UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
7600 Sand Point Way N.E.
Seattle, Washington 98115

December 17, 2015

In Reply Refer to:
2015/2975

David Fox
Chief, Dredged Material Management Office
U.S Army Corps of Engineers, Seattle District
PO Box 3755
4735 E. Marginal Way South
Seattle, Washington 98124-3755

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation and Fish and Wildlife Coordination Act Recommendations for the Continued Use of Multi-User Dredged Material Disposal Sites in Puget Sound and Grays Harbor, (Fourth Field HUCs 17110020 Dungeness-Elwha, 17110002 Strait of Georgia, 1711019 Puget Sound, and 17100105 Grays Harbor), Washington

Dear Mr. Fox:

Thank you for your letter received July 29, 2015, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the continued use of ten multi-user dredged material disposal sites in Puget Sound and Grays Harbor.

The enclosed document contains a biological opinion (opinion) that analyzes the effects of your proposal to permit the transport and disposal of dredged material at eight multi-user open-water disposal sites in Puget Sound and two multi-user open-water disposal sites in Grays Harbor. In this opinion, NMFS concludes that the action, as proposed, is not likely to adversely affect the Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionary Significant Unit (ESU), and the Lower Columbia River (LCR), Upper Willamette River Chinook salmon LCR coho salmon (*O. kisutch*), Hood Canal (HC) summer-run, Columbia River chum salmon (*O. keta*), and LCR steelhead (*O. mykiss*) ESUs. NMFS also concludes that the action, as proposed, is not likely to adversely affect the Southern Distinct Population Segment (DPS) of Pacific eulachon (*Thaleichthys pacificus*), the Southern DPS of North American green sturgeon (*Acipenser medirostris*), the Southern Resident (SR) killer whale DPS (*Orcinus orca*), and humpback whale (*Megaptera novaeangliae*). NMFS also concludes that the proposed action is not likely to jeopardize the continued existence of the PS/Georgia Basin DPSs of bocaccio (*Sebastes paucispinis*), canary rockfish (*S. pinniger*), and yelloweye rockfish (*S. ruberrimus*). Further, NMFS concludes that the proposed action would not result in the destruction or adverse modification of designated critical habitat for PS Chinook salmon, HC summer-run chum salmon, PS/Georgia Basin bocaccio, canary rockfish, and yelloweye rockfish, Southern green sturgeon, SR killer whale, or leatherback sea turtle (*Dermochelys coriacea*). NMFS also concludes that the proposed action would have no effect on proposed critical habitat for PS steelhead.

As required by section 7 of the ESA, NMFS provided an incidental take statement with the biological opinion. The incidental take statement describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize incidental take associated with this action. The take statement sets forth nondiscretionary terms and conditions, including reporting requirements that the COE and any person who performs the action must comply with to carry out the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions would be exempt from the ESA take prohibition.

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

If the response is inconsistent with the essential fish habitat conservation recommendation, the COE must explain why the recommendation will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendation. In response to increased oversight of overall essential fish habitat 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 essential fish habitat consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the essential fish habitat portion of this consultation, you clearly identify the conservation recommendation(s) accepted.

Please contact Dan Tonnes of my staff at the Protected Resources Division in Seattle, Washington at (206) 526-4643, by e-mail at dan.tonnes@noaa.gov, or by mail at the letterhead address if you have questions regarding the rockfish portion of this section 7 consultation, or if you require additional information. Contact Matthew Longenbaugh of my staff at the Oregon/Washington Area Office in Lacey, Washington at (360) 753-7761, by e-mail at matthew.longenbaugh@noaa.gov, or by mail at the letterhead address for questions regarding questions on the salmonid, sturgeon, or eulachon portions of this section 7 consultation; and Teresa Mongillo of my staff at the Protected Resources Division in Seattle, Washington at (206) 526-4749, by e-mail at teresa.mongillo@noaa.gov, or by mail at the letterhead address for questions regarding the marine mammal portions of this section 7 consultation.

Sincerely,

FOR William W. Stelle, Jr.
Regional Administrator

Enclosure

cc: Jeff Laufle, COE
Evan Lewis, COE
OWAO
Teresa Mongillo, PRD
Longenbaugh, OWAO
Evan Lewis, COE Evan.R.Lewis @ usace.army.mil
David Fox, COE David.F.Fox@usace.army.mil
Jeff Laufle, COE Jeffrey.C.Laufle@usace.army.mil
Administrative File: 151401WCR2015PR

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Section 7(a)(2) "Not Likely to Adversely Affect" Determination, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation, and Fish and Wildlife Coordination Act Recommendations

Continued use of multi-user dredged material disposal sites in Puget Sound and Grays Harbor
(Fourth Field HUCs 17110020 Dungeness-Elwha, 17110002 Strait of Georgia,
1711019 Puget Sound, and 17100105 Grays Harbor)
Washington

NMFS Consultation Number: WCR-2015-2975

Action Agency: 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 Destroy or Adversely Modify Critical Habitat?
Puget Sound/Georgia Basin yelloweye rockfish (*Sebastes ruberrimus*)	Threatened	Yes	No	No
Puget Sound/Georgia Basin canary rockfish (*S. pinniger*)	Threatened	Yes	No	No
Puget Sound/Georgia Basin bocaccio (*S. paucispinis*)	Endangered	Yes	No	No
Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*)	Threatened	*No		
Lower Columbia River Chinook salmon (*O. tshawytscha*)	Threatened	*No		
Upper Willamette River Chinook salmon (*O. tshawytscha*)	Threatened	*No		
Hood Canal summer-run chum salmon *(O. keta*)	Threatened	*No		
Columbia River chum salmon (*O. keta*)	Threatened	*No		
Lower Columbia River coho salmon (*O. kisutch*)	Threatened	*No		
Puget Sound steelhead (*O. mykiss*)	Threatened	*No		
Southern North American green sturgeon (*Acipenser medirosris)*	Threatened	*No		
Southern Pacific eulachon (*Thaleichthys pacificus*)	Threatened	*No		
Southern Resident killer whale (*Orcinus orca*)	Endangered	*No		
Humpback whale (*Megaptera novaeangliae*)	Endangered	*No		
Leatherback sea turtle (*Dermochelys coriacea*)	Endangered			*No

*Please refer to section 2.11 for the analysis of species or critical habitat that are not likely to be adversely affected.

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	No	No
Groundfish Species	Yes	Yes
Coastal Pelagic Species	Yes	Yes

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

Issued By:

FOR William W. Stelle, Jr.
Regional Administrator

Date: December 17, 2015

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LIST OF ABBREVIATIONS AND ACRONYMS

BE	Biological Evaluation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COE	United States Army Corps of Engineers
CR	Columbia River
CY	Cubic Yards
DMMP	Dredge Material Management Program
DMMU	Dredged Material Management Unit
DNA	Deoxyribonucleic Acid
DPS	Distinct Population Segment
DQA	Data Quality Act
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FR	Federal Register
HC	Hood Canal
HUC	Hydrologic Unit Code
ISAB	Independent Scientific Advisory Board
ITS	Incidental Take Statement
LCR	Lower Columbia River
ML	Maximum Levels
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MTCA	Model Toxics Control Act
NLAA	May Affect, Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NWR	Northwest Region
OA	Ocean Acidification
PAH	Polycyclic Aromatic Hydrocarbon
PBDE	Polybrominated Diphenyl Ether
PCB	Polychlorinated Biphenyl
PCDD/F	Polychlorinated Dioxins/Furans
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
PS	Puget Sound
RSET	Regional Sediment Evaluation Team
ROV	Remotely Operated Vehicle
SL	Screening Levels
SR	Southern Resident
U.S.C.	United States Code
UWR	Upper Willamette River
WDFW	Washington State Department of Fish and Wildlife

1.0 INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973(16 U.S.C. 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.

Because the proposed action would modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources, and enabling the Federal agency to give equal consideration with other project purposes, as required under the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.).

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). The document will be available through NMFS' Public Consultation Tracking System. A complete record of this consultation is on file at the Protected Resources Division Office in Seattle, Washington.

1.2 Consultation History

The U.S. Army Corps of Engineers (COE) proposes to permit the continued management of the Dredged Material Management Program (DMMP) through the year 2040. The COE leads administration of the DMMP with several other Federal and state agencies including the Environmental Protection Agency; the Washington Department of Natural Resources; and the Washington Department of Ecology. The COE is the lead Federal agency for this consultation. The program includes sediment tests, transport, and disposal of dredged material at eight open-water dredged material disposal sites located in Puget Sound and the Strait of Juan de Fuca, and two sites in Grays Harbor in Washington State.

The Puget Sound Dredge Disposal Analysis (PSDDA) and dredge material management program (later termed the DMMP), initiated in the 1980s, identified dredged material disposal sites (sites) that minimized transportation costs and intended to keep effects on the benthic environment to a low level (among other factors) (COE 2015b). The COE commissioned several studies to assess fish and invertebrate assemblages and determine the benthic characteristics of candidate sites. These studies used bottom trawls and submersibles to document the types and relative abundance of fish and invertebrates in various depth zones around and within the proposed dredge disposal sites (Dinnel et al. 1986, Donnelly et al. 1988). The Puget Sound and Strait of Juan de Fuca disposal site selection process and the dredge material quality screening process were assessed in a Draft and Final Environmental Impact Statement in 1988 and 1989 (COE 2015b). Eight sites in the Puget Sound and Strait of Juan de Fuca were selected based on the sites' proximity to the sources of dredged materials, their bathymetry, local water currents, and the characteristics of benthic substrates. Each of eight sites has been in periodic use for the past 26 years. Although dredged material has been placed in the vicinity of the Point Chehalis site in Grays Harbor since the 1940s, its current configuration was established in 1976 (COE 2015b). The South Jetty site has been in use since 1988. Both sites were established for use in the disposal of material from the Federal navigation channel, and were selected based on their bathymetry and local water currents such that deposited material would move out of the estuary and into the longshore drift cell. The COE described these sites and implementation of the DMMP in greater detail in the Biological Evaluation (BE; COE 2015).

We first consulted on the disposal sites and program in 1999 (NMFS 1999) with subsequent consultations in 2000 (NMFS 2000, 2000a), 2005 (NMFS 2005), 2007 (2007, 2007a), and 2010 (NMFS 2010a). Except for 2010, Letters of Concurrence were issued. In 2010 we issued an opinion (NMFS Tracking Number NWR-2010-4249) on the DMMP's effects on the Puget Sound/Georgia Basin Distinct Population Segments (DPSs) of yelloweye rockfish, canary rockfish, and bocaccio of the Puget Sound/Georgia Basin listed under the Endangered Species Act (ESA-listed rockfish). The opinion, which expires at the end of 2015, included a conservation recommendation for the COE to gather additional information on the distribution of larval rockfish in Puget Sound. The COE subsequently worked with NOAA's Northwest Fisheries Science Center to collect ichthyoplankton data at the eight Puget Sound/Straits of Juan de Fuca disposal sites and, in addition, processed other sample sites in Puget Sound. The findings of the study were released in a report (Greene and Godersky 2012).

On June 29, 2015, we received a letter from the COE requesting consultation on the continued use of the eight Puget Sound and two Grays Harbor open-water dredged material disposal sites. We submitted clarifying and additional information questions to the COE on August 5, 2015. Information was received on August 11, 2015, at which time we initiated formal consultation.

In its letter requesting consultation, the COE determined that the proposed action was not likely to adversely affect (NLAA):

- Puget Sound (PS), Lower Columbia River (LCR), Upper Willamette River (UWR) Chinook salmon,
- Hood Canal (HC) summer-run and CR chum salmon,
- LCR coho salmon,
- PS steelhead,
- Southern Distinct Population Segment (DPS) of Pacific eulachon
- Southern DPS of North American green sturgeon,
- PS/Georgia Basin DPSs of bocaccio, canary rockfish, and yelloweye rockfish,
- Southern Resident (SR) killer whale, and
- Humpback whale.

The COE also determined the proposed action is not likely to adversely affect:

- Designated critical habitat for
    - PS Chinook salmon,
    - HC summer-run chum salmon,
    - Southern DPS green sturgeon,
    - PS/Georgia Basin DPS bocaccio, canary rockfish, and yelloweye rockfish,
    - SR killer whale,
- Proposed critical habitat for PS steelhead, and
- Essential fish habitat (EFH) utilized by Pacific salmon, groundfish and coastal pelagic species.

Designated critical habitat for Southern DPS Pacific eulachon and LCR and UWR Chinook salmon does not occur in the action area. Nor does proposed critical habitat for LCR coho salmon or PS steelhead occur in the action area. Designated critical habitat for Southern DPS green sturgeon only occurs within the action area in Grays Harbor and designated critical habitat for ESA-listed rockfish occurs in the Puget Sound action area.

After analyzing the effects of the action, NMFS concurs with the COE "not likely" determinations above, as discussed in section 2.11 of this document, with one exception[1]. NMFS does not concur with the COE for ESA-listed rockfish. We have provided analyses to support this conclusion in the biological opinion. The COE determined the proposed action would not affect leatherback sea turtle designated critical habitat. Although the proposed action does not occur with that critical habitat, a primary constituent element (PCE) for the conservation of the species does. We believe the proposed action may affect that PCE, and have provided an analysis to support this conclusion in section 2.11 of this document.

1.3 Description of the 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).

The COE proposes to administer the DMMP for a period of 25 years (2015-2040). The DMMP authorizes the use of three dispersive and five non-dispersive sites in Puget Sound and the Straits of Georgia, and two dispersive sites in Grays Harbor (Table 1). Non-dispersive disposal sites are located in areas where currents are slow enough that dredged material is deposited on the disposal site; dispersive sites have higher current velocities, so dredged material does not accumulate at the disposal site and settles on benthic environments elsewhere. All sites but one near Port Angeles and two in Grays Harbor are located in the range of the Puget Sound/Georgia Basin DPSs of ESA-listed rockfish. The locations, depth, and size of each of the sites are described in Table 1.

The DMMP consists of four management actions. They are: (1) the evaluation of sediment quality before it is dredged, (2) the transportation of sediment. Some sediment is transported to

[1] Although NMFS concurs with these determinations with regard to PS steelhead, there is no critical habitat proposed in the action area, thus NMFS finds no effect.

upland areas if it is too contaminated for open-water disposal. If the sediment is deemed by the DMMP agencies as clean enough, it is transported to the nearest open-water disposal site. Once on-site, (3) the materials are dumped into the water, and (4) the sites are monitored. Each of these steps are described in COE (2015), and summarized below.

Table 1. Puget Sound and Grays Harbor disposal site descriptions (Table 1 in COE 2015).

Site	Type	Area (Acres)	Depth in Feet (Meters)	Disposal Coordinates (NAD83)
Bellingham Bay	Non-Dispersive	260	96 (29)	48° 42.82' North; -122° 33.11' West
Port Gardner	Non-Dispersive	318	420 (128)	47° 58.85' North; -122° 16.74' West
Elliott Bay	Non-Dispersive	415	300-360 (91-110)	47° 35.91' North; -122° 21.45' West
Commencement Bay	Non-Dispersive	310	540-560 (165-171)	47° 18.145' North; -122°27.815' West
Anderson Island	Non-Dispersive	318	360-460 (110-140)	47° 09.42' North; -122° 39.47' West
Port Angeles	Dispersive	884	435 (133)	48° 11.67' North; -123° 24.94' West
Port Townsend	Dispersive	884	361 (110)	48° 13.61' North; -122° 59.03' West
Rosario Strait	Dispersive	650	97-142 (30-43)	48° 30.87' North; -122° 43.56' West
Point Chehalis	Dispersive	230	>50 (15)	Corners of rectangle: 46° 55’00.51” North; -124° 08’06.94” West 46° 55’17.09” North; -124° 06’59.10” West 46° 54’41.91” North; -124° 07’57.26” West 46° 54’58.50” North; -124° 06’49.42” West
South Jetty	Dispersive	55	>40 (12)	Corners of rectangle: 46° 54’34.82” North; -124° 09’30.67” West 46° 54’32.06” North; -124° 08’47.65” West 46° 54’26.96” North; -124°09’31.74” West 46° 54’24.20” North; -124° 08’48.72” West

1.3.1 Sediment Evaluation

Sediment quality is evaluated before dredging to determine its suitability for open-water disposal. The COE administers a four-tiered process to assess possible contaminant levels (Figure 1). The first tier is conducted to assess possible contaminant sources near the dredge project, such as outfalls, recent chemical spills, and past sediment quality testing data. No new sediment testing is required if the site history and data indicate it is suitable for open-water disposal. If the first tier assessment finds possible contaminant sources, tier two screening begins, which requires new sediment tests. The DMMP requires testing for 10 metals, one organometallic compound, 16 polycyclic aromatic hydrocarbons (PAHs) (including total low and molecular weight PAHs), four chlorinated hydrocarbons, six phthalates, five phenols, four miscellaneous extractables, polychlorinated biphenyls (PCBs), and eight pesticides (COE 2015b). Invertebrate toxicity research is used to determine if contaminant levels (if present) are low enough to allow in-water disposal (COE 2015b). Testing is conducted to assess whether sediments have the potential to adversely affect biological resources by exceeding acute or chronic toxicological effects thresholds (typically for invertebrate species such as bivalves and polycheates). The thresholds are termed 'screening levels' (SL) and 'maximum levels'[2] (ML). If all contaminants are below screening levels in tier two tests, the sediment is considered acceptable for open water disposal. If contaminants are above screening levels but below maximum levels, tier three tests are required. If maximum levels are exceeded, tier three and four tests are required.

The DMMP sediment screening process also requires the assessment of some chemicals based on their potential for accumulation in invertebrates—termed a bioaccumulation trigger (COE 2010, 2015). Bioaccumulation triggers have been developed for 10 metals, one organometallic compound, two organics, one chlorinated hydrocarbon, one phenol, and four pesticides/ polychlorinated biphenyls (PCBs)[3], but have not been developed for polybrominated diphenyl ethers (PBDEs).

Tier three is initiated if the bioaccumulation trigger is reached. Bioaccumulation testing must be performed before suitability of the test sediment for open-water disposal can be determined. The results of a tier three bioaccumulation test are compared directly with invertebrates from nearby reference sites to determine ecological effects. Significant bioaccumulation of chemicals of concern in test species relative to reference areas may signify food-web effects. If the mean tissue concentration of one or more contaminants of concern is greater than or equal to the target tissue level, the dredged material would not be acceptable for open-water disposal. If the mean tissue concentration of a chemical of concern is less than the applicable target tissue level, a one-tailed, one-sample t-test is conducted. The dredged material is considered acceptable for open-water disposal if the null hypothesis is rejected, meaning that there is no significant difference (defined by at $p < 0.05$) between the tissue levels of the on-site and reference site organism.

If test results show all chemicals are below screening levels, then the sediment is determined to be suitable for open water disposal. The DMMP agencies determine that adverse biological effects could occur if one or more chemical is above the screening level but below the maximum level. If one or more chemical is above the maximum level, then adverse biological effects are presumed and the proposed dredge area is unsuitable for open-water disposal.

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[2] The COE defines screening levels as "…the concentration level of specific chemicals below which there is no reason to believe that disposal of that material would result in unacceptable adverse biological impacts." The COE defines maximum levels as "…a concentration above which there is reason to believe that the material would be unsuitable for unconfined, open-water disposal."

[3] http://www.nws.usace.army.mil/PublicMenu/documents/DMMO/Nov_2009_UM.pdf

Tier three (and possibly tier four) sediment evaluation would occur if: (1) one chemical concentration is more than double the maximum level concentration, or (2) two or more chemicals exceed the maximum level. Tier 3 involves solid phase bioassay testing to assess the effects of a particular chemical on an organism. Tier four testing would include time-sequenced bioaccumulation or tissue analysis of organisms collected from the area to be dredged.

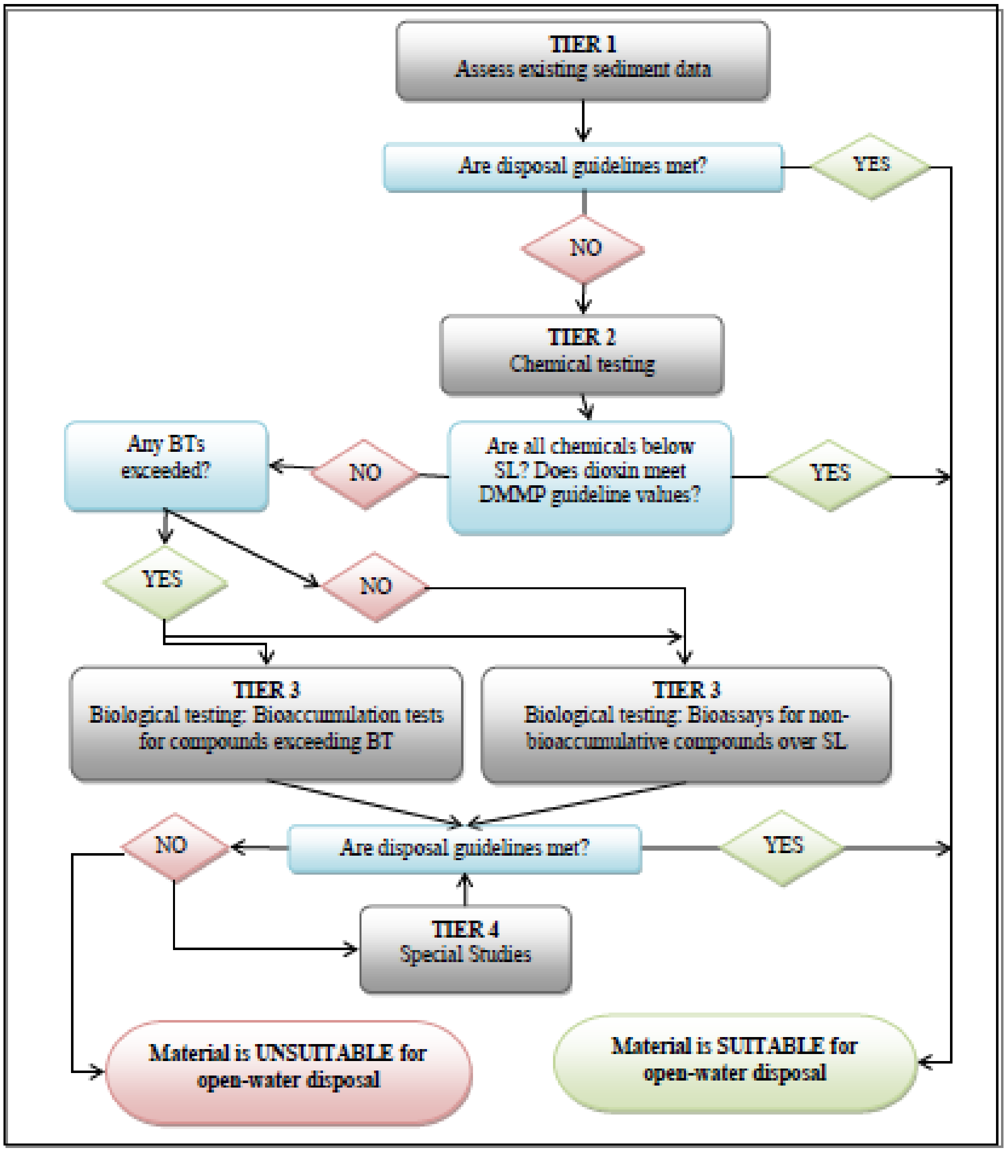

Figure 1. Schematic of the COE's sediment screening process. From COE (2015).

<u>1.3.2 Sediment Transport and Disposal</u>

If the dredged material is found suitable for disposal in the Puget Sound/ Straits of Juan de Fuca, it is transported to the disposal site by a tugboat pulling a bottom-dump (split-hull) barge. The barges transport approximately 1,500 cubic yards (cy) of material each trip. Dredging projects dictate the timing of sediment disposal. Most dredging takes place between July 16 and February 15. The disposal sites near Port Townsend and Port Angeles are closed from

September 1 to November 30 to protect a shrimp fishery, and the Bellingham Bay site is closed from November 1 to February 28 to protect crab and shrimp resources. Disposal is not allowed anywhere in the Puget Sound between March 15 and June 15 (COE 2015b).

In Grays Harbor, dredged material may also be transported by a bottom-dump hopper dredge. Vessels used in Grays Harbor have the ability to transport between 800 and 6,000 cy of material each trip, and the number of barge discharges per day is between three and five depending upon the extent of dredging activity.

Dredged material disposal at the non-dispersive sites is designed to maintain dispersion within a 600-foot radius target zone at each site. The barges doing the disposal are towed at the minimum speed necessary to maintain control. In most instances, material is released from the bottom of the barge which is about 10 feet down in the water column. All disposal tugs are required to record and report when and where sediment is released within the target zone. The disposal sites were originally sized so that a barge being towed at an average speed of three knots can unload completely in a few minutes.

The total annual volume of disposed sediment (Table 2) is expected to be similar to those listed in Table 2 (COE 2015b).

Table 2. Cumulative volumes of sediment dumped at disposal sites, adapted from Table 3 in COE (2015). Note that the Port Angeles, Point Chehalis and South Jetty sites are outside of the action area for ESA-listed rockfish.

Non-dispersive Disposal Site	Cumulative Volumes (cy)	Average Volume Per Year (cy/yr)	Site Capacity (cy)[1]	Percent of Site Capacity
Bellingham Bay[3] (1990-2014)	78,883	3,155	9,000,000	0.9
Port Gardner (1989-2014)	3,326,221	127,932	9,000,000	37.0
Elliott Bay (1989-2014)	3,030,788	116,569	9,000,000	33.7
Commencement Bay (1989-2014)	8,196,707	315,258	23,000,000[4]	35.6
Anderson/Ketron Island (1990-2014)	157,215	6,289	9,000,000	1.7
Dispersive Disposal Site	**Cumulative Volumes (cy)**	**Average Volume per Year (cy/yr)**	**Site Capacity (cy)**	**Percent of Site Capacity**
Rosario Strait (1990-2014)	2,122,509	84,900	N/A	N/A
Port Townsend (1990-2014)	55,528	2,221	N/A	N/A
Port Angeles (1990-2014)	22,344	894	N/A	N/A
Point Chehalis (1996-2014)	15,780,365	830,546	N/A	N/A
South Jetty (1996-2014)	11,355,966	597,682	N/A	N/A

1.3.3 Benthic Habitat Monitoring

Non-Dispersive Sites

Monitoring at each site and nearby reference sites involves the collection of physical, chemical and biological data. This data is then used to inform an annual review of site management. The trigger for post-disposal monitoring is 300,000 cy at the Bellingham Bay site and the Anderson/Ketron Island disposal sites. The trigger for post-disposal monitoring at the Commencement Bay, Elliott Bay, and the Port Gardner sites is 500,000 cy.

There are three types of post-disposal monitoring:

(1) Full monitoring entails mapping the disposal site with a sediment profile imaging which determines the depth and spread of dredged material. Box core benthic samples and images are used to provide quantitative and qualitative information on benthic infaunal conditions both on and off site. Chemical monitoring is used to determine the concentrations of chemicals of concern present on and off the site. Biological monitoring includes toxicity bioassays to assess dredged material that has been deposited on the site. Offsite benthic communities are evaluated by a comparison of baseline data and post-disposal data along a gradient. The COE looks at sediment chemistry, conducts sediment bioassays, monitors infaunal tissue chemistry, and takes a census of infaunal abundance.

(2) Partial monitoring takes place when the dredged material does not exceed the screening levels (or does so only to a minimal degree). The COE conducts bathymetric mapping of the site with sediment profile imaging in order to determine the depth of dredged material and sediment dispersal. The imaging is also used to provide information on general benthic conditions both on and off site and includes collection of sediment at and near the site for chemical analysis. No quantitative biological information is collected during partial monitoring events.

(3) Tiered monitoring is triggered when monitoring results indicate that materials are creating offsite impacts to biota or sediment quality. To determine possible toxicity level changes, archived samples of invertebrates from the 1980s are used for comparisons to recently sampled invertebrates.

Dispersive Sites

Dispersive sites are only monitored for possible bottom composition changes. Post-disposal monitoring is conducted to determine if sediment is unintentionally depositing at the site. The survey consists of using precision vertical soundings to detect possible mounding of dredged material. The baseline and post-disposal soundings are then compared to determine if there is mounding of dredged material within the target area.

1.3.4 Measures to Avoid and Minimize Adverse Effects of the Action

The COE proposes the following additional measures that would reduce potential harm to ESA-listed species and their habitats:

1. Consolidation of dredged material disposal sites to minimize the area and locations affected by dredged material disposal.
2. Siting of dredged material disposal sites in areas of relatively low habitat value or low use by biota.
3. Siting of the Grays Harbor disposal sites so as to retain sediment circulating in the regional cell and feeding stabilizing sand to protect the South Jetty toe, thereby reducing the need for rock placement.
4. Evaluation of the chemical suitability of dredged material for beneficial use as an alternative to disposal. Beneficial use may include capping of contaminated material at CERCLA and MTCA cleanup sites, or in-water habitat restoration projects.
5. Sequencing the disposal of dredged material management units (DMMUs) within a dredging project at non-dispersive sites. Using the cleanest material disposed last, thereby improving the quality of the surface sediment at the disposal site.
6. Requiring barge operators to maintain the seals on the bottom dump barges to minimize loss of sediment during transport.
7. Adaptively managing sites based on feedback from site monitoring events.

Program Reporting

On December 4, 2015, the COE agreed to amend the proposed action related to program reporting and continuing programmatic coverage (COE 2015a). The DMMP writes biennial reports that include summaries of all project-specific sediment characterization activities; dredged material disposal locations and volumes; and a summary of disposal site monitoring activities for the two preceding years. The COE agreed to provide the biennial reports, in addition to copies of clarification and issue papers adopted through the Sediment Management Annual Review Meeting (SMARM) process during the two preceding years; a link to the current DMMP user manual, which is updated annually to incorporate changes made through the SMARM process. In addition, in the 2019 cover letter the COE will include an assessment and determination if programmatic coverage is still warranted for an additional 5 years. NMFS would notify the COE if programmatic coverage is continued for an additional 5 years by June 1, 2020. This same reporting and confirmation of programmatic coverage would occur in subsequent years. In the event that programmatic coverage is not extended for the next period, the COE would then need to request a new consultation (and provide associated information within a Biological Evaluation). These provisions are also found in section 2.8.4.

“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). We have determined that there are no interdependent or interrelated activities associated with the proposed action. The COE did not request consultation for the projects that actually generate the sediment to be disposed. All dredging actions require the issuance of a section 10 permit of the Rivers and Harbors Act and/or a section 404 permit (Clean Water Act). The issuance of a Section 10/404 permit is a Federal action requiring an ESA Section 7 consultation. We do not assess the dredging projects that generate sediment for several reasons. Project proponents can choose to dispose of their sediment at upland sources, thus these projects (which are identified on an individual basis) do not rely on the COE's approval for open-water disposal at the DMMP sites. The existence of the DMMP (and finished consultation with NMFS) does not result in the pre-approval of subsequent dredging projects. These individual actions may or may not occur, and must be approved separately by the DMMP and the COE through separate permits. In each of these instances, separate consultations would be conducted—ones requiring site-specific assessment of the direct and indirect effects of the proposed dredge project.

Therefore, the potential effects of specific dredging activities on threatened and endangered species would be addressed in separate biological evaluations prepared by individual project proponents once specific future plans are known.

1.4 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area has elements in two separate geographic areas:

- Puget Sound, which includes the entire Puget Sound, the Strait of Juan de Fuca, Hood Canal, and the Strait of Georgia westward to Low Point and north to the Canadian Border. Most habitats within the action area can be used by larval, juvenile and adult yelloweye rockfish, canary rockfish, and bocaccio. More detailed information on these species' use of the action area follows in section 2.0 of this document.

- Grays Harbor, which includes the entire estuary east of the line drawn across the seaward extremities (above water) of the Grays Harbor Entrance Jetties. Columbia River chum and LCR and UWR Chinook salmon, and Southern DPSs of Pacific eulachon and green sturgeon are most likely of the 14 ESA-listed species in Table 3 to use the Grays Harbor element of the action area.

The two action area components fall within the range of a total of 15 listed species considered in this document (Table 3). In addition, the action area overlaps with the designated critical habitat for seven of these species and with proposed critical habitat for PS steelhead.

As stated above, NMFS has determined that adverse effects on yelloweye rockfish, canary rockfish, and bocaccio and are likely to occur (see effects analysis). We have also determined that PS, LCR, and UWR Chinook salmon, HC summer-run and CR chum salmon, LCR coho salmon, PS steelhead, Southern DPS of green sturgeon, Southern DPS of Pacific eulachon, SR killer whale, and humpback whale are not likely to experience any adverse effects (see section 2.11).

Table 3. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation.

Species	ESU or DPS	Original Listing Notice[1]	Listing Status Reaffirmed	Critical Habitat	Protective Regulations
Chinook salmon (*Oncorhynchus tshawytscha*)	Lower Columbia River ESU	T; 3/24/99 64 FR 14308	T: 6/28/05 70 FR 37160	9/02/05 70 FR 52630	6/28/05 70 FR 37160
	Upper Willamette	T; 3/24/99	T; 6/28/05	9/02/05	6/28/05

Species	ESU or DPS	Original Listing Notice[1]	Listing Status Reaffirmed	Critical Habitat	Protective Regulations
	River spring-run ESU	64 FR 14308	70 FR 37160	70 FR 52630	70 FR 37160
	Puget Sound ESU	T; 06/28/05 70 FR 37160	T; 08/15/11 76 FR 50448	09/02/05 70 FR 52630	06/28/05 70 FR 37160
Chum salmon *(O. keta*)	Hood Canal summer-run ESU	T; 06/28/05 70 FR 37160	T; 08/15/11 76 FR 50448	9/02/05 70 FR 52630	6/28/05 70 FR 37160
	Columbia River ESU	T; 3/25/99 64 FR 14507	T; 6/28/05 70 FR 37160	9/02/05 70 FR 52630	6/28/05 70 FR 37160
Coho salmon (*O. kisutch*)	Lower Columbia River ESU	T; 06/28/05 70 FR 37160	T; 08/15/11 76 FR 50448	01/14/13 78 FR 2726[2]	06/28/05 70 FR 37160
Steelhead (*O. mykiss*)	Puget Sound DPS	T; 05/11/07 72 FR 26722	08/15/11 76 FR 50448	01/14/13 78 FR 2726[2]	09/25/08 73 FR 55451
Bocaccio (*Sebastes paucispinis*)	Puget Sound/ Georgia Basin DPS	E; 04/28/10 75 FR 22276	Not applicable	11/13/14 79 FR 68042	Not applicable
Canary Rockfish (*S. pinniger*)	Puget Sound/ Georgia Basin DPS	T; 04/28/10 75 FR 22276	Not applicable	11/13/14 79 FR 68042	Not applicable
Yelloweye Rockfish (*S. ruberrimus*)	Puget Sound/ Georgia Basin DPS	T; 04/28/10 75 FR 22276	Not applicable	11/13/14 79 FR 68042	Not applicable
North American Green Sturgeon (*Acipenser medirostris*)	Southern DPS	T; 4/07/06 71 FR 17757	Not applicable	10/09/09 74 FR 52300	6/02/2010 74 FR 30714
Pacific eulachon (*Thaleichthys pacificus)*	Southern DPS	T; 3/18/10 75 FR 13012	Not applicable	10/20/11 76 FR 65324	Not applicable
Killer whale (*Orcinus orca*)	Southern Resident	E; 11/15/04 70 FR 69903	03/15/11 5-year Status Review	11/29/06 71 FR 69054	04/14/11 76 FR 20870
Humpback whale (*Megaptera novaeangliae*)	14 DPSs proposed 4/21/2015 80 FR 22304	E; 12/02/70 35 FR 18319	Not applicable	Not applicable	Not applicable
Leatherback sea turtle (*Dermochelys coriacea*)		E; 06/02/70 35 FR 8491	Not applicable	03/23/79 44 FR 17710; 01/26/12 77 FR 4170	Not applicable

[1]T=listed as threatened under the ESA; E=listed as endangered under the ESA.
[2]Proposed.

The action area has also been identified by the Pacific Fishery Management Council (PFMC) as a Habitat Area of Particular Concern (estuaries) and EFH for Pacific salmon (PFMC 2014), groundfish (PMFC 2005), and coastal pelagic species (PMFC 1998). Environmental effects of the proposed project will adversely affect EFH for these species.

2.0 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, Federal agencies must ensure that their 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 expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

When they initiated this consultation, the COE requested that we concur with their determination that their action, as proposed, was "not likely to adversely affect" (NLAA) PS, LCR, and UWR Chinook salmon, HC summer-run and CR chum salmon, LCR coho salmon, PS steelhead, Southern DPS of green sturgeon, Southern DPS of Pacific eulachon, SR killer whale, humpback whale and ESA-listed rockfish. We have determined that the proposed action is not likely to adversely affect (NLAA) all of these species with the exception of ESA-listed rockfish. These analyses are found in section 2.11 of this document. We cannot concur with the COE regarding the effects of the proposed action on ESA-listed rockfish because, similar to 5 years ago, we have determined that the DMMP is likely to adversely affect some ESA-listed rockfish in the Puget Sound/Georgia Basin.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "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.

The adverse modification analysis considers the impacts of the Federal action on the conservation value of designated critical habitat. This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[4]

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

- Identify the rangewide status of the species and critical habitat likely to be adversely affected by the proposed action.
- Describe the environmental baseline for the proposed action.
- 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.

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[4] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species and critical habitat.
- Reach jeopardy and adverse modification conclusions.
- If necessary, define a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

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

One factor affecting the rangewide status of ESA-listed rockfish and aquatic habitat at large is climate change. We discuss the known and potential influence of climate change in section 2.2.1

2.2.1 Status of the Species

We describe the status of each ESA-listed rockfish species with nomenclature referring to specific areas of the Puget Sound. The Puget Sound is the second largest estuary in the United States, located in northwest Washington State and covering an area of about 900 square miles (2,330 square km), including 2,500 miles (4,000 km) of shoreline. Puget Sound is part of a larger inland waterway, the Georgia Basin, situated between southern Vancouver Island, British Columbia, Canada and the mainland coast of Washington State. We subdivide the Puget Sound into five interconnected basins because of the presence of shallow sills: (1) The San Juan/Strait of Juan de Fuca Basin (also referred to as "North Sound"), (2) Main Basin, (3) Whidbey Basin, (4) South Sound, and (5) Hood Canal. We use the term "Puget Sound proper" to refer to all of these basins except the San Juan/Strait of Juan de Fuca Basin.

The Puget Sound/Georgia Basin DPSs of yelloweye rockfish and canary rockfish are listed under the ESA as threatened, and bocaccio are listed as endangered (75 Fed. Reg. 22276, April 28, 2010). These DPSs include all yelloweye rockfish, canary rockfish, and bocaccio found in waters of the Puget Sound, the Strait of Georgia, and the Strait of Juan de Fuca east of Victoria Sill (Figure 2). Unlike ESA-listed salmonids, we have not identified biological populations of each species below the DPS level; thus, we use the term "populations" to refer to groups of fish within a particular basin. Yelloweye rockfish, canary rockfish, and bocaccio are 3 of 28 species of rockfish in Puget Sound (Palsson et al. 2009).

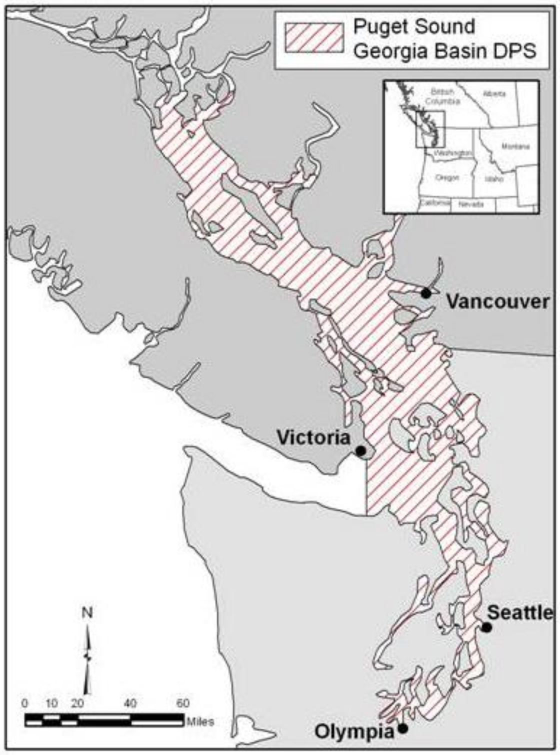

Figure 2. ESA-listed rockfish DPSs.

The life histories of yelloweye rockfish, canary rockfish, and bocaccio include a larval and pelagic juvenile stage followed by a nearshore juvenile stage, and sub-adult and adult stages. Much of the life history and habitat use for these three species is similar, with important differences noted below.

Rockfish fertilize their eggs internally and the young are extruded as larvae. Yelloweye rockfish, canary rockfish, and bocaccio produce from several thousand to over a million eggs (Love et al. 2002). Larvae are observed under free-floating algae, seagrass, and detached kelp (Love et al. 2002; Shaffer et al. 1995), but are also distributed throughout the water column (Weis 2004). Unique oceanographic conditions within Puget Sound proper likely result in most larvae staying within the basin where they are released (e.g., the South Sound) rather than being broadly dispersed (Drake et al. 2010).

When bocaccio and canary rockfish reach sizes of 1 to 3.5 inches (3 to 9 centimeters (cm)) (approximately 3 to 6 months old), they settle onto shallow nearshore waters in rocky or cobble substrates with or without kelp (Love et al. 1991, 2002). These habitat features offer a beneficial mix of warmer temperatures, food, and refuge from predators (Love et al. 1991). Areas with floating and submerged kelp species support the highest densities of most juvenile rockfish (Carr 1983; Halderson and Richards 1987; Hayden-Spear 2006; Matthews 1989). Unlike bocaccio and canary rockfish, juvenile yelloweye rockfish do not typically occupy intertidal waters (Love et al. 1991; Studebaker et al. 2009), but settle in 98 to 131 feet (30 to 40 m) of water near the upper depth range of adults (Yamanaka and Lacko 2001).

Sub-adult and adult yelloweye rockfish, canary rockfish, and bocaccio typically utilize habitats with moderate to extreme steepness, complex bathymetry, and rock and boulder-cobble complexes (Love et al. 2002). Within Puget Sound proper, each species has been documented in areas of high relief rocky and non-rocky substrates such as sand, mud, and other unconsolidated sediments (Miller and Borton 1980; Washington 1977). Yelloweye rockfish remain near the bottom and have small home ranges, while some canary rockfish and bocaccio have larger home ranges, move long distances, and spend time suspended in the water column (Love et al. 2002). Adults of each species are most commonly found between 131 to 820 feet (40 to 250 m) (Love et al. 2002; Orr et al. 2000).

Yelloweye rockfish are one of the longest-lived of the rockfishes, with some individuals reaching more than 100 years of age. They reach 50 percent maturity at sizes around 16 to 20 inches (40 to 50 cm) and ages of 15 to 20 years (Rosenthal et al. 1982; Yamanaka and Kronlund 1997). The maximum age of canary rockfish is at least 84 years (Love et al. 2002), although 60 to 75 years is more common (Caillet et al. 2000). They reach 50 percent maturity at sizes around 16 inches (40 cm) and ages of 7 to 9 years. The maximum age of bocaccio is unknown, but may exceed 50 years, and they are first reproductively mature near age 6 (FishBase 2010).

In the following section, we summarize the condition of yelloweye rockfish, canary rockfish, and bocaccio at the DPS level according to the following demographic viability criteria: abundance and productivity, spatial structure/connectivity, and diversity. These viability criteria are outlined in McElhaney et al. (2000) and reflect concepts that are well founded in conservation biology and are generally applicable to a wide variety of species. These criteria describe demographic risks that individually and collectively provide strong indicators of extinction risk (Drake et al. 2010). There are several common risk factors detailed below at the introduction of each of the viability criteria for each listed rockfish species. Information on species and habitat limiting factors can affect abundance, spatial structure and diversity, and are described.

Abundance and Productivity

There is no single reliable historic or contemporary population estimate for the yelloweye rockfish, canary rockfish, or bocaccio within the Puget Sound/Georgia Basin DPSs (Drake et al. 2010). Despite this limitation, there is clear evidence each species' abundance has declined dramatically (Drake et al. 2010). The total rockfish population in the Puget Sound region is estimated to have declined around 3 percent per year for the past several decades, which corresponds to an approximate 70 percent decline from 1965 to 2007 (Drake et al. 2010).

Fishery-independent estimates of population abundance come from spatially and temporally limited research trawls, drop camera surveys and underwater remotely operated vehicle (ROV) surveys conducted by the Washington Department of Fish and Wildlife (WDFW). Using these methods, the WDFW has estimated that 47,407 yelloweye rockfish, 20,548 canary rockfish, and 4,606 bocaccio inhabit the Puget Sound region (Pacunski et al. 2013). Most of the fish WDFW observed (and used to inform population estimates) were in the San Juan portion of the DPSs. These population estimates have generally large variances (or standard errors), and thus there remains uncertainty regarding the total abundance and distribution of ESA-listed rockfish in the

Puget Sound/Georgia Basin DPSs. In addition, there have been no peer reviewed historic or contemporary population estimates for any ESA-listed rockfish species in Puget Sound Proper.

Productivity is the measurement of a population's growth rate through all or a portion of its life cycle. Life history traits of yelloweye rockfish, canary rockfish, and bocaccio suggest generally low levels of inherent productivity because they are long-lived, mature slowly, and have sporadic episodes of successful reproduction (Drake et al. 2010; Tolimieri and Levin 2005). Overfishing can have dramatic impacts on the size or age structure of the population, with effects that can influence ongoing productivity. When the size and age of females decline, there are negative impacts to reproductive success. These impacts, termed maternal effects, are evident in a number of traits. Larger and older females of various rockfish species have a higher weight-specific fecundity (number of larvae per unit of female weight) (Bobko and Berkeley 2004; Boehlert et al. 1982; Sogard et al. 2008). Similarly, larger or older females provide more nutrients to larvae by developing a larger oil globule released at parturition, which provides energy to the developing larvae (Berkeley et al. 2004; Fisher et al. 2007), and in black rockfish enhances early growth rates (Berkeley et al. 2004).

Historic over fishing can have dramatic impacts on the size or age structure of the population, with effects that can influence ongoing productivity. When the size and age of females decline, there are negative impacts to reproductive success. These impacts, termed maternal effects, are evident in a number of traits. Larger and older females of various rockfish species have a higher weight-specific fecundity (number of larvae per unit of female weight) (Boehlert et al. 1982, Bobko and Berkeley 2004, Sogard et al. 2008). A consistent maternal effect in rockfishes relates to the timing of parturition. Larger or older females release larvae earlier in the season compared to smaller or younger females in several studies of rockfish species (Sogard et al. 2008, Nichol and Pikitch 1994). Larger or older females provide more nutrients to larvae by developing a larger oil globule released at parturition, which provides energy to the developing larvae (Berkeley et al. 2004, Fisher et al. 2007), and in black rockfish enhances early growth rates (Berkeley et al. 2004).

Contaminants such as PCBs, chlorinated pesticides, PBDEs, polychlorinated dioxins/furans (PCDD/F) (collectively referred to as bioaccumulative toxins) appear in rockfish collected in urban areas of the Puget Sound, such as Port Gardner, Elliot Bay and Commencement Bay (West et al. 2001, Palsson et al. 2009). While the highest levels of contamination are found in urban areas, toxins can be found in the tissues of salmon and forage fish throughout the region (Puget Sound Action Team 2007).

Reproductive function and therefore productivity of rockfish is likely affected by contaminants (Palsson et al. 2009). Adverse reproductive effects in rockfish could occur via maternal transfer of bioaccumulative toxics to larvae. Male rockfish typically accumulate more toxins than females, which provides evidence that the transfer of some toxins from females to larvae occurs during gestation (Palsson et al. 2009) (Figure 3).

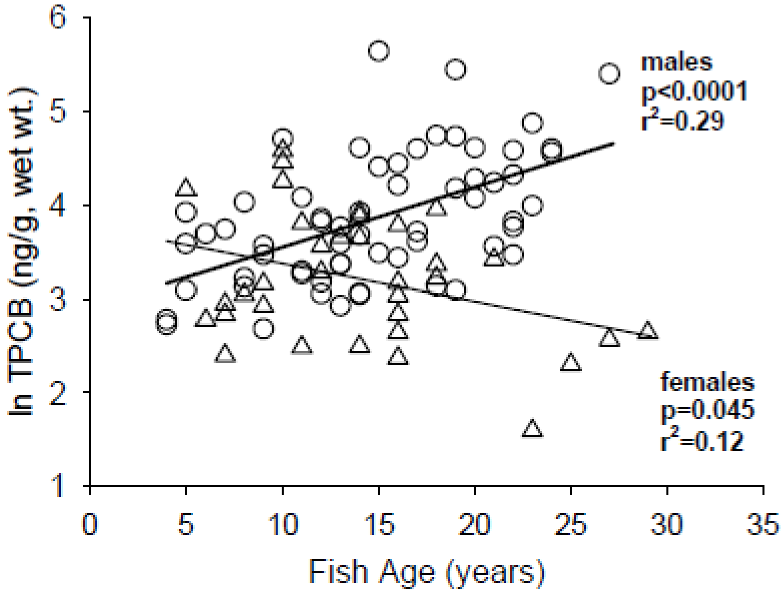

Figure 3. Total PCBs (log transformed) in quillback rockfish (*Sebastes maliger*) accumulates in males (circles) but not females (triangles) from Elliot Bay, Puget Sound. From Palsson et al. 2009.

In summary, though abundance and productivity information for yelloweye rockfish, canary rockfish and bocaccio is relatively imprecise, both abundance and productivity have been reduced largely by fishery removals within the range of the three Puget Sound/Georgia Basin DPSs.

Spatial Structure and Connectivity

Spatial structure consists of a population's geographical distribution and the processes that generate that distribution (McElhaney et al. 2000). A population's spatial structure depends on habitat quality, spatial configuration, and dynamics as well as dispersal characteristics of individuals within the population (McElhaney et al. 2000). Prior to contemporary fishery removals, each of the major basins in the range of the DPSs likely hosted relatively large populations of yelloweye rockfish, canary rockfish, and bocaccio (Moulton and Miller 1987; Washington 1977; Washington et al. 1978). Spatial distribution provides a measure of protection from larger scale anthropogenic changes that damage habitat suitability, such as oil spills or hypoxia that can occur within one basin, but not necessarily the other basins. Rockfish population resilience is sensitive to changes in connectivity among various groups of fish (Hamilton 2008). Hydrologic connectivity of the basins of the Puget Sound is naturally restricted by relatively shallow sills located at Deception Pass, Admiralty Inlet, the Tacoma Narrows, and in Hood Canal (Burns 1985). These sills regulate water exchange from one basin to the next, and thus likely moderate the movement of rockfish larvae (Drake et al. 2010). When localized depletion of rockfish occurs, it can reduce stock resiliency (Hamilton 2008; Hilborn et al. 2003). The effects of localized depletions of rockfish are likely exacerbated by the natural hydrologic constrictions within Puget Sound.

Spatial Structure and Connectivity

Yelloweye rockfish spatial structure and connectivity is threatened by the reduction of fish within each basin. This reduction is most acute within the basins of Puget Sound proper. Canary rockfish were present in each of the major basins in the 1970s (Moulton and Miller 1987). Several historically large populations in the canary rockfish DPS may be severely reduced, including an area of distribution in South Sound (Drake et al. 2010). The ability of adults to migrate hundreds of kilometers could allow the DPS to re-establish spatial structure and connectivity in the future under favorable conditions (Drake et al. 2010). Most bocaccio may have been historically spatially limited to several basins. They were historically most abundant in the Main Basin and South Sound (Drake et al. 2010) with only limited documented occurrences in the San Juan Basin. Positive signs for spatial structure and connectivity come from the propensity of some adults and pelagic juveniles to migrate long distances, which could re-establish aggregations of fish in formerly occupied habitat (Drake et al. 2010). In summary, spatial structure and connectivity for each species have been adversely impacted, mostly by fishery removals. These impacts to species viability are likely most acute for yelloweye rockfish because of their sedentary nature as adults.

Diversity

Characteristics of diversity for rockfish include fecundity, timing of the release of larvae and their condition, morphology, age at reproductive maturity, physiology, and molecular genetic characteristics. In spatially and temporally varying environments, there are three general reasons why diversity is important for species and population viability: 1) diversity allows a species to use a wider array of environments; 2) it protects a species against short-term spatial and temporal changes in the environment; and 3) genetic diversity provides the raw material for surviving long-term environmental changes. Though currently there is limited genetic data for the ESA-listed rockfish DPSs, the unique oceanographic features and relative isolation of some of its basins may have led to unique adaptations, such as timing of larval release (Drake et al. 2010).

Yelloweye rockfish, canary rockfish and bocaccio size and age distributions have been truncated in the Puget Sound/Georgia Basin. Recreationally caught fish in the 1970s spanned a broad range of sizes. By the 2000s, there was some evidence of fewer older fish in the population (Drake et al. 2010). As a result, the reproductive burden may be shifted to younger and smaller fish. This shift could alter the timing and condition of larval release, which may be mismatched with habitat conditions within the range of the DPS, potentially reducing the viability of offspring (Drake et al. 2010).

Limiting factors

Climate change and other ecosystem effects. Since pre-industrial times, global concentrations of carbon dioxide, methane, and nitrous oxides have increased considerably (IPCC 2007). Carbon dioxide (CO2) concentrations have increased from approximately 280 ppm 250 years ago to present levels of approximately 387 ppm, mostly because of the burning of fossil fuels and deforestation (IPCC 2007). Nearly half of this increase has occurred in the past three decades (IPCC 2007), and around one-third of the CO2 produced in the last 200 years has been taken up by oceans (Sabine et al. 2004). Atmospheric CO2 concentrations may exceed 500 parts per million and global temperatures may rise by at least 2°C by approximately 2050 to 2100 (Hoegh-Guldberg et al. 2007; Feely et al. 2008). As reviewed in ISAB (2007), average annual Northwest air temperatures have increased by approximately 1.8°F (1°C) since 1900, which is nearly twice that for the last 100 years, indicating an increasing rate of change. This change in surface temperature has already modified, and is likely to continue to modify, marine habitats of listed rockfish.

In addition to anthropogenic climate change, the ocean along the Pacific Coast of North America is influenced by a number of natural climatic factors such as the El Niño/Southern Oscillation and the Pacific Decadal Oscillation, during which their warm and cool phases affect ocean temperature and stratification (Mantua and Hare 2002). These and other naturally occurring factors strongly influence inter-annual and inter-decadal variability in ocean conditions and can confound the effects of anthropogenic climate change (Mantua and Hare 2002; Chavez et al. 2003). The effects of climate change include, but are not limited to, changes in temperature, distribution shifts of species, OA, changes in primary production, changes in biodiversity, declining mid-water oxygen concentrations, changes in upwelling and vertical mixing, sea-level rise, erosion, and more severe and frequent inundation of low-lying areas from the combined effects of rising sea levels and intensified and more frequent storms (Harley et al. 2006; IPCC 2007; Feely et al. 2008; Fabry et al. 2008; Ainsworth et al. 2011; Feely et al. 2012; Dalton et al. 2013)

Future climate-induced changes to rockfish habitat could alter their productivity (Drake et al. 2010). Harvey (2005) created a generic bioenergetic model for rockfish, showing that their productivity is highly influenced by climate conditions. For instance, El Niño-like conditions generally lowered growth rates and increased generation time. The negative effect of the warm water conditions associated with El Niño appear to be common across rockfishes (Moser et al. 2000). Recruitment of all species of rockfish appears to be correlated at large scales. Field and Ralston (2005) hypothesized that such synchrony was the result of large-scale climate forcing.

Increased concentration of CO2 (termed Ocean Acidification, or OA) reduces carbonate availability for shell-forming invertebrates. OA will adversely affect calcification, or the precipitation of dissolved ions into solid calcium carbonate structures, for a number or marine organisms, which could alter trophic functions and the availability of prey (Feely et al. 2010). Further research is needed to understand the implications of OA on trophic functions in Puget Sound and their effects on rockfish. Adult fish generally have the ability to largely control internal physiology, including acid-base equilibrium. Conversely, early life history stages of fish often lack the physiological control mechanisms present in adults (Feely et al. 2012). For example, early larval stages of fish lack gills, which are an important organ for maintaining acid-base balance, making some larval stages more sensitive to changes in ocean chemistry. These sensitivities may vary among fish species and life history stages (Feely et al. 2012). Thus far, studies conducted in other areas have shown that the effects of OA will be variable (Ries et al. 2009) and species-specific (Miller et al. 2009). As mentioned above, though organisms may be able to overcome corrosive conditions through responses such as modifying internal fluid chemistry, these responses could be energetically costly, and may reduce productivity, growth, or survivorship (Wood et al. 2008; Fitzer et al. 2012; Feely et al. 2012).

There have been very few studies to date on the direct effect OA may have on rockfish. In a laboratory setting OA has been documented to affect rockfish behavior (Hamilton et al. 2014). Fish behavior changed significantly after juvenile Californian rockfish (*Sebastes diploproa*) spent one week in seawater with the OA conditions that are projected for the next century in the California shore. Research conducted to understand adaptive responses to OA on other marine organisms has shown that although some organisms may be able to adjust to OA to some extent, these adaptations may reduce the organism's overall fitness or survival (Wood et al. 2008). More research is needed to further understand rockfish-specific responses and possible adaptations to OA.

Sea level has risen by an average of 0.7 ± .01 inch (1.7 ± 0.3 mm)/year since 1950 after remaining relatively stable for approximately the last 3,000 years (Church and White 2006; Nicholls and Cazenave 2010). Global SLR is projected to rise by approximately 23.6 inches (60 cm) by 2100 (IPCC 2007) to as much as 3.28 feet (1 m) because of recently identified declines in polar ice sheet mass (Pfeffer et al. 2008). However, Washington State is situated above an active subduction zone, which may mean that sea-level rise could differ from the global average, depending on the activity of the zone (Dalton et al. 2013). Puget Sound lowlands are thought to be more stable in the north, but are tilting downward toward Tacoma in the south. This subsidence may amplify SLR and could effectively double the rate in areas of South Puget Sound, such as Olympia (Craig 1993). In areas of South Puget Sound, SLR could, among other impacts, contaminate surface and groundwater; cause shoreline erosion and landslides, which may lead to a loss of tidal and estuarine habitat (Craig 1993); and may cause shifts in species distribution (Harley et al. 2006). The effect on the nearshore is of particular note because it is used by juvenile canary rockfish and bocaccio, and likely has a critical role in their successful recruitment (Love et al. 1991).

Despite the growth of knowledge regarding measured and potential changes from climate change, there remains a great deal of uncertainty and best available information and science does not currently support our current ability to predict specific changes in timing, location, and the magnitude of future effects to listed rockfish and their habitat based on climate change.

Other Limiting Factors. In addition to the factors listed above, the yelloweye rockfish, canary rockfish and bocaccio DPSs are at reduced abundance and face several threats, including bycatch in commercial and recreational fisheries, non-native species introductions, and habitat degradation.

In summary, despite some limitations on our knowledge of past abundance and specific current viability parameters, characterizing the viability of yelloweye rockfish, canary rockfish, and bocaccio includes their severely reduced abundance from historic times, which in turn hinders productivity and diversity. Spatial structure for each species has also likely been compromised because of the lack of mature fish of each species distributed throughout their historic range within the DPSs (Drake et al. 2010).

2.2.2 Status of Critical Habitat

Critical habitat was designated for ESA-listed rockfish in 2014 under section 4(a)(3)(A) of the ESA (79 FR 68041, November 13, 2014). The specific areas designated for canary rockfish and bocaccio are the same and include approximately 1,083.11 square miles (1,743.10 sq. km) of deep water (< 98.4 feet [30 m]) and nearshore (> 98.4 feet [30 m]) marine habitat in Puget Sound. The specific areas designated for yelloweye rockfish include 438.45 square miles (705.62 sq. km) of deepwater marine habitat in Puget Sound, all of which overlap with areas designated for canary rockfish and bocaccio (Figure 4). Section 3(5)(A) of the ESA defines critical habitat as "(i) the specific areas within the geographical area occupied by the species, at the time it is listed . . . on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed . . . upon a determination by the Secretary that such areas are essential for the conservation of the species."

Critical habitat is not designated in areas outside of U.S. jurisdiction; therefore, although waters in Canada are part of the DPSs' ranges for all three species, critical habitat was not designated in that area. We also excluded 13 of the 14 Department of Defense Restricted Areas, Operating Areas, and Danger Zones and waters adjacent to tribal lands from the critical habitat designation.

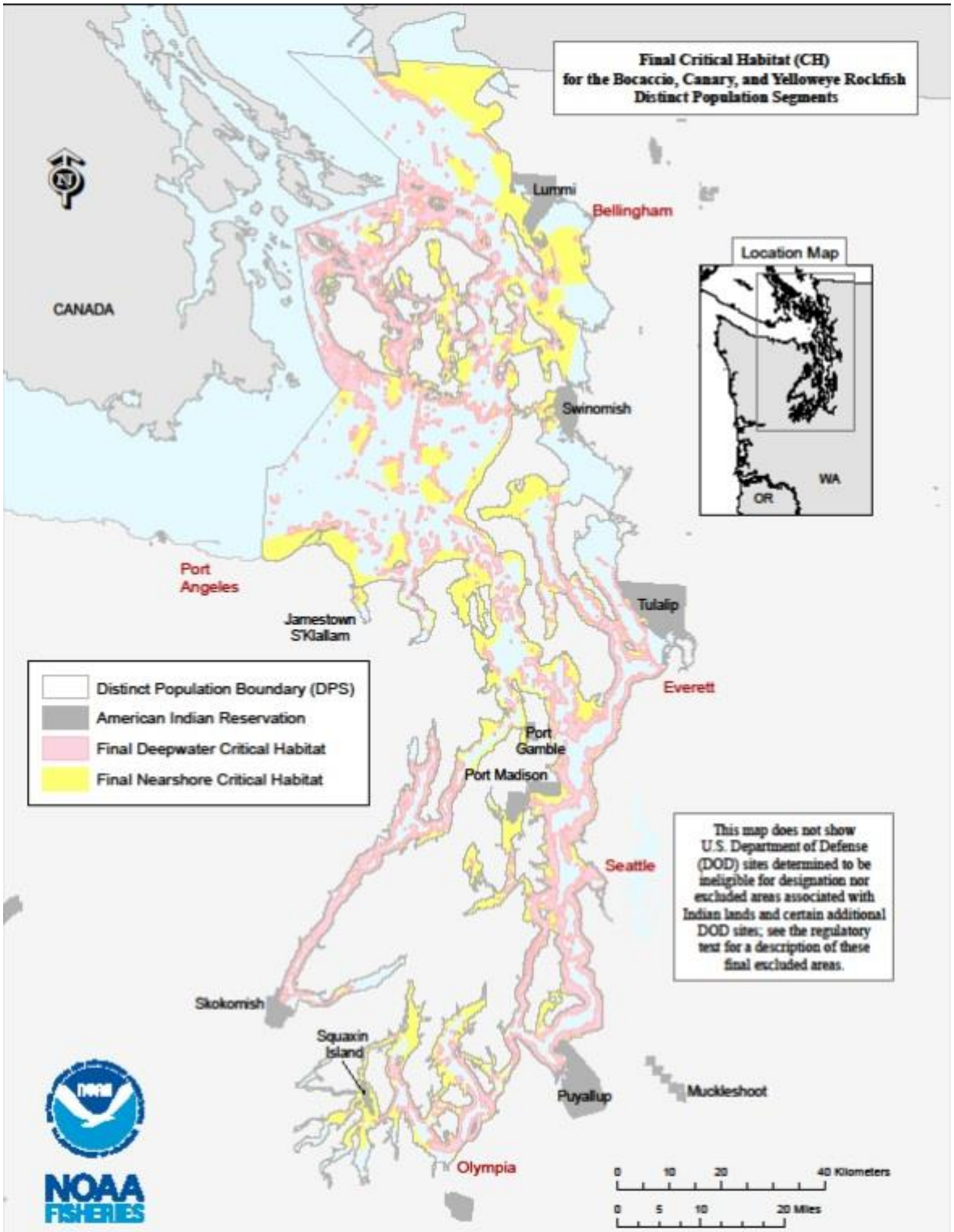

Figure 4. ESA-listed rockfish critical habitat in the Puget Sound area.

Based on the best available scientific information regarding natural history and habitat needs, we developed a list of physical and biological features essential to the conservation of adult and juvenile yelloweye rockfish, canary rockfish, and bocaccio, and relevant to determining whether proposed specific areas are consistent with the above regulations and the ESA section (3)(5)(A) definition of "critical habitat." The physical or biological features essential to the conservation of yelloweye rockfish, canary rockfish, and bocaccio fall into major categories reflecting key life history phases:

Adult canary rockfish and bocaccio, and adult and juvenile yelloweye rockfish: We designated sites deeper than 98 feet (30 m) that possess (or are adjacent to) areas of complex bathymetry. These features are essential to conservation because they support growth, survival, reproduction, and feeding opportunities by providing the structure to avoid predation, seek food, and persist for decades. Several attributes of these sites affect the quality of the area and are useful in considering the conservation value of the feature in determining whether the feature may require special management considerations or protection, and in evaluating the effects of a proposed action in a section 7 consultation if the specific area containing the site is designated as critical habitat. These attributes include: 1) quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; 2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities; and 3) structure and rugosity to support feeding opportunities and predator avoidance.

Juvenile canary rockfish and bocaccio only: Juvenile settlement sites located in the nearshore with substrates such as sand, rock, and/or cobble compositions that also support kelp. These features are essential for conservation because they enable forage opportunities and refuge from predators, and enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats. Several attributes of these sites affect the quality of the area and are useful in considering the conservation value of the feature in determining whether the feature may require special management considerations or protection, and in evaluating the effects of a proposed action in a section 7 consultation if the specific area containing the site is designated as critical habitat. These attributes include: 1) quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and 2) water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.

Regulations for designating critical habitat at 50 CFR 424.12(b) state that the agencies shall consider physical and biological features essential to the conservation of a given species that "may require special management considerations or protection." Joint NMFS and USFWS regulations at 50 CFR 424.02(j) define "special management considerations or protection" to mean "any methods or procedures useful in protecting physical and biological features of the environment for the conservation of listed species." We identified a number of activities that may affect the physical and biological features essential to yelloweye rockfish, canary rockfish, and bocaccio such that special management considerations or protection may be required. Major categories of such activities include: 1) nearshore development and in-water construction (e.g., beach armoring, pier construction, jetty or harbor construction, pile driving construction, residential and commercial construction); 2) dredging and disposal of dredged material; 3) pollution and runoff; 4) underwater construction and operation of alternative energy hydrokinetic projects (tidal or wave energy projects) and cable laying; 5) kelp harvest; 6) fisheries; 7) non-indigenous species introduction and management; 8) artificial habitat creation; 9) research activities; 10) aquaculture, and 11) activities that lead to global climate change.

Overall, the status of critical habitat in the nearshore is impacted in many areas by the degradation from coastal development and pollution. The status of deepwater critical habitat is impacted by remaining derelict fishing gear, and degraded water quality among other factors. Pollutants affect water quality, sediment quality, and food resources in the nearshore and deepwater areas of critical habitat.

2.3 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).

The Puget Sound and Georgia Basin form the southern arm of an inland sea located on the Pacific Coast of North America that is directly connected to the Pacific Ocean. Most of the water exchange in Puget Sound proper is through Admiralty Inlet near Port Townsend, and the configuration of sills and deep basins results in the partial recirculation of water masses and the retention of contaminants, sediment, and biota (Rice 2007).

Listed rockfish are linked to numerous other fish species in Puget Sound through the food web. Groundfish (often referred to as demersal fish, or bottom fish), make up the majority of the estimated 253 species of fish within Puget Sound (Pietsch and Orr 2015) and constitute the largest number of species in the action area. Groundfish collectively occupy habitats ranging from intertidal zones to the deepest waters of the region. WDFW estimated that the biomass of benthic bottom fishes in Puget Sound is 220 million pounds (WDFW 2010).

Habitats of ESA-listed rockfish DPSs can be divided into the nearshore, demersal, and pelagic zones. The nearshore refers to intertidal waters to roughly 90 feet deep, which is typically the deepest extent of photosynthesis. The demersal zone refers to the water column near the sea-bottom, and the pelagic zone refers to the water column. These habitats have been influenced by a number of human-induced alterations, and we discuss the environmental baseline of the demersal and pelagic zones in more detail than the nearshore, as these habitats are most affected by sediment disposal.

Most of the benthic deepwater (e.g., deeper than 90 feet) habitats of Puget Sound proper consist of unconsolidated sediments such as sand, mud, and cobbles. The vast majority of the rocky-bottom areas of Puget Sound occur within the San Juan Basin, with the remaining portions spread among the rest of Puget Sound proper (Palsson et al. 2009). Depths in the Puget Sound extend to over 920 feet (280 meters). Benthic habitats within Puget Sound have been influenced by a number of factors. The degradation of some rocky habitat, loss of eelgrass and kelp, introduction of non-natural-origin species that modify habitat, and degradation of water quality are threats to marine habitat in Puget Sound (Drake et al. 2010; Palsson et al. 2009). Some benthic habitats have been impacted by derelict fishing gear that include lost fishing nets, and shrimp and crab pots (Good et al. 2010). Derelict fishing gear can continue "ghost" fishing and is known to kill rockfish, salmon, and marine mammals as well as degrade rocky habitat by altering bottom composition and killing numerous species of marine fish and invertebrates that are eaten by rockfish (Good et al. 2010). Thousands of nets have been documented within Puget Sound and most have been found in the San Juan Basin and the Main Basin. The Northwest Straits Initiative has operated a program to remove derelict gear throughout the Puget Sound region. In addition, WDFW and the Lummi, Stillaguamish, Tulalip, Nisqually, and Nooksack Tribes and others have supported or conducted derelict gear prevention and removal efforts. Net removal has mostly concentrated in waters less than 100 feet (33 m) deep where most lost nets are found (Good et al. 2010). The removal of over 4,600 nets and over 3,000 derelict pots have restored over 650 acres of benthic habitat (Northwest Straights Initiative 2014), though many derelict crab and shrimp pots remain in the marine environment. Several hundred derelict nets have been documented in waters deeper than 100 feet deep (NRC 2014). Because habitats deeper than 100 feet (30.5 m) are most readily used by adult yelloweye rockfish, canary rockfish, and bocaccio, there is an unknown but potentially significant impact from deepwater derelict gear on rockfish habitats within Puget Sound.

The nearshore of the action area consists of rocky, sandy or cobble-sized shorelines and benthic areas. Development has occurred along approximately 30% of the Puget Sound shoreline (Broadhurst 1998), and has increased in recent years (Cornwall and Mayo 2008). Development along the shoreline has been linked to reductions in invertebrate abundance, species diversity (Dugan et al. 2003), and forage fish egg viability (Rice 2007).

Habitats of the demersal zone are most prevalently influenced by pollution that includes excess nutrients and contaminants, and derelict fishing gear (Palsson et al. 2009). As with the nearshore areas, the sea-bottom of the demersal zone consists of rocky/cobble areas, and soft-bottomed habitats of mud, sand or clay. Most of the bottom substrates of the action area consist of unconsolidated sediments that are clay, sand and mud. Rocky habitats are extremely limited in Puget Sound Proper, with only 3.8 sq miles (10 km^2) in Hood Canal and waters east of Admiralty Inlet, and 80 sq miles (207 km^2) in the eastern Strait of Juan de Fuca and the San Juan basin (Palsson et al. 2009).

There are 14 major river basins that deposit sediment into Puget Sound and the Strait of Juan de Fuca as well as natural shoreline-bluff deposition (Burns 1985). The Frasier and Skagit Rivers alone deposit approximately 24 million metric tons of sediment annually (COE 1989). This sediment ranges from sand (less than 1/16 millimeters (mm)) to mud, silt and clay (greater than1/16mm to less than 1/256mm) (Burns 1985). Many of these sediments settle onto local estuaries and nearshore areas that have been transformed for human uses that include vessel navigation and marinas. Some finer-grained sediment is distributed more broadly across the Puget Sound/Georgia Basin and eventually settles onto demersal habitats, mostly in areas with relatively slow currents (Burns 1985). The amount of suspended sediments within the pelagic zone of the Puget Sound typically ranges from 0.5 to 2 milligrams per liter (mg/l), but is quite variable with higher concentrations generally occurring near the surface, and in demersal areas (COE 1989). Sediment accumulates on the bottom of North Puget Sound at an annually estimated rate of 200 to 300 milligrams per square centimeter (COE 1989).

Over the last century, human activities have introduced a variety of toxins into the action area. Areas of higher concentrations of contaminated sediments include Bellingham Bay, Commencement Bay, Elliot Bay and Port Gardner. Some toxins remain suspended within the pelagic zone. However, most of these toxins bind to sediments and settle onto demersal habitats. The Washington State Department of Ecology estimates that Puget Sound receives between 14 and 94 million pounds of toxic pollutants per year, which include oil and grease, bioaccumulative toxins, and heavy metals such as zinc, copper, and lead (Ecology 2010). Toxic chemicals in the Puget Sound alter water and sediment quality and can affect ESA-listed rockfish, their habitats, and prey. Chemicals enter from direct and indirect pathways, including surface runoff; inflow from fresh and salt water, aerial deposition, discharges from wastewater treatment plants and combined sewer overflows, oil spills, and migrating biota (Crowser et al. 2007). Contaminants can include metals, organometallic compounds, chlorinated hydrocarbons, phenols, PCBs, PBDEs, and PAHs (Army Corps of Engineers 2015). Persistent bioaccumulative toxics (PBTs) are chemicals that persist in the environment and can accumulate in animal tissues or fat. Fat-bonding, or lipophilic contaminants, such as PCBs and PBDEs, can be taken up and retained by plankton, or attach to particles and settle into the bottom sediments. PBTs retained by plankton are rapidly assimilated into the food web and accumulated by pelagic consumers such as zooplankton, and forage fish and then amplified throughout the food web to higher trophic level predators like demersal rockfish, salmon, orcas, birds, and humans (PSAT 2007).

The baseline environmental conditions of the seven disposal sites within the ESA-listed rockfish DPSs are described in more detail below, and in greater detail in the COE’s Biological Assessment (2015).

Non-Dispersive Sites

The non-dispersive sites are in Bellingham Bay, Port Gardner, Elliot Bay and Commencement Bay and are close to major industrial ports and large rivers. Each has relatively slow currents and fine-grained benthic sediments. The Anderson/Ketron Island site is not near a major port or large river, but it is also characterized by relatively slow currents and fine-grained sediments. Adult yelloweye rockfish, canary rockfish, and bocaccio have been documented within one mile of all sites except the Commencement Bay site. Larval and pelagic juveniles likely periodically use habitats within or near each of the non-dispersive sites (Greene and Godersky 2012). In addition, small numbers of quillback and copper rockfish have been documented near all sites and various flatfish species were found to be the most dominant group of fish near all of them (Donnelly et al. 1988). Sediment quality monitoring has generally found concentrations of chemicals to be lower than nearby reference sites. The concentration of PCBs in sediments within the disposal zones of Bellingham Bay, Port Gardner, and Commencement Bay are within the range of average or lower than Puget Sound benthic concentrations (COE 2010). At Elliot Bay, PCBs were detected in 88.6% of the samples from the disposal site, and 87.6% of the samples from off-site areas, and the onsite and offsite median concentrations were not significantly different (with 95% confidence) (COE 2010).

Dispersive Sites

The dispersive sites within the DPSs are in Rosario Strait near Fidalgo Island and near Port Townsend Bay in Admiralty Inlet (each within the San Juan Basin). Since sediment does not readily deposit within the boundaries of the dispersive sites, their benthic habitats are characteristic of adjacent habitats of the area. Epibenthic organisms such as scallops are more numerous than infaunal organisms such as annelid worms, which is typical for these types of benthic habitats. Common invertebrate biota also includes shrimp and sea urchins (Donnelly et al. 1988). Twelve demersal fish species have been document at these sites, including Dover sole, rex sole, Pacific cod, and walleye pollock and arrowtooth flounder (Donnelly et al. 1988). Habitats near the Rosario Strait and Port Townsend sites have steeper slopes and greater benthic habitat complexity. The Rosario Strait site seafloor is composed of coarse-grained sediments, rocks and cobble, which is typical for areas which experience strong current flows. The currents at the Rosario Strait site typically range from 10 to 30 cm/sec, with peak speeds of 100 cm/sec. Mean current speeds at the Port Townsend site are between 30 to 50 cm/sec, with peak speeds of 75 to 100 cm/sec (COE 2010).

2.4 Effects of the Action

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, 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). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

Three components of the proposed action are unlikely to harm to any life stage of ESA-listed rockfish or their habitats. They include: (1) the transportation of sediment, and (2) the monitoring of benthic habitats, (3) sediment disposal activities at the Port Angeles and Grays Harbor occur outside of the DPSs' boundaries. Thus, these components of the proposed action are not analyzed further. These three aspect of the proposed action would not alter the behavior and habitats of ESA-listed rockfish. The act of dumping sediment can result in harm to ESA-listed rockfish and their habitat, and thus we assess this aspect of the proposed action in detail.

Adult yelloweye rockfish, canary rockfish and bocaccio have been documented within several miles of each of the disposal sites (Washington 1977, Dinnel 1986, WDFW unpublished data) and larval rockfish (not identified to species) have been documented within each as well (Greene and Godersky 2012). Thus it is likely that some larval and a few adult ESA-listed rockfish would be exposed to sediment as it is dumped at both the dispersive and non-dispersive sites. The trajectory of dumped sediment differs at the two site types. The trajectory and concentrations of dumped sediment at the dispersive sites is difficult to predict because the sites are characterized by complex and strong currents. However, the COE has predicted that a 1,500 cy disposal would reach extremely low concentrations after one hour (COE 1989). When sediment is released from barges at the non-dispersive sites, it travels through the water column "…as a dense fluid like jet. When…it hits the bottom it collapses, and moves radially outward" (COE 1989). The COE depicted the fate of dumped material at non-dispersive sites (Figure 5), and modeled sediment concentrations. The modeled surface sediment concentrations remain at low levels for up to 24 minutes, while mid-water and bottom concentrations spike for shorter periods of time, but at much higher levels (COE 2015b). Upon contact with the bottom, the estimated diameter of the sediment plume (jet) at a 400 foot side is 250 feet (COE 2015b).

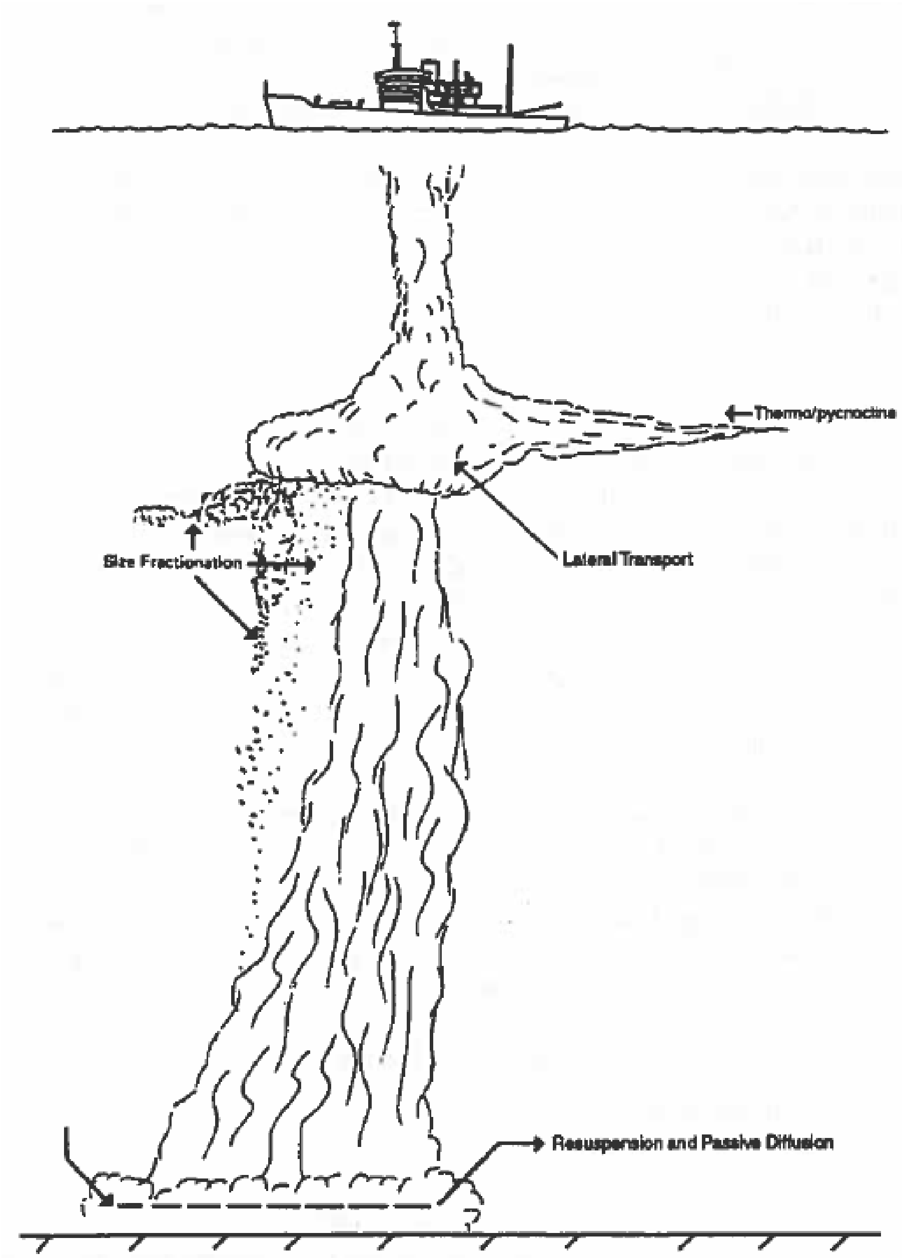

Figure 5. Schematic of dumped dredge material (COE 2015b).

Larvae/pelagic juveniles

Some larvae and pelagic juveniles of ESA-listed rockfish would be in the dredge disposal sites during sediment disposal activities (Figure 6.) (Greene and Godersky 2012). The work window used by the COE to protect salmonids (disposal is not allowed anywhere in the Puget Sound between March 15 and June 15) would also protect the early peak of rockfish larvae in April and May. Dredge disposal occurring from June 16 through October would coincide with the presence of rockfish larvae. Rockfish larvae are largely absent in the winter.

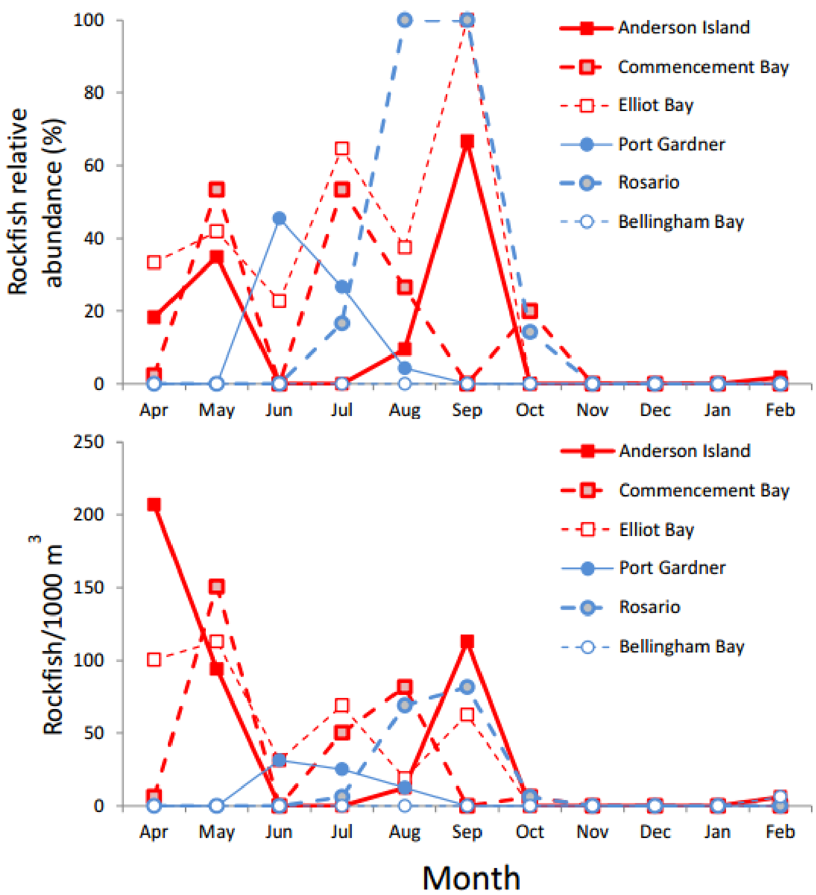

Figure 6. Relative abundance (% of all specimens identified as rockfish) and density (rockfish larvae/1000 m3) at the six sediment disposal sites from April 2011 through February 2012. Image from Greene and Godersky (2012).

For periods when larval rockfish and dredge disposal co-occur, determining the extent of effect is dependent upon the frequency of disposal, estimated sediment concentrations, and the relative abundance of ESA-listed rockfish. The concentrations and duration of suspended sediments within the water column depends upon the depth, currents, and composition of the material, and concentrations of up to 1,000 mg/l have been documented (COE 2015b). Suspended sediment at these concentrations would injure or kill them or alter their feeding rate. Underwater sound could also affect larval rockfish, though suspended sediment falling through the water column is much more likely to result in injury or death than sound would. A number of studies have assessed suspended sediment effects on Pacific herring larvae, as well as other marine fish. Larval herring death rates ranged from 82.8 to 99.4%, compared to 23.6% of the control group when they were exposed to suspended sediment levels of 10,000, 5,000, and 500 mg/l for four days (Morgan and Levings 1989). Larval herring had abraded yolk sacs that increased relative to the concentration when exposed for 24 hours to suspended sediment concentrations of up to 8,000 mg/l (Boehlert 1984), and their feeding rates were observed to maximize when concentrations reached 500 mg/l, and decreased at higher concentrations (Boehlert and Morgan (1985). When exposed to 10,000, 5,000 and 500 mg/l for ten days, larval lingcod death rates ranged from 90 to 98%, compared to 18% in a control group (Morgan and Levings 1989). None of the aforementioned studies replicate the short term but very high concentrations of suspended sediment that would result from sediment disposal in Puget Sound.

Given the extreme fragility of larval rockfish, some fish within the water column of the active disposal zone would be injured or killed by ruptured capillaries, maceration of highly vascular organs and internal bleeding. As an example of their fragility, larval rockfish were observed to be injured by strong water flow in laboratory-rearing environments (Canino and Francis 1989).

The COE estimated that 5,532.4 larval yelloweye rockfish, 8,282.5 larval canary rockfish, and 179.5 larval bocaccio would be exposed to sediment disposal at each of the non-dispersive sites on an annual basis, and acknowledged that these larvae would be injured or killed (see Appendix D of the COE BA for calculation methodologies)[5]. The COE assessment assumed that rockfish larvae only occur in waters shallower than 80 meters, but they have been documented in the full water column in local waters (Weis 2004). As such, the COE estimates of exposed rockfish larvae are likely low.

In order to determine the proportion of ESA-listed rockfish larvae exposed, the COE used the numbers we derived from recreationally caught rockfish in WDFW catch statistics from 2004 to 2008 and used in our 2010 opinion. There is new data that provides insight to the proportion of ESA-listed rockfish compared to other rockfish species in the Main Basin and South Sound as a result of an on-going genetics study using hook and line methods. Of the 631 rockfish caught in 2014 and through June of 2015 in the Main Basin and South Sound, 5 (0.016%) were yelloweye rockfish, 20 (0.06%) were canary rockfish and 2 (0.006%) were bocaccio (NMFS unpublished data). Rockfish in Puget Sound occupy a wide variety of depths, and the genetics study is targeting deepwater ESA-listed rockfish. Thus the proportions of yelloweye rockfish, canary

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[5] Here's the COE's methodology from their BE (COE 2015b) (edited for brevity): "The cross-sectional area of the disposal plume at the point of discharge is assumed to be equal to the dimensions of the dredged material compartment of the dump scow when the doors open. A scow with capacity of 1,500 cy was used in NMFS (2010), so the cross-sectional area of the Point Defiance was increased proportionally to estimate the area of the compartment in a 1,500 cubic yard barge. Applying a multiplier of 1,500/1,375 yields a cross-sectional area of 5,590 ft2. To simplify calculation of the volume of water affected by a disposal event, the three-dimensional shape of the disposal plume can be modeled using a truncated cone. To yield a cross-sectional area equal to the dimensions of the dump scow, the diameter of the upper surface of the truncated cone would need to be approximately 84 feet (25.6 m). The diameter of the lower surface of the truncated cone is assumed to be 250 feet (76.2 m) for a disposal site with a depth of 400 feet (PSDDA/DSSTA, 1988). Using the mean monthly density of rockfish larvae during the dredging season at each site; the average annual disposal volumes; the ESA-listed fractions of recreational rockfish catches from NMFS (2010); and the volume of water affected by the disposal plume; the numbers of listed rockfish larvae potentially affected by disposal were calculated."

rockfish and bocaccio caught in this study may over represent their actual proportion of all rockfish species (many of which occur in waters shallower than ESA-listed rockfish).

We consider these new rockfish proportions more accurate than the WDFW recreational fishing data used by the COE in their Biological Evaluation (2015) and in our 2010 opinion. We multiplied the COE's estimates of larvae exposed to sediment disposal by the new data regarding the proportion of the general larvae population, and using the same assumptions as the COE, estimate that 11,064 larval yelloweye rockfish, 41,412 larval canary rockfish and 4,129 larval bocaccio would be injured or killed annually, but note that these estimates do not include larvae in the water column below 80 m at all but the Bellingham Bay site (which is shallower than 80 m) or any dredge disposal at the dispersive sites. We are unable to determine the extent of larvae exposed to sediment at the dispersive sites due to their complex currents and relatively rapid spread and dilution of dumped sediment. Nonetheless, the amount of larval yelloweye rockfish, canary rockfish, and bocaccio killed is a fraction of the total amount likely to occur in the action area. The amount of larval rockfish killed for each listed species is well less than the equivalent of the amount for one mature female, and thus has nearly inconsequential impacts on abundance, productivity, diversity and productivity for each species as a whole.

Adults

Adult yelloweye rockfish are unlikely to occupy demersal habitats within most of the non-dispersive sites because of their lack of steepness and relative lack of structural complexity. For example the Port Gardner and Port Townsend sites (indicated by black arrows and circles in Figure 7) have much less complex habitat compared to adjacent and steeper benthic areas (indicated by white arrows in Figure 7), as is the case for each of the disposal sites.

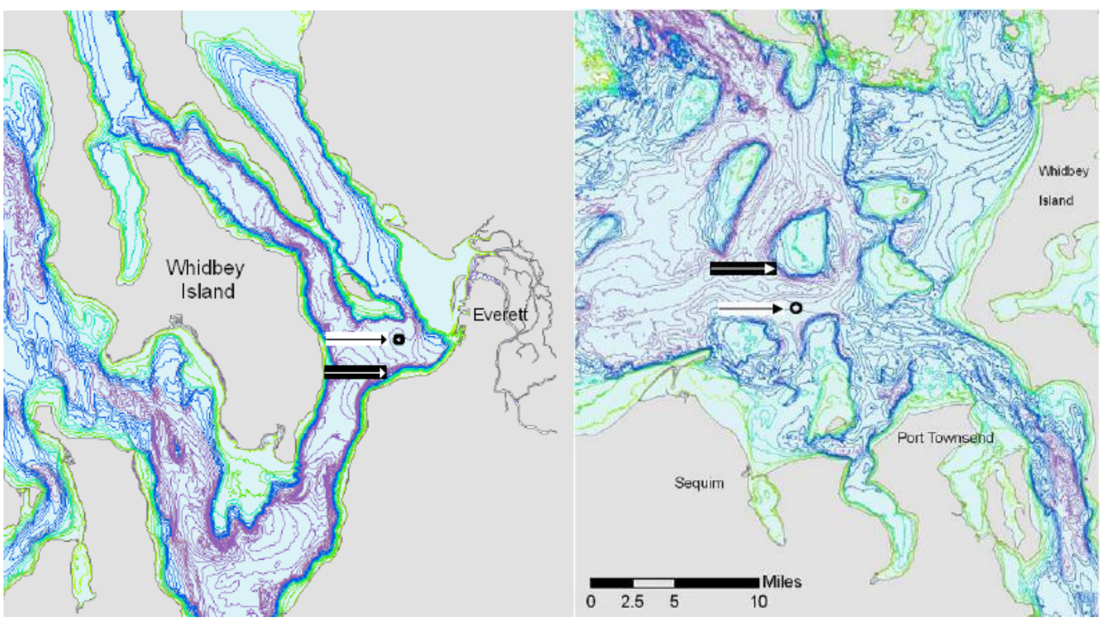

Figure 7. The black circles and black arrows indicate the Port Gardner non-dispersive site (left) and Port Townsend dispersive sites (right). Benthic areas with increased steepness (and rugosity values) are indicated by thick purple, blue and green bathymetric lines (examples indicated by the white arrows). Images generated by NMFS.

Parts of the Bellingham Bay, Elliot Bay and Rosario Strait sites are within designated critical habitat and therefore are more likely to host adult ESA-listed rockfish, and it is possible that some adults could occupy the water column near or within the disposal sites because of their propensity to travel. Adult yelloweye are generally sedentary (Love et al. 2002) and thus unlikely to occupy the water column of any of the disposal sites. Canary rockfish and bocaccio are more likely to be within the water column than yelloweye rockfish, but are similarly unlikely to occupy the target zones where sediment disposal occurs

If an adult ESA-listed rockfish is present within the affected water column during a disposal event they would likely move away from the sediment plume and thus avoid injury. Suspended sediment concentrations from the dumping at the non-dispersive sites would be at extremely low concentrations by the time they reach any habitat likely to contain adult listed rockfish, and thus would not result in harm. At the non-dispersive sites the COE estimated that a typical 1,500 cy sediment dump would create sediment concentrations of 0.0007 mg/l six hours after the event. This is equivalent to $1/100^{th}$ of the typical background concentration of suspended sediment (COE 1989). This level of additional sediment concentration is well within the range of natural variation (Burns 1985, COE 1989). Thus exposure would be unlikely to have any short-term or lasting effects on adults because, (1) the adults are unlikely to be in the areas in the first place, (2) they would in most cases be able to avoid the dumpling, and (3) possibly harmful sediment levels would swiftly drop back to background levels.

Loss of Food Sources and Exposure to Contaminants

Aside from harming and killing larvae, there are several different general mechanisms by which sediment disposal could affect ESA-listed rockfish. Some rockfish prey are probably injured or killed by the sediment plume, sediments with contaminants could accumulate in benthic habitats, and contaminants adhering to sediments could accumulate in the rockfishes' food.

Adult, larval, and rearing juvenile surf smelt, Pacific sand lance, and herring are present in the action area throughout the year, and likely use habitat within each of the disposal zones on a sporadic basis. Other life-stages of potential rockfish food (e.g., flatfish and other species) also use habitat in the affected water column or demersal habitats at the dispersive and non-dispersive sites (Dinnel et al. 1986, Donnelly et al. 1988). As dumped sediment descends some of these species' larvae and juveniles would be killed or injured within the water column by similar injures as rockfish larvae. Flatfish and invertebrates could be smothered as the jet hits bottom and expands outward, causing high turbidity and temporarily reduced dissolved oxygen levels at the non-dispersive sites. Because forage fish move throughout the Puget Sound, the loss of some forage fish in one area could eventually reduce later prey availability in other areas.

The direct loss of rockfish prey from sediment disposal is unlikely to appreciably alter rockfish feeding opportunities for a number of reasons. First, invertebrate production has been found to respond relatively quickly after disposal events (COE 2015b). For example, the Commencement Bay site has more individuals of some invertebrate taxa (polychaetes, crustacean, mollusks) than were found at the nearby reference site (COE 2010). Second, the habitat area affected by sediment disposal is less than 0.25% of the benthic habitats of Puget Sound, thus the number of rockfish prey killed would constitute only a fraction of available food sources during transitory sediment disposal. Third, rockfish eat many different species of fish and invertebrates (Washington et al. 1978, Lea et al. 1999, Love et al. 2002, Palsson et al. 2009) thus the loss of some fraction of their of their prey that is less than 0.25% and takes place in areas where adult rockfish are unlikely to occur in great numbers in the first place means that the action is unlikely to result in fewer feeding opportunities.

Sediment disposal would transfer some level of contaminants from the relatively shallow waters of rivers and marinas to the disposal sites. Contaminants such as PCBs, PCDD/F and PBDEs can slowly leach from sediments in soluble form and be taken up by phytoplankton, zooplankton, benthic invertebrates, demersal fish, forage fish and other fishes (COE 2010), while exposure to and dietary intake of PAHs in dredged and disposed sediments can occur as well. Some contaminants can then be bioaccumulated by long-lived predators such as rockfish (West et al. 2001, Palsson et al. 2009). A recent draft white paper by the U.S. Fish and Wildlife Service and NOAA's Northwest Fishery Science Center proposed a revision of sediment screening criteria for PAHs to be more protective of salmonids (Buck and Johnson, 2014). Currently the DMMP evaluates suitability of dredged materials for PAHs are primarily derived for protection of benthic invertebrates and not fish. Buck and Johnson (2014) summarized literature demonstrating that fish respond to some contaminants in sediment in a way that may not be accounted for in benthic invertebrate tests and, further, that impacts on fish can occur at lower concentrations than those considered protective of invertebrates. These effects include liver lesions, DNA damage, and changes in lipid content—all of which may affect fish growth and disease resistance (Johnson et al. 2002). Buck and Johnson recommended using updated screening criteria to help determine the fate of dredged sediment. The authors did not address potential toxicity to rockfish, but the recommendations are being considered the Regional Sediment Evaluation Team (RSET) forum[6].

As part of the effort to assess potential transfer of contaminants, the COE assessed the bioaccumulation of PCCD/F (dioxin) in English sole that occupy demersal habitats of the non-dispersive sites (COE 2010). English sole occupy these habitats continuously and eat invertebrates living with disposed sediments, thus are more likely than rockfish to bioaccumulate contaminants in disposed sediment. Small concentrations of PCCD/F were found in English sole tissue, but most were at levels below "no-effects thresholds[7]" for fish (COE 2010). Though ESA-listed rockfish typically live longer than English sole, they are less likely to bioaccumulate chemicals that adhere to disposed sediments because adult rockfish are much less likely to reside at the non-dispersive sites. The COE does not include PBDEs on the list of potentially bioaccumulative substances to be tested at dredge sites, but we consider it likely that dredge disposal would introduce PBDEs to benthic habitats at the disposal sites. This is because the prevalence of PBDEs throughout Puget Sound make it likely they would be present at dredge

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[6] The Regional Sediment Evaluation Team is a multiagency group that facilitates communication, coordination and resolution of dredging issues among agencies with jurisdiction over dredged material management. http://www.nwp.usace.army.mil/Missions/Environment/DMM.aspx

[7] "No-effect threshold" means the tested dose is below which there is a measurable effect in the organism, such as behavioral change, injury or death.

sites[8]. Despite this uncertainty, there is additional evidence that the sediment disposal program is unlikely to cause rockfish to bioaccumulate more contaminants than any background level of uptake: (1) The DMMP removes contaminated sediments from the Puget Sound, and this trend is expected to continue for the foreseeable future. Over the past 26 years, nearly 5% of the dredged sediment has been deemed too contaminated for in-water disposal, and was disposed at upland sites. As an example, nearly 50% of the dredged sediments of Elliot Bay and the Duwamish River area have been disposed at upland locations (COE 2010), (2) The non-dispersive sites encompass less than 0.25% of the habitat of the rockfish DPSs, and most of these habitats are unlikely to host adult ESA-listed rockfish anyway, (3) Concentrations of sediments settling in the San Juan region from the dispersive sites are extremely low, (4) Monitoring of the non-dispersive sites provides evidence that the sediment disposal sites have the same or better sediment quality than the nearby reference sites.

Critical Habitat

Of the eight dredge disposal sites within the Puget Sound, three partially overlap with ESA-listed rockfish critical habitat. These are the Bellingham Bay, Elliot Bay, and Rosario Strait site. We assess how the proposed action may affect the following three features of designated critical habitat:

Quantity, quality, and availability of prey species to support individual growth, survival, and reproduction, and feeding opportunities. As mentioned above, a small loss of invertebrate and fish prey may occur as a result of sediment disposal, but is unlikely to appreciably alter rockfish feeding opportunities, and thus adversely affect critical habitat via that pathway. First, invertebrate production has been found to respond relatively quickly after disposal events and almost all loss of invertebrates would occur outside of critical habitat. Second, the critical habitat area affected by sediment disposal is less extremely small, thus the number of rockfish prey killed would constitute only a fraction of available food sources during transitory sediment disposal. Third, rockfish eat many different species of fish and invertebrates thus the loss of some of their prey would be unlikely to result in fewer feeding opportunities.

Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities. Some sediment disposal can create areas of decreased dissolved oxygen, particularly in the lower water column (COE 2015b). However, it is unlikely that dissolved oxygen conditions would be impaired in critical habitat as virtually all sediment disposal would occur in non-designated areas and any decrease would be temporary.

The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance. Disposed sediment accumulates at the non-dispersive sites, most of which are not designated critical habitat. Where sediment settles to the seafloor in critical habitat, it would not negatively alter structure and rugosity that support feeding opportunities and predator avoidance, in part because the DDMP monitors accumulation and manages disposal to ensure it

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[8] The COE has collected PBDE data for Federal navigation projects since 2010, including the Duwamish Waterway, Hylebos Waterway, Kenmore navigation channel. PBDE data has also been collected in Port Gardner and Elliot Bay dredge disposal sites as part of DMMP monitoring events (Fox 2015).

occurs in target areas, and because these areas are largely located away from naturally rugose habitat. Material deposited in dispersive disposal sites is spread over large areas and does not appreciably accumulate on the seafloor. As a result, there would be no detectable effect on the type and amount of structure and rugosity at these disposal sites.

We conclude that in the small areas of critical habitat within Elliot Bay, Bellingham Bay, and Rosario Strait (the areas where critical habitat overlaps with the action area), the amount and structure of rugosity would not be meaningfully altered to affect feeding opportunities and predator avoidance.

2.5 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). 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.

Cumulative effects for ESA listed-rockfish will be influenced by several factors. In early 2010, WDFW adopted a series of measures to reduce rockfish mortality from non-tribal fisheries within the Puget Sound/Georgia Basin. These measures include:

1. A closure of the entire Puget Sound to the retention of any rockfish species
2. Prohibition of fishing for bottom fish deeper than 120 feet (36.6 m)
3. Closure of several non-tribal commercial fisheries that caught rockfish

These measures will eliminate future direct harvest of rockfish, and reduce or prevent bycatch from future non-tribal recreational and commercial fisheries within the U.S. portion of the Puget Sound/Georgia Basin. In addition, a recovery plan for listed rockfish in the Puget Sound/Georgia basin is currently under development that will assess long term research and recovery action needs.

Some types of human activities that contribute to cumulative effects are expected to have adverse impacts on populations and features of critical habitat, many of which are activities that have occurred in the recent past and had an effect on the environmental baseline. These can be considered reasonably certain to occur in the future because they occurred frequently in the recent past, especially if authorizations or permits have not yet expired. State, tribal, and local government actions are likely to be in the form of legislation, administrative rules, or policy initiatives, shoreline growth management and resource permitting. Private activities include continued resource extraction, development and other activities which contribute to non-point source pollution and storm water run-off. Although these factors are ongoing to some extent and likely to continue in the future, past occurrence is not a guarantee of a continuing level of activity. This level of activity will depend on whether there are economic, administrative, and legal impediments (or in the case of contaminants, safeguards). Therefore, although NMFS finds it likely that the cumulative effects of these activities will have adverse effects commensurate to those of similar past activities; it is not possible to quantify these effects.

2.6 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 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species.

There are a number of reasons why the proposed action is unlikely to harm adult ESA-listed rockfish. First, they are unlikely to occupy most of the benthic habitats of the non-dispersive sites. Second, they are also unlikely to be in the water column when sediments are dumped, and even if they are present, they would likely be able to avoid any briefly harmful sediment concentrations. Third, suspended sediment pluming out from the dumping at the non-dispersive sites would be at extremely low concentrations by the time it reaches any habitat used by adult listed rockfish, and thus would not result in harm. However, suspended sediment from the dumping would probably kill or injure some larval ESA-listed rockfish. The estimated number of fish harmed/killed by dumped sediment at the non-dispersive sites on an annual basis would be approximately 11,064 larval yelloweye rockfish, 41,412 larval canary rockfish and 4,129 larval bocaccio. Yelloweye rockfish produce between 1,200,000 and 2,700,000 larvae per year (Love et al. 2002). Canary rockfish produce between 260,000 and 1,900,000 larvae per year (Love et al. 2002). Bocaccio produce between 20,000 and 2,298,000 eggs per year (Love et al. 2002). We could not estimate the amount a larvae harmed/killed below 282 feet (80 m) of the non-dispersive sites nor any of the dispersive sites. If we conservatively assume that the actual number of larvae that may be killed is double what we estimate, the total for each species would still represent less than one typical cohort of larvae from one female (on an annual basis).

The sediment disposal activities are therefore likely (by killing an injuring larvae) to lower abundance within the cohorts exposed to sediment disposal activities. However, the change in population abundance is not likely to be appreciable because of relatively small number of larvae that would be affected.

The proposed action would also kill some invertebrates and forage fish in the action area that are possible rockfish prey. Adult rockfish have diverse diets that include many species of fish and invertebrates (Washington et al. 1978, Lea et al. 1999, Love et al. 2002). Therefore the death of some invertebrates, flatfish, sand lance, surf smelt, herring and other fish near the disposal sites is not expected to appreciably reduce forage opportunities.

ESA-listed rockfish could be exposed to toxins, including bioaccumulative toxins, which enter the food chain after they leach from disposed sediments. However, the COE use several screening methods that reduce the potential for sediments to cause rockfish to be exposed to toxins (such as copper and zinc) and bioaccumulate contaminants (such as PCBs and PCCD/F). Evidence of the effectiveness of these screening criteria comes from the general finding that the sediment quality at non-dispersive sites is comparable to or better than nearby reference sediment quality, and the net removal of the five percent of sediment that is deemed too contaminated.

The benthic environment of the Puget Sound has been affected by toxin loading, bioaccumulating contaminants, and the accumulation of derelict fishing gear. Recent and on-going removal of derelict fishing gear has improved benthic habitat suitability for ESA-listed rockfish and their prey base, though nets deeper than 100 feet persist. The cumulative effects of new non-tribal recreational and commercial fishing regulations will further reduce risks to the viability parameters of ESA-listed rockfish.

Thus, while the proposed action may have some small effect on the species' abundance (by killing a relatively small number of larvae), it is not likely to have an appreciable effect on their productivity, diversity, or structure within the Puget Sound/Georgia Basin.

Critical habitat overlaps in small areas of sediment disposal within Elliot Bay, Bellingham Bay and Rosario Strait and does not overlap with the rest of the sites in Puget Sound. The quantity and availability of prey species, and water quality and the amount and structure of rugosity would not be meaningfully altered to affect feeding opportunities and predator avoidance.

2.7 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent activities, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of yelloweye rockfish, canary rockfish or bocaccio of the Puget Sound/Georgia Basin or destroy or adversely modify their designated critical habitat.

2.8 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.

2.8.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take would occur as a result of dredge disposal activities. Larvae of yelloweye rockfish, canary rockfish, and bocaccio would be present in the action area and thus exposed to elevated sediment levels and any bioaccumlative toxins attached to sediment. This exposure is likely to incidentally harm some larvae of each species by injuring or killing them. NMFS defines harm as acts that actually injure or kill individuals, or habitat degradation which kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering (50 CFR 222.102).

We estimate that 11,064 larval yelloweye rockfish, 41,412 larval canary rockfish and 4,129 larval bocaccio would be injured or killed at the non-dispersive sites on an annual basis. Although we have information indicating various life stages of ESA-listed rockfish would be present and exposed to elevated sediment levels at the two dispersive sites, we were unable to quantify the number of larvae harmed or killed by sediment dumping at these sites. We also have no information that enables us to precisely predict how many of the affected fish would be injured rather than killed at the non-dispersive or dispersive sites. We have conservatively assumed that all exposed larvae would be killed. In addition, it would be extremely difficult to monitor the numbers of affected rockfish larvae because there would only be a small number at each individual dumping event and their small size makes them difficult to detect and identify to species.

Thus, we cannot estimate the amount of take in numbers of affected fish of each species at the dispersive sites, and enumerating the rockfish larvae that the action may kill (e.g. by observation or collecting them) is not possible. Therefore we estimate the extent of take based on the extent of habitat modified by those elements of the proposed action that may cause harm as defined above. The extent of habitat change to which fish would be exposed is more readily discernable and presents a reliably measureable surrogate for the number of individuals to be affected. When the specific number of individuals "harmed" cannot be determined, NMFS quantifies the extent of take based on the extent of habitat modified (50 FR 26832; May 11, 2015).

The size of the area within which adverse effects are likely to occur is defined by the full benthic footprint of the dumping (and the water column through which the sediments fall) at both the dispersive and non-dispersive sites:

The applicant is authorized to dispose of sediment within the following areas[9]:

1. At the non-dispersive sites, the 260 acres of the Bellingham Bay site, 318 acres of the Port Gardner site, 415 acres of the Elliot Bay site, 310 acres of the Commencement Bay site, and 318 acres of the Anderson/Ketron Island site (conforming with the latitudes and longitudes listed in the COE's BE), and;

[9] For clarity – the disposal sites outside of the ESA-listed rockfish DPSs areas may be used as proposed in the BE.

2. At the dispersive sites, the 650 acres of the Rosario Strait site, and 884 acres of the Port Townsend site (conforming to the latitudes and longitudes listed in the COE's BE).

2.8.2 Effect of the Take

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

2.8.3 Reasonable and Prudent Measures

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

The COE (and by extension the DMMP agencies) shall:

1. Ensure that disposal activities take place at times and in locations that will minimize incidental take of ESA-listed rockfish species.

2. Ensure that the activities are monitored to ensure that the contemplated levels of take are not exceeded and that the actions is carried out in a manner that effectively minimizes take as a general matter (per 50 CFR 402.14(i)(1)(iv) and (I)(3)).

3. Ensure monitoring reports are submitted regularly to confirm the action agencies are meeting their obligation to minimize incidental take, and to ensure conditions and considerations (e.g. environmental, DMMP standards and procedures described in the BE) remain within the parameters analyzed in this opinion.

2.8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the COE or any cooperating party must comply with them in order to implement the reasonable and prudent measures (50 CFR 402.14). The COE or any cooperating party 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 incidental take statement (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:
    a. No sediment disposal activities occur between March 15 and June 15 of any year.
    b. All sediment disposal activities take place within the latitude and longitudes listed in the BE.

2. The following terms and conditions implement reasonable and prudent measure 2:

a. Ensure that all disposal tugs record and report when and where the doors on the barge are opened and closed to ensure that all disposals occur within the target zones.
b. Annually quantify the amount of sediment disposed at all sites—upland and open water (see reporting provisions below).

3. The following terms and conditions implement reasonable and prudent measure 3:

   a. During the first 5 years of programmatic coverage (2015-2020) addressed in this opinion: The COE will submit their biennial report to NMFS by no later than December 31, 2017. The biennial report will includes summaries of all project-specific sediment characterization activities; dredged material disposal locations and volumes; and a summary of disposal site monitoring activities for the two preceding years; copies of clarification and issue papers adopted through the Sediment Management Annual Review Meeting (SMARM) process during the two preceding years; a link to the current DMMP user manual, which is updated annually to incorporate changes made through the SMARM process. In addition, in the 2019 cover letter the COE will include an assessment and determination if programmatic coverage is still warranted for an additional 5 years. NMFS will notify the COE if programmatic coverage is continued for an additional 5 years by June 1, 2020.

   b. Second (2021-2025), and subsequent periods (2026-2030, 2031-2035, 2036-2040, and 2041-2046) of programmatic coverage addressed in this opinion: Continue to submit the biennial monitoring report and include in each monitoring report the same information as in (3)(a) above. Within the second biennial report of that period submit a cover letter that includes an assessment and determination if programmatic coverage is still warranted for an additional period. NMFS will notify the COE if programmatic coverage is continued for the following period by June 1^{st} of the last year in the reporting term.

   c. All reports shall be sent to:
   National Marine Fisheries Service, West Coast Region
   Attention: Puget Sound Ecosystem Branch Chief
   7600 Sandpoint Way NE, Building #1
   Seattle, Washington 98115.

2.9 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. Continue to conduct or support comprehensive ichthyplankton surveys near each of the DMMP dispersive and non-dispersive sites within the Puget Sound/Georgia Basin.

2. Analyze the dissolved and particulate PCB and PBDE in the open waters of Puget Sound. This may be accomplished through ongoing studies or new studies initiated under the DMMP.

3. Initiate systematic monitoring for PBDEs at candidate dredge sites, and manage dredge disposal to reduce PBDE content within the receiving sites. Work towards inclusion of PBDEs on the list of potentially bioaccumulative substances that require testing under the DMMP.

4. Annually assess new scientific research for bioaccumulative compounds, including new and existing literature regarding effect thresholds (that include synergistic and sublethal effects) for aquatic species.

5. Assess and consider the recommendations to improve sediment PAH values when evaluating dredging and disposal activities (see Buck and Johnson, 2014).

2.10 Reinitiation of Consultation

This concludes formal consultation for U.S. Army Corps of Engineers (COE) regarding their proposal to continue the management of the Dredge Material Management Program (DMMP) through the year 2040.

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

2.11 "Not Likely to Adversely Affect" Determinations

2.11.1 Effects on the Species

NMFS does not anticipate the proposed action will take PS, LCR, or UWR Chinook salmon, HC summer-run or CR chum salmon, LCR coho salmon, PS steelhead, Southern DPS North American green sturgeon, Southern DPS Pacific eulachon, Southern Resident killer whales, or humpback whales. Off the Washington coast, leatherback sea turtles typically occur in continental shelf and slope habitat (200-2,000 meters) (Benson et al. 2011), and there are no nesting sites in Washington (NMFS and USFWS 2013). Thus, we expect no effect on leatherback turtle from the proposed action.

Puget Sound, Hood Canal, Columbia River, and Willamette River Salmon; Puget Sound Steelhead; Southern DPSs of Green Sturgeon and Pacific Eulachon (Table 3)

To assess the effects on these species, we first present the likelihood of individuals being present and exposed to the proposed activities. Following the discussion of presence, we assess the effects of exposure for two pathways of effects.

Puget Sound Chinook Salmon, Hood Canal Summer-run Chum Salmon, Puget Sound Steelhead. Adult summer-run chum salmon typically return to natal Strait of Juan de Fuca and Hood Canal tributaries from mid-August through October. Adult spring-run PS Chinook salmon typically return to freshwater in April; summer-run fish in June and July; and, summer/fall-run Chinook salmon August. Summer-run PS steelhead enter freshwater from May to October, and winter-run fish enter freshwater from November to April. Information regarding preferred water depths by migrating adult chum and Chinook salmon or steelhead in Puget Sound/Strait of Juan de Fuca is limited. Data from the commercial troll fishery in the Strait of Juan de Fuca (1967-68, 1970) indicated Chinook salmon were caught between 0 and 55 meters (0-180 feet). Recreational fishermen report resident Chinook salmon are generally found in 24-76 meters (80 250 feet) of water within 3 meters (10 feet) of the bottom near land masses or structure such as underwater drop offs, ledges or on and around ridges on the bottom in currents less than 1.2 knots. While they could potentially be in the action area during disposal operations, migrating adult chum and Chinook salmon and steelhead clearly use nearshore habitats as they return to natal estuaries and freshwater spawning areas (Redman et al. 2005); only two of the sites are at apparent preferred water depths; and none of the sites have habitat or biological features attractive for migration. While they could potentially be in the action area during disposal operations, the likelihood that migrating adult chum salmon, Chinook salmon, or steelhead may be present at any of the disposal sites during disposal operations is very low, but not discountable.

A proportion of sub-adult and adult Chinook salmon remain in Puget Sound as residents instead of migrating to oceanic feeding grounds. Current hatchery practices throughout Puget Sound purposely encourage residency for the benefit of recreational fisheries (Chamberlin et al. 2011). Analysis of 21 years of hatchery releases (1972-1993) by Chamberlin et al. (2011) indicated the best single predictor of residency was release region. The conservative criteria they used revealed that approximately 24 percent of the Chinook salmon from the selected hatchery release groups displayed a resident behavior based on the date and location of capture. The percent contribution of releases to the level of residency was 30 for Hood Canal releases, 27 for South Puget Sound, 26 for Middle Puget Sound, 16 for the Strait of Juan de Fuca, and 14 for the Nooksack River. The data also indicated significant year-to-year variability about the overall mean, and that the overall best model included an interactive effect between release region and size at release. In general, the relative contribution by age-1 fish was greater than that by age-0 fish, but the degree of the effect varied among regions. O'Neill and West (2009) estimated 29 percent of subyearling and 45 percent of yearling outmigrant Chinook salmon display resident behavior. To estimate a potential number of resident Chinook sub-adult and adults that might be present in the eight Puget Sound disposal sites, we analyzed a worse-case scenario with the following data and assumptions: (1) 45 percent of sub-adult and adult Chinook salmon are resident (O'Neill and West 2009); (2) resident fish distribution across Puget Sound is equal; and (3) a Chinook run size of 231,060 (1999-2012 geometric mean; pers. comm. Tynan 8/7/2015); and (4) total acreage of the eight Puget Sound disposal sites represents only 0.25 percent of all Puget Sound. Using these data and assumptions, we estimated about 260 sub-adult and adult

Chinook salmon may be concurrently present during disposal during any given year at in all eight sites, combined. However, distribution is not even across Puget Sound (Chamberlin et al. 2011); three of the sites are dispersive with current speeds greater than 1.2 knots; only two of the sites are at apparent preferred water depths; and none of the sites have habitat or biological features attractive for migration, rearing, or foraging. Thus, the likelihood that resident Chinook salmon will be present in a disposal site during a time disposal operations are occurring is very low, but not discountable.

Hood Canal summer-run chum salmon fry begin to emerge in February and immediately migrate to the estuary where they rear in shallow eelgrass beds, tidal creeks, and sloughs in nearshore areas (Brewer et al. 2005). Chum salmon abundance in nearshore areas peaks in May and June, after which abundance declines significantly as chum salmon move farther offshore and migrate out of Puget Sound, although some are still found in nearshore areas through October (Fresh et al. 2006). Juvenile Chinook salmon are present in nearshore areas of Puget Sound between April and November (Rice et al. 2011), with peak occurrence between May and July (Duffy et al. 2005; Fresh et al. 2006), although they can be present in shoreline habitats as late as October (Fresh et al. 1979). At about 65 to 70 millimeters, juvenile Chinook salmon are physiologically capable of osmoregulating in full strength seawater (Clarke and Shelbourn 1985) and are large enough to feed on larger prey including larval and juvenile fish (Healey 1991). As the juveniles increase in size, fish occupy deeper water in search of larger prey. Juvenile chum and Chinook salmon sampled by Kemp (2014) in offshore areas of Puget Sound were 100 millimeters or larger. Although information about epipelagic habitat use is limited, in Puget Sound juvenile salmon use of offshore areas appears to increase progressively during the summer and shift to deeper depths (Kemp 2014). Kemp (2014) found Chinook salmon at all depths sampled (0-60 meters), with highest densities in 0-15 meters in July and 0-45 meters in September. Chum salmon were found only in the upper 15 meters of the water column in July, but in September, although predominantly in the upper 15 meters, they were present throughout the upper 45 meters of the water column (Kemp 2014). Juvenile steelhead rear 1 to 4 years in freshwater prior to smoltification and emigration, which typically occurs from April through May, but can occur as early as March and as late as June or July. Steelhead smolts are of large size (140 to 160 millimeters in length (Wydoski and Whitney 1979); 150 to 220 millimeters (Ward et al. 1989)), less dependent on nearshore areas for feeding and rearing, and are generally found in offshore waters (Brennan et al. 2004; Fresh et al. 2006). The likelihood that juvenile chum and Chinook salmon and steelhead will be present in the action area during disposal operations is extremely low, but not discountable.

Lower Columbia River and Upper Willamette River Chinook Salmon, Lower Columbia River Coho Salmon, Columbia River Chum Salmon. Although there are no ESA-listed salmon or steelhead runs in the Grays Harbor Watershed, juvenile salmonids from some Columbia River stocks may enter Grays Harbor for some portion of their early marine rearing. Specifically, emigrating juveniles that have left the Columbia River estuary may feed in the nearshore oceanic environment as they move north, and may consequently find their way into Grays Harbor. Juvenile CR chum, LCR coho, and LCR and UWR Chinook likely utilize the action area in Grays Harbor (Casillas pers. comm., in NMFS 2009). Peak outmigration to the Columbia River estuary for ocean type salmonids occurs from March through July, with ocean entry between August and November. Columbia River chum initially use nearshore coastal habitats and move offshore at 50 to 110 millimeters fork length (Irie 1985). Stream-type salmonids emigrate in spring of their second year as larger yearlings (73 to 134 millimeters fork length; Healey 1991), with ocean entry occurring from May through June. Coho leave the estuary in the late spring of their second year at a much larger size and move rapidly to deeper water upon ocean entry. Ocean entry is considered prerequisite for the use of Grays Harbor by Columbia River salmonid ESUs. These ocean entry periods overlap the dredged material disposal timing of April-February 14 for the two Grays Harbor dispersive sites of proposed; thus, the likelihood that juvenile salmonids from the Columbia River could be in the action area during disposal operations in the March 15-May and July 16-February 14 Grays Harbor in-water work windows is very low, but not discountable.

Southern DPS North American Green Sturgeon. The only known spawning population of this DPS occurs in the Sacramento River and juveniles spend 1 to 4 years in freshwater before migrating to the ocean. Evidence of green sturgeon spawning in the coastal estuaries of Washington is lacking (Adams et al. 2002). Consequently, the proposed action will have no impact on green sturgeon spawning or juvenile rearing. During the late summer and early fall, subadult and non-spawning adult green sturgeon can frequently be found aggregating in estuaries along the Pacific coast (Moser and Lindley 2007) with particularly large concentrations occurring in the Columbia River estuary, Willapa Bay, and Grays Harbor (Moyle et al. 1992). Adult green sturgeon are common in the seawater and mixing zones of Grays Harbor during high salinity periods, with the highest abundance from July through early October (Monaco et al. 1990). Thus, sub-adult and adult green sturgeon could be present in the action area during disposal operations in the March 15-May and July 16-February 14 Grays Harbor in-water work windows.

Southern DPS Pacific Eulachon. Eulachon are endemic to the eastern Pacific Ocean and range from northern California to southwest Alaska and into the southeastern Bering Sea. The SDPS of eulachon includes populations spawning in rivers south of the Nass River in British Columbia to the Mad River in California. Eulachon primarily spawn in the Columbia River system in Washington State, although sporadic spawning runs in Grays Harbor tributaries, including the Chehalis River, have been reported (WDFW and ODFW (Oregon Department of Fish and Wildlife) 2001; Gustafson 2010). Eulachon runs are typically found in systems with snow pack or glacier-fed freshets, or extensive spring freshets (Hay and McCarter 2000), which are not typical characteristics of tributaries in the Grays Harbor watershed. Eulachon leave saltwater to spawn in their natal streams in late winter through early summer and typically spawn in the lower reaches of larger rivers fed by snowmelt, glacial runoff, or extensive spring freshets (Gustafson 2010). Spawning begins as early as December and January in the Columbia River system, peaks in February, and can continue through May. Larval outmigration occurs 30 to 40 days after spawning. After hatching, larvae are carried downstream and are widely dispersed by estuarine and ocean currents. Eulachon movements in the ocean are poorly understood. Recent (2013-2015) sampling by the Quinault Indian Nation (QIN 2014) and the Washington Department of Fish and Wildlife (Langness 2015) indicate presence of eulachon in in variable, but low, abundance in Grays Harbor tributaries. Presuming similar run-timing as the Columbia River where adults can enter as early as December and spawn through May, adult and larval eulachon could be present in the action area during disposal operations in the March 15-May and July 16-February 14 Grays Harbor in-water work windows. Given mean larval densities of

0.021, 0.023, and 0.7 larvae per cubic meter sampled in 2013, 2014, and 2015, respectively, that presence is expected to be low, but not discountable.

Summary of Effects on Salmonids, Green Sturgeon, and Eulachon. Above the likelihood of species presence and exposure is presented. While the likelihood of individuals being present is low, a small number of individuals could be affected. Effects of the proposed disposal of dredged material at eight Puget Sound and two Grays Harbor open-water dredged material disposal sites include two pathways: (1) increased turbidity and suspended sediment concentrations and (2) underwater noise from the tugboat and bottom-dump (split-hull) barge or bottom-dump hopper dredge during disposal operations.

Turbidity and Suspended Sediment Concentrations. Turbidity from disposal operations is expected to occur at both the Puget Sound and Grays Harbor disposal sites. Dumped material trajectory and concentrations at the Puget Sound sites is described in section 2.4 above, and in the BE (COE 2015b) in more detail. The Grays Harbor sites are shallower, and have a reduced descent time and potential for lateral transport. In-water disposal of source material will create a discharge field from the bottom of the ship's hull (hopper dredge or bottom-dump barge) to the bottom of the open water disposal site. However, only 1 to 5 percent of the released material will be transported within the upper water column (Truitt 1988). Tidal action, currents, and wave action relative to the disposal site will influence the spread of the turbidity plume. Any turbidity is anticipated to dissipate within a few hours or less. Newcombe and Jensen (1996) analyzed numerous reports on documented fish responses to suspended sediment in streams and estuaries, and identified a 14 point scale of ill effects based on sediment concentration and duration of exposure. A severity level of six on the Newcombe and Jensen (1996) scale correlates to moderate physiological stress, is associated with a large increase in the coughing rate and an increase in blood glucose levels (Servizi and Martens 1992), and is considered the break point whereby an adverse effect by NMFS is concluded from exposure. Level six for juvenile salmonids equates to an increase in suspended sediment concentration of about 1,097 milligrams per liter for 1 to 3 hours exposure time (see Figure 3 of Newcombe and Jensen 1996).

We reviewed data from several reports regarding dredged material behavior and sediment resuspension due to clamshell dredging and associated in-water disposal (Havis 1988; Herbich and Brahme 1991; LaSalle et al. 1991; McLellan et al. 1989; Palermo et al. 2009; Truitt 1988). Clamshell dredging can create water column concentrations of resuspended sediment of 500 to 1,100 milligrams per liter, mainly near the bottom, that quickly return to background levels within several hundred feet of the dredge. Material deposited at the Grays Harbor sites is predominantly sand, which quickly settles out of the water column. Similar material dredged from the Columbia River has settling velocities in the range of 0.03 to 0.06 feet per second, such that sand resuspended 3 to 6 feet off of the bottom redeposits in approximately 1 to 2 minutes. Although we view the suspended sediment concentration by exposure time to be a continuum of potential adverse effects on juvenile salmonids, the threshold values in Figure 3 of Newcombe and Jensen (1996) are adequate to support inferences for this analysis. Based on the results from past monitoring and dredging actions as summarized above, we do not expect that that level six will be reached. Further, studies show that salmonids are able to detect and distinguish turbidity and other water quality gradients (Bisson and Bilby 1982), and that larger juvenile salmonids (greater than 100 millimeters fork length), such as those entering Grays Harbor or using offshore areas in Puget Sound, are more tolerant of suspended sediment than smaller juveniles (Servizi and Martens 1991).

Except for the Bellingham Bay and Rosario Strait sites, none of the Puget Sound open-water disposal sites are at a depth (Table 1) likely to be occupied by juvenile or adult salmonids. The two Grays Harbor disposal sites are at depths ranging from minus 35 feet to minus 120 feet mean lower low water (MLLW) (COE 2011). None of the 10 open-water disposal sites contain habitat or biological features that would typically to attract rearing or migrating adult or juvenile salmon, and operations are timed to occur when the fewest possible juvenile salmonids are present. The likelihood that adult or juvenile salmon or steelhead will be present at any one Puget Sound or Grays Harbor open-water disposal sites during disposal operations is extremely low. However, if present, potential suspended sediment-related effects on ESA-listed salmonids from the proposed disposal operations would be short-term, temporary, and highly localized and therefore insignificant.

In the absence of data on the specific effects of suspended sediments on green sturgeon and eulachon, potentially harmful effects associated with elevated suspended sediments are assumed to be similar to those found in salmonids, which are among the most sensitive species for which such effects from suspended sediments have been evaluated in estuarine dependent species (Wilber and Clarke 2001). Subadult or non-spawning adult green sturgeon that may be present in the action area would be mobile enough to avoid the discharge fields and suspended sediments created. Further, the species is typically found in turbid conditions and forages in the benthos by stirring up the sediment to access benthic prey such as burrowing shrimp and is thus relatively tolerant of higher suspended sediment concentrations. While a small number of adult and larval eulachon could be present in the action area during project activities, their presence, while not discountable, is considered unlikely. Any adult eulachon that happened to be in the area during disposal operations is expected to avoid the plume and move to a less turbid portion of the harbor. Any larval eulachon that happened to drift into the area during disposal operations is expected to be rapidly dispersed out of the area by the fast tidal currents at the either Grays Harbor disposal site.

Thus, Because sediments would quickly dissipate, there would be little effect in the upper water column where a small number of ESA-listed fish are expected to be found, and the few fish that encounter sediment disposal would be able to quickly and easily avoid it, we expect any sediment-related effects onto PS, LCR, and UWR Chinook salmon, Hood Canal Summer-run chum salmon, LCR coho salmon, and PS steelhead; Southern DPS of North American green sturgeon; and Southern DPS Pacific eulachon from suspended sediment released at any of the 10 open-water dredged material disposal sites would be insignificant.

Underwater Noise. In the "Agreement in Principle for Interim Criteria for Injury to Fish from Pile Driving" (Fisheries Hydroacoustic Working Group 2008) the Federal Highway Administration and Federal Agencies including NMFS agreed upon threshold criteria where harm or injury to fish may occur. The dual criteria injury threshold established by the Agencies gives an upper sound pressure level of 206 dB (re: 1μPa) peak and 187 dB (re: 1μPa·sec) accumulated sound exposure level (SEL) for all listed fish weighing more than 2 grams. The SEL for listed fish weighing less than 2 grams is 183 dB (re: 1μPa·sec).

While the COE (Clarke et al. 2002; Dickerson et al. 2001) has measured sounds produced by different dredging methods, including clamshell, hydraulic cutterhead, and hopper dredges, few studies exist regarding underwater noise generated by the pump-out or other dredge disposal operation. Sound produced by a clamshell bucket was composed of distinct events, and sound produced by the impact of the bucket hitting the bottom was the most intense with a peak sound pressure level of 124.01 dBpeak (re: 1µPa) at 150 meters. Based on the dredge operation studies, NMFS estimates that root-mean-squared (RMS) sound pressure levels (SPLs) will exceed the threshold for adverse behavioral modification (150 dBRMS re: 1µPa) of salmonids at a maximum distance of 13 meters from the dredge, regardless of the type of dredge used, but will not exceed injury thresholds of 187 dB (re: 1µPa2·sec) cumulative SEL. We expect sound produced by disposal operations would similarly not exceed the threshold for adverse behavioral modifications, but not injury thresholds. Reine et al. (2014) measured a maximum SPL of 144.15 dBRMS (re: 1µPa) during offloading of excavated sediment from a trailing suction hopper dredge. Noise levels did not exceed 180 dBRMS (re: 1µPa).

Those few juvenile or adult salmonids or green sturgeon that may be present in the action area during disposal operations are likely to exhibit noise-induced avoidance behavior that causes them to avoid the area in which sediment disposal would occur. Larger salmonids are better able to avoid potentially harmful acoustic noise. Little information is available on the effects of underwater noise on sturgeon (Hastings and Popper 2005). However, all fish with swim-bladders are potentially affected by underwater noise that can cause barotrauma and its associated injuries; thus, potential effects onto salmonids from barotrauma can be reasonably assumed possible for sturgeon. Although no published data regarding hearing by sturgeon is available, Popper (2005) reported that initial data from an unpublished study by Meyer and Popper indicates sturgeon may be able to determine the direction from which sound occurs. Any juvenile and adult salmonid or subadult and non-spawning adult green sturgeon in the action area during disposal operations are presumed to be able to avoid the highly localized, short-term noise generated by the disposal operations. Thus, because the noise levels are not expected to rise to a level where injury occurs and because the various listed fish would easily be able to avoid the source of the effects, we expect the sound-related impacts effects onto PS, LCR, and UWR Chinook salmon, Hood Canal Summer-run chum salmon, LCR coho salmon, and PS steelhead, and Southern DPS of North American green sturgeon from underwater noise generated by disposal operations at any of the 10 open-water dredged material disposal sites would be insignificant.

Adult eulachon are not affected by noise disturbance from pile driving to the same degree as other fishes because they do not have a swim-bladder; thus, they are not susceptible to barotrauma and the associated internal injuries it can cause. Thus, we do not expect sound generated by the proposed action to affect eulachon and therefore the possibility of take via that pathway is extremely unlikely to occur and is therefore discountable.

ESA-listed Marine Mammals

NMFS analyzed the potential effects of the proposed dredge disposal operations on Southern Resident killer whales and humpback whales. Background information on species status and distribution relative to the action area is provided below, followed by the effects analysis.

Southern Resident killer whales (SR killer whales). The final rule listing SR killer whales as endangered identified several potential factors that may have caused their decline or may be limiting recovery. These are: quantity and quality of their salmon prey, toxic chemicals which accumulate in top predators, and disturbance from sound and vessel traffic. The rule also identified oil spills as a potential risk factor for this species. The final recovery plan includes more information on these potential threats to SR killer whales (73 FR 4176).

Southern Residents occur throughout the coastal waters of Washington and are known to travel as far south as central California and as far north as southeast Alaska. SR killer whales spend considerable time in the Salish Sea from late spring to early autumn, with concentrated activity in the inland waters of the state of Washington around the San Juan Islands, and then move south into Puget Sound in early autumn. While these are seasonal patterns, SR killer whales have the potential to occur throughout their range at any time of the year. SR killer whales have been observed in the vicinity of all eight PSDDA disposal locations in Puget Sound. Although SR killer whales also occur near shore along the outer Washington coast, they are unlikely to occur in the vicinity of the two PSDAA disposal sites located in Grays Harbor.

Humpback whales**.** Humpback whales were recently petitioned for delisting under the ESA. NMFS published a proposed rule identifying multiple DPS and proposing reclassification to list two DPS as threatened and two as endangered and 10 others as not warranted for listing (80 FR 22304; April 21, 2015). Humpback whales from two of the DPS that would remain listed occur along the west coast, including waters of Washington State. The whales feed off the U.S. west coast, with a winter migratory destination in coastal waters of Mexico and Central America. In recent years humpback whales have been sighted with increasing frequency in the inland waters of Washington, including Puget Sound (primarily during the fall and spring); however, occurrence is still relatively uncommon and their DPS origin is unknown. Humpback whales more commonly occur in coastal waters and forage on a variety of crustaceans, other invertebrates and forage fish. Although humpback whales occur along the Washington coast and in Puget Sound, they are extremely unlikely to occur in the vicinity of the disposal locations during times of in-water disposal.

Summary of Effects on Marine Mammals

Presence of SR killer whales and humpback whales is likely to be limited in the action area. If individuals are present during dredge disposal operations, effects will occur through two pathways: (1) prey and (2) vessels and sound.

Prey Quantity and Quality. The proposed action is not likely to adversely affect salmonids, as described above. NMFS anticipates similar effects on non-listed fishes. Based on the above analysis and similar effects anticipated for non-listed fishes, the proposed action will not affect the quantity of salmonids and other prey available to SR killer whales and humpback whales .

The proposed action may affect the quality of prey for these marine mammal species by introducing contaminants into their food chain. Persistent pollutants (PCBs, PBDEs, PAHs, PCDD/Fs) and metals can be part of dredge spoils that are disposed of at marine disposal sites through the proposed program. These contaminants persist in the environment and in the organisms that ingest them. As these organisms are consumed at higher trophic levels, the contaminants can accumulate. For top predators like SR killer whales and other marine mammals, this bioaccumulation of contaminants can affect health and reproductive success. Thus, our analysis examines the extent to which lower trophic organisms would ingest these contaminants in dredge material disposed of at PSDDA sites, and any potential food web transfer of these contaminants that may result. This would determine the extent to which the proposed action could result in bioaccumulation in these marine mammal species.

The DMMP uses dredged material testing protocols to ensure the suitability of materials for unconfined, open-water discharge and conducts site-monitoring activities to assess impacts at disposal sites. The DMMP designed their sediment screening process to assess existing pollutant levels of benthic sediments proposed for dredge disposal. However, this screening process does allow for low levels of some contaminants to transfer from the dredge sites in relatively shallow waters of rivers and marinas to the deep-water disposal sites. Site monitoring at non-dispersive sites indicates that onsite sediment concentrations of PCB, PCDD/F, and PBDEs are below offsite sediment concentrations, with one exception (one measure of PCBs suggested greater concentration onsite at Port Gardner than offsite). These persistent pollutants can slowly leach from sediments in soluble form and be ingested by phytoplankton, zooplankton, benthic invertebrates, demersal fish, forage fish and other fishes. However, the selection of PSDDA disposal locations was based on an evaluation of fish and invertebrate assemblages and benthic resources at candidate sites in order to minimize potential effects on prey resources (COE 2015b). Furthermore, even in the event that low levels of contaminants moved into the pelagic food web, Chinook salmon (primary prey of SR killer whales) are not expected to be present in disposal areas as discussed above, and other fish would at most spend very little time in the disposal areas.

Given the total quantity of prey available to SR killer whales and humpback whales throughout their ranges, and that there is a low probability that Chinook salmon or other non-listed fish may be exposed to dredged materials, it’s unlikely that exposure from ingesting contaminated prey and any subsequent chance of bioaccumulation in SR killer whales or humpback whales would occur.

Thus, (1) very few salmonids or other fish will be exposed to persistent pollutants or metals at the disposal sites; (2) fish that are exposed would accumulate extremely small amounts of persistent pollutants or metals because the fish would spend very little time in the area; and (3) SR killer whales and humpback whales would be extremely unlikely to consume one of the few salmonids or other fish that may pass through these disposal sites. For these reasons, NMFS does not expect that the low concentration of contaminants in dredge materials disposed of at PSDDA sites will lead to bioaccumulation in these ESA-listed marine mammals and the effects are therefore discountable.

Vessel Effects and Sound: Vessels associated with the proposed transport and disposal activities are primarily tug/barges, which are slow moving, follow a predictable course, do not target whales, and should be easily detected by ESA-listed marine mammals. Vessel strikes are extremely unlikely and any potential for effects from vessel strikes is therefore discountable. Vessel operations may cause temporary disturbance; however, such disturbance is likely to be short-term and localized, with no lasting effects, and therefore insignificant. When in motion, sound produced by the tug will be transient and expected to be below background levels a short distance from the moving vessel with no lasting effects, and therefore insignificant.

Because all potential adverse effects are discountable or insignificant, NMFS concurs with the COE's effect determination of "may affect, not likely to adversely affect" for SR killer whales, and humpback whales.

2.11.2 Effects on Critical Habitat

The NMFS does not anticipate the proposed action will destroy or adversely affect designated critical habitat for PS Chinook salmon, HC summer-run chum salmon, Southern DPS North American green sturgeon, SR killer whales, or leatherback sea turtles, or proposed critical habitat for PS steelhead.

Puget Sound Chinook Salmon, Hood Canal Summer-run Chum Salmon, Puget Sound Steelhead, LCR Coho

The NMFS designated critical habitat for PS Chinook salmon and HC summer-run chum salmon on September 2, 2005, (70 FR 52630). At the time of this opinion, PS steelhead and LCR coho critical habitat has been proposed, but not designated (78 FR 2726, January 14, 2013). There is no critical habitat for PS steelhead or LCR coho proposed in the action area, and in the event that PS steelhead or LCR critical habitat is designated consistent with the proposed designation (78 FR 2726, January 14, 2013) we have determined that determined the proposed action would have no effect. The Primary Constituent Element (PCE) for PS Chinook salmon, and HC summer-run chum salmon critical habitat in the action area is:

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

The open-water disposal of dredged material will mobilize small amounts of sediment into the water column. This sediment suspension and subsequent re-settlement will be short-term, temporary, and highly localized, and will not substantially or permanently degrade water quality. Consequently, any effects on PS Chinook salmon and HC summer-run chum salmon via the water quality pathway will are expected to be insignificant, and NMFS has determined that the proposed action "may affect, but is not likely to adversely affect" critical habitat for these species.

Southern DPS North American Green Sturgeon

The NMFS designated critical habitat for the Southern DPS North American green sturgeon on October 9, 2009 (74 FR 23822). The PCEs potentially found in the action area include:

1. Food resources. Abundant prey items within estuarine habitats and substrates for juvenile, subadult, and adult life stages.
2. Water quality. Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.
3. Migratory corridor. A migratory pathway necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between estuarine and riverine or marine habitats.
4. Depth. A diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages.
5. Sediment quality. Sediment quality (i.e., chemical characteristics) necessary for normal behavior, growth, and viability of all life stages. This includes sediments free of elevated levels of contaminants (e.g., selenium, PAHs, and pesticides) that can cause adverse effects on all life stages of green sturgeon.

The open-water disposal of dredged material will disrupt the substrate and entrain some green sturgeon prey items. However, changes in prey availability are unlikely to be of a magnitude or extent that would appreciably diminish forage resources in the action area. Fast currents at the deep water disposal sites prohibit significant benthic macroinvertebrate production, and benthic macroinvertebrate and fish prey species will continue to be available from the surrounding area, particularly since invertebrates have the ability to recolonize disturbed locations relatively rapidly (Dernie et al. 2003). There is also a lack of any evidence to indicate benthic food resources for green sturgeon are limited in Grays Harbor. Consequently, the small, temporary, and highly localized loss of benthic food items is expected to be insignificant to the species.

The open-water disposal of dredged material will mobilize small amounts of sediment into the water column. As described above in subsection 2.11.1, sediment suspension and subsequent re-settlement will be short-term, temporary, and highly localized, and will not substantially or permanently degrade water quality. Further, the species is typically found in turbid conditions and forages in the benthos by stirring up the sediment to access benthic prey such as burrowing shrimp and is thus relatively tolerant of higher suspended sediment concentrations. Thus, effects on the water quality in the action area are expected to be insignificant to the species.

The migration of subadult/adult green sturgeon will not be impeded by project activities. The area affected by any disposal operation is extremely small compared to the area of Grays Harbor, and any sturgeon present will be mobile enough to avoid the area. The effects on the migration corridor are therefore expected to be insignificant to the species.

Fast currents at the Grays Harbor disposal sites prohibit significant sediment deposition at the sites. Both sites are subject to strong, predominantly westward, tidal currents which disperses disposed material rapidly. Thus, any effects on the depth diversity within Grays Harbor are expected to be insignificant to the species.

Prior to approved use of an open-water disposal site, dredged material undergoes rigorous screening for suitability for disposal to verify the material does not contain elevated levels of contaminants (e.g., selenium, PAHs, and pesticides) that can cause adverse effects on aquatic organisms. Any effects on sturgeon via the sediment quality pathway are thus expected to be discountable. Thus, NMFS has determined that the proposed action "may affect, but is not likely to adversely affect" Southern DPS green sturgeon critical habitat.

Southern Resident (SR) Killer Whale

Critical habitat includes approximately 2,560 square miles of Puget Sound, excluding areas with water less than 20 feet deep relative to extreme high water. The primary constituent elements (PCEs) for SR killer whale critical habitat are:

(1) Water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

The action area includes the inland waters of Washington where the marine ranges of the killer whales and affected PS Chinook salmon overlap. The proposed project is not expected to have a long term effects on water quality. As described above, the action is not likely to adversely affect salmonids, therefore, NMFS does not anticipate effects on quality or quantity of prey species in the action area, which includes designated critical habitat of SR killer whales.

Because all potential adverse effects on SR killer whale critical habitat are insignificant, NMFS has determined that the proposed action "may affect, but is not likely to adversely affect" SR killer whale critical habitat.

Leatherback Sea Turtle

The NMFS designated critical habitat for leatherback sea turtles on January 26, 2012, (77 FR 4170). While the proposed action does not occur within that designated critical habitat, a PCE essential for the conservation of the species does:

> The occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (e.g., *Chrysaora*, *Aurelia*, *Phacellophora*, and *Cyanea*), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

Jellyfish, which have high reproduction and growth rates, have experienced dramatic increases in biomass over the past two decades, and are a major portion of the pelagic biomass in the northern California Current (Ruzicka et al. 2007). Jellyfish blooms are seasonally and regionally predictable. Great densities of primary prey species, brown sea nettle (*C. fuscescens*), occur seasonally north of Cape Blanco (Reese 2005). While fine-scale, local distribution is patchy and dependent upon oceanographic conditions, it is ultimately the benthic polyp stages that contribute to seasonal and annual population variation of the adult medusa. The open-water disposal of dredged material will mobilize small amounts of sediment into the water column. This sediment suspension and subsequent re-settlement will be short-term, temporary, and highly localized. Any benthic polyps or adult medusa present in the immediate area where suspended sediment concentrations are increased in the water column or re-settle onto the substrate are likely to be destroyed. However, because the area of the disposal sites—even in total—represents only 0.44 square miles out of the total area available to the jellyfish polyps, it is extremely unlikely the amounts of sedimentation generated during any disposal event at either the South Jetty or the Point Chehalis dispersive disposal site will measurably or perceivably reduce of the leatherback sea turtle's primary prey species. Thus, because the effects are insignificant at best, NMFS has determined the proposed action "may affect, but is not likely to adversely affect" designated critical habitat for leatherback sea turtles.

3.0 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 EFH. The MSA (section 3) defines EFH as "those waters and substrate 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 EFH assessment provided by the COE and descriptions of EFH for Pacific coast groundfish (PFMC 2005), coastal pelagic species (PFMC 1998), Pacific coast salmon (PFMC 2014); and highly migratory species (PFMC (2007) contained in the fishery management plans developed by the Pacific Fishery Management Council and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The following species have EFH within the project/action area of the DMMP:

Groundfish Species	redstripe rockfish *S. proriger*	Dover sole *Microstomus pacificus*
spiny dogfish *Squalus acanthias*	rosethorn rockfish *S. helvomaculatus*	English sole *Parophrys vetulus*
big skate *Raja binoculata*	rosy rockfish *S. rosaceus*	flathead sole *Hippoglossoides elassodon*
California skate *Raja inornata*	rougheye rockfish *S. aleutianus*	petrale sole *Eopsetta jordani*
longnose skate *Raja rhina*	sharpchin rockfish *S. zacentrus*	rex sole *Glyptocephalus zachirus*
ratfish *Hydrolagus colliei*	splitnose rockfish *S. diploproa*	rock sole *Lepidopsetta bilineata*
Pacific cod *Gadus macrocephalus*	striptail rockfish *S. saxicola*	sand sole *Psettichthys melanostictus*
Pacific whiting (hake) *Merluccius productus*	tiger rockfish *S. nigrocinctus*	starry flounder *Platichthys stellatus*
black rockfish *Sebastes melanops*	vermilion rockfish *S. miniatus*	arrowtooth flounder *Atheresthes stomias*
bocaccio *S. paucispinis*	yelloweye rockfish *S. ruberrimus*	
brown rockfish *S. auriculatus*	yellowtail rockfish *S. flavidus*	**Coastal Pelagic Species**
canary rockfish *S. pinniger*	shortspine thornyhead *Sebastolobus alascanus*	anchovy *Engraulis mordax*
China rockfish *S. nebulosus*	cabezon *Scorpaenichthys marmoratus*	Pacific sardine *Sardinops sagax*
copper rockfish *S. caurinus*	lingcod *Ophiodon elongatus*	Pacific mackerel *Scomber japonicus*
darkblotch rockfish *S. crameri*	kelp greenling *Hexagrammos decagrammus*	market squid *Loligo opalescens*
greenstriped rockfish *S. elongatus*	sablefish *Anoplopoma fimbria*	**Pacific Salmon Species**
Pacific ocean perch *S. alutus*	Pacific sanddab *Citharichthys sordidus*	chinook salmon *Oncorhynchus tshawytscha*
quillback rockfish *S. maliger*	butter sole *Isopsetta isolepis*	coho salmon *O. kisutch*
redbanded rockfish *S. babcocki*	curlfin sole *Pleuronichthys decurrens*	Puget Sound pink salmon *O. gorbuscha*

3.2 Adverse Effects on Essential Fish Habitat

We have determined that there will be no adverse effects to EFH for Pacific salmonids. As described in Section 2.4 of this opinion, NMFS believes that the DMMP would have the following adverse effects on the EFH of Pacific groundfish and coastal pelagic species:

1. Disposal of dredged material is expected to cause a short-term increase in turbidity and suspended sediments in the vicinity of the disposal sites. Fishes, particularly non-salmonids that are more likely to be on site, may be entrained by released dredged material as it falls through the water column. Increased turbidity could cause a temporary, localized reduction in feeding success. High levels of suspended sediments can clog gills and cause sublethal physiological effects or mortality. Most of the

suspended sediment is found in deep water as the jet of dredged material impacts the bottom and is therefore most likely to affect groundfishes. As the material impacts the bottom, it spreads out and can affect epibenthic and benthic organisms.

2. Low levels of bioaccumulation may occur to some groundfishes (flatfish species) residing at the non-dispersive sites.

3.3 Essential Fish Habitat Conservation Recommendations

The following conservation measures, which are not a subset of the ESA terms and conditions, are necessary to avoid, mitigate, or offset the impact of the proposed action on EFH. The COE should ensure that all sediment disposal activities:

1. Take place only between June 16 and March 14 of any year in Puget Sound, or March 15 and May; and July 16 or August 1 and February 14 in Grays Harbor.
2. Take place only within bounds of the latitude and longitudes listed in Table 1 of this opinion.
3. The COE should ensure that all sediment disposal minimizes potential bioaccumulation, by:
    a. Continuing to conduct or support comprehensive ichthyplankton surveys near each of the DMMP program dispersive and non-dispersive sites within the Puget Sound/Georgia Basin.
    b. Analyzing the dissolved and particulate PCB and PBDE in the open waters of Puget Sound. This may be accomplished through ongoing studies or new studies initiated under the DMMP.
    c. Initiate systematic monitoring for PBDEs at candidate dredge sites, and manage dredge disposal to reduce PBDE content within the receiving sites. Work towards inclusion of PBDEs on the list of potentially bioaccumulative substances that require testing under the DMMP.
    d. Annually assessing new scientific research for bioaccumulative compounds, including new and existing literature regarding effect thresholds (that include synergistic and sublethal effects) for aquatic species.
    e. Assessing and considering the recommendations to improve sediment PAH values when evaluating dredging and disposal activities (Buck and Johnson, 2014).

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, approximately 4,324 acres of designated EFH for Pacific coast groundfish, and coastal pelagic species (see Table 1).

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the COE 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, mitigating, or 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 COE 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. FISH AND WILDLIFE COORDINATION ACT

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 USC 661). The FWCA establishes a consultation requirement for Federal agencies that undertake any action to modify any stream or other body of water for any purpose, including navigation and drainage (16 USC 662(a)), regarding the impacts of their actions on fish and wildlife, and measures to mitigate those impacts. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources, and providing equal consideration for these resources. NMFS' recommendations are provided to conserve wildlife resources by preventing loss of and damage to such resources. The FWCA allows the opportunity to provide recommendations for the conservation of all species and habitats within NMFS' authority, not just those currently managed under the ESA and MSA.
The recommendations listed in sections 2.9 and 3.3 apply to the proposed action. The action agency must give these recommendations equal consideration with the other aspects of the proposed action so as to meet the purpose of the FWCA. This concludes the FWCA portion of this consultation.

5.0 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.

5.1 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 COE. Other interested users could include the Ports of Seattle, Tacoma, Everett, Bellingham and others. Individual copies of this opinion were provided to the COE. This opinion will be posted on the Public Consultation Tracking System web site (https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts). The format and naming adheres to conventional standards for style.

5.2 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.

5.3 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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