National Marine Fisheries Service Endangered Species Act (ESA) Section 7(a)(2) Framework Programmatic Biological Opinion, Conference Letter and Letter of Concurrence, and Magnuson- Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

Pacific Coastal Salmon Recovery Fund

NMFS Consultation Number: WCRO-2024-02445
ARN: 151422WCR2024PR00178

Action Agency: The National Marine Fisheries Service (NMFS)

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely To Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
North Pacific Right whale (*Eubalaena japonica*)	Endangered	No	No	No	No
Southern Resident killer whale (*Orcinus orca*)	Endangered	No	No	No	No
Beluga Whale (*Delphinapterus leucas*)	Endangered	No	No	No	No
Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No
Puget Sound Steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Puget Sound/Georgia Basin Bocaccio (*S. paucispinis*)	Endangered	No	No	No	No
Puget Sound/Georgia Basin Yelloweye Rockfish (*Sebastes ruberrimus*)	Threatened	No	No	No	No
Hood Canal Summer-Run Chum Salmon (*O. keta*)	Threatened	Yes	No	Yes	No
Ozette Lake Sockeye Salmon (*O. nerka*)	Threatened	Yes	No	Yes	No
Upper Columbia River Spring-Run Chinook salmon (*O. tshawytscha*)	Endangered	Yes	No	Yes	No
Upper Columbia River Steelhead (*O. mykiss*)	Endangered	Yes	No	Yes	No

ESA-Listed Species	**Status**	**Is Action Likely To Adversely Affect Species?**	**Is Action Likely To Jeopardize the Species?**	**Is Action Likely To Adversely Affect Critical Habitat?**	**Is Action Likely To Destroy or Adversely Modify Critical Habitat?**
Middle Columbia River Steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Snake River spring/summer-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Snake River Fall-Run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Snake River Sockeye Salmon (*O. nerka*)	Endangered	Yes	No	Yes	No
Snake River basin Steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Lower Columbia River Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Lower Columbia River Steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Lower Columbia River Coho Salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
Columbia River Chum Salmon (*O. keta*)	Threatened	Yes	No	Yes	No
Upper Willamette River Steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Upper Willamette River Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Oregon Coast (coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
Southern Oregon/Northern California Coast coho salmon (*O. kisutch*)	Threatened	Yes	No	Yes	No
Northern California steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
California Coastal Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	Yes	No	Yes	No

ESA-Listed Species	Status	Is Action Likely To Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Sacramento River winter-run Chinook salmon (*O. tshawytscha*)	Endangered	Yes	No	Yes	No
Central Valley spring-run Chinook salmon (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
California Central Valley steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Central California Coast coho salmon (*O. kisutch*)	Endangered	Yes	No	Yes	No
Central California Coast steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
South-Central California Coast steelhead (*O. mykiss*)	Threatened	Yes	No	Yes	No
Southern California steelhead (*O. mykiss*)	Endangered	Yes	No	Yes	No
Eulachon (*Thaleichthys pacificus*)	Threatened	Yes	No	Yes	No
Green Sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	Yes	No
Sunflower Sea Star (*Pycnopodia helianthoides*)	Proposed	No	No	NA	NA

Fishery Management Plan That Describes EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	No
Pacific Coast Groundfish	Yes	No
Coastal Pelagic Species	Yes	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued by: Chris E Yates

For Jennifer Quan
Regional Administrator

Date: March 28, 2025

cc: Robert Anderson (WCR-PRD), Rob Markle (WCR-PRD), Jennie Franks (WCR-PRD), Stephanie Johnson (GC-NW), Korie Schaeffer, (WCR-RAO), Jamal Moss (AK-RAO).

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1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background

The National Marine Fisheries Service (NMFS) prepared this framework programmatic Biological Opinion (opinion), Conference Letter[1] and Letter of Concurrence on administering the Pacific Coastal Salmon Recovery Fund (PCSRF) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.), and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Protected Resources Division in Portland, OR.

1.2 Consultation History

On June 28, 2024, NMFS' West Coast Region (WCR) initiated formal consultation under Section 7 of the ESA, and section 305(b) of the MSA (16 U.S.C.1855(b)) on the PCSRF program. Consultation was paused to gather additional information on the proposed action. On October 29, 2024, NMFS resumed formal consultation.

Since 2000, Congress has provided funding to NMFS for the protection, conservation, and restoration of Pacific salmon and steelhead and their habitats [(16 U.S.C. 3645 (d)(2), and the Consolidated Appropriations Act, 2010, P.L. 111–117)]. Congressionally appropriated funds are distributed by NMFS' PCSRF program to eligible states and tribes through an annual grant competition. Grants supplement existing state and tribal programs to advance salmon and steelhead recovery and conservation.

[1] Sunflower sea star is proposed to be listed as a threatened species, so this document will serve as a conference letter of concurrence.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 Fed. Reg. 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act. 89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015. We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

1.3 Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (see 50 CFR 402.02). Under MSA, federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded or undertaken by a federal agency (50 CFR 600.910).

The proposed action is NMFS' awarding congressionally appropriated funds[2] to eligible applicants for eligible activities. Eligible applicants are the states of Alaska, Washington, Oregon, California, Idaho, and Nevada; as well as federally recognized tribes of the Columbia River and Pacific Coast (including Alaska). Eligible projects and activities are those necessary for conservation of salmon and steelhead populations listed as threatened or endangered, or identified by a state as at-risk to be so listed; for maintaining populations necessary for the exercise of tribal treaty fishing rights or native subsistence fishing (including species not listed under the ESA); or for conservation of Pacific coastal salmon and steelhead habitat.

All funding awarded by NMFS through the PCSRF program, as well as any non-federal match funding or in-kind support, is included in this consultation. For purposes of this framework programmatic consultation, we analyzed the effects of the proposed action at the program-level, as project-level actions subsequently authorized, funded, or carried out will be addressed in subsequent project- or programmatic-level Section 7 consultations, as appropriate.

Awarding of Funds

NMFS solicits (typically annually) proposals from eligible applicants through a Notice of Funding Opportunity (NOFO) (i.e., states of Alaska, Washington, Oregon, California, Idaho, and Nevada; and federally recognized tribes of the Columbia River and Pacific Coast, including Alaska). The NOFO identifies the program objectives, program priorities, program authority,

[2] These appropriated funds can include additional supplemental funding like the Bipartisan Infrastructure Law and the Inflation Reduction Act.

award information, eligibility information, application and submission information, application review information, and award administration information.

In general, NMFS awards funds to eligible applicants to implement their respective salmon and steelhead recovery programs provided the awarded funds are consistent with the NOFO, their final application, and in compliance with the specific grant agreement, including award conditions. Recipients in turn may issue competitive solicitations, non-competitive sub-awards, or a combination of both. State applicants typically provide a project selection framework to demonstrate how awarded funds would benefit specific species and select specific projects for sub-awards later in time during the award period, which frequently is a 5-year period. Tribes and tribal commissions/consortia typically offer representative projects in their application to demonstrate how awarded funds would benefit specific species. However, funds awarded to tribes and tribal commissions/consortia may be applied to projects not specifically identified in the application, provided that those projects deliver equitable value to the identified species and comply with the appropriate grant conditions.

Pre-determined project design criteria are not specified in the NOFO or by NMFS. Each recipient applies their own policies and procedures to selected projects and, as per award requirement, all applicable environmental reviews must be completed and permits secured before project work commences. Consequently, each grant competition may ultimately result in hundreds of projects distributed across the program area. However, at the time of award issuance, NMFS does not possess detailed information regarding the funded projects.

The Assistant Administrator for NMFS is the selecting official and NOAA’s Grants Management Division issues and oversees the grant awards. NMFS’ WCR manages the grant competition and provides implementation oversight, including quality assurance of the project reporting database.

Project Reporting

PCSRF award recipients are required, as a condition of the grant, to submit interim semi-annual progress and financial reports during the period of their award, as well as submit a final report following award closure. This provides NMFS the opportunity to maintain grant oversight and verify award funds are used appropriately. Furthermore, it allows tracking of program benefits and performance.

To facilitate reporting, NMFS has established a database to track projects implemented in association with the PCSRF Program. Recipients are required to report projects to the database within 30 days prior of project selection. Project data must be updated in the database as project status changes or 30 days prior to submitting interim semi-annual progress reports. NMFS has established a hierarchical structure to organize projects by category, sub-category, work type, and metrics. Each category has one or more sub-categories. The program-level project category types evaluated in this framework programmatic consultation include:

1. Salmonid Restoration Planning and Assessments

2. Salmonid Habitat Restoration and Acquisition

3. Salmonid Hatcheries and Harvest Management

4. Salmonid Research, Monitoring, and Evaluation

5. Public Outreach, Education, and Landowner Recruitment

6. Program Administration

We considered, under the ESA, whether or not the proposed action would cause any other activities. That is, we considered whether the proposed action would result in activities that would not take place "but for" the proposed action and examined which of those activities was reasonably certain to occur. We determined that no other activities are reasonably certain to occur due to the PCSRF program. There are a great many activities that are likely to depend on the proposed action (i.e., would not happen without the PCSRF funding), none of them, individually, are reasonably certain to occur due to how the PCSRF program is structured. PCSRF provides funds to eligible states and tribes for their programs. In any given year, states, tribes and other proponents seek funding for programs that support hundreds of projects. These projects vary widely in number, scope, location, and effect each year. States and tribes, not NMFS, choose which projects to fund and they can modify or replace selected projects. While NMFS has oversight of the PCSRF grants, we have no project selection or oversight role. Therefore, we determined that specific, individual projects are not reasonably certain to occur due to the proposed action.

Additionally, we determined that we cannot analyze specific, individual projects funded by the PCSRF grant program in this consultation because we do not have detailed information about specific, individual projects at the time of the grant funding decision and no specific, individual project is reasonably certain to occur given how the PCSRF program functions. Instead, when applicable, individual projects would therefore undergo project- or programmatic-level Section 7 consultation, once they are actually proposed by the states or tribes. Thus, specific, individual projects are beyond the scope of this opinion.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with

NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

As described in the proposed action section, the PCSRF grant program does not include specific projects at specific sites, when issuing funds, rather, it is a framework for a comprehensive programmatic program that will guide the development of subsequent project-level actions selected by the applicants. Thus, the PCSRF is a framework programmatic action as defined in 50 C.F.R. 402.02. Therefore, this document does not include an incidental take statement (ITS), consistent with 50 C.F.R. 402.14(i)(6). Any incidental take resulting from any PCSRF-funded or non-federally-matched action subsequently authorized, funded, or carried out will be addressed in subsequent project- or programmatic-level Section 7 consultations, as appropriate.

In this opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Puget Sound Chinook salmon, Puget Sound steelhead, Hood Canal summer-run chum salmon, Ozette Lake sockeye salmon, Upper Columbia River spring-run Chinook salmon, Upper Columbia River steelhead, Middle Columbia River steelhead, Snake River spring/summer-run Chinook salmon, Snake River fall-run Chinook salmon, Snake River steelhead, Snake River sockeye salmon, Lower Columbia River Chinook salmon, Lower Columbia River coho salmon, Lower Columbia River steelhead, Columbia River chum salmon, Upper Willamette River Chinook salmon, Upper Willamette River steelhead, Oregon Coast coho salmon, Southern Oregon/Northern California Coast coho salmon, Northern California steelhead, California Coastal Chinook salmon, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, Central California Coast coho salmon, Central California Coast steelhead, South-Central California Coast steelhead, Southern California steelhead, eulachon, and green sturgeon listed as threatened or endangered under the ESA.

Furthermore, NMFS, pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402, also concludes that all effects of the action are insignificant or discountable, and therefore are not likely to adversely affect (NLAA) north Pacific right whale, Southern Resident killer whale, Cook Inlet beluga whale, sunflower sea star, Puget Sound/Georgia Basin bocaccio, and Puget Sound/Georgia Basin yelloweye rockfish, or their respective designated critical habitats.

NMFS also determined that the proposed action will not destroy or adversely modify designated or proposed critical habitat for Puget Sound Chinook salmon, Puget Sound steelhead, Hood Canal summer-run chum salmon, Ozette Lake sockeye salmon, Upper Columbia River spring-run Chinook salmon, Upper Columbia River steelhead, Middle Columbia River steelhead, Snake

River spring/summer-run Chinook salmon, Snake River fall-run Chinook salmon, Snake River steelhead, Snake River sockeye salmon, Lower Columbia River Chinook salmon, Lower Columbia River coho salmon, Lower Columbia River steelhead, Columbia River chum salmon, Upper Willamette River Chinook salmon, Upper Willamette River steelhead, Oregon Coast coho salmon, Southern Oregon/Northern California Coast coho salmon, Northern California steelhead, California Coastal Chinook salmon, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, Central California Coast coho salmon, Central California Coast steelhead, South-Central California Coast steelhead (O. mykiss), Southern California steelhead, eulachon, and green sturgeon.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of “jeopardize the continued existence of” a listed species, which is “to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species” (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory definition of “destruction or adverse modification,” which “means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species” (50 CFR 402.02).

The critical habitat designations for many of the species considered herein use the term primary constituent element (PCE). The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a “destruction or adverse modification” analysis, which is the same regardless of whether the original designation identified PCEs or PBFs. In this document, we use the terms PCE and PBF as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term “consequences” (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this document, we use the terms “effects” and “consequences” interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their critical habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" for the jeopardy analysis as described in 50 CFR 402.02. The document also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and the function of the PBFs that are essential for the conservation of the species.

Climate Change

Major ecological realignments are already occurring in response to climate change, which is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species and the conservation value of designated critical habitats in the West Coast Region (Crozier et al. 2019). Long-term trends in warming have continued at global, national, and regional scales (Siegel and Crozier 2020). It is almost certain that annual and seasonal surface temperatures over all of North America will continue to increase at a rate greater than the global average (Gutiérrez et al. 2021). As described in the Intergovernmental Panel on Climate Change Sixth Assessment Report (Gutiérrez et al. 2021), precipitation is also very likely to continue to increase over most of North America above 45°N, and likely to decrease in the southwestern U.S. (particularly in winter), and there is high certainty snow cover will decline over most regions of North America during the 21st century in terms of water equivalent, extent and annual duration (the only exception being high-latitude regions).

These changes will not be spatially homogeneous across the landscape, and are therefore discussed in regionally-specific sections below.

Alaska

The decadal global land and ocean surface average temperature anomaly for 2011–2020 indicates that it was the warmest decade on record for the globe, with a surface global temperature of +1.48°F above the 20th century average[3]. This surpassed the previous decadal record (2001–2010) value of +1.12°F[4]. The 2020 Northern Hemisphere land and ocean surface temperature was the highest in the 141-year record at +2.30°F above average. This was 0.11°F higher than the previous record set in 2016[5].

Since 2000, the Arctic (latitudes between 60ºN and 90ºN) has been warming at more than two times the rate of lower latitudes because of "Arctic amplification," a characteristic of the global climate system influenced by changes in sea ice extent, atmospheric and oceanic heat transports, cloud cover, black carbon, and many other factors[6] (Serreze and Barry 2011; Overland et al. 2017) and the average annual temperature is now 3-4° F warmer than during the early and mid-century. The statewide average annual temperature in 2020 was 27.5°F, 1.5°F above the long-term average even though it was the coldest year since 2012[7]. Some of the most pronounced effects of climate change in Alaska include disappearing sea ice, shrinking glaciers, thawing permafrost, and changing ocean temperatures and chemistry (Chapin et al. 2014).

Pacific Northwest

During the last century regional temperatures in the Pacific Northwest have increased substantially—nearly 2°F—and are projected to continue to increase during all seasons under all climate change prediction scenarios (Abatzoglou et al. 2014, Vose et al. 2017, Rupp et al. 2017). Temperatures have risen steadily, while precipitation remains highly variable, thus intensifying the hydrological cycle within the atmosphere and causing more intense storm events (Warner et al. 2015). Warming is likely to continue during the next century as average temperatures are projected to increase on average by another 3 to 5°F by the end of the 21st century, with the largest increases predicted to occur in the summer (Rupp et al. 2017). Decreases in summer precipitation of 4-10% by the end of the century are also consistently predicted across climate models, although much higher predictions for winter precipitation (8-14% increase) result in a predicted overall increase in annual precipitation (Rupp et al. 2017). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events),

[3] https://www.ncdc.noaa.gov/sotc/global/202013
[4] https://www.ncdc.noaa.gov/sotc/global/202013
[5]https://www.ncdc.noaa.gov/sotc/global/202013
[6] https://www.carbonbrief.org/state-of-the-climate-how-the-world-warmed-in-2019
[7] https://www.ncdc.noaa.gov/sotc/national/202013

in the western United States, with the largest increases in winter flood frequency and magnitude predicted for mixed rain-snow watersheds (Dominguez et al. 2012, Mote et al. 2014). Winter precipitation will also be more likely to fall as rain than snow, resulting in decreased snowpack and earlier snowmelt (Mote et al. 2014, Mote et al. 2016). Within snow-dominated watersheds, warmer winters and springs reduce snow accumulation and hasten snowmelt. Reduced snowpack causes an earlier and smaller freshet in spring. Reduced snowpack also can lead to lower minimum flows and higher stream temperatures in summer (May 2018). Decreased snowpack will increase risks of drought, lower instream flows, warmer water temperatures, and wildfires (Mote et al. 2014, McKenzie and Littell 2017).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua et al. 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (Mantua et al. 2010, Crozier et al. 2019). Temperature increases also shift timing of key life cycle events for salmonids and species forming the base of their aquatic food webs (Crozier et al. 2019, Tillmann and Siemann 2011, Winder and Schindler 2004). Higher stream temperatures will cause decreases in dissolved oxygen, and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer et al. 1999, Winder and Schindler 2004, Raymondi et al. 2013). Higher temperatures are also likely to cause physiological stress that could result in decreased disease resistance and lower reproductive success for many salmon species (Beechie et al. 2013; Wainwright and Weitkamp 2013; Whitney et al. 2016).

Reduced streamflows will also likely reduce available suitable habitat for anadromous fish by making it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua et al. 2010; Isaak et al. 2012, Tonina et al. 2022). As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may also increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode et al. 2013). Earlier peak stream flows will also alter migration timing for salmon smolts and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson et al. 2004). There is also evidence that changes in weather patterns and reductions in spring freshets have altered migration timing for eulachon, which may lead to earlier spawning and flushing of juveniles out of rivers (Moody 2008, Schweigert et al. 2007). Such changes in migration timing could result in a mismatch between juvenile outmigration and favorable marine upwelling conditions in the eastern Pacific (Gustafson et al. 2010, Sharma et al. 2016).

California

One factor affecting the rangewide status of ESA-listed salmonids in California, and aquatic habitat at large, is climate change. For the Southwest region (southern Rocky Mountains to the Pacific Coast), the average temperature has already increased roughly 1.5°F compared to a 1960-1979 baseline period. High temperatures will become more common, indicating that southern California steelhead may experience increased thermal stress even though this species has shown to endure higher than preferable body temperatures (Spina 2007).

Additionally, changes in precipitation trends, e.g., increase in the frequency of heavy rainfall events, can impact salmon and steelhead in freshwater streams including damage to spawning redds and washing away of incubating eggs due to higher winter stream flow (USGCRP 2009). It can also result in poor freshwater survival due to longer and warmer periods of drought (Hanak et al. 2001; Mastrandrea and Luers 2012), which may lead to lower host resistance of salmon and steelhead to more virulent parasitic and bacterial diseases (McCullough 1999; Marcogliese 2001). Snyder and Sloan (2005) projected mean annual precipitation in southwestern California to decrease by 2.0 cm (four percent) by the end of the 21st century.

Wildfires periodically burn large areas of chaparral and adjacent woodlands in autumn and winter in southern California (Westerling et al. 2004). Increased wildfire activity over recent decades reflects sub-regional responses to changes in climate, specifically observations of warmer and earlier onset of spring along with longer summer-dry seasons (Westerling et al. 2004; Westerling and Bryant 2008).

In general, fire impacts include changes in geomorphology (e.g., sediment filled pools and riffles), decreased pool depth, increased solar radiation owing to losses in riparian cover, changes in water quality, increased dissolved nutrients and pH, and changes in pool:riffle ratios (Dunham et al. 2003; Earl and Blinn 2003; Aha et al. 2014). However, these effects may be pronounced or muted depending on the fire burn severity, timing of subsequent rainfalls, intensity and duration of ensuing rains, and volume of debris and sediment entering streams. After a fire disturbance, decreased water quality and loss of salmon and steelhead habitat can be facilitated by the following physical, chemical and biological changes (USFS 2018):

- Increased surface flows resulting in flooding;
- Increased sedimentation leading to changes in food web structure, reducing primary productivity, with effects to grazers and other benthic macroinvertebrates and their predators (e.g., fish);
- Changes to water quality and chemistry due to ash, smoke, nutrients, and hazardous materials;
- Increased water temperature due to reduction/elimination of riparian cover and increased fine sediment loads;

- Scouring of riparian/aquatic vegetation;
- Changes in streambed/pool habitat due to geomorphic movement (debris flows);
- Mass failure of culverts leading to stream habitat degradation; and
- Flushing and extirpation of aquatic biota with limited ability to recolonize rivers, including fish, downstream during and after flood events, respectively.

In summary, observed and predicted climate-change effects are generally detrimental to the species, given the unprecedented rate of change and uncertainty about the ability to adapt, so unless offset by improvements in other factors, status of the species and critical habitat is likely to decline over time.

Marine Habitats

Higher air temperatures have led to higher ocean temperatures. More than 90 percent of the excess heat created by global climate change is stored in the world's oceans, causing increases in ocean temperature (IPCC 2019; Cheng et al. 2020). The upper ocean heat content, which measures the amount of heat stored in the upper 2000 m (6,561 ft) of the ocean, was the highest on record in 2019 by a wide margin and is the warmest in recorded human history (Cheng et al. 2020).

The seas surrounding Alaska have been unusually warm in recent years, with unprecedented warmth in some cases (Thoman and Walsh 2019). This effect can be seen throughout the Alaska region, including the Bering, Chukchi, and Beaufort seas. Along the west coast, the surface waters were 4–11ºF warmer than average in the summer of 2019 (Thoman and Walsh 2019).

Warmer ocean water affects sea ice formation and melt. In the first decade of the 21st century, Arctic sea ice thickness and annual minimum sea ice extent (i.e., September sea ice extent) began declining at an accelerated rate and continues to decline at a rate of approximately minus 2.7 percent per decade (Stroeve et al. 2007; Stroeve and Notz 2018). Although Arctic sea ice loss has been well documented, the seasonal ice cover in Cook Inlet has not been characterized in as much detail, but we expect that the same general trend of later ice formation and earlier melt occurs in that body of water as well.

Changing ocean conditions in the Pacific largely come in the form of sea level rise and the loss of coastal wetlands. Sea levels will likely rise exponentially over the next 100 years, with possibly a 43-84 cm rise by the end of the 21st century (IPCC 2019). In addition, changes in climate along the entire Pacific Coast and along the northern California and southern Oregon coasts will further change hydrologic patterns and ultimately pose challenges to anadromous fish spawning because of decreased snowpack, increased peak flows, and decreased base flow. Low river flow decreases river plume volumes and increases water temperatures, disrupting the distribution of fish into the marine environment (Morrison et al. 2002).

In the marine environment a change to a warm-water regime in the ocean creates larger areas of hypoxia or anoxia because warmer water holds less dissolved oxygen. This shifts more species into shallower waters where atmospheric oxygen mixes more freely into the water column (Meyer-Gutbrod et al. 2021) and could have future impacts on predation and feeding in the nearshore environment.

These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of the Species

This section identifies the ESA-listed species that are likely to be adversely affected by the proposed action (Table 1), and includes their regulatory status, the most recent available information, including the 5-year status reviews and recovery plans, and a summary of their biology, ecology and life histories. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of designated critical habitat, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated critical habitat, and discusses the function of the PBFs that are essential for the species' conservation.

For Pacific salmon and steelhead, NMFS commonly uses four parameters to assess the viability of the populations that, together, constitute the species: spatial structure, diversity, abundance, and productivity (McElhany et al. 2000). These "viable salmonid population" (VSP) criteria therefore encompass the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. We apply the same criteria for other species as well, but in those instances, they are not referred to as "salmonid" population criteria. When any animal population or species has sufficient spatial structure, diversity, abundance, and productivity, it will generally be able to maintain its capacity to adapt to various environmental conditions and sustain itself in the natural environment.

"Spatial structure" refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population's spatial structure depends fundamentally on habitat quality and spatial configuration and the dynamics and dispersal characteristics of individuals in the population.

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation at single genes to complex life history traits (McElhany et al. 2000).

"Abundance" generally refers to the number of naturally produced adults (i.e., the progeny of naturally spawning parents) in the natural environment (e.g., on spawning grounds).

"Productivity," as applied to viability factors, refers to the entire life cycle; i.e., the number of naturally spawning adults produced per parent. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms "population growth rate" and "productivity" interchangeably when referring to production over the entire life cycle. They also refer to "trend in abundance," which is the manifestation of long-term population growth rate.

In addition, it should be noted that for many species in this document, hatchery populations make up part of the listed unit and may be tied to the four VSP parameters defined above. As a result, this document often analyzes effects on hatchery components, and when it does, the terms "artificially propagated" and "hatchery" are used interchangeably, as are the terms "naturally propagated" and "natural."

For species with multiple populations, once the biological status of a species' populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams (Table 1).

Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close enough to allow them to function as metapopulations (McElhany et al. 2000).

A species' status thus is a function of how well its biological requirements are being met: the greater the degree to which the requirements are fulfilled, the better the species' status. Information on the status and distribution of all the species considered here can be found in a number of documents, but the most pertinent are the status review updates and recovery plans listed in Table 1 and the specific species sections that follow. These documents and other relevant information may be found on the NOAA Fisheries West Coast Region website; the discussions they contain are summarized in the tables below. For the purposes of our later analysis, all the species considered here require functioning habitat and adequate spatial structure, abundance, productivity, and diversity to ensure their survival and recovery in the wild.

Table 1. ESA-listed species listing classification and dates, most recent status review, and recovery plan reference for each species considered in this opinion.

Species	Listing Status[8]	Recovery Plan	5- Year Review or Viability Assessment[9]
Puget Sound Chinook salmon (*O. tshawytscha*)	Threatened (79 FR 20802; April 14, 2014)	SSDC 2007	Ford 2022
Puget Sound Steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2019	Ford 2022
Hood Canal Summer-Run Chum Salmon (*O. keta*)	Threatened (79 FR 20802; April 14, 2014)	HCCC 2005	Ford 2022
Ozette Lake Sockeye Salmon (*O. nerka*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2009a	NMFS 2022a
Upper Columbia River Spring-Run Chinook salmon (*O. tshawytscha*)	Endangered (79 FR 20802; April 14, 2014)	UCSRB 2007	NMFS 2022b
Upper Columbia River Steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	UCSRB 2007	NMFS 2022b
Middle Columbia River Steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2009b	NMFS 2022c
Snake River spring/summer-run Chinook salmon (*O. tshawytscha*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2017a	NMFS 2022d
Snake River Fall-Run Chinook salmon (*O. tshawytscha*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2017b	NMFS 2022e
Snake River Basin Steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2017a	NMFS 2022f
Snake River Sockeye Salmon (*O. nerka*)	Endangered (79 FR 20802; April 14, 2014)	NMFS 2015	NMFS 2022g

[8] The species' current listing status (January 2025). See the linked Federal Register notice for any listing history.
[9] 5-Year Reviews or Viability Assessments for each species, whichever is more recent.

Species	Listing Status[8]	Recovery Plan	5- Year Review or Viability Assessment[9]
Lower Columbia River Chinook salmon (*O. tshawytscha*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2013a	NMFS 2022h
Lower Columbia River Steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2013a	NMFS 2022h
Lower Columbia River Coho Salmon (*O. kisutch*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2013a	NMFS 2022h
Columbia River Chum Salmon (*O. keta*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2013a	NMFS 2022h
Upper Willamette River Steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	ODFW and NMFS 2011	Ford 2022
Upper Willamette River Chinook salmon (*O. tshawytscha*)	Threatened (79 FR 20802; April 14, 2014)	ODFW and NMFS 2011	Ford 2022
Oregon Coast (coho salmon (*O. kisutch*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2016b	NMFS 2022i
Southern Oregon/Northern California Coast coho salmon (*O. kisutch*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2014a	SWFSC 2023
Northern California steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2016b	SWFSC 2023
California Coastal Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2016b	SWFSC 2023
Sacramento River winter-run Chinook salmon (*O. tshawytscha*)	Endangered (79 FR 20802; April 14, 2014)	NMFS 2014b	SWFSC 2023
Central Valley spring-run Chinook salmon (*O. tshawytscha*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2014b	SWFSC 2023

Species	Listing Status[8]	Recovery Plan	5- Year Review or Viability Assessment[9]
California Central Valley steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2014b	NMFS 2024a
Central California Coast coho salmon (*O. kisutch*)	Endangered (79 FR 20802; April 14, 2014) Range extension (79 FR 19552; April 2, 2012)	NMFS 2012a	NMFS 2023a
Central California Coast steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2016b	SWFSC 2023
South-Central California Coast steelhead (*O. mykiss*)	Threatened (79 FR 20802; April 14, 2014)	NMFS 2013b	NMFS 2023
Southern California steelhead (*O. mykiss*)	Endangered (79 FR 20802; April 14, 2014)	NMFS 2012b	NMFS 2023c
Eulachon (*Thaleichthys pacificus*)	Threatened (75 FR 13012; March 18, 2010)	NMFS 2017c	NMFS 2022j
Green Sturgeon (*Acipenser medirostris*)	Threatened (71 FR 17757; April 7, 2006)	NMFS 2018	NMFS 2021a

ESU/DPS description, status summary, and limiting factors/threats for each species considered in this opinion.

Puget Sound Chinook Salmon

This ESU comprises 22 populations distributed over five geographic areas, from rivers and streams flowing into Puget Sound from the Elwha River eastward, including rivers in Hood Canal, South Sound, North Sound, and the Strait of Georgia, as well as Chinook salmon from 26 artificial propagation programs. Most populations within the ESU have declined in abundance over the past 7 to 10 years, with widespread negative trends in natural-origin spawner abundance, and hatchery-origin spawners present in high fractions in most populations outside of the Skagit watershed. Escapement levels for all populations remain well below the Technical Recovery Team (TRT) planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the TRT as consistent with recovery.

Foremost limiting factors for this ESU include: degraded floodplain and in-river channel structure, degraded estuarine conditions and loss of estuarine habitat, degraded riparian areas and loss of in- river large woody debris; excessive fine-grained sediment in spawning gravel, degraded water quality and temperature, degraded nearshore conditions, and impaired passage for migrating fish.

Based on the geographic overlap of this species and the proposed action, we expect Puget Sound Chinook salmon to be present in the action area.

Puget Sound Steelhead

This DPS comprises 32 populations. The DPS is currently at very low viability, with most of the 32 populations and all three population groups at low viability. Information considered during the most recent status review indicates that the biological risks faced by the Puget Sound Steelhead DPS have not substantively changed since the listing in 2007, or since the 2011 status review. Furthermore, the Puget Sound Steelhead TRT recently concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 populations. In the near term, the outlook for environmental conditions affecting Puget Sound steelhead is not optimistic. While harvest and hatchery production of steelhead in Puget Sound are currently at low levels and are not likely to increase substantially in the foreseeable future, some recent environmental trends not favorable to Puget Sound steelhead survival and production are expected to continue.

Foremost limiting factors/threats for this DPS include: continued destruction and modification of habitat; widespread declines in adult abundance despite significant reductions in harvest; threats to diversity posed by use of two hatchery steelhead stocks; declining diversity in the DPS, including the uncertain but weak status of summer-run fish; a reduction in spatial structure; reduced habitat quality; urbanization; and dikes, hardening of banks with riprap, and channelization.

Based on the geographic overlap of this species and the proposed action, we expect Puget Sound steelhead to be present in the action area.

Hood Canal Summer-Run Chum Salmon

This ESU is made up of two independent populations in one major population group. Natural-origin spawner abundance has increased since ESA-listing and spawning abundance targets in both populations have been met in some years. Productivity was quite low at the time of the last review, though rates have increased in the last five years, and have been greater than replacement rates in the past two years for both populations. However, productivity of individual spawning aggregates shows only two of eight aggregates have viable performance. Spatial structure and diversity viability parameters for each population have increased and nearly meet the viability criteria. Despite substantive gains towards meeting viability criteria in the Hood Canal and Strait of Juan de Fuca summer chum salmon populations, the ESU still does not meet all of the recovery criteria for population viability at this time.

Foremost limiting factors for this ESU include: loss of channel complexity, sediment accumulation, altered flows and water quality, reduced floodplain connectivity and function, and poor riparian condition.

Based on the geographic overlap of this species and the proposed action, we expect Hood Canal summer-run chum salmon to be present in the action area.

Ozette Lake Sockeye Salmon

This single population ESU's size remain very small compared to historical sizes. Additionally, population estimates remain highly variable and uncertain, making it impossible to detect changes in abundance trends or in productivity in recent years. Spatial structure and diversity are also difficult to appraise; there is currently no successfully quantitative program to monitor beach spawning or spawning at other tributaries. Assessment methods must improve to evaluate the status of this species and its responses to recovery actions. Abundance of this ESU has not changed substantially from the last status review. The quality of data continues to hamper efforts to assess more recent trends and spatial structure and diversity although this situation is improving.

Foremost limiting factors/threats for this ESU include: predation by harbor seals, river otters, and predaceous non-native and native species of fish; reduced quality and quantity of beach spawning habitat in Lake Ozette; increased competition for beach spawning sites due to reduced habitat availability; and stream channel simplification and increased sediment in tributary spawning areas.

Based on the geographic overlap of this species and the proposed action, we expect Lake Ozette ESU sockeye salmon to be present in the action area.

Upper Columbia River Spring-Run Chinook Salmon

This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat populations and unchanged for the Methow population. However, abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations.

Foremost limiting factors/threats for this ESU include: effects related to hydropower system in the mainstem Columbia River, degraded freshwater habitat, degraded estuarine and nearshore marine habitat, hatchery-related effects, persistence of non-native (exotic) fish species, and harvest in Columbia River fisheries.

Based on the geographic overlap of this species and the proposed action, we expect upper Columbia River spring-run Chinook salmon to be present in the action area.

Upper Columbia River Steelhead

This DPS comprises four independent populations. Three populations are at high risk of extinction while 1 population is at moderate risk. Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin abundance and productivity remain well below viability thresholds for three out of the four populations. The status of the Wenatchee River steelhead population continued to improve based on the additional year's information available for the most recent review. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5% extinction risk. However, the overall DPS status remains unchanged from the prior review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.

Foremost limiting factors/threats for this ESU include: Adverse effects related to the mainstem Columbia River hydropower system; impaired tributary fish passage; degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality; hatchery-related effects; predation and competition; and harvest-related effects.

Based on the geographic overlap of this species and the proposed action, we expect Upper Columbia steelhead to be present in the action area.

Middle Columbia River Steelhead

This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population above the Pelton Round Butte Hydroelectric Project. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan. In general, the majority of population level viability ratings remained unchanged from prior reviews for each major population group within the DPS.

Foremost limiting factors/threats for this DPS include: degraded freshwater habitat; mainstem Columbia River hydropower- related impacts; degraded estuarine and nearshore marine habitat; hatchery-related effects; harvest-related effects; and effects of predation, competition, and disease.

Based on the geographic overlap of this species and the proposed action, we expect Middle Columbia steelhead to be present in the action area.

Snake River spring/summer-run Chinook Salmon

This ESU comprises 28 extant and four extirpated populations. All except one extant population (Chamberlin Creek) are at high risk. Natural origin abundance has increased over the levels reported in the prior review for most populations in this ESU, although the increases were not substantial enough to change viability ratings. Relatively high ocean survivals in recent years were a major factor in recent abundance patterns. While there have been improvements in abundance and productivity in several populations relative to prior reviews, those changes have not been sufficient to warrant a change in ESU status.

Foremost limiting factors/threats for this ESU include: degraded freshwater habitat, effects related to the hydropower system in the mainstem Columbia River, altered flows and degraded water quality, harvest-related effects, and predation.

Based on the geographic overlap of this species and the proposed action, we expect Snake River spring/summer-run Chinook salmon to be present in the action area.

Snake River fall-run Chinook Salmon

This ESU has one extant population. Historically, large populations of fall Chinook salmon spawned in the Snake River upstream of the Hells Canyon Dam complex. The extant population is at moderate risk for both diversity and spatial structure and abundance and productivity. The overall viability rating for this population is ‘viable.’ Overall, the status of Snake River fall Chinook salmon has clearly improved compared to the time of listing and compared to prior status reviews. The single extant population in the ESU is currently meeting the criteria for a rating of ‘viable’ developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be “highly viable with high certainty” and/or will require reintroduction of a viable population above the Hells Canyon Dam complex.

Foremost limiting factors/threats for this ESU include: degraded floodplain connectivity and function, harvest-related effects, loss of access to historical habitat above Hells Canyon and other Snake River dams, impacts from mainstem Columbia River and Snake River hydropower systems, hatchery-related effects, and degraded estuarine and nearshore habitat.

Based on the geographic overlap of this species and the proposed action, we expect Snake River fall-run Chinook salmon to be present in the action area.

Snake River Sockeye Salmon

This single population ESU is at very high-risk due to small population size. There is high risk across all four basic risk measures. Although the captive brood program has been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, substantial increases in survival rates across all life history stages must occur to re- establish sustainable natural production In terms of natural production, the Snake River Sockeye salmon ESU remains at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach – developing a hatchery based program to amplify and conserve the stock to facilitate reintroductions.

Foremost limiting factors/threats for this ESU include: effects related to the hydropower system in the mainstem Columbia River, reduced water quality and elevated temperatures in the Salmon River, water quantity, and predation.

Based on the geographic overlap of this species and the proposed action, we expect Snake River sockeye salmon to be present in the action area.

Snake River Basin Steelhead

This DPS comprises 24 populations. Two populations are at high risk, 15 populations are rated as maintained, 3 populations are rated between high risk and maintained, 2 populations are at moderate risk, 1 population is viable, and 1 population is highly viable. Four out of the five MPGs are not meeting the specific objectives in the recovery plan based on the updated status information available for this review, and the status of many individual populations remains uncertain A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations.

Foremost limiting factors/threats for this DPS include: impaired tributary fish passage; degraded freshwater habitat; increased water temperature; harvest-related effects, particularly for B- run steelhead; predation; and genetic diversity effects from out-of- population hatchery releases

Based on the geographic overlap of this species and the proposed action, we expect Snake River basin steelhead to be present in the action area.

Lower Columbia River Chinook Salmon

This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk. Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.

Foremost limiting factors/threats for this ESU include: reduced access to spawning and rearing habitat, hatchery-related effects, harvest-related effects on fall Chinook salmon, an altered flow regime and Columbia River plume, reduced access to off-channel rearing habitat, reduced productivity resulting from sediment and nutrient-related changes in the estuary, and contaminants.

Based on the geographic overlap of this species and the proposed action, we expect Lower Columbia River Chinook salmon to be present in the action area.

Lower Columbia River Steelhead

This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self- sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.

Foremost limiting factors/threats for this DPS include: degraded estuarine and nearshore marine habitat, degraded freshwater habitat, reduced access to spawning and rearing habitat, avian and marine mammal predation, hatchery-related effects, an altered flow regime and Columbia River plume, reduced access to off-channel rearing habitat in the lower Columbia River, reduced productivity resulting from sediment and nutrient-related changes in the estuary, juvenile fish wake stranding, and contaminants.

Based on the geographic overlap of this species and the proposed action, we expect Lower Columbia River steelhead to be present in the action area.

Lower Columbia River Coho Salmon

Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer-term data sets it is not possible to parse out these effects.

Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners. Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade habitat, especially in lowland areas. Although populations in this ESU have generally improved, recent poor ocean conditions suggest that population declines might occur in the upcoming return years.

Foremost limiting factors/threats for this ESU include: degraded estuarine and near-shore marine habitat, fish passage barriers, degraded freshwater habitat, hatchery-related effects, harvest-related effects, an altered flow regime and Columbia River plume, reduced access to off-channel rearing habitat in the lower Columbia River, reduced productivity resulting from sediment and nutrient-related changes in the estuary, juvenile fish wake stranding, and contaminants.

Based on the geographic overlap of this species and the proposed action, we expect lower Columbia River Coho salmon to be present in the action area.

Columbia River Chum Salmon

Overall, the status of most chum salmon populations is unchanged from the baseline VSP scores estimated in the recovery plan. A total of 3 of 17 populations are at or near their recovery viability goals, although under the recovery plan scenario these populations have very low recovery goals of zero. The remaining populations generally require a higher level of viability and most require substantial improvements to reach their viability goals. Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high-risk category and considerable progress remains to be made to achieve the recovery goals.

Foremost limiting factors/threats for this ESU include: reduced water quality, current or potential predation, an altered flow regime and Columbia River plume, reduced access to off-channel rearing habitat in the lower Columbia River, reduced productivity resulting from sediment and nutrient-related changes in the estuary, juvenile fish wake stranding, and contaminants.

Based on the geographic overlap of this species and the proposed action, we expect Columbia River chum salmon to be present in the action area.

Upper Willamette River Steelhead

This DPS has four demographically independent populations. Three populations are at low risk and one population is at moderate risk. Declines in abundance noted in the last status review continued through the period from 2010-2015. While rates of decline appear moderate, the DPS continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The causes of these declines are not well understood, although much accessible habitat is degraded and under continued development pressure. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity and a source of competition for the DPS. While the collective risk to the persistence of the DPS has not changed significantly in recent years, continued declines and potential negative impacts from climate change may cause increased risk in the near future.

Foremost limiting factors/threats for this DPS include: degraded freshwater habitat; degraded water quality; increased disease incidence; altered stream flows; reduced access to spawning and rearing habitats due to impaired passage at dams; altered food web due to changes in inputs of microdetritus; predation by native and non-native species, including hatchery fish and pinnipeds; competition related to introduced salmon and steelhead; and altered population traits due to interbreeding with hatchery origin fish.

Based on the geographic overlap of this species and the proposed action, we expect Upper Willamette steelhead to be present in the action area.

Upper Willamette River Chinook Salmon

This ESU comprises seven populations. Five populations are at very high risk, one population is at moderate risk (Clackamas River) and one population is at low risk (McKenzie River). Consideration of data collected since the last status review in 2010 indicates the fraction of hatchery origin fish in all populations remains high (even in Clackamas and McKenzie populations). The proportion of natural origin spawners improved in the North and South Santiam basins, but is still well below identified recovery goals. Abundance levels for five of the seven populations remain well below their recovery goals. Of these, the Calapooia River may be functionally extinct and the Molalla River remains critically low. Abundances in the North and South Santiam rivers have risen over the past decade, but still range only in the high hundreds of fish. The Clackamas and McKenzie populations have previously been viewed as natural population strongholds, but have both experienced declines in abundance despite having access to much of their historical spawning habitat. Overall, populations appear to be at either moderate or high risk, there has been likely little net change in the VSP score for the ESU since the last review, so the ESU remains at moderate risk.

Foremost limiting factors/threats for this ESU include: degraded freshwater habitat; degraded water quality; increased disease incidence, altered stream flows; reduced access to spawning and rearing habitats; altered food web due to reduced inputs of microdetritus; predation by native and non-native species, including hatchery fish; competition related to introduced salmon and steelhead; and altered population traits due to fisheries and bycatch.

Based on the geographic overlap of this species and the proposed action, we expect Upper Willamette River Chinook salmon to be present in the action area.

Oregon Coast Coho Salmon

This ESU comprises 56 populations including 21 independent and 35 dependent populations. The last status review indicated a moderate risk of extinction. Significant improvements in hatchery and harvest practices have been made for this ESU. Most recently, spatial structure conditions have improved in terms of spawner and juvenile distribution in watersheds; none of the geographic area or strata within the ESU appear to have considerably lower abundance or productivity. The ability of the ESU to survive another prolonged period of poor marine survival remains in question.

Foremost limiting factors/threats for this ESU include: reduced amount and complexity of habitat including connected floodplain habitat, degraded water quality, blocked/impaired fish passage, inadequate long-term habitat protection, and changes in ocean conditions.

Based on the geographic overlap of this species and the proposed action, we expect lower Columbia River coho salmon to be present in the action area.

Southern Oregon/Northern California Coast Coho Salmon

This ESU comprises 31 independent, 9 independent, and 5 ephemeral populations all grouped into 7 diversity strata. Of the 31 independent populations, 24 are at high risk of extinction and 6 are at moderate risk of extinction. The extinction risk of an ESU depends upon the extinction risk of its constituent independent populations; because the population abundance of most of the independent populations are below their depensation threshold, the SONCC coho salmon ESU is at high risk of extinction and is not viable.

Foremost limiting factors/threats for this ESU include: lack of floodplain and channel structure; impaired water quality; altered hydrologic function, impaired estuary/mainstem function; degraded riparian forest conditions; altered sediment supply; increased, disease, predation, and competition; blocked/impaired fish passage; fishery-related effects; and hatchery-related effects.

Based on the geographic overlap of this species and the proposed action, we expect SNOCC coho salmon to be present in the action area.

Northern California Steelhead

This DPS historically comprised 42 independent populations of winter-run steelhead (19 functionally independent and 23 potentially independent), and up to 10 independent populations (all functionally independent) of summer-run steelhead, with more than 65 dependent populations of winter-run steelhead in small coastal watersheds, and Eel river tributaries. Many populations are considered to be extant. Significant gaps in information exist for the Lower Interior and North Mountain Interior diversity strata. All winter-run populations are currently well below viability targets, with most at 5-13% of these goals. Mixed population trends arise depending on time series length; thus, there is no strong evidence to indicate conditions for winter-run populations have worsened appreciably since the last status review. Summer-run populations are of concern. While one run is near the viability target, others are very small or there is a lack of data. Overall, available information for winter- and summer-run populations do not suggest an appreciable increase or decrease in extinction risk since the last status review.

Foremost limiting factors/threats for this ESU include: dams and other barriers to migration, logging, agriculture, ranching, fishery-related effects, and hatchery-related effects.

Based on the geographic overlap of this species and the proposed action, we expect northern California steelhead to be present in the action area.

California Coastal Chinook Salmon

This ESU historically supported 16 Independent populations of fall-run Chinook salmon (11 Functionally Independent and five potentially Independent), six populations of spring-run Chinook salmon, and an unknown number of dependent populations. Based on the data available, eight of the 16 populations were classified as data deficient, one population was classified as being at a Moderate/High risk of extirpation, and six populations were classified as being at a High risk of extirpation. There has been a mix in population trends, with some population escapement numbers increasing and others decreasing. Overall, there is a lack of compelling evidence to suggest that the status of these populations has improved or deteriorated appreciably since the previous status review.

Foremost limiting factors/threats for this ESU include: logging and road construction altering substrate composition, increasing sediment load, and reducing riparian cover; estuarine alteration resulting in lost complexity and habitat from draining and diking; dams and barriers diminishing downstream habitats through altered flow regimes and gravel recruitment, climate change; urbanization and agriculture degrading water quality from urban pollution and agricultural runoff; gravel mining creating barriers to migration, stranding of adults, and promoting spawning in poor locations; non-native species; and hatchery-related effects.

Based on the geographic overlap of this species and the proposed action, we expect California coastal Chinook salmon to be present in the action area.

Sacramento River winter-run Chinook Salmon

This ESU historically supported 18 or 19 Independent populations, with some smaller dependent populations, and four diversity groups. Only three populations are extant (Mill, Deer, and Butte creeks on the upper Sacramento River) which only represent one diversity group (Northern Sierra Nevada). Spatial diversity is increasing with presence (at low numbers in some cases) in all diversity groups. Recolonization of the Battle Creek population with increasing abundance of the Clear Creek population is benefiting ESU viability. The reappearance of phenotypic spring-run to the San Joaquin River tributaries may be the beginning of natural recolonization processes in once extirpated rivers. Active reintroduction efforts on the Yuba and San Joaquin rivers shows promise. The ESU is trending positively towards achieving at least two populations in each of the four historical diversity groups necessary for recovery.

Foremost limiting factors/threats for this ESU include: dams block access to 90 percent of historic spawning and summer holding areas along with altering river flow regimes and temperatures; diversions; urbanization and rural development; logging; grazing; agriculture; mining – historic hydraulic mining from the California Gold Rush era; estuarine modified and degraded, thus reducing developmental opportunities for juvenile salmon; fisheries; hatcheries; "natural' factors (e.g. ocean conditions).

Based on the geographic overlap of this species and the proposed action, we expect Sacramento River winter-run Chinook salmon to be present in the action area.

Central Valley spring-run Chinook Salmon

This ESU historically supported 18 or 19 Independent populations, with some smaller dependent populations, and four diversity groups. Only three populations are extant (Mill, Deer, and Butte creeks on the upper Sacramento River) which only represent one diversity group (Northern Sierra Nevada). Spatial diversity is increasing with presence (at low numbers in some cases) in all diversity groups. Recolonization of the Battle Creek population with increasing abundance of the Clear Creek population is benefiting ESU viability. The reappearance of phenotypic spring-run to the San Joaquin River tributaries may be the beginning of natural recolonization processes in once extirpated rivers. Active reintroduction efforts on the Yuba and San Joaquin rivers shows promise. The ESU is trending positively towards achieving at least two populations in each of the four historical diversity groups necessary for recovery.

Foremost limiting factors/threats for this ESU include: major dams, water diversions, barriers, levees and bank protection, dredging and sediment disposal, mining, contaminants, non-native species, fishery-related effects, and hatchery-related effects.

Based on the geographic overlap of this species and the proposed action, we expect central valley spring-run Chinook salmon to be present in the action area.

California Central Valley Steelhead

Steelhead are present throughout most of the watersheds in the Central Valley, but often in low numbers, especially in the San Joaquin River tributaries. The status of this DPS appears to have changed little since the 2011 status review stating the DPS was in danger of extinction. There is still a paucity of data on the status of wild populations. There are some encouraging signs of increased returns over the last few years. However, the catch of unmarked (wild) steelhead at Chipps Island is still less than 5 percent of the total smolt catch, which indicates natural production of steelhead throughout the Central Valley remains at very low levels. Despite a positive trend on Clear Creek and encouraging signs from Mill Creek, all other concerns raised in the previous status review remain.

Foremost limiting factors/threats for this DPS include: major dams, water diversions, fish passage barriers, levees and bank protection, dredging and sediment disposal, mining, contaminants, non-native species, fishery-related effects, and hatchery-related effects.

Based on the geographic overlap of this species and the proposed action, we expect California central valley steelhead to be present in the action area.

Central California Coast Coho Salmon

This ESU comprises approximately 76 populations that are mostly dependent populations. Historically, the ESU had 11 functionally independent populations and one potentially independent population organized into four strata. The available data for populations within the CCC coho salmon ESU indicate that all independent and dependent populations remain far below recovery targets for abundance and, in some cases, are below high-risk thresholds established by the TRTs. Data suggests some populations show a slight positive trend in annual escapement in recent years, long-term trends of low abundance remain unchanged. Overall, all populations remain, at best, a slight fraction of their recovery target levels, and, aside from the Santa Cruz Mountains strata, the continued extirpation of dependent populations continues to threaten the ESU's future survival and recovery.

Foremost limiting factors/threats for this ESU include: logging; agriculture, mining, urbanization; stream modifications - including altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel and wood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas; dams; wetland loss, water withdrawals, including unscreened diversions for irrigation; wildfires; and climate change impacts to the marine environment (including reduced prey availability and increased sea surface temperatures) reducing marine survival.

Based on the geographic overlap of this species and the proposed action, we expect central California coast coho salmon to be present in the action area.

Central California Coast Steelhead

Both adult and juvenile abundance data are limited for this DPS. It was historically comprised of 37 independent populations (11 functionally independent and 26 potentially independent) and perhaps 30 or more dependent populations of winter-run steelhead. Most of the coastal populations are assumed to be extant with other populations (Coastal San Francisco Bay and Interior San Francisco Bay) likely at high risk of extirpation. While data availability for this DPS remains poor, there is little new evidence to suggest that the extinction risk for this DPS has changed appreciably in either direction since the last status review.

Foremost limiting factors/threats for this DPS include: dams and other barriers to migration, stream habitat degradation, estuarine habitat degradation, and hatchery-related effects.

Based on the geographic overlap of this species and the proposed action, we expect central California coast steelhead to be present in the action area.

South-Central California Coast Steelhead

Currently, nearly half of this DPS reside in the Carmel River. Most other streams and rivers have small populations that can be stochastically driven to extirpation. The ability to fully assess the status of individual populations and the DPS as whole has been limited. There is little new evidence to indicate that the status of the SCCC Steelhead DPS has changed appreciably since the last status review, though the Carmel River runs have shown a long-term decline. Threats to the DPS identified during initial listing have remained largely unchanged, though some fish passage barriers have been removed. Threats to this DPS are likely to exacerbate the factors affecting the continued existence of the DPS. SCCC steelhead recovery will require reducing threats, maintaining interconnected populations across their native range, and preserving the diversity of life history strategies.

Foremost limiting factors/threats for this DPS include: hydrological modifications — dams, surface water diversions, groundwater extraction; agricultural and urban development, roads, other passage barriers; flood control, levees, channelization; non-native species; estuarine habitat loss; marine environment threats; natural environmental variability; and pesticide contaminants.

Based on the geographic overlap of this species and the proposed action, we expect south-central California coast steelhead to be present in the action area.

Southern California Steelhead

This DPS includes steelhead populations along the coast of California from the Santa Maria River system to the border between the U.S. and Mexico. Within this area there are a number of very small (<10 fish) but enduring annual runs. There is little new evidence to indicate that the status of the SCCC Steelhead DPS has changed appreciably since the last status review, although further research is needed to determine the extent to which resident O. mykiss may contribute to population viability. Recent extended drought (with accompanying wildfires) and genetic data documenting a large amount of introgression and extirpation of native fish suggest threats are increasing, particularly in the southern portion of their range. There has been progress in removing fish passage barriers and in constructing fish passage in some watersheds. However, anthropogenic effects are overall unchanged, and impacts from climate change are expected to intensify these threats.

Foremost limiting factors/threats for this DPS include: loss and degradation of estuarine habitats; dams; urban development; mining, agriculture, ranching, recreation; predation by and competition with non-native species; disease; more frequent and extended river mouth closures; inadequate regulatory mechanisms; climate change induced environmental variability; and extended drought conditions and accompanying wildfires.

Based on the geographic overlap of this species and the proposed action, we expect southern California steelhead to be present in the action area.

Eulachon

This DPS comprises 4 subpopulations. Eulachon are endemic to the northeastern Pacific Ocean; they range from northern California to southwest and south-central Alaska and into the southeastern Bering Sea. The southern DPS of eulachon is comprised of fish that spawn in rivers south of the Nass River in British Columbia to, and including, the Mad River in California. In the most recent status review (NMFS 2022), none of the eulachon mean SSB estimates for the years 2016 – 2021 met the HIGH demographic recovery criteria for either the Columbia River subpopulation or the Fraser River subpopulation. For the Columbia River subpopulation, the LOW demographic recovery criterion was met in 2020, and for the Fraser River subpopulation, the LOW demographic recovery criterion was met in 2018 and 2020. In 2022 and 2023 none of the eulachon mean SSB estimates met the HIGH demographic recovery criteria for either the Columbia River subpopulation or the Fraser River subpopulation; however, for the Columbia River subpopulation the LOW demographic recovery criteria was met in both years. For the Fraser River subpopulation, the LOW demographic was not met in either 2022 and 2023. And, for the years 2016 through 2023, the eulachon presence, spatial distribution, and frequency of occurrence recovery criterion was met in several, but not all, representative watersheds.

Foremost limiting factors/threats for this DPS include: climate-induced impacts on ocean conditions, climate-induced impacts on freshwater habitat, bycatch in offshore shrimp trawl fisheries, changes in downstream flow-timing and intensity due to dams and water diversions, and predation.

Based on the geographic overlap of this species and the proposed action, we expect eulachon to be present in the action area.

Green Sturgeon

The Sacramento River contains the only known green sturgeon spawning population in this DPS. The current estimate of spawning adult abundance is between 824-1,872 individuals. Telemetry data and genetic analyses suggest that SDPS green sturgeon generally occur from Graves Harbor, Alaska to Monterey Bay, California and, within this range, most frequently occur in coastal waters of Washington, Oregon, and Vancouver Island and near San Francisco and Monterey bays. Within the nearshore marine environment, tagging and fisheries data indicate that Northern and SDPS green sturgeon prefer marine waters of less than a depth of 110 meters.

Foremost limiting factors/threats for this DPS include: reduction of its spawning area to a single known population, lack of water quantity, poor water quality, and poaching.

Based on the geographic overlap of this species and the proposed action, we expect green sturgeon to be present in the action area.

2.2.2 Status of the Species' Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features (PBFs) of that habitat throughout the designated areas (Table 2). These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (*e.g.*, sites with conditions that support spawning, rearing, migration and foraging).

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

Table 2. Critical habitat designation date, federal register citation, and status summary for critical habitat for each species considered in this opinion.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	09/02/2005 70 FR 52630	Critical habitat for Puget Sound Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in Puget Sounds. The Puget Sound Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value. Primary constitute elements relevant for this consultation include: 1) Estuarine areas free of obstruction with water quality and aquatic vegetation to support juvenile transition and rearing; 2) Nearshore marine areas free of obstruction with water quality conditions, forage, submerged and overhanging large wood, and aquatic vegetation to support growth and maturation; 3) Offshore marine areas with water quality conditions and

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		forage, including aquatic invertebrates and fishes, supporting growth and maturation.
Puget Sound steelhead	02/24/2016 81 FR 9252	Critical habitat for Puget Sound steelhead includes 2,031 stream miles. Nearshore and offshore marine waters were not designated for this species. There are 66 watersheds within the range of this DPS. Nine watersheds received a low conservation value rating, 16 received a medium rating, and 41 received a high rating to the DPS.
Hood Canal summer-run chum salmon	09/02/2005 70 FR 52630	Critical habitat for Hood Canal summer-run chum salmon includes 79 miles and 377 miles of nearshore marine habitat in HC. Primary constituent elements relevant for this consultation include: 1) Estuarine areas free of obstruction with water quality and aquatic vegetation to support juvenile transition and rearing; 2) Nearshore marine areas free of obstruction with water quality conditions, forage, submerged and overhanging large wood, and aquatic vegetation to support growth and maturation; 3) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.
Ozette Lake sockeye salmon	09/02/2005 70 FR 52630	Critical habitat is comprised of a single subbasin containing a single watershed, Ozette Lake Subbasin located in Clallam County, Washington. It encompasses approximately 101 mi^2 and approximately 317 miles of streams; Ozette Lake, the dominant feature of the watershed, is entirely located within the Olympic National Park. The known beach spawning areas, and three tributaries used by sockeye salmon for spawning, incubation, and migration, are encompassed as part of critical habitat for the listed species. Beach spawning is degraded by historical sediment loading, disrupted hydrology, and encroachment of riparian vegetation. Streams supporting spawning, rearing, and migration are impaired by lack of large wood, excessive fine sediment levels (Big River), and mammalian predation.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Upper Columbia River spring-run Chinook salmon	09/02/2005 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Columbia River steelhead	09/02/2005 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Middle Columbia River steelhead	09/02/2005 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.
Snake River spring/summer-run Chinook salmon	10/25/1999 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Snake River fall-run Chinook salmon	10/25/1999 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers presently or historically accessible to this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River sockeye salmon	10/25/1999 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015). Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River basin steelhead	09/02/2005 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar et al. 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Lower Columbia River Chinook salmon	09/02/2005 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to- good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River steelhead	09/02/2005 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to- good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Lower Columbia River coho salmon	02/24/2016 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair- to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Columbia River chum salmon	09/02/2005 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to- good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Upper Willamette River steelhead	09/02/2005 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to- good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.
Upper Willamette River Chinook salmon	09/02/2005 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon containing 56 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PBFs for salmon are in fair-to-poor or fair-to- good condition. However, most of these watersheds have some, or high, potential for improvement. Watersheds are in good to excellent condition with no potential for

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 22 watersheds, medium for 16 watersheds, and low for 18 watersheds.
Oregon Coast coho salmon	02/11/2008 73 FR 7816	Critical habitat encompasses 13 subbasins in Oregon. The long-term decline in Oregon Coast coho salmon productivity reflects deteriorating conditions in freshwater habitat as well as extensive loss of access to habitats in estuaries and tidal freshwater. Many of the habitat changes resulting from land use practices over the last 150 years that contributed to the ESA-listing of Oregon Coast coho salmon continue to hinder recovery of the populations; changes in the watersheds due to land use practices have weakened natural watershed processes and functions, including loss of connectivity to historical floodplains, wetlands and side channels; reduced riparian area functions (stream temperature regulation, wood recruitment, sediment and nutrient retention); and altered flow and sediment regimes (NMFS 2016). Several historical and ongoing land uses have reduced stream capacity and complexity in Oregon coastal streams and lakes through disturbance, road building, splash damming, stream cleaning, and other activities. Beaver removal, combined with loss of large wood in streams, has also led to degraded stream habitat conditions for coho salmon (Stout et al. 2012).
Southern Oregon/Northern California Coast coho salmon	05/05/1999 64 FR 24049	Critical habitat includes all areas accessible to any life-stage up to long-standing, natural barriers and adjacent riparian zones. SONCC coho salmon critical habitat within this geographic area has been degraded from historical conditions by ongoing land management activities. Habitat impairments recognized as factors leading to decline of the species that were included in the original listing notice for SONCC coho salmon include: 1) Channel morphology changes; 2) substrate changes; 3) loss of in-stream roughness; 4) loss of estuarine habitat; 5) loss of wetlands; 6) loss/degradation of riparian areas; 7) declines in water quality; 8) altered stream flows; 9) fish passage impediments; and 10) elimination of habitat.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Northern California steelhead	9/2/2005 70 FR 52488	There are approximately 3,028 miles of stream habitats and 25 square miles of estuary habitats designated as critical habitat for NC steelhead. NMFS determined that marine areas did not warrant consideration as critical habitat for this DPS. NC steelhead PBFs are sites and habitat components which support one or more life stages. There are 50 watersheds within the range of this DPS. Nine watersheds received a low rating, 14 received a medium rating, and 27 received a high rating of conservation value to the DPS. Two estuarine habitats, Humboldt Bay and the Eel River estuary, have high conservation value ratings. Since designation, critical habitat for this species has continued to be degraded somewhat by the factors listed above in the status section. Nonetheless, a number of restoration efforts have been undertaken by local, state, and federal entities resulting in slightly improved conditions in some areas and a slowing of the negative trend.
California Coastal Chinook salmon	09/02/2005 70 FR 52488	Critical habitat includes approximately 1,475 miles of stream habitats and 25 square miles of estuary habitats. There are 45 watersheds within the range of this ESU. Eight watersheds received a low rating, 10 received a medium rating, and 27 received a high rating of conservation value to the ESU. Two estuarine habitat areas used for rearing and migration (Humboldt Bay and the Eel River Estuary) also received a high conservation value rating. PBFs include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and nearshore marine areas. Since designation, critical habitat for this species has continued to be. Nonetheless, a number of restoration efforts have been undertaken by local, state, and Federal entities resulting in slightly improved conditions in some areas and a slowing of the negative trend.
Sacramento River winter-run Chinook salmon	06/16/1993 58 FR 33212 Modified 03/23/1999 64 FR 14067	Critical habitat includes the following waterways, bottom and water of the waterways and adjacent riparian zones: The Sacramento River from Keswick Dam, Shasta County (RK 486) to Chipps Island (RK 0) at the westward margin of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. The critical habitat for this species was designated before the CHART team process, thus watersheds have not yet been evaluated for conservation value. Since

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		designation, critical habitat for this species has continued to be degraded. Nonetheless, a number of restoration efforts have been undertaken by local, state, and Federal entities resulting in slightly improved conditions in some areas and a slowing of the negative trend.
Central Valley spring-run Chinook salmon	09/02/2005 70 FR 52488	Critical habitat includes approximately 1,373 miles of stream habitats and 427 square miles of estuary habitats in 37 watersheds. The CHART rated seven watersheds as having low, three as having medium, and 27 as having high conservation value to the ESU. Four of these watersheds comprise portions of the San Francisco-San Pablo-Suisun Bay estuarine complex, which provides rearing and migratory habitat for the ESU. PBFs include freshwater spawning sites, freshwater rearing sites, and freshwater migration corridors. Since designation, critical habitat for this species has continued to be degraded somewhat by the factors listed above in the status section. Nonetheless, a number of restoration efforts have been undertaken by local, state, and Federal entities resulting in slightly improved conditions in some areas and a slowing of the negative trend.
California Central Valley steelhead	9/2/2005 70 FR 52488	There are approximately 2,308 miles of stream habitats and 254 square miles of estuary habitats designated as critical habitat for CCV steelhead. NMFS determined that marine areas did not warrant consideration as critical habitat for this DPS. CCV steelhead PBFs are those sites and habitat components which support one or more life stages. There are 67 watersheds within the range of this DPS. Twelve watersheds received a low rating, 18 received a medium rating, and 37 received a high rating of conservation value to the DPS. Since designation, critical habitat for this species has continued to be degraded somewhat by the factors listed above in the status section. Nonetheless, a number of restoration efforts have been undertaken by local, state, and Federal entities resulting in slightly improved conditions in some areas and a slowing of the negative trend.
Central California Coast coho salmon	05/05/1999 64 FR 24049	Critical habitat encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between Punta Gorda and the San Lorenzo River (inclusive) in California, including two streams entering San Francisco Bay: Arroyo Corte Madera Del Presidio and Corte Madera Creek. Critical habitat includes all waterways, substrate, and adjacent riparian zones below longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). NMFS has identified several dams in the CCC

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		coho salmon critical habitat range that currently block access to habitats historically occupied by coho salmon. However, NMFS has not designated these inaccessible areas as critical habitat because the downstream areas are believed to provide sufficient habitat for conserving the ESUs. The critical habitat for this species was designated before the CHART team process, thus watersheds have not yet been evaluated for conservation value. Since designation, critical habitat for this species has continued to be degraded. Nonetheless, a number of restoration efforts have been undertaken by local, state, and Federal entities resulting in slightly improved conditions in some areas and a slowing of the negative trend.
Central California Coast steelhead	9/2/2005 70 FR 52488	There are approximately 1,465 miles of stream habitats and 386 square miles of estuary habitats designated as critical habitat for CCC steelhead. NMFS determined that marine areas did not warrant consideration as critical habitat for this DPS. CCC steelhead PBFs are sites and habitat components which support one or more life stages including freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and nearshore marine areas. There are 46 watersheds within the range of this DPS. For conservation value to the DPS, fourteen watersheds received a low rating, 13 received a medium rating, and 19 received a high rating. Since designation, critical habitat for this species continues to be degraded by several factors listed in the status section. Nonetheless, a number of restoration efforts have been undertaken by local, state, and Federal entities to improve conditions in some areas and slow the negative trend.
South-Central California Coast steelhead	9/2/2005 70 FR 52488	There are approximately 1,249 miles of stream habitats and three-square miles of estuary habitats designated as critical habitat for SCCC steelhead. NMFS determined that marine areas did not warrant consideration as critical habitat for this DPS. SCCC steelhead PBFs are sites and habitat components which support one or more life stages including freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and nearshore marine areas. There are 30 watersheds within the range of this DPS. For conservation value to the DPS, six watersheds received a low rating, 11 received a medium rating, and 13 received a rated high. Morro Bay, an estuarine habitat, is used as rearing and migratory habitat for spawning and rearing steelhead. SCCC steelhead inhabit coastal river basins from the Pajaro River south to, but not including, the Santa Maria River. Major

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		watersheds include Pajaro River, Salinas River, Carmel River, and numerous smaller rivers and streams along the Big Sur coast and southward. Only winter-run steelhead are found in this DPS. The climate is drier and warmer than in the north that is reflected in vegetation changes from coniferous forests to chaparral and coastal scrub. The mouths of many rivers and streams in this DPS are seasonally closed by sand berms that form during the low stream flows of summer. Since designation, critical habitat for this species continues to be degraded by several factors listed in the status section Nonetheless, a number of restoration efforts have been undertaken by local, state, and Federal entities to improve conditions in some areas and slow the negative trend.
Southern California steelhead	9/2/2005 70 FR 52488	Critical habitat consists of 708 miles of stream habitat from 32 watersheds, with almost all occupied habitat from southern San Luis Obispo at the Santa Maria River to northern San Diego County at the San Mateo Creek designated. Within occupied habitat all military lands are excluded. There are also portions excluded due to economic considerations. Most watersheds south of Malibu Creek were not designated, though San Juan Creek and San Mateo Creek were designated. There are two general types of watersheds within the range of this DPS: those with short coastal streams that drain mountain ranges directly adjacent to the coast, and watersheds that contain larger river systems that continue inland through gaps in the coastal ranges. The rivers and streams in this area often have interrupted base flow patterns due to geologic formations and precipitation patterns that have strong seasonality. Restoration efforts are driven by two primary strategies. The first is working toward solutions that address fundamental causes of degradation. The second is based on resilience against climate change and harmony between human communities and this DPS.
Southern DPS of eulachon	10/20/2011 76 FR 65324	Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, we designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. We also designated the mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles. Dams and water diversions are moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath river basins, large-scale impoundment of water has increased winter water temperatures. Numerous chemical contaminants are also present in spawning rivers. Dredging is a low to moderate threat to eulachon in the Columbia River.
Southern DPS of green sturgeon	10/09/2009 74 FR 52300	Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; tidally influenced areas of the Columbia River estuary from the mouth upstream to river mile 46; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor), including, but not limited to, areas upstream to the head of tide in various streams that drain into the bays (USDC 2009). The CHART identified several activities that threaten the PBFs in coastal bays and estuaries and necessitate the need for special management considerations or protection. The application of pesticides is likely to adversely affect prey resources and water quality within the bays and estuaries, as well as the growth and reproductive health of SDPS green sturgeon through bioaccumulation. Other activities of concern include those that disturb bottom substrates, adversely affect prey resources, or degrade water quality through re-suspension of contaminated sediments. Of particular concern are activities that affect prey resources. Prey resources are affected by: commercial shipping and activities generating point source pollution and non-point source pollution that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom (but result in beneficial or adverse effects on prey resources for green sturgeon).

2.3 Action Area

"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). For the purposes of this opinion, the action area includes all areas, including river reaches, tributaries, and riparian and aquatic areas, in the states of Alaska, Washington, Oregon, California, Idaho, and Nevada where environmental effects of actions funded through the PCSRF program may occur that are within the range of the fish species listed in Table 1and their designated critical habitats. Additionally, the action area includes all marine waters off the West Coast of the contiguous United States (including nearshore waters, from California to the Canadian border and Puget Sound), and Alaska where environmental effects of actions funded through the PCSRF program may occur that are within the range of the fish species listed in Table 1 and their designated critical habitat.

The reason the action area for this document is so large is that PCSRF program provides funds to state and tribal programs that support projects that will take place over wide portions of the listed species' range. Other projects may take place in freshwater and marine environments where practitioners could intercept individual animals from anywhere in their respective ranges.

Nonetheless, the action area is generally spread out over much of Alaska, Washington, Oregon, California, Idaho, and a small portion of northern Nevada as well as waters off the West Coast of the contiguous United States and Alaska. The proposed action to fund state and tribal salmon and steelhead recovery programs will facilitate the implementation of future state and tribal projects that are well distributed both spatially and temporally within the action area.

2.4 Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of state or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The best scientific information presently available demonstrates that a multitude of factors, past and present, have contributed to the decline of the species subject to this consultation by adversely affecting the environmental baseline.

As discussed above in Section 2.2.1, the effects of climate change and other large-scale environmental phenomena on species considered in the framework programmatic consultation cannot be predicted with certainty, impacts to their prey from oceanic regime shifts, or changes in freshwater habitat (hydrologic changes, increased water temperature) are projected to occur.

For purposes of the framework programmatic consultation, we provide a high-level summary of the many ways in which past and present natural factors and human activities are adversely affecting ESA-listed species and critical habitat in the action area. Subsequent specific project-level actions authorized, funded, or carried out will provide detailed descriptions of the environmental baseline at the site-specific and project-specific scales when addressed in subsequent project- or programmatic-level Section 7 consultations, as appropriate.

As described above in the Status of the Species and Critical Habitat sections, factors that limit the recovery of species considered in this framework programmatic consultation vary with the overall condition of aquatic habitats and stressors on private, state, and federal lands, and within the marine environment.

Freshwater Habitats

Within the action area, many stream and riparian areas have been degraded by the effects of land and water development. Habitat loss and degradation from land and water use development have disrupted watershed processes, reduced water quality, and diminished habitat quantity, quality, and complexity in many watersheds throughout the action area. Past and/or current land use or water management activities have adversely affected stream and side channel structure, riparian conditions, floodplain function, sediment conditions, and water quality and quantity, as well as the watershed processes that create and maintain properly functioning conditions for listed species.

Specific land use or water management activities and their impacts include the following (LCFRB 2010a; 2010b; ODFW 2010; NMFS 2014):

- Logging and other forest management practices on unstable slopes and in riparian areas have degraded watershed processes through erosion and sedimentation. Improperly located, constructed, or maintained forest roads disrupt stream flow patterns and sediment supply processes, disconnect streams from floodplains, and reduce wood recruitment to streams. Past use of splash dams to transport logs reduced instream structure and spawning gravel in several stream systems. Impacts continue in many areas, and the legacy of historical practices will continue for some time.

- Agricultural activities have diminished overall habitat productivity and connectivity and degraded riparian areas and floodplains in many areas of the action area, especially along lowland valley bottoms. Floodplain habitats have been lost through levee construction and the filling of wetlands. Pesticide, herbicide, and fertilizer runoff from agricultural lands has reduced water quality. Water withdrawal for irrigation alters stream flow and raises water temperatures. Livestock grazing affects soil stability (via trampling), reduces streamside vegetation (via foraging), and delivers potentially harmful bacteria and nutrients (via animal wastes) to streams.

- Man-made fish passage barriers affect fish habitat. The main barriers for anadromous fish passage are dams and culverts, with occasional barriers such as irrigation diversion structures, fish weirs, road crossings, tide gates, channel alterations, and localized temperature increases. Although dams are responsible for the greatest share of blocked habitat, inadequate culverts make up the vast majority of all barriers. Many barriers have been improved to allow for fish passage, but a substantial number of barriers remain. Hatchery structures also sometimes act as passage barriers in tributaries.

- Urban and rural development has diminished overall habitat productivity and connectivity, degraded riparian and floodplain conditions, and increased urban surface water runoff. The drainage network from roads, ditches, and impervious surfaces alters the hydrograph and delivers sediment and contaminants to streams, reducing water quality, and thus, the health and fitness of salmonids and other aquatic organisms. Loss of riparian vegetation to development increases stream temperatures by increasing the sun exposure of the stream, bank hardening, channel simplification, and disruptions in natural flow regimes. Municipal water withdrawal alters stream flows and increased water temperatures.

- The development of hydropower and water storage projects within the action area have resulted in the inundation of many mainstem spawning and shallow-water rearing areas (loss of spawning gravels and access to spawning and rearing areas); altered water quality (reduced spring turbidity levels), water quantity (seasonal changes in flows and consumptive losses resulting from use of stored water for agricultural, industrial, or municipal purposes), water temperature (including generally warmer minimum winter temperatures and cooler maximum summer temperatures), water velocity (reduced spring flows and increased cross-sectional areas of the river channel), food (alteration of food webs, including the type and availability of prey species), and safe passage (increased mortality rates of migrating juveniles) (Ferguson et al. 2005; Williams et al. 2005).

- The existing network of road systems contributes to a poor environmental baseline condition in several significant ways. Hundreds of miles of highway that parallel streams have degraded stream bank conditions by armoring the banks with rip rap, degraded floodplain connectivity by adding fill to floodplains, and discharge untreated or marginally treated highway runoff to streams. Culvert and bridge stream crossings have similar effects, and create additional problems for fish when they act as physical or hydraulic barriers that prevent fish access to spawning or rearing habitat, or contribute to adverse stream morphological changes upstream and downstream of the crossing itself.

- In addition, numerous anthropogenic features or activities in the action area (e.g., ports, docks, roads, railroads, bank stabilization, irrigation withdrawals, and landscaping) have become permanent fixtures on the landscape, and have displaced and altered native riparian habitat. Consequently, the potential for normal riparian processes (e.g., litter fall, channel complexity, and large wood recruitment) to occur is diminished and aquatic habitat has become simplified. Shoreline development has reduced the quantity and quality of nearshore habitat by eliminating native riparian vegetation, displacing shallow water habitat with fill materials, and by disconnecting the rivers from their floodplain or side channel areas.

Collectively, these factors have reduced the amount and quality of habitat available to listed species, severed access to other historically productive habitats, and degraded watershed processes and functions that once created healthy ecosystems for salmon and steelhead production. Many streams now have lower pool complexity and frequency compared to historical conditions and stream channels also lack the complex structures needed to retain gravels for spawning and invertebrate (prey) production. Also missing from many channels is connectivity with shallow, off-channel habitat and floodplain areas that once provided productive early rearing habitat, flood refugia, overwintering habitat, and cover from predators. In many areas, contemporary watershed conditions have changed so much that they now pose a significant impediment to achieving recovery of the listed species.

Predation

Listed fish species considered in this framework programmatic consultation are exposed to high rates of predation during all life stages in the action area. Fish, birds, and marine mammals, including, but not limited to harbor seals, sea lions, and killer whales all prey on juvenile and adult salmon. Other predators include channel catfish (introduced), Pacific lamprey (native), yellow perch (introduced), largemouth bass (introduced), and bull trout (native). Increased predation by non-native predators has and continues to decrease population abundance and productivity.

Marine Habitats

In the action area, ocean fisheries in the offshore and near shore marine areas (defined as the area from zero to three miles offshore) of the U.S. Exclusive Economic Zone (EEZ) and the coastal and inland marine waters of the west coast states (Washington, Oregon, and California) are not directed at eulachon, chum salmon, or steelhead, all of which are rarely caught in Pacific Fishery Management Council (PFMC)-managed fisheries (PFMC 2013), and are not directed at steelhead in the Southeast Alaska fishery (NMFS 2024). The ocean distributions for ESA-listed steelhead are not known in detail, but steelhead are caught only rarely in ocean salmon fisheries, and consideration of the likely stock composition suggests that the catch of steelhead is less than 10 per year from all the steelhead DPSs combined (NMFS 2001). Eulachon and chum salmon catch levels in ocean fisheries are expected to be similar as steelhead.

Ocean fisheries in the action area are directed at Chinook and coho salmon, therefore Snake River sockeye salmon are unlikely to be caught in ocean harvest, which has been verified

through fishery sampling and post season reporting (PFMC 2016). Spring-run Chinook salmon stocks' harvest mortality in ocean fisheries is also assumed to be zero based on the timing for when ocean fisheries are prosecuted, allowing spring-run Chinook salmon to enter freshwater areas before ocean salmon fisheries begin. These low levels of catch of all spring-run Chinook salmon have similarly been verified from these same sampling activities.
Anadromous fish have been harvested in the action area as long as there have been people here. For thousands of years, Native Americans have fished for salmon and steelhead, as well as for other species such as eulachon and rockfish, in the tributaries and mainstems of the Rivers along the Pacific Coast for ceremonial, subsistence, and economic purposes. Commercial fishing developed rapidly with the arrival of European settlers and the advent of canning technologies in the late 1800s. The development of non-Indian fisheries began circa 1830, and by 1861 commercial fishing was an important economic activity. Fishing pressure, especially in the late nineteenth and early twentieth centuries, has long been recognized as a key factor in the decline of Columbia River salmon runs (NRC 1996).

PBFs

As described above, factors that limit the recovery of species considered in this framework programmatic consultation vary with the overall condition of aquatic habitats on private, state, and federal lands. Within the action area, many stream and riparian areas have been degraded by the effects of land and water use, including road construction, forest management, agriculture, mining, transportation, urbanization, and water development. Each of these economic activities has contributed to a myriad of interrelated factors for the decline of species considered in this framework programmatic consultation. Among the most important of these are changes in stream channel morphology, degradation of spawning substrates, reduced instream roughness and cover, loss and degradation of estuarine rearing habitats, loss of wetlands, loss and degradation of riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants) degradation, blocked fish passage, direct take, and loss of habitat refugia.

In general, and with respect to the species' habitat, the environmental baseline is the culmination of these effects on the PBFs that are essential to the conservation of the species. The PBFs for listed species in the action area are best expressed in terms of the sites essential to supporting one or more of the species' life stages. These sites, in turn, contain physical and biological features essential to conserving the species (70 FR 52630). The specific PBFs/PCEs include (for most species):

1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage

supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Salmonid Habitat Restoration

In addition to the land use or water management activities and their impacts describe above, there are also a number of past and ongoing federal, state, and local habitat conservation and protection programs within the action area. For example, the states of Alaska, Washington, Oregon, California, Idaho, and Nevada; and federally recognized tribes of the Columbia River and Pacific Coast, including Alaska; as well as the U.S. Bureau of Indian Affairs, U.S. Bureau of Land Management, the U.S. Forest Service, the Bonneville Power Administration, NOAA's Restoration Center, and the U.S. Fish and Wildlife Service have developed and implemented restoration programs that consist of habitat restoration activities designed to address ESA-listed species limiting factors.

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur.

Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.02).

This section assesses the potential effects of the proposed action — which is NMFS' awarding congressionally appropriated funds to eligible applicants for eligible activities under the PCSRF program.[10]

The awarding of congressionally appropriated funds in-and-of-itself will have no effects on listed species or designated critical habitat. However, states and tribes use PCSRF funds to support future projects and some of these projects may affect listed species or designated critical habitat. We assessed the potential effects of the states and tribes implementing those future projects funded with PCSRF funds and non-federal match funds on listed species and designated critical habitat. We did not look at the effects of individual, specific projects. Instead, we assessed the range of effects associated with the types of projects typical to the six PCSRF project categories:

1. Salmonid Restoration Planning and Assessments.
2. Salmonid Habitat Restoration and Acquisition.
3. Salmonid Hatcheries and Harvest Management.
4. Salmonid Research, Monitoring, and Evaluation.
5. Public Outreach, Education, and Landowner Recruitment.
6. Program Administration.

Approach to the Effects Analysis

The PCSRF program does require applicants to identify details about the specific location, magnitude, number, or duration of future projects. Thus, analyses of whether effects of specific, individual projects or groups of projects are sufficient to reduce the viability of populations and species that those individuals represent, or whether effects of specific, individual projects or groups of projects on critical habitat are sufficient to result in destruction or adverse modification of critical habitat, will be addressed in subsequent project- or programmatic-level Section 7 consultations, as appropriate.

Rather, this framework programmatic consultation analyzes the range of effects associated with the types of projects that typically occur in each of the six PCSRF project categories. For this framework programmatic consultation, our effects analysis on future types of projects that are reasonably certain to occur later in time is divided into two groups—(1) the types of projects that are expected to have no direct or indirect effects on listed species or designated critical habitat because these projects do not involve any ground-disturbing or in-water work, nor do they involve trapping, capturing, or collecting and handling of listed species, and; (2) the types of

[10] NMFS funds the associated state and tribal recovery programs, not projects. The grantees select the projects.

projects that may have direct or indirect effects on listed species or designated critical habitat because these projects do involve ground-disturbing or in-water work, or involve trapping, capturing, or collecting and handling of listed species.

As our analysis does not include an incidental take statement, any incidental take of listed species resulting from specific actions subsequently authorized, funded, or in association with the PCSRF program will be addressed in subsequent project- or programmatic-level Section 7 consultations, as appropriate.

2.5.1. Effects on the Species

NMFS expects that the types of projects that states and tribes typically fund with PCSRF awarded funds or match funds will be distributed, albeit strategically, throughout the action area, and that both short-term adverse effects and long-term beneficial effects will therefore be similarly distributed across the species and populations throughout the action area. Furthermore, NMFS expects the exposure-response of individuals to the effects associated with the implementation of projects funded with PCSRF awarded funds and match funds to be similar in intensity, magnitude, frequency, and duration to the 15,942 previously funded projects.[11]

There are six PCSRF project category types (Appendix A):

1. Salmonid Restoration Planning and Assessments.
2. Salmonid Habitat Restoration and Acquisition.
3. Salmonid Hatcheries and Harvest Management.
4. Salmonid Research, Monitoring, and Evaluation.
5. Public Outreach, Education, and Landowner Recruitment.
6. Program Administration.

Three of the six category types are expected to have no direct or indirect effects on listed species or designated critical habitat.

These project category types are:

1. Salmonid Restoration Planning and Assessments.
5. Public Outreach, Education, and Landowner Recruitment.
6. Program Administration.

Salmonid restoration planning and assessments includes projects that assess current or baseline salmonid habitat conditions to determine factors limiting native salmonid production and develop, implement, or coordinate necessary measures to restore habitat and recover salmonid populations. Public outreach, education, and landowner recruitment involves projects that educate constituencies on the value and types of actions that should be taken for conservation,

[11] Pacific Coastal Salmon Recovery Fund FY 2023 Report to Congress.

restoration, and sustainability of Pacific salmonid populations and their habitat. Program administration are the oversight and administrative activities conducted by the grantee or Subgrantee to disperse funds to contractors/sponsors and support PCSRF projects. None of the projects in these three categories involve any ground-disturbing or in-water work, or involve trapping, capturing, or collecting and handling of listed species. We therefore determine that projects (sub-categories) in these project category types will have no effect on listed species and designated critical habitat under NMFS's jurisdiction, and therefore, will not be considered further.

Activities with the Potential to Adversely Affect Listed Species and Critical Habitat

Three of the six project category types have the potential to adversely affect listed species or designated critical habitat or both.

These project category types are:

2. Salmonid Habitat Restoration and Acquisition.
3. Salmonid Hatcheries and Harvest Management.
4. Salmonid Research, Monitoring, and Evaluation.

Projects in these three categories that involve the purchase of restoration structures (e.g. logs) or equipment (e.g. bulldozers) for future habitat restoration projects (i.e., projects not yet designed, planned, or proposed); or projects that fund a nursery operation for vegetation that will be used in multiple or unspecified restoration projects are expected to have no effect on listed species or designated critical habitat under NMFS's jurisdiction because these projects do not involve any ground-disturbing or in-water work, or involve trapping, capturing, or collecting and handling of listed species, and therefore, will not be considered further.

Additionally, projects in these three categories that involve land or conservation easements; lease of land or easements, or acquisition of land-use rights are expected to have no effect on listed species or designated critical habitat under NMFS's jurisdiction because these projects do not involve any ground-disturbing or in-water work, or involve trapping, capturing, or collecting and handling of listed species, and therefore, will not be considered further.

In large part, projects under Project Category Type 2 — Salmonid Habitat Restoration and Acquisition Category, are intended to address various limiting factors identified in salmon and steelhead recovery plans. Implementation of these projects will have long-term beneficial effects to salmonids and their habitats, and are likely to have incremental beneficial effects to the other fish species considered in this framework programmatic consultation. Given that projects shall address a limiting factor, habitat restoration projects carried out in critical habitat will by design improve the conservation value of the essential biological and physical features of habitat at the site and watershed scales — all of which would serve to benefit listed species and their habitats.

Projects under Project Category Type 3 — Salmonid Hatcheries and Harvest Management Category, are intended to yield improvements to hatchery production and/or supplementation, and to support enforcement or observers, as well as fishing gear to test the improved retention of hatchery fish, reduce bycatch, or decrease post-release mortality of fish — all of which would serve to benefit listed species.

Projects under Project Category Type 4 — Salmonid Research, Monitoring, and Evaluation Category, are intended to increased our knowledge of anadromous fish abundance, migration timing, and survival, and to improve our knowledge of the respective species' life histories, biological requirements, genetic make-up, responses to human activities (positive and negative), and survival in the rivers and ocean — all of which would serve to benefit listed species and their habitats.

Because applications requesting funding through the PCSRF program do not include details about the specific location, magnitude, number, or duration of future projects, the analysis of effects in this opinion are described in terms broad enough to cover the range of effects generally associated with the projects listed in the three subject project category types that may occur throughout the action area. However, project-specific effects analyses will be addressed in subsequent project- or programmatic-level Section 7 consultations, as appropriate.

This analysis begins with an overview of the PCSRF program by project category types and the types of projects (sub-categories), then examines environmental and physical effects common to all projects on listed species, followed by an exposure-response analysis of the types of projects implemented in each project category on individual fish at the site and reach scale.

Project Category Type 2[12] - Effects of Salmonid Habitat Restoration Projects on Listed Species

This category includes projects that restore ecosystem characteristics and processes and address priority habitat factors that are limiting salmonid production. There are 10 different types (sub-categories) of habitat projects:

2.1. Fish Screens

- New fish screens
- Pre-existing fish screens that are replaced, repaired, or modified

2.2. Fish Passage Improvement

[12] For this section of the analysis, this category does not consider acquisitions, as we have determined that land or conservation easements; lease of land or easements, or acquisition of land-use rights as we have determined that this sub-category of projects will have no effect on listed species or designated critical habitat. Additionally, this category does not consider pre-restoration acquisitions and nursery operations, as we have determined that projects involving the purchase of restoration structures (e.g. logs) or equipment (e.g. bulldozers) for future habitat restoration projects (i.e., projects not yet designed, planned, or proposed); or projects that fund a nursery operation for vegetation that will be used in multiple or unspecified restoration projects are expected to have no effect on listed species or designated critical habitat.

- Fish passage blockages removed or altered
- Fishway chutes or pools installed
- Culvert installed or improved at road stream crossing
- Bridge installed or improved at road stream crossing
- Rocked ford - road stream crossing
- Road stream crossing removal
- Unspecified or other fish passage project

2.3. Instream Flow Improvement

- Water gauges
- Irrigation practice improvements
    - Reducing withdrawals
    - Installing a head gate with water gauge to control water flow into irrigation canals and ditches
    - Regulating flow on previously unregulated diversions
    - Installing a well to eliminate a diversion
    - Replacing open canals with pipes to reduce water loss to evaporation
- Water lease or purchase
- Maintain adequate flow or reducing withdrawals
- Unspecified or other instream flow project

2.4. Instream Habitat Projects

- Channel connectivity
    - Instream pools added/created
    - Removal of instream sediment
    - Meanders added
    - Former channel bed restored
    - Removal or alteration of levees or berms (including setback levees) to connect floodplain
    - Creation of off-channel habitat consisting of side channels, backwater areas, alcoves, oxbows, ponds, or side-pools
- Channel structure placement
    - Placement of large woody debris or rocks/boulders (including deflectors, barbs, weirs)
    - Floodplain roughening or fencing.
- Streambank stabilization
    - Re-sloping and/or placement of rocks, logs, or other material on streambank
- Spawning gravel placement

2.5. Riparian Habitat Projects

- Riparian planting
- Fencing
- Riparian exclusion
    - Preventing or removing access to riparian areas by means other than fencing
- Water gap development
    - Fenced livestock stream crossing or livestock bridge
- Conservation grazing management

    - Alteration of agricultural land use practices to reduce grazing pressure for conservation (rotational grazing)
- Riparian plant removal/control
- Forestry practices/stand management
    - Prescribed burns
    - Stand thinning
    - Stand conversions
    - Silviculture
- Debris/structure removal
- Unspecified or other riparian habitat project

2.6. Upland habitat projects

- Road drainage system improvements and reconstruction
    - placement of structures to contain/ control run-off from roads
    - road reconstruction or reinforcement
    - surface and peak-flow drainage improvements
    - roadside vegetation
- Road closure/abandonment
    - Closure (abandonment)
    - Relocation
    - decommissioning or obliteration of existing roads (including pavement such as parking areas)
- Erosion control structures installed
    - sediment basins
    - sediment collection ponds
    - sediment traps
    - water bars (other than road projects or upland agriculture)
- Planting for erosion and sediment control
- Slope stabilization
    - Landslide reparation
    - Non-agricultural terracing
- Upland vegetation management
    - Plant removal (juniper or noxious weeds)
    - Selective tree thinning
    - Undergrowth removal
    - Prescribed burning
    - Stand conversion
    - Silviculture
- Upland agriculture management
    - Low or no till agriculture
    - Conservation land management
    - Upland irrigation water management
- Upland livestock management
    - Livestock watering schedules
    - Grazing management plans
    - Upland exclusion and fencing

    - Livestock water development (off-channel watering, installation of upland ditches, wells, and ponds)
- Trail or campground improvement
- Upland wetland improvement
- Unspecified or other upland project

2.7. Water quality projects

- Refuse/debris removal
- Sewage clean-up
    - Sewage outfalls and failed septic systems
- Toxin reduction
    - Clean-up/reduction of min or dredge tailings, herbicides, pesticides, or toxic sediments
- Carcass or nutrient placement
    - Salmonid carcasses
    - Fishmeal bricks
    - Other fertilizer in or along stream for nutrient enrichment
- Livestock manure management
    - Relocation/modification of livestock manure holding structures and/or manure piles to reduce or eliminate drainage into streams
- Stormwater wastewater modification or treatment
    - Bioswales and rain gardens
- Return flow cooling (extracted water that has heated during use is cooled before it is returned to the stream)
- Replacing old open return ditches with underground polyvinyl chloride pipe
- Other urban impact reduction activity

2.8. Wetland Projects

- Wetland planting
- Wetland plant removal/control
- Wetland improvement/restoration
- Artificial wetland created

2.9. Estuarine/Nearshore Projects

- Channel modification
    - Deepening or widening an existing tidal channel
    - Adding structures to improve salmonid habitat
    - Creation of new channels
- Dike or berm modification or removal
    - Removal, breaching, reconfiguration or other action affecting the physical presence of barriers or structures that prevent tidal or riverine access to the estuary
    - Lateral structures only
    - Does not include dams or other perpendicular obstructions to flow
- Tidegate alteration/removal
- Estuarine culvert modification/removal
- Removal of existing fill material not associated with a dike
- Fill placement
- Regarding slope

- Estuarine plant control/removal
- Removal/modification of shoreline armoring
- Beach nourishment
- Contaminant removal/remediation
  - Physical removal (through chemical remediation or biological treatment, if possible)
  - Prevention of contaminant sources (stormwater modification)
- Debris removal
- Overwater structure removal/modification
  - piers, floating decks and docks
- Exclusion devices
  - Fencing
  - Mooring buoys
  - Boardwalks/trails
- Creation of new estuarine area
- Estuarine planting

2.10. Site Maintenance

General Effects Common to Salmonid Habitat Restoration Projects

Salmon habitat restoration projects involve near- and in-water activities that include, but are not limited to, demolishing, building, or rehabilitation; road or trail repairs, construction, or removal; installing, replacing, or removing culverts, small dams, levees or revetments; fish screen repair or installation; plantings; and shoreline or channel modifications. These activities can cause a number of negative effects on fish and their habitat. The effects pathways include:

- Elevated suspended sediment and water quality
- Work area isolation, fish relocation, and fish handling
- Riparian and streambank disturbance
- Reduction of water quantity/flow
- Spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants
- Physical injury or death of fish through contact with heavy equipment
- Pile driving and debris removal
- Water quality impacts from land-based activities

Elevated Suspended Sediment and Water Quality

Increased runoff resulting from soil and vegetation disturbance at a construction site during both preconstruction and construction phases is likely to suspend and transport more sediment to receiving waters as long as construction continues. Multi-year projects are likely to cause more sedimentation. This increases total suspended solids. Sediments in the water column reduce light penetration, increase water temperature, and modify water chemistry. Redeposited sediments partly or completely fill pools, increase the width to depth ratio of streams, and change the distribution of pools, riffles, and glides, and can reduce survival of eggs and fry, reducing spawning success of some fishes.

Fish have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such high pulse exposures. For example, adult and larger juvenile salmonids may be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjorn and Reiser 1991), although these events may produce behavioral effects, such as gill flaring and feeding changes (Berg and Northcote 1985). Deposition of fine sediments reduces incubation success (Bell 1991), interferes with primary and secondary productivity (Spence et al. 1996), and degrades cover for juvenile salmonids (Bjorn and Reiser 1991). Chronic, moderate turbidity can harm newly-emerged fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth and increases basal metabolic requirements (Redding et al. 1987, Lloyd 1987, Bjorn and Reiser 1991, Servizi and Martens 1991, Spence et al. 1996).

Salmonid habitat restoration activities may cause increased suspended sediment. However, we expect the amount of increased suspended sediment caused by in-water and riparian zone habitat restoration activities to be localized and temporary given the scope of work, limited duration of suspended sediment-generating activities, and ability of salmonids to detect and distinguish suspended sediment (Quinn 2005) and move away from those areas (Kjelland et al. 2105). Thus, NMFS does not expect acute or chronic effects on aquatic habitat because increases in sedimentation resulting from in-water restoration/construction activities are expected to be minimal and temporary (i.e., a few hours to few days following the first rain event). Thus, we expect the amount of increased suspended sediment caused by in-water and riparian zone habitat restoration activities to be localized and temporary, and we expect the effects on highly mobile species such as fish to be insignificant.

Work Area Isolation, Fish Relocation, and Fish Handling

In-water work isolation often involve capture and release of trapped fish. Capturing and handling all fish causes them stress, though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived (NMFS 2002). The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. For example, stress on salmonids increases rapidly from handling if the water temperature exceeds 64°F or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis. Work involving the presence of equipment or vehicles in the active channel when listed fish are present is likely to cause some fish to experience elevated stress or leave the area. Essential behaviors such as feeding and sheltering are also interrupted during in-water work.

Additionally, work involving the presence of equipment or vehicles in the active channel when listed fish are present is likely to cause some fish to experience elevated stress or leave the area. Essential behaviors such as feeding and sheltering are also interrupted during in-water work.

Riparian and Streambank Disturbance and Stabilization

Near-water construction causes disturbance of vegetation and soils that support floodplain and riparian function, such as delivery of large wood and particulate organic matter, shade, development of root strength for slope and bank stability, and sediment filtering and nutrient absorption from runoff (Darnell 1976; Spence et al. 1996). Although the size of areas likely to be adversely affected by actions proposed to be authorized or carried out under this document are small, and those effects are likely to be short-term (weeks or months), even small denuded areas will lose organic matter and dissolved minerals, such as nitrates and phosphates. The microclimate at each action site where vegetation is removed is likely to become drier and warmer, with a corresponding increase in wind speed, and soil and water temperature. Water tables and spring flow in the immediate area may be temporarily reduced. Loose soil will temporarily accumulate in the construction area. In dry weather, part of this soil is dispersed as dust and in wet weather; part is transported to streams by erosion and runoff, particularly in steep areas. Erosion increases the supply of sediment to lowland drainage areas and eventually to aquatic habitats, where they increase total suspended solids and sedimentation.

Many projects implemented in the category will install rock or other hard structures within a functional floodplain to stabilize a streambank or channel and reduce erosion of the approach to, or foundation of, a road, culvert, or bridge. The adverse impacts of hardening the functional floodplain include direct habitat loss, reduced water quality, upstream and downstream channel impacts, reduced ecological connectivity, and the risk of structural failure (Barnard et al. 2013; Cramer 2012; Fischenich 2003; NMFS 2011; Schmetterling et al. 2001). The habitat features of concern include water velocity, depth, substrate size, gradient, accessibility and space that are suitable for fish rearing. In spawning areas, rock and other hard structures are often used to replace spawning gravels, and realign channels to eliminate natural meanders, bends, spawning riffles and other habitat elements. Riffles and gravel bars downstream are scoured when flow velocity is increased.

Additionally, work involving the presence of equipment or vehicles in the active channel when listed fish are present is likely to cause some fish to experience elevated stress or leave the area. Essential behaviors such as feeding and sheltering are also interrupted during in-water work.

Reduction of Water Quantity/Flow

The withdrawal of water for construction activities decreased the amount of water in streams and rivers. This can reduce the depth of wetted width of streams, decreasing the amount of habitat available for listed fish. Withdrawal without an adequate fish screen can entrain eggs, larvae, and juvenile fish, which typically injures or kills them. These impacts are typically short duration, lasting a few hours at a time during active construction. Other than temporary reduction in aquatic invertebrate prey, impacts from reduction of water quantity are not long lasting.

Spills or Leaks of Fuel, Lubricants, Hydraulic Fluid, Coolants, and Other Contaminants

Use of heavy equipment for vegetation removal and earthwork compact the soil, thus reducing permeability and infiltration. Use of heavy equipment, including stationary equipment like generators and cranes, also creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants may occur. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain polycyclic aromatic hydrocarbons, which are acutely toxic to listed fish species and other aquatic organisms at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz et al. 2000; Heintz et al. 1999; Incardona et al. 2005; Incardona et al. 2004; Incardona et al. 2006). In the unlikely event that a spill does occur, we would expect the impacts to be short in duration and small in geographic scope as best management practices (such as the use of vegetable-based hydraulic fluids which lack chemical compounds that are acutely toxic to aquatic organisms, and a spill and containment and minimization measures) would minimize exposure by keeping the incident localized and of short duration. Furthermore, we expect any spill of fuel or similar fluids to rapidly diminish as it would not mix with water, but would form a thin layer on the surface, continually spreading while it evaporated, broke apart, and was hydrolyzed by ultraviolet light — minimizing oxidation reactions (oxygen depletion). Thus, we expect effects on highly mobile species such as fish associated with accidental spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, to be transitory and unlikely to be meaningfully measurable, detectable or evaluated as adverse.

Physical Injury or Death of Fish through Contact with Heavy Equipment

Work involving the presence of equipment or vehicles in the active channel when listed fish are present is likely to result in injury or death of some individuals as they come in contact with the equipment.

Pile Driving

The installation and removal of piling with a vibratory or impact hammer is likely to result in adverse effects to salmon, steelhead, green sturgeon, and eulachon due to high levels of underwater sound that will be produced. Although there is little information regarding the effects on fish from underwater sound pressure waves generated during the piling installation (Anderson and Reyff 2006; Laughlin 2006), laboratory research on the effects of sound on fish has used a variety of species and sounds (Hastings et al. 1996; Popper and Clarke 1976; Scholik and Yan 2002).

Because those data are not reported in a consistent manner and most studies did not examine the type of sound generated by pile driving, it is difficult to directly apply the results of those studies to pile driving effects on salmon, steelhead, green sturgeon and eulachon. However, it is well established that elevated sound can cause injuries to fish swim bladders and internal organs or temporary and permanent hearing damage. The degree to which normal behavior patterns are altered is less known, although it is likely that salmon, steelhead, green sturgeon, and eulachon that are present within the action area are more likely to sustain an injury than fish that are migrating up or downstream. It is still likely that sound energy will radiate directly or indirectly into the water as a result of pile driving, although widespread propagation of sounds injurious to fish is not expected to occur. Removal of pilings, derelict fishing gear, sunken refuse within the wetted perimeter will disturb sediments that become suspended in the water, often along with contaminants that may have been pulled up with, or attached to, the pile. A major release of contaminants into the water is likely to occur if creosote-treated pilings are damaged during removal, or if debris is allowed to re-enter or remain in the water. Nonetheless, a small contaminant release will occur when a creosote pile is removed, and total suspended sediment will increase with every pile removal, although these effects are expected to rapidly diminish.

Water Quality Impacts from Land-Based Activities

For projects that require land-based work, for example beach re-nourishment, shorelines, wetlands and banks, levees or berms, and channel connectivity or off-channel work, vegetation management or loss of land may compact soil in construction staging or access areas, contribute to erosion, temporarily increase sediment input, and increase turbidity, release contaminants while soils mobilized during project work may act as a delivery mechanism for chemical pollutants, and can result in accidental spills of fuel, lubricants, and hydraulic fluids.

Table 4. Summary of project sub-categories (projects) and effect pathways on listed species.

Project Sub-Category	Effect Pathway	Elevated suspended sediment, water quality impacts	Work area isolation, fish relocation and fish handling	Riparian and streambank disturbance and stabilization	Reduction of water quantity/flow	Spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants	Physical contact with heavy equipment	Pile driving	Water quality impacts from land-based runoff of sediment
Fish Screens			X				X		X
Fish passage Improvement		X	X	X	X	X	X	X	X
Instream Flow Improvement		X							
Instream Habitat Projects		X	X	X	X	X			X
Riparian Habitat Projects		X		X		X	X		X
Upland Habitat Projects		X				X			X
Water Quality Projects		X	X	X		X			
Wetland Projects		X	X	X		X	X		
Estuarine/Nearshore Projects		X	X			X	X	X	
Site Maintenance		X							

Cells with an **X** indicate the effect pathways that may cause adverse effects to listed species considered in this opinion for each project sub-category. Blank cells indicate insignificant/discountable effects.

Exposure-Response Analysis for Salmonid Habitat Restoration Projects

Projects implemented in this category may affect individual fish at the site and reach scale. However, the intensity, magnitude, frequency, and duration of these effects will vary by project type (sub-category), and project location, timing, scale, and duration. The intensity of the effects, in terms of changes in the condition of individual fish and the number of individuals affected, and severity of these effects will also vary somewhat between projects because of differences at each site and the particular life history stages present, the baseline condition of each fish present, and factors responsible for those conditions. In general, direct effects (acute) are ephemeral (instantaneous to hours) or short-term (days to months), and indirect effects (chronic) are long-term (weeks to years to decades, or the life of the project). The severity of effects on listed species depends on the intensity and duration of exposure to project-specific effects pathways during and-or after project implementation. Projects that involve in-water work are more likely to adversely affect more fish, and to take a longer time to recover, than projects that do not involve in-water work. We also expect effects on salmonids to have somewhat similar effects to all fish species considered in this opinion, albeit the specific behavioral or physiological effects will differ between species based on particular life history stages exposed to effect pathways and adaptation of species to those conditions. And, except for fish that are captured and handled, individual fish whose condition or behavior is impaired by the effects of a project are likely to suffer primarily from ephemeral or short-term sublethal effects, including diminished rearing and migration. Nonetheless, we expect most individuals to survive from exposure to the range, intensity, magnitude, frequency, and duration of these effects.

Additionally, projects implemented in this category are intended to address various limiting factors identified in salmon and steelhead recovery plans. Implementation of these projects will have long-term beneficial effects to salmonids and their habitats, and are likely to have incremental beneficial effects to the other fish species considered in this opinion.

Table 5. Exposure-response summary of salmonid habitat restoration projects on listed species.

Exposure Pathway	Elevated suspended sediment, water quality impacts	Work area isolation, fish relocation and fish handling	Riparian and streambank disturbance	Reduction of water quantity/flow	Spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants	Physical contact with heavy equipment	Pile driving	Water quality impacts from land-based runoff of sediment		
Severity of Effects									**Response**	**Life Stages Affected**
									Gill Flaring/Behavioral Effects	J/S/A
									Reduced Feeding and Growth	S/J/AL
									Reduced Incubation Success	E
		A							Physiological Stress	A/S/J/AL/E
		A/S				A	A/S		Physical Injury/Death	A/S/J/AL/E
		A	A				A/S		Displacement	A/S/J
		A							Reduced Spawning Success	
		A			A/S				Impaired Migration	A/S/J

Severity of effects rating: (A) acute, (C) chronic, (blank) insignificant/discountable, (S,) sublethal.
Life stage: (A) adult, (S) smolt, (J) juvenile, (AL) alevin, (E) egg.

Effects of Project Category Type 3 - Salmonid Hatcheries and Harvest Management Projects on Listed Species

Projects in this category are for enhancing naturally spawning anadromous salmonid populations through improvements to hatchery production and/or supplementation. There are 4 different types (sub-categories) of hatchery/harvest projects:

3.1. Hatchery Production
- Collect and spawn adult salmon
- Incubate eggs
- Rear and maintain fry/smolt in a hatchery facility or pond
- Outplant fry/smolt
- Hatchery operations-facility or equipment
  - Purchase, replacement or modification of equipment or structures

3.2. Fish Marking
- Marking or tagging hatchery salmonids (clipping or coded wire tags)
- Purchase, replacement, or modification of marking equipment (including marking trailers) or development of new technology for marking/tagging

3.3. Harvest Management
- Fishery evaluations
- ESA fishery management plans development
- Fisheries management improvements
  - Regulations/management actions
- Enforcement
- Fishing strategy or gear development

3.4. Hatchery Reform
- Hatchery assessments
- Hatchery reform development/implementation
  - HGMP development for facilities

General Effects Common to Salmonid Hatcheries and Harvest Management Projects

Salmonid hatchery and harvest management projects may include hatchery production, fish marking, harvest management, and hatchery reform and assessment. The purpose of these projects is to rear/release hatchery salmonids; purchase, replace, or modify hatchery facility equipment or structures necessary for salmonid production; collect native/wild broodstock for hatchery production or for relocation above barriers or other streams; fish marking; develop or implement harvest management measures including enforcement; and assess or evaluate hatchery production. Salmonid hatcheries and harvest management activities cause a number of negative effects on fish and their habitat. The effects occur through pathways including:

- Elevated suspended sediment and water quality
- Fish handling
- Spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants
- Stocking

Elevated Suspended Sediment and Water Quality

Hatchery operations-facilities or equipment are likely to suspend and transport sediment to receiving waters during the replacement or modification of hatchery facility equipment or structures (i.e. construction, demolition, or rehabilitation of hatchery buildings; roadway or parking improvements; incubation or other facility improvements; rearing or abatement pond expansion or improvements; surface or groundwater supply or storage systems; access roads or driveways; wells to reduce surface water consumption; or installation, removal, or maintenance of weirs for trapping and sorting fish) leading to an increase in total suspended solids. Sediments in the water column reduce light penetration, increase water temperature, and modify water chemistry. Redeposited sediments partly or completely fill pools, increase the width to depth ratio of streams, and change the distribution of pools, riffles, and glides, and can reduce survival of eggs and fry, reducing spawning success of some fishes, such as salmon and steelhead.

Fish have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such high pulse exposures. For example, adult and larger juvenile salmonids may be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjorn and Reiser 1991), although these events may produce behavioral effects, such as gill flaring and feeding changes (Berg and Northcote 1985). Deposition of fine sediments reduces incubation success (Bell 1991), interferes with primary and secondary productivity (Spence et al. 1996), and degrades cover for juvenile salmonids (Bjornn and Reiser 1991). Chronic, moderate turbidity can harm newly-emerged fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth and increases basal metabolic requirements (Redding et al. 1987, Lloyd 1987, Bjornn and Reiser 1991, Servizi and Martens 1991, Spence et al. 1996).

Hatchery operations-related activities may cause increased suspended sediment. However, we expect the amount of increased suspended sediment caused by hatchery operations-related activities to be localized and temporary given the scope of work, limited duration of suspended sediment-generating activities, and ability of salmonids to detect and distinguish suspended sediment (Quinn 2005) and move away from those areas (Kjelland et al. 2105). Thus, NMFS does not expect acute or chronic effects on aquatic habitat because increases in sedimentation resulting from hatchery operations-related activities are expected to be minimal and temporary (i.e., a few hours to few days following the first rain event). Thus, we expect the amount of increased suspended sediment caused by hatchery operations-related activities to be localized and temporary, and we expect the effects on highly mobile species such as fish to be insignificant.

Fish Handling and Marking

Collecting, handling and marking fish can cause physiological stress, though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived (NMFS 2002). The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. For example, stress on salmonids increases rapidly from handling if the water temperature exceeds 64°F or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis. In addition to handling, hatchery fish may be accidentally injured or killed during transportation.

A common strategy used to identify hatchery-origin fish, for fishing, hatchery performance monitoring, and for managing hatchery fish on the spawning grounds, is to mark the fish. Marking may consist of removing the adipose fin prior to release, coded-wire tag implant, thermal-marking of the otolith (inner ear bone), passive integrated transponder tagging, or ventral fin clipping. The marking process requires physical handling of the fish.

Fish that are clipped, tagged, or marked may suffer short-term effects, such as physiological stress, but have little effect on growth, mortality or behavior (NMFS 2020). Fish with internal tags often die at higher rates than fish tagged by other means because of handling during tagging, since tagging is a complicated and stressful behavior (NMFS 2020).

Spills or Leaks of Fuel, Lubricants, Hydraulic Fluid, Coolants, and Other Contaminants

Use of heavy equipment, including stationary equipment like generators and cranes, also creates a risk that accidental spills of fuel, lubricants, hydraulic fluid, coolants, and other contaminants may occur. Petroleum-based contaminants (such as fuel, oil, and some hydraulic fluids) contain polycyclic aromatic hydrocarbons, which are acutely toxic to listed fish species and other aquatic organisms at high levels of exposure and cause sublethal adverse effects on aquatic organisms at lower concentrations (Heintz et al. 2000; Heintz et al. 1999; Incardona et al. 2005; Incardona et al. 2004; Incardona et al. 2006). In the unlikely event that a spill does occur, we would expect the impacts to be short in duration and small in geographic scope as best management practices (such as the use of vegetable-based hydraulic fluids which lack chemical compounds that are acutely toxic to aquatic organisms, and a spill and containment and minimization measures) would minimize exposure by keeping the incident localized and of short duration. Furthermore, we expect any spill of fuel or similar fluids to rapidly diminish as it would not mix with water, but would form a thin layer on the surface, continually spreading while it evaporated, broke apart, and was hydrolyzed by ultraviolet light — minimizing oxidation reactions (oxygen depletion). Thus, we expect effects on highly mobile species such as fish associated with accidental spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, to be transitory and unlikely to be meaningfully measurable, detectable or evaluated as adverse.

Stocking

Fish stocking efforts that increase population abundance, rebuild depleted stocks, or re-introduce stocks to previously habited areas. These efforts rely on species that are or were previously present in the ecosystem or those that have similar ecological requirements. Stocking can have negative effects, such as reduced resource availability for host individuals, increase predation by stocked individuals, changes in lower trophic level production, and introduction of non-native organisms (as cited in NMFS 2021).

Table 6. Summary of project sub-categories (projects) and effect pathways on listed species.

Project Sub-Category	**Effect Pathway**	Elevated suspended sediment, water quality impacts	Fish handling and marking	Spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants	Stocking
Hatchery Production		X	X	X	X
Fish Marking			X		
Harvest Management			X		
Hatchery Reform					

Cells with an **X** indicate the effect pathways that may cause adverse effects to listed species considered in this opinion for each project sub-category. Blank cells indicate insignificant/discountable effects.

Exposure-Response Analysis for Hatchery and Harvest Projects

Projects implemented in this category may affect individual fish at the site and reach scale. However, the intensity, magnitude, frequency, and duration of these effects will vary by project type (sub-category), and project location, timing, scale, and duration. The intensity of the effects, in terms of changes in the condition of individual fish and the number of individuals affected, and severity of these effects will also vary somewhat between projects because of differences at each site and the particular life history stages present, the baseline condition of each fish present, and factors responsible for those conditions. In general, direct effects (acute) are ephemeral (instantaneous to hours) or short-term (days to months), and indirect effects (chronic) are long-term (weeks to years to decades, or the life of the project). The severity of effects on listed species depends on the intensity and duration of exposure to project-specific effects pathways during and-or after project implementation. Projects that involve in-water work are more likely to adversely affect more fish, and to take a longer time to recover, than projects that do not involve in-water work. And, except for fish that are captured and handled, individual fish whose condition or behavior is impaired by the effects of a project are likely to suffer primarily from ephemeral or short-term sublethal effects, including diminished rearing and migration. nonetheless, we expect most individuals to survive from exposure to the range, intensity, magnitude, frequency, and duration of these effects.

Additionally, projects implemented in this category are intended to address various limiting factors identified in salmon and steelhead recovery plans. Implementation of these projects will have long-term beneficial effects to salmonids and their habitats, and are likely to have incremental beneficial effects to the other fish species considered in this opinion.

Table 7. Exposure-response summary of harvest and hatchery projects on listed species.

Exposure Pathway	Elevated suspended sediment, water quality impacts	Fish handling and marking	Spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants	Stocking		
Severity of Effects					**Response**	**Life Stages Affected**
					Gill Flaring/Behavioral Effects	A/S/J/AL/E
					Displacement	A/S/J
					Impaired Migration	A/S/J

Severity of effects rating: (A) acute, (C) chronic, (blank) insignificant/discountable, (S,) sublethal.
Life stage: (A) adult, (S) smolt, (J) juvenile, (AL) alevin, (E) egg.

Effects of Project Category Type 4 - Salmonid Research, Monitoring, and Evaluation Projects on Listed Species

This category includes field projects that conduct research or monitoring/evaluation. There are 2 different types (sub-categories) of research, monitoring, and evaluation projects:
4.1. Monitoring projects

- Adult salmonid population monitoring
- Salmonid smolt or fry monitoring
- Biological instream monitoring (other than salmon)
- Redd counts
- Carcass counts
- Harvest monitoring
- Test fishery
- Water quality monitoring
- Water quantity monitoring
- Ocean condition monitoring
- Habitat condition monitoring

- Post-project implementation or design compliance monitoring
- Restoration effectiveness monitoring
- Restoration validation monitoring
- Intensively monitored watersheds
- Monitoring effectiveness of forest management strategies
- Monitoring stormwater, wastewater, or sewage outfall
- Predator/competitor monitoring

4.2. Research project

- Modeling and data analysis
- Tissue sampling and analysis
- Genetic analysis
- Life history study
- Habitat attribute study
- Wild salmonid tagging/marking study
- Investigating fish health/disease/parasites
- Climate change studies

General Effects Common to Salmonid Research, Monitoring, and Evaluation Projects

Research, monitoring, and evaluation activities cause a number of negative effects on fish and their habitat. The effects occur through pathways including:

- Elevated suspended sediment and water quality
- Work area isolation, fish relocation, and fish handling
- Riparian and streambank disturbance

Elevated Suspended Sediment and Water Quality

Soil and vegetation disturbance associated with research and monitoring activities are likely to suspend and transport sediment to receiving waters during monitoring activities leading to an increase in total suspended solids. Suspended solids in the water column reduce light penetration, increase water temperature, and modify water chemistry. Redeposited sediments partly or completely fill pools, increase the width to depth ratio of streams, and change the distribution of pools, riffles, and glides, and can reduce survival of eggs and fry, reducing spawning success of some fishes, such as eulachon, salmon and steelhead.

Fish have evolved in systems that periodically experience short-term pulses (days to weeks) of high suspended sediment loads, often associated with flood events, and are adapted to such high pulse exposures. For example, adult and larger juvenile salmonids may be little affected by the high concentrations of suspended sediments that occur during storm and snowmelt runoff episodes (Bjorn and Reiser 1991), although these events may produce behavioral effects, such as gill flaring and feeding changes (Berg and Northcote 1985). Deposition of fine sediments reduces incubation success (Bell 1991), interferes with primary and secondary productivity (Spence et al. 1996), and degrades cover for juvenile salmonids (Bjornn and Reiser 1991). Chronic, moderate turbidity can harm newly-emerged fry, juveniles, and even adults by causing physiological stress that reduces feeding and growth and increases basal metabolic requirements (Redding et al. 1987, Lloyd 1987, Bjornn and Reiser 1991, Servizi and Martens 1991, Spence et al. 1996).

Research and monitoring activities may cause increased suspended sediment. However, we expect the amount of increased suspended sediment caused by research and monitoring activities to be localized and temporary given the scope of work, limited duration of suspended sediment-generating activities, and ability of salmonids to detect and distinguish suspended sediment (Quinn 2005) and move away from those areas (Kjelland et al. 2105). Thus, NMFS does not expect acute or chronic effects on aquatic habitat because increases in sedimentation resulting from research and monitoring activities are expected to be minimal and temporary (i.e., a few hours to few days following the first rain event). Thus, we expect the amount of increased suspended sediment caused by research and monitoring activities to be localized and temporary, and we expect the effects on highly mobile species such as fish to be insignificant.

Fish Handling and Marking

Capturing and handling all fish causes them stress, though they typically recover fairly rapidly from the process and therefore the overall effects of the procedure are generally short-lived (NMFS 2002). The primary contributing factors to stress and death from handling are differences in water temperatures (between the river and wherever the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma. For example, stress on salmonids increases rapidly from handling if the water temperature exceeds 64°F or dissolved oxygen is below saturation. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis. Debris buildup at traps can also kill or injure fish if the traps are not monitored and cleared on a regular basis. Work involving the presence of equipment in the active channel when listed fish are present is likely to cause some fish to experience elevated stress or leave the area. Essential behaviors such as feeding and sheltering are also interrupted during in-water work.

A common strategy used to identify hatchery- and natural-origin fish, is to mark the fish. Marking may consist of removing the adipose fin prior to release, coded-wire tag implant, thermal-marking of the otolith (inner ear bone), passive integrated transponder tagging, or ventral fin clipping. The marking process requires physical handling of the fish.

Fish that are clipped, tagged, or marked may suffer short-term effects, such as physiological stress, but have little effect on growth, mortality or behavior (NMFS 2020). Fish with internal tags often die at higher rates than fish tagged by other means because of handling during tagging, since tagging is a complicated and stressful behavior (NMFS 2020).

Riparian and Streambank Disturbance

Monitoring projects can disturb vegetation and soils. Although the size of areas likely to be affected by monitoring projects are small, and those effects are likely to be short-term (hours to days), even small areas that will lose organic matter and dissolved minerals, such as nitrates and phosphates. The microclimate at each action site where vegetation is removed is likely to become drier and warmer, with a corresponding increase in wind speed, and soil and water temperature. Erosion increases the supply of sediment to lowland drainage areas and eventually to aquatic habitats, where they increase total suspended solids and sedimentation.

Additionally, work in the active channel when listed fish are present is likely to cause some fish to experience elevated stress or leave the area. Essential behaviors such as feeding and sheltering are also interrupted during in-water work. We expect the amount of increased suspended sediment caused by research and monitoring activities to be localized and temporary. Due to the temporary and localized effects from disturbed sediments during hatchery operations, the effects on highly mobile species such as fish will be insignificant.

Table 8. Summary of project sub-categories (projects) and effect pathways on listed species.

Project Sub-Category	Effect Pathway	Elevated suspended sediment, water quality impacts	Work area isolation, fish relocation, or fish handling	Riparian and streambank disturbance
Monitoring Projects		X	X	X
Research Projects			X	

Cells with an **X** indicate the effect pathways at may cause adverse effects to listed species considered in this opinion for each project sub-category. Blank cells indicate insignificant/discountable effects.

Exposure-Response Analysis for Research, Monitoring, and Evaluation Projects

Projects implemented in this category may affect individual fish at the site and reach scale. However, the intensity, magnitude, frequency, and duration of these effects will vary by project type (sub-category), and project location, timing, scale, and duration. The intensity of the effects, in terms of changes in the condition of individual fish and the number of individuals affected, and severity of these effects will also vary somewhat between projects because of differences at each site and the particular life history stages present, the baseline condition of each fish present, and factors responsible for those conditions. In general, direct effects (acute) are ephemeral (instantaneous to hours) or short-term (days to months), and indirect effects (chronic) are long-term (weeks to years to decades, or the life of the project). The severity of effects on listed species depends on the intensity and duration of exposure to project-specific effects pathways during and-or after project implementation. Projects that involve in-water work are more likely to adversely affect more fish, and to take a longer time to recover, than projects that do not involve in-water work. And, except for fish that are captured and handled, individual fish whose condition or behavior is impaired by the effects of a project are likely to suffer primarily from ephemeral or short-term sublethal effects, including diminished rearing and migration. However, we expect most individuals to survive from exposure to the range, intensity, magnitude, frequency, and duration of these effects.

Additionally, projects implemented in this category are intended to address various limiting factors identified in salmon and steelhead recovery plans. Implementation of these projects will have long-term beneficial effects to salmonids and their habitats, and are likely to have incremental beneficial effects to the other fish species considered in this opinion.

Table 9. Exposure-response summary of research, monitoring, and evaluation projects on listed species.

Exposure Pathway	Elevated suspended sediment, water quality impacts	Work area isolation, fish relocation, or fish handling	Riparian and streambank disturbance		
Severity of Effects				**Response**	**Life Stages Affected**
				Gill Flaring/Behavioral Effects	A/S/J
		A/S		Physiological Stress	A/S/J/AL/E
		A/S		Physical Injury/Death	A/S/J/AL/E
		A/S		Displacement	A/S/J

Severity of effects rating: (A) acute, (C) chronic, (blank) insignificant/discountable, (S,) sublethal.
Life stage: (A) adult, (S) smolt, (J) juvenile, (AL) alevin, (E) egg.

Summary of Effects on the Species

Effects to species considered in this opinion include elevated suspended sediment and water quality; fish handling; riparian and streambank disturbance; reduction of water quantity/flow; spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants; physical injury or death of fish through contact with heavy equipment; pile driving and debris removal; and water quality impacts from land-based activities. The timing, duration, and intensity of the effects on species assessed in this framework programmatic consultation are evaluated in the analysis, and we also consider them as the pathways of exposure creating effects to the species, as discussed above.

2.5.2 Effects on Critical Habitat

Projects implemented under the proposed action may affect critical habitat PBFs. These effects will vary somewhat in intensity, magnitude, frequency, and duration of these effects will vary by project type (sub-category), project location, timing, scale, and duration. The intensity of the effects, in terms of changes in the condition of PBFs affected, and severity of these effects will also vary somewhat between projects because of differences in the scope of activities at each site, and in the current condition of PBFs and the factors responsible for those conditions. This assumption is based on the fact that all of the actions are based on the same set of underlying actions, and the PBFs and conservation needs identified for each species are also essentially the same. In general, ephemeral effects are likely to last for hours or days, short-term effects are likely to last for weeks, and long-term effects are likely to last for months, years or decades. The intensity of each effect, in terms of change in the PFB from baseline condition, and severity of each effect, measured as recovery time, will vary somewhat between projects because of differences in the scope of the work. However, no individual project is likely to have any effect on PCEs that is greater than the full range of effects summarized here.

Because the area affected for individual projects generally tends to be small, the intensity and severity of the effects described is relatively low, and their frequency in a given watershed is very low, PBF conditions and conservation value of critical habitat at the site level or reach level are likely to quickly return to, and improve beyond, critical habitat conditions that existed before the action. Moreover, most projects completed under the proposed program, and thus the proposed action as a whole, are also reasonably certain to lead to some degree of ecological recovery across the action area, including the establishment of environmental conditions associated with functional aquatic habitat and high conservation value. This is because most actions that will affect PBFs are likely to partially or fully help to restore lost habitat, improve water quality, reduce upstream and downstream channel impacts, and improve floodplain connectivity are likely to have long-term beneficial effects.

The PBFs for ESA-listed species affected by the proposed action include freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas, and offshore marine areas. Each future project, when implemented, is likely to have predictable short-term and long-term effects on critical habitat PBFs. The effects will vary depending on project location, timing, scale, and duration and the condition of the PBFs.

Projects covered by this framework programmatic consultation, both individually and collectively, are likely to have some short-term impacts, but by design none of those impacts will be severe enough to impair the ability of critical habitat to support recovery. The frequency of disturbance will usually be limited to a single project or, at most, a few projects within the same watershed. It is also unlikely that several projects within the same watershed, or even within the same action area, will have a severe enough adverse effect on the function of PBFs to affect the conservation value of critical habitat in the action area, watershed, or designation area. Also, on the whole, the proposed action is reasonably certain to lead to some degree of ecological recovery within the action area, including the establishment or restoration of environmental conditions associated with functional habitat and high conservation value.

Effects of the action on salmon and steelhead critical habitat PBFs

Freshwater spawning sites

a. Water quantity. Ephemeral reduction due to in-water construction-related activities including reduced riparian soil permeability, and riparian runoff; long-term improvement based on restoration actions targeting irrigation improvements, reconnection of side channels and alcoves, and improved riparian function and floodplain connectivity.

b. Water quality. Short-term increase in turbidity, dissolved oxygen demand, and temperature due to riparian and channel disturbance.

c. Substrate. Short-term reduction due to increased compaction and sedimentation, with a long-term improvement because of reduced sediment transport as a consequence of restoration activities designed to store sediment in the channels, increase channel complexity, and increase the shoreline length.

Freshwater rearing sites

a. Water quantity. As above. Improved irrigation efficiencies must show that in-stream flow will not be reduced.

b. Floodplain connectivity. Short-term negative impacts during construction, but significant long-term benefits as side channels and alcoves are reconnected, and riparian function improved.

c. Water quality. Same as above.

d. Forage. Minor, short-term decreased at a local scale is expected due to construction effects (riparian and channel disturbance). In the long term, restoration activities will improve riparian function and reduce inputs of fine sediments. Secondary productivity is expected to increase because of nutrient enrichments, improvements in habitat diversity and complexity, riparian function and floodplain connectivity and leaf litter retention. If herbicides are expected; the scale of the effect would depend on the amount (concentration and length of time) of the herbicide in the water, but is expected to be short term.

e. Natural cover. Short-term decrease due to riparian and channel disturbance; long- term improvements as a consequence of restoration action to improve channel complexity, riparian function and off-channel and alcove habitats.

Freshwater migration corridors

a. Free passage. Short-term decrease due to in-water work isolation; long-term improvement due to restoration actions.

b. Water quantity. Same as above.

c. Water quality. Same as above.

d. Forage. Same as above.

e. Natural cover. Same as above.

Estuarine areas

a. Free passage. Long-term improvements due to restoration of an estuarine transition zone; restoration of estuarine functions such as temperature, tidal currents and salinity; reduced number of sites for avian predators to rest and hunt; and removal of tide gates.

b. Water quality. Same as above.

c. Water quantity. Same as above.

d. Natural cover. Long-term improvements due to shirt in vegetative community composition and distribution toward more native species including salt marsh species; reestablishment of cover in historical distributary channels; increase in riparian vegetation and habitat complexity; increase fish access for cover habitat in tributaries and floodplain habitats; and reduced filling of estuaries by fine sediment.

e. Juvenile forage. Long-term improved foraging habitat abundance from reestablishing historical distributary channels that increase in size after tidal flows are allowed to inundate and scour twice a day; increased access into tributaries and floodplain habitats to forage.

f. Adult forage. Long-term improvements due to restoration activities that improve habitat quality.

Nearshore marine areas

a. Free passage. No effect.

b. Water quality. Short-term increase in contaminants, impoverished community structure; long-term reduced contaminants, more normative community structure.

c. Water quantity. No effect.

d. Forage. Same as above.

e. Natural cover. Short-term decrease in natural cover quantity and quality due to reduced large wood; long-term increase in natural cover due to increased LW.

Offshore marine areas

No effects are anticipated because no projects will be implemented in these areas.

Effects of the action on eulachon critical habitat PBFs

Freshwater spawning sites and incubation

a. Flow. Ephemeral reduction due to short-term construction needs, reduced riparian permeability and increased riparian runoff due to soil compaction; slight long-term increase based on improved riparian function and floodplain connectivity.
b. Water quality. Short-term releases of suspended sediment and contaminants, increased dissolved oxygen demand, and increased temperature due to riparian and channel disturbance. Long-term water quality will improve as riparian vegetation becomes established.
c. Water temperature. Slight long-term improvement based on improved riparian function and floodplain connectivity.
d. Substrate. Short-term reduction due to increased compaction and sedimentation and removal. Long-term benefit from the restoration of natural sediment transport.
e. Free passage. Short-term decrease due to decreased water quality and in-water work isolation. Long-term improvement after stream connectivity is improved as a result of improved stream crossings structures.

Freshwater and estuarine migration corridors

a. Free passage. Short-term decrease due to decreased water quality and in-water work isolation. Long-term improvement after stream connectivity is improved as a result of improved stream crossings structures.
b. Flow. Same as above.
c. Water quality. Same as above.
d. Water temperature. No effect.
e. Food. No effect.

Nearshore and offshore marine foraging areas

a. Food. No effect.
b. Water quality. No effect.

Effects of the action on green sturgeon critical habitat PBFs

Estuarine areas

a. Food. Short-term decrease due to stream and river-bottom disturbance.
b. Passage. Short-term decrease due to stream and river-bottom channel

disturbance:
c. Sediment quality. Short-term decrease due to stream and river-bottom disturbance.
d. Water quality. Short-term increase in turbidity, dissolved oxygen demand, and temperature due to riparian and channel disturbance.

Coastal marine areas

a. Food resources. No effect.
b. Migratory corridor. No effect.
c. Water quality. Short-term increase in contaminants, impoverished community structure; long-term reduced contaminants, more normative community structure.

Summary of Critical Habitat Effects

Effects to habitat features include temporary and permanent impediments to migration, potential permanent increases in predators and predator success upon juvenile salmonids, temporary and permanent diminishment of forage opportunities (i.e., prey abundance and diversity), and temporary and permanent impacts to water quality. Timing, duration, and intensity of the effects on critical habitat are considered in the analysis, and we also consider them as the pathways of exposure creating effects to the species, as discussed above.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state, tribal, local, or private activities, not involving federal activities, that are reasonably certain to occur within the Action Area of the federal action subject to consultation (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. Because many activities that have the potential to affect the ESA-listed species considered in this framework programmatic consultation involve some degree of future federal authorization, e.g., federal permits, NMFS expects that project-level actions subsequently authorized, PCSRF-funded, or carried out will be fully addressed in subsequent project- or programmatic-level Section 7 consultations, as appropriate.

We expect the future state, tribal, local, or private actions that are reasonably certain to occur in the action area to be similar to those described in the environmental baseline section of this framework programmatic consultation. The actions include, but are not limited to, fisheries, pollution, water management, forestry, agricultural practices, and coastal development, and climate change, as discussed in Section 2.2.1. With human population expansion in the action area, these actions are expected to intensify over time, though the degree to which this may affect the ESA- listed species considered in this framework programmatic consultation cannot be quantified. Future changes in state and local government and private actions may include variation in land and water-use patterns, including ownership and intensity, any of which could affect listed species or their habitat. It is difficult, and perhaps speculative, to analyze the effects of such actions, considering the broad geographic landscape covered by this framework programmatic consultation, the geographic and political variation in the action area, extensive private land holdings, the uncertainties associated with state and local government and private actions, and ongoing changes in the region's economy. Adverse effects to riverine and coastal habitat from continued urbanization are reasonably certain to occur. However, state and local governments have regulations in place to minimize these effects to listed species, including regulations regarding construction best management practices, storm water control, and treatment of wastewater.

Based on the best available information, NMFS is not aware of any specific anticipated changes in other human-related actions or natural conditions that would substantially change the impacts that ESA-listed species covered by this framework programmatic consultation may experience.

It is not possible to predict the future intensity of specific non-federal actions related to resource-based industries such as timber harvest, agriculture, mining at this program scale due to uncertainties about the economy, funding levels for restoration actions, and individual investment decisions. However, the adverse effects of resource-based industries in the action area are likely to continue in the future. These effects, both negative and positive, will be expressed most strongly in rural areas where these industries occur, and therefore, somewhat in contrast to human population density. The future effects of river restoration projects are also unpredictable for the same reasons, but their net beneficial effects may grow with the increased sophistication and size of projects completed and the additive effects of completing multiple projects in some watersheds.

In summary, resource-based activities such as timber harvest, agriculture, mining, shipping, and energy development is likely to continue to exert an influence on the quality of freshwater and estuarine habitat in the action area. The intensity of this influence is difficult to predict and is dependent on many social and economic factors. However, the adoption of industry-wide standards to reduce environmental impacts and the shift away from resource extraction to a mixed manufacturing and technology-based economy should result in a gradual decrease in influence over time. In contrast, the populations of Alaska, Washington, Oregon, California, Idaho, and Nevada are expected to increase in the next several decades with a corresponding increase in natural resource consumption. Additional residential and commercial development and a general increase in human activities are expected to cause localized degradation of freshwater and estuarine habitat. Interest in restoration activities is also increasing as is environmental awareness among the public. This will lead to localized improvements to freshwater and estuarine habitat. When these influences are considered collectively, we expect trends in habitat quality to remain flat or improve gradually over time.

In general, we expect trends in habitat quality in the action area to generally remain flat with gradual declines or improvements in some areas depending on spatial scale (e.g., site, reach, watershed, basin), level of development (i.e., forest, rural, suburban, urban), and variation in levels of economic activity in different geographic regions (e.g., valley, coastal). At best, these trends will increase population abundance and productivity for the species affected by this consultation. However, given the degraded state of the environmental baseline and the small population levels of the listed species, listed species exposed to additional negative effects in the action area is likely to be sensitive to those changes and exhibit a disproportionate adverse response, particularly those populations at an elevated risk of extinction (i.e., high or very high extinction risk). Therefore, in most instances, we expect cumulative effects will have a minor, negative effect on population abundance trends. Similarly, we expect the quality and function of critical habitat PBFs generally to express a minor negative trend over time as a result of the cumulative effects, with the possibility of a gradual positive or negative trend depending on the balance between economic activity and habitat protection and restoration.

This will, at best, have positive influence on population abundance and productivity for the species affected by the proposed action. In a worst cases scenario, we expect cumulative effects will have a relatively neutral effect on population abundance trends. Similarly, we expect the quality and function of critical habitat PBFs or physical and biological features to express a slightly positive to neutral trend over time as a result of the cumulative effects.

2.7 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

This opinion provides discussions in Section 2.2 of the current status of each listed species and designated critical habitat that is likely to be adversely affected by the proposed action. The status of each species varies based on the unique condition of that species and its critical habitat. Status reviews indicate that the species herein continue to be threatened by the particular stressors that have contributed to their at-risk state. Some of those stressors are, or have the potential to be, produced by activities authorized, funded, or carried out by the proposed action.

As we describe in the Environmental Baseline, Section 2.4 of this opinion, the ESA-listed species considered in this opinion have been affected by a number of federal, state, local, and private activities in the action area that impacted their survival and recovery. These actions include, but are not limited to, forest practices, agricultural practices, urban and rural development, hydropower development, fisheries, dredging, pollution, and coastal development. The ESA-listed species considered in this opinion have been, and continue to be, negatively affected both directly (e.g., mortality from fisheries interactions) and indirectly (e.g., through habitat degradation) by these activities. Also, of note is climate change, though is it is difficult to accurately predict the consequences of climate change to the species considered in this opinion. As described in the Status and Environmental Baseline (Section 2.2 and Section 2.4, respectively) of this opinion, a range of consequences are expected, varying from beneficial to catastrophic. In the action area there are also a number of ongoing federal, state, and local habitat conservation and protection programs. Many of these actions are specifically targeted at reducing threats to ESA-listed species and restoring their habitats.

In the Effects of the Action - Species and Critical Habitat Analysis, Section 2.5 of this opinion, we assessed the potential effects of the proposed action on listed species and their critical habitat. The state and tribal programs implementing future projects funded with PCSRF funds and non-federal match funds have the potential to affect listed species and their designated critical habitat. Many, but not all, of the future projects proposed have the potential to adversely affect listed species and their designated critical habitats in the short term.

Additionally, as described in the Cumulative Effects, Section 2.6 of this opinion, with human population growth in the action area, the adverse effects of some state, local, and private actions are expected to intensify over time, though the degree to which this may affect the ESA-listed species considered in this opinion cannot be quantified. A wide variety of programs undertaken by state, and local governments, non-governmental organizations, and private individuals have been established to protect or restore the watersheds, coastal ecosystems, and the ESA-listed species considered in this opinion. Those programs have helped slow and, for some areas, reverse the declining trends that began in the past. However, despite these efforts at every level of government, non-governmental organizations, and private individuals, the Alaska-Pacific ecosystem remains degraded and populations of the ESA-listed species considered in this opinion have not recovered.

Analyses of whether adverse effects of specific projects on individuals are sufficient to jeopardize the continued existence of the listed species by reducing the reproduction, numbers, or distribution of the affected species to such an extent as to reduce appreciably the likelihood of both survival and recovery in the wild will occur through project- or programmatic-level Section 7 consultations, as appropriate. Likewise, analyses of whether adverse effects of specific projects are sufficient to result in destruction or adverse modification of designated critical habitats will also occur through project- or programmatic-level Section 7 consultations, as appropriate.

Implementation of the proposed action will have long-term beneficial effects to salmonids and their habitats, and are likely to have incremental beneficial effects to the other fish species considered in this framework programmatic consultation. These beneficial effects will improve the environmental baseline and all four salmon and steelhead VSP parameters: abundance, productivity, spatial structure, and spatial, genetic, and life history diversity. These improvements will translate into decreased risk of extinction and increased probability of recovery for all of the species addressed by this framework programmatic consultation. Given that projects must address at least one limiting factor, habitat restoration projects carried out in critical habitat will by design improve the conservation value of the essential biological and physical features of habitat at the site and watershed scales — all of which would serve to benefit listed species and their habitats.

In summary, the aggregate of effects associated with the proposed action to fund state and tribal salmon and steelhead recovery programs, in addition to the environmental baseline, cumulative effects, status of the species, and critical habitat, is not expected to reduce appreciably the likelihood of both the survival and recovery of the listed species considered in this opinion in the wild by reducing their numbers, reproduction, or distribution; or appreciably diminish the value of designated critical habitat for the conservation of the species considered in this opinion.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action (e.g., habitat restoration projects), the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS's biological opinion that the PCSRF program is not likely to jeopardize the continued existence of any listed endangered or threatened species under the jurisdiction of NMFS and is not likely to destroy or adversely modify any designated critical habitat.

This opinion constitutes formal consultation and an analysis of effects solely for the species that are the subject of this opinion (Table 1). Herein, NMFS determined that the proposed action to award grants using PCSRF funds to states and tribes to support their respective salmon and steelhead recovery programs, individually or in aggregate:

- May adversely affect Puget Sound Chinook salmon, Puget Sound steelhead, Hood Canal summer-run chum salmon, Ozette Lake sockeye salmon, upper Columbia River spring-run Chinook salmon, upper Columbia River steelhead, middle Columbia River steelhead, Snake River spring/summer-run Chinook salmon, Snake River fall-run

Chinook salmon, Snake River steelhead, Snake River sockeye salmon, lower Columbia River Chinook salmon, lower Columbia River coho salmon, lower Columbia River steelhead, Columbia River chum salmon, upper Willamette River Chinook salmon, upper Willamette River steelhead, Oregon Coast coho salmon, Southern Oregon/Northern California Coast coho salmon, northern California steelhead, California Coastal Chinook salmon, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, Central California Coast coho salmon, Central California Coast steelhead, South-Central California Coast steelhead, Southern California steelhead, eulachon, and green sturgeon, but would not jeopardize their continued existence.

- Will not destroy or adversely modify designated critical habitat for Puget Sound Chinook salmon, Puget Sound steelhead, Hood Canal summer-run chum salmon, Ozette Lake sockeye salmon, upper Columbia River spring-run Chinook salmon, upper Columbia River steelhead, middle Columbia River steelhead, Snake River spring/summer-run Chinook salmon, Snake River fall-run Chinook salmon, Snake River steelhead, Snake River sockeye salmon, lower Columbia River Chinook salmon, lower Columbia River coho salmon, lower Columbia River steelhead, Columbia River chum salmon, upper Willamette River Chinook salmon, upper Willamette River steelhead, Oregon Coast coho salmon, Southern Oregon/Northern California Coast coho salmon, northern California steelhead, California Coastal Chinook salmon, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, California Central Valley steelhead, Central California Coast coho salmon, Central California Coast steelhead, South-Central California Coast steelhead (O. mykiss), Southern California steelhead, eulachon, and green sturgeon.

2.9 Incidental Take Statement

This consultation does not authorize any incidental take associated with future projects funded with PCSRF funds and non-federal match funds. In accordance with 50 CFR 402.14, for a framework programmatic action, an incidental take statement is not required at the programmatic level. Any incidental take resulting from PCSRF-funded projects subsequently authorized, or carried out will be addressed in subsequent project- or programmatic-level Section 7 consultations, as appropriate.

2.10 Reinitiation

This concludes formal consultation for the ESA Section 7 framework programmatic consultation on the PCSRF program.

As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this document, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this document, or (4) a new species is listed or critical habitat designated that may be affected by the action.

In the context of this framework programmatic consultation, there is no incidental take anticipated or authorized and the reinitiation trigger set out in the first scenario listed above is not applicable.

2.11 "Not Likely to Adversely Affect" Determinations

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02). When evaluating whether the proposed action is not likely to adversely affect listed species or critical habitat, NMFS considers whether the effects are expected to be completely beneficial, insignificant, or discountable. Completely beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Effects are considered discountable if they are extremely unlikely to occur.

Because north Pacific right whales, Southern Resident killer whales, Cook Inlet beluga whales, sunflower sea star[13], Puget Sound/Georgia Basin bocaccio, and Puget Sound/Georgia Basin yelloweye rockfish are expected to occur only rarely in the action area, we do not expect the proposed action to have adverse effects on them or their designated critical habitat. This expectation is based on the following considerations.

[13] As noted above, we conclude that the proposed action will only have discountable or insignificant effects on Sunflower sea star, which is currently proposed to be listed as threatened. NMFS may confirm its concurrence with the NLAA finding once Sunflower sea star are listed. If we review the proposed action and find there have been no significant changes to the action that would alter the contents of this conference letter of concurrence and no significant new information has been developed (including during the rulemaking process), we may determine that no further consultation will be necessary.

Effects on Species

Three of the six project category types are expected to have no direct or indirect effects on listed species or designated critical habitat.

These project category types are:

1. Salmonid Restoration Planning and Assessments.
5. Public Outreach, Education, and Landowner Recruitment.
6. Program Administration.

Projects in these three categories do not involve any ground-disturbing or in-water work, or involve trapping, capturing, or collecting and handling any animals. We therefore determine that projects (sub-categories) in these project category types will have no effect on listed or proposed species or designated critical habitat under NMFS's jurisdiction. Therefore, they will not be considered further.

Activities that May Adversely Affect Listed Species and Critical Habitat

Three of the six project category types have the potential to affect listed and proposed species and designated critical habitat.

These project category types are:

2. Salmonid Habitat Restoration and Acquisition.
3. Salmonid Hatcheries and Harvest Management.
4. Salmonid Research, Monitoring, and Evaluation.

Projects in these three categories that involve the purchase of restoration structures (e.g., logs) or equipment (e.g., bulldozers) for future habitat restoration projects (i.e., projects not yet designed, planned, or proposed); or projects that fund a nursery operation for vegetation that will be used in multiple or unspecified restoration projects are expected to have no effect on listed species or designated critical habitat under NMFS's jurisdiction because these projects do not involve any ground-disturbing or in-water work, or involve trapping, capturing, or collecting and handling of listed species, and therefore, will not be considered further.

Additionally, projects in these categories that involve land or conservation easements; lease of land or easements, or acquisition of land-use rights are expected to have no effect on listed species or designated critical habitat under NMFS's jurisdiction because these projects do not involve any ground-disturbing or in-water work, or involve trapping, capturing, or collecting and handling of listed species, and therefore, will not be considered further.

In large part, projects under Project Category Type 2 — Salmonid Habitat Restoration and Acquisition Category, are intended to address various limiting factors identified in salmon and steelhead recovery plans. Implementation of these projects will have long-term beneficial effects to salmonids and their habitats, and are likely to have incremental beneficial effects to the non-salmonid, marine mammal, and invertebrate species considered in this framework programmatic consultation. These beneficial effects will improve the environmental baseline and all four salmon and steelhead VSP parameters: abundance, productivity, spatial structure, and spatial, genetic, and life history diversity. These improvements will translate into decreased risk of extinction and increased probability of recovery for all of the species addressed by this framework programmatic consultation. Given that projects shall address one or more limiting factors, habitat restoration projects carried out in critical habitat will by design improve the conservation value of the essential biological and physical features of habitat at the site and watershed scales — all of which would serve to benefit listed species and their habitats.

Projects under Project Category Type 3 — Salmonid Hatcheries and Harvest Management Category, are intended to yield improvements to hatchery production and/or supplementation, and to support enforcement or observers, as well as fishing gear to test the improved retention of hatchery fish, reduce bycatch, or decrease post-release mortality of fish — all of which would serve to benefit listed species.

Projects under Project Category Type 4 — Salmonid Research, Monitoring, and Evaluation Category, are intended to increased our knowledge of anadromous fish abundance, migration timing, and survival, and to improve our knowledge of the respective species' life histories, biological requirements, genetic make-up, responses to human activities (positive and negative), and survival in the rivers and ocean — all of which would serve to benefit listed species and their habitats.

With regards to projects in these three categories, the projects most likely to pose a risk to north Pacific right whales, Southern Resident killer whales, Cook Inlet beluga whales, sunflower sea stars, Puget Sound/Georgia Basin bocaccio, and Puget Sound/Georgia Basin yelloweye rockfish are those that involve in-water activities.

Because north Pacific right whales, Southern Resident killer whales, Cook Inlet beluga whales, sunflower sea stars, Puget Sound/Georgia Basin bocaccio, and Puget Sound/Georgia Basin yelloweye rockfish are found in estuarine/nearshore habitats, in-water activities in estuarine/nearshore habitats that take place when the species are present may pose a risk to these species.

The most likely effect pathway that may affect these species is spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants associated with in-water activities, which are acutely toxic to whales, and sea stars at high levels of exposure and can cause sublethal adverse effects on whales, and sea stars at lower concentrations (NMFS 2013, Mongillo et al. 2016, NMFS 2016, Guillemette et al. 2008). In the unlikely event that a spill does occur, we would expect the impacts to be short in duration and small in geographic scope as best management practices (such as the use of vegetable-based hydraulic fluids which lack chemical compounds that are acutely toxic to aquatic organisms, and a spill and containment and minimization measures) would minimize exposure by keeping the incident localized and of short duration. Furthermore, we expect any spill of fuel or similar fluids to rapidly diminish as it would not mix with water, but would form a thin layer on the surface, continually spreading while it evaporated, broke apart, and was hydrolyzed by ultraviolet light — minimizing oxidation reactions (oxygen depletion).

Thus, we expect effects associated with accidental spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, to be transitory and unlikely to be meaningfully measurable, detectable or evaluated as adverse. Therefore, we expect the likelihood of effects on the species considered herein would be too small to meaningfully measure, detect or evaluate, and therefore are likely to be insignificant.

Effects on Critical Habitat

North Pacific Right Whales

The effects of the action are unlikely to adversely affect designated critical habitat for North Pacific right whales as designated critical habitat for Pacific right whales is limited to two specific marine areas in the Gulf of Alaska and the Southeast Bering Sea (73 FR 19000, April 8, 2008) — the Gulf of Alaska area is off the coast of Kodiak Island and is approximately 1,175 square miles, while the Southeast Bering Sea area is about 35,460 square miles. As these two areas are in marine waters well offshore, only in-water activities in these marine areas pose a potential risk to designated critical habitat for Pacific right whales. For any PCSRF-funded or non-federal match projects that would occur in these marine areas, the effects of the action that may affect designated critical habitat include the effects pathway spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, which are acutely toxic to north Pacific right whales at high levels of exposure and can cause sublethal adverse effects on north Pacific right whales at lower concentrations (NMFS 2013). In the unlikely event that a spill does occur, we would expect the impacts to be short in duration and small in geographic scope as best management practices (such as the use of vegetable-based hydraulic fluids which lack chemical compounds that are acutely toxic to aquatic organisms, and a spill and containment and minimization measures) would minimize exposure by keeping the incident localized and of short duration. Furthermore, we expect any spill of fuel or similar fluids to rapidly diminish as it would not mix with water, but would form a thin layer on the surface, continually spreading while it evaporated, broke apart, and was hydrolyzed by ultraviolet light — minimizing oxidation reactions (oxygen depletion). Thus, we expect effects associated with accidental spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, to be transitory and unlikely to be meaningfully measurable, detectable or evaluated as adverse.

Thus, we would expect the effects of the proposed action on North Pacific right whale critical habitat to be minor, short in duration, small in geographic scope, and have no quantifiable effects on Pacific right whale critical habitat PBFs. Therefore, we expect the likelihood of effects on critical habitat PBFs for Pacific right whales would be too small to meaningfully measure, detect or evaluate as adverse, and therefore are insignificant.

Southern Resident Killer Whales

Effects of the action are unlikely to adversely affect designated critical habitat for Southern Resident killer whales as the designation is in marine waters between the 20-foot depth contour and the 656.2-foot depth contour — an area where estuarine/nearshore projects funded under the PCSRF program are likely to be rare. Thus, only in-water activities in these marine areas pose a potential risk to designated critical habitat for Southern Resident killer whales. For any PCSRF-funded projects that would occur in these marine areas, the effects of the action that may affect designated critical habitat include the effects pathway spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, which are acutely toxic to killer whales at high levels of exposure and cause sublethal adverse effects on killer whales at lower concentrations (Mongillo et al. 2016). In the unlikely event that a spill does occur, we would expect the impacts to be short in duration and small in geographic scope as best management practices (such as the use of vegetable-based hydraulic fluids which lack chemical compounds that are acutely toxic to aquatic organisms, and a spill and containment and minimization measures) would minimize exposure by keeping the incident localized and of short duration. Furthermore, we expect any spill of fuel or similar fluids to rapidly diminish as it would not mix with water, but would form a thin layer on the surface, continually spreading while it evaporated, broke apart, and was hydrolyzed by ultraviolet light — minimizing oxidation reactions (oxygen depletion). Thus, we expect effects associated with accidental spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, to be transitory and unlikely to be meaningfully measurable, detectable or evaluated as adverse.

Thus, we would expect the effects of the proposed action on Southern Resident killer whale critical habitat to be minor, short in duration, small in geographic scope, and have no quantifiable effects on Southern Resident killer whale critical habitat PBFs, with the exception of incremental increases in the PBF prey species (salmon – a beneficial effect) in response to salmonid habitat restoration projects. Therefore, we expect the likelihood of effects on critical habitat PBFs for Southern Resident killer whales would be too small to meaningfully measure, detect or evaluate as adverse, and therefore are insignificant.

Cook Inlet Beluga Whales

Effects of the action are unlikely to adversely affect designated critical habitat for Cook Inlet beluga whales. Designated critical habitat for Cook Inlet beluga whales includes two specific marine areas in Cook Inlet, Alaska. Thus, only in-water activities in these marine areas in Cook Inlet, Alaska pose a potential risk to designated critical habitat for Cook Inlet beluga whales. For any PCSRF-funded or non-federal match projects that would occur in these marine areas, the effects of the action that may affect designated critical habitat include the effects pathway spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants. In the unlikely event that a spill does occur, we would expect the impacts to be short in duration and small in geographic scope as best management practices (such as the use of vegetable-based hydraulic fluids which lack chemical compounds that are acutely toxic to aquatic organisms, and a spill and containment and minimization measures) would minimize exposure by keeping the incident localized and of short duration. Furthermore, we expect any spill of fuel or similar fluids to rapidly diminish as it would not mix with water, but would form a thin layer on the surface, continually spreading while it evaporated, broke apart, and was hydrolyzed by ultraviolet light — minimizing oxidation reactions (oxygen depletion). Thus, we expect effects associated with accidental spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, to be transitory and unlikely to be meaningfully measurable, detectable or evaluated as adverse.

Thus, we would expect the effects of the proposed action on Cook Inlet beluga whale critical habitat to be minor, short in duration, small in geographic scope, and have no quantifiable effects on Cook Inlet beluga whale critical habitat PBFs, with the exception of incremental increases in the PBF prey species (salmon – a beneficial effect) in response to salmonid habitat restoration projects. Therefore, we expect the likelihood of effects on critical habitat PBFs for Cook Inlet beluga whales would be too small to meaningfully measure, detect or evaluate as adverse, and therefore are insignificant.

Puget Sound/Georgia Basin Bocaccio

Effects of the action are unlikely to adversely affect designated critical habitat for Puget Sound/Georgia Basin bocaccio. Designated critical habitat for Puget Sound/Georgia Basin bocaccio includes 590.4 square miles of nearshore habitat and 414.1 square miles of deepwater habitat. Thus, only in-water activities in these areas in Puget Sound pose a potential risk to designated critical habitat for Puget Sound/Georgia Basin bocaccio. For any PCSRF-funded or non-federal match projects that would occur in these marine areas, the effects of the action that may affect designated critical habitat include the effects pathway spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants. In the unlikely event that a spill does occur, we would expect the impacts to be short in duration and small in geographic scope as best management practices (such as the use of vegetable-based hydraulic fluids which lack chemical compounds that are acutely toxic to aquatic organisms, and a spill and containment and minimization measures) would minimize exposure by keeping the incident localized and of short duration. Furthermore, we expect any spill of fuel or similar fluids to rapidly diminish as it would not mix with water, but would form a thin layer on the surface, continually spreading while it evaporated, broke apart, and was hydrolyzed by ultraviolet light — minimizing oxidation reactions (oxygen depletion). Thus, we expect effects associated with accidental spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, to be transitory and unlikely to be meaningfully measurable, detectable or evaluated as adverse.

Thus, we would expect the effects of the proposed action on Puget Sound/Georgia Basin bocaccio critical habitat to be minor, short in duration, small in geographic scope, and have no quantifiable effects on Puget Sound/Georgia Basin bocaccio critical habitat PBFs, with the exception of incremental increases in the PBF prey species (salmon – a beneficial effect) in response to salmonid habitat restoration projects. Therefore, we expect the likelihood of effects on critical habitat PBFs for Puget Sound/Georgia Basin bocaccio would be too small to meaningfully measure, detect or evaluate as adverse, and therefore are insignificant.

Puget Sound/Georgia Basin Yelloweye Rockfish

Effects of the action are unlikely adversely affect designated critical habitat for Puget Sound/Georgia Basin yelloweye rockfish. Designated Critical habitat for Puget Sound/Georgia Basin yelloweye rockfish includes 414.1 square miles of deep-water marine habitat at depths greater than 98 feet in Puget Sound, all of which overlaps with areas designated Puget Sound/Georgia Basin yelloweye bocaccio. Thus, only in-water activities in these areas in Puget Sound pose a potential risk to designated critical habitat for Puget Sound/Georgia Basin yelloweye rockfish. For any PCSRF-funded or non-federal match projects that would occur in these marine areas, the effects of the action that may affect designated critical habitat include the effects pathway spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants. In the unlikely event that a spill does occur, we would expect the impacts to be short in duration and small in geographic scope as best management practices (such as the use of vegetable-based hydraulic fluids which lack chemical compounds that are acutely toxic to aquatic organisms, and a spill and containment and minimization measures) would minimize exposure by keeping the incident localized and of short duration. Furthermore, we expect any spill of fuel or similar fluids to rapidly diminish as it would not mix with water, but would form a thin layer on the surface, continually spreading while it evaporated, broke apart, and was hydrolyzed by ultraviolet light — minimizing oxidation reactions (oxygen depletion). Thus, we expect effects associated with accidental spills or leaks of fuel, lubricants, hydraulic fluid, coolants, and other contaminants, to be transitory and unlikely to be meaningfully measurable, detectable or evaluated as adverse.

Thus, we would expect the effects of the proposed action on Puget Sound/Georgia Basin yelloweye rockfish critical habitat to be minor, short in duration, small in geographic scope, and have no quantifiable effects on Puget Sound/Georgia Basin yelloweye rockfish critical habitat PBFs, with the exception of incremental increases in the PBF prey species (salmon – a beneficial effect) in response to salmonid habitat restoration projects. Therefore, we expect the likelihood of effects on critical habitat PBFs for Puget Sound/Georgia Basin yelloweye rockfish would be too small to meaningfully measure, detect or evaluate as adverse, and therefore are insignificant.

Summary

PCSRF-funded projects, especially habitat restoration projects – which comprise the bulk of on-the-ground projects funded under the PCSRF – are intended to address various limiting factors identified in salmon and steelhead recovery plans. And while implementation of these projects funded under the PCSRF program will have short-term negative effects on salmon and steelhead and their habitats, they will also have long-term beneficial effects to salmon and steelhead and their habitats, and incremental beneficial effects, e.g., improved ecosystem functions, to non-salmonid, marine mammal, and invertebrate species considered in this framework programmatic consultation.

Given these circumstances, and the fact that we anticipate little to no interaction between any of the projects funded under the PCSRF program and these species, NMFS finds that the effects of the proposed action on north Pacific right whales, Southern Resident killer whales, Cook Inlet beluga whales, sunflower sea stars, Puget Sound/Georgia Basin bocaccio, and Puget Sound/Georgia Basin yelloweye rockfish would be too small and transitory to meaningfully measure, detect or evaluate as adverse, and determines that the proposed action may affect, but is not likely to adversely affect, north Pacific right whales, Southern Resident killer whales, Cook Inlet beluga whales, sunflower sea stars, Puget Sound/Georgia Basin bocaccio, and Puget Sound/Georgia Basin yelloweye rockfish. NMFS also determines that the proposed action may affect, but is not likely to adversely affect, designated critical habitat for north Pacific right whales, Southern Resident killer whale, Cook Inlet beluga whales, Puget Sound/Georgia Basin bocaccio, or Puget Sound/Georgia Basin yelloweye rockfish.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)].

The proposed action of funding state and tribal salmon and steelhead recovery programs may result in future, site-specific projects that could have impacts on EFH and thereby trigger the requirements of the MSA. The proposed action does not include details about the specific location, magnitude, number, or duration of future project-specific actions.

As such, any impacts to EFH resulting from activities subsequently authorized, funded, or carried out in association with the proposed action will be addressed in subsequent project- or programmatic-level MSA EFH consultations, as appropriate. Thus, for this framework programmatic consultation, NMFS is not including any EFH conservation recommendations.

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are states of Alaska, Washington, Oregon, California, Idaho, and Nevada, as well as tribes of the Columbia River and Pacific Coast (including Alaska). Other interested users could include other organizations that implement restoration actions including both governmental and nongovernmental organizations. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3 Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was written by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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