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-2019-00019

May 13, 2019

David Stalters
United States Coast Guard
Civil Engineering Unit Oakland
1301 Clay Street, Suite 700N
Oakland, California 94612-5203

Re: Endangered Species Act Section 7 Formal Consultation and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation for the U.S. Coast Guard Base Seattle Pier 36B Repair Project, King County, Washington, HUC: 171100191200 – Elliott Bay.

Dear Mr. Stalters:

Thank you for your February 12, 2019, request to initiate 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 U.S. Coast Guard (USCG) Base Seattle Pier 36B Repair Project in Elliott Bay, Washington.

The enclosed document contains the biological opinion (Opinion) prepared by NMFS pursuant to section 7(a)(2) of the ESA on the effects of the proposed action. In this Opinion, NMFS concludes that the proposed action is likely to adversely affect but not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon and Puget Sound/Georgia Basin (PS/GB) bocaccio. NMFS also concludes that the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon but is not likely to result in the destruction or adverse modification of that designated critical habitat. The action area is outside of designated critical habitat for PS/GB bocaccio. In this Opinion, we also conclude that the proposed action is not likely to adversely affect Hood Canal summer run chum salmon, PS steelhead, and southern resident (SR) killer whales and their designated critical habitat.

As required by section 7 of the ESA, NMFS has provided an incidental take statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures (RPM) NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action, and sets forth nondiscretionary terms and conditions that the USCG must comply with to meet those 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.

NMFS also reviewed the likely effects of the proposed action on essential fish habitat (EFH), pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1855(b)), and concluded that the action would adversely affect the EFH of Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. Therefore, we have included the results of that review in Section 3 of this document.

Please contact Donald Hubner in the North Puget Sound Branch of the Oregon/Washington Coastal Office at (206) 526-4359, or by electronic mail at Donald.Hubner@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: Constance Callahan, USCG
Rory Lee, USACE
Erika Hoffman, USEPA

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

for the

U.S. Coast Guard Base Seattle Pier 36B Repair Project

NMFS Consultation Number: WCRO-2019-00019

Action Agencies: U.S. Coast Guard
U.S. Army Corps of Engineers

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound (PS)	Threatened	Yes	No	Yes	No
Chum salmon (*O. keta*) Hood Canal Summer Run	Threatened	No	No	N/A	N/A
Steelhead (*O. mykiss*) PS	Threatened	No	No	N/A	N/A
Bocaccio (*Sebastes paucispinis*) Puget Sound /Georgia Basin (PS/GB)	Endangered	Yes	No	N/A	No
Killer whales (*Orcinus orca*) Southern resident (SR)	Endangered	No	No	No	No

N/A = not applicable. The action area is outside designated critical habitat, or critical habitat has not been designated.

Affected Essential Fish Habitat (EFH) and NMFS' Determinations:

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: May 13, 2019

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LIST OF ACRONYMS

BMP – Best Management Practices
CFR – Code of Federal Regulations
DO – Dissolved Oxygen
DPS – Distinct Population Segment
DQA – Data Quality Act
EF – Essential Feature
EFH – Essential Fish Habitat
ESA – Endangered Species Act
ESU – Evolutionarily Significant Unit
FR – Federal Register
HUC – Hydrologic Unit Code
Hz – Hertz (or cycles per second)
ITS – Incidental Take Statement
JARPA – Joint Aquatic Resource Permit Application Form
MLLW – Mean Lower Low Water
MPG – Major Population Group
MSA – Magnuson-Stevens Fishery Conservation and Management Act
NMFS – National Marine Fisheries Service
NTU – Nephlometric Turbidity Units
NWP – Nationwide Permit
OWCO – Oregon Washington Coastal Office
PAH – Polycyclic Aromatic Hydrocarbon
PBF – Primary Biological Feature
PCB – Polychlorinated Biphenyl
PCE – Primary Constituent Element
PFMC – Pacific Fishery Management Council
PS – Puget Sound
PSTRT – Puget Sound Technical Recovery Team
PTS – Permanent Threshold Shift
RL – Received Level
RPM – Reasonable and Prudent Measure
SAV – Submerged Aquatic Vegetation
TSS – Total Suspended Solids
SL – Source Level
TTS – Temporary Threshold Shift
USACE – U.S. Army Corps of Engineers
USCG – U.S. Coast Guard
USEPA – U.S. Environmental Protection Agency
VSP – Viable Salmonid Population
WCR – Westcoast Region (NMFS)
WCRO – Westcoast Region Office (NMFS)
WDFW – Washington State Department of Fish and Wildlife
WDOE – Washington State Department of Ecology

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 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.

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 (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). A complete record of this consultation is on file at the Oregon Washington Coastal Area Office.

1.2 Consultation History

On April 13, 2018 the USCG sent a hardcopy letter to NMFS at Sand Point in Seattle, Washington (USCG 2018a). That letter requested concurrence with the USCG's determination that the proposed action was not likely to adversely affect Hood Canal summer-run chum salmon; Puget Sound (PS) Chinook salmon; PS steelhead; Puget Sound/Georgia Basin (PS/GB) bocaccio; and southern resident killer whales. However, that letter never arrived in our office at Sand Point. On November 9, 2018, in response to an inquiry by the USCG, the NMFS informed the USCG that their request had not been received, and that based on the information provided with their inquiry, the proposed action would require formal consultation. The NMFS requested the USCG to withdraw their request for concurrence, and to request formal consultation. NMFS also requested more detailed information about the project and the action area.

The USCG withdrew their request for concurrence on November 16, 2018. Numerous e-mails and phone calls were exchanged between that date and February 12, 2019, when NMFS received an electronic request for formal consultation for the proposed action (USCG 2019a). The request included all necessary information. Therefore, formal consultation was initiated on that date. The request was assigned the consultation number WCR-2017-6656. On March 15, 2019, NMFS transitioned to a new consultation tracking system. Subsequently, this consultation was assigned the new tracking number: WCRO-2019-00019.

This Opinion is based on the review of the information and project drawings identified in the USCG's revised project description (USCG 2018b), Joint Aquatic Resources Permit Application (JARPA) form (USCG 2018c), and responses to NMFS questions (USCG 2019b); recovery plans, status reviews, and critical habitat designations for ESA-listed PS Chinook salmon and PS/GB bocaccio; published and unpublished scientific information on the biology and ecology of those species; and relevant scientific and gray literature (see Literature Cited). A complete record of this consultation is on file at the Oregon Washington Coastal Office (OWCO) in Lacey, Washington.

1.3 Proposed 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). "Interrelated actions" are those that are part of a larger action and depend on the larger action for their justification. "Interdependent actions" are those that have no independent utility apart from the action under consideration (50 CFR 402.02).

The USCG proposes to perform pile repairs at Pier 36B, and bulkhead maintenance along Pier 37 and the concrete apron to extend the useful life of these failing structures at USCG Base Seattle (Figure 1). The U.S Army Corps of Engineers (USACE) would authorize this work under Nationwide Permit (NWP) 3. The USCG is the lead federal agency for this consultation. USCG vessels would conduct operations from, and undergo refueling, maintenance, and repair work while moored at these piers. Future vessel activity, maintenance, and repair work done at the piers would be interrelated and interdependent with the proposed action.

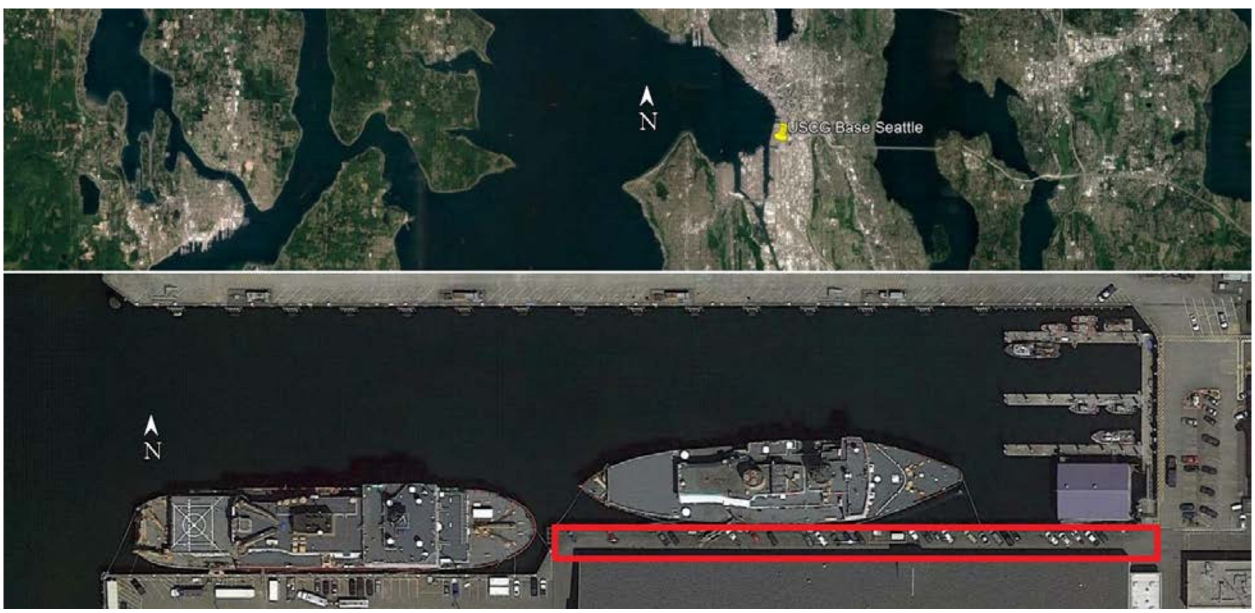

Figure 1. Google satellite photographs of USCG Base Seattle, Washington. The top image shows the project site. Elliott Bay extends to the northwest, the City of Seattle extends north and south, and the Duwamish Waterway is visible to the south. The lower image shows Pier 36B outlined in red. Pier 37 runs along the north side of the berthing, and the concrete apron runs along the east end.

Work would be staged from the piers, but would likely also include the use of small work boats and floating platforms. The USCG expects that about 60 days of work would be required to complete the project, with no plans for night work. To reduce environmental impacts, work would be completed within the July 16 to February 15 in-water work window for the action area. Additionally, the USCG would require their contractors to fully enclose pile work within full-depth floating silt curtains, and to comply with all of the conservation measure and BMPs identified in the revised project description and in the project JARPA.

Pier 36B Pile Repairs

The USCG's contractors would repair about 104 of the 1,588 existing creosote-treated timber piles that support Pier 36B. Prior to work, the contractors would deploy full-depth silt curtains to fully enclose the work area. Working from support boats and/or floating platforms, divers would use hand tools to remove marine growth and old shotcrete jacketing from about 75 piles, they would also remove the marine growth from about 29 additional piles that have no jackets. After cleaning, all debris would be removed from the substrate and the water and disposed of at an appropriate upland facility.

The divers would then use hand tools to remove bottom sediments from around the bases of the piles. They would then fasten fiber-reinforced polymer (FRP) jackets around the piles. The jackets would extend from about 2 feet below the mudline to above mean high water (MHW). They would then pump underwater grout (QwakeWrap 2019) into the FRP jackets via piping. The grout would be injected from the bottom so that water within the jacket would be forced up and out of the top of the jacket (tremie method). Discharged water would be pumped through a filter before returning to marine waters. After jacketing is complete, the divers would use hand tools to return the sediments that had been removed from around the bases of the piles.

Pier 37 and Concrete Apron Steel Bulkhead Maintenance

The USCG's contractors would clean and repaint about 2,000 square feet of steel sheet pile bulkhead. The work would be done along portions of Pier 37 and along the entire length of the concrete apron. The contractor would implement a containment system to prevent any debris or contaminants from entering the water during cleaning and repainting of the bulkhead. All debris shall be contained and disposed of at an appropriate upland facility.

Working from support boats and/or floating platforms during negative low tides, workers would use power-washers and hand tools to remove marine growth and rust from the above the water portion of the bulkhead. After cleaning, they would apply SeaShield SplashZone hydrophobic epoxy paint (Premier Coatings 2019) by hand while the surfaces are above the water.

Interrelated and Interdependent Activities

A mix of up to four USCG cutters, icebreakers, and other vessels and support craft would moor at the USCG piers to be repaired by this action. While moored, some vessels would undergo routine small scale maintenance and repairs, as well as operational refueling and replenishment. Typical pier-side maintenance and repairs would include exterior hull work done above the waterline such as welding, surface preparation and painting, as well as similar work done on the upper decks and within the ships along with machinery and equipment repairs.

Vessel operations would include a mix of scheduled and emergent departures and arrivals. Therefore, vessel moorage and operations would vary greatly over time. To be conservative, this consultation assumes that vessels could be present any day of the year, and that internal auxiliary systems and propulsion would be operated daily.

To reduce the environmental impacts of their activities, the USCG uses best management practices (BMPs) to prevent and control accidental spills and releases of fuels and other potential contaminants to surface waters. The USCG also conducts regular facility inspections and implements BMP upgrades as needed to address stormwater quality issues.

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 provides an opinion stating how the agency's actions would affect listed species and their critical habitat. 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.

As described above in section 1.2, the USCG initially determined that the proposed action is not likely to adversely affect all of the species identified in Table 1. However, following input from NMFS, the USCG requested formal consultation for the proposed action. The NMFS did not concur that the proposed action is not likely to adversely affect PS Chinook salmon and PS/GB bocaccio and designated critical habitat for PS Chinook salmon, and thus have proceeded with formal consultation for those species and critical habitats. Our concurrence with the USCG's "not likely to adversely affect" determinations for the remaining species and critical habitat identified in Table 1 is documented in the "Not Likely to Adversely Affect" Determinations section (2.12).

Table 1. ESA-listed species and critical habitat that may be affected by the proposed action.

ESA-listed marine species and critical habitat likely to be adversely affected (LAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
Chinook salmon (*Oncorhynchus tshawytscha*) Puget Sound	Threatened	LAA	LAA	06/28/05 (70 FR 37160) / 09/02/05 (70 FR 52630)
bocaccio (*Sebastes paucispinis*) Puget Sound/Georgia Basin	Endangered	LAA	N/A	04/28/10 (75 FR 22276) / 11/13/14 (79 FR 68041)
ESA-listed marine species and critical habitat not likely to be adversely affected (NLAA)				
Species	**Status**	**Species**	**Critical Habitat**	**Listed / CH Designated**
Hood Canal summer-run chum salmon (O. keta)	Threatened	NLAA	N/A	03/25/1999 (64 FR 14507) 09/02/2005 (70 FR 52630)
steelhead (*O. mykiss*) Puget Sound	Threatened	NLAA	N/A	05/11/07 (72 FR 26722) / 02/24/16 (81 FR 9252)
killer whales (*Orcinus orca*) southern resident	Endangered	NLAA	NLAA	11/18/05 (70 FR 57565) / 11/29/06 (71 FR 69054)

LAA = likely to adversely affect NLAA = not likely to adversely affect
N/A = not applicable. The action area is outside designated critical habitat, or critical habitat has not been designated.

2.1 Analytical Approach

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

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (81 FR 7214).

Past critical habitat designations have used the terms primary constituent element (PCE) or essential feature (EF) to identify important habitat qualities. However, the new critical habitat regulations (81 FR 7414; February 11, 2016) replace those terms with physical or biological features (PBF). This shift in terminology does not change the approach used in conducting our analysis, whether the original designation identified PCE, EF, or PBF. For simplicity, we universally apply the term PBF in this Opinion for all critical habitat, regardless of the term used in the specific critical habitat designation.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or to cause the destruction or adverse modification of designated critical habitat:

- Identify the range-wide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Describe the environmental baseline in the action area.
- Analyze the effects of the proposed action on both species and their habitat using an “exposure-response-risk” approach.
- Describe any cumulative effects in the action area.
- Integrate and synthesize the above factors by: (1) Reviewing the status of the species and critical habitat; and (2) adding the effects of the action, the environmental baseline, and cumulative effects to assess the risk that the proposed action poses to species and critical habitat.
- Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified.
- If necessary, suggest a reasonable and prudent alternative (RPA) to the proposed action.

2.2 Range-wide Status of the Species and Critical Habitat

This Opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species’ likelihood of both survival and recovery. The species status section also helps to inform the description of the species’ current “reproduction, numbers, or distribution” as described in 50 CFR 402.02. This 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 current function of the essential PBF that help to form that conservation value.

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the action area and are considered in this opinion. More detailed information on the biology, habitat, and conservation status and trend of these listed resources can be found in the listing regulations and critical habitat designations published in the Federal Register and in the recovery plans and other sources at: http://www.nmfs.noaa.gov/pr/species/fish/, and are incorporated here by reference.

Listed Species

Viable Salmonid Population (VSP) Criteria: For Pacific salmonids, we commonly use four VSP criteria (McElhany *et al*. 2000) to assess the viability of the populations that constitute the species. These four criteria (spatial structure, diversity, abundance, and productivity) encompass the species’ “reproduction, numbers, or distribution” as described in 50 CFR 402.02. When these parameters are collectively at appropriate levels, they maintain a population’s capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment.

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

"Diversity" refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation in single genes to complex life history traits.

"Abundance" generally refers to the number of naturally-produced adults that return to their natal spawning grounds.

"Productivity" refers to the number of naturally-spawning adults produced per parent. When progeny replace or exceed the number of parents, a population is stable or increasing. When progeny fail to replace the number of parents, the population is in decline.

For species with multiple populations, we assess the status of the entire species based on the biological status of the constituent populations, using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread to avoid concurrent extinctions from mass catastrophes and spatially close to allow functioning as metapopulations (McElhany *et al*. 2000).

The summaries that follow describe the status of the ESA-listed species, and their designated critical habitats, that occur within the geographic area of this proposed action and are considered in this opinion. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register.

<u>Puget Sound (PS) Chinook Salmon</u>

The PS Chinook salmon evolutionarily significant unit (ESU) was listed as threatened on June 28, 2005 (70 FR 37160). We adopted the recovery plan for this ESU in January 2007. The recovery plan consists of two documents: the Puget Sound salmon recovery plan (SSPS 2007) and the final supplement to the Shared Strategy's Puget Sound salmon recovery plan (NMFS 2006). The recovery plan adopts ESU and population level viability criteria recommended by the Puget Sound Technical Recovery Team (PSTRT) (Ruckelshaus *et al*. 2002). The PSTRT's biological recovery criteria will be met when all of the following conditions are achieved:

- The viability status of all populations in the ESU is improved from current conditions, and when considered in the aggregate, persistence of the ESU is assured;
- Two to four Chinook salmon populations in each of the five biogeographical regions of the ESU (Table 2) achieve viability, depending on the historical biological characteristics and acceptable risk levels for populations within each region;
- At least one population from each major genetic and life history group historically present within each of the five biogeographical regions is viable;
- Tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations are functioning in a manner that is sufficient to support an ESU-

wide recovery scenario; Production of Chinook salmon from tributaries to Puget Sound not identified as primary freshwater habitat for any of the 22 identified populations occurs in a manner consistent with ESU recovery; and

- Populations that do not meet all the Viable Salmon Population (VSP) parameters are sustained to provide ecological functions and preserve options for ESU recovery.

General Life History: Adult Chinook salmon spawn in freshwater streams, depositing fertilized eggs in gravel "nests" called redds. The eggs incubate for three to five months before juveniles hatch and emerge from the gravel. Juveniles spend from three months to two years in freshwater before migrating to the ocean to feed and mature. Chinook salmon spend from one to six years in the ocean before returning to their natal freshwater streams where they spawn and then die.

Chinook salmon are divided into two races, stream-types and ocean-types, based on the major juvenile development strategies. Stream-type Chinook salmon tend to rear in fresh water for a year or more before entering marine waters. Conversely, ocean-type juveniles typically migrate out of their natal streams early in their first year of life. Both stream- and ocean-type Chinook salmon are present, but ocean-type Chinook salmon predominate in Puget Sound populations.

Chinook salmon are further grouped into "runs" that are based on the timing of adults that return to freshwater. Early- or spring-run chinook salmon tend to enter freshwater as immature fish, migrate far upriver, and finally spawn in the late summer and early autumn. Late- or fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas, and spawn within a few days or weeks. Summer-run fish show intermediate characteristics of spring and fall runs, without the extensive delay in maturation exhibited by spring-run Chinook salmon. In Puget Sound, spring-run Chinook salmon tend to enter their natal rivers as early as March, but do not spawn until mid-August through September. Returning summer- and fall-run fish tend to enter the rivers early-June through early-September, with spawning occurring between early August and late-October.

Yearling stream-type fish tend to leave their natal rivers late winter through spring, and move relatively directly to nearshore marine areas and pocket estuaries. Out-migrating ocean-type fry tend to migrate out of their natal streams beginning in early-March. Those fish rear in the tidal delta estuaries of their natal stream for about two weeks to two months before migrating to marine nearshore areas and pocket estuaries in late May to June. Out-migrating young of the year parr tend to move relatively directly into marine nearshore areas and pocket estuaries after leaving their natal streams between late spring and the end of summer.

Spatial Structure and Diversity: The PS Sound Chinook salmon ESU includes all naturally spawning populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington. The ESU also includes the progeny of numerous artificial propagation programs (NWFSC 2015). The PSTRT identified 22 extant populations, grouped into five major geographic regions, based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity. The PSTRT distributed the 22 populations among five major biogeographical regions, or major population groups (MPGs), that are based on similarities in hydrographic, biogeographic, and geologic characteristics (Table 2).

Table 2. Extant PS Chinook salmon populations in each biogeographic region (Ruckelshaus *et al*. 2002, NWFSC 2015).

Biogeographic Region	Population (Watershed)
Strait of Georgia	North Fork Nooksack River
	South Fork Nooksack River
Strait of Juan de Fuca	Elwha River
	Dungeness River
Hood Canal	Skokomish River
	Mid Hood Canal River
Whidbey Basin	Skykomish River
	Snoqualmie River
	North Fork Stillaguamish River
	South Fork Stillaguamish River
	Upper Skagit River
	Lower Skagit River
	Upper Sauk River
	Lower Sauk River
	Suiattle River
	Upper Cascade River
Central/South Puget Sound Basin	North Lake Washington/ Sammamish River
	Cedar River
	Green/Duwamish River
	Puyallup River
	White River
	Nisqually River

Hatchery-origin spawners are present in high fractions in most populations within the ESU, with the Whidbey Basin being the only MPG with consistently high fractions of natural-origin spawners. Between 1990 and 2014, the fraction of natural-origin spawners has declined in many of the populations outside of the Skagit watershed (NWFSC 2015).

<u>Abundance and Productivity:</u> Available data on total abundance since 1980 indicate that abundance trends have fluctuated between positive and negative for individual populations, but productivity remains low in most populations, and hatchery-origin spawners are present in high fractions in most populations outside of the Skagit watershed. Available data now show that most populations have declined in abundance over the past 7 to 10 years. Further, escapement levels for all populations remain well below the PSTRT planning ranges for recovery, and most populations are consistently below the spawner-recruit levels identified by the PSTRT as consistent with recovery (NWFSC 2015). The current information on abundance, productivity, spatial structure and diversity suggest that the Whidbey Basin MPG is at relatively low risk of extinction. The other four MPGs are considered to be at high risk of extinction due to low

abundance and productivity (NWFSC 2015). The most recent 5-year status review concluded that the ESU should remain listed as threatened (NMFS 2017a).

Limiting Factors: Factors limiting recovery for PS Chinook salmon include:

- Degraded floodplain and in-river channel structure
- Degraded estuarine conditions and loss of estuarine habitat
- Riparian area degradation and loss of in-river large woody debris
- Excessive fine-grained sediment in spawning gravel
- Degraded water quality and temperature
- Degraded nearshore conditions
- Impaired passage for migrating fish
- Severely altered flow regime

PS Chinook Salmon within the Action Area: The PS Chinook salmon that occur in the action area may belong to the Green River (Duwamish), White River, Puyallup River, and Nisqually River populations of the Central/South Puget Sound Basin MPG. Those populations include spring and fall-run fish (WDFW 2019a; NWFSC 2015). Adults and juveniles from any of these populations may migrate through or past the action area. However, juveniles from the Green River fall-run population are the most likely to enter the action area because of the close proximity of that river system to the south of the project site, the strong shoreline obligation exhibited by juvenile Chinook salmon when they first enter estuarine and marine waters, and their need to migrate north to reach oceanic waters.

Since 1968, the estimated total abundance for returning adult PS Chinook salmon in the Green River basin has fluctuated between about 688 and 11,512, with the overall trend being negative (NWFSC 2015). Since 2003, the fraction of natural-origin spawners has fluctuated between about 21 to 53%. In 2018, the total numbers of returning adults was about 6,891, 32% of which were natural-origin spawners. The Nisqually, White, and Puyallup River populations are all relatively small, with relatively high proportions of hatchery fish. The abundance trends in the Nisqually and White River populations appear to be slightly positive, but mostly due to hatchery fish. The abundance trend in the Puyallup River population is flat to slightly negative (WDFW 2019b).

Returning adult Chinook salmon return to the Green River mid-June through November (peaking in August). They spawn between mid-September and mid-November, well upstream and away from the action area. Juveniles typically leave the river and enter estuarine/marine waters between early April and mid-July (Gregory *et al*. 2004). Juvenile Chinook salmon from the rest of the Central/South Puget Sound Basin MPG likely leave their natal streams at close to the same time as those from the Green River population, and may pass through the action area as they migrate north toward the ocean.

Puget Sound/Georgia Basin (PS/GB) Bocaccio

The PS/GB bocaccio distinct population segment (DPS) was listed as endangered on April 28, 2010 (75 FR 22276). In April 2016, we completed a 5-year status review that recommended the

DPS retain its endangered classification (Tonnes *et al*. 2016), and we released a recovery plan in October 2017 (NMFS 2017b).

The VSP criteria described by McElhaney *et al*. (2000), and summarize at the beginning of Section 2.2, identified spatial structure, diversity, abundance, and productivity as criteria to assess the viability of salmonid species because these criteria encompass a species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. These viability criteria reflect concepts that are well founded in conservation biology and are generally applicable to a wide variety of species because they describe demographic factors that individually and collectively provide strong indicators of extinction risk for a given species (Drake *et al*. 2010), and are therefore applied here for PS/GB bocaccio.

<u>General Life History:</u> The life history of bocaccio includes a larval/pelagic juvenile stage that is followed by a juvenile stage, and subadult and adult stages. As with other rockfish, bocaccio fertilize their eggs internally and the young are extruded as larvae that are about 4 to 5 mm in length. Females produce from several thousand to over a million offspring per spawning (Love et al. 2002). The timing of larval parturition in PS/GB bocaccio is uncertain, but likely occurs within a five- to six-month window that is centered near March (Greene and Godersky 2012; NMFS 2017b; Palsson *et al*. 2009). Larvae are distributed by prevailing currents until they are large enough to actively swim toward preferred habitats, but they can pursue food within short distances immediately after birth (Tagal *et al*. 2002). Larvae are distributed throughout the water column (Weis 2004), but are also observed under free-floating algae, seagrass, and detached kelp (Love *et al*. 2002; Shaffer *et al*. 1995). Unique oceanographic conditions within Puget Sound likely result in most larvae staying within the basin where they are released rather than being broadly dispersed (Drake *et al*. 2010).

At about 3 to 6 months old and 1.2 to 3.6 inches (3 to 9 cm) long, juvenile bocaccio gravitate to shallow nearshore waters. Rocky or cobble substrates with kelp is most typical, but sandy areas with eelgrass are also utilized for rearing (Carr 1983; Halderson and Richards 1987; Hayden-Spear 2006; Love *et al*. 1991 & 2002; Matthews 1989; NMFS 2017b; Palsson *et al*. 2009). Young of the year rockfish may spend months or more in shallow nearshore rearing habitats before transitioning toward deeper water habitats (Palsson *et al*. 2009). As bocaccio grow, their habitat preference shifts toward deeper waters with high relief and complex bathymetry with rock and boulder-cobble complexes (Love *et al*. 2002), but they also utilize non-rocky substrates such as sand, mud, and other unconsolidated sediments (Miller and Borton 1980; Washington 1977). Adults are most commonly found between 131 to 820 feet (40 to 250 m) (Love *et al*. 2002; Orr *et al*. 2000). The maximum age of bocaccio is unknown, but may exceed 50 years, and they reach reproductive maturity near age six.

<u>Spatial Structure and Diversity:</u> The PS/GB bocaccio DPS includes all bocaccio from inland marine waters east of the central Strait of Juan de Fuca and south of the northern Strait of Georgia. The waters of Puget Sound and Straits of Georgia can be divided into five interconnected basins that are largely hydrologically isolated from each other by relatively shallow sills (Burns 1985; Drake *et al*. 2010). The basins within US waters are: (1) San Juan, (2) Main, (4) South Sound, and (4) Hood Canal. The fifth basin consists of Canadian waters east and north of the San Juan Basin into the Straights of Georgia (Tonnes *et al*. 2016). Although most

individuals of the PS/GB bocaccio DPS are believed to remain within the basin of their origin, including larvae and pelagic juveniles, some movement between basins occurs, and the DPS is currently considered a single population.

Abundance and Productivity: The PS/GB bocaccio DPS exists at very low abundance and observations are relatively rare. No reliable range-wide historical or contemporary population estimates are available for the PS/GB bocaccio DPS. It is believed that prior to contemporary fishery removals, each of the major PS/GB basins likely hosted relatively large, though unevenly distributed, populations of bocaccio. They were likely most common within the South Sound and Main Basin, but were never a predominant segment of the total rockfish abundance within the region (Drake *et al*. 2010). The best available information indicates that between 1965 and 2007, total rockfish populations have declined by about 70 percent in the Puget Sound region, and that bocaccio have declined by an even greater extent (Drake *et al*. 2010; Tonnes *et al*. 2016; NMFS 2017b).

Limiting Factors: Factors limiting recovery for PS/GB bocaccio include:

- Fisheries Removals (commercial and recreational bycatch)
- Derelict fishing gear in nearshore and deep-water environments
- Degraded water quality (chemical contamination, hypoxia, nutrients)
- Climate change
- Habitat disruption

PS/GB Bocaccio within the Action Area: Very little specific information is available to describe PS/GB bocaccio in the action area, but the best available information suggests that they are rare, including in the areas where they were historically most common, such as the South Sound (Palsson *et al*. 2009). Very little potentially suitable nearshore bocaccio habitat exists within the action area. A very small area of intertidal and subtidal habitat that may be supportive of juvenile bocaccio is located at the southwest corner of the berthing, under and south of the west end of Pier 35. The remaining shoreline within the berthing consists of vertical bulkhead that is overlain by pier decking. Within the berthing, the substrate consists of unconsolidated sediments at depths of about -20 to -39 feet relative to mean lower low water (MLLW). Diver surveys indicate the marine vegetation is absent within the berthing and under the piers. Therefore, the bocaccio that may be present at the project site would likely be limited to very low numbers of pelagic larvae and pre-settlement juveniles that may occasionally pass through the area on the currents. Rearing juveniles are extremely unlikely to be present, and would likely be limited to a small area southwest of Pier 35. If present, larval and/or juvenile bocaccio are most likely March through October (Greene and Godersky 2012; NMFS 2017b; Palsson *et al*. 2009).

Critical Habitat

This section describes the status of designated critical habitat that would be affected by the proposed action by examining the condition and trends of PBFs that are essential to the conservation of the listed species throughout the designated areas. The PBFs are essential because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging). The proposed project would affect critical habitat for PS Chinook salmon.

Puget Sound Chinook Salmon Critical Habitat: NMFS designated critical habitat for PS Chinook salmon on September 2, 2005 (70 FR 52630). That critical habitat is located in 16 freshwater subbasins and watersheds between the Dungeness/Elwha Watershed and the Nooksack Subbasin, inclusively, as well as in nearshore marine waters of the Puget Sound that are south of the US-Canada border and east of the Elwha River, and out to a depth of 30 meters. Although offshore marine is an area type identified in the final rule, it was not designated as critical habitat for PS Chinook salmon.

The PBFs of salmonid critical habitat include: (1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development; (2) Freshwater rearing sites with: (i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (ii) Water quality and forage supporting juvenile development; and (iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks; (3) Freshwater migration corridors free of obstruction 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 supporting juvenile and adult mobility and survival; (4) Estuarine areas free of obstruction and excessive predation with: (i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; (ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and (iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation; (5) Nearshore marine areas free of obstruction and excessive predation with: (i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and (ii) 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. The PBF for PS Chinook salmon CH are listed in Table 3. The PBF of PS Chinook salmon critical habitat that may be affected by the proposed action is limited to nearshore marine.

Table 3. Physical or biological features (PBFs) of designated critical habitat for PS Chinook salmon, and corresponding life history events. Although offshore marine areas were identified in the final rule, none was designated as critical habitat.

Physical or Biological Features		
Site Type	**Site Attribute**	**Life History Event**
Freshwater spawning	Water quantity Water quality Substrate	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Water quantity and Floodplain connectivity Water quality and Forage Natural cover	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	(Free of obstruction and excessive predation) Water quantity and quality Natural cover	Adult sexual maturation Adult upstream migration and holding Fry/parr/smolt growth, development, and seaward migration
Estuarine	(Free of obstruction and excessive predation) Water quality, quantity, and salinity Natural cover Forage	Adult sexual maturation and "reverse smoltification" Adult upstream migration and holding Fry/parr/smolt growth, development, and seaward migration
Nearshore marine	(Free of obstruction and excessive predation) Water quality, quantity, and forage Natural cover	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine	Water quality and forage	Adult growth and sexual maturation Adult spawning migration Subadult rearing

Major tributary river basins in the Puget Sound basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar, Sammamish, Green, Duwamish, Puyallup, White, Carbon, Nisqually, Deschutes, Skokomish, Duckabush, Dosewallips, Big Quilcene, Elwha, and Dungeness rivers and Soos Creek. Critical habitat throughout the Puget Sound basin has been degraded by numerous activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of large wood (LW) from the waterways, intense urbanization, agriculture, alteration of floodplain and stream morphology (*i.e.*, channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, logging, and mining. Changes in habitat quantity, availability, and diversity, and flow, temperature, sediment load and channel instability are common limiting factors of critical habitat throughout the basin.

Land use practices have likely accelerated the frequency of landslides delivering sediment to streams. Fine sediment from unpaved roads also contributes to stream sedimentation. Unpaved roads are widespread on forested lands in the Puget Sound basin, and to a lesser extent, in rural residential areas. Historical logging removed most of the riparian trees near stream channels. Subsequent agricultural and urban conversion permanently altered riparian vegetation in the river valleys, leaving either no trees, or a thin band of trees. The riparian zones along many agricultural areas are now dominated by alder, invasive canary grass and blackberries, and provide substantially reduced stream shade and LW recruitment (SSPS 2007).

Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flows that remove smaller substrate particles and LW. The loss of side-channels, oxbow lakes, and backwater habitats has resulted in a significant loss of juvenile salmonid rearing and refuge habitat. When the water level of Lake Washington was lowered 9 feet in the 1910s, thousands of acres of wetlands along the shoreline of Lake Washington, Lake Sammamish and the Sammamish River corridor were drained and converted to agricultural and urban uses. Wetlands play an important role in hydrologic processes, as they store water which ameliorates high and low flows. The interchange of surface and groundwater in complex stream and wetland systems helps to moderate stream temperatures. Forest wetlands are estimated to have diminished by one-third in Washington State (FEMAT 1993; Spence *et al*. 1996; SSPS 2007).

Loss of riparian habitat, elevated water temperatures, elevated levels of nutrients, increased nitrogen and phosphorus, and higher levels of suspended sediment, presumably from urban and highway runoff, wastewater treatment, failing septic systems, and agriculture or livestock impacts, have been documented in many Puget Sound tributaries (SSPS 2007).

Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation clear cuts (SSPS 2007). In urbanized Puget Sound, there is a strong association between land use and land cover attributes and rates of coho spawner mortality likely due to runoff containing contaminants emitted from motor vehicles (Feist *et al*. 2011).

Dams constructed for hydropower generation, irrigation, or flood control have substantially affected PS Chinook salmon populations in a number of river systems. The construction and operation of dams have blocked access to spawning and rearing habitat changed flow patterns, resulted in elevated temperatures and stranding of juvenile migrants, and degraded downstream spawning and rearing habitat by reducing recruitment of spawning gravel and LW to downstream areas (SSPS 2007). These actions tend to promote downstream channel incision and simplification (Kondolf 1997), limiting fish habitat. Water withdrawals reduce available fish habitat and alter sediment transport. Hydropower projects often change flow rates, stranding and killing fish, and reducing aquatic invertebrate (food source) productivity (Hunter 1992).

Juvenile mortality occurs in unscreened or inadequately screened diversions. Water diversion ditches resemble side channels in which juvenile salmonids normally find refuge. When diversion headgates are shut, access back to the main channel is cut off and the channel goes dry. Mortality can also occur with inadequately screened diversions from impingement on the screen, or mutilation in pumps where gaps or oversized screen openings allow juveniles to get into the system. Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in many Puget Sound tributary basins (SSPS 2007). The nearshore marine habitat has been extensively altered and armored by industrial and residential development near the mouths of many of Puget Sound's tributaries. A railroad runs along large portions of the eastern shoreline of Puget Sound, eliminating natural cover along the shore and natural recruitment of beach sand (SSPS 2007).

Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has degraded certain physical and chemical characteristics of the near-shore environment (HCCC 2005; SSPS 2007).

<u>Critical Habitat within the Action Area</u>: Nearshore Marine critical habitat has been designated for PS Chinook salmon along the entire Elliott Bay shoreline, including within the berthing at USCG Base Seattle.

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). As described in Sections 2.5 and 2.12, vessel-related propeller wash within about 250 yards (229 m) of the entrance to the USCG berthing would be the project-related stressor with the greatest range of effect for fish, but SR killer whales that are within about 4 miles of the berthing could theoretically detect USCG vessel noise. All other project-related effects, including indirect effects would be undetectable beyond that range. Therefore, the action area for NMFS trust resources includes all waters and substrates within 4 miles of the entrance to the USCG Base Seattle Berthing. This action area overlaps with the geographic ranges and boundaries of the ESA-listed species and designated critical habitat identified earlier in Table 1. The action area also overlaps with areas that have been designated, under the MSA, as EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species.

2.4 Environmental Baseline

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 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

<u>Environmental conditions at the project site and the surrounding area:</u> The project site is located in Seattle, along the southeastern shore of Elliott Bay (Figure 1). The USCG base is at the end of the east branch of the Duwamish Waterway, immediately east of the northeast corner of Harbor Island. The Duwamish River is the downstream reach of the Green-Duwamish River basin,

which originates on the western slopes of the Cascade Mountains, and flows northwesterly through glaciated lowland valleys. The basin includes the Green and Black Rivers, which combine at river mile 12 to become the Duwamish River, which enters Puget Sound at Elliott Bay. The water within the Lower Duwamish River is a well-stratified estuary that is driven by tidal actions and river flow. Fresh water moving downstream typically overlies the tidally influenced salt water entering the system.

The geography and ecosystems in and adjacent to the action area have been dramatically altered by human activity since European settlers first arrived in the 1800s. Historically this watershed included the Green, White, Black, and Cedar Rivers, which combined to become the Duwamish River (King County 2019). Prior to development, the Duwamish River meandered widely, with well-developed connectivity to its floodplains, freshwater wetlands, and tidal marshes, and an estuary that covered about 1,600 acres. Since the 1850s, the watershed and surrounding lands have been heavily impacted by development. Seattle was incorporated in 1869. Tacoma was incorporated in 1875. Logging and shipping of timber were the primary initial industries in the area, with coal, fishing, wholesale trade, and shipbuilding becoming increasingly important over time.

In 1906, the White River was diverted to the Puyallup River, and the lower Duwamish was straightened and dredged to improve navigation and industrial development. Dredged materials were used to fill-in shallow marshes and tide flats to create Harbor Island in support of the Port of Seattle. The banks of Harbor Island and the Duwamish Waterway were armored with levees, bulkheads, dikes, and other structures. The development converted about 9.3 miles of meandering river into 5.3 miles of straightened channel with hardened banks. In 1911, the Cedar River was rerouted away from the Black River so that it flowed into the south end of Lake Washington. Regular dredging of the Lower Duwamish River has occurred since 1916 to support ship navigation.

The Lower Duwamish River now serves as a major shipping route for bulk and containerized cargo ships. The depth of the river varies from about -56 feet MLLW near its mouth, to -10 feet MLLW adjacent to the upper turning basin. The shoreline along the majority of the Lower Duwamish River consists of steeply sloped riprap banks, concrete and sheet piling bulkheads, piers, wharves, and buildings that extend over the water (LDWG 2010).

Decades of industrial activity such as aircraft manufacturing, ship building and maintenance work, shipyard, marina, and aircraft operations, as well as sewer overflows and urban runoff from more than 100 storm drains have contaminated soils, groundwater, and river sediments in the Lower Duwamish River. Sediment contamination in the Lower Duwamish River has been characterized as localized areas with relatively high chemical concentrations (hot spots) separated by relatively large areas with lower chemical concentrations (LDWG 2010). Sediment contaminants include, but are not limited to Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs), mercury, other metals, and phthalates (WDOE 2019a). The U.S. Environmental Protection Agency (USEPA) added shoreline areas and the river along the lower 5 mile portion of the Duwamish River to the Superfund National Priorities List in 2001, creating the Lower Duwamish Waterway Superfund Site. WDOE added the site to the Washington Hazardous Sites List in 2002. The most of the Duwamish River is on WDOE's 2012

303(d) list of polluted waterways for many water and sediment contaminants and exceedance of temperature standards.

The USCG Base Seattle berthing site was first operated as a shipping terminal from about 1924 to 1940. In 1940, the site was acquired by the Department of Defense in its current configuration. The USCG took over, and has been operating at the site continuously since 1975. The berthing extends about 1,100 feet to the east. It is about 280 feet wide between Piers 35 and 37, and about 230 feet wide between Piers 36B and 37. Pier 36B is on the southeast side of the berthing. It is 750 feet long and 100 feet wide. It is supported by 1,595 14-inch creosote-treated timber piles. About 633 of those piles are at least partially wrapped. The pier deck is about 15 feet above MLLW. The shoreline under Pier 36B consists of a vertical concrete bulkhead. The shoreline under the concrete apron and Pier 37 consists of vertical steel sheet pile bulkhead. The bottom depth within the berthing varies from about 26 to 39 feet below MLLW. However the design depth of the berthing is 40 feet below MLLW. The bottom substrate consists of dark sandy soils with interbedded layers of clay and silt. Dive surveys have documented no submerged aquatic vegetation.

The site is included within the Harbor Island Superfund Site. The near-surface sediments are moderately to heavily contaminated by PAHs, and PCB's, and metals have been detected in some areas. Duwamish Waterway immediately southwest of the USCG Base is currently identified on the Washington State Department of Ecology (WDOE) 303d list (Category 5) of impaired water bodies for PAH, and for contaminated sediments. (WDOE 2019b). The USCG reports that there is no water quality monitoring within the berthing, but assumes similar water quality as the adjacent Duwamish Waterway. The sediments within the berthing are identified by the State as Category 2 sediments.

The action area provides migratory habitat for adult and juvenile PS Chinook salmon, larval and pelagic juvenile PS/GB bocaccio may also pass through the area on the currents, but they are unlikely to settle out in the action area. The juvenile Chinook salmon leaving the Duwamish River would be highly shoreline dependent, and are very likely to migrate through or very close to the project area. The area has also been designated as critical habitat for PS Chinook salmon. The past and ongoing anthropogenic impacts described above have established conditions that maintain poor water quality, as well as overwater structures and shoreline hardening that hinder migration of juvenile salmonids, and may expose PS Chinook salmon to high levels of predation.

<u>Climate Change:</u> Climate change has affected the environmental baseline of aquatic habitats across the region and within the action area. However, the effects of climate change have not been homogeneous across the region, nor are they likely to be in the future. During the last century, average air temperatures in the Pacific Northwest have increased by 1 to 1.4° F (0.6 to 0.8 °C), and up to 2° F (1.1 °C) in some seasons (based on average linear increase per decade; Abatzoglou *et al*. 2014; Kunkel *et al*. 2013). Recent temperatures in all but two years since 1998 ranked above the 20th century average (Mote *et al*. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10° F (1.7 to 5.6° C), 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 and 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote *et al*. 2014). 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).

The combined effects of increasing air temperatures and decreasing spring through fall flows are expected to cause increasing stream temperatures; in 2015 this resulted in 3.5-5.3ºC increases in Columbia Basin streams and a peak temperature of 26ºC in the Willamette (NWFSC 2015). 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 (Isaak *et al*. 2012; Mantua *et al*. 2010). 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 (DO) 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; Raymondi *et al*. 2013; Winder and Schindler 2004). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier *et al*. 2008; Raymondi *et al*. 2013; Wainwright and Weitkamp 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 (Lawson *et al*. 2004; McMahon and Hartman 1989).

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.

2.5 Effects of the Action on Species and Designated Critical Habitat

Under the ESA, “effects of the action” means the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Direct effects are caused by exposure to action-related stressors that occur at the time of the action. Indirect effects are effects caused by the proposed action that occur later in time but are still reasonably certain to occur.

As described in Section 1.3, the USCG’s contractors would conduct about 60 days of in- and above-water work between July 16 and February 15 to fully jacket about 104 creosote-treated timber piles under Pier 36B and to clean and repaint about 2,000 square feet of steel sheet pile bulkhead along Pier 37 and the concrete apron at USCG Base Seattle. As described in Section 2.2, PS Chinook salmon inhabit the action area, and pelagic PS/GB bocaccio may also occasionally pass through the action area, carried by the currents. It is extremely unlikely that rearing juvenile bocaccio would be present. Critical habitat has been designated for PS Chinook salmon within the action area. The proposed work window would avoid the typical out-migration season for juvenile Chinook salmon, but it overlaps with in-migrating adult Chinook salmon. It also overlaps with the latter half of the season when PS/GB bocaccio larvae and pelagic juveniles could be present.

Construction is likely to cause direct effects through construction-related water quality impacts, and indirect effects through contamination of forage. The USCG’s repairs would have the additional effect of extending the useful life of the piers and apron beyond that of the existing structures. Over that time, those structures and their interrelated activities would cause effects on both species through structure-related impacts on water quality, contaminated forage, altered lighting, shoreline armoring, vessel noise, and propeller wash.

2.5.1 Effects on Listed Species

Construction-related Degraded Water Quality

Exposure to construction-related degraded quality would cause minor effects in PS Chinook salmon. Given the rarity of PS/GB bocaccio and the short 60-day period of work, it is extremely unlikely that any PS/GB bocaccio would be exposed to construction-related effects. Construction would temporarily affect water quality by increased turbidity that may also reduce DO levels. It would also temporarily introduce toxic materials into the water column.

Turbidity: The planned hand-excavation around 104 piles under Pier 36B would mobilize such small amounts of sediment that they would likely settle out of the water within a few feet, and turbidity would likely return to background levels within a few minutes after excavation is complete. Further, full depth sediment curtains would limit the movement of the mobilized sediments to the area immediately under the pier, and act as a fish exclusion device. Based on the timing of in-water work, it is extremely unlikely that juvenile salmonids would be present during construction. Adult Chinook salmon are very unlikely to enter the berthing, and even less so to be within the sediment curtain. In the unlikely event of exposure, the best available information, suggests that excavation-related turbidity would be episodic, very short-lived, and of TSS concentrations too low to cause more than temporary, non-injurious behavioral effects such as avoidance of the plume and minor gill flaring (coughing), which individually or in combination would cause no effect on the fitness of exposed individuals.

Dissolved Oxygen (DO): Mobilization of anaerobic sediments can decrease DO levels (Morton 1976). However, as described immediately above, excavation would mobilize such a small amount of near-surface sediment that any impacts on DO would be too small and short-lived to cause detectable effects in exposed fish. Further, exposure of list-fish is extremely unlikely because the effected water would be within full-depth sediment curtains that would also act as a fish exclusion device.

Toxic Materials: Toxic materials may enter the water through construction-related spills and discharges, the mobilization of contaminated sediments, and/or the release of creosote-related PAHs directly from timber piles during their repair. As discussed in more detail below under structure-related effects, many of the fuels, lubricants, and other fluids used by common construction-related equipment are petroleum-based hydrocarbons with PAHs and other substances that are known to be injurious to fish. However, the project includes comprehensive best management practices (BMPs) to reduce the risk and intensity of discharges and spills from construction-related equipment, as well as required measures to capture and remove toxic materials that may enter the water. In the unlikely event of a construction-related spill or discharge, the amount of material released would likely be very small. Further, most of the petroleum-based fuels and lubricants that are used for this type of work typically float on the surface, so their residence time in the water column would likely be measured in minutes. While at the surface, the petroleum-based fluids would be restricted to small enclosed areas immediately around the work area, and quickly removed from the water by absorbent pads. Wood particles and other floating debris would be removed with fine-mesh nets and/or by hand.

The sediment that would be mobilized during hand excavation for pile repair is very likely to contain PAHs and other substances that are known to be injurious to fish. PAHs may also be released directly from the timber piles when they are being cleaned. As described above, the amount of sediment that would be mobilized during hand excavation would be very small. Similarly, the amount of PAHs that may be released from the piles is expected to be very low. Further, any mobilized contaminants would be contained within full-depth sediment curtains that would exclude fish. Most lighter-weight PAHs would dissipate within a few hours after their release into the water through evaporation at the surface (Smith 2008; Werme *et al*. 2010). The remaining contaminants would quickly settle out of the water along with the sediments.

Based on the best available information, it is extremely unlikely that juvenile salmonids would be present during construction. Adult Chinook salmon are very unlikely to enter the berthing, and even less so to be within the sediment curtain. Further, the in-water concentration of construction-related contaminants would likely be too low and too short-lived to be detectable against background contamination, and too low to cause detectable effects on the fitness and normal behaviors in any fish that may be exposed to it.

Construction-related Contaminated Forage:

Exposure to construction-related contaminated forage would cause minor effects in PS Chinook salmon and bocaccio. Shoreline obligated juvenile Chinook salmon are likely to pass forage within the action area every year. Over time, some pelagic PS/GB bocaccio are likely to be carried through the action area by the currents and may forage while present. Rearing juvenile bocaccio are extremely unlikely to be present.

As discussed in more detail below under structure-related contaminated forage, salmonids and other fish absorb contaminants through the consumption of small invertebrates in contaminated habitats (Meador et al. 2006; Varanasi et al. 1993). However, the planned hand-excavation around the timber piles under Pier 36B would mobilize very small amounts of contaminated subsurface sediments in an area where surface sediment contamination currently exists. The excavation is extremely unlikely to measurably increase the concentration of biologically available contaminants at the site. Further, full depth sediment curtains would limit the movement of the mobilized sediments to the area immediately under the pier, and prevent any increase in the size of the contaminated area. Therefore, the construction would not measurably increase the concentration or availability of contaminated forage for either species.

Structure-related Degraded Water Quality

Structure-related impacts on water quality is likely to adversely affect PS Chinook salmon and PS/GB bocaccio. Shoreline obligated juvenile Chinook salmon are likely to pass through the action area every year. Over time, some pelagic PS/GB bocaccio are likely to be carried through the action area by the currents. Rearing juvenile bocaccio are extremely unlikely to be present.

The project would affect water quality through the retention of creosote-treated timber piles under Pier 36B, and though the discharge of untreated stormwater runoff from Piers 36B and 37, the concrete apron, and the ships that moor at the piers. Additionally, pollutants are likely to enter the water from periodic discharges of petroleum-based fuels and lubricants from moored ships, and from ship maintenance and repair work done while moored. Moored ships may also have hulls coated with anti-fouling paints that contain copper. Unlike the small-scale and brief introduction of pollutants that may occur during construction, the piers, apron, and ships would be continuous year-round sources of pollutants for the duration of the structures' functional lives.

PS Chinook salmon and PS/GB bocaccio can uptake contaminants directly through their gills, and through dietary exposure (Karrow *et al*. 1999; Lee and Dobbs 1972; McCain *et al*. 1990; Meador *et al*. 2006; Neff 1982; Varanasi *et al*. 1993). Many of the structure-related pollutants that may enter the water can cause effects in exposed fish that range from no detectable effects, through reduced growth, altered immune function, and mortality. The intensity of the effects depends largely on the pollutant, its concentration, and the duration of exposure (Brette *et al*. 2014; Feist *et al*. 2011; Gobel *et al*. 2007; Incardona *et al*. 2004, 2005, and 2006; Mcintyre *et al*. 2012; Meadore *et al*. 2006; Sandahl *et al*. 2007; Spromberg *et al*. 2015).

Creosote-treated Timber Piles: Pier 36B was constructed with creosote-treated piles and timbers. About 1,595 creosote-treated timber piles currently support the pier. Of those, 633 are at least partially enclosed in some type of wrap or containment. The project would fully enclose about 104 piles (some of which currently have some containment) and leave about 933 creosote-treated timber piles fully exposed to the water. The exposed piles that would remain at the site would exude PAHs into the water for years. The overwater creosote-treated timber that comprises much of the pier's upper structure would also leach PAHs into the water for years. The in-water PAH concentrations and durations of exposure that any individual fish may experience due to the retention of the USCG's creosote-treated piles and timbers, along with the intensity of the resulting effects, are unquantifiable with any degree of certainty. However, over the life of Pier 36B in its current configuration, some juvenile Chinook salmon and bocaccio are reasonably likely to be exposed to pier-attributable PAHs at concentrations high enough to measurably reduce their fitness or alter their normal behaviors.

<u>Untreated Stormwater:</u> Piers 36B and 37 and the concrete apron are used for equipment movement and operation as well as vehicle parking (Figure 1). The USCG reports that surface runoff from USCG Base Seattle is currently untreated, and discharged to the waters of their berthing through a network of stormwater catch basins, drain lines, and outfalls. The USCG reports that they employ BMPs to reduce the accumulation of pollutants on the pier, and they also conduct regular facility inspections and upgrade the BMPs as needed to address stormwater quality issues. However, given the equipment/vehicular traffic, the large amount of creosote-treated wood in the pier, and the absence of specific treatments to remove pollutants, NMFS expects that some level of contamination by PAH and other pollutants exists in the stormwater runoff from the pier.

Untreated stormwater runoff from roads and bridges has been identified as an important source of water contamination in Puget Sound watersheds, and has been directly linked to pre-spawner die off in adult coho salmon and to mortality in aquatic invertebrates that are important forage resources for juvenile salmonids (Mcintyre *et al*. 2015; Spromberg *et al*. 2015). Traffic-related contaminants include PAHs, heavy metals, and a growing list of contaminants that are just beginning to be identified (Peter *et al*. 2018). Those contaminants accumulate on surfaces until they are carried away with stormwater runoff. As described earlier, the primary effects of PAH exposure in salmonids are reduced growth, increased susceptibility to infection, and increased mortality (Meador *et al*. 2006; Varanasi *et al*. 1993).

The in-water pollutant concentrations and durations of exposure any individual fish may experience due to stormwater runoff from the piers and apron, along with the intensity of the resulting effects, are unquantifiable with any degree of certainty. However, over the life of the pier, some Chinook salmon and bocaccio are reasonably likely to be exposed to PAHs and other contaminants at concentrations high enough to measurably reduce their fitness or alter their normal behaviors.

<u>Vessel-related Petroleum-based Fuels and Lubricants:</u> Vessels, large and small, routinely but unintentionally discharge small amounts petroleum-based fuels and lubricants into the surrounding waters, as would the USCG vessels that moor at Piers 36B and 37. The USCG employs measures to protect against discharges that would reduce the likelihood, frequency, and size of discharges. They also employ standard operating procedures to contain and remove discharged pollutants from the berthing. However, over the life of the piers, discharges that

escape the control measures are likely to occur. The relatively protected conditions within the berthing would facilitate the accumulation petroleum-based pollutants. The concentrations, and the distances from the piers that vessel-related contaminants may be present at detectable levels are unknown. However, over the life of the pier, some juvenile Chinook salmon and bocaccio are reasonably likely to be exposed to these contaminants at levels high enough to measurably reduce their fitness or alter their normal behaviors.

Vessel Maintenance and Repair Work: Pier-side ship maintenance and repair work would involve the year-round use or generation of materials that contain hazardous substances. Common pollutants include petroleum-based fuels and lubricants that are used in equipment, paints, solvents, abrasive grits, and heavy metals. These materials can enter the water directly from spills, overspray, and fugitive dusts. Contaminants that accumulate on the pier and the decks of moored ships also enter the water in stormwater runoff. The USCG employs measures to reduce the likelihood of contaminants entering the water during maintenance and repair work. Common control measures include procedures for the proper storage, use, and disposal of toxic chemicals; spill containment and clean-up procedures; requirements to enclose work areas where dusts, chips, and paint spray would be generated; and requirements to routinely sweep, vacuum, and clean work areas, including pier and ship decks to reduce the accumulation of materials that could enter the water.

Despite these measures, small amounts of contaminants are likely to enter the water at the site, particularly during rain storms. In addition to the effects of exposure to toxins previously discussed, the mix of pulverized paint chips, metal dusts, and abrasive grits that enter the water are also harmful to salmonids and other fish. The concentrations, and the distances from the pier that contaminants from pier-side ship maintenance and repair may be present at detectable levels are unknown. However, over the life of Pier 36B, some juvenile Chinook salmon and bocaccio are reasonably likely to be exposed to these contaminants at levels high enough to measurably reduce their fitness or alter their normal behaviors.

Copper from Anti-fouling Hull Paints: Exposure to dissolved copper at concentrations between 0.3 to 3.2 µg/L above background levels has been shown to cause avoidance of an area, to reduce salmonid olfaction, and to induce behaviors that increase juvenile salmon's vulnerability to predators in freshwater (Giattina *et al.* 1982; Hecht *et al*. 2007; McIntyre *et al*. 2012; Sommers *et al*. 2016; Tierney *et al*. 2010). However, copper is much less toxic to fish in saltwater than in freshwater. Baldwin (2015) reports that dissolved copper's olfactory toxicity in salmon is greatly diminished with increased salinity. In estuarine waters with a salinity of 10 parts per thousand (ppt), no toxicity was reported for copper concentrations below 50 µg/L, as compared to 0.3 to 3.2 µg/L in freshwater. Sommers *et al.* (2016) report no copper-related impairment of olfactory function in salmon in saltwater. Sub-lethal copper toxicity in bocaccio is not yet understood, but may be similar to that of salmonids.

Copper-based anti-fouling paints leach copper into the water at fairly constant levels, and can be a significant source of dissolved copper in harbors and marinas with high boat occupancy and restricted water flows (Schiff *et al*. 2004). WDOE (2017) reports that dissolved copper concentrations from anti-fouling paints can be above 5 µg/L in protected moorages, but below 0.5 µg/L in open moorages with high flushing rates. The number of ships that would moor at

USCG Base Seattle with copper-based antifouling paint is unknown, but is likely mute because the salinity at the pier is likely between 20 and 30 ppt. Should the dissolved copper concentration at USCG Base Seattle be at the high end of WDOE's predicted range, it would still be well below the expected threshold of effect for salmonids and other fish like bocaccio that are exposed to dissolved copper in estuarine and marine water.

Summary: Over the life of the piers and apron, creosote-treated timber, moored vessels, and pier-side ship maintenance and repair work would continuously introduce low levels of harmful contaminants into the waters of the berthing. The in-water concentrations, and the distances from the piers that these contaminants may be present at detectable levels are unknown, but expected to be limited to the berthing. However, over the life of the pier, some juvenile Chinook salmon and bocaccio are reasonably likely to be exposed to some combination of these contaminants at concentrations high enough to measurably reduce their fitness and/or alter their normal behaviors. The annual number of juvenile PS Chinook salmon and pelagic bocaccio that may be impacted by pier-related degraded water quality is unquantifiable with any degree of certainty, as is the intensity of the effects that an exposed individual may experience. However, the relatively small affected area suggests that the probability of exposure would be very low for any individual fish. Therefore, for both species, the numbers of fish that may be annually exposed to pier-related degraded water quality would likely comprise extremely small subsets of the cohorts from their respective populations, and the numbers of exposed fish would be too low to cause detectable population-level effects.

Structure-related Contaminated Forage

Exposure to contaminated forage is likely to adversely affect PS Chinook salmon and bocaccio. Shoreline obligated juvenile Chinook salmon are likely to pass through the action area every year. Over time, some pelagic PS/GB bocaccio are likely to be carried through the action area by the currents. Rearing juvenile bocaccio are extremely unlikely to be present.

Due to the continuous input from the creosote-treated piles and other pier-related sources of pollution discussed above, contaminants such as PAHs and PCBs would be biologically available at the site into the foreseeable future. Amphipods and copepods uptake PAHs from contaminated sediments (Landrum and Scavia 1983; Landrum *et al*. 1984; Neff 1982), and pass them to juvenile Chinook salmon and other fish through the food web. The primary effects of dietary PAH exposure in salmonids include reduced growth, increased susceptibility to infection, and increased mortality.

Varanasi *et al*. (1993) found high levels of PAHs in the stomach contents of juvenile Chinook salmon in the contaminated Duwamish Waterway. They also reported reduced growth, suppressed immune competence, as well as increased mortality in juvenile Chinook salmon that was likely caused by the dietary exposure to PAHs. Meador *et al*. (2006) demonstrated that dietary exposure to PAHs caused "toxicant-induced starvation" with reduced growth and reduced lipid stores in juvenile Chinook salmon. The authors surmised that these impacts could severely impact the odds of survival in affected juvenile Chinook salmon. PS/GB bocaccio were not specifically addressed in the available literature, but it is reasonable to expect that they may be similarly affected by dietary uptake of contaminants.

The annual numbers of juvenile PS Chinook salmon and pelagic bocaccio that may be exposed to contaminated forage that would be attributable to Pier 36B is unquantifiable with any degree of certainty, as is the amount of contaminated prey that any individual fish may consume, or the intensity of any effects that an exposed individual may experience. However, the small affected area suggests that the probability of trophic connectivity to the contamination would be very low for any individual fish. Therefore, for both species, the numbers of fish that may be annually exposed to contaminated prey would likely comprise extremely small subsets of the cohorts from their respective populations, and the numbers of exposed fish would be too low to cause detectable population-level effects.

Structure-related Altered Lighting

Structure-related altered lighting related to Piers 36B and 37, and the concrete apron is likely to adversely affect PS Chinook salmon and PS/GB bocaccio. Shoreline obligated juvenile Chinook salmon are likely to pass through the action area every year. Over time, some pelagic PS/GB bocaccio are likely to be carried through the action area by the currents. Rearing juvenile bocaccio are extremely unlikely to be present.

Shade: The piers and apron are all solid-decked and totally opaque, with a combined overwater footprint of over 120,000 square feet. Ships moored alongside the piers would add to the shaded area. The shadow would reduce aquatic productivity. It may also alter migration and increase exposure and vulnerability to predators for juvenile salmonids. The intensity of these effects are likely to vary based on the brightness and angle of the sun, being most intense on sunny days, and less pronounced to possibly inconsequential on cloudy days.

Juvenile salmon feed on planktonic organisms such as amphipods, copepods, and euphausiids, as well as the larvae of many benthic species and fish (NMFS 2006). Pelagic bocaccio feed on similar but likely smaller planktonic organisms. Shade limits primary production and can reduce the diversity of the aquatic communities under over-water structures (Nightingale and Simenstad 2001; Simenstad *et al*. 1999). Because the pier and moored ships are solid-decked, they cast hard shadows over water and substrate that may otherwise be supportive of submerged aquatic vegetation (SAV) and benthic invertebrates. Therefore, it is highly likely that the shadows limit the availability of natural cover that would be provided by SAV, and reduce the quantity and diversity of prey organisms for juvenile Chinook salmon and pelagic bocaccio.

Shade can affect juvenile salmon migration, but is unlikely to affect the migration of pelagic bocaccio who’s movement would be driven more by the current than by directional swimming. Numerous studies demonstrate that juvenile salmonids, in both freshwater and marine habitats, are more likely to avoid the shadow of an overwater structure than to pass through it (Celedonia *et al*. 2008a and b; Kemp *et al*. 2005; Moore *et al*. 2013; Munsch *et al*. 2014; Nightingale and Simenstad 2001; Ono *et al*. 2010; Southard *et al*. 2006). Swimming around overwater structures increases the migratory distance, which has been positively correlated with increased mortality in juvenile Chinook salmon (Anderson *et al*. 2005). However, unlike piers that extend out from the shoreline and across the along shore migratory path of out-migrating juvenile salmon, Pier 36B extends inland and away from the expected migratory path. Therefore, the shadow is not likely to cause a migratory delay or increase the migratory distance by inducing the fish to avoid it.

Similarly, given the location and orientation of Piers 36B and 37 relative the shoreline, their shadows are extremely unlikely to cause any measurable increase in exposure or vulnerability to predators for juvenile Chinook salmon that migrate near them. Although exposure and vulnerability to piscivorous predators tends to increase with water depth, the shadows would cause virtually no effect on the water depth the juveniles would travel in. Also, NMFS knows of no marine analogs to the much studied freshwater piscivorous ambush predators that tend to concentrate in the shadows under overwater structures.

Artificial Lighting: The piers and concrete apron have lighting systems that would cause nighttime artificial illumination of the water, as would some or all of the ships that would moor there. The lighting systems at the USCG piers and concrete apron are undescribed. However, current satellite imagery of USCG Base Seattle shows numerous tall light poles along the length of Pier 37 and the concrete apron, as well as lights along the roof edge of the building on Pier 36B. Nighttime artificial illumination of the water's surface attracts fish (positive phototaxis) and often shifts nocturnal behaviors toward more daylight-like behaviors. It may also affect light-mediated behaviors such as migration timing.

Becker *et al*. (2013) found that the abundance of fish increased in artificially illuminated estuarine waters. Ina *et al*. (2017) reported strong positive phototaxis in juvenile Pacific bluefin tuna. In the Lake Washington Ship Canal, Celedonia and Tabor (2015) found that juvenile Chinook salmon were attracted to artificially lit areas at 0.5 to 2.5 lumens per square meter. Tabor *et al*. (2017) found that sub yearling Chinook, coho, and sockeye salmon in lacustrine environments exhibit strong nocturnal phototaxis when exposed to 5.0 to 50.0 lumens per square meter, with phototaxis positively correlated with light intensity. In the absence of artificial illumination, juvenile Chinook salmon in lacustrine environments typically feed and migrate during the day, and are inactive at night, residing at the bottom in shallow waters. They tend to move off the bottom and become increasingly active at dawn when light levels reach 0.8 to 2.1 lumens per square meter (Tabor and Piaskowski 2002). Celedonia and Tabor (2015) reported that attraction to artificial lights can delay the onset of early morning migration by up to 25 minutes for juvenile Chinook salmon in freshwater, but didn't alter migration timing in the evening.

NMFS recently completed a consultation for a bridge replacement project that included a lighting system designed to limit illumination of the water yet still meet roadway safety standards (NMFS 2019). That system was predicted to illuminate the water's surface along the sides of the bridge at 1.08 lumens per square meter, which exceeds the 0.5 lumen per square meter level where phototaxis has been documented in Chinook salmon (Celedonia and Tabor 2015). Given the industrial nature the USCG base combined with its security and safety concerns, NMFS expects that the overwater illumination caused by the existing lighting systems are likely to exceed the threshold where the onset of daylight activities and phototaxis would occur, and that the illumination would extend to tens of feet over the water around the piers and moored ships. Therefore, juvenile Chinook salmon that are within the berthing are likely to experience some level of nocturnal phototaxis, and may experience other altered behaviors, such as delayed resumption of migration in the morning. Over the life of the piers and apron, it is likely that a small subset of the exposed individuals would experience reduced fitness and/or altered behaviors that could reduce their overall likelihood of survival.

Summary: Structure-related shade is likely to cause a combination of reduced natural cover and prey availability for juvenile Chinook salmon and pelagic bocaccio. Artificial illumination would cause altered nighttime behaviors in juvenile Chinook salmon. Over the lives of the USCG's structures, shade and artificial illumination are likely to reduce fitness or cause mortality for some individuals of both species. The annual numbers of individuals that would be impacted by this stressor is unquantifiable with any degree of certainty, and the numbers are likely to vary greatly over time. However, the available information suggests that the probability of exposure would be very low for any individual fish, and only a subset of the exposed individuals would be measurably affected. Therefore, the proportion of any year's cohort that would be killed or experience measurably reduced fitness due to this stressor would be too low to cause any detectable population-level effects.

Structure-related Armored Shoreline

Structure-related shoreline armoring related to Piers 36B and 37, the concrete apron, and their bulkheads is likely to adversely affect PS Chinook salmon, but would cause minor effects in PS/GB bocaccio. Shoreline obligated juvenile Chinook salmon are likely to pass through the action area every year. Over time, some pelagic PS/GB bocaccio are likely to be carried through the action area by the currents. Rearing juvenile bocaccio are extremely unlikely to be present. Unlike the juvenile Chinook salmon that would pass through the action area, the life stages of the pelagic bocaccio that would drift through the action area would be independent of the shoreline and of benthic habitats. Therefore, the effects described below for juvenile Chinook salmon would be largely inconsequential for the pelagic bocaccio.

Juvenile PS Chinook salmon survival is positively influenced by rapid growth during early estuarine and nearshore marine residence (Duffy and Beauchamp 2011). For several weeks to months after Chinook salmon leave their natal streams, they tend to prefer undisturbed, gently sloping shallow nearshore estuarine and marine habitats. These habitats are very important to juvenile salmon because they provide high quality forage resources and refuge from predators while the juveniles grow and undergo their physiological transition to offshore marine life.

A growing body of research indicates, shoreline armoring is negatively impacting estuarine and nearshore marine areas that are important for juvenile PS Chinook salmon. Shoreline armoring interrupts sediment recruitment and transport, which alters grain size and artificially steepens the shore. It often disconnects aquatic and terrestrial ecosystems that are naturally inter-dependent. It prevents the recruitment of drift wood and beach wrack that support myriad invertebrate organisms that are prey resources for juvenile salmon (Dethier *et al*. 2016; Heerhartz and Toft 2015; Sobocinski *et al*. 2010).

Additionally, the steepened banks that are typical along shoreline armoring effectively forces the juvenile salmon that pass it into deeper waters where foraging often comes at a higher energetic cost, and where they may encounter increased predation risk. Heerhartz and Toft (2015) report that feeding behaviors of juvenile salmon are higher along unarmored shorelines than along armored shorelines, and that decreased or altered prey availability along armored shorelines is detrimental to juvenile salmon in nearshore ecosystems. Willette (2001) reports that marine piscivorous predation of juvenile salmon increased fivefold when the juvenile salmon were forced to leave shallow nearshore habitats. Shoreline armoring can also negatively impact forage fish spawning by reducing the amount of available spawning habitat, and/or by increasing egg mortality (Rice 2006), which may reduce the available forage for adult salmon.

The shoreline conditions created by Piers 36B and 37, the concrete apron, and their bulkheads consist of hardened vertical banks, deep water, and virtually no SAV. Therefore, while within the USCG berthing, juvenile Chinook salmon are likely to experience increased energetic costs during a life stage when rapid growth is critical. They may also experience increased exposure to piscivorous predators. Those that fail to escape would be killed. Individuals that do escape would experience reduced fitness due to increased energetic costs and stress-related effects that may reduce their overall likelihood of survival.

The annual numbers of juvenile Chinook salmon that may exposed to this stressor along with the intensity of the resulting effects for any individual fish are unquantifiable with any degree of certainty. However, over the life of the piers and concrete apron, some Chinook salmon are reasonably likely to experience measurably reduced fitness or mortality due to the exposure. The relatively small affected area suggests that the probability of exposure would be very low for any individual fish. Therefore, the annual numbers of fish that may experience measurably reduced fitness or mortality due to structure-related shoreline armoring would likely comprise an extremely small subset of its cohort, and be too low to cause detectable population-level effects.

Structure-related Vessel Noise

Exposure to structure-related vessel noise would cause adverse effects in juvenile PS Chinook salmon and PS/GB bocaccio. Shoreline obligated juvenile Chinook salmon are likely to pass through the action area every year. Over time, some pelagic PS/GB bocaccio are likely to be carried through the action area by the currents. Rearing juvenile bocaccio are extremely unlikely to be present.

Ocean-going cutters and icebreakers up to about 400 feet long routinely moor at the USCG's piers (Figure 1), and the operation of those vessels would cause elevated in-water noise at levels capable of causing detectable effects in exposed fish. Because vessel operations at the piers may occur at any time during the year, over the life of the piers, this assessment assumes that continuous vessel operations may occur during peak outmigration season for juvenile PS Chinook salmon, and during the pelagic drift and rearing nearshore juvenile phases for PS bocaccio.

The effects of a fishes' exposure to noise vary with the hearing characteristics of the exposed fish, the frequency, intensity, and duration of the exposure, and the context under which the exposure occurs. At low levels, effects may include the onset of behavioral disturbances such as acoustic masking (Codarin *et al*. 2009), startle responses and altered swimming (Neo *et al*. 2014), abandonment or avoidance of the area of acoustic effect (Mueller 1980; Picciulin *et al*. 2010; Sebastianutto *et al*. 2011; Xie *et al*. 2008) and increased vulnerability to predators (Simpson *et al*. 2016). At higher intensities and/or longer exposure durations, the effects may rise to include temporary hearing damage (a.k.a. temporary threshold shift or TTS, Scholik and Yan 2002) and increased stress (Graham and Cooke 2008). At even higher levels, exposure may lead to physical injury that can range from the onset of permanent hearing damage (a.k.a. permanent threshold shift or PTS) and mortality.

The best available information about the auditory capabilities of the fish considered in this Opinion suggest that their hearing capabilities are limited to frequencies below 1,500 Hz, with peak sensitivity between about 200 and 300 Hz (Hastings and Popper 2005; Picciulin *et al*. 2010; Scholik and Yan 2002; Xie *et al*. 2008). The NMFS uses two metrics to estimate the onset of injury for fish exposed to high intensity impulsive sounds. The metrics are based on exposure to peak sound level and sound exposure level (SEL), respectively. Both are expressed in decibels (dB). The metrics are: 1) exposure to 206 dB_{peak}; and 2) exposure to 187 dB SEL_{cum} for fish 2 grams or larger, or 183 dB SEL_{cum} for fish under 2 grams. Any received level (RL) below 150 dB_{SEL} is considered "Effective Quiet". The distance from a source where the RL drops to 150 dB_{SEL} is considered the maximum distance from that source where fishes can be affected by the noise, regardless of accumulation of the sound energy (Stadler and Woodbury 2009). Therefore, when there is a difference between the ranges to the isopleths for effective quiet and SEL_{cum}, the shorter range shall apply.

The discussion in Stadler and Woodbury (2009) makes it clear that the thresholds likely overestimate the potential effects of exposure to impulsive sounds. Further, the assessment did not consider non-impulsive sound because it is believed to be less injurious to fish than impulsive sound. Therefore, any application of the criteria to non-impulsive sounds is also likely to overestimate the potential effects in fish. However, this assessment applies the criteria to both impulsive and non-impulsive sounds for continuity, and as a tool to gain a conservative idea of the sound energies that fish may be exposed to during the majority of this project.

Vessel operations near the piers would typically consist of episodic periods of relatively low-speed propulsion operations that could last from many minutes up to a couple hours while the vessels maneuver in or out of the berthing. The vessels' auxiliary systems may also cause continuous in-water noises while they are moored at the piers. Numerous sources describe the source levels for ocean-going vessels operating at transit speeds (Blackwell and Greene 2006; McKenna *et al*. 2012; Picciulin *et al*. 2010; Reine *et al*. 2014; Richardson *et al*. 1995). Table 4 summarizes the expected sound levels for some of those vessels, with ranges to applicable effects thresholds for fish.

Table 4 In-water Source Levels for ocean-going vessels similar in size to those likely to moor at USCG Base Seattle, with estimated ranges to effects thresholds for fish.

Source	Acoustic Signature	Source Level	Threshold Range
Tanker	< 2 kHz Combination	191 dB_{peak}	206 @ N/A
Episodic periods measured in minutes to low hours		176 dB_{SEL}	150 @ 54 m
85 foot long tourist ferry	< 2 kHz Combination	187 dB_{peak}	206 @ N/A
Episodic periods measured in minutes to low hours		177 dB_{SEL}	150 @ 63 m
Tugboat	< 2 kHz Combination	185 dB_{peak}	206 @ N/A
Episodic periods measured in minutes to low hours		170 dB_{SEL}	150 @ 22 m

It is extremely unlikely that USCG vessels would operate at anything above minimal speeds when near the berthing. However, they may briefly use bursts of higher power settings while maneuvering, and some of the vessels' auxiliary systems could be very loud and may be operated continuously while moored. To be conservative, NMFS estimates that noise levels approaching that of tugboat operations may be present at the USCG berthing anytime ships are present.

The best available information suggests that no vessel-related sound sources would exceed the 206 dB_{peak} exposure threshold. However, the 150 dB_{SEL} isopleth may extend as far as 72 feet (22 m) around moored and maneuvering vessels within the berthing. Any juvenile Chinook salmon or bocaccio that are within that isopleth would likely experience behavioral disturbance, such as acoustic masking, startle responses, altered swimming patterns, avoidance, and increased risk of predation. The intensity of these effects would increase with increased proximity to the source and/or duration of exposure.

Given the short duration and episodic nature of vessel noise events, the small size of the affected area, and the low numbers of juvenile PS Chinook salmon and PS/GB bocaccio that may be present at the project site at any given time, the numbers of individuals that may be exposed to structure-related noise would likely comprise extremely small subsets of the cohorts from their respective populations, and the numbers of exposed fish would be too low to cause any detectable population-level effects.

<u>Structure-related Propeller Wash</u>

Structure-related propeller wash is likely to adversely affect juvenile PS Chinook salmon and PS/GB bocaccio. Spinning propellers can kill fish and small aquatic organisms (Killgore *et al*. 2011; VIMS 2011). Spinning propellers also generate fast-moving turbulent water known as propeller wash that can displace and disorient small fish. Propeller wash can also mobilize sediments and dislodge aquatic organisms and SAV, particularly in shallow water and/or at high power settings. This is called propeller scour.

The distance where propeller wash from USCG ship movement would no longer be detectable is unknown. However, a recent study of turbidly cause by tugboat operations described plumes extending to about 550 yards in about 13 minutes (ESTCP 2016). However, USCG vessels would be moving very slowly near the berthing, and about 750 feet (250 yards) away from the berthing entrance the east bank of Harbor Island would block the propeller wash. Therefore, the effects of propeller wash would likely be limited to the berthing and the waters within 250 yards of its entrance.

The episodic vessel operations at the USGC piers would involve spinning propellers and cause propeller wash within the USGC berthing. Adult Chinook salmon that migrating past the berthing are likely to avoid the area and be relatively deep. Further, they would be able to swim against most propeller wash they might be exposed to without any measurable effect on their fitness or normal behaviors. Conversely, juvenile Chinook salmon and bocaccio that are within or migrating past the berthing are likely to be relatively close to the surface and too small to effectively swim against the propeller wash. Individuals that are struck or very nearly missed by propeller blades would be injured or killed by the exposure. Those that are caught in the propeller wash, are likely to experience displacement that could increase energetic costs and reduce feeding success. Some may also experience increased vulnerability to predators as they tumble stunned or disoriented in the wash.

Although the likelihood of this interaction is very low for any individual fish or any individual vessel trip, it is likely that over the life of the USCG's piers, at least some juvenile Chinook salmon and bocaccio would experience reduced fitness or mortality from exposure to spinning propellers and/or propeller wash related to their piers. The annual number of individuals that may be impacted by this stressor is unquantifiable with any degree of certainty. However, based on the expectation that exposed individuals would be very small subsets of the cohorts from their respective populations, the numbers of exposed fish would be too low to cause detectable population-level effects.

2.5.2 Effects on Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected Primary Biological Features (PBFs) from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely last for weeks, and long-term effects are likely to last for months, years or decades.

Puget Sound Chinook Salmon Critical Habitat: The proposed action is likely to adversely affect critical habitat that has been designated for PS Chinook salmon. The essential PBFs of PS Chinook salmon critical habitat are listed below. The expected effects on those PBFs from completion of the planned project, including full application of the conservation measures and BMPs, would be limited to the impacts on the PBF of estuarine and nearshore marine areas free of obstruction and excessive predation as described below.

1. Freshwater spawning sites – None in the action area.
2. Freshwater rearing sites – None in the action area.
3. Freshwater migration corridors – None in the action area.
4. Estuarine areas free of obstruction and excessive predation
   a. Free of obstruction and excessive predation – The proposed action would maintain long-standing physical conditions and noise levels, which in combination with adjacent structures act to greatly limit access to shoreline areas for juvenile Chinook salmon, and supports the success of predatory species that feed on them.
   b. Water quality – The proposed retention of creosote-treated piles and timbers would maintain long-standing input of PAHs, and interrelated pier-side vessel repairs and maintenance work would maintain the persistent low level inputs of contaminants. The action would cause no measurable changes in water temperature.
   c. Water quantity – The proposed action will cause no effect on water quantity.
   d. Salinity – The proposed action will cause no effect on salinity.
   e. Natural Cover – The proposed action would maintain long-standing shading that limits SAV productivity within the berthing.
   f. Forage – The proposed action would maintain long-standing shading that limits the abundance and diversity of invertebrate organisms within the berthing. It would also

maintain long-standing sources of contamination that could be taken up by benthic invertebrates that are forage resources for juvenile Chinook salmon. The area of contamination would likely be limited to the berthing. The action would not affect forage fish spawning habitat.

5. <u>Nearshore marine areas free of obstruction and excessive predation</u>
    a. Free of obstruction and excessive predation – Same as above.
    b. Water quality – Same as above.
    c. Water quantity – Same as above.
    d. Forage – Same as above.
    e. Natural Cover – Same as above.
6. <u>Offshore marine areas</u> – None in the action area.

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 the consultation (50 CFR 402.02). Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

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 (Section 2.4).

The current condition of ESA-listed species and designated critical habitat within the action area are described in the Status of the Species and Critical Habitat and the Environmental Baseline sections above. The contribution of non-federal activities to those conditions include past and on-going shoreline development in the action area, as well as upstream forest management, agriculture, urbanization, road construction, water development, and restoration activities. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, general resource demands associated with settlement of local and regional population centers, and the efforts of conservation groups dedicated to restoration and use of natural amenities, such as cultural inspiration and recreational experiences.

NMFS is unaware of any specific future non-federal activities that are reasonably certain to affect the action area. However, NMFS is reasonably certain that future non-federal actions such as the previously mentioned shoreline and upstream activities are all likely to continue and increase in the future as the human population continues to grow across the region. Continued habitat loss and degradation of water quality from development and chronic low-level inputs of non-point source pollutants will likely continue into the future. Recreational and commercial use of the waters within the action area are also likely to increase as the human population grows.

The intensity of these influences depends on many social and economic factors, and therefore is difficult to predict. Further, the adoption of more environmentally acceptable practices and standards may gradually reduce some negative environmental impacts over time. Interest in restoration activities has increased as environmental awareness rises among the public. State, tribal, and local governments have developed plans and initiatives to benefit ESA-listed PS Chinook salmon within many of the watersheds that flow into the action area. However, the implementation of plans, initiatives, and specific restoration projects are often subject to political, legislative, and fiscal challenges that increase the uncertainty of their success.

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) Appreciably reduce 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 for the conservation of the species.

As described in more detail above at section 2.4, climate change is likely to increasingly affect the abundance and distribution of the ESA-listed species considered in the Opinion. It is also likely to increasingly affect the PBF of designated critical habitats. The exact effects of climate change are both uncertain, and unlikely to be spatially homogeneous. However, climate change is reasonably likely to cause reduced instream flows in some systems, and may impact water quality through elevated in-stream water temperatures and reduced DO, as well as by causing more frequent and more intense flooding events.

Climate change may also impact coastal waters through elevated surface water temperature, increased and variable acidity, increasing storm frequency and magnitude, and rising sea levels. The adaptive ability of listed-species is uncertain, but is likely reduced due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. The proposed action will cause direct and indirect effects on the ESA-listed species and critical habitats considered in the Opinion well into the foreseeable future. However, the action's effects on water quality, substrate, and the biological environment are expected to be of such a small scale that no detectable effects on ESA-listed species or critical habitat through synergistic interactions with the impacts of climate change are expected.

2.7.1 ESA-listed Species

Both of the species considered in this Opinion are listed as threatened, based on declines from historic levels of abundance and productivity, loss of spatial structure and diversity, and an array of limiting factors as a baseline habitat condition. Both species will be affected over time by cumulative effects, some positive – as recovery plan implementation and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation persist or increase.

Overall, to the degree that habitat trends are negative, as described below, effects on viability parameters of each species are also likely to be negative. In this context we consider the effects of the proposed action's effect on individuals of the listed species at the population scale.

PS Chinook salmon

The long-term abundance trend of the PS Chinook salmon ESU is slightly negative, and the South Puget Sound MPG, which includes the Green River (Duwamish), White River, Puyallup River, and Nisqually River populations is considered at high risk of extinction due to low abundance and productivity. Reduced or eliminated accessibility to historically important habitat, combined with degraded conditions in available habitat due to land use activities appear to be the greatest threats to the recovery of PS Chinook salmon. Commercial and recreational fisheries also continue to impact this species.

The project site is located along the southeastern shore of Elliott Bay, adjacent confluence of the east branch of the Duwamish Waterway with the bay. Is located along the migratory route taken juveniles and adults of the populations identified above, particularly those of the Green River population. The environmental baseline within the action area has been degraded by the effects of intense streambank and shoreline development and by maritime activities. The baseline has also been degraded by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance.

The timing of project-related work would avoid the typical out-migration season for juvenile Chinook salmon, but it overlaps with in-migrating adults. However, over the life of the repaired piers, out-migrating juveniles that pass close to the project site are likely to be exposed to reduced water quality, contaminated forage, altered lighting, altered shoreline, elevated noise, and propeller wash as a result of this action. These stressors, both individually and collectively, are likely to cause a range of effects that would include some combination of altered behaviors, reduced fitness, and mortality in some exposed individuals.

The annual number of juveniles that are likely to be injured or killed by exposure to action-related stressors is unknown, but is expected to be very low. Based on the best available information, the scale of the direct and indirect effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause detectable effects on any of the characteristics of a viable salmon population (abundance, productivity, distribution, or genetic diversity) for the affected PS Chinook salmon populations. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

PS/GB Bocaccio

No reliable population estimates or trend information are available for the DPS. However, the best available information indicates that bocaccio were never a predominant segment of the total rockfish abundance in Puget Sound, and their abundance has declined by more than 70 percent since 1965. PS/GB bocaccio are relatively rare throughout the range of the DPS, and it is uncertain whether or not they currently utilize the habitat within the action area. Fishing removals and derelict fishing gear, combined with degraded water quality appear to be the greatest threats to the recovery of the DPS.

The project site is located along the southeastern shore of Elliott Bay, adjacent confluence of the east branch of the Duwamish Waterway with the bay. The environmental baseline within the action area has been degraded by the effects of intense streambank and shoreline development and by maritime activities. The baseline has also been degraded by nearby and upstream industry, urbanization, agriculture, forestry, water diversion, and road building and maintenance.

The timing of project-related work overlaps with the latter half of the season when PS/GB bocaccio pelagic larvae and juveniles could be present, and over the life of the repaired piers, pelagic larvae and juveniles that pass close to the project site are likely to be exposed to reduced water quality, contaminated forage, altered lighting, altered shoreline, elevated noise, and propeller wash as a result of this action. These stressors, both individually and collectively, are likely to cause a range of effects that would include some combination of altered behaviors, reduced fitness, and mortality in some exposed individuals.

The annual number of pelagic larvae and juveniles that are likely to be injured or killed by exposure to action-related stressors is unknown, but is expected to be very low. Based on the best available information, the scale of the direct and indirect effects of the proposed action, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause detectable effects on any of the characteristics of a viable fish population (abundance, productivity, distribution, or genetic diversity) for the PS/GB bocaccio DPS. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

2.7.2 Critical Habitat

Chinook salmon critical habitat

As described above at Section 2.5, the proposed action is likely to adversely affect designated critical habitat for PS Chinook salmon. Past and ongoing land and water use practices have degraded salmonid critical habitat throughout the Puget Sound basin. Hydropower and water management activities have reduced or eliminated access to significant portions of historic spawning habitat. Timber harvests, agriculture, industry, urbanization, and shoreline development have adversely altered floodplain and stream morphology in many watersheds, diminished the availability and quality of estuarine and nearshore marine habitats, and reduced water quality across the region.

Global climate change is expected to increase in-stream water temperatures and alter stream flows, possibly exacerbating impacts on baseline conditions in freshwater habitats across the region. Rising sea levels are expected to increase coastal erosion and alter the composition of nearshore habitats, which could further reduce the availability and quality of estuarine habitats. Increased ocean acidification may also reduce the quality of estuarine habitats.

In the future, non-federal land and water use practices and climate change are likely to increase. The intensity of those influences on salmonid critical habitat is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally acceptable land use practices, by the implementation of non-federal plans that are intended to benefit salmonids, and by efforts to address the effects of climate change.

The PBF for PS Chinook salmon critical habitat in the action area are limited to estuarine and nearshore marine areas free of obstruction and excessive predation. The site attributes of those PBF that would be affected by the action are limited to obstruction and predation, water quality, natural cover, and forage. As described above, the project site is located along a heavily impacted waterway, and all of these site attributes currently function at greatly reduced levels as compared to undisturbed habitat. The long-term presence of the USCG piers and their interrelated activities would cause long term effects on the site attributes identified above.

Based on the best available information, the scale of the proposed action’s effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would be too small to cause any detectable long-term negative changes in the quality or functionality of estuarine and nearshore marine areas free of obstruction and excessive predation in the action area. Therefore, this critical habitat will maintain its current level of functionality, and retain its current ability for PBF to become functionally established, to serve the intended conservation role for PS Chinook salmon.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS’ opinion that the proposed action is not likely to jeopardize the continued existence of PS Chinook salmon and PS/GB bocaccio, nor is it likely to destroy or adversely modify designated critical habitat for PS Chinook salmon.

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 incidental take statement (ITS).

2.9.1 Amount or Extent of Take

NMFS determined that incidental take is reasonably certain to occur as follows:

Harm of PS Chinook salmon from exposure to:

- structure-related degraded water quality,
- structure-related contaminated forage,
- structure-related altered lighting,
- structure-related armored shoreline,
- structure-related vessel noise, and
- structure-related propeller wash.

Harm of PS/GB bocaccio from exposure to:

- structure-related degraded water quality,
- structure-related contaminated forage,
- structure-related altered lighting,
- structure-related vessel noise, and
- structure-related propeller wash.

NMFS cannot predict with meaningful accuracy the number of PS Chinook salmon and PS/GB bocaccio that are reasonably certain to be injured or killed by exposure to any of these stressors. The distribution and abundance of the fish that occur within an action area are affected by habitat quality, competition, predation, and the interaction of processes that influence genetic, population, and environmental characteristics. These biotic and environmental processes interact in ways that may be random or directional, and may operate across far broader temporal and spatial scales than are affected by the proposed action. Thus, the distribution and abundance of fish within the action area cannot be attributed entirely to habitat conditions, nor can NMFS precisely predict the number of fish that are reasonably certain to be injured or killed if their habitat is modified or degraded by the proposed action.

Additionally, NMFS knows of no device or practicable technique that would yield reliable counts of individuals that may experience these impacts. In such circumstances, NMFS uses the causal link established between the activity and the likely extent and duration of changes in habitat conditions to describe the extent of take as a numerical level of habitat disturbance.

The most appropriate surrogates for take are action-related parameters that are directly related to the magnitude of the expected take. For this action, the size and configuration of Piers 36B and 37 and the apron is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to structure-related degraded water quality, contaminated forage, altered lighting, armored shoreline, vessel noise, and propeller wash. Also, although no take is anticipated from construction, the timing and duration of work must be considered as a take surrogate because the planned work window was selected to reduce the potential for juvenile Chinook salmon presence in the action area. Working outside of the planned work window and/or working for longer than planned would increase the potential for juvenile PS Chinook salmon and PS/GB bocaccio to be exposed to construction-related impacts.

The number of existing creosote-treated timber piles that support Pier 36B is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to structure-related degraded water quality and contaminated forage. This is because both would be positively correlated with the number of exposed creosote-treated timber piles that would be present at the site to introduce PAHs into the the water and the trophic web. As the number of exposed creosote-treated timber piles increases, the number of contaminated prey organisms and the concentration of water-borne PAHs would increase. As either of those measures increase, the number of juvenile PS Chinook salmon and PS/GB bocaccio that would be exposed and/or the intensity the effects of exposure would increase.

The size and configuration of Piers 36B and 37 and the apron is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to structure-related altered lighting. This is because the size of the shaded area is positively correlated with sizes and the piers and the apron, and the size and intensity of the artificially illuminated of the area is positively correlated with number and type of lights that are installed along those structures. As the size of the shadow increases, the amount of productive habitat decreases. This reduces available shelter and forage, which increases risk of predation, increases energetic costs, and reduces fitness in exposed individuals. As the number and intensity of the pier lights increase, the size and intensity of the artificially illuminated area increases. Increases in either would increase the number of exposed fish and/or increase the intensity of phototaxis and other light altered behaviors that exposed fish would experience.

The size and configuration of the bulkheads currently installed under Piers 36B and 37 and the apron is the best take surrogate for structure-related armored shoreline. This is because increasing their length may increase the migratory distance for shoreline-obligated juvenile Chinook salmon that swim along the bulkhead, and alteration of the configuration, such as installing rip rap would improve habitat conditions for piscivorous predators. Those changes are likley to increase energetic costs and risk of predation for juvenile Chinook salmon.

The size and configuration of Piers 36B and 37 is the best available surrogate for the extent of take of juvenile PS Chinook salmon and PS/GB bocaccio from exposure to structure-related vessel noise and propeller wash. This is because both stressors are positively correlated with the number of ships that moor at the piers, which is largely a function of the piers' lengths. As the lengths of the piers increase, the number of ships that can moor there would increase. As the number of ships increase, vessel activity would likely increase, and the potential for juvenile PS Chinook salmon and PS/GB bocaccio to be exposed to the related noise and propeller wash would also increase.

In summary, the extent of take for this action is defined as:

Puget Sound Chinook salmon:

- Sixty days of in- and over-water work between July 16 and February 15.
- The current size and configuration of Piers 36B and 37 and the apron, as described in the proposed action section of this biological opinion.

Puget Sound / Georgia Basin bocaccio:

- Sixty days of in- and over-water work between July 16 and February 15.
- The current size and configuration of Piers 36B and 37 and the apron, as described in the proposed action section of this biological opinion.

Exceedance of any of the exposure limits described above would constitute an exceedance of authorized take that would trigger the need to reinitiate consultation.

Although these take surrogates could be construed as coextensive with the proposed action, they nevertheless function as effective reinitiation triggers. If the size and configuration of the structures exceeds the proposal, it could still meaningfully trigger reinitiation because the Corps has authority to conduct compliance inspections and to take actions to address non-compliance, including post-construction (33 CFR 326.4).

2.9.2 Effect of the Take

In the Opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to jeopardize the continued existence of PS Chinook salmon and PS/GB bocaccio, nor is it likely to destroy or adversely modify designated critical habitat for PS Chinook salmon (Section 2.8).

2.9.3 Reasonable and Prudent Measures

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

The USCG shall:

1. Implement monitoring and reporting to confirm that the take exemption for the proposed action is not exceeded.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary. The USCG must comply with them in order to implement the RPM (50 CFR 402.14). The USCG 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 USCG does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. To implement RPM Number 1, Implement a monitoring and reporting program to confirm that the take exemption for the proposed action is not exceeded, the applicant shall collect and report details about the take of listed fish. That plan shall:
    a. Require the contractor to maintain and submit construction logs to verify that all take indicators are monitored and reported. Minimally, the logs should include:
        i. The dates (with workday start and stop times) and descriptions of all in- and over-water water work;

    ii. Descriptions of BMP and protective measures that are employed, especially the deployment of full-depth sediment curtains during pile jacketing, and the catchment systems employed during bulkhead cleaning and painting; and
    iii. The post-construction size and configuration of Piers 36B and 37 and the apron.
  b. Require the contractor to establish procedures for the submission of the construction logs and other materials to the appropriate USCG office and to NMFS; and
  c. Submit an electronic post-construction report to NMFS within six months of project completion. Send the report to: projectreports.wcr@noaa.gov. Be sure to include Attn: WCRO-2019-00019 in the subject line.

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).

1. The USCG should encourage contracted tugboat operator(s) and USCG ship crews to use the lowest safe maneuvering speeds and power settings when maneuvering within and near the berthing, with the intent to minimize propeller wash effects and mobilization of sediments at the site.
2. The USCG should develop a long-term plan to reduce the environmental impacts of their overwater structures at USCG Base Seattle. Suggested measures include:
    a. Removal or full encapsulation of all creosote-treated piles;
    b. Removal of all creosote-treated timbers;
    c. Installation of modern stormwater treatment systems that are designed to remove petrochemicals, metals, and sediments at the highest practicable levels during high-intensity storms events;
    d. Installation or adjustment of shipyard lighting systems to meet operational and safety needs yet also minimize nighttime illumination of canal waters; and
    e. Modernization of bulkheads to reduce their adverse effects on migrating juvenile Chinook salmonid.

2.11 Reinitiation of Consultation

This concludes formal consultation for the U.S. Coast Guard Base Seattle Pier 36B Repair Project in King County, Washington. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitats in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitats that was not considered in this Opinion, or (4) a new species is listed or critical habitat is designated that may be affected by the action.

2.12 Not Likely to Adversely Affect Determinations

This concurrence was prepared pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402 and agency guidance for preparation of letters of concurrence. Refer to the opinion for a description of the proposed action and action area.

Our concurrence with the USCG's determination that the proposed action is not likely to adversely affect Hood Canal summer-run chum salmon; PS steelhead; and southern resident killer whales and their designated critical habitat follows. Detailed information on the biology, habitat, and conservation status and trend of these listed resources can be found in the recovery plans and other sources at: http://www.nmfs.noaa.gov/pr/species/fish/, http://www.nmfs.noaa.gov/pr/species/mammals/, and in the listing regulations and critical habitat designations published in the Federal Register. That information is incorporated here by reference.

The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

As described above in Section 2.5, the proposed action is may affect listed species and/or critical habitat features through construction effects, structure-related effects, and interrelated vessel activities. For simplicity, the effects analysis in this section relies heavily on the discussions in Section 2.5. As described earlier, action-related stressors would cause no measurable effects beyond about 250 yards (229 m) around the entrance to the USCG berthing.

2.12.1 Effects on Listed Species

Given the location of the project site relative to the location of habitats likely to be occupied by Hood Canal summer-run chum salmon, it is extremely unlikely that individuals of that species would be present within action area.

PS steelhead would be periodically present within the action area. However, juvenile steelhead are generally relatively large and independent of shallow nearshore areas soon after entering marine water (Bax *et al*. 1978, Brennan *et al*. 2004, Schreiner *et al*. 1977). They typically migrate to the Strait of Juan de Fuca very quickly (Moore *et al*. 2010). Similarly, returning adult steelhead typically migrate past the site very quickly. Therefore, both life stages and are very unlikely to linger near the entrance to the USCG berthing long enough to be measurably affected by the proposed action.

SR killer whales that are within about 4 miles of the USCG berthing could theoretically detect USCG vessel noise. However, the peak noise levels would be non-injurious to SR killer whales and other marine mammals (NMFS 2018b). Also, the high levels of shipping in Elliott Bay and the relatively high ambient noise levels in Puget Sound (Bassett *et al*. 2010) suggest that project-related noise would often be nearly undetectable by SR killer whales much beyond 690 yards. Should any SR killer whales approach close enough to hear and respond to project-related noise, they would, at most, experience brief periods of low-level acoustic masking, and they may exhibit temporary minor avoidance of the area within about 690 yards of the berthing. The exposure would cause no impacts on their fitness, and it would cause no meaningful impacts on their normal behaviors. Further, as described in section 2.5, the proposed action would cause no population-level effects on Chinook salmon, which is the main prey resource for SR killer whales. Therefore, the project is not likely to cause measurable trophic effects on these whales.

2.12.2 Effects on Critical Habitat

This assessment considers the intensity of expected effects in terms of the change they would cause in affected PBFs from their baseline conditions, and the severity of each effect, considered in terms of the time required to recover from the effect. Ephemeral effects are those that are likely to last for hours or days, short-term effects would likely to last for weeks, and long-term effects are likely to last for months, years or decades.

SR killer whale Critical Habitat: The proposed action is not likely to adversely affect critical habitat that has been designated for SR killer whales. Designated critical habitat for SR killer whales includes marine waters of the Puget Sound that are at least 20 feet deep. The expected effects on SR killer whale critical habitat from completion of the proposed action, including full application of the conservation measures and BMP, would be limited to the impacts on the PBF as described below.

1. Water quality to support growth and development
   The proposed work would cause ephemeral minor effects, and the structure would cause long-term minor effects on water quality. It would cause no measurable changes in water temperature and salinity. Construction would briefly introduce low-levels of contaminants that would likely remain within the footprint of Pier 36B, and would not persist past several hours after work stops. Legacy creosote-treated timber piles would continue to cause PAH contamination into the foreseeable future.
2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth
   The proposed action would cause long-term minor effects on prey. Action-related impacts would injure individual Chinook salmon (primary prey), but the impacts would be too small to cause population-level effects on that species, and it would cause no detectable reduction in prey availability for SR killer whales.
3. Passage conditions to allow for migration, resting, and foraging
   The proposed action would cause ephemeral minor effects on passage conditions. Structure-related vessel noise would, at most, cause brief episodic periods of low-level acoustic masking, and minor avoidance of the area within about 690 yards around the east entrance to the Duwamish Waterway. However, avoidance of that area would not hinder migration, or limit access to important habitat resources.

For the reasons expressed immediately above, NMFS has determined that the proposed action is not likely to adversely affect Hood Canal summer-run chum salmon; PS steelhead; and southern resident killer whales and their designated critical habitat.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect essential fish habitat (EFH). The MSA (section 3) defines EFH as "those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity." 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) also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. This analysis is based, in part, on the description of EFH for Pacific Coast salmon contained in the fishery management plans developed by the Pacific Fishery Management Council (PFMC 2014) and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action and action area for this consultation are described in section 1 of this document. The action area includes areas designated as EFH for various life-history stages of Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. The PFMC described and identified EFH for Pacific coast groundfish (PFMC 2005), Pacific salmon (PFMC 2014), and coastal pelagic species (PFMC 1998). In addition, the action area is within habitat area of particular concern (HAPC) for estuarine habitat.

3.2 Adverse Effects on Essential Fish Habitat

The ESA portion of this document describes the adverse effects of this proposed action on ESA-listed species and critical habitat, and is relevant to the effects on EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. Based on the analysis of effects presented in Section 2.5 the proposed action will cause small scale adverse effects on this EFH through direct or indirect physical, chemical, or biological alteration of the water or substrate, and through alteration of benthic communities, and the reduction in prey availability. Therefore, we have determined that the proposed action would adversely affect the EFH identified above.

3.3 Essential Fish Habitat Conservation Recommendations

The proposed action includes design features that are expected to reduce impacts on the quantity and quality of EFH that has been designated for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Species. It also includes a comprehensive set of conservation measures and BMP to minimize construction-related effects. NMFS knows of no other reasonable measures to further reduce the level of these effects. Therefore, additional conservation recommendations pursuant to MSA (§305(b)(4)(A)) are not necessary.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the USCG 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 USCG 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 user of this Opinion is the USCG, USACE, and USEPA. Other users could include WDFW, the governments and citizens of King

County and the City of Seattle, and Native American tribes. Individual copies of this Opinion were provided to the USCG. 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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