UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

Refer to NMFS No:
WCRO-2020-02481

October 29, 2020

William D. Abadie
Chief, Regulatory Branch
U.S. Army Corps of Engineers - Portland District
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Port of Astoria Maintenance Dredging (Clatsop County, Oregon, Columbia River – Baker Bay, HUC: 170800060500) (NWP-2004-369-14)

Dear Mr. Abadie:

Thank you for your letter of September 13, 2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Port of Astoria Maintenance Dredging (NWP-2004-369-14). This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA)(16 U.S.C. 1855(b)) for this action.

In the attached biological opinion, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), Snake River basin (SR) fall-run Chinook salmon, SR spring/summer run Chinook salmon, Upper Columbia River (UCR) spring-run Chinook salmon, Upper Willamette River (UWR) Chinook salmon, Columbia River (CR) chum salmon (*O. keta*), LCR coho salmon (*O. kisutch*), SR sockeye salmon (*O. nerka*), LCR steelhead (*O. mykiss*), Middle Columbia River (MCR) steelhead, UCR steelhead, SR steelhead, UWR steelhead, southern designated population segment (DPS) of green sturgeon (*Acipenser medirostris*), southern DPS of eulachon (*Thaleichthys pacificus*), or Southern Resident Killer Whale (*Orcinus orca*) or result in the destruction or adverse modification of critical habitats.

As required by section 7 of the ESA, NMFS is providing an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements, that the U.S. Army Corps of Engineers or any applicant must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

This document also includes the results of our analysis of the action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. These conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations.

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

If the response is inconsistent with the EFH conservation recommendations, the Corps must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations.

Please contact Joshua Ashline, Oregon Washington Coastal Area Office in Lacey, Washington, 562-533-0987, Joshua.ashline@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Danielle Erb
Eric Campbell
Matt McGrath

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the

Port of Astoria Maintenance Dredging (NWP-2004-369-14)

NMFS Consultation Number: WCRO-2019-02481

Action Agency: U.S. Army Corps of Engineers – Portland District

Affected Species and NMFS' Determinations:

ESA-Listed Species	ESA Status	Is the action likely to adversely affect the species	Is the action likely to adversely affect the critical habitat?	Is the action likely to jeopardize the species?	Is the action likely to destroy or adversely modify critical habitat
Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tschawtscha*)	T	Yes	Yes	No	No
Upper Columbia River (UCR) spring-run Chinook salmon	E	Yes	Yes	No	No
Upper Willamette River (UWR) spring-run Chinook salmon	T	Yes	Yes	No	No
Snake River (SR) spring/summer run Chinook salmon	T	Yes	Yes	No	No
SR fall-run Chinook salmon	T	Yes	Yes	No	No
Columbia River (CR) chum salmon (*O. keta*)	T	Yes	Yes	No	No
LCR coho salmon (*O. kisutch*)	T	Yes	Yes	No	No
SR sockeye salmon (*O. nerka*)	E	Yes	Yes	No	No
LCR steelhead (*O. mykiss*)	T	Yes	Yes	No	No
Middle Columbia River (MCR) steelhead	T	Yes	Yes	No	No
UCR steelhead	T	Yes	Yes	No	No
UWR steelhead	T	Yes	Yes	No	No
SR steelhead	T	Yes	Yes	No	No
Southern DPS of green sturgeon (*Acipenser medirostris*)	T	Yes	Yes	No	No
Southern DPS of Pacific eulachon (*Thaleichthys pacificus*)	T	Yes	Yes	No	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast salmon	Yes	Yes
Pacific Coast groundfish	Yes	Yes

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

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: October 29, 2020

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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 the biological opinion (opinion), and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 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 Oregon Washington Coastal Office in Lacey, Washington.

1.2 Consultation History

This biological opinion is in response to the U.S. Army Corps of Engineers – Portland District (USACE) request for formal consultation on ESA listed species detailed in Table 1, authorizing the proposed action under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act, received by NMFS on September 13, 2019. Included in this request from the applicant, the Port of Astoria (hereafter; Port), and their agent, Campbell Environmental Consulting, LLC was a biological assessment, and supplemental information.

- On April 15, 2020, NMFS responded to the USACE request for a status update that the project had been overlooked, and was immediately assigned to a project biologist.
- On April 21, 2020, NMFS informed USACE that Southern Resident killer whale (SRKW) were not included within their species effects determinations, and would be included within the consultation.
- On September 19, 2019, critical habitat designations for SRKW were proposed to include new areas immediately adjacent to the action area. NMFS identified activities that would occur because of the proposed action and were likely to adversely affect SRKW and their proposed critical habitat.
- On May 4, 2020, representatives from USACE and NMFS held a meeting to discuss how to best proceed with the analysis of effects on proposed SRKW critical habitat, and determined, pending approval from the applicant on a conference biological opinion.

- On June 8, 2020, USACE formally requested a conference opinion for the proposed SRKW critical habitat. Upon further review of the proposed action NMFS determined that a conference biological opinion for SRKW was unnecessary, as the proposed action and its associated activities would not adversely affect SRKW and their proposed critical habitats.
- On August 14, 2020, USACE contacted NMFS to inquire about the possibility of modifying the proposed action to include upland disposal for a proportion of the dredged materials.
- On August 17, 2020, NMFS informed USACE of their willingness to modify the proposed action to include upland disposal, and requested an amendment to the biological assessment.
- On August 25, 2020, due to the modification to the proposed action NMFS closed the original consultation (WCRO-2019-02765).
- On September 8, 2020, USACE requested formal consultation including the modified proposed action by submitting an amendment to the biological assessment, upon which NMFS initiated formal consultation.

Table 1. List of species included in the consultation for the Port of Astoria Maintenance Dredging

ESU or DPS Species	Listing Notice	Listing Status	Critical Habitat Listing
Lower Columbia Chinook	6/28/2005 ; 70 FR 37160	Threatened	9/2/2005 ; 70 FR 52630
Lower Columbia Steelhead	1/5/2006 ; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Lower Columbia Coho	6/28/2005 ; 70 FR 37160	Threatened	2/24/2016 ; 81 FR 9252
Columbia River Chum	6/28/2005 ; 70 FR 37160	Threatened	9/2/2005 ; 70 FR 52630
Upper Columbia Chinook	6/28/2005 ; 70 FR 37160	Endangered	9/2/2005 ; 70 FR 52630
Upper Columbia Steelhead	1/5/2006 ; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Middle Columbia Steelhead	1/5/2006 ; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Snake River Sockeye	4/14/2014 ; 79 FR 20802	Endangered	12/28/1993 ; 58 FR 68543
Snake River Spring/Summer Chinook	6/28/2005 ; 70 FR 37160	Threatened	10/25/1999 ; 64 FR 57399
Snake River Fall Chinook	6/28/2005 ; 70 FR 37160	Threatened	10/25/1999 ; 64 FR 57399
Snake River Steelhead	1/5/2006 ; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Upper Willamette River Chinook Salmon	6/28/2005 ; 70 FR 37160	Threatened	9/2/2005 ; 70 FR 52630
Upper Willamette River Steelhead	1/5/2006; 71 FR 834	Threatened	9/2/2005 ; 70 FR 52630
Southern DPS Pacific Eulachon	3/18/2010 ; 75 FR 13012	Threatened	10/20/2011 ; 76 FR 65324
Southern DPS Green Sturgeon	4/7/2006 ; 71 FR 17757	Threatened	10/9/2009 ; 74 FR 52300
Southern Resident Killer Whale	2/16/2006 ; 70 FR 69903	Endangered	9/19/2019 ; 84 FR 49214

1.3 Proposed Federal Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). The EFH definition of a 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 USACE proposes to issue a permit authorizing dredging and deep-water disposal of dredged sediment within the Columbia River. The dredging will be done in the Port's Central Waterfront District (CWD) which includes three piers and two slips. All portions of the proposed action are located in the Columbia River adjacent to the city of Astoria, Oregon (Figure 1). The CWD is used to moor a variety of large marine vessels including, cruise ships, U.S. Coast Guard Response Units, U.S. Navy Ships, USACE dredging vessels, barges, commercial fishing vessels, and log hauling ships.

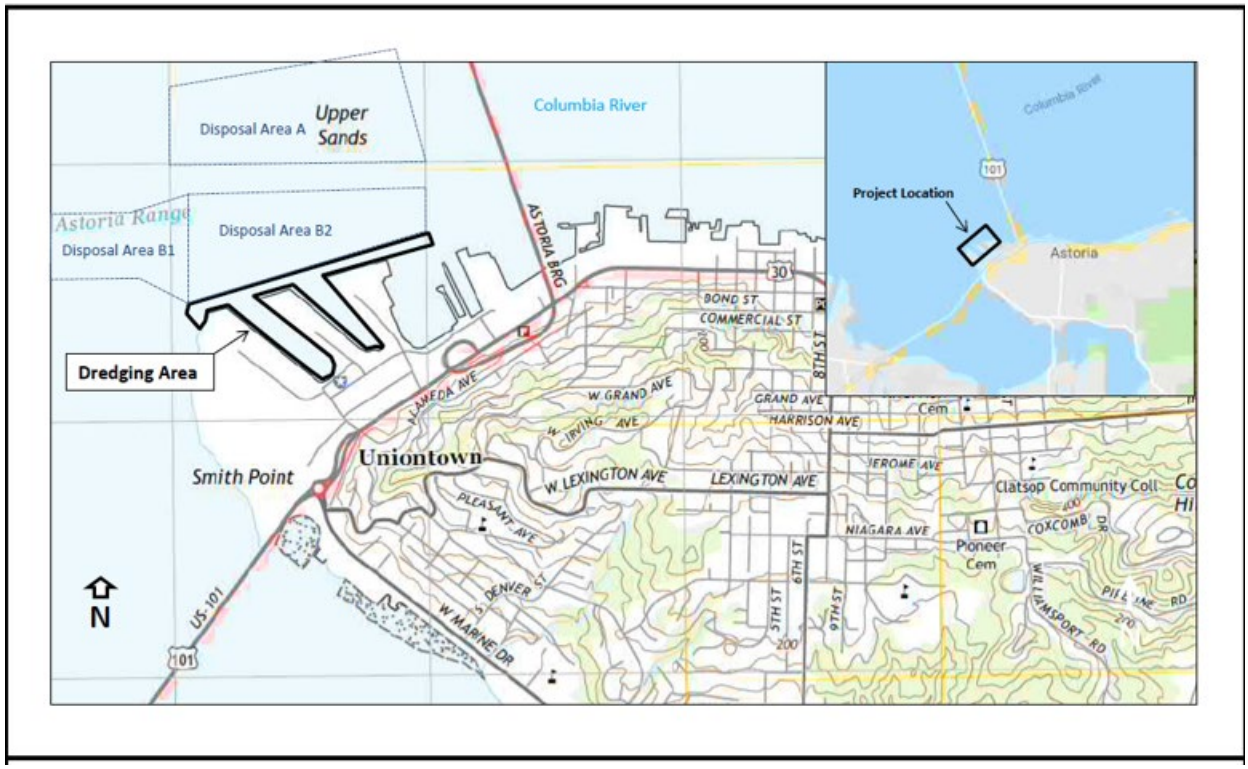

Figure 1. Port of Astoria maintenance dredging and disposal locations. Figure courtesy of Campbell Environmental LLC.

The Port is requesting a 10-year permit to conduct maintenance dredging of a maximum of 1,130,400 cubic yards (CY) of sediment. Dredging would occur for a maximum of 120 days per year for ten years. The proposed dredge prism is 31.5 acres at depths ranging from -18.0 to -45.0 feet mean-low-low-water (MLLW). The Port proposes to remove 50,000 – 100,000 CY accumulated sediment annually during the duration of the 10-year permit. If the Port is successful in securing funds to hire a dredging contractor a single year effort to remove 230,400

CY of sediment would occur, after which the Port would resume maintenance dredging of 50,000 – 100,000 CY per year.

All resulting dredge material will be deposited in the deep water flow lane of the Columbia River at three locations shown in Figure 1, with the exception of dredge materials originating from dredge material management unit (DMMU) 2 (Figure 2.), which will be disposed of at a to-be-determined upland site. The Portland Sediment Evaluation Team (PSET) reviewed the Sediment Characterization Report for the proposed dredging site and approved the associated dredge material for unconfined, aquatic disposal, with the exception of DMMU two which contains 4-methylphenol levels unsuitable for in-water disposal. The Port expects no more than 17,000 CY of sediment will be dredged annually from DMMU 2, and will not exceed 38,000 CY total, all of which will be disposed of at an approved to-be-determined upland site.

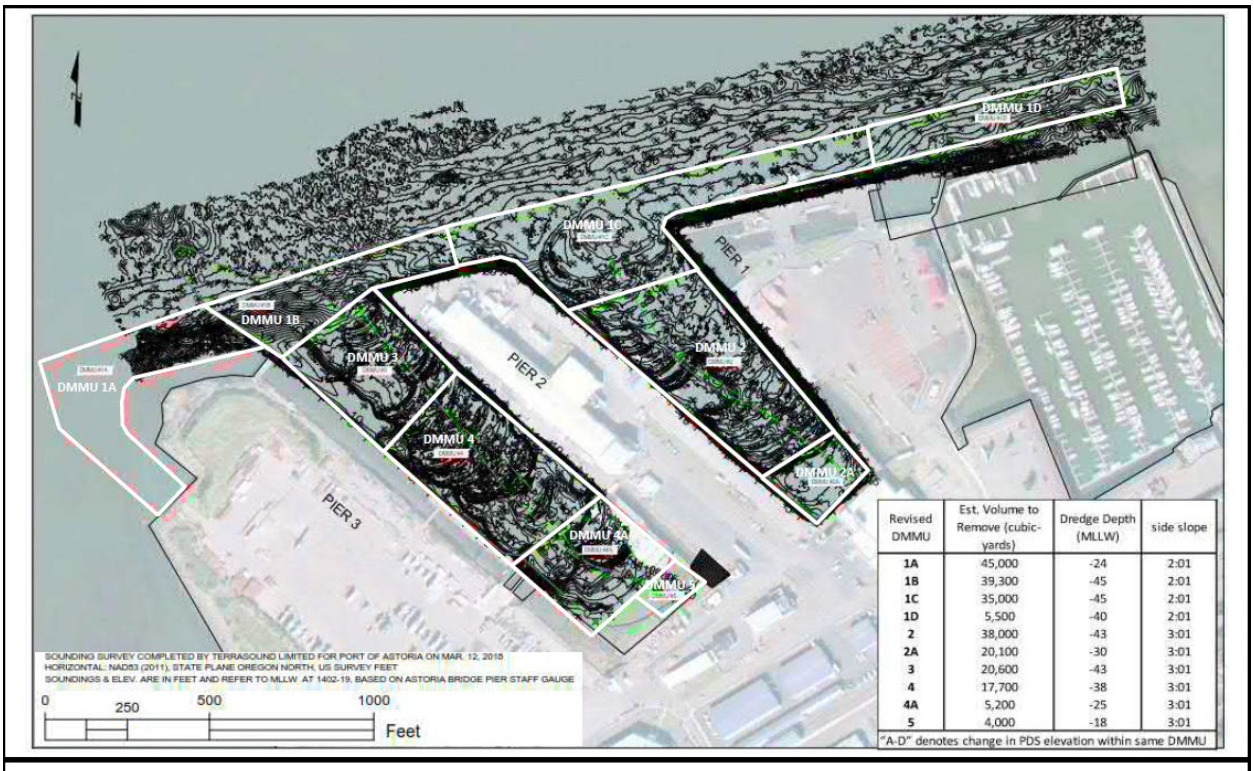

Figure 2. Locations of DMMUs and associated dredging quantities within the Port of Astoria's CWD. Figure courtesy of Campbell Environmental LLC.

The Port proposes to conduct dredging using a combination of clam shell, and hydraulic suction operated from a floating barge. Dredged sediments suitable for in-water disposal will be

discharged from a pipeline into the Columbia River to the designated disposal location adjacent to the navigation channel.

Conservation measures as proposed within the biological assessment submitted by the Port and their consultant Campbell Environmental LLC, have been incorporated into the proposed action to minimize adverse effects to ESA-listed species and their designated critical habitats. These conservation measures include the following:

- All in-water work will occur during the Oregon Department of Fish and Wildlife (ODFW) – preferred in-water work window (IWWW) for the Columbia River estuary (November 1 – February 28), a period when ESA-listed species are less likely to be present within the project action area.
- All construction equipment will access the project site via existing roadways and floating barges.
- All dredged materials and leave surface will be suitable and approved for in-water disposal based on the Sediment Evaluation Framework.
- All dredged sediment will be deposited in the flow lane of the Columbia River, where it will be recruited by the next high flow event and provide aquatic habitat functions.
- Dredge material will be deposited primarily during the ebb tide in the upper half of the water column to promote dispersal and prevent mounding.
- After each 10,000 CY of material placement the end of the discharge pipe will be moved a minimum of 500-600 feet from its previous location. In addition, the location of the discharge pipe shall alternate from one side of the placement area to the other for each move.
- Proposed dredging will not alter the character, slope, or size of the project area.
- Operation of a hydraulic intake below the mudline, and or slow operation of a clam shell or excavator will minimize the potential for entrainments during dredging activities.
- Where feasible, floating silt curtains will be placed around the in-water dredge area to minimize the dispersion of suspended sediment. Pollution Control Plan (PCP) will be prepared by the Contractor and carried out commensurate with the scope of the project that includes best management practices (BMPs) to confine, remove, and dispose of construction waste.
    - Procedures to contain and control a spill of any hazardous material.
    - Best management practices (BMPs) to confine, remove, and dispose of construction waste.
- All conditions of Oregon Department of Environmental Quality's 401 Water Quality Certification will be followed, specifically:
    - Fish protection via in water work timing.
    - Turbidity monitoring, compliance, and reporting.
- All equipment will be inspected daily for fluid leaks, any leaks detected will be repaired before operation is resumed.

We considered whether or not the proposed action would cause any other activities and determined based on USACE's statements that ocean going vessels utilizing the Ports CWD may affect proposed SRKW critical habitat at the mouth of the Columbia River, due to noise, and prey effects. Upon further review it was determined that this activity would not adversely affect

the SRKW proposed habitat (see Section 2.12) and that no other associated activities would also be caused by the proposed action.

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 non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

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 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the 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 designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 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, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion 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 adversely 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 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' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion 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 discusses the function of the essential PBFs that help to form that conservation value.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change 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 Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote et al. 2014, Mote et al 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague et al. 2013, Mote et al. 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou et al. 2014; Kunkel et al. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote et al. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote et al. 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote et al. 2013). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote et al. 2013). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez et al. 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote et al. 2014).

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 (ISAB 2007). Reduced flows will make 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). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier et al. 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also 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 likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier et al. 2008; Wainwright and Weitkamp 2013; Raymondi et al. 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may 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).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote et al. 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7ºC by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011, Reeder et al. 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely et al. 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder et al. 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick et al. 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel et al. 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder et al. 2013).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney et al. 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of the 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 of that habitat throughout the designated areas. 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). Table 2, below, summarizes the general status of critical habitat, range-wide, for each species considered in this analysis.

Physical and Biological Features of Salmon and Steelhead Critical Habitat

The NMFS designated critical habitat for three different groups of salmonids that occupy the LCR, on three different dates. For each designation, NMFS used slightly different descriptions of the physical and biological features (PBFs) of critical habitat. In addition, NMFS identified the essential elements of the PBFs using slightly different terminology. This section presents each of the approaches to terminology used for each of the subsequent designations and attributes those to the specific salmonids covered by each designation. For convenience, many of the PBFs and their essential elements actually overlap from designation to designation.

The NMFS designated critical habitat for several Snake River salmonids on October 25, 1999(64 FR 57399), including Snake River Sockeye and separate Spring/Summer, and Fall-run Snake River Chinook salmon ESUs. Snake River steelhead critical habitat was designated in 2005 and is detailed below. The PBFs of critical habitat for Snake River salmonids are (1) Spawning and juvenile rearing areas; (2) juvenile migration corridors; (3) areas for growth and development to adulthood; and (4) adult migration corridors. The essential elements of the spawning and rearing PBFs are: 1) Spawning gravel; (2) water quality; (3) water quantity; (4) water temperature; (5) food; (6) riparian vegetation; and (7) access. The designation also breaks down the migration corridor for juvenile and adult salmonids as follows: Essential features of the juvenile migration corridors include adequate: (1) Substrate (2) water quality; (3) water quantity; (4) water temperature; (5) water velocity; (6) cover/shelter; (7) food; (8) riparian vegetation; (9) space; and (10) safe passage conditions. The adult migration corridors are the same areas included in juvenile migration corridors. Essential features would include those in the juvenile migration corridors, excluding adequate food.

Subsequently, NMFS designated critical habitat for 10 ESUs and DPSs of Columbia River salmon and steelhead and Snake River steelhead on September 2, 2005 (70 FR 52630), and lower Columbia River coho salmon on February 24, 2016 (81 FR 9252) as shown in Table 2. The PBFs are referred to as Primary Constituent Elements (PCE) in 70 FR 52630 and in 81 FR 9252, and those terms are used interchangeably in this document. Specific PCEs, and the essential features associated with the PCEs for salmonids designated in 2005, and 2016 include:

1. Freshwater spawning sites with water quantity and quality conditions and substrate that support 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 that support juvenile development, and natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;

3. Freshwater migration corridors free of obstruction and excessive predation 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 that support juvenile and adult mobility and survival;

4. Estuarine areas free of obstruction and excessive predation 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, side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation;

5. Nearshore marine areas free of obstruction and excessive predation 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; and

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

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.

Physical and Biological Features of Pacific Eulachon Critical Habitat

The NMFS designated critical habitat for the southern DPS of Pacific eulachon on October 11, 2011 (76 FR 65324). Critical habitat includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). We designated all of these areas as migration and spawning habitat for this species. Specific PBFs, and the essential features associated with the PBFs for Pacific eulachon designated in 2011 include:

1. Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.

2. Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.

3. Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. Eulachon prey on a wide variety of species including crustaceans such as copepods and euphausiids (Hay and McCarter 2000, WDFW and ODFW 2001), unidentified malacostracans (Sturdevant 1999), cumaceans (Smith and Saalfeld 1955), mysids, barnacle larvae, and worm larvae (WDFW and ODFW 2001). These features are essential to conservation because they allow juvenile fish to survive, grow, and reach maturity, and they allow adult fish to survive and return to freshwater systems to spawn.

Physical and Biological Features of Green Sturgeon Critical Habitat

NMFS designated critical habitat for the southern DPS of Green sturgeon on October 09, 2009 (74 FR 52300). Specific PBFs, and the essential features associated with the PBFs for Green sturgeon designated in 2009 include:

1. Freshwater riverine systems which provide food resources, and water quality including depth and flow for embryo, larval and juvenile growth and development. Adult spawning requires appropriate substrate and sediment quality, in addition to migratory corridors free of obstruction.
2. Estuarine areas which provide food resources, migratory corridors, and appropriate water and sediment quality, flow and depth to support growth of juvenile, sub-adult, and sexually mature green sturgeon.
3. Costal marine areas with adequate food resources are necessary for sub-adult and sexually mature green sturgeon growth. These areas also provide migratory corridors with appropriate water quality to spawning streams.

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

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 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 PCEs 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.
Upper Columbia River spring-run Chinook salmon	9/02/05 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 PCEs 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.
Snake River spring/summer-run Chinook salmon	10/25/99 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.
Upper Willamette River Chinook salmon	9/02/05 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 PCEs 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 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.
Snake River fall-run Chinook salmon	10/25/99 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.
Columbia River chum salmon	9/02/05 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 PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 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 PCEs 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.
Snake River sockeye salmon	10/25/99 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 2015b). 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	9/02/05 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 PCEs 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.
Lower Columbia River steelhead	9/02/05 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 PCEs 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.
Upper Willamette River steelhead	9/02/05 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 PCEs 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.
Middle Columbia River steelhead	9/02/05 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 PCEs 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 basin steelhead	9/02/05 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

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		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.
Southern DPS of green sturgeon	10/09/09 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, as listed in Table 1 in USDC (2009). The CHRT 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 Southern DPS 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).
Southern DPS of eulachon	10/20/11 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 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, potentially altering the water temperature during eulachon spawning periods. Numerous chemical contaminants are also present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown. Dredging is a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.

2.2.2 Status of the Species

Table 3, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), and VSP (Viable Salmonid Population).

Table 3. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	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.	• 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 • Contaminant
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	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.	• 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 • Harvest in Columbia River fisheries

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2017a	NWFSC 2015	This ESU comprises 28 extant and four extirpated populations. All expect 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.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011	NWFSC 2015	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 since the 2010 review, 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.	• 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 • Altered population traits due to fisheries and bycatch

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2017b	NWFSC 2015	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.	• 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 • Degraded estuarine and nearshore habitat.
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	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 0. 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.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • 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 strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	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, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years	• 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 strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015	NWFSC 2015	This single population ESU is at very high risk dues 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 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.	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	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.	• 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 • Harvest-related effects

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NWFSC 2015	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.	• 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 strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NWFSC 2015	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.	• 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 • Altered population traits due to interbreeding with hatchery origin fish
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NWFSC 2015	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.	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Snake River basin steelhead	Threatened 1/5/06	NMFS 2017a	NWFSC 2015	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 draft 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.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases
Southern DPS of green sturgeon	Threatened 4/7/06	NMFS 2018	NMFS 2015c	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 Southern DPS 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 Southern DPS green sturgeon prefer marine waters of less than a depth of 110 meters.	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017c	Gustafson et al. 2016	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that these conditions will persist into the near future suggest that population declines may be widespread in the upcoming return years	• Changes in ocean conditions due to climate change, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation

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).

The action area is located within Baker Bay on the Columbia River within the 12 digit, 6th level HUC 170800060500, at river mile 13. Specifically, the action area includes the Ports 31.5 acre CWD, where dredging will occur, and the three flow-lane disposal sites located within the main-stem Columbia River, including 300 feet downstream of these sites were suspended coarse grain sediments (e.g. gravel, and sand) are expected to settle out (Figure 1). Although the action area occurs in the tidally influenced Columbia River, the action area during dredge material disposal only extends downstream 300 ft because dredging disposal will occur exclusively during ebb tides.

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 action area is located in Astoria, Oregon near the confluence of the Columbia River and the Pacific Ocean, and so is influenced by water quality and prey community impacts associated with all upstream uses. Fish habitat in the action area has been adversely affected by a variety of in-water and upland human activities, including habitat losses from all causes (urbanization, roads, diking, etc.), flood control, irrigation dams, pollution, municipal and industrial water use, introduced species, hatchery production (NMFS 2013), and climate change as described in section 2.2 above. The action area is affected by many upriver activities and uses in Columbia River basin watersheds. In general, those conditions have declined in the last 150 years, together influencing conditions in the action area. These multiple watersheds, like the action area, are characterized by loss of connectivity with floodplains and feeding and resting habitat for juvenile salmonids in the form of low-velocity marshland and tidal channel habitats (Bottom *et al.* 2005). Each of the upland conditions influence habitat characteristics in the action area such as water quality and amount and composition of prey base. Water quality throughout the action area is degraded by urban, industrial, and agricultural practices across the basin that contributes multiple pollutants at levels above natural conditions. Habitat degradation has generally reduced the quality, complexity, and amount of this important rearing and migration habitat for salmon and steelhead. Survival through this reach has declined for both juvenile and adult salmonids resulting in reduced population productivity and abundance.

In addition, the environmental baseline includes the impacts from deep-water dredging to maintain the federal navigation channel for large commercial vessel traffic and shallow water dredging to maintain marinas for recreational vessels. Therefore, dredging activities occur across numerous areas and microhabitats within the Lower Columbia River including sloughs area, secondary channels, sloughs, and floodplain wetlands. All of these habitat areas provide rearing space for ESA-listed fish, and all have been degraded by shore-based development and construction and maintenance of boat moorage facilities. Floodplain and off-channel sloughs have been cut off by dikes and flood control levees, limiting potential refuge areas and forage sites for juvenile salmonids. The dredge sediment disposal in the Lower Columbia River has had adverse effects, including displacement of seasonally-flooded wetlands, regular disruption of shallow water benthic prey communities, and most significantly creation of attractive nesting habitat for avian predators feeding on juvenile salmonids (Evans *et al.* 2012; Sebring *et al.* 2013).

The hydrology and hydrograph of the Columbia River is significantly altered from historical conditions, shifting natural cues that salmonids rely on for spawning and outmigration behavior. River flow is less dynamic (Sherwood *et al.* 1990), sediment transport has decreased by as much as 50 percent (Simenstad *et al.* 1992). Other actions such as the depredation and relocation of large colonial nesting waterbird colonies have reduced the numbers of avian predators that prey upon salmonids in the Columbia River estuary that may improve progress in reaching recovery goals by up to 6 percent (NMFS 2011b). Degraded water quality in the action area results from load of increased fine sediments, elevated water temperatures especially during the winter (Weitkamp 1994), and a host of municipal and industrial discharges, permitted or otherwise (LCREP 2007). These conditions are a result of upstream land uses, and operations within the Port, all of which influence the LCR estuary and its recovery potential (Fresh *et al.* 2005).

All ESA-listed Columbia basin salmon and steelhead, in addition to eulachon and green sturgeon may rear and/or migrate through the action area, resulting in effects to individuals of species and rearing and migration critical habitat PBFs. Rearing of juvenile salmonids, and green sturgeon is likely to occur within the CWD, due to its isolation from main stem currents from mooring structures, and shallower waters composed primarily of sand/silt bathos near shorelines. Upstream migration of adult salmoinds and eulachon and downstream migrations of salmonid smolts are likely to occur in the mainstem LCR in proximity to the dredge disposal sites. Thus dredging of the CWD will affect rearing fish and dredging disposal will affect migrating fish. Adult salmonids will move upstream and through the action area within minutes. Juvenile salmonids, depending on the species and age of the fish, may spend hours to months within the action area. Juvenile salmonid foraging primarily occurs in waters less than 25 feet deep, which is a very small proportion of the action area due to historical maintenance dredging of the CWD and Columbia River flow lane to depths greater than 30 feet. Deeper waters and greater flows found in the Columbia River flow land disposal sites will provide a migration corridor.

The baseline also includes the effects of projects that have proceeded subsequent to section 7 consultation. During the last five years, NMFS has engaged in various Section 7 consultations on Federal projects adversely affecting ESA-listed fish and their habitats in and near the action area. These include vicinity (Clatsop County, Oregon; Pacific County, Washington) to the action area (WCR-2019-11648, WCR-2018-10138, WCR-2017-7450, WCR-2017-6622, WCR-2016-5516),

including the effects of actions addressed in programmatic consultations (the SLOPES IV programmatic consultation; NMFS number WCR-2011-05585). In general, those actions caused temporary, construction-related effects (increased noise and turbidity), and longer term effects like increasing overwater coverage. Longer term effects that remain part of the baseline now include hindering quality of downstream migration and reduced benthic production of forage items.

All actions processed under the SLOPES IV programmatic consultation also include minimization measures to reduce or avoid both short- and long-term effects in the environment. These include requiring grated and translucent materials to allow light penetration, pile caps to prevent piscivorous bird perching, and limits on square footage of new overwater coverage. While some adverse effects of actions implemented under SLOPES IV can reduce fitness and survival in a small number of individuals, the minimization measures reduce the overall contribution to habitat degradation at large. So the overall effects of these actions do contribute to the present environmental baseline and the effects of existing structures (e.g. increased shading, reduction in prey, increased predation, and possible minor migration delays) are considered in this consultation.

Despite degraded habitat conditions ESA-listed species migrate through and rear in the action area. Numerous early life history strategies of CR salmonids have been lost as a result of past management actions discussed under the environmental baseline (Bottom *et al.* 2005). Salmonids in the action area will generally exhibit either a stream-maturing or ocean-maturing life history type. A stream-type life history is exemplified by juvenile salmon and steelhead that typically rear in upstream tributary habitats for over a year. Salmonids exhibiting this life history include LCR Chinook salmon (spring runs), LCR steelhead, LCR coho salmon, MCR steelhead, UWR steelhead, UWR Chinook salmon, SR spring/summer Chinook salmon, UCR Chinook salmon, SR steelhead, SR sockeye, and UCR steelhead. These juvenile fish will migrate through the action area as smolts, approximately 100 to 200 mm in size, move quickly downstream, and pass by the action area within one to two days (Dawley *et al*. 1986). An ocean-type life history is exemplified by juvenile salmon that move out of spawning streams and migrate towards the LCR estuary as sub-yearlings and are actively rearing within the LCR estuary. Fish that exhibit these life histories include LCR Chinook salmon (fall runs), CR chum salmon, and SR fall-run Chinook salmon. These fish are generally smaller in size (less than 100 mm) and more likely to spend days to weeks residing in tidal freshwater habitats characterized by the action area, with peak abundances occurring March through May (Hering *et al.* 2010; McNatt *et al.* 2016).

In addition to variations in outmigration timing, juvenile ESA-listed species also have a wide horizontal and vertical distribution in the CR related to size and life history stage. Generally speaking, juvenile salmonids will occupy the action area across the width of the river, and to average depths of up to 35 feet (Carter *et al.* 2009). Smaller-sized fish use the shallow inshore habitats and larger fish will use the channel margins and main channel. The pattern of use generally shifts between day and night. Juvenile salmon occupy different locations within the CR, and are typically in shallower water during the day, avoiding predation by larger fish that are more likely to be in deeper water. These juveniles will venture into the deeper areas of the river away from the shoreline, towards the navigation channel and along the bathymetric break – or channel margin – and will be closer to the bottom of the channel (Carter *et al.* 2009). The smaller

sub-yearling salmonids will likely congregate along the nearshore areas in shallow water and extend into the channel margins (Bottom *et al.* 2011). Yet, as Carlson *et al.* (2001) indicated, there is higher use of the channel margins than previously thought and considering the parameters above, relative juvenile position in the water column suggests higher potential sub-yearling use in areas of 20 to 30 feet deep.

Pacific eulachon are tributary spawners within the lower Columbia River, and utilize the main-stem Columbia River for adult migration, and drift of eggs and larvae to the estuary. Migration of adults into the Columbia River and its tributaries occurs from December through May, with peak abundances and spawning during February and March over sandy substrates in LCR tributaries. Eggs and larvae are present from February until early June, as they drift in currents downstream to the Columbia River estuary.

Green sturgeon utilize the action area during the summer and early fall months (Moser and Lindley 2007; Moser *et al.* 2016) and may be present within the action area early in the IWWW (November). Commercial catches of green sturgeon peak in October in the Columbia River estuary, and records from other estuarine fisheries (Willapa Bay and Grays Harbor, Washington) support the conclusion that sturgeon are present in these estuaries from June until October (Moser and Lindley 2007).

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 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

Effects of the proposed action are reasonably certain to include: 1) annual temporary, localized reduction in water quality; 2) annual temporary, localized reduction in available prey; and 3) annual, temporary, localized obstruction to safe passage. These changes in the environment will affect PBFs of critical habitat, and the species that are preset when these effects occur.

2.5.1 Effects on Critical Habitat

The proposed action will affect designated critical habitat for LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, UWR spring-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SR steelhead, UWR steelhead, green sturgeon, eulachon, and SRKW. Given the location of the proposed action and life history expression, all of the species considered in these opinions use this area for migration and rearing, with the exception of SRKW that use the area for migration, resting and predominantly foraging on Columbia River Chinook salmon.

The magnitude of these effects will vary spatially and by, species, and life stage, and are discussed by general species in turn below.

Salmonid Critical Habitat

The action area includes the PBFs for freshwater rearing and migration corridor for all salmonids considered in this opinion. The essential elements of freshwater rearing sites with substrate, water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, water quality and forage that support juvenile development, and natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

The essential features of freshwater migration corridors are freedom of obstruction and excessive predation 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 which support foraging, mobility and survival.

These two conservation roles that are served by the action area share many of the same essential features. The essential features in the action area affected by the proposed action would include: water quality, substrate, forage, and a corridor free of obstruction and predation.

The proposed action will have temporary effects to migration corridors and water quality (due to turbidity) within the Columbia River, including that it will temporarily obstruct or decrease safe passage, in a small area immediately around the suction dredge, clamshell bucket, and disposal pipeline during the November 1 to February 28 IWWW. Passage conditions will be made less safe by elevated turbidity, and a risk of entrainment (juveniles only). The majority of turbidity produced by the suction dredge is expected to remain localized within the 31.5-acre CWD, and in proximity to the active suction dredge due to the CWD being isolated from main-stem flows. Due to the coarseness of the predominant sediments (gravels and sands) being suspended by the dredge and disposal pipeline they are expected to settle out rapidly (within minutes), and in close proximity (several feet) to their source location. Any finer sediments (silts and clays) that happen to be suspended by the suction dredge and disposal pipeline will settle out slower (within an hour). Although the sediments responsible for increased turbidity produced by the suction dredge, and disposal pipeline are expected to settle out quickly, dredging is proposed to occur daily for four months. Due to the relative isolation of the CWD from the main-stem Columbia River, turbidity generated by suction dredge is only expected to enter the main-stem when suction dredging is occurring in close proximity to the ingress and egress channels, where water flow velocities are greatest during ebb tidal cycles.

The proposed action will temporarily reduce food availability in a limited area within the CWD, but available forage from littoral sources in the immediate area outside of the CWD will remain plentiful. Benthic invertebrates provide the primary food source for these juvenile salmonids – dominated by families of midges (Johnson *et al*. 2011). The aquatic invertebrates occupy the upper surface of the river bottom with a life cycle of many weeks to months before emerging into the water column. The proposed dredging operation will disturb benthic habitat and reduce

benthic productivity. The level and nature of the disturbance is not unlike natural processes that continually move river bottom sediments, burying or eroding benthic habitat. Recolonization of the benthic habitat by invertebrates is generally rapid – within weeks to months (McCabe *et al.* 1998), but is dependent upon the frequency of the dredging disturbance. Because dredging will not occur on the same location within the CWD more than once annually, reducing the frequency of the disturbance should allow for more rapid recolonization (weeks) by benthic invertebrates. Loss of forage will occur where the frequency and duration of the dredging delays natural recolonization.

We do not expect reduced food availability to juvenile salmonids to occur as a result of disposal of dredged sediments. The sediment disposal sites are outside the littoral area, and the community of benthic invertebrates are more evolved to handle natural disturbance regimes of faster flows and dynamic coarse grain sediment redistribution. Juvenile salmonids are likely not rearing in these locations due to a lack of habitat complexity (no wood or current breaks), and the benthic invertebrates occupying sediment disposal sites will likely be much larger and rearing juveniles will be gape limited in foraging on them. Adult salmonids do not forage when in freshwater.

Eulachon Critical Habitat

The action area includes eulachon PBFs for migration corridors, spawning and egg/larval development.

The proposed action will not have any permeant effects to adult migration corridors within the Columbia River, but will temporarily obstruct or decrease safe passage, in a small area immediately around the suction dredge, clamshell bucket, and disposal pipeline during the November 1 to February 28 IWWW due to elevated turbidity, and a risk of entrainment (eggs/larvae only). Additionally, the proposed action will not alter spawning substrate that eulachon rely because adult eulachon don't spawn in this section of the LCR as they typically favor large tributaries (i.e., Sandy River, Washougal River).

Green Sturgeon Critical Habitat

The action area includes the PBFs of estuary migratory corridors and prey base for green sturgeon, and the effects of the proposed action on green sturgeon critical habitat are similar to those described above for juvenile salmonids critical habitat PBFs. Both estuary migratory corridors and prey base are categorized as low-level threats to the southern DPS of green sturgeon critical habitat (NMFS 2018).

2.5.2 Species Effects

Effects of the action on species is based on individual fish exposure to the habitat changes described above, or effects occurring to the fish themselves. In this case, fifteen ESA-listed fish species of the upper and lower Columbia basins occupy the action area and they will be exposed to the habitat effects of the action, as well as direct exposure to the dredging equipment.

The potential effects anticipated to ESA-listed fish species exposed in the action area are associated with the habitat effects described above (i.e., short-term alterations in water quality from the action, short-term changes in benthic forage), and temporary obstruction of safe passage due to entrainment of fish by the dredge equipment. The level of exposure varies by timing and location of activity when different densities and life history stages of the ESA-listed fish will be present. The magnitude of exposure experienced by ESA-listed fish species is directly related to the amount of time the dredge is actively removing material from the benthos, as approximated by days of operation per year. In this case, dredging will occur for up to 120 days per year over a 10-year period.

Exposure of adult and juvenile fish will increase with greater duration and frequency of dredging. The greatest exposure for juvenile salmonids and green sturgeon to water quality, forage, and entrainment effects will occur during dredging activities with the CWD in water depths typically less than -25 feet where sub-yearling salmonids (fall Chinook, and LCR chum salmon) tend to rear and forage. Adult salmonids, and eulachon, as well as smolting stream-type salmonids (spring Chinook salmon, coho salmon, sockeye salmon and steelhead), will have the greatest risk of exposure to short-term water quality alterations while migrating though the dredge disposal sites, these fish will likely not be exposed to the dredging effects described for rearing fish above as the Port's CWD is mostly enclosed by an ingress and egress channels. This would likely preclude most, but certainly not all, fish from entering the area where the majority of dredging will occur.

Salmonid Exposure and Effects

Adult salmonids. Though peak migratory periods vary by species, some adult Columbia River salmonids are reasonably certain to be present in the action area during the IWWW, and are therefore will be exposed to the effects of the action. Adult Chinook salmon presence in the action area is most likely from late spring through the fall. Adult coho salmon presence is most likely in late summer through early winter. Adult chum salmon primarily occur during the fall. Adult sockeye salmon presence will most likely range from late spring to late summer. Adult steelhead presence will most likely range from early summer to early fall (from passage data at Bonneville Dam 10-year average, http://www.cbr.washington.edu/dart/adult_hrt.html). Based on the broad run timing of these species, and the proposed work period of November 1 - February 28, exposure is extremely unlikely for adult SR sockeye salmon. All other Columbia River species of adult salmonids have at least some exposure to the effects of the proposed action, but peak times of presence for most adults do not correspond fully with the IWWW.

Exposure and Response to Dredging Equipment Operation: Although adult Chinook salmon, coho salmon, chum salmon and steelhead will be present in the action area during the proposed action, only a few adult fish will experience adverse effects from the proposed action due to: (1) the limited footprint dredging disposal pipeline relative to the size of the Columbia River estuary (limiting probability of exposure to individual fish); (2) the isolation of the dredging sites within the enclosed CWD from the main-stem Columbia River; (3) the intermittent nature of the action; and (4) the migratory and avoidance behaviors inherent to adult salmon and steelhead.

Exposure to the habitat disruptions and the suction dredge are likely to be limited because of the size of the migration corridor in this area. The Lower Columbia River estuary is a massive body of water that presents no current migratory obstacles beyond high water temperatures that can occur during late summer (outside of the proposed work period); thus, migrating adult salmon are typically widely dispersed in the estuary. The action area is less than one percent of the total area of the Columbia River estuary, with sufficient space (3.5 miles) to the north of the dredging disposal location for adult fish to safely pass. Further, the port's narrow access channel would prevent most adult fish from entering the CWD dredge area. In the unlikely event these adult fish enter the CWD they are not likely to come within proximity of the dredge operation, due to their strong swimming ability. Adult salmonids are able to avoid the suction dredge intake with no likelihood of entrainment. These conditions, coupled with the adult run-timing previously discussed, result with few adult salmon, of any species, being exposed to dredging equipment operations. Operation of equipment used for disposal of the dredged material has minimal risk to adult salmonids because of their strong swimming ability which allows for avoidance of entrainment and turbidity plumes (see below) generated by the dredging operation during their upstream migrations, we anticipate adult salmonids will pass through the action area without experiencing adverse effects.

Exposure and Response to Turbid Conditions: Given that adult salmonid migration rates range up to a few miles per hour (Matter and Sandford, 2003), we expect adult ESA-listed salmonids that do encounter the turbidity associated dredge or dredge material disposal operations, to be moving upstream at such a rate as to limit exposure to a matter of minutes. Studies show that salmonids are able to detect and distinguish turbidity and other water quality gradients (Bisson and Bilby 1982), and that larger salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens 1991, 1992). As salmonids grow and their swimming ability increases, their dependence on shallow nearshore habitat declines rapidly (Groot and Margolis 1991). Adult salmonids will typically be in the main river channel at depths of 10 to 20 feet below the water surface and off the bottom (Johnson *et al.* 2005). Larger adult salmon readily respond by avoiding waters affected by suspended sediment to find refuge and/or passage conditions within unaffected adjacent areas. Thus, to the extent that any adults are exposed to turbidity generated by project activities, they are expected to respond by avoiding excessively turbid conditions and find passage within unaffected adjacent areas. Specifically, we do not expect these fish to move into the confined CWD space where dredging will occur. These fish may experience some turbidity near the entrance of the CWD or within 300 ft. of the sediment discharge pipe located within the main-stem Columbia River where sediments are actively settling out. In both cases, we anticipate adult salmonids will pass through the action area without experiencing adverse effects due to the brevity of exposure.

Juvenile salmonids. Dredging around the ports slips and piers in fall through mid-winter will occur when juvenile salmonids are present, but at very low density (Roegner *et al.* 2012), and at depths ranging from approximately -18' to -45' MLLW. These depths are deeper than juveniles preferred rearing and migratory habitats. Removal of dredged material will temporarily and minimally alter the river bed, yet would be within the normal range of seasonal changes to the river bed from typical bed load transport. The level of exposure juvenile salmonids will have to the effects of the action will vary and depend on species and life history, along with the location,

timing, and depth of the activities. Among those exposed, specific species will be more vulnerable due to their age/size when they experiencing the effects of the action.

Juvenile ESA-listed species migrate in the vicinity of and may rear in the action area at different time periods. Juvenile salmonids are present in the action area year round, peaking during one or two periods from late winter (March) through summer, with lesser presence in the fall, and early winter. Juvenile Chinook salmon and sockeye salmon are present year round; primary timing ranges from spring to early fall, although sub-yearlings presence extends later in the fall. Juvenile chum salmon are present from winter to spring. Juvenile coho salmon are present year-round with primary timing from spring to mid-summer. Juvenile steelhead are present year-round with a primary timing range of spring to mid-summer.

Juvenile ESA-listed species migrate through the action area at different rates depending on species and life history. Numerous early life history strategies of Columbia River salmonids have been lost as a result of past management actions discussed under the environmental baseline (Bottom *et al.* 2005). Today, salmonids expected in the action area will generally exhibit either a stream-maturing or ocean-maturing life history type. Stream type juvenile salmon and steelhead typically rear in upstream tributary habitats for over a year. These include LCR Chinook salmon (spring runs), LCR steelhead, LCR coho salmon, MCR steelhead, UWR steelhead, UWR spring run Chinook salmon, SR spring/summer Chinook salmon, UCR Chinook salmon, SR steelhead, SR sockeye, and UCR steelhead. These fish will migrate through the action area as smolts. These juveniles tend to be 100 to 200 mm in size, move quickly downstream, and will be through the action area within 1 - 2 days. Ocean-type juvenile salmon tend to move out of spawning streams and migrate towards the lower Columbia River estuary as subyearlings and are actively rearing within the Lower Columbia River. These include LCR Chinook salmon (fall runs), CR Chum salmon, and SR fall-run Chinook salmon. These fish are smaller in size (less than 100 mm) and more likely to spend days to weeks in the action area foraging (Carter *et al*. 2009).

Juvenile ESA-listed species have a wide horizontal and vertical distribution related to size and life history stage. Generally speaking, juvenile salmonids will occupy the action area, as well as across the width of the river, and to average depths of up to 35 feet (Carter *et al*. 2009). Smaller-sized fish use the shallow nearshore and shoreline habitats and larger fish will use the channel margins and main channel. The pattern of use generally shifts between day and night. Juvenile salmon occupy different locations within the Columbia River, and are typically in shallower water during the day, and may avoid predation by larger fish that are more likely to be in deeper water. Apparently these younger fish will venture into the deeper areas of the river away from the shoreline, moving towards the navigation channel and along the bathymetric break – or channel margin – and will be closer to the bottom of the channel. Carlson *et al.* (2001) notes there is a higher percentage of use along the channel margins than either the shallow nearshore or channel, which indicates potential underestimates for nearshore sub-yearlings. Juvenile salmon position in open water tends to be about 3 meters below the surface (Carter *et al*. 2009), a minimum of 2 meters off of the bottom in shallow areas, 3 to 10 meters off the bottom on the channel margins, and 5 to 15 meters off the bottom in the main channel (Carlson 2001) with sub-yearlings being closer to the bottom than older 1+ year-old fish (Carter *et al*. 2009). The smaller sub-yearling salmonids will likely congregate along the nearshore areas in shallow water and extend into the channel margins (Bottom *et al.* 2011). Yet, as Carlson *et al*. (2001) indicated,

there is higher use of the channel margins than previously thought and considering the parameters above, relative juvenile position in the water column suggests higher potential sub-yearling use in areas of 20 to 30 feet deep.

Exposure and Response to Equipment Operation: Sub-yearling salmonids including LCR Chinook salmon, CR chum salmon, and to a limited extent SR fall Chinook salmon in the action area are more likely to be displaced and entrained by dredging equipment due to their smaller size (<100mm), and inferior swimming ability. The IWWW for dredging has been established when the density of sub-yearlings will be lowest, thus limiting exposure probability. At low densities (number of fish per unit area), the probability of a sub-yearling occupying the same area in which the suction dredge operating, is extremely low, as the suction dredge is highly localized to the area in which the suction head is operating (<1 cubic meter). However, any sub-yearlings that happen to encounter the suction head and are within 1-meter above the substrate actively being dredged will be subject to an increased likelihood of entrainment, and elevated turbidity (see below) leading to injury or death. In the shallower waters, sub-yearlings are closer to the bottom and are less able to escape entrainment flows. Larger, juvenile smolts (>100mm), that are actively migrating within the mainstem Columbia River, and like adult salmonids are not likely to enter the enclosed CWD during their migration. However in the event that a smolt does enter the CWD their increased swimming abilities, allow for a similar avoidance response to dredging disturbance as adults, which will further minimize but not completely eliminate entrainment and subsequent injury or death of these fish.

Exposure and Response to Turbid Conditions: The effects of suspended sediment and turbidity on fish range from beneficial to detrimental. Elevated total suspended solids (TSS) have been reported to enhance cover conditions, reduce piscivorous fish/bird predation rates, and improve survival, although elevated TSS have also been reported to cause physiological stress, reduce growth, and adversely affect survival (Newcombe and Jensen 1996). Fish may experience a reduction in predation from piscivorous fish and birds by occupying turbid waters (Gregory and Levings 1998), but chronic exposure to these conditions can cause physiological stress responses that can increase maintenance energy needs and reduce feeding and growth (Lloyd *et al.* 1987; Redding *et al.* 1987; Servizi and Martens 1991). Juvenile salmonids tend to avoid streams that are chronically turbid, such as glacial streams or those disturbed by human activities, unless the fish traverse these streams along migration routes (Lloyd *et al.* 1987). Depending on the concentrations of suspended solids and the food supply, juvenile fish will either seek refuge in adjacent areas with less turbidity, or remain in the area, taking advantage of additional cover provided by the turbid water. Death or injury to ESA-listed salmonids directly from an increase in turbidity within the CWD and the disposal pipeline is not likely. Given the small area of river affected and the low densities of ESA-listed juvenile salmonids likely to be present and exposed to elevated turbidity, only a few ESA-listed fish in the action area are likely to experience any of the beneficial or the adverse effects caused by suspended solids as described above.

Exposure and Response to Reduced Benthic Prey: Sub-yearling salmonids in the action area are also likely to be exposed to a slight reduction in forage, described above in the effects on Critical Habitat. Sub-yearlings are actively feeding as they move downstream. Benthic invertebrates provide the primary food source for these fish – dominated by families of midges (Johnson *et al*. 2011). Loss of forage will occur where frequency and duration of the dredging delays natural

recolonization, as dredging operations will disturb benthic habitat and reduce benthic productivity temporarily. Because disturbance to the benthos will be localized and infrequent recolonization of the benthic habitat is relatively rapid – within weeks to months (McCabe *et al*. 1998), and prey availability nearby undisturbed sites will remain unaffected, we expect fish to not have noticeably diminished growth or fitness. The limited and localized loss of prey is not likely to reduce available forage for rearing salmonids in sufficient degree to have an impact on juvenile fish survival. However, juvenile salmonids in the Columbia River estuary primarily feed visually on small invertebrates (i.e., *Dipterans*, *Psychosidadae*, and *Corophium*) (Roegner *et al.* 2004), so their ability to effectively feed will decline with elevated turbidity. This will likely reduce growth, lipid stores, and ultimately fitness and survival in a small number of sub-yearling juvenile fish, which are more likely to be rearing within the CWD.

Summary of Salmonid Response to Effects

When adults and juveniles are considered together, it remains likely that some individual fish will encounter the dredge within their migration corridor, and of these most should not alter their pathway or delay their rate of migration. Adult fish are intent on moving upstream and a small deviation from the migration path will not significantly change overall distribution or risk of predation. Migrating juvenile salmonids will largely avoid the dredging and can move in and out of the turbidity plume. This level of avoidance will be minor and within the normal migration patterns, and thus not likely to increase the risk of predation or otherwise harm these fish, especially adults.

Adult salmonids will easily escape entrainment flows. However, sub-yearling salmonids are less able to escape entrainment and are subject to a wider zone of potential entrainment due to less swimming stamina and speed. Dredging in channel margins and shallows where sub-yearling salmonids congregate is likely to entrain sub-yearlings. The zone of potential entrainment extends one meter from the suction dredge. A few sub-yearling salmonids, including fall LCR Chinook salmon, SR fall Chinook salmon, and CR chum salmon are reasonably certain to be injured or killed over for the 10-year duration of the permit. We cannot quantify the number of sub-yearling salmonids that will be killed from entrainment but expect the numbers to be low based on BMPs that restrict the suction dredge being operated within the water column. However, because the number of sub-yearling salmonids killed or injured will be minimal, entrainment will not meaningfully decrease the abundance or productivity of any of the populations considered in this opinion.

Salmonid foraging in the action area occurs exclusively among juveniles. Few if any individual fish will experience a reduction of food or foraging opportunities due to elevated TSS. Benthic habitat disturbance will be of limited extent, and temporary in nature. However, because the action is essentially repetitive annually and will occur in shallow water preferred by juvenile salmonids, we expect the forage base to be slightly diminished within the action area relative to unaffected adjacent shallow water habitats. The availability of alternative feeding areas and upstream food sources is plentiful so that the cohort of fish present during and for several weeks after the action occurs will not be adversely affected.

Green Sturgeon and Eulachon Exposure and Effects

Green Sturgeon. Few, if any, green sturgeon are likely to be present within the action area during the period in which the action is proposed because they are not known to use the estuary habitat for rearing except during the summer and early fall months (Moser and Lindley 2007) As cited by these authors, commercial catches of green sturgeon peak in October in the Columbia River estuary, and records from other estuarine fisheries (Willapa Bay and Grays Harbor, Washington) support the idea that sturgeon are only present in these estuaries from June until October. However, comprehensive fishery sampling has not been conducted year-round in the Columbia River estuary, and some overlap with sub-adult green sturgeon presence with the proposed dredge timing is therefore possible. In the event that green sturgeon are present during dredging actions in the action area, they are likely to be larger sub-adults that are extremely unlikely to be present within the mostly enclosed CWD. Further, even those that may be present will easily able to avoid the dredge head without adverse effects from entrainment. Notwithstanding, unpublished photographic evidence of sub-adult sturgeon entrainments from dredging operations elsewhere along the West Coast (maintained on file at NMFS) supports the possibility that green sturgeon could become entrained, as does other published and contractual reports (Buell 1992). Thus, the potential entrainment of green sturgeon by dredging cannot be discounted, even though their co-occurrence within the CWD where dredging will occur is extremely unlikely.

Green sturgeon, if present in the main-stem Columbia River, may encounter the turbid conditions created by the proposed action. Green sturgeon are typically found in turbid conditions and forage in the benthos by stirring up the sediment to access benthic prey such as burrowing shrimp and are thus relatively tolerant of higher suspended sediment concentrations. As such, in the unlikely event that individual green sturgeon are present to encounter turbidity and elevated total suspended solids related the project, effects on green sturgeon are not expected to rise to the level of take. This conclusion is supported further by recent results in the closely related Atlantic sturgeon, wherein juveniles were experimentally exposed to 100, 250 or 500 mg/L TSS for three consecutive days and found to exhibit no significant effects on survival or swimming performance even while prevented from seeking cleaner waters in the tests (Wilkens *et al.* 2015).

Eulachon. Adult eulachon may be exposed to the effects of the dredging during their annual winter spawning migration through the action area, but the peak of their migration occurs during the latter portion of the IWWW and after (February- March). Migrating adult eulachon will respond similarly to the turbidity as adult salmonids (discussed above), as few individual fish will encounter the dredge within their migration corridor, and of these most will not alter their pathway or delay their rate of migration. The vast majority of eulachon spawning takes place in Washington State tributaries, including the Cowlitz, Elochoman, Kalama, and others. Spawning takes place atop sand and fine gravel substrates to which the eggs adhere and mature, often being transported downstream through this maturation process through sediment transport processes that occur along the riverine corridor. Once eggs are hatched, typically after about 30 days, the larvae disperse throughout the water column and are widely distributed as they drift downstream passively. The proposed work window for this project ends in late February, prior to the peak of eulachon larval outmigration (which occurs from April through June). Thus, outmigration

timing, along with the partially enclosed CWD, significantly reduces the potential of eulachon eggs and larvae to be present in the action area during the dredging and disposal activities.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state 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 and 402.17(a)). 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.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

For this action, state or private activities in the vicinity of the project location are expected to cause cumulative effects in the action area. Additionally, future state and private activities in upstream areas are expected to cause habitat and water quality changes that are expressed as cumulative effects in the action area. Our analysis considers: (1) how future activities in the Columbia River basin are likely to influence habitat conditions in the action area; and (2) cumulative effects caused by specific future activities in the vicinity of the project location.

Approximately 6 million people live in the Columbia River basin, concentrated largely in urban centers. The effect of that population is expressed as changes to physical habitat and loadings of pollutants contributed to the Columbia River. These changes were caused by residential, commercial, industrial, agricultural, and other land uses for economic development, and are described in the Environmental Baseline (Section 2.3). The collective effects of these activities tend to be expressed most strongly in lower river systems where the impacts of numerous upstream land management actions aggregate to influence natural habitat processes and water quality. As such, these effects accrue within this action area, though most are generated from actions upstream of the action area. As human population grows, the range of effects described here are likely to intensify.

Resource-based industries (*e.g*., agriculture, hydropower facilities, timber harvest, fishing, and metals and gravel mining) caused many long-lasting environmental changes that harmed ESA-listed species and their critical habitats, such as basin-wide loss or degradation of stream channel morphology, spawning substrates, instream roughness and cover, estuarine rearing habitats, wetlands, floodplains, riparian areas, water quality (*e.g.*, temperature, sediment, dissolved oxygen, contaminants), fish passage, and habitat refugia. Those changes reduced the ability of populations of ESA-listed species to sustain themselves in the natural environment by altering or interfering with their behavior in ways that reduce their survival throughout their life cycle. The environmental changes also reduced the quality and function of critical habitat PBFs that are necessary for successful spawning, production of offspring, and migratory access necessary for

adult fish to swim upstream to reach spawning areas and for juvenile fish to proceed downstream and reach the ocean. Without those features, the species cannot successfully spawn and produce offspring.

While widespread degradation of aquatic habitat associated with intense natural resource extraction is no longer common, ongoing and future land management actions are likely to continue to have a depressive effect on aquatic habitat quality in the Columbia River basin and within the action area. As a result, recovery of aquatic habitat is likely to be slow in most areas and cumulative effects from basin-wide activities are likely to have a slightly negative impact on population abundance trends and the quality of critical habitat PBFs into the future.

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.

Most of the component populations of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, UWR spring-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SR steelhead, UWR steelhead, southern green sturgeon, Pacific eulachon, and SRKW are at a low level of persistence, or, at risk of extinction. Individuals from all ESA listed populations are likely to move through or utilize the action area at some point during their life history.

Factoring the current environmental baseline, fish from the component populations that move through and/or use the action area encounter habitat conditions that have been degraded by restricted natural flows, reduced water quality from substantial chemical pollution, loss of functioning floodplains and secondary channels, and loss of vegetated riparian areas and associated shoreline cover. The significance of the degradation is reflected in the limiting factors identified above including habitat access to floodplain and secondary channels, degraded habitat, loss of spawning and rearing space, pollution, juvenile fish stranding, and increased predation, highlighting the importance of protecting current functioning habitat and limiting water quality degradation, minimizing entrainment, and reducing potential predation of ESA-listed fish.

Within this context, the proposed action will create an annual four-month physical disturbance in the water column, and redistribute material from the bottom of the Columbia River. The modified bathymetry within the CWD will be maintained for the duration of the 10-year permit. These habitat alterations will cause displacement of a small number of adult and juvenile fish, as they avoid the dredging operation (entrainment and elevated turbidity), plus a short-term (*weeks* -

month) period in which fish have reduced prey as the benthic biological productivity is reduced, and then re-establishes, in the vicinity of the dredge prism. These alterations will occur each year of the 10-year permit, during the 120-day work window. Finally, entrainment of a few juvenile salmonids is reasonably certain to occur.

The last element in the integration of effects includes a consideration of the cumulative effects anticipated in the action area. Primarily, the recovery of aquatic habitat from the degraded baseline conditions is likely to be slow in most of the action area, and cumulative effects (from continued or increasing uses of the action area) are likely to have a negative impact on habitat conditions, which in turn may cause slight negative pressure on population abundance trends in the future.

However, even when we consider the current status of the threatened and endangered fish populations and degraded environmental baseline within the action area, the proposed action itself is not expected to affect abundance, distribution, diversity, or productivity of any of the component populations of the ESA-listed species, nor further degrade baseline conditions or limiting factors. The effects of the action will be too minor to have a measurable impact on the affected populations. Because the proposed action will not reduce the abundance, productivity, spatial structure, or diversity the affected populations, the action, when combined with a degraded environmental baseline and additional pressure from cumulative effects, will not appreciably reduce the survival or recovery any of the listed species considered in this opinion.

In the context of the status of designated critical habitat and the specific baseline conditions of PBFs in the action area, the proposed action will not obstruct the passage of migrating fish, reduce cover, remove riparian vegetation, alter flows, destabilize the channel or change its characteristics, alter water temperature, or substantially reduce available forage. However, the proposed action will temporarily effect safe migration corridors, forage, and water qualify PBFs within the action area. When considering the cumulative effects of non-federal actions, recovery of aquatic habitat is likely to be slow in most of the action area and cumulative effects from basin-wide activities are likely to have a slightly negative impact on the quality of critical habitat PBFs.

As a whole, the critical habitat for migration and rearing is functioning moderately under the current environmental baseline in the action area. Given that the proposed action will have low-level and periodic but largely temporary effects on the PBFs for migration and rearing for salmonids and estuarine areas for eulachon and green sturgeon, even when considered as an addition to the baseline conditions, the proposed action is not likely to appreciably diminish the value of designated critical habitat for the conservation of subject species of this consultation.

In summary, ESA listed salmon and steelhead, eulachon, and green sturgeon occupying the action area will be exposed to suspended sediment that originates from the suction dredge and a reduction in benthic prey availability. Dredging-caused entrainment, turbidity, and loss of benthic prey are of limited duration, and we expect BMPs to lower intensity. NMFS analysis did not identify entrainment, turbidity or reduced prey availability effects with intensities or durations that would result in a reduction of the conservation value of designated critical habitats or reductions in abundance and productivity of exposed populations, thus the survival and

recovery of ESA listed species are also not reduced. As such, the proposed action will not reduce the survival or recovery of ESA-listed species within the Columbia River.

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, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, UWR spring-run Chinook salmon, SR fall-run Chinook salmon, CR chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SR steelhead, UWR steelhead, southern DPS of green sturgeon, or southern DPS of eulachon or destroy or adversely modify its designated critical habitat. The USACE can confirm this conclusion if the affected area is included in the final designation.

2.9 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

NMFS has not yet promulgated an ESA section 4(d) rule prohibiting take of threatened eulachon. Therefore to the extent this ITS contains RPMs and terms and conditions that address requirements other than monitoring, those are voluntary until any future 4(d) rule goes into effect However, our jeopardy analysis is based on anticipated levels of eulachon incidental take and so we have included a take indicator for eulachon that will function as a reinitiation check on that jeopardy conclusion. Monitoring requirements related to the take indicator go into effect immediately so that there is a way to know if the reinitiation trigger has been exceeded [50 CFR 402.14(i)(3)].

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

The proposed dredging will take place when juvenile and/or adult individuals of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, UWR Chinook salmon, Columbia River chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SR steelhead, UWR steelhead and eulachon are reasonably certain (or conservatively assumed—green sturgeon) to be present.

Incidental take caused by the adverse effects of the proposed action will include injury or death of a small number of ESA-listed fish due to entrainment during suction dredging, and behavioral avoidance response effects due to a temporary localized increased turbidity during dredging and disposal. Take by these mechanisms will affect juvenile ESA-listed salmon and steelhead (entrainment, turbidity, and forage), sub-adult green sturgeon (forage) and Pacific eulachon (egg/larvae entrainment, all life stages turbidity).

Due to the overall nature of the proposed action, a definitive number of ESA-listed fish that will be killed, injured or otherwise adversely affected cannot be determined and/or adequately detected. Instead NMFS will use a habitat-based surrogate to account for the amount of take, which is called an "extent" of take. For this proposed action, the potential for entrainment, being exposed to elevated turbidity and reductions in forage for juvenile salmonids, sub-adult green sturgeon, and eggs/larvae of Pacific eulachon is directly related to the amount of time that the suction dredge is operating. Since the potential for ESA listed fish to be entrained, exposed to elevated turbidity, and experience reduced foraging opportunities is most directly measured by the amount of time the dredge is actively operating, the extent of take identified for the proposed action has been related to the number of days of dredging per year. For the proposed action, this is up to 120 days of dredging per calendar year for 10 years during IWWW, dredging operations that exceed 120 days or are outside of IWWW, and increase the probability of more individuals being exposed to the effects of the action described above. The number of days of dredging per year is a threshold for reinitiating consultation. Exceeding this indicator for extent of take will trigger the reinitiation provisions of this opinion.

2.9.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. Minimize incidental take by minimizing entrainment during dredging;
2. Minimize incidental take by minimizing turbidity; and
3. Ensure completion of an annual monitoring and reporting program to confirm the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the USACE or the Port of Astoria must comply with them in order to implement the RPMs (50 CFR 402.14). The USACE or the Port of Astoria has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1) The following term and condition implements reasonable and prudent measure 1, minimize entrainment during dredging:
   a) The Port of Astoria shall ensure that during dredging and active pumping of sediment, the suction dredge will remain in contact with the river bottom to the maximum extent possible, and will be raised no more than 1 meter above the bottom so as to reduce the likelihood of pulling fish from the water column into the dredge.
   b) USACE shall ensure in-water work will be performed in accordance with permit conditions, which set timing restriction for in-water work of November 1 – February 28.

2) The following term and condition implements reasonable and prudent measure 2, minimize turbidity during dredge disposal:
   a) Port of Astoria, shall ensure turbidity remains at background levels 300 ft downstream during dredging and placement operations by adhering to dredge management protocols including monitoring and compliance reporting of turbidity levels observed during dredging operations.

3) The following term and condition implements reasonable and prudent measure 3, monitoring and reporting:
   a) Action Monitoring. The applicant shall submit a monitoring report to NMFS by March 31 of each year summarizing the following for the previous calendar year:
      i) Hours of dredging for each day dredging occurred
      ii) The number of days dredging occurred each month
      iii) The number of days of dredging occurred for the previous calendar year
      iv) The extent and depth of dredging conducted for the calendar year
      v) Whether turbidity compliance was met.
   b) Monitoring reports shall be submitted to:
      i) National Marine Fisheries Service
         Oregon Washington Coastal Office
         Attn: Joshua Ashline (WCRO-2019-02481)
         510 Desmond Drive SE, Suite 103
         Lacey, Washington 98503

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding

discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

The following conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the USACE:

1. Use floating silt curtains around the in-water dredge area to minimize the dispersion of suspended sediment thereby reducing turbidity.

2. The USACE should conduct an analysis of the entrainment of eulachon during hydraulic dredging, and of the potential modifications of dredging practices to further minimize entrainment of these species.

3. The USACE should develop and carry out a monitoring and reporting program to develop basic data on eulachon presence and timing in proximity within the Lower Columbia River during winter dredging.
    a. Should conservation recommendation 2 be implemented, we request the following information.
        i. Name, address, and qualifications of the supervising biologist.
        ii. River temperature and discharge at time of sampling.
        iii. Methods used to capture eggs and larvae.
        iv. Methods used to process content sampled.
        v. For each sample:
            (1) Date sampled.
            (2) Location sampled.
            (3) Sampling starting and ending times.
            (4) Starting and ending flow meter values.
            (5) River temperature.
            (6) Field observations
            (7) Number of eggs and larvae collected by date and sample number.
            (8) For each date sampled, indicate if pumping also occurred that date.
            (9) Please send the requested information to: National Marine Fisheries Service, Oregon-Washington Coastal Area Office, Attn: Joshua Ashline (WCRO-2019-02481), 510 Desmond Drive Southeast, Suite 103, Lacey, Washington 98503-1263.

Please notify NMFS if the USACE carries out either of these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

2.11 Reinitiation of Consultation

This concludes formal consultation for the Port of Astoria Maintenance Dredging.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service 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 ITS 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 opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12 "Not Likely to Adversely Affect" Determinations

Southern Resident Killer Whale

SRKW move into the coastal waters along the outer coast from the Queen Charlotte Islands south to central California, including coastal Oregon and off the Columbia River although they do not have critical habitat designated in Oregon (NMFS, 2008). SRKW have been documented in the Columbia River plume (Zamon *et al*., 2007). SRKW primarily eat salmon, and prefer Chinook salmon (Hanson et al., 2010; NMFS, 2008; Ford 2013).

There are only two confirmed cases of SRKW injuries and deaths due to boat strikes since 2005 (Carretta *et al*. 2019; Gaydos and Raverty 2007). There was documentation of a whale-boat collision in Haro Strait (Puget Sound) in 2005 which resulted in a minor injury to a whale. In 2006, whale L98 was killed during a vessel interaction. It is important to note that L98 had become habituated to regularly interacting with vessels during its isolation in Nootka Sound. Both of these collisions were from small vessels. There are two other cases that may or may not be caused by boat strike, but for purposes of this biological opinion (assuming worst-case scenario) we will assume they are. In 2012, a moderately decomposed juvenile female (L-112) was found dead near Long Beach, WA. A full necropsy determined the cause of death was blunt force trauma to the head, however the source of the trauma could not be established (Carretta *et al*. 2019). Similarly, in 2016, a young adult male (J34) was found dead in the northern Georgia Strait. His injuries were consistent with those incurred during a vessel strike, though a final determination has not been made (Carretta *et al*. 2019).

From 1982-2016, there were 49 confirmed sightings of SRKW in coastal waters off the western U.S. No documented SRKW deaths or strandings have occurred near the action area. The relatively small action area, low presence of SRKW in the action area, and the lack of interactions with large ships through reporting or the stranding network, with none near the action area, leads us to conclude that risk of collision from vessels is discountable.

The sound from OGVs is largely low frequency sound that does not overlap with the most sensitive hearing range of SRKW (Gordon and Moscrop 1996; Holt 2008; Richardson *et al.* 1995). Vessel sound may still be audible to the whales, but any disturbance from the sound of passing OGVs is expected to be short-term, transitory, and insignificant. Therefore, acoustic effects of the proposed action will be insignificant on SRKW and proposed SRKW critical habitat.

The proposed action may affect SRKW indirectly by reducing availability of their primary prey, Chinook salmon. The proposed activities are not expected to produce a measurable effect on the abundance, distribution, diversity, or productivity of Chinook salmon at either the population or species level. Given the total quantity of prey available to SRKW throughout their range, this reduction in prey is extremely small, and is not anticipated to be different from zero by multiple decimal places (based on NMFS previous analyses of the effects of in-river salmon harvest on SRKW , e.g. NMFS No. WCR-2017-7164). Because the reduction is so small, there is also a low probability that any juvenile Chinook salmon killed by the proposed activities would have later (in 3-5 years' time) been intercepted by the SRKW across their vast range in the absence of the proposed activities. Therefore, the anticipated reduction of salmonids associated with the proposed action would result in an insignificant reduction in adult equivalent prey resources for SRKW and an insignificant effect on proposed SRKW critical habitat.

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)].

This analysis is based, in part, on the EFH assessment provided by the USACE and descriptions of EFH for Pacific Coast salmon (PFMC 2014), and Pacific Coast groundfish (PFMC 2005) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

As part of the information provided in the request for ESA concurrence, the USACE determined that the proposed action may have an adverse effect on EFH designated for Pacific Coast Salmon, Pacific Coast groundfish, specifically the habitat areas of particular concern (HAPC) include, coastal estuary habitats. The effects of the proposed action on EFH are the same as those

described above in the ESA portion of this document and NMFS concurs with the findings in the EFH assessment.

3.2 Adverse Effects on Essential Fish Habitat

The proposed dredging will temporarily disturb benthic habitat and create turbidity affecting forage production and local hydraulic conditions. Overall, the area of disturbance is relatively small in relation to the Columbia River Estuary, partially disconnected/isolated from the main-stem Columbia River, the disturbance will be short-lived, will maintain current conditions, and will not change the functional characteristics of the habitat.

3.3 Essential Fish Habitat Conservation Recommendations

The effects of the proposed dredging activity will be contained and turbidity minimized by use of the suction dredge and monitoring and controlling discharge of return waters at the material disposal site. To minimize the effects on Pacific Coast salmon and Pacific Coast groundfish EFH, including coastal estuary habitat HPAC the USACE should: (1) ensure that during dredging and active pumping of sediment, the suction dredge will remain in contact with the river bottom to the maximum extent possible, and will be raised no more than 3 feet above the bottom, and (2) ensure in-water work will be performed in accordance with permit conditions, which set timing restrictions for in-water work of November 1 to February 28.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 40 acres of designated EFH and HAPC for Pacific Coast salmon, and Pacific Coast groundfish.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, USACE must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5 Supplemental Consultation

The USACE must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

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 USACE. Other interested users could include the Port of Astoria, and Campbell Environmental LLC. Individual copies of this opinion were provided to the USACE. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres 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 drafted 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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