqua population).

4) Key Regulatory Measures Since the 2016 5-Year Review

The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and the previous 2016 5-year review (NMFS 2016b) identified agriculture, forestry, water quality, and beaver management regulatory mechanisms as priority issues affecting salmon recovery for the watersheds within the Umpqua Biogeographic Stratum. Various federal, state, county and tribal regulatory mechanisms are in place to minimize or avoid habitat degradation caused by human use and development. Although many of these mechanisms have been improved and updated in the past five years, the implementation and effectiveness of these land use regulations remain a concern. See Listing Factor D: Inadequacy of Regulatory Mechanisms in this document for details.

5) Recommended Future Actions Over the Next Five Years Toward Achieving Population Viability

- Finalize and implement the Oregon Private Forest Accords to achieve improvements to forest practices benefiting the South Umpqua, Middle Umpqua, and Lower Umpqua populations.
- Rehabilitate wildfire areas to minimize further habitat destruction and restore aquatic habitats (South Umpqua and North Umpqua populations).
- Protect and enhance juvenile coldwater refugia habitats used during the summer (South

Umpqua, Middle Umpqua, and Lower Umpqua populations).
- Finalize and implement the Habitat Conservation Plan (HCP) for the Elliott State Forest (Lower Umpqua population).
- Identify and prioritize opportunities for water use conservation and instream flow increases (South Umpqua and Middle Umpqua populations).
- Increase access to lowland habitats (i.e., side-channels, alcoves, and floodplains) to improve high flow refugia, estuarine productivity, and life-history diversity in the lower basins for outmigrating smolts from the upstream basin reaches (Lower Umpqua population).
- Work with ODFW and others to increase beaver pond habitat by promoting beaver protection on state and privately-owned lands (All populations).
- Implement tide gate replacement/enhancement projects to improve fish passage and create winter rearing habitats for rearing juvenile OC coho salmon (Lower Umpqua population).

Mid-South Coast Biogeographic Stratum

1) Population-Specific Key Emergent or Ongoing Habitat Concerns Since the 2016 5-Year Review

For the four independent populations (Coos, Coquille, Floras, and Sixes) comprising the Mid-South Coast Biogeographic Stratum, the primary habitat concerns as reported in the previous 2016 5-year review (NMFS 2016b) continue to be:

- Insufficient stream habitat complexity, including lack of large wood debris and off-channel overwintering habitat (All populations).
- Inadequate tidal/freshwater wetlands connectivity (Coos and Coquille populations).
- Inadequate riparian buffers on non-federal lands (All populations).
- Poor water quality/ stream temperature (All populations).
- Loss of beaver pond habitat through removal of beavers and beaver dams (All populations).

2) Population-Specific Geographic Areas of Habitat Concern Since the 2016 5-Year Review

- Conversion of floodplain habitat to low gradient agricultural valley uses (Coos and Coquille populations)
- Inadequate riparian buffers on private timberlands (Sixes population)
- Loss of estuarine habitat (Coos and Coquille populations).

3) Population-Specific Key Protective Measures and Major Restoration Actions Since the 2016 5-Year Review

Numerous restoration efforts associated with the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and implementation of the Oregon Plan for Salmon and Watersheds, and the Oregon Coast Coho Conservation Plan (ODFW 2007) have been funded by the Pacific Coast Salmon Restoration Fund/Oregon Watershed Enhancement Board, the NOAA Restoration Center, Federal Emergency Management Agency, USFS, BLM, and others for all Mid-South Coast biogeographic stratum populations. Key protective actions and major restoration actions since the 2016 5-year review include:

- The Coquille Valley Winter Lake Restoration project, which has yielded 1,707 acres of tidal wetland habitat while also improving cattle production for the landowners. The Cochran's and Seestrom's tide gate replacements yielded an additional 100 acres of tidal wetlands in the Coquille Valley for winter rearing habitats (Coquille population) (Huff and Claire 2019).
- The 2020 completion of the Baker Creek culvert removal project by Weyerhaeuser and the Coquille River Watershed Council restored access to 22 miles of stream habitat for the Coquille OC coho salmon population. Baker Creek is a tributary of the South Fork Coquille River.
- NOAA Restoration Center/Wild Salmon Center joint efforts with the Coquille Watershed Council for the development of an SAP targeting restoration of floodplain habitats, fish passage improvements, riparian plantings, enhancement of beaver habitats, and continued large wood placement projects (Coquille population).

4) Key Regulatory Measures Since the 2016 5-Year Review

The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and the previous 2016 5-year review (NMFS 2016b) identified agriculture, forestry, beaver management, and water quality regulatory mechanisms as priority issues affecting salmon recovery for the watersheds within the Mid-South Coast Biogeographic Stratum. Various federal, state, county and tribal regulatory mechanisms are in place to minimize or avoid habitat degradation caused by human use and development. Although many of these mechanisms have been improved and updated in the past five years, the implementation and effectiveness of these land use regulations remain a concern. See Listing Factor D: Inadequacy of Regulatory Mechanisms in this document for details.

5) Recommended Future Actions Over the Next Five Years Toward Achieving Population Viability

- Finalize the Oregon Private Forest Accords and implement the improvements to forest practices immediately, especially in the Coos, Coquille, and Sixes populations.
- Finalize and implement the new Habitat Conservation Plan (HCP) for the Elliott State Forest for protection and restoration of habitat in the Coos population.
- Finalize and implement the Strategic Action Plan (SAP) for the Coquille population.
- Improve stream and estuarine habitat complexity ─ including increasing amounts of large wood and pool habitat, connecting side channels, wetlands, and other off-channel areas (increase juvenile rearing habitat for all populations).
- Improve water quality, especially by reducing summer water temperatures, increasing water availability by reducing water withdrawals, reducing fine sediment levels, and increasing the amount of, and connectivity to, tidal wetland habitat (Sixes population).
- Increase riparian buffers with native riparian vegetation on agricultural lands and establish no touch buffers on forestry lands (improve large wood recruitment in streams for all populations).
- Work with ODFW and others to increase beaver pond habitat by promoting beaver protection on state and privately-owned lands (All populations).

- Continue replacement/enhancement of high-priority tide gates to enhance fish passage and create winter rearing habitats for rearing juvenile OC coho salmon while protecting land use activities (Coquille and Coos populations).

Lakes Biogeographic Stratum

1) Population-Specific Key Emergent or Ongoing Habitat Concerns Since the 2016 5-Year Review

For the three independent populations (Siltcoos, Takenitch, and Tenmile) comprising the Lakes Biogeographic Stratum, the primary habitat concerns as reported in the previous 2016 5-year review (NMFS 2016b) continue to be:

- Insufficient stream complexity/ loss of rearing habitat (All populations).
- Poor water quality: heavy nutrient loading, high water temperatures, and sediment loading, especially in the arms of the lakes (All populations).

2) Population-Specific Geographic Areas of Habitat Concern Since the 2016 5-Year Review

- Poor water quality - Sediment and nutrient loading in Siltcoos and Tenmile lakes (Siltcoos Lake and Tenmile Lake populations).
- Inadequate riparian conditions (stream protection and large wood recruitment) on private timber lands and state lands (i.e., Elliot State Forest) (Tenmile Lake population).
- Agriculture lands where management reduces stream complexity (lack of woody debris and side channels) (All populations).

3) Population-Specific Key Protective Measures and Major Restoration Actions Taken Since the 2016 5-Year Review

Numerous restoration efforts associated with the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and implementation of the Oregon Plan for Salmon and Watersheds and the Oregon Coast Coho Conservation Plan (ODFW 2007) have been funded by the Pacific Coast Salmon Restoration Fund (PCSRF)/Oregon Watershed Enhancement Board (OWEB), the NOAA Restoration Center, Federal Emergency Management Agency (FEMA), USFS, BLM, and others for all Lakes biogeographic stratum populations. The key protective action/major restoration action since the 2016 5-year review was:

- The design by the Tenmile Watershed Partnership of a beaver-related stream habitat enhancement project for tributaries of the Tenmile Watershed with permit request filed in 2019, with construction to have begun in 2020. The backwaters of beaver dams are prime winter habitat for OC coho salmon (Tenmile Population).

4) Key Regulatory Measures Since the 2016 5-Year Review

The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) and the previous 2016 5-year review (NMFS 2016b) identified agriculture, forestry, and water quality regulatory mechanisms as priority issues affecting salmon recovery for the watersheds within the Lakes Biogeographic Stratum. Various federal, state, county and tribal regulatory mechanisms are in place to minimize or avoid habitat degradation caused by human use and development. Although many of these mechanisms have been improved and updated in the past five years, the implementation and effectiveness of these land use regulations remain a concern. See Listing Factor D: Inadequacy of Regulatory Mechanisms in this document for details.

5) Recommended Future Actions Over the Next Five Years Toward Achieving Population Viability

- Finalize and implement the new Habitat Conservation Plan (HCP) for the Elliott State Forest to provide additional protection and restoration of habitat in the Tenmile population.
- Finalize and implement the Oregon Private Forest Accords to achieve improvements to forest practices (all populations).
- Systematically review and quantitatively analyze the amount of habitat addressed versus the priority watershed reaches targeted for protection and restoration activities in the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) in order to track progress against plan objectives (All populations).
- Protect current high-quality summer and winter rearing habitat in the tributaries of the lakes, and strategically restore the quality of adjacent habitat by improving water temperature and channel complexity through protection from adverse timber management and agricultural practices, and beaver control (All populations).
- Improve wood recruitment to support long-term increases in habitat complexity by improving timber harvest activities and agricultural practices (All populations).
- Increase habitat complexity by increasing large wood, boulders, or other instream structure and conducting riparian planting projects (All populations).
- Increase protection of riparian forests with no-touch buffer widths on state and private timberlands (All populations).
- Work with ODFW and others to increase beaver pond habitat by promoting beaver protection on state and privately-owned lands (All populations).

ESU Summary

The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) describes the key limiting factors/threats throughout the ESU. For all populations, reduced juvenile habitat complexity in the winter (and for some populations the summer period) from land management activities is the top key limiting factor for freshwater habitat. The following actions prioritize the most effective actions for recovery:

1. Protect existing high-quality winter and summer rearing habitat throughout the ESU by increasing native riparian vegetation on agricultural and forestry lands.
2. Implement the Private Forest Accords to improve the Forest Practices Act in Oregon for salmon.
3. Complete the Habitat Conservation Plans for the Western Oregon state forests and Elliot state forest.
4. Prioritize funding and actions to improve viability of populations within the Umpqua Stratum, which will ultimately improve the viability of the entire ESU.
5. Identify and prioritize opportunities for water use conservation and instream flow

increases (South Umpqua and Middle Umpqua populations).

6. Where local community support exists, develop, fund and implement a beaver conservation plan that will reduce the need for lethal removal of beavers, and increase the prevalence of beaver dams. A beaver conservation plan framework would consider; (1) passive actions such as trapping restrictions or changes to grazing regimes; (2) active habitat manipulation to entice beaver to build dams and establish colonies; and (3) actively relocating beaver to areas with the intent they will establish colonies.
7. Promote beaver-modified floodplain habitat restoration indirectly through installation of beaver dam analogues and post-assisted log structures which initiate floodplain reconnection processes and facilitate beaver recolonization of tributary environments that are currently too simplified and high energy.
8. Consider funding to support "right sizing" of culverts associated with roads, railroads and other infrastructure so that beavers will not be able to build dams and flood transportation corridors and become a nuisance.
9. Expand the knowledge of the beneficial role of beavers in OC coho salmon recovery and use of non-lethal options for co-existing with beavers to watershed councils, conservation districts, and private landowners.

Listing Factor A Conclusion

New information available since the last 5-year review indicates that a number of restoration and protection actions have been implemented in freshwater and estuarine habitat throughout the range of OC coho salmon ESU.

We remain concerned, however, about degraded habitat conditions throughout the range of the OC coho salmon ESU, particularly with regard to forest practices affecting riparian areas, and conversion of stream habitat complexity/floodplain habitat to agricultural and other land uses that affect the quality and quantity of habitats and habitat-forming processes. There have been some improvements recently through implementation of over 200 habitat restoration projects throughout the ESU. Continued implementation of existing management plans and regulations, such as the USFS's Northwest Forest Plan, BLM's Resource Management Plans, and instream mining restrictions have reduced impacts to freshwater habitats. However, there are still concerns about freshwater habitat for coho salmon being sufficiently protected under existing laws. See Listing Factor D: Adequacy & Inadequacy of Regulatory Mechanisms and Protective Efforts in this document for details. Overall, we conclude that the risk to the species' persistence because of habitat destruction or modification remains unchanged or has slightly decreased since the last 5-year review.

Listing Factor B: Overutilization for commercial, recreational, scientific, or educational purposes

Over-exploitation could be a concern for species abundance in several ways. Commercial harvest reduces abundance through catch of target species, and incidental bycatch on non-target species. Recreational harvest also reduces abundance through direct mortality from fishing that allows a fishing limit for target species, indirect mortality from catch and release, or incidental catch of non-target species that are released back to the water. A third area of exploitation occurs via the issuance of research permits that allow both lethal and non-lethal sampling of listed species.

Each of these areas of direct exploitation, and their indirect impact on non-target species, is evaluated through a biological opinion to ascertain species-level risk from take, and ensure that jeopardy from reductions in abundance, productivity, spatial structure, and diversity is avoided. Moreover, with regard to commercial and recreational harvest, annual run returns serve as calibration points upon which harvest can be curtailed, suspended, or closed, if return runs fail to meet target abundance. These strategies serve as a safeguard against over-exploitation.

Harvest

The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) does not identify fishery harvest as a primary or secondary limiting factor/threat for any coho salmon population within the ESU. For the recent period of 2015 through 2019, the average exploitation rate of OC coho salmon in all fisheries (ocean and freshwater) was 13% and ranged from 9% to 15% (PFMC 2021).

For freshwater fisheries, the harvest of wild coho salmon was closed in the 1990s in response to poor returns. The harvest of hatchery coho salmon was still permitted, but hatchery production in the OC ESU was greatly reduced in response to ESA-listing. Fishing for wild coho salmon was restored on two healthy populations in Siltcoos and Tahkenitch lakes in 2003 (NMFS 2003). In 2009, ODFW adopted an additional Fisheries Management and Evaluation Plan (FMEP) for the entire ESU to allow for wild coho salmon fishing. ODFW continues to operate within the criteria of these ESA-approved FMEPs for naturally produced coho salmon. Conducting these fisheries is dependent upon abundant adult returns and meeting the specified criteria developed in the Amendment 13 harvest metrics (PFMC 1999). Over the last decade, these fisheries have occurred in select years when adult returns were near or exceeded the full capacity of the freshwater habitat. However, in recent years, no wild coho salmon fisheries have occurred in the rivers due to lower adult returns.

Scientific Research and Monitoring

The quantity of OC coho salmon take authorized under ESA sections 10(a)(1)(A) and 4(d) for scientific research and monitoring remains low, and much of the work being conducted is done for the purpose of fulfilling state and federal agency obligations under the ESA to ascertain the species' status. Authorized mortality rates associated with scientific research and monitoring are generally capped at 0.5% across the West Coast Region for all listed salmonid ESUs and DPSs. As a result, the mortality levels that research causes are very low throughout the region. In addition, and as with all other listed salmonids, the effects research has on OC coho salmon are spread out over various reaches, tributaries, and areas across the range of this ESU, and thus no area or population is likely to experience a disproportionate amount of loss. Therefore, the research program, as a whole, has only a very small impact on overall population abundance, a similarly small impact on productivity, and no measurable effect on spatial structure or diversity.

Any time we seek to issue a permit for scientific research, we consult on the effects of the proposed work on each listed species' natural- and hatchery-origin components. However, because research has never been identified as a threat or a limiting factor for any listed species, and because most hatchery fish are considered excess to their species' recovery needs, examining the quantity of hatchery fish taken for scientific research would not inform our analysis of the threats to a species' recovery. Therefore, we only discuss the research-associated take of naturally produced fish in these sections.

From 2015 through 2019, researchers were approved to take an average of fewer than 11,700 adult (<160 lethally) and fewer than 659,000 juvenile (<14,600 lethally) OC coho salmon per year (NMFS APPS database; https://apps.nmfs.noaa.gov/). For the vast majority of scientific research permits, history has shown that researchers generally take far fewer salmonids than the number authorized every year. Over the same five-year period, actual average reported total take was fewer than 2,200 adults (<8 lethally) and fewer than 138,000 juveniles (<1,000 lethally) per year.

The majority of the requested research take for OC coho salmon juveniles has been (and is expected to continue to be) capture via screw traps, electrofishing units, beach seines, fyke nets, hoop nets, minnow traps, and incline plane traps, with smaller numbers being captured via hand or dip nets, hook and line angling, other seines, trawls, and weirs. Adult OC coho salmon take has been and is expected to continue to be requested primarily as capture via weirs and fish ladders, with smaller numbers that may be captured by hook and line angling, tangle nets, trawls, and unintentionally captured in seines or traps targeting juveniles (NMFS APPS database; https://apps.nmfs.noaa.gov/). Our records indicate that mortality rates for screw traps are typically less than one percent and for backpack electrofishing are typically less than three percent. Unintentional mortality rates from seining, hand or hoop netting, fyke nets, minnow or incline plane traps, weirs, and hook and line methods are also limited to no more than three percent. Also, a small number of adult fish may die as an unintended result of research because of interactions with trawl sampling equipment.

The quantity of take of naturally produced fish authorized over the past five years has decreased compared to the prior five years: the total take authorized from 2015 through 2019 was 14% lower than the total take authorized from 2010 to 2014, and total lethal take authorized from 2015 through 2019 was 15% lower than what had been authorized from 2010 to 2014. Actual numbers of take reported from 2015 through 2019 also decreased, with total take decreasing over 38% and lethal take decreasing almost 59% compared to the prior five years.

Overall, research impacts on OC coho salmon remain minimal due to the low mortality rates authorized under research permits and the fact that the research is spread out across the species' range. In addition, because the amount of take and number of mortalities have been decreasing over the last five years, the overall effect of research on listed populations is actually less than it was at the time of the last 5-year review (NMFS 2016b). We, therefore, conclude that the risk to the species' persistence because of utilization related to scientific studies remains low.

Listing Factor B Conclusion

Since the 2016 5-year review, scientific research impacts authorized through the West Coast Region have decreased compared to the past five years (NMFS APPS database;

https://apps.nmfs.noaa.gov/), and the trend in low harvest rates beginning in 1993 continues (Ford 2022). Therefore, the risk to the species' persistence because of overutilization remains essentially unchanged since our previous 5-year review with harvest and research sources of mortality continuing to have little to no impact on the recovery of the OC coho salmon ESU (NMFS 2016a). ODFW should continue to implement Oregon's Life Cycle Monitoring project on the Oregon Coast, which includes monitoring spawning ground escapement, juvenile outmigration, and marine survival to help gauge population status and recovery.

Listing Factor C: Disease or predation

Predation

Non-indigenous Fish Predation

NMFS (2016a) expressed concern about predation on OC coho salmon from introduced, warm water fishes such as smallmouth bass (*Micropterus dolomieu*) and largemouth bass (*Micropterus salmoides*). These predatory fish are more abundant in the lakes and the lower, middle, and south Umpqua River populations. Smallmouth bass are now present in the Coquille River because of illegal introduction in recent years. This is an emerging threat to salmon in the Coquille River and efforts to eradicate non-native bass have been implemented over the last few years. Non-indigenous fish predation of juvenile coho salmon in coastal lakes occurs primarily during summer rearing eliminating the life-cycle trait of the salmon. NMFS (2016b) concluded that predation and competition from exotic fishes, particularly in light of the warming water temperatures from climate change, could seriously affect the lake and slow water rearing life history of OC coho salmon by increasing predation (Stout et al. 2012). Further, ODFW's conservation plan recognizes that coho salmon populations in the Lakes stratum (Tahkenitch, Siltcoos, and Tenmile) are primarily limited by interactions (including predation) with exotic (warm water) fish species. Predation effects is a high priority for research and evaluation related to coastal coho salmon (NMFS 2016a).

NMFS recognizes that the lakes stratum has consistently been the most sustainable within the ESU. The primary strategy to ensure the continued health of the populations in the Lakes Stratum is to reduce summer predation rates by non-indigenous fish species. Non-indigenous fish predation of juvenile coho salmon occurs primarily during summer rearing in the lake populations reducing survival rates to the smolt stage. Because of this, the summer lake rearing life stage of OC coho salmon in the Lakes populations has been eliminated. A future action related to non-native fish predation would be to implement further actions to reduce the abundance of non-native predators, in particular for the South Umpqua and Coquille populations.

Bird and Marine Mammal Predation

NMFS (2016b) identified several bird species and marine mammals that prey on OC coho salmon but concluded that avian and mammalian predation may not have been a significant factor for decline when compared with other factors. More recent work showing predation by birds and marine mammals has raised concerns for some coho salmon populations in the ESU. The Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) recommends monitoring the predation by birds and marine mammals, and if research and monitoring shows significant threats to population viability, working with ODFW, FWS, and others to develop and implement appropriate responses.

The four main marine mammal predators of salmonids in the eastern Pacific Ocean are harbor seals (*Phoca vitulina richardii*), fish-eating killer whales (*Orcinus orca*), California sea lions (*Zalophus californianus*), and Steller sea lions (*Eumetopias jubatus*).

Recent research over the past five years suggests that predation pressure on ESA-listed salmon and steelhead from seals, sea lions, and killer whales has been increasing in the northeastern Pacific over the past few decades (Chasco et al. 2017a; Chasco et al. 2017b). Models developed by Chasco et al. (2017a) estimate that consumption of Chinook salmon in the eastern Pacific Ocean by three species of seals and sea lions and fish-eating (Resident) killer whales may have increased from 5 to 31.5 million individual salmon of varying ages since the 1970s, even as fishery harvest of Chinook salmon has declined during the same time period (Marshal et al 2016; Chasco et al 2017a; Ohlberger 2019). This same modeling suggests that these increasing trends have continued across all regions of the northeastern Pacific over the past five years. The potential predation impacts of specific marine mammal predators of ESA-listed salmonids on the West Coast are discussed individually below.

The three main seal and sea lion (pinniped) predators of ESA-listed salmonids in the eastern Pacific Ocean are harbor seals (*Phoca vitulina richardii*), California sea lions (*Zalophus californianus*), and Steller sea lions (*Eumetopias jubatus*). With the passing of the Marine Mammal Protection Act (MMPA) in 1972, these pinniped stocks along the West Coast of the United States have steadily increased in abundance (Carretta et al. 2019). With their increasing numbers and expanded geographical range, marine mammals are consuming more Pacific salmon and steelhead, and some are having an adverse impact on some ESA-listed species (Chasco et al. 2017a; Thomas et al. 2016; Marshall et al. 2016).

- <u>California Sea Lion (United States Stock)</u>

  The current population size of California sea lions (CSL) is 257,606 (Carretta et al. 2019). The stock is estimated to be approximately 40% above its maximum net productivity level (183,481 animals), and it is, therefore, considered within the range of its optimum sustainable population (OSP) size (Carretta et al. 2019). Estimates of the number of seasonal animals of CSL in the Columbia River Basin, based on surveys in the East Mooring Basin, Astoria, Oregon over the past five years have ranged from a high of 3,834 animals in 2016 to a low of 805 animals in 2019, with 952 individuals estimated in 2020.

- <u>Steller Sea Lion (Eastern United States Stock)</u>

  The current population size of Steller sea lions (SSL) is 71,562 (52,139 non-pups and 19,423 pups) (Muto et al. 2019). Muto et al. (2017) conclude that the eastern stock of

SSL is likely within its OSP range; however, NMFS has not determined its status relative to OSP.

- Harbor Seals (Oregon and Washington Coast Stock)

  The current population size of the Oregon and Washington Coast stock of harbor seals (HS) is 15,533 (Pearson and Jeffries 2018). This stock's status relative to OSP is unknown.

On a Pacific coast-wide scale, models converting juvenile Chinook salmon into adult equivalents estimated that by 2015 pinnipeds consumed an amount of Chinook salmon six times greater than the combined commercial and recreational catches (Chasco et al. 2017a). In the Columbia Basin, recent research found that survival of adult spring-summer Chinook salmon through the estuary and lower Columbia River is negatively impacted by higher sea lion abundance for populations with run timing that overlaps with seasonal increases in Steller and California sea lions (Rub et al. 2019; Sorel et al. 2020). Whether increasing sea lion populations in Oregon are associated with decreased survival of OC coho salmon adults through estuarine and freshwater migration corridors on the Oregon Coast is currently unknown, as there have not been similar survival assessments of populations in coastal estuaries/rivers to date. Some studies have found that pinnipeds like harbor seals can have a significant predation impact on coho salmon and other salmon species of conservation concern (Thomas et al. 2016), as well as steelhead (Moore et al. 2021), through the consumption of outmigrating juveniles. Harbor seal predation data specific to Oregon coastal tributaries is not currently available, so the extent to which predation of outmigrating juveniles in rivers and estuaries is a threat to specific OC coho salmon populations is currently unknown.

Disease

NMFS (2016b) determined that many of the streams coho salmon juveniles inhabit are already at or close to lethal temperatures during the summer months. With the expectation of rising stream temperatures due to climate change, increases in infection rates of juvenile coho salmon by parasites may become an increasingly important stressor both for freshwater and marine survival (Stout et al. 2012). However, the Oregon Coast Coho Salmon Recovery Plan determined that disease and parasites are a low risk to the ESU (NMFS 2016a).

Listing Factor C Conclusion

Predation from introduced warm water fishes, such as smallmouth bass and largemouth bass, continues to present a threat to OC coho salmon. NMFS (2016a; 2016b) identified these species as a limiting factor in the Lakes stratum. With increasing water temperatures, these warm water fish can also become an increasing threat to coho in warmer river reaches. Pinniped populations in Oregon have continued to increase over the past five years, and while there is no new evidence avian and mammalian predation is a significant factor limiting recovery, recent predation studies have raised sufficient concerns for some coho salmon populations that predation monitoring is warranted. Disease currently poses a lesser threat to ESU viability than predation (NMFS 2016a). Many streams inhabited by coho salmon are already approaching lethal temperatures and the fish may be at increased risk of disease if water temperatures rise further due to climate change (NMFS 2015).

Overall, the risk to the species' persistence because of disease and/or predation is increasing since our previous 5-year review due to warmer water temperatures throughout the ESU and increased predation from non-native bass (particularly in the Umpqua and Coquille watersheds).

Listing Factor D: Inadequacy of Regulatory Mechanisms

Various Federal, state, county and tribal regulatory mechanisms are in place to reduce habitat loss and degradation caused by human use and development. For this 5-year review, we focus our analysis on regulatory mechanisms for habitat that have either improved for OC coho salmon, or that are still causing the most concern in terms of providing adequate protection for this species.

Habitat

Habitat concerns are described throughout Listing Factor A as having either a system-wide influence, or more localized influence, on the populations and biogeographic strata that comprise the species. The habitat conditions across all habitat components (tributaries, mainstems, estuary, and marine) necessary to recover listed OC coho salmon are influenced by a wide array of federal, state, and local regulatory mechanisms. The influence of regulatory mechanisms on listed salmonids and their habitat resources is based in large degree by the underlying ownership of the land and water resources as federal, state, or private holdings.

One factor affecting habitat conditions across all land or water ownerships is climate change, the effects of which are discussed under Section 2.3.2.5 (Listing Factor E: Other natural or manmade factors affecting its continued existence). We reviewed summaries of national and international regulations and agreements governing greenhouse gas emissions, which indicate that while the number and efficacy of such mechanisms have increased in recent years there has not yet been a substantial deviation in global emissions from the past trend, and upscaling and acceleration of far-reaching, multilevel, and cross-sectoral climate mitigation will be needed to reduce future climate-related risks (IPCC 2014; IPCC 2018). These findings suggest that current regulatory mechanisms, both in the U.S. and internationally, are not currently adequate to address the rate at which climate change is negatively impacting habitat conditions for many ESA-listed salmon and steelhead.

The majority of the inland range of OC coho salmon is in private ownership (64 percent), with the remaining 36 percent under federal ownership (approximately 20 percent USFS and 16 percent BLM with small percentage ownership by the Bureau of Indian Affairs, United States Coast Guard, and USACE) (Burnett et al. 2007). Most of the landscape in federal ownership is high-quality USFS headwater habitats located in the higher elevations of the Cascade and Coast mountain ranges and is vital to the conservation of the OC coho salmon ESU.

Regulatory Mechanisms Resulting in Adequate or Improved Protection

New information available since the 2016 5-year review (NMFS 2016b) indicates that the adequacy of habitat regulatory mechanisms has remained the same or increased slightly to increase the protection of OC coho salmon during their juvenile rearing life stage in freshwater. Improvements that have occurred to OC habitat have been through some federal and state land and water management regulatory mechanisms.

1. Federal Forest Management

1.1 Northwest Forest Plan

Adequate Protection of Riparian and Stream Habitat Complexity

The Northwest Forest Plan (NWFP) is a series of federal policies and guidelines governing land use on federal lands in the Pacific Northwest region of the United States (USDA and USDI 1994). It covers 10 million hectares within Western Oregon and Washington and a small part of Northern California. A retrospective on 25 years of the Northwest Forest Plan reviewed the scientific literature published since the inception of the NWFP. It reports several key findings, including that conservation of at-risk species within national forests is challenging in the face of threats that are beyond the control of federal managers, even while the NWFP made substantial progress toward meeting several of its goals. The NWFP protected remaining old-growth forests from clearcutting and enabled growth and development of vegetation conditions to support threatened species, including salmonids and riparian-associated organisms (Spies et al. 2019). However, the number of ESA-listed salmonid species and population units has increased (Reeves et al. 2018). Management of riparian and stream habitat under this plan offers greater protection for OC coho salmon on federal lands than under state regulatory mechanisms.

1.2 BLM Revised Resource Management Plan

Adequate Protection of Riparian and Stream Habitat Complexity

The 2016 BLM Resource Management Plan (RMP) governing management of 2.6 million acres of Western Oregon included highly protective hydrology and riparian reserve management direction for protection of water quality and fish. Such action included 120' no-touch inner buffers on all perennial streams, and additional high protections for intermittent streams based on a key watershed strategy. In addition, the BLM has been implementing an aquatic habitat restoration program; although the number of restoration projects has been much lower than originally anticipated.

In 2019, a District of Columbia district court found that the 2016 BLM RMP violated the Oregon and California Railroad and Coos Bay Wagon Road Grant Lands Act ("O&C Act"). *American Forest Resource Council v. Hammond*, 422 F. Supp. 3d 184 (D.D.C. 2019), appeals docketed, No. 20-5008 (D.C. Cir. Jan. 24, 2020). In November 2021, the court vacated the 2016 RMP but the court left it in place until BLM develops and implements a revised RMP "consistent with the O&C Act and [the] Court's Memorandum Opinions." *American Forest Resource Council v.*

Nedd, No. CV 15-01419 (RJL), 2021 WL 6692032, at *8 (D.D.C. Nov. 19, 2021). As a result, how the BLM will manage the riparian reserves into the future is now uncertain.

2. Oregon Fish Passage Guidance (ORS 509.585)

Increased Habitat Restoration

ODFW developed new fish passage policy guidance in July 2021 and project review procedures for instream habitat restoration projects designed to specifically mimic instream natural habitat features created by beavers and beaver dams. The primary goal of this new policy guidance bulletin is to streamline and expedite the state's fish passage review and approval procedures for instream habitat restoration projects designed and implemented to specifically mimic natural habitat features created by beaver and beaver dams. This guidance is expected to benefit habitat complexity for OC coho salmon in Oregon streams.

3. State Water Management and Instream Flow Regulations

Improved Water Quantity and Temperature

In December 2017, the Water Resources Commission adopted Oregon's Integrated Water Resources Strategy, a framework for better understanding and meeting instream and out-of-stream water needs, including water quantity, water quality, and ecosystem needs. No records or reports of implementation for this strategy are more current than the 2016 monitoring strategy (https://www.oregon.gov/OWRD/programs/Planning/IWRS/Pages/default.aspx), thus we have no information as to whether the anticipated improvements in flows and water quality are being realized through the implementation of the new strategy.

4. State Mining Regulations

Improved Water and Habitat Quality

Gravel mining occurs in various areas throughout the freshwater range of OC coho salmon but is most common in the South Fork Coquille, Nehalem, Nestucca, Trask, Kilchis, Miami, and Wilson Rivers (NMFS 2016a). Effective in 2018, Oregon legislation placed restrictions on motorized in-stream placer mining (Department of State Lands Administrative Rules Governing the Issuance and Enforcement of General Authorizations within Waters of this State, OAR 141-089-0820). Previously, motorized in-stream placer mining, including suction dredging, was allowed during summer in streams containing rearing coho salmon. In order to protect indigenous anadromous salmonids and habitat essential to the recovery and conservation of Pacific lamprey, motorized in-stream placer mining is now not permitted to occur below the ordinary high water line in any river in Oregon containing essential indigenous anadromous salmonid habitat. Although Oregon's essential salmon habitat does not completely overlap with

OC coho salmon designated critical habitat, a large amount of OC coho salmon critical habitat in coastal Oregon is now protected from these mining activities.[2]

Regulatory Mechanisms Resulting in Inadequate or Decreased Protection

NMFS remains concerned about the adequacy of some existing regulatory mechanisms. For the OC coho salmon, our primary concerns are: 1) forest practices on state and private timber lands are not adequately protective of water quality; 2) conversion of low-gradient lands to agricultural uses is not adequately regulated to maintain complex stream habitat and floodplain connectivity; 3) water quality regulations have not provided adequate protection of the habitat conditions necessary for optimal growth and survival of salmonids (particularly elevated water temperatures in the summer); and 4) Oregon beaver management statutes and regulations that allow the unlimited lethal removal and harvest of animals and thus strongly reduces opportunities for natural processes that drive instream habitat improvements. The following regulatory mechanisms align with those concerns.

1. Oregon Forest Practices Act and Forest Practice Rules

Inadequate Protection of Riparian and Stream Habitat Complexity

Oregon Forest Practices Act stream rules were amended in 2017 for southwestern Oregon to increase buffer widths by 10 feet and retain more trees on private forestlands (Oregon Administrative Rule 629-645-0000). These rules became effective July 1, 2017, and might improve water quality by increasing shade and reducing sedimentation. Some of the highest quality coho salmon rearing habitat is on private forestlands, making these rule changes particularly important for salmon survival and recovery. However, we remain concerned that rules regarding road maintenance and density on private forest lands are still not adequate to address these activities ongoing impacts on water quality. While buffers widths were recently increased it is also not yet known whether they are now sufficient to adequately protect water quality in OC coho salmon critical habitat.

2. The Endangered Species Act

1.1 Section 10(a)(1)(B) - Habitat Conservation Plans

Inadequate Protection of Riparian and Stream Habitat Complexity

Approximately 567,000 acres (2,295 square kilometers) of forest land within the range of OC coho salmon are managed by the Oregon Board of Forestry (ODF) (ODF 2005). The majority of these lands are managed under the Northwest Oregon Forest Management Plan and the Elliott

[2] Oregon Department of Environmental Quality has an online interactive map (https://www.arcgis.com/apps/webappviewer/index.html?id=1fedde6ecbff46feb7c41524f21d42d7) that shows areas where motorized in-stream placer mining is prohibited.

Forest Management Plan (NMFA 2016a). NMFS is collaborating with ODF to develop an HCP for state forest lands (722,676 acres) within Western Oregon. In 2021, NMFS issued a Notice of Intent to Prepare an Environmental Impact Statement on the Western Oregon State Forest Habitat Conservation Plan (86 FR 13337; March 8, 2021). The Western Oregon State Forests HCP is in the early NEPA process and if approved, is expected to be finalized in 2023. Additionally, NMFS is collaborating with the DSL on an HCP on the Elliott State Lands. Due to NMFS staffing issues, input to the Elliott State Forest HCP has been delayed.

In 2019, Governor Kate Brown announced that representatives of the timber industry and conservation groups agreed to jointly pursue new forestry reforms (called the Private Forest Accords) in Oregon. On October 30, 2021, timber and conservation groups reached an unprecedented conservation agreement on the Private Forest Accords. The agreement represents changes to Oregon Forest Practices Act to better protect coho salmon streams on more than 10 million acres of private forestlands. These changes would dramatically improve Oregon's forestry rules, including improving water quality, large wood retention, increased riparian no-cut buffers, and commitments to upgrade culverts with new standards for fish passage. Agreement parties expect a habitat conservation plan based on enacted legislation will be developed under the ESA for consideration by NOAA Fisheries and the U.S. Fish and Wildlife Service.

3. Federal Clean Water Act

The Federal Clean Water Act (CWA) of 1973 addresses the development and implementation of water quality standards, the development of Total Maximum Daily Loads (TMDLs),[3] filling of wetlands, point source permitting, the regulation of stormwater, and other provisions related to protection of U.S. waters. Some authority for clean water regulation is retained by EPA and the Corps of Engineers, and some authority is delegated to the state of Oregon.

3.1 Section 303(d) – Impaired Waters and Temperature Total Maximum Daily Load Requirements

Ongoing Inadequate Water Temperatures

Under section 303(d) of the CWA, states, territories and authorized tribes are required to develop lists of impaired waters that do not meet the water quality standards set by states. The law requires that states establish priority rankings for waters on the lists and develop Total Maximum Daily Loads (TMDLs) for these waters. A TMDL includes a calculation of the maximum amount of a pollutant that can be present in a waterbody and still meet water quality standards. Despite the existence and enforcement of this law, a significant percentage of stream reaches in the range of the OC coho salmon do not meet current water quality standards. For instance, many of the populations in this ESU, such as the Nehalem, Wilson, Trask, Alsea, Siuslaw, Umpqua, and

[3] A TMDL is a pollution budget and includes a calculation of the maximum amount of a pollutant that can occur in a waterbody and allocates the necessary reductions to one or more pollutant sources. A TMDL serves as a planning tool and potential starting point for restoration or protection activities with the ultimate goal of attaining or maintaining water quality standards.

Coos populations, continue to have degraded water quality identified as a secondary limiting factor (NMFS 2016a).

The Oregon Department of Environmental Quality (DEQ) published the 2018/2020 Integrated Report, which was approved by the EPA in November 2020. Within the 2018/2020 Integrated Report, DEQ assessed 146,057 river miles and determined that 44 percent of Oregon's river miles are impaired (increased from 33 percent in 2012). The impairment of the fish and aquatic life use is the most common impairment. This is largely driven by non-attainment of the temperature criteria and suggests that the TMDLs are currently not sufficient to restore water quality in impaired waters.

3.2 Section 404 of the Clean Water Act - Permits and Exemptions

Inadequate Protection of Riparian and Stream Habitat Complexity

Section 404 of the CWA requires the Corps of Engineers to regulate the discharge of dredged or fill material into waters of the United States, including wetlands through permitting. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the United States, unless the activity is exempt from Section 404 regulation (e.g., certain farming and forestry activities). Permits may be individual, or general permits for a class of activities, such as "nationwide permits."

Development within floodplains continues to be a regional concern, including for forestry and agricultural activities. The CWA 404 permit exemptions, particularly those affecting agricultural and transportation activities, continue to degrade tributary and mainstem habitat conditions, and further constrains habitat complexity and off channel connectivity.

The USACE authorizes certain floodplain fill and removal activities with Nationwide Permits (NWPs). In 2021, the USACE finalized the re-issuance of existing NWPs with modifications (86 FR 2744, January 13, 2021; 86 FR 73522, December 27, 2021). The modifications are likely to increase the amount of fill and destruction of floodplain habitat allowed for NWPs. The NWP authorizations will disconnect off-channel stream and floodplain areas, and result in simplification of stream habitats.

3.3 Definition of the 'Waters of the United States'

Uncertainty in Applicability of ESA and EFH Consultation

As described above, fill and removal activities under the CWA apply to specifically defined 'waters of the United States' (WOTUS). On December 7, 2021, the USACE and EPA proposed a new rule defining the WOTUS for public review and comment (86 FR 69372). As it relates to coho salmon and their habitat, the proposal classifies WOTUS as intermittent streams, perennial streams and rivers, wetlands, and estuaries. The proposal would revert the definition of WOTUS to the definition that existed prior to 2015. The public comment period closed February 7, 2022. If the proposed rule becomes final, most, if not all, of the designated critical habitat for OC coho salmon would be defined as WOTUS and subject to section 404 of the CWA.

4. National Flood Insurance Program

Inadequate Protection of Riparian and Stream Habitat Complexity

The National Flood Insurance Program (NFIP) is a federal benefit program that extends access to federal monies or other benefits, such as flood disaster funds and subsidized flood insurance, in exchange for communities adopting local land use and development criteria consistent with federally established minimum standards. Under this program, development within floodplains continues to be a concern because it facilitates development in floodplains without mitigation for impacts on natural habitat values.

All West Coast salmon species, including 27 of the 28 species listed under the ESA, are negatively affected by an overall loss of floodplain habitat connectivity and complex channel habitat. The reduction and degradation of habitat has progressed over decades as flood control and wetland filling occurred to support agriculture, silviculture, or conversion of natural floodplains to urbanizing uses (e.g., residential and commercial development). Loss of habitat through conversion was identified among the factors for decline for most ESA-listed salmonids. "NMFS believes altering and hardening stream banks, removing riparian vegetation, constricting channels and floodplains, and regulating flows are primary causes of anadromous fish declines (65 FR 42450 July 10, 2000)"; "Activities affecting this habitat include…wetland and floodplain alteration; (64 FR 50414 Sept. 16, 1999)."

Development proceeding in compliance with NFIP minimum standards ultimately results in impacts to floodplain connectivity, flood storage/inundation, hydrology, and to habitat forming processes. Development consequences of levees, stream bank armoring, stream channel alteration projects, and floodplain fill, combine to prevent streams from functioning properly and result in degraded habitat. Most communities (counties, towns, cities) in Oregon are NFIP participating communities, applying the NFIP minimum criteria. For this reason, it is important to note that, where it has been analyzed for effects on salmonids, floodplain development that occurs consistent with the NFIP's minimum standards has been found to jeopardize 18 listed species of salmon and steelhead (Chinook salmon, steelhead, chum salmon, coho salmon, sockeye salmon) (NMFS 2008; NMFS 2016d). The Reasonable and Prudent Alternative provided in NMFS 2016 (Columbia Basin species, OC coho salmon, Southern Oregon/Northern California Coast coho salmon) has not yet been implemented.

5. Beaver Management in Oregon

Diminished Habitat Complexity

Over the last 250 years, the removal of beaver has resulted in profound changes to stream and wetland conditions. Some of the characteristics most pertinent to salmonids include channel simplification, loss of wetted area, increased water velocity, decreased invertebrate production, and decreased floodplain connection (Naiman et al. 1988). While beaver populations have rebounded the last few decades (Pollock et al. 2017), the effects of their removal on stream habitats persist throughout Oregon.

The current regulations regarding the lethal removal and harvest of beavers in Oregon is as follows. On public lands (state and federal), the harvest of beaver is prohibited unless the person has a valid furbearers permit issued by ODFW. On private lands, beaver can be harvested with a furbearers permit; or if property damages/threats are occurring, then the landowner can lethally remove beaver on their land without a permit. For furbearer permittees, they are required to report the harvest of beavers annually to ODFW. From 1997 to 2019, the number of beaver harvested by furbearer permittees in the OC ESU has been declining (ODFW Beaver Management Work Group Meeting, December 8, 2021). Over a recent five year period (2014-2019), the average number of beaver harvested annually has been approximately 400 (ODFW Beaver Management Work Group Meeting, December 8, 2021).

The US Department of Agriculture's Wildlife Services offers a program in Oregon to assist landowners in dealing with wildlife threats and damages that affect agricultural lands. In 2020, NMFS issued a biological opinion and incidental take statement (NMFS 2020b) on this program in Oregon. In the OC coho salmon ESU, beaver were removed from 62 sites (2013-2017), with by far the greatest occurrence in the Coquille basin (22 sites). NMFS estimated the effects on ESA-listed coho salmon in the Coquille River population from beaver removal to be less than four adult salmon equivalents annually (NMFS 2020b). Under the biological opinion, in the future, this program cannot exceed these recent take levels and education and outreach to inform private landowners about how to co-exist with beaver must occur with the landowner before a beaver is removed in hopes of reducing the loss of beavers.

Given the importance of beavers across the landscape to support and improve coho salmon habitat, greater emphasis has been placed on relocating beavers from problem areas. These efforts are growing, but the capacity for relocation efforts is limited. ODFW requires a permit to hold and relocate beaver (ORS 497.308) and has published beaver relocation guidelines relative to beavers and their dams on private property.

All current beaver protective efforts are voluntary and there is low certainty they will be fully implemented (NMFS 2016a). Oregon's statutes and regulations related to beaver management, reduce the amount of rearing habitat that support juvenile coho survival and productivity. To increase the prevalence of beaver dams and protect and restore juvenile rearing habitats, Oregon should consider revising its statutes and regulations related to beaver management, including developing regulatory approaches and policies that limit or temporarily close furbearer trapping of beaver, promote installation, use and maintenance of tools (*e.g.*, pond levelers) to facilitate non-lethal options for private landowners to co-exist with beaver, and support stream habitat restoration actions that promote the natural development and maintenance of beaver-modified floodplain habitat.

Listing Factor D Conclusion

Based on the improvements of some existing regulatory mechanisms, we conclude that the risk to the species' persistence has decreased slightly since the last review. Regulations governing forest practices, land conversion, water quality, and beaver management remain inadequate and in need of improvement. However, continued implementation of the USFS's NWFP and the 2016 BLM RMP resulted in improvements to riparian and freshwater habitat conditions. Recent state mining reforms will lessen impacts on aquatic habitat inhabited by coho salmon. Furthermore, we anticipate that negotiations related to state forests HCPs and the Private Forest Accords will result in additional benefits to aquatic habitat protection and restoration for coho salmon in the coming years. Additional focus on the lowest viability populations in the ESU (South Umpqua, Middle Umpqua, North Umpqua, and Coquille populations) is a high priority in order to increase stratum and ESU viability for recovery.

Listing Factor E: Other natural or manmade factors affecting its continued existence

Climate Change

Major ecological realignments are already occurring in response to climate change (Crozier et al. 2019). As observed by Seigel and Crozier in 2019, long-term trends in warming have continued at global, national and regional scales. Globally, 2014-2018 were the five warmest years on record, both on land and in the ocean (2018 was the 4th warmest). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018), have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality. These two factors are often examined in isolation, but likely have interacting effects on ecosystem function (Seigel and Crozier 2019). Conservation strategies now need to account for geographical patterns in traits sensitive to climate change, as well as climate threats to species-level diversity.

To provide such information, Crozier et al. (2019), conducted a climate vulnerability assessment that included all anadromous Pacific salmon and steelhead (*Oncorhynchus* spp.) population units listed under the federal ESA. Using an expert-based scoring system, they ranked 20 attributes for the 28 listed units and 5 additional units. Attributes captured biological sensitivity, or the strength of linkages between each listing unit and the present climate; climate exposure, or the magnitude of projected change in local environmental conditions; and adaptive capacity, or the ability to modify phenotypes to cope with new climatic conditions. Each listing unit was then assigned one of four vulnerability categories. Five Chinook, one coho, and one sockeye salmon DPSs ranked very high in total vulnerability to climate change due to a combination of high and very high scores for sensitivity and exposure. Bootstrap analyses indicated that two additional DPSs, Southern Oregon/Northern California Coast coho and Mid-Columbia spring-run Chinook, were borderline between high and very high. Among species, Chinook salmon had the highest vulnerability rankings overall (mostly very high and high rankings), followed by coho and sockeye. Steelhead and chum DPS scores were generally lower and nearly equally spread across high and moderate vulnerability categories. Units ranked most vulnerable overall were the California Central Valley Chinook, California and southern Oregon coho, the Snake River sockeye, interior Columbia Spring Chinook, and Willamette River Basin Spring Chinook (Crozier et al. 2019).

Projected Climate Change

Climate change is systemic, influencing ocean temperatures, ocean salinity, ocean acidity, and the composition and presence of a vast array of oceanic species. Other systems are also being influenced by changing climatic conditions. Seigel and Crozier (2019) provide the following observations: As stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changes in flow regimes may alter the amount of habitat available for spawning. This, in turn, could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence.

Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, Seigel and Crozier (2019) observe that a newer study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Updated projections of change are similar to or greater than previous projections. NMFS is confident in the projections because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity and access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Seigel and Crozier 2019).

Impacts on Salmon

As Seigel and Crozier (2019) describe, for salmon, correlations between freshwater and marine survival have important consequences for population dynamics. Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased in spatial scale, causing the highest levels of synchrony in the last 250 years (Black et al. 2018). Salmon productivity (recruits/spawner) has also become more synchronized across 24 wild Chinook populations from Oregon to the Yukon (Dorner et al. 2018). Contrary to previous summaries, which found that northern and southern stocks had inverse responses to ocean temperatures, the current analysis found positive pairwise correlations between nearly all stocks. Although a few populations tended to be less correlated with others, there was no latitudinal trend in correlations. Nearly all listing units faced high exposures to projected increases in stream temperature, sea surface temperature, and ocean acidification, but other aspects of exposure peaked in particular regions. Anthropogenic factors, especially migration barriers, habitat degradation, and hatchery influence, have reduced the adaptive capacity of most steelhead and salmon populations. (Crozier et al. 2019).

At the individual scale, climate impacts in one life stage generally affect body size or timing in the next life stage and can be negative across multiple life stages (Healey 2011; Wade et al. 2013; Wainwright and Weitkamp 2013). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation could influence migration cues for fall and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al. 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Quinn 2005; Crozier and Zabel 2006; Crozier et al. 2010).

At the population level, the ability of organisms to genetically adapt to climate change depends on how selection on multiple traits interact, and whether those traits are linked genetically. Upper thermal limits and hypoxia tolerance are likely to be important traits in determining the effects of climate change on fish populations. For example, Healy et al. 2018, compared genetic diversity associated with thermal and hypoxia tolerance in two sub-species of Atlantic killifish, *Fundulus heteroclitus*, which have previously been shown to differ in these traits. Single nucleotide polymorphisms (SNPs) were found related to each trait independently, but none were shared between both traits. These results suggest that, at least in Atlantic killifish, thermal and hypoxia tolerance are genetically independent traits. At present, more than half of all anadromous Pacific salmon and steelhead DPSs remaining in the contiguous U.S. are threatened with extinction. Suboptimal climate conditions within the historical range of climate variability have been associated with detectable declines in many of these DPSs, highlighting their sensitivities to climatic drivers. In some cases, the synergistic effects of suboptimal climate conditions and intense anthropogenic stressors precipitated the population declines that led to these listing decisions (Crozier et al. 2019).

Another potential limitation in the ability of salmon populations to adapt to climate change is the reduced level of existing genetic diversity compared to historic levels. Johnson et al. 2018, compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin.

Terrestrial and Ocean Conditions and Marine Survival

The following is excerpted from Seigel and Crozier 2019, who present a review of recent scientific literature evaluating the effects of climate change.

"Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter's precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018b) predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable."

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Combining the VIC and MODFLOW models (VIC-MF), they predicted flow for 1986-2042. Comparisons with historical data show improved performance of the combined model over the VIC model alone. Projections using RCP 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas. Such assessments will help stakeholders manage water supplies more sustainably.

Forests

Climate change will impact forests of the Western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak. Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018b) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low-elevation dry forests and diminishing high-elevation cold forests and subalpine habitats. Halofsky et al. (2018a) also assessed climate adaptation strategies for forest management in the region.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend to of more extensive and severe forests fires.

Beyond environmental factors, management practices have left forests more dense and less diverse, which increases vulnerability to fire damage. Attempting to restore forest composition to a state more similar to historical conditions would likely increase fire resiliency, though methods to do so are often contentious (Johnston et al. 2018). Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology.

They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type."

Freshwater Environments

As cited in Seigel and Crozier (2019), Isaak et al. (2018) examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018), concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm.

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created an index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration.

Seigel and Crozier (2019) point out concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days. Populations from higher elevation and further inland streams arrived in the estuary later, and different populations encountered distinct prey fields. They recommended that managers maintain and augment such life-history diversity.

Marine Survival

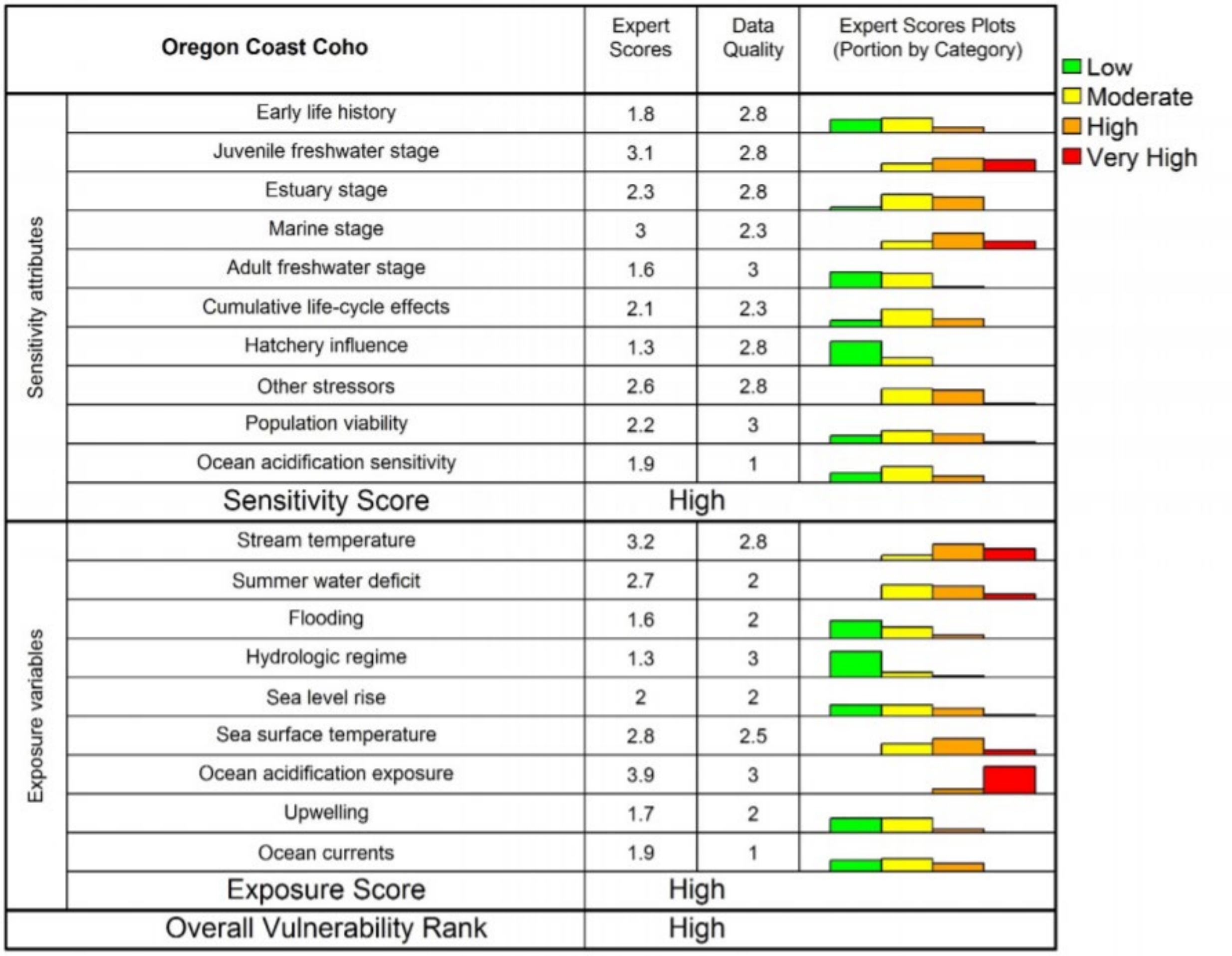
Marine survival of salmonids is affected by a complex array of factors, including prey abundance, predator interactions, and the physical condition of salmon within the marine environment. Seigel and Crozier (2019), observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al. 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al. 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems. Continued ocean marine indicators salmon survival research would help inform how current and predicted future ocean conditions may affect survival of salmon stocks.

Species-Specific Climate Effects (from Crozier et al. 2019)

Climate Effects on Abundance and Distribution of Oregon Coast coho- In September, early returning adults may encounter seasonally warm temperatures or low flows that delay entry into spawning tributaries. However, OC coho salmon adults will typically hold in estuaries or larger rivers and rapidly ascend tributaries to spawn when conditions become suitable (Clark et al. 2014). Autumnal drops in stream temperature and increases in stream discharge improve conditions for adult migration and egg incubation. Thus, incubating eggs are unlikely to be exposed to excessively warm temperatures or desiccation.

Because juveniles typically spend at least one year in freshwater, they can be exposed to warm summer conditions or stress from low flows (Ebersole et al. 2009). In winter, exposure to floods may displace juveniles or reduce egg survival (Nickelson et al. 1992). Flood exposure was expected to change somewhat less for this ESU than for those with more southerly populations, which were projected to face larger changes in flooding due to atmospheric rivers. OC coho salmon ranked high in sensitivity at the juvenile freshwater stage and in exposure to stream temperature; thus, the juvenile freshwater stage for this ESU was considered a highly vulnerable life stage. Exposures may vary significantly among major freshwater habitats where coho juveniles rear. These habitats include coastal dune lakes, coastal tributaries, and the Umpqua River—the only habitat occupied by this ESU that includes the Cascade Mountains within its catchment (Wainwright and Weitkamp 2013). The former two habitats frequently warm to levels that pose physiological or survival challenges to coho salmon, and also support a large contingent of non-native warm water fishes, which may have negative ecological effects (Sanderson et al. 2009). However, declines in snowpack could also have negative consequences for coho inhabiting inland tributaries of the Umpqua River.

Information regarding the potential sensitivity of OC coho salmon to climate change is of mixed quality. However, exposure to changing marine conditions will certainly occur, for example, with increasing levels of ocean acidification. The importance of marine conditions to productivity (number and size of returning adults) was stressed by Wainwright and Weitkamp (2013), and OC coho salmon scored high in sensitivity at the marine stage in this assessment. However, data quality for these threats was limited.



	Oregon Coast Coho	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Early life history	1.8	2.8	
	Juvenile freshwater stage	3.1	2.8	
	Estuary stage	2.3	2.8	
	Marine stage	3	2.3	
	Adult freshwater stage	1.6	3	
	Cumulative life-cycle effects	2.1	2.3	
	Hatchery influence	1.3	2.8	
	Other stressors	2.6	2.8	
	Population viability	2.2	3	
	Ocean acidification sensitivity	1.9	1	
	Sensitivity Score	High		
Exposure variables	Stream temperature	3.2	2.8	
	Summer water deficit	2.7	2	
	Flooding	1.6	2	
	Hydrologic regime	1.3	3	
	Sea level rise	2	2	
	Sea surface temperature	2.8	2.5	
	Ocean acidification exposure	3.9	3	
	Upwelling	1.7	2	
	Ocean currents	1.9	1	
	Exposure Score	High		
Overall Vulnerability Rank		High		

Figure 3. OC coho salmon Vulnerability Ratings by life stage (Crozier et al. 2019).

Overall vulnerability—Moderate (60% Moderate, 40% High) Biological sensitivity—Moderate (58% Moderate, 42% High) Climate exposure—High (6% Moderate, 94% High) Adaptive capacity—Moderate (2.0) Data quality—89% of scores ≥ 2

Adaptive Capacity - OC coho salmon ranked moderate for adaptive capacity, as it likely has flexibility in the juvenile rearing period similar to that of other coho salmon.

Hatchery Effects

The effects of hatchery fish on the status of an ESU or DPS depends upon which of the four key attributes -- abundance, productivity, spatial structure, and diversity -- are currently limiting the ESU/DPS, and how the hatchery fish within the ESU/DPS affect each of the attributes (70 FR 37204). Hatchery programs can provide short-term demographic benefits, such as increases in abundance during periods of low natural abundance. They also can help preserve genetic resources until limiting factors can be addressed. However, the long-term use of artificial propagation may pose risks to natural productivity and diversity. The magnitude and type of the risk depends on the status of affected populations and on specific practices in the hatchery program.

Caldwell and Cramer (2015) advocate that declining productivity of OC coho salmon during the last half-century is not due exclusively to freshwater habitat degradation, but also reflects past management practices of high hatchery releases and harvest rates prior to ESA listing of the OC coho salmon ESU in the late 1990s. They argue that these management practices allowed hatchery fish to dominate naturally spawning populations, which decreased population productivity. The state of Oregon made an unprecedented effort to reduce hatchery influence in wild OC coho salmon populations by greatly reducing the production of hatchery coho salmon along the coast. These reductions in the release of hatchery salmon have increased the abundance and productivity of the ESU (Buhle et al. 2009; Jones et al. 2018). This management strategy has continued since the last 5-year review and the hatchery effects on wild OC coho salmon continue to be minimal. The result of this action is that all but two independent populations in the OC coho salmon ESU currently have a five-year average of >95 percent of wild spawners (Ford 2022). The sole exceptions are the North and South Umpqua populations, both of which have reduced hatchery influence compared to previous reviews. Hatchery production in the North Umpqua was terminated in the late 2000s, and the population now has a positive DSS score for population persistence (Table 11; Ford 2022).

According to the NMFS (2018b) evaluation of ODFW's hatchery and genetic management plans for the operation of ten Oregon coast hatchery facilities under Limit 5 of the Endangered Species Act Section 4(d) rule, presently only 260,000 hatchery coho salmon are released throughout the entire ESU. The massive reduction of hatchery fish from tens of millions released annually prior to ESA-listing to the present level of 260,000 hatchery fish has substantially reduced hatchery-related genetic and ecological risks (NMFS 2018b). The percentage of natural spawners throughout the entire ESU that are of hatchery-origin has been less one percent over the last five years for which data are available (2014-2018) (ODFW 2020a). The genetic risks of hatchery fish interbreeding with natural fish for this ESU is extremely low.

NMFS (2018b) also evaluated the hatchery programs for all other species in addition to coho salmon (i.e., Chinook salmon and steelhead) and concluded these programs do not jeopardize the continued existence of OC coho salmon ESU. The risks associated with these programs are the ecological interactions with juvenile and adult wild coho salmon with the greatest ecological risks from hatchery steelhead smolts released in areas where young of the year (age-0) coho salmon are also present. Overall, these risks were low in time and space throughout the ESU, occurring in late winter and early spring depending upon the specific program (NMFS 2018b). All of the HGMPs implement best management practices to minimize and reduce the impacts to natural populations consistent with the goals of Oregon's Coastal Multi-Species Conservation and Management Plan (ODFW 2014).

Listing Factor E Conclusions

Climate Change

Crozier et al. (2019) recently assessed the vulnerability of ESA-listed salmonids to climate change and concluded that OC coho salmon had a moderate vulnerability overall, moderate biological sensitivity, and moderate climate exposure risk. Since coho salmon spend over a year in freshwater before entering the ocean phase of the life cycle, juvenile salmon during the freshwater stage will be highly vulnerable to climate change. These findings are consistent with Wainwright and Weitkamp (2013) who also concluded that OC coho salmon will likely be negatively affected by climate change.

Hatchery Effects

In general, hatchery programs can provide short-term demographic benefits to salmon and steelhead, such as increases in abundance during periods of low natural abundance. They also can help preserve genetic resources until limiting factors can be addressed. However, the long-term use of artificial propagation may pose risks to natural productivity and diversity. The magnitude and type of risk depends on the status of affected populations and on specific practices in the hatchery program. Hatchery programs can affect naturally produced populations of salmon and steelhead in a variety of ways, including competition (for spawning sites and food) and predation effects, disease effects, genetic effects (e.g., outbreeding depression, hatchery-influenced selection), broodstock collection effects (e.g., to population diversity), and facility effects (e.g., water withdrawals, effluent discharge) (NMFS 2018).

Hatchery effects on this ESU have been greatly reduced since ESA listing in 1998, with the significant reduction in the number of hatchery coho salmon being released. The influence of hatchery programs continues to be minimal since the last 5-year review. Recently, less than one percent of coho salmon spawning in the wild have been of hatchery-origin (ODFW 2020a). In our previous 2016 5-year review, hatchery concerns were described for the North Umpqua and Salmon populations, but these concerns have been addressed since the termination of the North Umpqua and Salmon River hatchery coho salmon programs (NMFS 2018). The DSS population persistence score for the North Umpqua population has improved substantially in this current review from a negative to positive value (Table 11; Ford 2022). The federal recovery plan did not identify any primary or secondary limiting factors/threats related to hatcheries for any population in this ESU (NMFS 2016a).

Since ESA listing, threats posed by hatchery practices have largely been addressed (NMFS 2016a). ODFW has taken numerous steps to minimize adverse impacts of hatcheries on the OC coho salmon ESU. Consequently, NMFS found that hatchery practices that were detrimental to the long-term viability of this ESU have been eliminated (Stout et al. 2012; NMFS 2018). Changes in ODFW hatchery management, including the termination of coho releases from the Salmon River and North Umpqua hatcheries, have resulted in substantial decreases in the proportion of hatchery fish on the spawning grounds in the North Coast, Mid-Coast, and Umpqua Strata. Since 2008, the proportion of hatchery-origin coho has stabilized to very low levels for individual strata and the ESU as a whole (NMFS 2018).

ODFW's Coastal Multi-Species Conservation and Management Plan (ODFW 2014) discusses hatchery production levels and has been approved under the ESA (NMFS 2018). Hatchery coho salmon releases are limited to the basins supporting the Nehalem, Tillamook and South Umpqua populations. Chinook salmon and/or steelhead, however, are being released varying numbers in the basins supporting the Necanicum, Nehalem, Tillamook, Nestucca, Siletz, Yaquina, Siuslaw, Umpqua, Tenmile, Coos Bay, and Coquille populations (NMFS 2018).

2.4 Synthesis

The ESA defines an endangered species as one that is in danger of extinction throughout all or a significant portion of its range, and a threatened species as one that is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range. Under ESA section 4(c)(2), we must review the listing classification of all listed species at least once every five years. While conducting these reviews, we apply the provisions of ESA section 4(a)(1) and NMFS' implementing regulations at 50 CFR part 424.

To determine if a reclassification is warranted, we review the status of the species and evaluate the five factors identified in ESA section 4(a)(1): (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; and (5) other natural or man-made factors affecting a species continued existence. We then make a determination based solely on the best available scientific and commercial information, taking into account efforts by states and foreign governments to protect the species.

Biological Viability Assessment Update

The Ford (2022) update indicates that the biological status of the species did slightly decline since the 2015 review (NWFSC 2015), yet was still higher than the 2012 status update:

- 2012--Moderate certainty of persistence, low to moderate certainty of sustainability
- 2015--High certainty of persistence, moderate certainty of sustainability
- 2020--High certainty of persistence, low to moderate certainty for sustainability

In the latest viability assessment, Ford (2022) concluded that OC coho salmon "fared surprisingly well compared to many other ESUs" and showed a remarkable ability to avoid the extremely low abundances and marine survival rates observed in the late 1990s during the previous extended downturn". Similarly, ODFW (May 2020 letter to NMFS) observed that despite challenging conditions during 2015-2019, "…the abundance of natural origin spawners in the OC ESU has not fallen to low points observed during the 1990s, and ODFW expects the ESU to respond positively as ocean productivity improves".

ESA Listing Factor Analysis

Listing Factor A (habitat): We conclude that since the last 5-year review, the risk to OC coho salmon persistence because of freshwater habitat conditions remains unchanged or has decreased slightly from implementation of the NWFP and 2016 BLM RMP, and improvements in freshwater habitat from over 200 habitat restoration projects within the Oregon Coast coho salmon ESU. Despite these habitat benefits, increasing habitat impacts from climate change and associated effects to coho salmon (Listing Factor E) may have offset some of those habitat benefits.

Listing Factor B (overutilization): We conclude that since the last 5-year review, the risk to OC coho salmon persistence because of overutilization and scientific study remains very low because fishery harvest rates are low and the amount of take for scientific study is limited.

Listing Factor C (disease and predation): We conclude that since the last 5-year review, the risk to OC coho salmon persistence because of disease or predation is slightly increasing, primarily due to drought and higher water temperatures during the summer which increases disease outbreaks and the increase in abundance of non-native, predatory fish like smallmouth bass.

Listing Factor D (inadequacy of regulatory mechanisms): We conclude that since the last 5-year review, the risk to persistence of OC coho salmon because of the inadequacy of regulatory mechanisms remained unchanged since no substantial protective regulations have been promulgated, including any substantive improvements in FEMA's implementation of the NFIP.

Listing Factor E (other manmade or natural factors): We conclude that since the last 5-year review, the risk to OC coho salmon persistence because of other manmade and natural factors is slightly increasing due to recent droughts, low summer streamflows, higher water temperatures, and wildfires causing higher mortality of juvenile coho salmon while residing in freshwater.

In summary, our analysis of the ESA section 4(a)(1) factors indicates that the collective risk to the persistence of OC coho salmon ESU has slightly improved since our previous 5-year review. OC coho salmon's stratum and ESU scores, in light of very poor ocean and freshwater survival conditions from marine heatwaves and droughts over the last five to seven years, are noteworthy. When discussing cycles in ocean productivity, habitat restoration, and the productivity of OC coho salmon, Lawson (1993) stated, "The true measure of success for such [stream restoration] projects is the continued survival of the population through subsequent episodes of low abundance." Lawson cautioned that variation in ocean productivity can mask the true benefits of stream restoration projects. Increased abundances are often incorrectly attributed to stream restoration when the increases resulted from high marine survival. Consequently, he continued that it is only when marine survival is low that it becomes apparent whether habitat quality and quantity are sufficient to support self-sustaining populations (*i.e.*, "ocean test). Therefore, considering the scores at the stratum and ESU levels during a period of very poor ocean conditions between 2015 to 2020 suggests that freshwater habitat may be sufficient to support self-sustaining populations and serves as an indication that OC coho recovery is within reach. At the same time, the Umpqua stratum currently has the lowest viability status. Improvements in this stratum would substantially increase the overall sustainability of the entire ESU.

After considering the biological viability of the OC coho salmon ESU during the 2015-2020 downturn in ocean conditions and low marine productivity with the current status of its ESA section 4(a)(1) factors, we conclude that the risk to the species' persistence has improved since the 2016 5-year review. However, further implementation of sound management actions, habitat restoration and protection efforts must continue to improve population and species viability.

2.4.1 ESU Delineation and Hatchery Membership

- Ford (2022) found that no new information had become available that would justify a change in the delineation of the OC coho salmon ESU.

- Our review of new information since the previous 2016 5-year review regarding the ESU/DPS membership status of various hatchery programs indicates no changes in the OC coho salmon ESU membership are warranted.

2.4.2 ESU Viability and Statutory Listing Factors

- Ford (2022) does not indicate a change in the biological risk for the OC coho salmon ESU since the time of the previous review (NWFSC 2015).

- Our analysis of the ESA section 4(a)(1) factors indicates that the collective risk to the persistence of OC coho salmon ESU has remained unchanged or slightly improved since our previous 2016 5-year review. Only the Umpqua Stratum continues to not meet the Oregon Coast Coho Salmon Recovery Plan (NMFS 2016a) viability criteria.

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3. Results

3.1 Classification

Listing Status:

Based on the information identified above, we recommend that the OC coho salmon ESU remain listed as threatened.

ESU Delineation:

Ford (2022) found that no new information has become available that would justify a change in the delineation of for the OC coho salmon ESU.

Hatchery Membership:

For the OC coho salmon ESU, we do not recommend any changes to the hatchery program membership.

3.2 New Recovery Priority Number

Since the previous 2016 5-year review, NMFS revised the recovery priority numbers guidelines and twice evaluated the numbers (NMFS 2019a, NMFS 2022). Table 4 indicates the number in place for the OC coho salmon ESU at the beginning of the current review (5C). In January 2022, the number remained unchanged.

As part of this 5-year review we re-evaluated the number based on the best available information, including the new viability assessment (Ford 2022), and concluded that the current recovery priority number remains 5C.

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4. Recommendations for Future Actions

In our review of the listing factors, we identified several actions critical to improving the status of the OC coho salmon ESU. While we recognize and will continue to support recovery actions that improve the status of contributing and sustaining salmonid populations of the Oregon Coast, we will continue to emphasize efforts that benefit independent populations in need of the greatest acceleration in viability to support recovery of the OC coho salmon ESU. These efforts will be directed according to recovery criteria, the best available scientific information concerning ESU status, the role of the populations in meeting ESU recovery goals and stratum viability, the limiting factors and threats recognized at the population level, and the likelihood of action effectiveness to guide our recommendations for future actions. NMFS will continue to coordinate with the federal, state, tribal, and local implementing entities during this prioritization process to ensure that identified risk factors and actions are taken.

The greatest opportunity to advance recovery of the OC coho salmon ESU is to:

- Implement recovery actions (NMFS 2016a) that improve the viability of the Umpqua Stratum. This stratum is currently at the lowest viability within the ESU. Improvements in the status of the South Umpqua, North Umpqua, and Middle Umpqua populations, in particular, would likely allow the ESU as a whole to meet ESA viability criteria (assuming other populations do not decline).
- Implement the Private Forest Accords to improve the Forest Practices Act in Oregon for salmon and other sensitive species.
- Complete ESA consultation and section 10 permit for the HCPs for the Western Oregon state forests and Elliot State Forest consistent with OC coho salmon recovery.
- Collaborate with public and private organizations and others to identify and implement approaches to avoid, reduce, and mitigate the impact of future floodplain development on OC coho salmon.
- Fund, implement, and promote habitat restoration actions that increase stream complexity for juvenile coho salmon rearing by applying the principles of process-based habitat restoration (e.g. beaver dams, large wood pools, floodplains, etc).
- Where local community support exists, develop, fund and implement a beaver conservation plan that will reduce the need for lethal removal of beavers, increase the prevalence of beaver dams, and protect and restore high quality rearing habitats that support juvenile salmon survival and productivity.

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5. References

5.1 Federal Register Notices

November 20, 1991 (56 FR 58612). Notice of Policy: Policy on Applying the Definition of Species Under the Endangered Species Act to Pacific Salmon.

February 7, 1996 (61 FR 4722). Notice of Policy: Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act.

August 10, 1998 (63 FR 42587). Final Rule: Endangered and Threatened Species; Threatened Status for the Oregon Coast Evolutionarily Significant Unit of coho Salmon.

February 16, 2000 (65 FR 7764). Final Rule: Designated Critical Habitat: Critical Habitat for 19 Evolutionarily Significant Units of Salmon and Steelhead in Washington, Oregon, Idaho, and California.

July 10, 2000 (65 FR 42422). Final Rule: Endangered and Threatened Species; Final Rule Governing Take of 14 Threatened Salmon and Steelhead Evolutionarily Significant Units (ESUs).

March 28, 2003 (68 FR 15100). Announcement of final policy; Policy for Evaluation of Conservation Efforts When Making Listing Decisions.

June 14, 2004 (69 FR 33102). Final Rule: Endangered and Threatened Species: Proposed Listing Determinations for 27 ESUs of West Coast Salmonids.

June 28, 2005 (70 FR 37159). Final Rule: Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs.

June 28, 2005 (70 FR 37204). Final Policy: Policy on the Consideration of Hatchery-Origin Fish in Endangered Species Act Listing Determinations for Pacific Salmon and Steelhead.

January 5, 2006 (71 FR 834). Final Rule: Endangered and Threatened Species: Final Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead.

January 19, 2006 (71 FR 3033). Proposed Rule/Withdrawal: Endangered and Threatened Species: Withdrawal of Proposals to List and Designate Critical Habitat for the Oregon Coast Evolutionarily Significant Unit (ESU) of coho Salmon.

February 11, 2008 (73 FR 7816). Final Rule: Endangered and Threatened Species: Final Threatened Listing Determination, Final Protective Regulations, and Final Designation of Critical Habitat for the Oregon Coast Evolutionarily Significant Unit of coho Salmon.

June 20, 2011 (76 FR 35755). Final Rule: Listing Endangered and Threatened Species: Threatened Status for the Oregon Coast coho Salmon Evolutionarily Significant Unit.

August 15, 2011 (76 FR 50448). Proposed Rule: Endangered and Threatened Species: 5-Year Reviews for 17 Evolutionarily Significant Units and Distinct Population Segments of Pacific Salmon and Steelhead; Notice of availability of 5-year reviews.

October 13, 2015 (80 FR 61379). Notice of availability; request for comments: Endangered and Threatened Species; Recovery Plans.

May 26, 2016 (81 FR 33468). Notice of availability: Endangered and Threatened Species: 5-Year Reviews for 28 Listed Species of Pacific Salmon, Steelhead, and Eulachon.

December 15, 2016 (81 FR 90780). Notice of availability: Endangered and Threatened Species: Recovery Plan for Oregon Coast coho Salmon ESU.

April 30, 2019 (84 FR 18243). Notice of final guidelines: Endangered and Threatened Species: Listing and Recovery Priority Guidelines.

October 4, 2019 (84 FR 53117). Notice of initiation of 5-year reviews; request for information: Endangered and Threatened Species: Initiation of 5-Year Reviews for 28 Listed Species of Pacific Salmon and Steelhead.

December 17, 2020 (85 FR 81822). Final Rule: Revisions to Hatchery Programs Included as Part of Pacific Salmon and Steelhead Species Listed Under the Endangered Species Act.

March 8, 2021 (86 FR 13337). Notice of Intent to Prepare an Environmental Impact Statement on the Western Oregon State Forest Habitat Conservation Plan.

December 27, 2021 (86 FR 73522). Reissuance and Modification of Nationwide Permits.

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NATIONAL MARINE FISHERIES SERVICE
5-YEAR REVIEW
Oregon Coast Coho Salmon ESU

Current Classification: Threatened

Recommendation resulting from the 5-Year Review

- [ ] Downlist to Threatened
- [ ] Uplist to Endangered
- [ ] Delist
- [x] No change is needed

Review Conducted By (Name and Office):

West Coast Region Oregon Coast Coho Salmon ESU Evaluation Team

REGIONAL OFFICE APPROVAL:

Lead Regional Administrator, NOAA Fisheries

Approve Scott Rumsey Digitally signed by Scott M. Rumsey Date: 2022.09.23 11:45:22 -07'00' Date: 9/23/22

Cooperating Regional Administrator, NOAA Fisheries

[ ] Concur [ ] Do Not Concur [x] N/A

Signature________________________ Date: _______

HEADQUARTERS APPROVAL:

Assistant Administrator, NOAA Fisheries

[x] Concur [ ] Do Not Concur

Signature RAUCH.SAMUEL.D.III.1365850948 Digitally signed by RAUCH.SAMUEL.D.III.1365850948 Date: 2022.10.07 14:17:40 -04'00' Date: _______