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

Refer to NMFS No:
WCRO-2019-03654

July 14, 2020

Michelle Walker
Chief, Regulatory Branch
Department of the Army
Seattle District Corps of Engineers
P.O. Box 3755
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 Response for the Stevens Single Use Dock, Wahkiakum County, Cathlamet, Washington (Columbia River, HUC 17080006) (USACE Number NWS-2019-934)

Dear Ms. Walker:

Thank you for your letter of December 18, 2019, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Stevens Single Use Dock installation. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016).

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

The enclosed document contains a biological opinion (opinion) that analyzes the effects of your proposal to permit the Stevens family in the construction of a single use dock at river mile 39.5, of the Columbia River. In this opinion, we conclude that the proposed action, is not likely to jeopardize the continued existence of Lower Columbia River (LCR) Chinook salmon (*Oncorhynchus tshawytscha*), LCR coho salmon (*O. kisutch*), LCR chum salmon (*O. keta*), LCR steelhead (*O. mykiss*), Middle Columbia River (MCR) steelhead, Upper Columbia River (UCR) spring-run Chinook salmon, UCR steelhead, Snake River (SR) spring/summer run Chinook salmon, SR fall-run Chinook salmon, SR sockeye salmon (*O. nerka*), Snake River Basin (SRB) steelhead, Upper Willamette River (UWR) Chinook salmon, UWR steelhead, Green sturgeon (*Acipenser medirostris*) and Pacific eulachon (*Thaleichthys pacificus*). Further, we conclude that the proposed action will not result in the destruction or adverse modification of their designated critical habitats.

As required by section 7 of the ESA, we are providing an incidental take statement with the opinion. The incidental take statement describes reasonable and prudent measures we consider 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 USACE 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 will be exempt from the ESA take prohibition.

This document also includes the results of our analysis of the action's likely effects on EFH pursuant to section 305(b) of the MSA, and includes three conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. Two of these conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b)(4)(B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving these recommendations. If the response is inconsistent with the EFH conservation recommendations, the Federal action agency must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations.

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

Please contact Joshua Ashline of the Oregon Washington Area Coastal Office in Lacey, Washington at 360-753-9456 or by e-mail at Joshua.Ashline@NOAA.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

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

cc: Danette Guy (USACE)

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

Stevens Single Use Dock Installation, Wahkiakum County, Cathlamet, Washington (Columbia River, HUC 17080006) (USACE Number NWS-2019-934)

NMFS Consultation Number: WCRO-2019-03654

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

Affected Species and NMFS' Determinations:

ESA-Listed Species	ESA Status	Is the action likely to adversely affect this species or its critical habitat?	Is the action likely to jeopardize this species?	Is the action likely to adversely affect critical habitat?	Is the action likely to destroy or adversely modify critical habitat for this species?
Lower Columbia River Chinook salmon (*Oncorhynchus tshawytscha*)	T	Yes	No	Yes	No
Upper Columbia River spring-run Chinook salmon	E	Yes	No	Yes	No
Snake River spring/summer run Chinook salmon	T	Yes	No	Yes	No
Snake River fall-run Chinook salmon	T	Yes	No	Yes	No
Upper Willamette River spring Chinook Salmon	T	Yes	No	Yes	No
Columbia River chum salmon (*O. keta*)	T	Yes	No	Yes	No
Lower Columbia River coho salmon (*O. kisutch*)	T	Yes	No	Yes	No
Snake River sockeye salmon (*O. nerka*)	E	Yes	No	Yes	No
Lower Columbia River steelhead (*O. mykiss*)	T	Yes	No	Yes	No
Middle Columbia River steelhead	T	Yes	No	Yes	No
Upper Columbia River steelhead	T	Yes	No	Yes	No
Snake River Basin steelhead	T	Yes	No	Yes	No
Upper Willamette River steelhead	T	Yes	No	Yes	No
Pacific Eulachon (*Thaleichthys pacificus*)	T	Yes	No	Yes	No
North American green sturgeon (*Acipenser medirostris*)	T	Yes	No	Yes	No

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

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

Issued By:

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

Date: July 14, 2020

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1. INTRODUCTION

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

1.1 Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

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

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

1.2 Consultation History

On December 18, 2019, the U.S. Army Corps of Engineers, Seattle District (USACE), sent a request for informal consultation. The request included a memorandum for services, and a biological evaluation (including project drawings and photos). On January 10, 2020 the NMFS project biologist reached out to USACE informing them the proposed action would be likely to adversely affect ESA listed species and their critical habitats, and asked that formal consultation be requested. On January 16, 2020, USACE requested formal consultation. Upon review of the provided biological evaluation NMFS determined the consultation package to be complete, and initiated formal consultation with USACE on February 14, 2020.

1.3 Proposed Federal Action

“Action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

The USACE, proposes to issue a permit under section 10 of the Rivers and Harbors Act. Under the proposed permit, the applicant will construct a single use dock, and remove existing in-water derelict structures at river mile 39.5 of Columbia River, within the Cathlamet Channel (46.1989, -123.3840). This single use dock will be used for moorage and recreational access to the Columbia River.

Contractors will build the single use dock by installing, an access stairway (4 feet [ft] x 52 ft ; 208 square feet [sq/ft]), fixed pier (5 ft x 34 ft ; 170 sq/ft), gangway (4 ft x 40 ft ; 160 sq/ft), and float (8 ft x 40 ft ; 320 sq/ft), all of which will be secured using five 16-inch galvanized steel piles. The completed single use dock will have approximately 740 sq/ft of overwater structure, which will include steel grating with at least 60% open area to allow light penetration. Additionally, contractors will remove approximately 2,612 sq/ft of derelict overwater structures and 20 piles, prior to the installation of the new single use dock.

Construction will occur between November 1 and February 28. All work will be performed during daylight hours between 7:00 a.m. to 7:00 p.m., and will require approximately two weeks to complete. Contractors will use a barge-mounted crane and vibratory pile hammer to drive the steel piles 20-30 feet into the substrate, or until refusal. An impact hammer maybe used for piles not fully-seated by the vibratory hammer. The barge-mounted crane will remain on-site until all phases of derelict structure removal and new dock construction are complete. Once piles are installed, the access stairway, fixed pier, gangway, and float (all constructed offsite), will be attached.

The applicant proposes to incorporate a number of measures to minimize the adverse environmental effects of the proposed action. These measures include:

- The applicant will constrain all in-water work to between November 1 to February 28 to avoid or reduce the extent of fish exposure to the adverse effects of construction.
- Pile driving is expected to occur over 2-3 days, with maximum pile driving time up to 150 minutes (15-30 minutes per pile).
- If an impact hammer is needed to seat piles, a bubble curtain which completely surrounds the pile will be used to reduce pressure levels generated by pile strikes.
- Deterrent devices will be installed on the piles to prevent perching by avian predators.
- Grated steel will comprise sixty percent of the over water decking material to allow light penetration.
- During construction, best management practices will include, spill kits, and floating surface collectors to prevent the release of chemicals/debris into the Columbia River during derelict structure removal and pile driving/ pile pulling by the barge-mounted crane.
- A net decrease of approximately 1,870 sq/ft of overwater structure, and 15 piles within the action area.

We considered whether or not the proposed action would cause any other activities and determined that boat moorage and dock related recreation activities would produce sound and shade.

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

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The action agency determined, and NMFS concurs, that the proposed action is not likely to adversely affect the southern resident killer whale (*Orcinus orca*) or their designated critical habitats. These analyses are found in the "Not Likely to Adversely Affect" Determinations section 2.12.

2.1 Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

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

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a ''destruction or adverse modification'' analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

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

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.

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

2.2 Rangewide Status of the Species and Critical Habitat

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

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

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou *et al.* 2014; Kunkel *et al.* 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote *et al.* 2014). Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote *et al.* 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote *et al.* 2014). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote *et al.* 2014). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez *et al.* 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote *et al.* 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua *et al.* 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua *et al.* 2010; Isaak *et al.* 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier *et al.* 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer *et al.* 1999; Winder and Schindler 2004, Raymondi *et al.* 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier *et al.* 2008; Wainwright and Weitkamp 2013; Raymondi *et al.* 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode *et al.* 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson *et al.* 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest as a result of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote *et al.* 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7^{o}C by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011, Reeder *et al.* 2013). Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely *et al.* 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder *et al.* 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick *et al.* 2007). Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel *et al.* 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder *et al.* 2013).

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

2.2.1 Status of the Critical Habitat

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

Physical and Biological Features of Salmon and Steelhead Critical Habitat

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

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

Subsequently, NMFS designated CH for 10 ESUs and DPSs of Columbia River salmon and steelhead on September 2, 2005 (70 FR 52630), and lower Columbia River coho salmon on February 24, 2016 (81 FR 9252) as shown in Table 1. The PBFs are referred to as Primary Constituent Elements (PCE) in 70 FR 52630 and in 81 FR 9252, and those terms are used interchangeably in this document. Specific PCEs, and the essential features associated with the PCEs for salmonids designated in 2005 include:

1. Freshwater spawning sites with water quantity and quality conditions and substrate that support spawning, incubation, and larval development;
2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility, water quality and forage that support juvenile development, and natural cover such as shade, submerged and overhanging large wood, logjams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;
3. Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks that support juvenile and adult mobility and survival;
4. Estuarine areas free of obstruction and excessive predation with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation;
5. Nearshore marine areas free of obstruction and excessive predation with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and
6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

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

Physical and Biological Features of Pacific Eulachon Critical Habitat

The NMFS designated CH for the southern DPS of Pacific eulachon on October 11, 2011 (76 FR 65324). Specific PBFs, and the essential features associated with the PBFs for Pacific eulachon designated in 2011 include:

1. Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with 14 migratory access for adults and juveniles. These features are essential to conservation because without them the species cannot successfully spawn and produce offspring.
2. Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free of obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean.
3. Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival. Eulachon prey on a wide variety of species including crustaceans such as copepods and euphausiids (Hay and McCarter 2000, WDFW and ODFW 2001), unidentified malacostracans (Sturdevant 1999), cumaceans (Smith and Saalfeld 1955) mysids, barnacle larvae, and worm larvae (WDFW and ODFW 2001). These features are essential to conservation because they allow juvenile fish to survive, grow, and reach maturity, and they allow adult fish to survive and return to freshwater systems to spawn.

Physical and Biological Features of Green Sturgeon Critical Habitat

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

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

Table 1. Critical habitat, designation date, federal register citation, and status summary for critical habitats considered in this opinion.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Lower Columbia River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 47 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some, or high potential for improvement. We rated conservation value of HUC5 watersheds as high for 30 watersheds, medium for 13 watersheds, and low for four watersheds.
Upper Columbia River spring-run Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses four subbasins in Washington containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. We rated conservation value of HUC5 watersheds as high for 10 watersheds, and medium for five watersheds. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Snake River spring/summer-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers (except the Clearwater River) presently or historically accessible to this ESU (except reaches above impassable natural falls and Hells Canyon Dam). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar *et al.* 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Willamette River Chinook salmon	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Oregon containing 56 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition. However, most of these watersheds have some, or high, potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 22 watersheds, medium for 16 watersheds, and low for 18 watersheds.
Snake River fall-run Chinook salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers, and all tributaries of the Snake and Salmon rivers presently or historically accessible to this ESU (except reaches above impassable natural falls, and Dworshak and Hells Canyon dams). Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar *et al.* 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Columbia River chum salmon	9/02/05 70 FR 52630	Critical habitat encompasses six subbasins in Oregon and Washington containing 19 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 16 watersheds, and medium for three watersheds.
Lower Columbia River coho salmon	2/24/16 81 FR 9252	Critical habitat encompasses 10 subbasins in Oregon and Washington containing 55 occupied watersheds, as well as the lower Columbia River and estuary rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		improvement. We rated conservation value of HUC5 watersheds as high for 34 watersheds, medium for 18 watersheds, and low for three watersheds.
Snake River sockeye salmon	10/25/99 64 FR 57399	Critical habitat consists of river reaches of the Columbia, Snake, and Salmon rivers; Alturas Lake Creek; Valley Creek; and Stanley, Redfish, Yellow Belly, Pettit and Alturas lakes (including their inlet and outlet creeks). Water quality in all five lakes generally is adequate for juvenile sockeye salmon, although zooplankton numbers vary considerably. Some reaches of the Salmon River and tributaries exhibit temporary elevated water temperatures and sediment loads that could restrict sockeye salmon production and survival (NMFS 2015b). Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Upper Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 10 subbasins in Washington containing 31 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 20 watersheds, medium for eight watersheds, and low for three watersheds.
Lower Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses nine subbasins in Oregon and Washington containing 41 occupied watersheds, as well as the lower Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of HUC5 watersheds as high for 28 watersheds, medium for 11 watersheds, and low for two watersheds.
Upper Willamette River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses seven subbasins in Oregon containing 34 occupied watersheds, as well as the lower Willamette/Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. Watersheds are in good to excellent condition with no potential for improvement only in the upper McKenzie River and its tributaries (NMFS 2005). We rated conservation value of HUC5 watersheds as high for 25 watersheds, medium for 6 watersheds, and low for 3 watersheds.
Middle Columbia River steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 15 subbasins in Oregon and Washington containing 111 occupied watersheds, as well as the Columbia River rearing/migration corridor. Most HUC5 watersheds with PCEs for salmon are in fair-to-poor or fair-to-good condition (NMFS 2005). However, most of these watersheds have some or a high potential for improvement. We rated conservation value of occupied HUC5 watersheds as high for 80 watersheds, medium for 24 watersheds, and low for 9 watersheds.
Snake River basin steelhead	9/02/05 70 FR 52630	Critical habitat encompasses 25 subbasins in Oregon, Washington, and Idaho. Habitat quality in tributary streams varies from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (Wissmar *et al.* 1994). Reduced summer stream flows, impaired water quality, and reduced habitat complexity are common problems. Migratory habitat quality in this area has been severely affected by the development and operation of the dams and reservoirs of the Federal Columbia River Power System.
Southern DPS of eulachon	10/20/11 76 FR 65324	Critical habitat for eulachon includes portions of 16 rivers and streams in California, Oregon, and Washington. All of these areas are designated as migration and spawning habitat for this species. In Oregon, we designated 24.2 miles of the lower Umpqua River, 12.4 miles of the lower Sandy River, and 0.2 miles of Tenmile Creek. We also designated the mainstem Columbia River from the mouth to the base of Bonneville Dam, a distance of 143.2 miles. Dams and water diversions are moderate threats to eulachon in the Columbia and Klamath rivers where hydropower generation and flood control are major activities. Degraded water quality is common in some areas occupied by southern DPS eulachon. In the Columbia and Klamath river basins, large-scale impoundment of water has increased winter water temperatures, potentially altering the water temperature during eulachon spawning periods. Numerous chemical contaminants are also

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
		present in spawning rivers, but the exact effect these compounds have on spawning and egg development is unknown. Dredging is a low to moderate threat to eulachon in the Columbia River. Dredging during eulachon spawning would be particularly detrimental.
Southern DPS of green sturgeon	10/09/09 74 FR 52300	Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; tidally influenced areas of the Columbia River estuary from the mouth upstream to river mile 46; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor), including, but not limited to, areas upstream to the head of tide in various streams that drain into the bays, as listed in Table 1 in USDC (2009). The CHRT identified several activities that threaten the PCEs in coastal bays and estuaries and necessitate the need for special management considerations or protection. The application of pesticides is likely to adversely affect prey resources and water quality within the bays and estuaries, as well as the growth and reproductive health of Southern DPS green sturgeon through bioaccumulation. Other activities of concern include those that disturb bottom substrates, adversely affect prey resources, or degrade water quality through re-suspension of contaminated sediments. Of particular concern are activities that affect prey resources. Prey resources are affected by: commercial shipping and activities generating point source pollution and non-point source pollution that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom (but result in beneficial or adverse effects on prey resources for green sturgeon).

2.2.2 Status of the Species

Table 2, below, provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. These documents are available on the NMFS West Coast Region website (http://www.westcoast.fisheries.noaa.gov/).

Table 2. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Lower Columbia River Chinook salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	This ESU comprises 32 independent populations. Twenty-seven populations are at very high risk, 2 populations are at high risk, one population is at moderate risk, and 2 populations are at very low risk Overall, there was little change since the last status review in the biological status of this ESU, although there are some positive trends. Increases in abundance were noted in about 70% of the fall-run populations and decreases in hatchery contribution were noted for several populations. Relative to baseline VSP levels identified in the recovery plan, there has been an overall improvement in the status of a number of fall-run populations, although most are still far from the recovery plan goals.	• Reduced access to spawning and rearing habitat • Hatchery-related effects • Harvest-related effects on fall Chinook salmon • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Contaminants
Upper Columbia River spring-run Chinook salmon	Endangered 6/28/05	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This ESU comprises four independent populations. Three are at high risk and one is functionally extirpated. Current estimates of natural origin spawner abundance increased relative to the levels observed in the prior review for all three extant populations, and productivities were higher for the Wenatchee and Entiat populations and unchanged for the Methow population. However, abundance and productivity remained well below the viable thresholds called for in the Upper Columbia Recovery Plan for all three populations.	• Effects related to hydropower system in the mainstem Columbia River • Degraded freshwater habitat • Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Persistence of non-native (exotic) fish species • Harvest in Columbia River fisheries
Snake River spring/summer-run Chinook salmon	Threatened 6/28/05	NMFS 2016a	NWFSC 2015	This ESU comprises 28 extant and four extirpated populations. All expect one extant population (Chamberlin Creek) are at high risk. Natural origin abundance has increased over the levels reported in the prior review for most populations in this ESU, although the increases were not substantial enough to change viability ratings. Relatively high ocean survivals in recent years were a major factor in recent abundance patterns. While there have been improvements in abundance and productivity in several populations relative to prior reviews, those changes have not been sufficient to warrant a change in ESU status.	• Degraded freshwater habitat • Effects related to the hydropower system in the mainstem Columbia River, • Altered flows and degraded water quality • Harvest-related effects • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
Upper Willamette River Chinook salmon	Threatened 6/28/05	NMFS 2011	NWFSC 2015	This ESU comprises seven populations. Five populations are at very high risk, one population is at moderate risk (Clackamas River) and one population is at low risk (McKenzie River). Consideration of data collected since the last status review in 2010 indicates the fraction of hatchery origin fish in all populations remains high (even in Clackamas and McKenzie populations). The proportion of natural origin spawners improved in the North and South Santiam basins, but is still well below identified recovery goals. Abundance levels for five of the seven populations remain well below their recovery goals. Of these, the Calapooia River may be functionally extinct and the Molalla River remains critically low. Abundances in the North and South Santiam rivers have risen since the 2010 review, but still range only in the high hundreds of fish. The Clackamas and McKenzie populations have previously been viewed as natural population strongholds, but have both experienced declines in abundance despite having access to much of their historical spawning habitat. Overall, populations appear to be at either moderate or high risk, there has been likely little net change in the VSP score for the ESU since the last review, so the ESU remains at moderate risk.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats • Altered food web due to reduced inputs of microdetritus • Predation by native and non-native species, including hatchery fish • Competition related to introduced salmon and steelhead • Altered population traits due to fisheries and bycatch
Snake River fall-run Chinook salmon	Threatened 6/28/05	NMFS 2015a	NWFSC 2015	This ESU has one extant population. Historically, large populations of fall Chinook salmon spawned in the Snake River upstream of the Hells Canyon Dam complex. The extant population is at moderate risk for both diversity and spatial structure and abundance and productivity. The overall viability rating for this population is 'viable.' Overall, the status of Snake River fall Chinook salmon has clearly improved compared to the time of listing and compared to prior status reviews. The single extant population in the ESU is currently meeting the criteria for a rating of 'viable' developed by the ICTRT, but the ESU as a whole is not meeting the recovery goals described in the recovery plan for the species, which require the single population to be "highly viable with high certainty" and/or will require reintroduction of a	• Degraded floodplain connectivity and function • Harvest-related effects • Loss of access to historical habitat above Hells Canyon and other Snake River dams • Impacts from mainstem Columbia River and Snake River hydropower systems • Hatchery-related effects • Degraded estuarine and nearshore habitat.

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				viable population above the Hells Canyon Dam complex.	
Columbia River chum salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Overall, the status of most chum salmon populations is unchanged from the baseline VSP scores estimated in the recovery plan. A total of 3 of 17 populations are at or near their recovery viability goals, although under the recovery plan scenario these populations have very low recovery goals of 0. The remaining populations generally require a higher level of viability and most require substantial improvements to reach their viability goals. Even with the improvements observed during the last five years, the majority of populations in this ESU remain at a high or very high risk category and considerable progress remains to be made to achieve the recovery goals.	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Degraded stream flow as a result of hydropower and water supply operations • Reduced water quality • Current or potential predation • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Lower Columbia River coho salmon	Threatened 6/28/05	NMFS 2013	NWFSC 2015	Of the 24 populations that make up this ESU, 21 populations are at very high risk, 1 population is at high risk, and 2 populations are at moderate risk. Recent recovery efforts may have contributed to the observed natural production, but in the absence of longer term data sets it is not possible to parse out these effects. Populations with longer term data sets exhibit stable or slightly positive abundance trends. Some trap and haul programs appear to be operating at or near replacement, although other programs still are far from that threshold and require supplementation with additional hatchery-origin spawners. Initiation of or improvement in the downstream juvenile facilities at Cowlitz Falls, Merwin, and North Fork Dam are likely to further improve the status of the associated upstream populations. While these and other recovery efforts have likely improved the status of a number of coho salmon populations, abundances are still at low levels and the majority of the populations remain at moderate or high risk. For the Lower Columbia River region land development and increasing human population pressures will likely continue to degrade	• Degraded estuarine and near-shore marine habitat • Fish passage barriers • Degraded freshwater habitat: Hatchery-related effects • Harvest-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				habitat, especially in lowland areas. Although populations in this ESU have generally improved, especially in the 2013/14 and 2014/15 return years, recent poor ocean conditions suggest that population declines might occur in the upcoming return years.	
Snake River sockeye salmon	Endangered 6/28/05	NMFS 2015b	NWFSC 2015	This single population ESU is at very high risk dues to small population size. There is high risk across all four basic risk measures. Although the captive brood program has been successful in providing substantial numbers of hatchery produced fish for use in supplementation efforts, substantial increases in survival rates across all life history stages must occur to re-establish sustainable natural production In terms of natural production, the Snake River Sockeye ESU remains at extremely high risk although there has been substantial progress on the first phase of the proposed recovery approach – developing a hatchery based program to amplify and conserve the stock to facilitate reintroductions.	• Effects related to the hydropower system in the mainstem Columbia River • Reduced water quality and elevated temperatures in the Salmon River • Water quantity • Predation
Upper Columbia River steelhead	Threatened 1/5/06	Upper Columbia Salmon Recovery Board 2007	NWFSC 2015	This DPS comprises four independent populations. Three populations are at high risk of extinction while 1 population is at moderate risk. Upper Columbia River steelhead populations have increased relative to the low levels observed in the 1990s, but natural origin abundance and productivity remain well below viability thresholds for three out of the four populations. The status of the Wenatchee River steelhead population continued to improve based on the additional year's information available for the most recent review. The abundance and productivity viability rating for the Wenatchee River exceeds the minimum threshold for 5% extinction risk. However, the overall DPS status remains unchanged from the prior review, remaining at high risk driven by low abundance and productivity relative to viability objectives and diversity concerns.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded floodplain connectivity and function, channel structure and complexity, riparian areas, large woody debris recruitment, stream flow, and water quality • Hatchery-related effects • Predation and competition • Harvest-related effects
Lower Columbia River steelhead	Threatened 1/5/06	NMFS 2013	NWFSC 2015	This DPS comprises 23 historical populations, 17 winter-run populations and six summer-run populations. Nine populations are at very high risk, 7 populations are at high risk, 6 populations are at moderate risk, and 1 population is at low risk. The majority of winter-run steelhead populations in this	• Degraded estuarine and nearshore marine habitat • Degraded freshwater habitat • Reduced access to spawning and rearing habitat

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				DPS continue to persist at low abundances. Hatchery interactions remain a concern in select basins, but the overall situation is somewhat improved compared to prior reviews. Summer-run steelhead populations were similarly stable, but at low abundance levels. The decline in the Wind River summer-run population is a source of concern, given that this population has been considered one of the healthiest of the summer-runs; however, the most recent abundance estimates suggest that the decline was a single year aberration. Passage programs in the Cowlitz and Lewis basins have the potential to provide considerable improvements in abundance and spatial structure, but have not produced self-sustaining populations to date. Even with modest improvements in the status of several winter-run DIPs, none of the populations appear to be at fully viable status, and similarly none of the MPGs meet the criteria for viability.	• Avian and marine mammal predation • Hatchery-related effects • An altered flow regime and Columbia River plume • Reduced access to off-channel rearing habitat in the lower Columbia River • Reduced productivity resulting from sediment and nutrient-related changes in the estuary • Juvenile fish wake strandings • Contaminants
Upper Willamette River steelhead	Threatened 1/5/06	NMFS 2011	NWFSC 2015	This DPS has four demographically independent populations. Three populations are at low risk and one population is at moderate risk. Declines in abundance noted in the last status review continued through the period from 2010-2015. While rates of decline appear moderate, the DPS continues to demonstrate the overall low abundance pattern that was of concern during the last status review. The causes of these declines are not well understood, although much accessible habitat is degraded and under continued development pressure. The elimination of winter-run hatchery release in the basin reduces hatchery threats, but non-native summer steelhead hatchery releases are still a concern for species diversity and a source of competition for the DPS. While the collective risk to the persistence of the DPS has not changed significantly in recent years, continued declines and potential negative impacts from climate change may cause increased risk in the near future.	• Degraded freshwater habitat • Degraded water quality • Increased disease incidence • Altered stream flows • Reduced access to spawning and rearing habitats due to impaired passage at dams • Altered food web due to changes in inputs of microdetritus • Predation by native and non-native species, including hatchery fish and pinnipeds • Competition related to introduced salmon and steelhead • Altered population traits due to interbreeding with hatchery origin fish
Middle Columbia River steelhead	Threatened 1/5/06	NMFS 2009b	NWFSC 2015	This DPS comprises 17 extant populations. The DPS does not currently include steelhead that are designated as part of an experimental population	• Degraded freshwater habitat • Mainstem Columbia River hydropower-related impacts

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				above the Pelton Round Butte Hydroelectric Project. Returns to the Yakima River basin and to the Umatilla and Walla Walla Rivers have been higher over the most recent brood cycle, while natural origin returns to the John Day River have decreased. There have been improvements in the viability ratings for some of the component populations, but the DPS is not currently meeting the viability criteria in the MCR steelhead recovery plan. In general, the majority of population level viability ratings remained unchanged from prior reviews for each major population group within the DPS.	• Degraded estuarine and nearshore marine habitat • Hatchery-related effects • Harvest-related effects • Effects of predation, competition, and disease
Snake River basin steelhead	Threatened 1/5/06	NMFS 2016a	NWFSC 2015	This DPS comprises 24 populations. Two populations are at high risk, 15 populations are rated as maintained, 3 populations are rated between high risk and maintained, 2 populations are at moderate risk, 1 population is viable, and 1 population is highly viable. Four out of the five MPGs are not meeting the specific objectives in the draft recovery plan based on the updated status information available for this review, and the status of many individual populations remains uncertain A great deal of uncertainty still remains regarding the relative proportion of hatchery fish in natural spawning areas near major hatchery release sites within individual populations.	• Adverse effects related to the mainstem Columbia River hydropower system • Impaired tributary fish passage • Degraded freshwater habitat • Increased water temperature • Harvest-related effects, particularly for B-run steelhead • Predation • Genetic diversity effects from out-of-population hatchery releases
Southern DPS of eulachon	Threatened 3/18/10	NMFS 2017	Gustafson *et al.* 2016	The Southern DPS of eulachon includes all naturally-spawned populations that occur in rivers south of the Nass River in British Columbia to the Mad River in California. Sub populations for this species include the Fraser River, Columbia River, British Columbia and the Klamath River. In the early 1990s, there was an abrupt decline in the abundance of eulachon returning to the Columbia River. Despite a brief period of improved returns in 2001-2003, the returns and associated commercial landings eventually declined to the low levels observed in the mid-1990s. Although eulachon abundance in monitored rivers has generally improved, especially in the 2013-2015 return years, recent poor ocean conditions and the likelihood that likelihood that these conditions will persist into the near future suggest that population	• Changes in ocean conditions due to climate change, particularly in the southern portion of the species' range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success. • Climate-induced change to freshwater habitats • Bycatch of eulachon in commercial fisheries • Adverse effects related to dams and water diversions • Water quality, • Shoreline construction • Over harvest • Predation

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				declines may be widespread in the upcoming return years	
Southern DPS of green sturgeon	Threatened 4/7/06	NMFS 2018	NMFS 2015c	The Sacramento River contains the only known green sturgeon spawning population in this DPS. The current estimate of spawning adult abundance is between 824-1,872 individuals. Telemetry data and genetic analyses suggest that Southern DPS green sturgeon generally occur from Graves Harbor, Alaska to Monterey Bay, California and, within this range, most frequently occur in coastal waters of Washington, Oregon, and Vancouver Island and near San Francisco and Monterey bays. Within the nearshore marine environment, tagging and fisheries data indicate that Northern and Southern DPS green sturgeon prefer marine waters of less than a depth of 110 meters.	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching

2.3 Action Area

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

For this consultation, the action area is the entire Columbia River at river mile 39.5 of Columbia River, within the Cathlamet Channel, one half mile upstream and downstream from the pile installation and removal where the acoustic effects and increased turbidity from pile driving are reasonably certain to occur. These effects are considered within the effects of the action and bound the action area upriver. Recreational boat use is also evaluated. We expect that the largest effect of boating to and from this structure will be within the same distances from the new structure as the range of sound emanating from pile driving.

A total of fifteen ESA-listed species use the action area for adult migration, and/or juvenile rearing and migration. Critical habitat has been designated for all species. The action area is designated EFH for Chinook salmon and coho salmon (Pacific Fishery Management Council 2014), and is an area where environmental effects of the proposed action may adversely affect EFH of those species. The effects to EFH are analyzed in the MSA portion of the document.

2.4 Environmental Baseline

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

Fish habitat in the action area has been adversely affected by a variety of in-water and upland human activities, including habitat losses from all causes (urbanization, roads, diking, etc.), flood control, irrigation dams, pollution, municipal and industrial water use, introduced species, and hatchery production (NRC 1996, NMFS 2013). The action area reflects habitat extent and quality in many upriver Columbia River basin watersheds. In general, those conditions have declined in the last 150 years, together influencing conditions in the action area. These multiple watersheds, like the action area, are characterized by loss of connectivity with floodplains and feeding and resting habitat for juvenile salmonids in the form of low-velocity marshland and tidal channel habitats (Bottom *et al.* 2005). Water quality throughout the action area is degraded by urban, industrial, and agricultural practices across the basin that contributes multiple pollutants at levels above natural conditions. Habitat degradation has generally reduced the quality of this important rearing and migration habitat for salmon and steelhead. Survival through this reach has declined for both juvenile and adult salmonids resulting in reduced population productivity and abundance. The impact of habitat degradation is less understood.

In addition, the environmental baseline includes the impacts from deep-water dredging to maintain the federal navigation channel for large commercial vessel traffic and shallow water dredging to maintain marinas for recreational vessels. Therefore, dredging activities occur across numerous areas and microhabitats within the Lower Columbia River including secondary channels, sloughs, and floodplain wetlands. All of these habitat areas provide rearing opportunities for ESA-listed fish, and all have been degraded to some degree by shore-based development and construction and maintenance of marinas. Floodplain and off-channel sloughs have been cut off by dikes and flood control levees, limiting potential refuge areas and forage sites for juvenile salmonids. The dredge sediment disposal in the Lower Columbia River has had adverse effects, including displacement of seasonally-flooded wetlands and creation of attractive nesting habitat for avian predator species.

The hydrology and hydrograph of the Columbia River is significantly altered from historical conditions. River flow is less dynamic (Sherwood *et al.* 1990), sediment transport has decreased by as much as 50 percent (Simenstad *et al.* 1992), and temperatures are warmer, especially during the winter (Weitkamp 1994). These conditions, coupled with proliferation of overwater structures that obscure light penetration are ideal for native and non-native piscine predators alike. Since 1990 the Bonneville Power Administration has funded a sport-reward program that has removed millions of northern pikeminnow from the LCR (Beamesderfer *et al.* 1996; Friesen and Ward 1999; Knutsen and Ward 2011). Other actions such as the depredation and relocation of large colonial nesting waterbird colonies have reduced the numbers of avian predators that prey upon salmonids in the Columbia River estuary that may improve progress in reaching recovery goals by up to 6 percent (NMFS 2011b).

The action area is located in the Columbia River’s Cathlamet Channel at river mile 39.5, and so is influenced by water quality impacts associated with all upstream uses described above. Additionally, the action area’s habitat conditions include degraded water quality, from increased fine sediments and elevated water temperatures. These conditions are a result of upstream land uses within the Youngs Bay watershed (Bischoff *et al.* 2000). All ESA-listed Columbia basin salmon and steelhead, in addition to eulachon and green sturgeon may rear and/or migrate through the action area. Adult salmonids will move upstream and through the action area within minutes. Juvenile salmonids, depending on the species and age of the fish, may spend hours to months within the action area. Juvenile salmonid foraging primarily occurs in waters less than 25 feet deep, with deeper waters and greater flows providing a migration corridor for larger salmonids.

During the last five years, NMFS has engaged in various Section 7 consultations on Federal projects affecting ESA-listed fish and their habitats in and near the action area. These include vicinity (Clatsop County, Oregon; Wahkiakum County, Washington) to the action area (WCRO-2019-01083, WCRO-2019-00197, WCR0-2017-66222), including the effects of actions addressed in programmatic consultations (the SLOPES IV programmatic consultation; NMFS number WCRO-2011-05585). In general, those actions caused temporary, construction effects (increased noise and turbidity), and longer term effects like increasing overwater coverage. Longer term effects that remain part of the baseline now include hindering quality of downstream migration and reduced benthic production of forage items.

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

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

In addition to variations in outmigration timing, juvenile ESA-listed species also have a wide horizontal and vertical distribution in the CR related to size and life history stage. Generally speaking, juvenile salmonids will occupy the action area across the width of the river, and to average depths of up to 35 feet (Carter *et al.* 2009). Smaller-sized fish use the shallow inshore habitats and larger fish will use the channel margins and main channel. The pattern of use generally shifts between day and night. Juvenile salmon occupy different locations within the CR, and are typically in shallower water during the day, avoiding predation by larger fish that are more likely to be in deeper water. These younger fish will venture into the deeper areas of the river away from the shoreline, towards the navigation channel and along the bathymetric break – or channel margin – and will be closer to the bottom of the channel (Carter *et al.* 2009). The smaller sub-yearling salmonids will likely congregate along the nearshore areas in shallow water and extend into the channel margins (Bottom *et al.* 2011). Yet, as Carlson *et al.* (2001) indicated, there is higher use of the channel margins than previously thought and considering the parameters above, relative juvenile position in the water column suggests higher potential sub-yearling use in areas of 20 to 30 feet deep.

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

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

2.5 Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

2.5.1 Effects on Critical Habitat

Salmonid Critical Habitat

The action area includes the PBFs for freshwater rearing and migration corridor. These two PBFs share many of the same essential features. The essential features in the action area affected by the proposed action would include: water quality, forage, and a corridor free of obstruction and predation.

Designated critical habitat within the action area for ESA-listed salmon and steelhead considered in this opinion consists of freshwater rearing sites and freshwater migration corridors and their essential physical and biological features; these are called primary constituent elements (PCEs). The primary constituent elements for freshwater rearing include floodplain connectivity, forage, natural cover, water quality, and water quantity. Primary constituent elements for freshwater migration include unobstructed migratory corridor, natural cover, water quality, and water quantity. These PCEs fulfill many functions for migrating salmonids, including allowing them to successfully avoid predators.

Effects of the proposed action on critical habitat are reasonably certain to include: 1) Acoustic impacts to rearing and migratory habitats, 2) reduction of water quality, to rearing and migratory habitat 3) obstruction of the migratory habitat, 4) enhancement of piscivorous predator habitat, to rearing and migratory habitats 5) reduction in forage to rearing habitat. The magnitude of these effects will vary temporally, and are discussed below.

1) Acoustic Impacts:
Pressure waves are created by pile driving and transmitted through the water column. These waves are expected to induce behavioral effects, but will not reach the 183 decibel threshold known to impair and/or kill salmon, as a vibratory hammer will be used in-lieu of an impact hammer known to produce sound waves in exceedance of the 183 decibel threshold. This disturbance of aquatic habitat will persist for a maximum of 70 minutes during installation of new piles and affect migratory and rearing PBFs. When work ceases, sound pressure levels will return to the ambient, baseline level. However, the action area will experience episodes of noise for the life of the project as a result of future recreational boating activity, which is the intended use for this structure. As a result rearing and migratory PBFs will be episodically affected for the life of the structure.

2) Reduction of Water Quality
To complete the gangway, landing and dock installation, the applicant proposes to drive five 16-inch diameter hollow steel piles. In total, seven sq/ft of benthos will be replaced by the five steel piles. Each pile will need ten to thirty minutes to drive so all piles will require a maximum of 150 minutes, during the five to seven days needed to complete the project. Additionally, twenty derelict cresote wooded piles will be removed from the action area. Project timing is constrained to the period between November 1 and the end of February. Pile installation and extraction is reasonably certain to suspend existing bottom sediment in a way that will increase turbidity in the action area and spread downriver for a maximum of one half mile. Based on swift currents in the action area, river flow will, dilute the increased turbidity within 30 minutes during the process of each piles installation/extraction. We expect water quality to be diminished by turbid conditions for several daylight hours each day for one week, and then to recover to the ambient baseline level.

Some level of water quality reduction is also likely from the unintentional release of fuel, oil, and hydraulic fluids from interrelated recreational boat use, episodically, over the lifetime of the structure. Releases, while likely to be infrequent, and are reasonably certain to occur over the estimated lifetime of the proposed structure. We anticipate that the quantity of released hydrocarbons at any given time will be small and that such releases will be diluted quickly, but we cannot predict with certainty the amount or timing of such releases. Because the nature of releases of contaminants associated with boat use is expected to be small, infrequent, and in a location where there is sufficient flow for quick dilution, overall we do not expect the water quality impairments to significantly degrade the water quality PBF, but we do expect occasional episodes of impairment over the life of the project.

3) Obstruction of Migratory Pathway
The placement of the gangway, landing and dock is in the migratory pathway for both adult and juvenile salmonids. The presence of this structure is likely to cause the fish to swim around the overwater structures, which will slightly lengthen their migratory pathway. Even a small increase in the migration route has the potential to be adverse, as it can increase opportunities for piscivorous predators to prey on juveniles and has been shown to be correlated with juvenile mortality (Anderson *et al.*, 2005). As a result, the overwater structures are likely to reduce the quality of the migratory corridor PBF to a small degree. This effect to the migratory pathway will persist over the life of the structure, which is expected to be several decades.

4) Enhancement of Piscivorous Predator Habitat

The gangway, landing dock and piles will create overwater cover, and locally slow velocity, both of which are favorable habitat conditions for piscivorous predators, such as pike minnow, smallmouth bass, and largemouth bass, which occupy the LCR (Faler *et al.*, 1988; Isaak and Bjornn, 1996). Pike minnow and smallmouth bass have consistently been shown to use low-velocity habitats (Faler *et al.*, 1988; Isaak and Bjornn, 1996; Tabor *et al.* 1993; Martinelli and Shively, 1997). In Columbia River reservoirs, their preference for low-velocity microhabitats that are associated with overwater structures places them in the path of nearshore-associated outmigrating juveniles (Carrasquero, 2001). In McNary reservoir, smallmouth bass also have been found to prefer slow-velocity habitats (Tabor *et al.*, 1993). In his literature review Rondorf *et al.* (2010) cites further studies with the finding: pikeminnow and smallmouth bass seek out low velocity habitats, prefer cover, and utilize overwater structures including docks. Interpreting these findings and applying them to the proposed action, we are reasonably certain that the proposed float replacement will extend the duration that piscivorous predators will use the action area. This anticipated action-related outcome of improving habitat conditions for piscivorous predators, is expected to reduce the quality of critical habitat for two PBFs - juvenile salmonid rearing and outmigration - for the decades-long duration the proposed project will remain in place.

5) Shade/Reduction of Forage

Placement of the gangway, landing and dock will cause partial overwater shading under a 740 sq/ft area. Shading from overwater structures likely reduces the abundance of prey organisms for juvenile salmonids and also affects habitat complexity by reducing aquatic vegetation and phytoplankton abundance (Kahler *et al.* 2000; Carrasquero 2001). Additionally, the piles will replace 7.0 sq/ft of benthos, which will no longer support benthic aquatic vegetation, and macroinvertebrates. These anticipated effects will persist as long as the structure remains in place, thus lowering the quantity and quality of the forage PBF of rearing habitat in the action area over several decades.

Eulachon Critical Habitat

The proposed action will not alter substrate that eulachon rely on or affect the eulachon prey base. The single use dock will not affect availability of quality of eulachon spawning habitat within the Columbia River. Adult eulachon infrequently spawn in this section of the LCR and, typically favor large tributaries (i.e., Sandy River, Washougal River). Eulachon eggs and larvae, due to their passive drift characteristics, will have extremely limited contact with the structure.

Green Sturgeon Critical Habitat

The effects of the proposed action on green sturgeon critical habitat are similar to those described above for salmonids. The proposed action will not affect the following PBFs for green sturgeon critical habitat: water flow, water depth, or migratory corridor. Instead, the action causes changes in water flow, migratory corridor, and altered prey base similar to the proposed action that are categorized as low-level threats to the southern DPS of green sturgeon critical habitat (NMFS 2018).

In contrast, the action will affect food resources, sediment quality, and water quality. The effects of the action on food resources for are similar to that described above for juvenile salmonids. Piles and the dock will replace and shade the benthic community resulting in a small-scale, permanent reduction in the availability of benthic invertebrates that on which green sturgeon forage, to the same extent as described above for salmon and steelhead critical habitat.

2.5.2 Effects on Species

Species will be exposed to, and respond to each of the habitat effects described in Section 2.5.1:

1. reduced water quality due to turbidity from the construction of the project, and its future use,
2. increased noise/ sound pressure levels from pile removal and driving, and from future boating activity
3. reduced forage
4. overwater/in water structure,
5. predation opportunity.

Salmonid Exposure and Response Analysis

Exposure of listed fish to the effects of the action varies by timing and location of activity when different densities and life history stages of the ESA-listed fish will be present. The proposed action's construction related activities will occur over a period of five to seven days between November and the end of February when most of the species considered in this consultation will be present at low densities, if at all. Even then, most fish presence will overlap only the latter portion of the November 1 to February 28 Washington Department of Fish and Wildlife's approved window for in-water work. Thereafter, ESA listed species utilizing the action area (migration and rearing) will encounter effects from the presence of new in- and overwater infrastructure for it lifespan.

As described in the environmental baseline, sub-yearling migrant CR chum salmon, LCR Chinook salmon, SR fall Chinook salmon, and to a limited extent, LCR coho salmon, and LCR steelhead are likely to be present in the action area when the effects of construction occur and future generations will experience the effects of the presence of the subject infrastructure after completion. Constraining in-water work to the time of year when the density of sub-yearlings will be low reduces the number of individual animals exposed to the effects of construction, but not avoid it. Thus, a small number of juvenile salmonids will likely be exposed and associated, potential effects are described below.

Peak migratory periods for adult salmonids in the action area vary by species, but adult CR salmonids are reasonably certain to be present in the action area year-round (from passage data at Bonneville Dam 10-year average, http://www.cbr.washington.edu/dart/adult_hrt.html). As such, some number of individual adult fish will be present during the five to seven days expected for pile driving. While some exposed fish will respond to exposure by moving away, others will respond in a way that actually injures or kills them and are therefore susceptible to exposure to the effects of the action. Adult Chinook salmon most likely occur in the action area from late spring through the fall, but early-run fish may be present in late February and therefore potentially exposed to construction effects. Coho salmon presence is most likely in late summer through early winter. Chum salmon primarily occur during the fall. Adult sockeye salmon presence will most likely range from late spring to late summer. Steelhead are present from February to December, though the majority of upstream passage through the LCR occurs during spring and summer. Based on the broad run timing of these species, and the proposed work period of November 1 to February 28 exposure for all adult spring and summer run Chinook salmon ESUs, and SR sockeye salmon is unlikely. All other CR species of adult salmonids (*i.e*., coho salmon, fall Chinook salmon, chum salmon, and steelhead) have at least some potential for exposure to construction effects of the action.

Adult salmonid migration rates range up to a few miles per hour (Matter and Sandford, 2003), therefore we expect adult ESA-listed salmonids that do encounter underwater noise and turbidity plumes created during pile removal and installation to be moving upstream at such a rate as to limit this exposure to a matter of minutes. Adult salmonids typically migrate within the main river channel at depths of 10 to 20 feet below the water surface and off the bottom (Johnson *et al.* 2005).

Response to Diminished Water Quality

The effects of elevated levels of suspended sediment and turbidity range from improved survival via reduced piscivorous predation, to physiological stress and reduced growth, resulting in reduced survival (Newcombe and Jensen 1996). In general, little sediment is released during vibratory pile installation. Fish near this activity are likely to experience brief, low-level amounts of sediment and exhibit responses (*i.e*., coughing, gill flaring, and temporary limitation in foraging) characterized as sub-lethal (Newcombe and Jensen 1996). Chronic exposure to turbid water can cause physiological stress responses that increase maintenance energy needs and reduce feeding and growth (Lloyd *et al.* 1987; Redding *et al.* 1987; Servizi and Martens 1991). In contrast, limited duration exposure to low intensity turbidity make these responses extremely unlikely.

Juvenile and adult salmonids exposed to elevated turbidity respond similarly, physiologically. Because the action will occur in relatively shallow water used by sub-yearling migrating juvenile salmonids, juveniles are more likely to be exposed in a way that will elicit adverse behavioral responses than yearling migrants and adults. Given the small area, quick dilution of the turbidity and the small number of ESA-listed salmonids likely to be present and exposed to elevated suspended sediment, only a few ESA-listed fish in the action area are likely to experience any of the beneficial or adverse effects caused by suspended solids as described above. Therefore, we find that only a very few juveniles will experience adverse consequences to their individual fitness.

Larger adult salmon readily respond by avoiding waters affected by suspended sediment to find refuge and/or passage conditions within unaffected adjacent areas. Studies show that salmonids are able to detect and distinguish turbidity and other water quality gradients (Bisson and Bilby 1982), and that larger salmonids are more tolerant to suspended sediment than smaller juveniles (Servizi and Martens 1991 and 1992). As salmonids grow and their swimming ability increases, their dependence on shallow nearshore habitat declines rapidly (Groot and Margolis 1991). Thus, to the extent that adults are exposed to turbidity generated by project activities, they are expected to respond by avoiding excessively turbid conditions and find passage within unaffected adjacent areas. Specifically, we expect these fish to avoid the small turbidity plume created by pile extraction and placement without experiencing adverse effects. Therefore, we find it unlikely that adults will experience reduced fitness.

Response to Sound Pressure Waves

Behavioral effects associated with vibratory hammer operation are temporary, and generally characterized by increased heart rate and elevated cortisol levels (Wysocki *et al.* 2006). We anticipate juvenile salmonids will respond to underwater noise created by vibratory hammer operation similarly to adults because the threshold for injury to juvenile fish will not be exceeded. A small number of sub-yearling migrants will be exposed to increased noise from pile driving and likely will temporarily leave the rearing habitat within the action area. However, their behavioral response to leave the action area, slightly increases risk of injury or death, likely through increased predation risk, and to a lesser extent metabolic cost. Due to the limited amount of time required for pile removal and installation and relative low intensity method used, very few fish are likely to be harassed by sound waves. Those that are exposed may experience reduced fitness due to energy constraints or predation.

Response to In- and Overwater Structures

Installation of the new gangway, landing and dock will add 740 sq/ft of overwater structure to the action area in the river nearshore. In addition, new piles will occupy 7.0 sq/ft of the bottom of the river. All of the overwater structures will be grated to enable some light transmission into the water column and to the river bottom. Decreased light transmission reduces benthic productivity, which in turn reduces the availability of certain forage items consumed by rearing and migrating salmonids in the action area, and 7.0 sq/ft occupied by new piles will produce no forage at all for the life of the structure.

Loss of benthic production by the addition of shade is biologically insignificant in the action area as forage items are likely plentiful. Furthermore, elevating the gangway, and placing the floating landing and floating dock in deep water will minimize the reduction of benthic productivity. The effects on benthic forage will persist as long as the structure remains in place. However, due to the small footprint, deep water positioning, and light penetration through the gangway structure the amount of benthic forage reduction caused by the proposed action's reduction in forage is not expected to be biologically meaningful to rearing juvenile salmonids.

Adult salmon and steelhead do not use invertebrates as their primary forage while moving upstream. The reduction in invertebrate forage related to shade and loss of habitat will have no appreciable effect on adult salmon and steelhead.

Response to Enhanced Piscivorous Predation Habitat

The gangway, landing and dock will extend a total 45 of feet water-ward from the mean high water mark, adding 740 sq/ft of new overwater structure in the near shore portion of the action area for the life of the structure. Because of the relative permanence of the structure in the action area, migrating juvenile salmonids will encounter the structure for the foreseeable future. Juvenile salmonids that encounter overwater structure typically respond by swimming around it (Kemp *et al.* 2005). Swimming around the float will lengthen their migratory pathway. Even minor adjustments to the migration route can be adverse, as it increases energetic expenditure, and encounter time with predators (Peterson and DeAngelis, 2000). Additionally, as described in more detail below, increased expression of energy can increase vulnerability to piscivorous predators and has been shown to be correlated with juvenile mortality (Anderson *et al.* 2005). Rearing juveniles also experience diminished habitat condition as the structure and shade reduced forage opportunity and displace the smaller juveniles from shallow rearing areas. Thus, to the extent in-water and overwater structures will modify migratory and rearing habitat for a period of decades, these structures will reduce the quality of the migratory corridor and the rearing habitat to some degree.

As mentioned above, in addition to the increased expression of energy that can accompany juvenile migration around structures that cross the shoreline into the water, the in-water and overwater structures will create areas of cover that slow water velocity and shade the water column. Both enhance habitat for the piscivorous northern pikeminnow, a known predator of out-migrating ESA listed salmon smolts.

As we did not find literature reporting on predation effects associated with docks within the Lower Columbia River, we assume that results from other areas of the Columbia River and laboratory studies provide a reasonable surrogate for the interpretation of predation related effects. In the Columbia River, outmigrating juvenile salmon are a seasonally important part of the diet of piscivorous predators including northern pikeminnow. Historically, pikeminnow accounted for 78 percent of total salmonid losses to piscivorous predation (Rieman *et al.*, 1991). In nearshore areas of the Columbia River, including four sampling sites below Bonneville dam, more than 84 percent of fish consumed by northern pikeminnow were juvenile salmonids, regardless of river reach and season (Zimmerman and Ward, 1999).

To determine the extent to which the proposed action will increase predation opportunity, and predict the extent to which predation will increased under the proposed action, NMFS used published, peer-reviewed and technical reports of field and laboratory studies to create a deterministic model (based on arithmetic relationships) that calculates the number of smolts expected to be consumed in the area the gangway, floating landing and floating dock will occupy in pre and post construction conditions. Pikeminnow predation predictions (expressed as a total number of smolts consumed) were generated using long-term (17 year) average abundance estimates, published, average consumption rates in proximity to the action area, and an exponential decay function which estimates the predation success of pikeminnow under varying light intensities. The conceptual model including equations, supporting material, calculations, and key assumptions are detailed in Appendix A. This analysis only predicts predation by pikeminnow associated with the overwater structure, although we assume similar predatory responses are occurring with other piscivorous predators utilizing the overwater structure including smallmouth and largemouth bass. Thus the model estimates are likely an underestimate of enhanced predation due to the proposed action.

We quantified the additional predation likely to occur from enhanced predator habitat under the structures caused by shading effects. Because the consumption rate of pikeminnow increases with decreasing light intensity (Petersen and Gadomski 1994), we varied the amount of light under the dock utilizing the percentage of light penetrating surface area of the over water structure. The gangway, floating landing and floating dock are to be constructed of 60 percent light penetrating materials, thus the amount of light reaching the water's surface is 40 percent less than without the proposed overwater structure.

The reduction in light reaching the water's surface will affect the amount of light penetration at depth where piscivorous predators and juvenile salmon interact. Lower light intensity conditions increase the consumption rate of pikeminnow (Petersen and Gadomski, 1994), thus we can expect more juveniles to be eaten by pikeminnow using the new overwater structure. This difference in consumption rate (number of juveniles/pikeminnow/day) multiplied out over the juvenile outmigration period is the number of extra juvenile salmon predated due to the enhancement of predatory habitat due to shading. Results of the model are presented in Table 3. Due to the enhanced predatory conditions under the overwater structure, we estimated that 3 additional juveniles (rounded to the nearest whole fish) will be consumed by pikeminnow per year. Light penetration is the most sensitive variable with respect to estimated predation (See Appendix A, Table A2), because of this sensitivity, we've presented alternative estimates of predation for both the gangway, landing and dock, in comparison to the proposed action's amount of light penetration in Table 3. The increased consumption per year of juvenile salmonids due to light penetration scenarios ranges from 1-15 (average = 6.3) for the new structure. Adding this range to the overwater structure effects, we find between 0 and 9 juveniles could be predated.

Additional scenarios which vary density and consumption rates of pikeminnow, in addition to light intensity can be found in Appendix A.

Table 3. Results predicting northern pikeminnow predation associated with the gangway, floating landing, and floating dock for the proposed action, and alternative scenarios which vary the amount of light penetration. This table includes rounding errors as consumption estimates were rounded to the nearest whole fish.

Scenario	Sq Footage	Light Penetration	Pike-minnow Density	Consumption of Juvenile Salmonids: Without New Structure		With New Structure		Difference	
				1 Year	40 Years	1 Year	40 Years	1 Year	40 Years
Proposed Action	740	60%	0.26	10	394	12	485	2	92
Less Light	740	10%	0.26	10	394	21	847	11	453
More Light	740	90%	0.26	10	394	10	412	0	19

Adult salmonids, even those returning to spawn after only 1 year in the ocean, are too large to be consumed by piscine predators that may utilize in-water and overwater structures associated with the proposed action. Therefore, we do not expect injury or death among adult fish from this habitat alteration. Adult salmonids tend to be more mid-channel oriented and migrate in deeper waters. Thus, the frequency that adults will encounter the structure and likelihood for adverse effects is low. We expect adult salmonids that do encounter the main float and pier structure will swim around and/or underneath the structure with little or no variation in migratory pathway. To the extent in-water and overwater structures will modify critical habitat for a period of decades, the presence of in-water and overwater structure will only slightly reduce the quality of the migratory corridor for adult salmonids. Placement of the boat house in deeper water, farther from the shoreline, will maintain a migration corridor on either side of the structure.

Response to Episodic Effects from Boating Activity as a Consequence of Dock Installation

During consultation, NMFS identified boat use near new proposed structure as activity consequence of the action. NMFS has found that although boat use is already common in the general vicinity of new docks, some level of increased boat use is always associated with the larger action of building those docks.

As described in the pile driving sections underwater sound is known to cause physiological stress to fish. Boating activity is another known cause of underwater sound. However, boating sound effects (starting, leaving and returning to the dock) are only expected intermittently for short periods (minutes), primarily during spring and summer when boating typically occurs. Fish that encounter boating noise will likely move away from the area. Because the intermittent nature of the disturbance and the ability for fish to move away when it occurs, we do not expect this effect to be meaningful to survival in adult or juvenile fish that encounter noise from recreational boating.

Effects on Eulachon

Adult eulachon ascend large tributaries of the CR such as the Cowlitz, Elochoman, Grays, Kalama, Lewis, Sandy, and others during late winter and spring (Gustafson *et al.* 2016). They produce millions, if not hundreds of millions of eulachon eggs with a sticky exterior covering that adheres to the substrate until larvae hatch and are rapidly transported downstream as free-floating drift (Parente and Snyder 1970; Smith and Saalfeld 1955). Eulachon larvae rapidly disperse throughout the water column and are widely distributed as they passively drift downstream (Howell and Uusitalo 2000).

Adult eulachon may return as early as late November (NMFS 2016a), but typically this occurs during March and April leaving most adult fish to arrive after cessation of the work window. We expect adult eulachon that are present within the action area will have a similar response to construction effects (i.e., suspended sediment, temporary decrease in benthic productivity, and underwater noise) as salmonids. Eulachon exposure to underwater noise and resulting effects will be similar to those of salmonids, and because they lack a swim bladder, eulachon are not as susceptible to barotrauma injury (Caltrans 2015). The effects of underwater noise exposure to eggs and larvae are not well documented (Caltrans 2015). We do not anticipate eulachon will be present in any significant numbers at this location in the LCR. If any are present, the short duration of vibratory hammer use and relatively low-intensity (sub-injurious) effects of this equipment are anticipated to be similar to those of juvenile salmonids. Therefore, we expect some exposed individuals to show reduced fitness due to energy constraints or predation.

In years of great abundance, large numbers of eulachon may return to the CR. Some of these individuals will migrate through the action area to access spawning sites in nearby watersheds such as the Sandy and Washougal rivers as well as along beaches up to Bonneville Dam. Therefore, some adult eulachon, including their eggs and larvae will be exposed to permanent habitat effects of the action. The action area is not identified as a spawning area, and if spawning did occur the elevated orientation of the ramp and gangway structure should not restrict access to this area for either spawning or migration. Larval eulachon migrate through the LCR as passive drift the proposed action and will not be affected in their downstream migration. Adult eulachon are likely to respond to permanent habitat effects similarly to adult salmonids, by a slight adjustment in their migration pathway. Adult eulachon are typically 6-8 inches in length (NMFS 2017a), which is beyond the gape limit of all but the largest piscine predators in the LCR. Thus, we do not anticipate eulachon to be subjected to predation as the result of the action.

Effects on Southern DPS Green Sturgeon

Green sturgeon are likely to be present within the action area during pile installation, and will respond to sound effects similarly to salmon discussed above. However, green sturgeon are typically found in turbid conditions and forage in the benthos by stirring up the sediment to access benthic prey such as burrowing shrimp and are thus relatively tolerant of higher suspended sediment concentrations. In the event that green sturgeon encounter the turbidity plume and elevated suspended sediment associated with pile driving the effects do not classify as take. This conclusion is supported further by recent results in the closely related Atlantic sturgeon, wherein juveniles were experimentally exposed to 100, 250 or 500 mg/L TSS for three consecutive days and found to exhibit no significant effects on survival or swimming performance even while prevented from seeking cleaner waters in the tests (Wilkens et al. 2015).

As described above decreased light transmission reduces benthic productivity, which in turn reduces the availability of certain forage items consumed by rearing and migrating salmonids in the action area, and 7.0 sq/ft occupied by new piles will produce no forage at all for the life of the structure. Loss of benthic production by the addition of shade is biologically insignificant in the action area as forage items are otherwise already plentiful there. Furthermore, elevating the pier over shallow water will minimize the reduction of benthic productivity. The effects on benthic forage will persist as long as the structure remains in place.

In summary, the temporary sound effects and permanent loss of benthic habitat associated with pile installation, are short in duration and low magnitude respectively. Therefore, we find that these effects will not reduce the fitness of green sturgeon that occupy the action area.

2.6 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

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

The action area for this project is a half mile radius of the river at RM 39.5 where noise spreading from pile driving is reasonably certain to occur.

In contrast, NMFS is unaware of specific, future non-Federal actions reasonably certain to occur in the action area. However, the action area is reasonably certain to continue to experience the influence of the on-going and future activities that will be caused by anthropogenic growth and development. NMFS considers human population growth and associated development to be one of the main drivers for future negative effects on ESA listed salmonids and their habitat. While non-federal parties are also developing and implementing restoration projects and best management practices for development and resource extraction, these are ameliorating rather than offsetting impacts of development, and even when contemporaneous, are mitigation and restoration benefits are outpaced by the development impacts.

The collective effects of these future activities will tend to be expressed most strongly in lower river systems where the impacts of numerous upstream land management actions aggregate to influence natural habitat processes and water quality. As such, these effects accrue within this action area, though most are generated from actions upstream of the action area.

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

2.7 Integration and Synthesis

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

Considering the status of the ESA-listed species, all but two of the species considered in this opinion are listed as threatened, and two, UCR spring Chinook salmon and SR sockeye salmon, are listed as endangered. Most of the component populations of LCR Chinook salmon, UCR spring-run Chinook salmon, SR spring/summer run Chinook salmon, SR fall-run Chinook salmon, chum salmon, LCR coho salmon, SR sockeye salmon, LCR steelhead, MCR steelhead, UCR steelhead, SRB steelhead, and eulachon are at a low level of persistence. All individuals from populations of the listed species are likely to move through the action area at some point during their life history.

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

Within this context, the proposed action will create a brief physical disturbance in the water column will create noise and turbidity, as well as the placement of in-water and overwater structure that will modify fish migration and provide habitat for piscine predators, and reduce the production of benthic food items. The modified in-water structure and its disruption of rearing and migration values, including enhanced predator habitat, will persist for a period of decades. These habitat alterations will displace a small number of adult and juvenile fish as they migrate around the float structures. A relatively large number of juvenile fish migrating near the structure may be consumed by piscine predators using the piles, gangway, floating landing and floating dock as refugia and foraging habitat. Rearing conditions are slightly impaired by the structure, but fish may benefit slightly from improvements in shoreline habitat associated with the upstream pile removal.

The last element in the integration of effects includes a consideration of the cumulative effects anticipated in the action area. Primarily, the recovery of aquatic habitat from the degraded baseline conditions is likely to be slow in most of the action area, and cumulative effects (from continued or increasing uses of the action area) are likely to have a negative impact on habitat conditions, which in turn may cause negative pressure on population abundance trends in the future. Moreover, when we consider the design life of the structure (roughly 40 years), we anticipate that the effects of climate change will continue to impair habitat conditions in the action area, most notably, water temperature, and dissolved oxygen.

However, even when we consider the current status of the threatened and endangered fish populations and degraded environmental baseline within the action area, even when considered over the life of the project, together with the effects of increased recreational boat traffic, the effects of the proposed action on the abundance of fish[1] is insufficient by itself to affect the distribution, diversity, or productivity of any of the component populations of the ESA-listed species at a measurable level, nor further degrade baseline conditions or limiting factors to a degree that discernibly affects the conservation value of the action area. The effects of the action will be too minor to have a measurable impact on the affected populations because no particular population is expected to experience a greater proportion of the negative effects on abundance. Because the proposed action will not reduce the productivity, spatial structure, abundance, or diversity of the affected populations, the action, when combined with a degraded environmental baseline and additional pressure from cumulative effects, will not appreciably affect any of the listed species considered in this opinion.

Critical habitat throughout the range of these species is ranked at the watershed scale. While the portion of critical habitat in which the action area is located has suffered environmental degradation to some or all PBFs in varying degrees the LCR portion of critical habitat was rated as having medium to high conservation value due to the importance of the role those watersheds serve for the species' life cycle. As such, effects on critical habitat at the action area level have to be reviewed with an eye toward determining whether those effects will alter the conservation role of critical habitat at that scale.

In the context of the status of critical habitat and the specific baseline conditions of PBFs in the action area, the proposed action will add a slight obstruction to the migratory corridor, temporarily reduce water quality, and reduce some benthic forage, it will not reduce cover, remove riparian vegetation, alter flows, destabilize the channel or change its characteristics, or alter water temperature. When considering the cumulative effects of non-federal actions, recovery of aquatic habitat is likely to be slow in most of the action area and cumulative effects from basin-wide activities are likely to have a neutral to negative impact on the quality of critical habitat PBFs at the watershed scale.

As a whole, the critical habitat for migration and rearing is functioning under the current environmental baseline in the action area. Given that the proposed action will have a highly-localized, low-level effect on the PBFs for migration, rearing, (and spawning of eulachon), even when considered as an addition to the environmental baseline conditions, the proposed action is not likely to reduce the conservation value of critical habitat for the any species considered in this consultation.

2.8 Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of or destroy or adversely modify designated critical habitat of any of the ESA-listed species considered in this opinion.

[1] Based on the analysis in section 2.5.2 of the opinion, NMFS conservatively estimated the maximum number of juvenile salmonids of all listed ESUs that would likely experience predation by pikeminnows for the decades that over water structure will remain in place. Increased action-related piscivorous predation would occur as a result of predatory fish using the structure as ambush cover, and shading effects that increase the predatory efficiency of pikeminnows. We estimated a conservative maximum annual estimate of 2 smolts per year.

2.9 Incidental Take Statement

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

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

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take in the form of harm is reasonably certain to occur from sound and turbidity during the installation of the single use dock and the addition of overwater structure enhancing habitat and opportunity for piscivorous fish that feed on juvenile salmonids. Based on our current understanding of effects of these structures, and site specific conditions, despite the determined estimate of annual take for the purposes of the jeopardy analysis it is not feasible to monitor and document the actual number of juvenile salmonids that will be predated by piscivorous fishes occupying the area under the float either annually, nor over the decades the structure is anticipated to remain in place. In such circumstance we provide an “extent of take” which documents in an observable manner an area in which take is expected to occur consequential to the habitat effects of the proposed action. In this case, the extent of take is harm associated with the installation, presence, and use of in-water and overwater structure.

Take associated with sound and turbidity associated with the installation and use of in-and overwater structure:

- Sound and turbidity one half mile upstream and one half mile downstream of RM 39.5, during installation/removal of piles, and for the life of the structure through normal boating activity.

Take in the form of harm associated with the presence and use of in and overwater structure, for a duration of 40 years of:

- Five 16- inch diameter steel piles;
- 170 sq/ft (34-ft long and 5-ft wide) fixed pier with 60 percent light penetrating surface;
- 160 sq/ft (40-ft long by 4-ft wide) gangway with 60 percent light penetrating surface;
- 320 sq/ft (40-ft long by 8-ft wide) floating dock with 60 percent light penetrating surface;
    - For a total of 740 sq/ft of overwater coverage, and 7 sq/ft of lost benthos to piles.

The take represented by this estimate is equivalent to the maximum amount of take considered in our jeopardy analysis. Therefore, if exceeded, reinitiation of consultation will be required. This surrogate will function as an effective reinitiation trigger because, unlike the actual number of salmon lost to predation, the area of overwater structure can be measured.

2.9.2 Effect of the Take

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

2.9.3 Reasonable and Prudent Measures

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

1. Minimize take from sound and turbidity associated with pile installation/removal.
2. Minimize take from piscine predation.
3. Minimize take from impacts to migratory and rearing habitat.
4. Ensure completion of a reporting form to confirm that the take exemption for the proposed action is not exceeded, and that the terms and conditions in this incidental take statement are effective in minimizing incidental take.

2.9.4 Terms and Conditions

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

1. To minimize take from sound and turbidity associated with pile installation/removal, the USACE shall:
    a. Ensure pile installation/removal occurs from November – February
    b. Confirm the installed piles do not exceed 16-inches in diameter

2. To minimize take from piscine predation, the USACE shall:
   a. Confirm that the finished design does not exceed the following dimensions:
      i. The fixed pier is no more than 170 sq/ft
      ii. The gangways is no more than 160 sq/ft
      iii. The floating dock is no more than 320 sq/ft

3. To minimize take from effects on migratory and rearing habitat the USACE by ensuring:
   a. All overwater structure (gangway, fixed pier and dock) are constructed of materials allowing 60 percent light penetration.

4. To provide a completion report within 60 days of the close of any work window, that includes:
   a. A discussion of implementation of the terms and conditions in #1, and #2 above.
   b. Any exceedance of take covered by this opinion.
      Submit monitoring reports to:
      National Marine Fisheries Service
      Attn:WCR-2019-03654
      510 Desmond Drive SE, Suite 103
      Lacey, WA 98503
      or electronically to: Joshua.Ashline@noaa.gov

2.10 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

NMFS would like to include the following discretionary recommendations within this biological opinion which support Section 7(a)(1) of the ESA, which identify and implement habitat enhancement or restoration activities within the Lower Columbia River:

1. Increase the amount of shallow-water habitat to benefit ESA-listed species.
2. Restore, or create off-channel habitat or access to off-channel habitat, side channels, alcoves, wetlands, and floodplains.
3. Remove derelict docks and pilings that are no longer in use.
4. Protect and restore riparian areas to improve water quality.
5. Improve or regrade and revegetate degraded streambanks.
6. Restore instream habitat complexity.
7. Remove invasive plant species from riparian, and upland vegetation communities, and replant with native species.

Please notify NMFS if USACE carries out any of the previously described recommendations so that we will be kept informed of the actions that are intended to improve the conservation and recovery of ESA-listed species and/or their designated critical habitats.

2.11 Reinitiation of Consultation

This concludes formal consultation for Stevens Single Use Dock Installation.

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

2.12 "Not Likely to Adversely Affect" Determinations

Southern Resident (SR) Killer Whale. Southern Resident killer whales spend considerable time in the Georgia Basin from late spring to early autumn, with concentrated activity in the inland waters of Washington State around the San Juan Islands, and typically move south into Puget Sound in early autumn (NMFS 2008). Pods make frequent trips to the outer coast during this season. In the winter and early spring, SR killer whales move into the coastal waters along the outer coast from the Queen Charlotte Islands south to central California, including coastal Oregon and off the Columbia River although they do not have critical habitat designated in Oregon (NMFS 2008).

SR killer whales have been documented in the Columbia River plume (Zamon *et al.* 2007). SR killer whales primarily eat salmon and prefer Chinook salmon (Hanson et al 2010; NMFS 2008). The proposed program may affect the quantity of their preferred prey, Chinook salmon. Any salmonid take including Chinook salmon up to the aforementioned amount and extent of take would result in an insignificant reduction in adult equivalent prey resources for SR killer whales that may intercept these species within their range and therefore we find that the action may affect, but is not likely to adversely affect.

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

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. 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 USACE and descriptions of EFH for, Pacific Coast salmon (PFMC 2014); contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1 Essential Fish Habitat Affected by the Project

The proposed action and action area for this consultation are described in the Introduction to this document. The action area includes areas designated as EFH for various life-history stages of Chinook and coho salmon as identified in the Fishery Management Plan for Pacific coast salmon (PFMC 2014).

3.2 Adverse Effects on Essential Fish Habitat

Based on information provided by USACE and the analysis of effects presented in the ESA portion of this document, NMFS concludes that proposed action will have adverse effects on EFH designated for Chinook and coho salmon. These effects include a temporary reduction in water quality from increased suspended sediment and associated contaminants, as well as acoustic impacts from pile installation and removal, shading impacts from the refurbished boat house, and a short-term loss of benthic invertebrates due to sediment disturbance. These effects are described in more detail in section 2 of this document, above.

3.3 Essential Fish Habitat Conservation Recommendations

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

1. To minimize enhancements of predatory fish habitat for piscine predation, USACE should:
   a. Confirm that the finished design does not exceed the following dimensions:
      i. The fixed pier is no more than 170 sq/ft
      ii. The gangway is no more than 160 sq/ft
      iii. The floating dock is no more than 320 sq/ft
      iv. Piles don't exceed 16-inches diameter
   b. Ensure that all overwater structures (i.e. gangway, fixed pier , and dock) will provide at least 60 percent light penetration.

2. Minimize effects on migratory and rearing habitat the USACE by ensuring:
   a. All overwater structures (i.e. gangway, landing and dock), consist of materials that allow for 60 percent light penetration.

3. The USACE should recommend that the applicant identify and implement habitat enhancement or restoration activities in the Lower Columbia River, as detailed within the

Conservation Recommendations section (Section 2.10) in the ESA portion of this consultation.

3.4 Statutory Response Requirement

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

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

3.5 Supplemental Consultation

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

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

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

4.1 Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are USACE – Seattle Districe. Other interested users could include the Steven's family and Grette Associates LLC. Individual copies of this opinion were provided to the USACE. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

4.2 Integrity

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

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 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 reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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6. APPENDIX A

Background

As we did not find literature reporting on predation effects associated with docks within the Lower Columbia River, we assume that empirical predation results from other areas of the Columbia River and laboratory studies provide a reasonable surrogate for the interpretation of predation related effects. In the Columbia River, out-migrating juvenile salmon are a seasonally important part of the diet of piscivorous predators including northern pikeminnow and smallmouth bass. Historically, pikeminnow accounted for approximately 78 percent of total salmonid losses to piscivorous predation in the Columbia River (Rieman *et al.*, 1991). In nearshore areas of the Columbia River, including four sampling sites below Bonneville dam, more than 84 percent of fish consumed by pikeminnow were juvenile salmonids, regardless of river reach and season (Zimmerman and Ward, 1999).

We utilized published peer-reviewed and technical reports of field and laboratory studies to predict likely predation of ESA-listed salmonid smolts, with and without the new, proposed structures. Pikeminnow predation predictions (expressed as a total number of juveniles consumed from April-August) were generated using calculated average abundances over a 17 year duration (Williams *et al.* 2018), calculated consumption rates based upon published consumption indexes in proximity to the action area (reported as an average [Friesen and Ward, 1999, Appendix, Williams *et al.* 2018]), and an exponential decay function published by Petersen and Gadomski (1994) which predicts the predation success of pikeminnow under varying light intensities. Key assumptions are presented in Table A1 and the conceptual model including equations, supporting material, and calculations are described below:

Table A1. Assumptions of the predation model, identifying which variable is influenced by the assumption.

Assumption	Variable(s) Influenced
1. Habitat is uniformly occupied by northern pikeminnow, and not limited by water velocity	Density
2. Pikeminnow age classes are randomly dispersed	Density, Consumption
3. Pikeminnow consumption is equal across habitats and age classes	Consumption
4. Prey (juvenile salmon smolts) are equally available to all predators	Consumption
5. Turbidity is constant throughout the outmigration	Light Intensity
6. Water stage height is constant throughout the outmigration	Light Intensity
7. Dock shading effects are only realized on sunny days	Light Intensity
8. Structures with no light penetration are assumed to have 1 percent light penetration	Light Intensity

Northern Pikeminnow Abundance Estimate

Published abundance estimates for pikeminnow within the Columbia River are outdated, and were estimated prior to the implementation of the pikeminnow sport fishery reward program (Beamesderfer *et al.*, 1996, Zimmerman and Ward, 1999). The purpose of this reward program is to remove pikeminnows in size classes known to predate juvenile salmoinds (>200mm; TL), during juvenile salmon outmigration. Removal of pikeminnows increases the outmigration survival probability of juvenile salmonids. Using exploitation data published by the pikeminnow reward program (Annual Reports from 2000-2017; http://www.pikeminnow.org/project-reports-2/annual-reports), it was possible to estimate an average abundance of pikeminnow occupying Columbia River below Bonneville Dam from 2000-2017 ($\bar{x}$ = 586,278, sd= 197,141, range 305,034-997,869), using the following equation:

$$\frac{[\sum_{i}^{2017} NH_i/ER_i]}{2017 - i}$$

Where:

NH= number of pikeminnows harvested Below Bonneville Dam in year i
ER= exploitation rate (expressed as a decimal percent) of pikeminnow in year i

Northern Pikeminnow Habitat Availability and Density

The 17 year average abundance estimate (calculated above) was used to calculate a density of northern pikeminnow (pikeminnow/square meter), occupying the shallow water habitats of the Columbia River below Bonneville Dam. For this analysis shallow shoreline habitats were defined as aquatic habitat with depths ranging from 0.5 - 13m, as pike minnows are rarely found in depths outside that range (Ward *et al*. 1995). Pikeminnow density was utilized within this effects analysis to estimate how many pikeminnows would associate with the shaded area under the proposed dock. Spatial analysis techniques were utilized within ArcGIS (Version 10.5.1; ESRI 2011), to calculate the total amount of aquatic habitat with depths ranging from 0.5-13m. The Lower Columbia Digital Terrain Model was acquired from the Lower Columbia Estuary Partnership (estuarypartnership.org), this bathymetric model of the lower Columbia River, is the best available depth profile, incorporating NOAA acoustic multi-beam sonar, bathymetric surveys from 2008-2009, US Army Corps of Engineers crossline and channel bathymetric surveys from 2000-2009, and topographical LiDAR surveys from 2009-2010, and Lower Columbia Estuary Partnership shallow water bathymetric surveys from 2009-2010. This raster dataset is high resolution with $1m^2$ grid cells, and can be seen in Figure A1. Preferred pikeminnow depths (0.5-13m) were extracted from the bathymetric dataset to determine that $153,442,900m^2$ of available pikeminnow habitat is below the Bonneville Dam as displayed in Figure A2, which results in a density of 0.0038 pikeminnow per square meter of habitat.

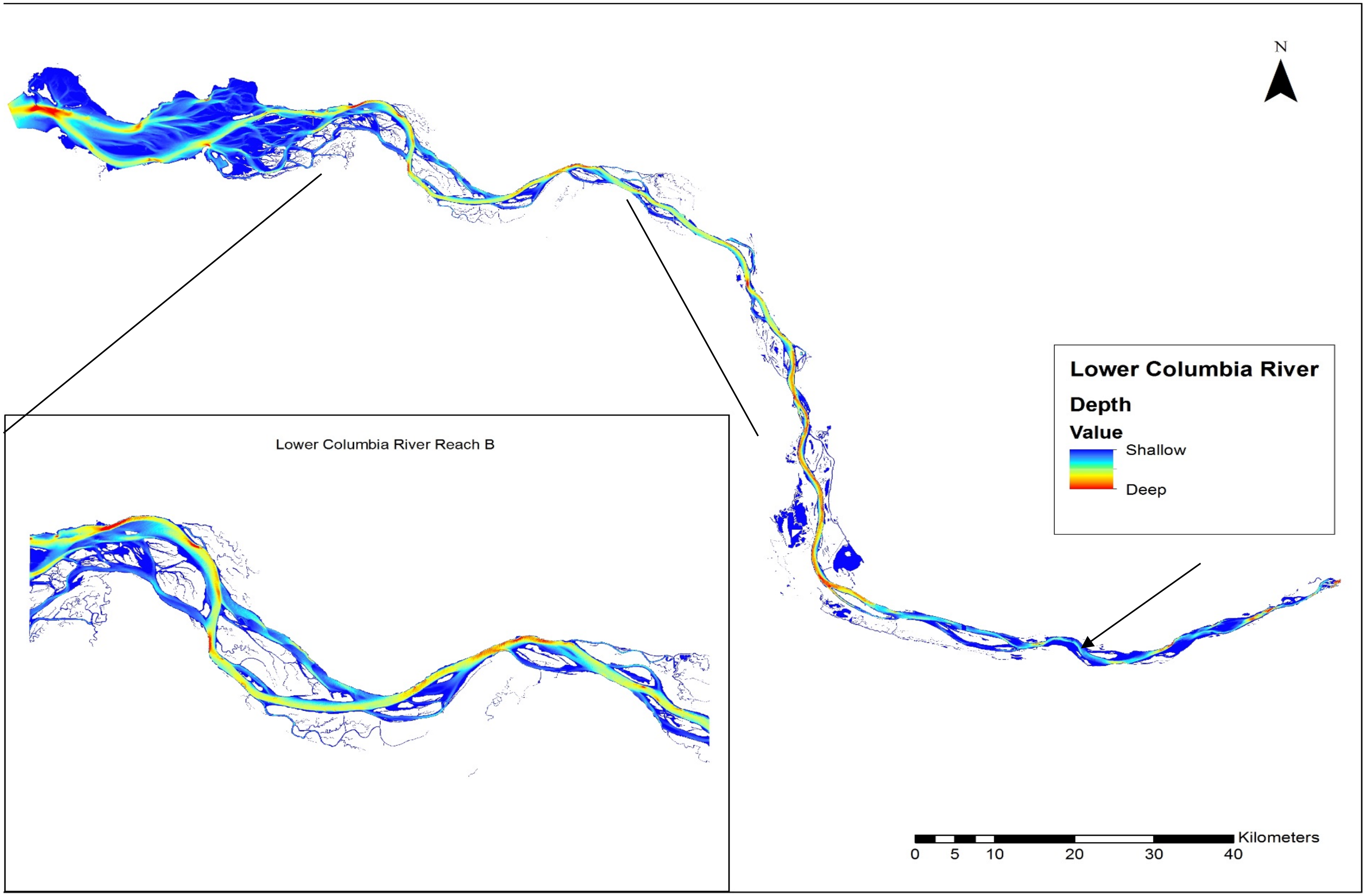

Figure A1. High resolution bathymetric map of the lower Columbia River used to calculate available pikeminnow habitat based upon known depth preferences. Reach B is emphasized for clarity, and because it's the lowest reach in the lower Columbia River with known pikeminnow presence due to saltwater inundation. Arrow points to location of action.

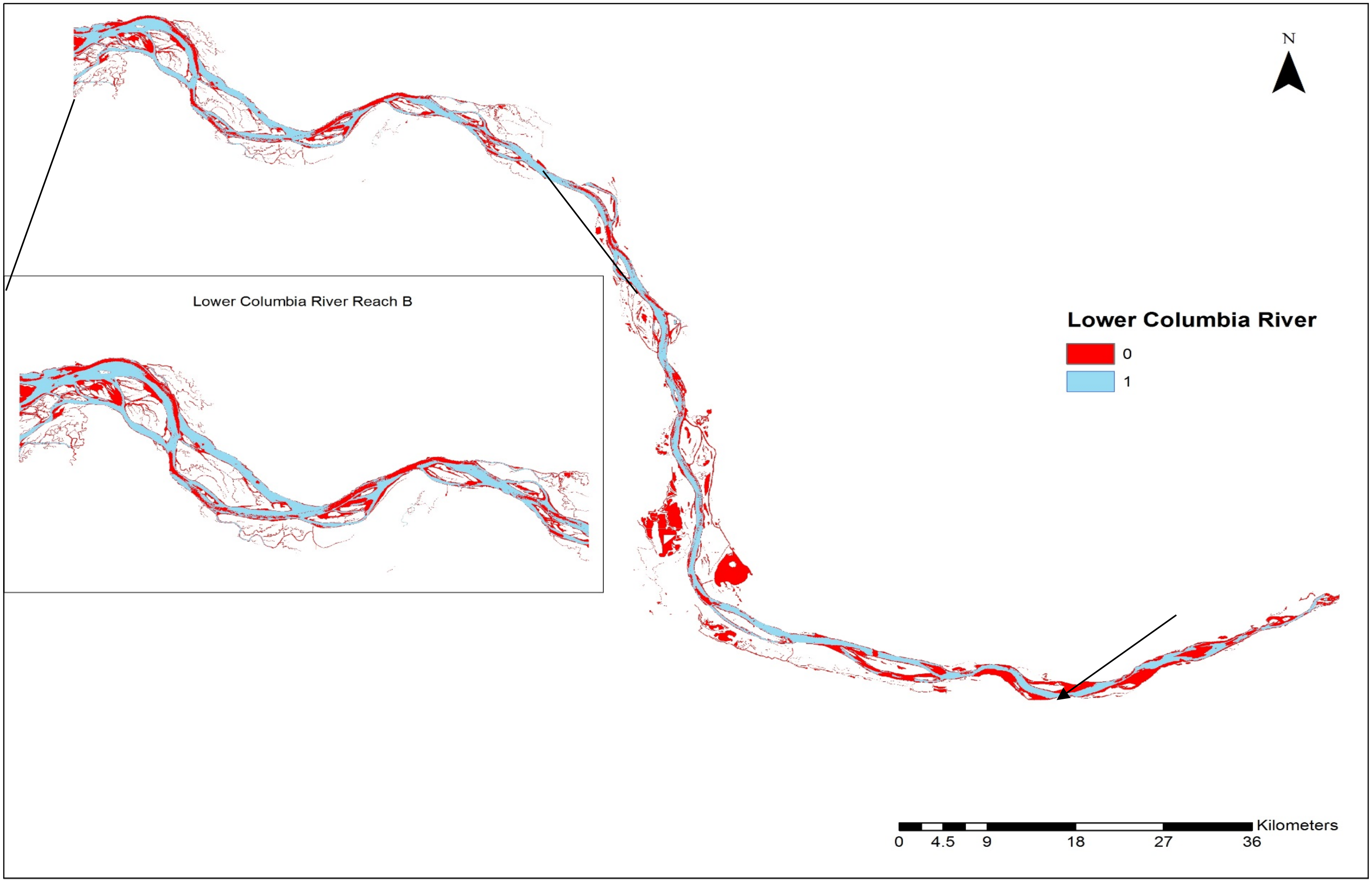

Figure A2. Habitat suitability map for northern pikeminnow in the lower Columbia River. Values of zero (red) represent areas that are either too shallow or too deep to be occupied by pike minnow, values of one (blue) are suitable habitats based solely upon depth. Arrow points to location of action.

Pikeminnow Consumption Index and Light Intensity Related Consumption

To estimate the average number of juvenile salmonids that could be consumed by pikeminnow we used recently published consumption index values (Williams *et al.* 2018) to calculate a mean consumption index (1.152) of northern pikeminnow in closest proximity to the action area, as consumption rates can vary by location (Zimmerman and Ward, 1999). To convert the mean consumption index to a consumption rate related to this project we used the relationship: consumption = -0.077+0.618 * Consumption Index [CI] (Friesen and Ward, 1999, Appendix). Thus, we calculated the consumption rate (CR) of 0.6349 juvenile salmon per pikeminnow per day across the April-August outmigration period.

Predation is, in part, regulated by light intensity, as foraging in aquatic habitats often involves light-mediated mechanisms whereby fish are able to identify and respond appropriately to prey and predator encounters. Petersen and Gadomski (1994) found the rate of predation by northern pikeminnow on subyearling Chinook salmon was inversely related to light intensity in laboratory studies, and five times more salmon were eaten in the darker than in the lighter conditions. Results of the model presented by Petersen and Gadomski (1994) were expressed as an exponential decay function predicting the number of juvenile salmon eaten over 4 hours under varying light intensity by northern pikeminnow. The exponential decay function published by Petersen and Gadomski is as follows and can be viewed graphically in Figure A3:

$$PE = 0.144 * \ e^{-0.61*\ln(LI)}$$

Where:
PE = prey eaten
LI = light intensity

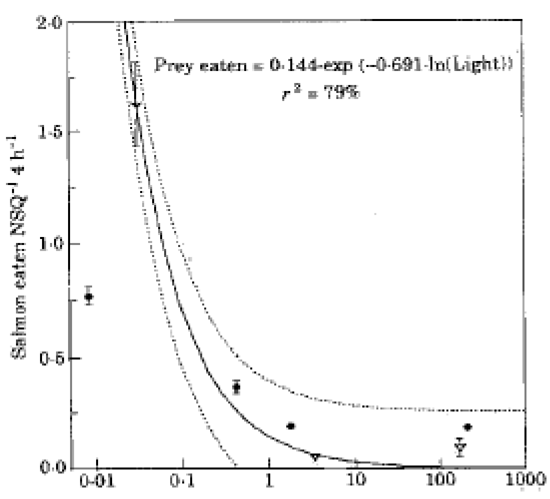

Figure A3. Exponential decay function from Petersen and Gadomski (1994)

Using the exponential decay function described above, the model input of LI, was varied by calculating the reduction in light intensity under the proposed dock when compared to the same area with no dock. By varying LI it was possible to calculate the difference in juvenile salmon predation success with and without the proposed structures. This difference was transformed to reflect consumption by pikeminnow over 24 hours as the decay function was calculated for 4 hour predation windows, the transformed consumption was then added to the consumption rate of pikeminnow within the action area. Reduction in light intensity due to shading under the dock was calculated using a standard light annulation in water equation expressed below:

$$I_z = I_0 e^{-(Kw+Kp)z}$$

Where:

I_z = Light intensity at depth z
I_o = Light intensity at surface
K_w= Light extinction do to water scatter
K_p= Light extinction due to dissolved particles (e.g. turbidity)

To calculate the difference with and without the proposed structures we varied I_o in the above equation, while keeping all other variables constant. To do so we assumed that the light intensity at the water surface under the dock would be a function of the amount of sunlight able to penetrate the docks surface. If the proposed dock is to be constructed of 60 percent light penetrating materials, thus the light intensity at the surface under the dock would be 60 percent of that at base line, thus a 40 percent reduction in light intensity. Using the calculated light intensity values at depth with and without the proposed structure, as the LI variable within the exponential decay function described above we could determine the difference in predated juvenile salmon between conditions.

We assumed that reduced light intensity will only be significant on sunny days, and shading effects would be negligible on cloudy days. Historical NOAA climate data from the last 30 years (http://w2.weather.gov/climate/xmacis.php?wfo=pqr) from Portland, Oregon located 10 river miles downstream of the action area reports and average of 1,417 sun hours during the months of April-August. Dividing the total number of sun hours by 24 hours we calculated the number of "sun days" (59), likely to occur within the action area during juvenile salmon outmigration, which would be equivalent to the number of days the shading effects of the dock will increase the predation efficiency of pikeminnow.

Finally to calculate the difference in predation by pike minnow under the proposed structure due to shading the following equation was used:

$$PI_i = D(CR + LIP_i) * SD - (D * CR) * SD$$

Where:
PI_i = Predation increase under structure i
CR= Pikeminnow consumption rate
LIP_i = Light related increased predation under structure i
D= Density of pikeminnow associated with area of structure
SD= Sun days

Density and consumption rates were consistent on both sides of the equation, as predation of juvenile salmon was assumed to occur in the action area regardless of the structure being present or not. However, the reduced light intensity increase in consumption rate was added to the consumption rate of pikeminnow to estimate the additional number of smolts predated by pikeminnow due to better foraging conditions created by the shading of the dock. Assuming the structure has a life of 40 years, a total amount of increased predation can be calculated.

Finally to highlight the sensitivity of the variables utilized to estimate predation losses. We varied one or a combination of density, consumption, and light intensity to identify which variable was the most sensitive resulting in greater predation losses. As shown in Table A2 light intensity is the most sensitive followed by density, consumption is the least sensitive.

Table A2. Predation differences highlighting variable sensitivity of density, consumption rate, and light intensity values. All were calculated for a 1000 sq/ft structure in 3meters of water with a constant turbidity value of 1.2 NTU. Mean values for density and consumption are calculated means presented above.

Scenario	Density	Consumption	Light Intensity	Structure Present		Difference
				No	Yes	
Mean	0.004	0.635	0.5	13	18	5
Density Low	0.002	0.635	0.5	7	9	2
Density High	0.008	0.635	0.5	26	35	9
Consumption Low	0.004	0.317	0.5	7	11	4
Consumption High	0.004	1.270	0.5	27	31	4
Light Intensity Reduction Low	0.004	0.635	0.9	13	14	1
Light Intensity Reduction High	0.004	0.635	0.1	13	29	16
All Low	0.002	0.317	0.9	3	4	1
All High	0.008	1.270	0.1	53	83	30

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