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-2022-01719

November 22, 2023

Todd Tillinger
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Seattle District
4735 East Marginal Way South, Bldg. 1202
Seattle, Washington 98134-2388

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Glaser Shellfish Farm After-the-Fact Project (NWS-2019-00388-AQ)

Dear Mr. Tillinger:

Thank you for your letter of March 28, 2022, 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 issuance of permits for the Glaser Shellfish Farm After-the-Fact Project.

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 (16 U.S.C. 1855(b)) for this action.

In this document, the NMFS concludes that the proposed action would adversely affect but is not likely to jeopardize the continued existence of Puget Sound (PS) Chinook salmon *(Oncorhynchus tshawytscha*), PS steelhead (*O. mykiss*), and PS/Georgia Basin (GB) bocaccio rockfish (*S. paucispinis*). The NMFS also concludes that the proposed action is likely to adversely affect critical habitat for PS Chinook salmon and PS/GB bocaccio rockfish but is not likely to result in the destruction or adverse modification of their designated critical habitat.

This document also includes the results of our analysis of the proposed action's likely effects on essential fish habitat (EFH) pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and includes two conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH.

Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to NMFS within 30 days after receiving our final 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 statutorily required reply to us regarding the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

Please contact Maria Pazandak, Central Puget Sound Branch, maria.pazandak@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
Tristan Carlson, Authorized Agent for Applicant

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

Glaser Shellfish Farm After-the-Fact Project
(NWS-2019-00388-AQ)

NMFS Consultation Number: WCRO-2022-01719

Action Agency: US Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Puget Sound steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	NA	No
Puget Sound Chinook (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Bocaccio rockfish (*Sebastes paucispinus*) (Georgia Basin)	Endangered	Yes	No	Yes	No
PS/GB Yelloweye rockfish (*S. ruberrimus*)	Threatened	No	No	NA	No
Southern Resident Killer Whale (*Orcinus Orca*)	Endangered	No	No	No	No

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

Consultation Conducted By: National Marine Fisheries Service
West Coast Region

Issued By:

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

Date: November 22, 2023

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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 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR part 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 at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Oregon-Washington Coastal Office.

1.2 Consultation History

On July 14, 2022, the NMFS received a consultation request from the USACE for the Glaser Shellfish Farm after-the-fact project. On August 18, 2022 the NMFS requested additional information from the Corps to clarify what was included in the proposed action. On October 12, 2022, the NMFS received a response from the USACE. On January 30, 2023, the USACE requested an update regarding consultation initiation and the NMFS responded on February 1, 2023 stating they would continue to review project details. On March 27, 2023, NMFS requested the Corps and the applicant clarify specific details of the proposed action and the portions of the action that had already been conducted. The Corps and the applicant responded on April 2, 2023. NMFS determined it had all of the necessary information and initiated consultation on July 11, 2023.

The USACE indicated in their consultation request that effects on Southern Resident killer whale were Not Likely to Adversely Affect. NMFS rationale for our concurrence can be found in Section 2.9.

The USACE also indicated that there would be No Effect to PS/GB yelloweye rockfish and their critical habitat, PS steelhead critical habitat, and Southern Resident killer whale critical habitat.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019

Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

1.3 Proposed Federal Action

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

Under the MSA, "Federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal agency (see 50 CFR 600.910).

The Corps is proposing to permit, under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, the placement of gravel and cultivation and harvest of Pacific oysters (*Crassostrea gigas*), Kumamoto oysters (*C. sikamea*), Belon oysters (*Ostrea edulis*), Olympia oysters (*Ostrea lurida*), Virginica oysters (*Crassostrea virginica*), and Manila clams (*Venerupis philippinarum*) for commercial harvest on intertidal tideflats in Case Inlet, Puget Sound, Washington. The Corps is also proposing to permit the retention of structures placed 2019 (beach nourishment placement and the installation of parking curbs). The farm is approximately .626 acres, located between +7 feet and -4 feet relative to MLLW (Figure 1).

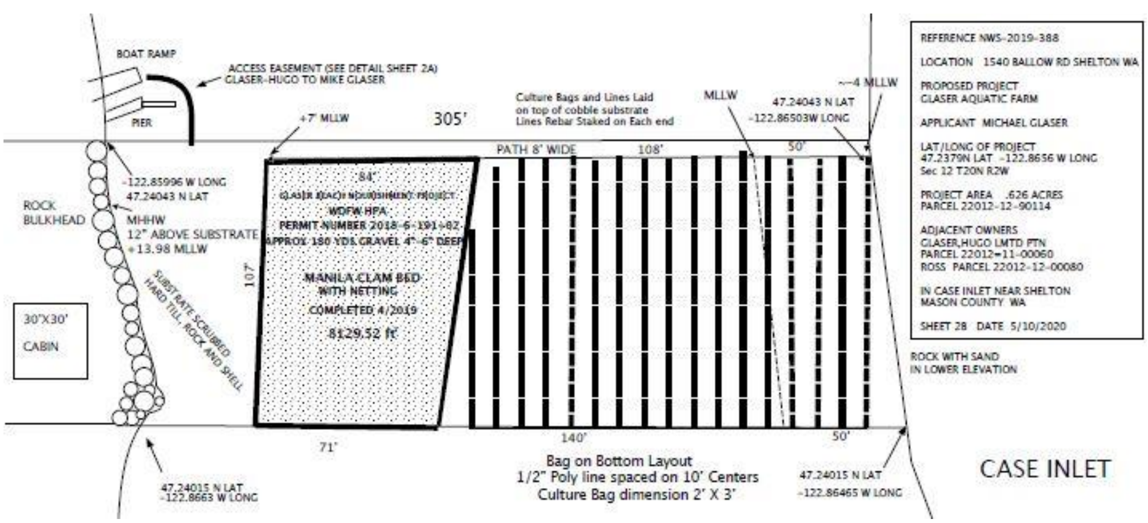

Figure 1. Illustration of Glaser Aquatic Farm layout

After-the-Fact/Completed Activity

<u>Bed preparation:</u>
In 2019, the applicant placed approximately 180 cubic yards of beach nourishment between +4 and +7 MLLW tidal elevations across 8,200 square feet. This activity resulted in a 4-6 inch increase of substrate within the area and was completed in compliance with an HPA issued by WDFW. A chute from above MHHW transported washed pea gravel to the project area in the dry during one tidal cycle. The gravel was said to have been placed due to local conditions and sediment dynamics causing erosion within the project area.

<u>Curb placement:</u>
Following the fill placement, the applicant placed 63 parking curbs (72 in. Length x 8 in. Width x 6 in. Height) around the perimeter of the fill to hold it in place (Figure 2). It took one week to install the curbs with minor maintenance conducted following weather events. This action was completed without a USACE permit and the installation of new berms (e.g. concrete curbing) is an activity that is excluded from the Programmatic Biological Opinion for Shellfish Activities in Washington State Marine Waters (WCR-2014-1502).

Figure 2. Image of curbs and anti-predator netting previously installed

Proposed New Activity:

<u>Bed preparation:</u>
The applicant is proposing to place no more than 1 inch of clean pea gravel, an action also referred to as "frosting" or "graveling," across 8,200 square feet approximately every 2-3 years.

Gravel would be placed using a small farm tractor, shovel casted over the proposed area at low tide, and would be completed in accordance with the Best Management Practices as identified in the shellfish programmatic Biological Opinion (WCR-2014-1052).

Curb maintenance:

The applicant is proposing to retain and maintain the 63 parking curbs that were previously placed in 2019. Maintenance is anticipated to occur following storm events, and the applicant does not expect that any damage would occur to the curbs that would require them to be replaced over the duration of the permit.

Clam Culture:

Manila clam seed would be broadcasted by hand at low tide, on an incoming tide when water depth is approximately 4 inches, or broadcasted by boat during an outgoing tide, resulting in a density of approximately 120 clam seed per square foot. Following dispersal, the area would be covered with an anti-predator net area and staked with rebar approximately every 5 feet.

Once clams reach market size, approximately after 2 years, they would be harvested manually at low tide using hand tools such as a rake. Prior to harvest, bed boundaries would be staked and anti-predator nets were folded back. After clams were harvested, they were transported to an upland facility either by hand-pulled carts or by a small rubber-tired vehicle with a trailer.

Oyster Culture:

Oyster seed would be placed in 2-foot by 3-foot mesh plastic bags for grow-out. The bags would be placed directly on the substrate, secured to a line and anchor, between +4 MLLW to -4 MLLW. Rows would be spaced at 10 feet. Due to the design of the bags and structures, the bags are flipped manually for the duration of their grow-out which typically lasted 14-15 months. Oysters would be harvested by manually removing the bags and brought to upland to be sorted. Oysters that need further grow-out would be placed back into the bags and then returned to the beach.

Figure 3. Example of on-bottom oyster culture in bags (Photo by Maria Pazandak)

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it because the activities are designed to maintain the site in active aquaculture, that it would 'cause' future maintenance and harvest activities. Proposed construction, maintenance, and harvest would occur during low tide, in the dry, as well as periods following tidal inundation.

Special Condition and Best Management Practices

The Corps included a special condition within the consultation request that states the following:

"Forage fish may be spawning in the project area during the allowed work window. If the work is occurring between October 15 and March 31, in order to meet the requirements of the Endangered Species Act and for the protection of Pacific herring, sand lance, and surf smelt, prior to construction, you must have an approved biologist confirm, in writing, that no forage fish are spawning in the area… If the approved biologist or WDFW Habitat Biologist confirms that no forage fish are spawning in the project area, you have two weeks from the date of the inspection to complete all work waterward of the High Tide Line."

Within the BE, all applicable conservation and minimization measures (referred to in this document as best management practices) that were described in the NMFS programmatic consultation (WCR-2014-1502) were reiterated, and can be found in Section 2.4 of the BE.

1.4 Action Area

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

The action area for the Project includes the geographic area likely to be affected by physical, chemical, and biological effects of the Project construction and operation activities. Likely effects include turbidity and changes to prey distribution and abundance, structures in aquatic habitat.

The action area would be .79 acre. This includes the .63 acre designated for shellfish cultivation and a buffer for activities that generate sediment causing turbid water to drift outside of the footprint of the active plot.

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

The USACE determined the proposed action is not likely to adversely affect Southern Resident killer whale (SRKW). The USACE also determined the proposed action would have no effect on PS steelhead critical habitat, PS/GB yelloweye or their critical habitat, and SRKW critical habitat. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.9).

2.1 Analytical Approach

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

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

The designations of critical habitat for PS Chinook and PS/GB bocaccio rockfish use the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, 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 ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and in this 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 critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to 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" for the jeopardy analysis. 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 PBFs that are essential for the conservation of the species.

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. Major ecological realignments are already occurring in response to climate change (IPCC WGII, 2022). Long-term trends in warming have continued at global, national and regional scales. Global surface temperatures in the last decade (2010s) were estimated to be 1.09 °C higher than the 1850-1900 baseline period, with larger increases over land ~1.6 °C compared to oceans ~0.88 (IPCC WGI, 2021). The vast majority of this warming has been attributed to anthropogenic releases of greenhouse gases (IPCC WGI, 2021). Globally, 2014-2018 were the 5 warmest years on record both on land and in the ocean (2018 was the 4th warmest) (NOAA NCEI 2022). Events such as the 2013-2016 marine heatwave (Jacox et al. 2018) have been attributed directly to anthropogenic warming in the annual special issue of Bulletin of the American Meteorological Society on extreme events (Herring et al. 2018). Global warming and anthropogenic loss of biodiversity represent profound threats to ecosystem functionality (IPCC WGII 2022). These two factors are often examined in isolation, but likely have interacting effects on ecosystem function.

Updated projections of climate change are similar to or greater than previous projections (IPCC WGI, 2021). NMFS is increasingly confident in our projections of changes to freshwater and marine systems because every year brings stronger validation of previous predictions in both physical and biological realms. Retaining and restoring habitat complexity, access to climate refuges (both flow and temperature) and improving growth opportunity in both freshwater and marine environments are strongly advocated in the recent literature (Siegel and Crozier 2020).

Climate change is systemic, influencing freshwater, estuarine, and marine conditions. Other systems are also being influenced by changing climatic conditions. Literature reviews on the impacts of climate change on Pacific salmon (Crozier 2015, 2016, 2017, Crozier and Siegel 2018, Siegel and Crozier 2019, 2020) have collected hundreds of papers documenting the major themes relevant for salmon. Here we describe habitat changes relevant to Pacific salmon and steelhead, prior to describing how these changes result in the varied specific mechanisms impacting these species in subsequent sections.

Forests

Climate change will impact forests of the western U.S., which dominate the landscape of many watersheds in the region. Forests are already showing evidence of increased drought severity, forest fire, and insect outbreak (Halofsky et al. 2020). Additionally, climate change will affect tree reproduction, growth, and phenology, which will lead to spatial shifts in vegetation. Halofsky et al. (2018) projected that the largest changes will occur at low- and high-elevation forests, with expansion of low-elevation dry forests and diminishing high-elevation cold forests and subalpine habitats.

Forest fires affect salmon streams by altering sediment load, channel structure, and stream temperature through the removal of canopy. Holden et al. (2018) examined environmental factors contributing to observed increases in the extent of forest fires throughout the western U.S. They found strong correlations between the number of dry-season rainy days and the annual extent of forest fires, as well as a significant decline in the number of dry-season rainy days over the study period (1984-2015). Consequently, predicted decreases in dry-season precipitation, combined with increases in air temperature, will likely contribute to the existing trend toward more extensive and severe forest fires and the continued expansion of fires into higher elevation and wetter forests (Alizedeh 2021).

Agne et al. (2018) reviewed literature on insect outbreaks and other pathogens affecting coastal Douglas-fir forests in the Pacific Northwest and examined how future climate change may influence disturbance ecology. They suggest that Douglas-fir beetle and black stain root disease could become more prevalent with climate change, while other pathogens will be more affected by management practices. Agne et al. (2018) also suggested that due to complex interacting effects of disturbance and disease, climate impacts will differ by region and forest type.

Freshwater Environments

The following is excerpted from Siegel and Crozier (2019), who present a review of recent scientific literature evaluating effects of climate change, describing the projected impacts of climate change on instream flows:

Cooper et al. (2018) examined whether the magnitude of low river flows in the western U.S., which generally occur in September or October, are driven more by summer conditions or the prior winter’s precipitation. They found that while low flows were more sensitive to summer evaporative demand than to winter precipitation, interannual variability in winter precipitation was greater. Malek et al. (2018), predicted that summer evapotranspiration is likely to increase in conjunction with declines in snowpack and increased variability in winter precipitation. Their results suggest that low summer flows are likely to become lower, more variable, and less predictable.

The effect of climate change on ground water availability is likely to be uneven. Sridhar et al. (2018) coupled a surface-flow model with a ground-flow model to improve predictions of surface water availability with climate change in the Snake River Basin. Projections using RCP 4.5 and 8.5 emission scenarios suggested an increase in water table heights in downstream areas of the basin and a decrease in upstream areas.

As cited in Siegel and Crozier (2019), Isaak et al. (2018), examined recent trends in stream temperature across the Western U.S. using a large regional dataset. Stream warming trends paralleled changes in air temperature and were pervasive during the low-water warm seasons of 1996-2015 (0.18-0.35°C/decade) and 1976-2015 (0.14-0.27°C/decade). Their results show how continued warming will likely affect the cumulative temperature exposure of migrating sockeye salmon *O. nerka* and the availability of suitable habitat for brown trout *Salmo trutta* and rainbow trout *O. mykiss*. Isaak et al. (2018) concluded that most stream habitats will likely remain suitable for salmonids in the near future, with some becoming too warm. However, in cases where habitat access is currently restricted by dams and other barriers salmon and steelhead will be confined to downstream reaches typically most at risk of rising temperatures unless passage is restored (FitzGerald et al. 2020, Myers et al. 2018).

Streams with intact riparian corridors and that lie in mountainous terrain are likely to be more resilient to changes in air temperature. These areas may provide refuge from climate change for a number of species, including Pacific salmon. Krosby et al. (2018), identified potential stream refugia throughout the Pacific Northwest based on a suite of features thought to reflect the ability of streams to serve as such refuges. Analyzed features include large temperature gradients, high canopy cover, large relative stream width, low exposure to solar radiation, and low levels of human modification. They created an index of refuge potential for all streams in the region, with mountain area streams scoring highest. Flat lowland areas, which commonly contain migration corridors, were generally scored lowest, and thus were prioritized for conservation and restoration. However, forest fires can increase stream temperatures dramatically in short time-spans by removing riparian cover (Koontz et al. 2018), and streams that lose their snowpack with climate change may see the largest increases in stream temperature due to the removal of temperature buffering (Yan et al. 2021). These processes may threaten some habitats that are currently considered refugia.

Marine and Estuarine Environments

Along with warming stream temperatures and concerns about sufficient groundwater to recharge streams, a recent study projects nearly complete loss of existing tidal wetlands along the U.S. West Coast, due to sea level rise (Thorne et al. 2018). California and Oregon showed the greatest threat to tidal wetlands (100%), while 68% of Washington tidal wetlands are expected to be submerged. Coastal development and steep topography prevent horizontal migration of most wetlands, causing the net contraction of this crucial habitat.

Rising ocean temperatures, stratification, ocean acidity, hypoxia, algal toxins, and other oceanographic processes will alter the composition and abundance of a vast array of oceanic species. In particular, there will be dramatic changes in both predators and prey of Pacific salmon, salmon life history traits and relative abundance. Siegel and Crozier (2019) observe that changes in marine temperature are likely to have a number of physiological consequences on fishes themselves. For example, in a study of small planktivorous fish, Gliwicz et al. (2018) found that higher ambient temperatures increased the distance at which fish reacted to prey. Numerous fish species (including many tuna and sharks) demonstrate regional endothermy, which in many cases augments eyesight by warming the retinas. However, Gliwicz et al. (2018) suggest that ambient temperatures can have a similar effect on fish that do not demonstrate this trait. Climate change is likely to reduce the availability of biologically essential omega-3 fatty acids produced by phytoplankton in marine ecosystems. Loss of these lipids may induce cascading trophic effects, with distinct impacts on different species depending on compensatory mechanisms (Gourtay et al. 2018). Reproduction rates of many marine fish species are also likely to be altered with temperature (Veilleux et al. 2018). The ecological consequences of these effects and their interactions add complexity to predictions of climate change impacts in marine ecosystems.

Perhaps the most dramatic change in physical ocean conditions will occur through ocean acidification and deoxygenation. It is unclear how sensitive salmon and steelhead might be to the direct effects of ocean acidification because of their tolerance of a wide pH range in freshwater (although see Ou et al. 2015 and Williams et al. 2019), however, impacts of ocean acidification and hypoxia on sensitive species (e.g., plankton, crabs, rockfish, groundfish) will likely affect salmon indirectly through their interactions as predators and prey. Similarly, increasing frequency and duration of harmful algal blooms may affect salmon directly, depending on the toxin (e.g., saxitoxin vs domoic acid), but will also affect their predators (seabirds and mammals). The full effects of these ecosystem dynamics are not known but will be complex. Within the historical range of climate variability, less suitable conditions for salmonids (e.g., warmer temperatures, lower streamflows) have been associated with detectable declines in many of these listed units, highlighting how sensitive they are to climate drivers (Ford 2022, Lindley et al. 2009, Williams et al. 2016, Ward et al. 2015). In some cases, the combined and potentially additive effects of poorer climate conditions for fish and intense anthropogenic impacts caused the population declines that led to these population groups being listed under the ESA (Crozier et al. 2019).

Climate change effects on salmon and steelhead

In freshwater, year-round increases in stream temperature and changes in flow will affect physiological, behavioral, and demographic processes in salmon, and change the species with which they interact. For example, as stream temperatures increase, many native salmonids face increased competition with more warm-water tolerant invasive species. Changing freshwater temperatures are likely to affect incubation and emergence timing for eggs, and in locations where the greatest warming occurs may affect egg survival, although several factors impact intergravel temperature and oxygen (e.g., groundwater influence) as well as sensitivity of eggs to thermal stress (Crozier et al. 2020). Changes in temperature and flow regimes may alter the amount of habitat and food available for juvenile rearing, and this in turn could lead to a restriction in the distribution of juveniles, further decreasing productivity through density dependence. For migrating adults, predicted changes in freshwater flows and temperatures will likely increase exposure to stressful temperatures for many salmon and steelhead populations, and alter migration travel times and increase thermal stress accumulation for ESUs or DPSs with early-returning (i.e. spring- and summer-run) phenotypes associated with longer freshwater holding times (Crozier et al. 2020, FitzGerald et al. 2020). Rising river temperatures increase the energetic cost of migration and the risk of *en route* or pre-spawning mortality of adults with long freshwater migrations, although populations of some ESA-listed salmon and steelhead may be able to make use of cool-water refuges and run-timing plasticity to reduce thermal exposure (Keefer et al. 2018, Barnett et al. 2020).

Marine survival of salmonids is affected by a complex array of factors including prey abundance, predator interactions, the physical condition of salmon within the marine environment, and carryover effects from the freshwater experience (Holsman et al. 2012, Burke et al. 2013). It is generally accepted that salmon marine survival is size-dependent, and thus larger and faster growing fish are more likely to survive (Gosselin et al. 2021). Furthermore, early arrival timing in the marine environment is generally considered advantageous for populations migrating through the Columbia River. However, the optimal day of arrival varies across years, depending on the seasonal development of productivity in the California Current, which affects prey available to salmon and the risk of predation (Chasco et al. 2021). Siegel and Crozier (2019) point out the concern that for some salmon populations, climate change may drive mismatches between juvenile arrival timing and prey availability in the marine environment. However, phenological diversity can contribute to metapopulation-level resilience by reducing the risk of a complete mismatch. Carr-Harris et al. (2018), explored phenological diversity of marine migration timing in relation to zooplankton prey for sockeye salmon *O. nerka* from the Skeena River of Canada. They found that sockeye migrated over a period of more than 50 days, and populations from higher elevation and further inland streams arrived in the estuary later, with different populations encountering distinct prey fields. Carr-Harris et al. (2018) recommended that managers maintain and augment such life-history diversity.

Synchrony between terrestrial and marine environmental conditions (e.g., coastal upwelling, precipitation and river discharge) has increased in spatial scale causing the highest levels of synchrony in the last 250 years (Black et al. 2018). A more synchronized climate combined with simplified habitats and reduced genetic diversity may be leading to more synchrony in the productivity of populations across the range of salmon (Braun et al. 2016). For example, salmon productivity (recruits/spawner) has also become more synchronized across Chinook populations from Oregon to the Yukon (Dorner et al. 2018, Kilduff et al. 2014). In addition, Chinook salmon have become smaller and younger at maturation across their range (Ohlberger 2018). Other Pacific salmon species (Stachura el al. 2014) and Atlantic salmon (Olmos et al. 2020) also have demonstrated synchrony in productivity across a broad latitudinal range.

At the individual scale, climate impacts on salmon in one life stage generally affect body size or timing in the next life stage and negative impacts can accumulate across multiple life stages (Healey 2011; Wainwright and Weitkamp 2013, Gosselin et al. 2021). Changes in winter precipitation will likely affect incubation and/or rearing stages of most populations. Changes in the intensity of cool season precipitation, snow accumulation, and runoff could influence migration cues for fall, winter and spring adult migrants, such as coho and steelhead. Egg survival rates may suffer from more intense flooding that scours or buries redds. Changes in hydrological regime, such as a shift from mostly snow to more rain, could drive changes in life history, potentially threatening diversity within an ESU (Beechie et al. 2006). Changes in summer temperature and flow will affect both juvenile and adult stages in some populations, especially those with yearling life histories and summer migration patterns (Crozier and Zabel 2006; Crozier et al. 2010, Crozier et al. 2019).

At the population level, the ability of organisms to genetically adapt to climate change depends on how much genetic variation currently exists within salmon populations, as well as how selection on multiple traits interact, and whether those traits are linked genetically. While genetic diversity may help populations respond to climate change, the remaining genetic diversity of many populations is highly reduced compared to historic levels. For example, Johnson et al. (2018), compared genetic variation in Chinook salmon from the Columbia River Basin between contemporary and ancient samples. A total of 84 samples determined to be Chinook salmon were collected from vertebrae found in ancient middens and compared to 379 contemporary samples. Results suggest a decline in genetic diversity, as demonstrated by a loss of mitochondrial haplotypes as well as reductions in haplotype and nucleotide diversity. Genetic losses in this comparison appeared larger for Chinook from the mid-Columbia than those from the Snake River Basin. In addition to other stressors, modified habitats and flow regimes may create unnatural selection pressures that reduce the diversity of functional behaviors (Sturrock et al. 2020). Managing to conserve and augment existing genetic diversity may be increasingly important with more extreme environmental change (Anderson et al. 2015), though the low levels of remaining diversity present challenges to this effort (Freshwater 2019). Salmon historically maintained relatively consistent returns across variation in annual weather through the portfolio effect (Schindler et al. 2015), in which different populations are sensitive to different climate drivers. Applying this concept to climate change, Anderson et al. (2015) emphasized the additional need for populations with different physiological tolerances. Loss of the portfolio increases volatility in fisheries, as well as ecological systems, as demonstrated for Fraser River and Sacramento River stock complexes (Freshwater et al. 2019, Munsch et al. 2022).

2.2.1 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. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population)

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
Puget Sound Chinook salmon	Threatened 6/28/05 (70 FR 37159)	Shared Strategy for Puget Sound 2007	NMFS 2017; Ford 2022	This ESU comprises 22 populations distributed over five geographic areas. All PS Chinook salmon populations continue to remain well below the TRT planning ranges for recovery escapement levels. Most populations also remain consistently below the spawner–recruit levels identified by the TRT as necessary for recovery. Across the ESU, most populations have increased somewhat in abundance since the last status review in 2016, but have small negative trends over the past 15 years. Productivity remains low in most populations. Overall, the PS Chinook salmon ESU remains at “moderate” risk of extinction.	• Degraded floodplain and in-river channel structure • Degraded estuarine conditions and loss of estuarine habitat • Degraded riparian areas and loss of in-river large woody debris • Excessive fine-grained sediment in spawning gravel • Degraded water quality and temperature • Degraded nearshore conditions • Impaired passage for migrating fish • Severely altered flow regime
Puget Sound steelhead	Threatened 5/11/07	NMFS 2019	NMFS 2016; Ford 2022	This DPS comprises 32 populations. Viability of has improved somewhat since the PSTRT concluded that the DPS was at very low viability, as were all three of its constituent MPGs, and many of its 32 DIPs (Hard et al. 2015). Increases in spawner abundance were observed in a number of populations over the last five years within the Central & South Puget Sound and the Hood Canal & Strait of Juan de Fuca MPGs, primarily among smaller populations. There were also declines for summer- and winter-run populations in the Snohomish River basin. In fact, all summer-run steelhead populations in the Northern Cascades MPG are likely at a very high demographic risk.	• Continued destruction and modification of habitat • Widespread declines in adult abundance despite significant reductions in harvest • Threats to diversity posed by use of two hatchery steelhead stocks • Declining diversity in the DPS, including the uncertain but weak status of summer-run fish • A reduction in spatial structure • Reduced habitat quality • Urbanization • Dikes, hardening of banks with riprap, and channelization
Puget Sound/ Georgia Basin DPS of Bocaccio	Endangered 04/28/10	NMFS 2017d	NMFS 2016d; Ford 2022	Though bocaccio were never a predominant segment of the multi-species rockfish population within the Puget Sound/Georgia Basin, their present-day abundance is likely a fraction of their pre-contemporary fishery abundance. Most bocaccio within the DPS may have been historically spatially limited to several basins	• Over harvest • Water pollution • Climate-induced changes to rockfish habitat • Small population dynamics

Species	Listing Classification and Date	Recovery Plan Reference	Most Recent Status Review	Status Summary	Limiting Factors
				within the DPS. They were apparently historically most abundant in the Central and South Sound with no documented occurrences in the San Juan Basin until 2008. The apparent reduction of populations of bocaccio in the Main Basin and South Sound represents a further reduction in the historically spatially limited distribution of bocaccio, and adds significant risk to the viability of the DPS.	

2.2.2 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).

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.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 3, below.

Table 3. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
Puget Sound Chinook salmon	9/02/05 70 FR 52630	Critical habitat for PS Chinook salmon includes 1,683 miles of streams, 41 square mile of lakes, and 2,182 miles of nearshore marine habitat in PS. The PS Chinook salmon ESU has 61 freshwater and 19 marine areas within its range. Of the freshwater watersheds, 41 are rated high conservation value, 12 low conservation value, and eight received a medium rating. Of the marine areas, all 19 are ranked with high conservation value.
Puget Sound/Georgia Basin DPS of bocaccio	11/13/2014 79 FR68042	Critical habitat for bocaccio includes 590.4 square miles of nearshore habitat and 414.1 square miles of deepwater habitat. Critical habitat is not designated in areas outside of United States jurisdiction; therefore, although waters in Canada are part of the DPSs' ranges for all three species, critical habitat was not designated in that area. Based on the natural history of bocaccio and their habitat needs, NMFS identified two physical or biological features, essential for their conservation: 1) Deepwater sites (>30 meters) that support growth, survival, reproduction, and feeding opportunities; 2) Nearshore juvenile rearing sites with sand, rock and/or cobbles to support forage and refuge. Habitat threats include degradation of rocky habitat, loss of eelgrass and kelp, introduction of non-native species that modify habitat, and degradation of water quality as specific threats to rockfish habitat in the Georgia Basin.

2.3 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).

Factors including climate change, contaminants, habitat modification, nutrients and pathogens affect the condition and quantity of habitat features and processes necessary to support the listed species in the area.

Habitat Conditions:

Forage Fish: According to the WDFW Forage Fish Spawning Map online tool (https://www.arcgis.com/apps/mapviewer/index.html?webmap=19b8f74e2d41470cbd80b1af8dedd6b3; accessed on April 3, 2023), there is documented forage fish spawning at or adjacent to the project site. Smelt spawning within the project area, and sand lance spawning habitat approximately 0.5 miles South of the proposed project. A survey conducted by a WDFW biologist prior to 2019 and the issuance of the HPA determined that the proposed project area is not suitable for forage fish spawning despite the documented surf smelt spawning at that location.

Eelgrass and Kelp: According to the Ecology online tool, Washington State Coastal Atlas Map (https://apps.ecology.wa.gov/coastalatlas/tools/Map.aspx;accessed on April 3, 2023), the project is within a ShoreZone unit with kelp. Submerged aquatic vegetation was not identified within the project area (JARPA, 2021).

Water Quality:
"The water quality within the Glaser Aquatic Farm and the surrounding area is generally not considered to be of concern. Subtidal areas of Case Inlet are included on the Washington Department of Ecology's (Ecology) 303(d) list, due to exceedances of established criteria for dissolved oxygen (Ecology 2021). However, no issues with dissolved oxygen have been noted within the nearshore waters along Harstine Island. Sampling near the Glaser Aquatic Farm in 2001 did show an exceedance of established bacteria criteria, but more recent data (2007-2009) showed no evidence of exceedances (Ecology 2021). The shoreline along Harstine Island is approved for commercial shellfish production by the Washington Department of Health (WDOH) and is not considered to have significant water quality issues (WDOH 2021)." (BE, 2021)

Surrounding land/water uses:
The primary land and water uses within Case Inlet and neighboring parcels include residential (predominately single family) and aquaculture, including native and commercial geoduck, hard-shell clam, and oyster beds.

Substrate Modification & Sediment Quality:
The shoreline within the action area is classified as a transport zone, and has experienced erosion (MacLennan et al. 2013, as cited within the BE). "It is located between a feeder bluff (source) and an accretion shoreform, suggesting that local currents and tides primarily work to move material along the shoreline. The direction of this drift cell is from south to north." (BE, 2021)

"Substrate within the Glaser Aquatic Farm between +4 feet MLLW and +7 feet MLLW was hard glacial till, prior to the placement of gravels to reestablish a clam bed. From -3 feet MLLW to +4 feet MLLW, the substrate is dominated by larger rock cobble and below -3 f MLLW it is primarily sand. No issues with sediment quality have been identified by Ecology (2021)." (BE, 2021)

The beach nourishment placement and parking curb placement modified the substrate and intertidal habitat within the project area. The placement of 0.19 acre gravel modified the substrate from hard glacial till to gravel.

Use of the action area by listed species:

Chinook salmon:
Chinook salmon may migrate within the action area. Case Inlet is a migratory corridor for adult Chinook salmon and provides habitat for out-migrating juvenile Chinook salmon from rivers into Puget Sound before their eventual oceanic phase as adults. Juvenile Chinook salmon habitat in the vicinity of the action area includes nearshore areas. It is expected that juvenile Chinook salmon may be present in the vicinity of the action area during construction, maintenance, and harvest activities. Juveniles may occur in the shallow nearshore during typical out-migration periods between February and July (the work window year-round, not avoiding peak presence of juvenile Chinook salmon).

"The closest major spawning river for Puget Sound Chinook salmon to Case Inlet is the Nisqually River, located approximately 12 miles southeast (WDFW 2021b). Other spawning rivers near the Project area used by Chinook salmon include Woodland Creek (approximately 11 miles south) and the Deschutes River (approximately 16 miles south). Chinook salmon spawning is also documented in smaller Puget Sound streams in the surrounding area." (BE, 2021)

"Within water resource inventory area (WRIA) 14, which includes Case Inlet, streams have typically showed low spawning abundance of Puget Sound Chinook salmon since about the mid-1980s (Kuttel 2002). Therefore, Chinook salmon are not likely to be present in high abundance within Case Inlet but have the potential to occur within the action area." (BE, 2021)

Steelhead:
Based on typical run timing for winter steelhead (December through mid-March) and spawning patterns, juvenile steelhead would be expected to out-migrate between mid-March and early June. Based on the year-round work window, both adult steelhead and juvenile steelhead would be present during construction, maintenance, and harvest activities.

The closest major spawning river for Puget Sound steelhead to Case Inlet is the Nisqually River, located approximately 12 miles southeast (WDFW 2021b). Other spawning rivers near the Project area used by Chinook salmon include Woodland Creek (approximately 11 miles south). Steelhead spawning is also documented in smaller Puget Sound streams in the surrounding area.

Bocaccio:
Bocaccio rockfish adults stay in deep waters (98 feet or deeper) but juveniles use shallow areas within their designated critical habitat, and larval lifestages float in the water column. Juvenile bocaccio are known to reside in intertidal waters before gradually moving to deeper waters. Larvae are born with limited abilities to swim, maintain buoyancy in the water column, and feed. These larvae are pelagic for approximately 2 months and occur in the water column from near the surface to depths of 328 feet or more. Larval presence in Puget Sound peaks in spring and again in summer, and larvae commonly associated with kelp beds. Larvae and small juveniles located within the greater Puget Sound during the spring and summer months are subject to currents that may potentially drift the fish into the action area.

PS/BG bocaccio have been found in low numbers associated with nearshore environments as juveniles by WDNR during their surveys across the Puget Sound. Therefore, their numbers in the action area are expected to be in low numbers.

2.4 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 (see 50 CFR 402.02). 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 the factors set forth in 50 CFR 402.17(a) and (b).

As described in Section 1.3, shellfish farm related activities were conducted and parking curbs were installed without consultation. Due to this, any adverse effects, including take that occurred, cannot be exempted ex post facto. For this reason, NMFS will not present an analysis of the effects that occurred when the project was constructed/installed. Instead NMFS focuses here on the ongoing pathways of effect from the presence of the structure, and the use of the structure.

After the application of all minimization and conservation measures as described in Section 2.4 of the BE, the proposed action would still result in adverse effects that cannot be avoided. Likely effects include short-term changes in water quality, disturbed substrate, and reduced forage, from maintenance and harvest activities, and long-term impacts from the existence of the anthropogenic structures.

2.4.1 Effects on Critical Habitat

The Physical and Biological Features (PBFs) of PS Chinook salmon and PS/GB bocaccio critical habitat that may occur in the action area are:

PS Chinook salmon critical habitat PBFs

- Estuarine areas should be free of obstruction and excessive predation, and have available:
    - 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.

- Nearshore marine areas should be free of obstruction and excessive predation, and have available:
    - 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.

PS/GB bocaccio rockfish critical habitat PBFs

- Juvenile bocaccio settlement habitats[1] located in the nearshore should have substrates such as sand, rock and/or cobble compositions that also support kelp, along with the following attributes:
    - Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities; and
    - Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.

Water Quality
Water quality is a feature of critical habitat for PS Chinook salmon and PS/GB bocaccio.

Water quality would occasionally be briefly diminished by suspended sediments. Proposed graveling, shellfish structure installation, maintenance, and harvest activities would be conducted during low tide ‘in the dry,’ creating a pulse of turbidity when disturbed sediments become suspended on the next tidal inundation. As described in Section 1.3, clam seed may be spread by boat during an outgoing tide and reduce water quality for the duration of the process. These effects are adverse to water quality as a feature of critical habitat, but because its duration is

[1] Based on the location of the action area, only areas identified for juvenile bocaccio are considered likely to be adversely affected. Critical habitat for adult bocaccio is not further analyzed in this document.

brief, baseline water quality conditions are promptly regained, and conservation values (for growth, maturation, or physical transitions, survival, reproduction of listed individuals) overall are not impaired.

Long term, an effect of the operation could be improved water quality and clarity by reducing the amount of nitrogen and phosphorus in the water (Pollack et al. 2013; Paraskevi et al. 2021). Oysters and clams filter nutrients, small phytoplankton, sediments, and detritus allowing for increased light penetration by improving water clarity through the water column (Dame et al. 1984; Peterson and Heck 2001; Newell et al. 2005; Lazar et al. 2022). This in turn can provide benefit to sea grasses such as kelps, eelgrass, and other submerged aquatic vegetation (Grabowski & Peterson 2007).

Modified and Disturbed Substrate:
Substrate is a feature of critical habitat for juvenile bocaccio. The retention of the parking curbs, graveling, and shellfish related activities are likely to disturb or modify the substrate.

Disturbed Substrate:
Physical disturbance of the substrate would occur as a result of bed preparation activities, planting activities, harvest, and the general traffic of personnel and equipment. Bed preparation and harvest activities that result in turning over the sediments may temporarily alter the physical composition and chemistry of the sediment (Mercaldo-Allen and Goldberg 2011, Bendell-Young 2006, WDNR 2014). The harvest of manila clams would be conducted during low tide using a handheld rake, and would disturb the substrate up to several inches and suspend sediment in areas immediately adjacent following tidal inundation. The bag on-bottom oyster culture method requires 2 ft by 3 ft mesh plastic bags (in up to 24 rows) to rest directly on the substrate, covering and abrading benthic habitat.

Modified Substrate:
Several activities will modify substrate in the action area. The retention of the 63 parking curbs would continue to displace approximately 252 square feet of intertidal habitat and have the potential to impact coastal sediment transport. The artificial structure allows for some biological processes to occur (such as forage fish spawning) but inhibits some ecological processes to fully occur such as suppressing some sediment transport, supply, or accretion, but not they do not fully preclude these processes.

The proposed pea gravel would be distributed at a depth of no more than 1 inch across 8,200 square feet and would maintain the modification of the native substrate within the project area. This action would occur every 2-3 years as the gravel is gradually transported away from the curbed area by natural processes.

The clam and oyster culture techniques would result in an altered substrate that is intermittently surfaced with plastic. For the bag on-bottom method, bags are placed in rows that result in alternating strips of plastic versus natural substrate. Clam culture would be covered with anti-predator netting. Sediment may gradually accumulate on top of the bags and nets that rest on the substrate possibly reestablishing substrate conditions similar to the unaltered conditions, however this is likely to be disrupted by maintenance including the manual flipping of the bags, that would dislodge any accumulated sediment. Bag on-bottom culture as well as anti-predator netting method reduces the amount of available settlement habitat for PS/GB juvenile bocaccio as it covers the substrate.

Cover
Kelp patches have previously been documented within the action area although it was not documented as being present by the applicant. Kelp may become re-established and expand within the action area in the future. The disturbance and modification of substrate are likely to affect the ability of kelp or other SAV to grow and/or recover within the project area. A study conducted by Kenworthy et al. (2006) observed seagrass recovery following substrate excavation and pea gravel fill placement. Results showed that the pea gravel inhibited the recovery of SAV, with impacts persisting up to 3 years after fill placement. Substrate disturbing activities and the placement of pea gravel every 2-3 years may reduce the ability for kelp to recover following the disturbances.

As such, due to the parking curbs, proposed graveling, and bag on-bottom oyster gear, the amount of available settlement habitat for GB juvenile bocaccio is reduced.

Forage
In the nearshore environment, forage, a PBF of Chinook salmon and GB bocaccio rockfish may temporarily be reduced by graveling, harvest activities, and reduced over the long term by the presence of the shellfish gear and parking curbs. Larval and juvenile rockfish feed on small organisms, such as zooplankton, copepods, phytoplankton, small crustaceans, invertebrate eggs, krill and other invertebrates (see NMFS 2017a). Juvenile salmonids also feed on copepods and invertebrates. The action area overlaps with documented forage fish spawning habitat. Surf smelt spawning was documented at the site and sand lance spawning has been documented 0.5 miles south of the project site.

Forage fish may be affected by the placement of gravel, use of anti-predator nets, retention of the parking curbs, and regular farm operations. As described in section 2.3 and mentioned above, surf smelt and sand lance spawning may occur within the action area. The Corps included a special measure to minimize the overlap of in-water work with forage (surf smelt and sand lance) fish spawning, although it does not reduce the overlap entirely, as surf smelt spawning may occur from July to April in south Puget Sound (WDFW 2010a).

<u>Graveling</u>
Graveling (or frosting) would be conducted in order to add additional gravel onto the intertidal area to reduce the potential for predation and burial of clams, and would be limited to no more than 1 inch of gravel added to the plot annually.

The placement of gravel across of 8,200 square feet may affect the availability of Chinook salmon and bocaccio forage species. Access to forage species is likely to become limited immediately following gravel placement and remain depressed until species re-colonize the area. The proposed placement of substrate that is dissimilar to the natural substrate will continue to modify habitat and the forage species would be present. The benthic recovery time relates to the fill material used and it increases when the fill material differs from the native substrate (Peterson et al. 2000).

However, the shift in the benthic community from polychaetes to amphipods and copepods, which are important prey items for juvenile salmonids (Jamieson et al. 2001), could result in improved salmonid forage production. Similar findings have been observed by Simenstad and Fresh (1995), and Thompson (1995), who observed an increase in density of both gammarid amphipods and nemertean worms on graveled plots, in addition to the presence of shore crabs not found on control plots. The greater diversity of biota may benefit rearing habitats for juvenile fishes, including ESA-listed species.

As discussed above, fill placement following ground disturbance such as clam harvest where SAV coincides has the potential to reduce its ability to recover. Forage fish such as herring lay their eggs on SAV, and these eggs are often part of the forage base for other fishes, including rockfish.

Surf smelt and sand lance reside and spawn within Puget Sound nearshore habitats that are comprised of fine gravel and coarse sand, with smaller grain sizes than the proposed pea gravel to be spread within the project area (Whitman 2011). Additionally, a study conducted by C. Rice (2006) found that anthropogenically altered shorelines reduces surf smelt eggs compared to unmodified beaches. As the substrate was determined to not be suitable for forage fish spawning by a WDFW biologist prior to beach nourishment activities, the proposed placement of gravel would maintain the modification of habitat that is not suitable for forage fish.

While there is a shift in benthic communities that could be beneficial to juvenile salmonids following graveling activities, due to the degree in difference between the fill material and native substrate, and potential loss of kelp or other SAV, forage species availability may be decreased for months or longer (see, e.g., Straus et al. 2008).

Shellfish Culture

As described above, maintenance and harvest activities disturb the substrate, which affects sediment and benthic fauna (Johnson 2002). These activities cause minor disturbance of benthic habitat affecting the availability of benthic food sources for listed fish for a short period of time following disturbance. Bottom-disturbing activities that could temporarily reduce or increase benthic resources occur every 1-3 years, depending on the species cultured. In places with normal benthic diversity, with regular flows and normal nutrient balance, benthic items rapidly recolonize after disturbance, making food available again at the disturbed site.

Forage will be reduced where the clam culture occurs. As mentioned above, the parking curbs would displace 252 square feet of substrate which provides habitat for epifauna and infauna.

Multiple studies have reported enhanced prey resources for some juvenile salmonids as well as for migratory and resident fish associated with on-bottom culture (Simenstad et al. 1991; Brooks 1995). The fixed benthic structuring on-bottom clam bags and anti-predator nets may provide surface area for organisms that do not typically use hard or graveled substrates. The parking curbs create vertical structure, adding to the habitat complexity where it is located. Ferris et al. (2021) found an increase in abundance of species of demersal and benthic species (including flatfish, sculpin, stickleback, and crab) in shellfish cultured areas versus non-cultured areas where only sediment is present. Other studies have also shown on-bottom oyster culture has greater abundances and diversities of fish in comparison to habitat areas without structure (Callier et al. 2017).

Thus, prey resources and the ability to forage is unlikely to be reduced where on-bottom culture is located.

The structures and anti-predator netting associated with the clam culture may cause forage fish mortalities. On one occasion in Baynes Sound, British Columbia, a Manilla clam net was documented to have killed forage fish (Caseinlet.org). Surrounding the anti-predator nets are the parking curbs, which may cause stranding of forage fish or eggs as the tides retreat. Vehicles and other on-site, substrate disturbing activities may destroy embryos or may compact the sediment, reducing the mobility of forage fish within the project area.

As discussed above, and discussed further in WCR 2014-1502, the presence of active aquaculture can also increase some aspects of forage, offsetting potential diminished forage resultant from graveling and benthic disturbance.

Due to the relatively small size of the farm in comparison to the entirety of Case Inlet, the reduction in forage is expected to affect only a small number of juvenile salmonids or juvenile bocaccio. However, forage is not identified as limiting in this location and this reduction, while adverse, is not at a scale that reduces the conservation role of the forage PBF of critical habitat for PS salmonids and PS/GB bocaccio.

Migratory Obstruction & Predation (long term)

Safe migration of juvenile PS Chinook salmon may be diminished by the presence of in water structures. The curbs associated with the clam culture adds hard, physical structure onto the substrate and into the water column. The presence of these structures could reduce safe migration pathways and patterns by potentially stranding some juveniles behind the curb structures, and increase the risk of avian predation on juvenile salmonids. Migration values are not expected to be impaired for juvenile PS/GB bocaccio as they do not rely on the nearshore area for migration.

The retention of the curbs and anti-predator netting represent an artificial habitat structure that constitutes an alteration of undisturbed habitat conditions. There is concern that these curbs can present conditions that are disruptive to normal feeding, rearing, and migration behaviors, either by reducing access to critical habitat or by increasing migration time, thus increasing the possibility of predation.

The retention of the 63 parking curbs would cause long-term, small-scale diminishments of safe migration/increase predation risk in the migratory area.

2.4.2 Effects on Listed Species

Effects on species are a function of exposure and response. The degree of exposure (duration and intensity) to habitat changes described above will influence response, as will the specific species, life stage, and underlying health of the individuals exposed. Proposed work including graveling, maintenance, and harvest would occur at low tide in dry conditions, reducing exposure to potential effects. However, exposure is not fully avoided.

Response to /Water Quality Changes:
Salmonids could be briefly exposed to areas of reduced water quality while sediment is suspended following tidal inundation after the installation of gear, placement of gravel, and harvest activities. The clam seed, when distributed during an outgoing tide, would be distributed through the water column. Typical response of salmonids is avoidance, so no injury from exposure to sediment is anticipated among individuals from PS Chinook or PS steelhead. Avoidance behavior however can increase the likelihood that juvenile salmonids enter deeper water where larger fish may prey upon them.

Shellfish aquaculture may improve water quality in estuarine habitats. This can be a result of a large number of shellfish filter feeding within the farmed area. These species filter large amounts of water and remove suspended particles, including pollutants and excess nutrients. The process can help reduce levels of pollutants, such as nitrogen and phosphorus, which are chemicals that can contribute to the development of harmful algal blooms and low oxygen conditions in aquatic ecosystems. Additionally, in limited amounts, the waste produced by the shellfish can provide a source of food and nutrients for deposit feeders and phytoplankton, helping to further support the health of the ecosystem (Shumway et al. 2003).

Individuals from all species considered in this consultation document that rely on the action area would be slightly benefited in their feeding, growth, maturation, and survival by improved water quality. Any exposure would result in a slightly beneficial response at the individual scale (although difficult to detect or document) for listed fishes.

Response to Prey Reduction
It is likely that listed fish will encounter areas where prey is slightly reduced. While it is an expected behavior that salmonids and juvenile PS/GB bocaccio will continue foraging behavior by seeking out locations where prey is more abundant, it is possible that a small number of individuals will have greater bioenergetic expenditure relative to prey consumption, that could reduce or delay their growth. Because smaller fish are more likely to be preyed upon, this suggests that a very small number of listed fish could be more susceptible to predation as a result of prey reduction. Because forage is not limiting, we expect this effect among only a very low number, even over the entire life of the proposed action.

Response to Gear in Aquatic Habitat/Passage:
PS Chinook salmon, PS steelhead, and PS/GB bocaccio rockfish could encounter the farm during their outmigration or residency within Case Inlet, as it would be in operation with no terminal date. The concrete curbs may disrupt their migration, increase their predation risk, or cause stranding and nets could create entanglement.

Juvenile PS Chinook salmon are nearshore oriented, typically migrating within shallow nearshore and intertidal areas (Levings et al. 1991; Duffy et al. 2005; Heerhatz and Toft 2015), coinciding with where the project would be located. Juvenile steelhead are less dependent on nearshore habitat, decreasing their likelihood of encountering the farm and associated structures during their outmigration to the ocean. Juvenile PS/GB bocaccio may reside in intertidal waters where the farm is located before moving to deeper waters, whereas smaller juveniles and larvae drift through the farm area.

In-water structures cause delays in migration for salmonids due to disorientation, fish school dispersal (resulting in a loss of refugia), and altered migration routes (Simenstad 1999). During tidal inundation and retreat, salmonids may encounter the parking curbs, potentially disrupting their migration through the nearshore. This disruption could cause salmonids to swim around the structure, lengthening their migration time and increasing the possibility of predation. Additionally, there would be increased bio-energetic expenditure and decreased growth, making them more vulnerable to predation.

The parking curbs create a berm-like structure, creating a 6-inch artificial ridge in the nearshore zone. There is concern that the curbs could cause stranding of ESA-listed species as the tide is retreating. As the parking curb berm is placed into a polygonal shape (enclosed on 4 sides), the ability of a juvenile PS salmonid or bocaccio to safely leave the area during retreating tides is reduced. With the curbing in the water indefinitely, coinciding with their migration every year as it occurs, a small fraction of every cohort would have a reduction in fitness. NMFS assumes that this would likely result in increased juvenile salmonid mortality, affecting a small number of fish in each year the structure is present.

Anti-predator exclusion nets would be installed and used in association with the clam beds. The nets pose an entanglement risk for ESA-listed species while migrating (salmon) or settling in the project area (bocaccio). While we could not locate any reports that indicated any ESA-listed fish have been killed by cover nets, we do not consider the risk of entanglement to be discountable because surf smelt have been entangled and killed (see WA Shellfish Aquaculture Programmatic Biological Opinion, WCR-2014-1502).

2.5 Cumulative Effects

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

Conditions in the action area are affected by upland activities. Future private and public development actions are reasonably certain to continue in and around PS. As the human population continues to grow, demand for agricultural, commercial, and residential development and supporting public infrastructure is also reasonably certain to grow. Land use changes and development of the built environment are likely to increase upland sources of water quality degradation that are detrimental to salmonid. Recreational demands of the adjacent waters are likely to intensify over time. Though the existing regulations minimize potential adverse effects on salmon habitat, as currently composed and implemented, they still allow systemic, incremental, additive degradation to occur.

The current condition of ESA-listed species and designated critical habitat within the action area are described in the Status of the Species and critical habitat and Environmental Baseline sections above. The contribution of non-federal activities to those conditions include past and ongoing shoreline development, aquaculture, and maritime activities, as well as upstream forest management, agriculture, urbanization, road construction, water development, and restoration activities.

Finally, climate change effects similar to those described earlier in this document are likely to occur within the action, including changing water temperatures, changing salinity, changing acidity, and modified food webs.

The cumulative effects are likely to have some negative impacts on the quality and conservation value of critical habitat of PS Chinook salmon and juvenile PS/GB bocaccio in the action area.

2.6 Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.4) to the environmental baseline (Section 2.3) and the cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

PS Chinook, PS steelhead, and PS/GB bocaccio rockfish are listed as threatened or endangered by extinction risk. The status of these species is due to lower abundance and productivity, and for salmonids reductions in spatial structure and diversity as well. These reduced viability parameters are due in part to reductions in habitat quality (and for salmonids, reduced habitat quantity) throughout some or all of their range. These degraded habitat conditions are described as limiting factors and impairments of features of critical habitat, even where conservation value of the habitat remains high. We add the effects of the proposed action to evaluate their effect on the conservation value of the critical habitat, and on the survival and recovery of species.

2.6.1 Critical Habitat

Critical habitat was designated for PS Chinook salmon and PS/GB bocaccio rockfish in Puget Sound to ensure that specific areas with PBFs that are essential to the conservation of those listed species are appropriately managed or protected. The action area is within designated critical habitat for PS Chinook salmon and juvenile PS/GB bocaccio rockfish. The PBFs for juvenile bocaccio's nearshore critical habitat are similar to those of PS Chinook salmon. We consider how the proposed action's impacts on the attributes of the action area's PBFs would affect these designated critical habitats' ability to support the conservation of the respective species.

The quality of critical habitat for PS Chinook salmon and juvenile PS/GB bocaccio as mentioned above, and has been diminished by several factors unrelated to shellfish culture. The most notable impairments to PS Chinook salmon CH are in freshwater environments and are due to land use practices, man-made fish passage barriers, and water use. The nearshore critical habitat suffers from pervasive systemic reductions in function caused by nearshore development, such as bank armoring, overwater structure, dredging, and upland sources of water pollution. Similar to PS Chinook salmon, PS/GB bocaccio's CH is impaired by invasive/nonindigenous species, contaminants, nutrient addition, and nearshore development (NMFS, 2017).

In the future, climate change is expected to increase in-stream water temperatures and alter stream flows, possibly exacerbating impacts on baseline conditions in freshwater habitats across the region. Rising sea levels are expected to increase coastal erosion and alter the composition of nearshore habitats, which could further reduce the availability and quality of estuarine habitats. Increased ocean acidification may also reduce the quality of estuarine and nearshore habitats. Also, non-federal land and water use practices and climate change are likely to increase. The intensity of those influences on salmonid and rockfish critical habitat is uncertain, as is the degree to which those impacts may be tempered by adoption of more environmentally protective land use practices, by the implementation of non-federal plans that are intended to benefit salmonids and rockfish, and by efforts to address the effects of climate change.

In this context we evaluate the effects of the project on critical habitats. The PBF for PS Chinook salmon critical habitat at and adjacent to the project site is the "nearshore marine area free of obstruction and excessive predation." The attributes of the PBF that would be affected by the action are [areas free of] obstruction and excessive predation, good water quality, sufficient forage, and presence of natural cover. The PBF for PS/GB bocaccio critical habitat at and adjacent to the project site is the nearshore area comprised of sand, rock and/or cobbles with eelgrass or kelp." The attributes of the PBF that would be affected by the action are water quality, substrate, and forage.

The project will add temporary reductions to water quality affecting both critical habitats, longer term reductions substrate (bocaccio CH), forage (Chinook salmon and bocaccio CH), cover (Chinook salmon CH) and safe passage (Chinook salmon CH) which accrue via retention of the parking curbs, gravel placement, and presence of culture bags, and nets. In addition to these detriments, however, the shellfish grown may create additional habitat features, and improve water quality locally. Despite the positive effects, and as described in the effects section, the proposed action would cause short- and long-term minor adverse effects on all of the PBFs. However, based on the best available information, the scale of the proposed action's effects, when considered in combination with the degraded baseline, cumulative effects, and the impacts of climate change, would cause detectable long-term negative changes in the quality or functionality of the estuarine areas PBF in the action area. In light of this, the negative effects are not sufficient, even over the long term, to reduce the conservation role that the habitat provides.

Therefore, this critical habitat would maintain its current level of functionality and conservation role for PS Chinook salmon and PS/GB bocaccio.

2.6.2 ESA Listed Species

PS Chinook salmon, PS steelhead, and PS/GB bocaccio are listed as threatened and endangered, based on declines from historic levels of abundance and productivity, loss of spatial structure and diversity, and these are driven in part by an array of limiting factors throughout their range, and as a baseline habitat condition. Baseline conditions in the action area, which were described earlier, reflect habitat degradation typical in the near-marine environment.

Within the action area, all three species would be affected over time by cumulative effects, some positive – as recovery plan implementation and regulatory revisions increase habitat protections and restoration, and some negative – as climate change and unregulated or difficult to regulate sources of environmental degradation impacting the action area persist or increase. Overall, to the degree that habitat trends are negative, the effects on viability parameters of each species are also likely to be negative. In this context we consider add the effects of the proposed action on individuals to determine effects on the listed species at the population and ESU/DPS scales.

A low number of individuals PS Chinook salmon from every cohort while the farm is in operation, will experience reduced prey abundance and obstructed migration/potential stranding that put them at greater risk of reduced growth, and/or greater susceptibility to predation. The annual number of PS steelhead expected to have similar consequences is lower, because they are larger fish when they reach this environment. Over the life of the project individuals from the same cohorts may also experience some slight habitat benefits (water quality) and prey recolonization could ameliorate the prey reductions. A few individuals from each species could experience improved fitness or growth. When considered over time, the effects are insufficient to reduce the productivity, spatial structure, or diversity of either salmonid species.

NMFS finds it likely that over the course of the project's existence, a very small number of larval and juvenile PS/GB bocaccio would encounter the project's anti-predator nets and parking curbs which increases the likelihood of their injury or death, and fewer still would experience direct injury or death. Considering the potential impacts together with the status of the species, the baseline, and cumulative effects, the reduced abundance of larval bocaccio is expected to be so low that the proposed action would not have any measurably alter PS/GB bocaccio population productivity, spatial structure, or diversity. Therefore, the proposed action would not appreciably reduce the likelihood of survival and recovery of this listed species.

2.7 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, it is NMFS' opinion that the proposed action is not likely to jeopardize the continued existence of Puget Sound Chinook salmon, PS steelhead, or GB bocaccio rockfish and would not destroy or adversely modify designated critical habitat for these species.

2.8 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by interim guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "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.

2.8.1 Amount or Extent of Take

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

- Harm of juvenile PS Chinook, PS steelhead, and GB bocaccio from reduced forage and increased predation risk.
- Injury or death of juvenile PS salmonids and GB bocaccio from entrapment in loose anti-predator nets.
- Injury or death of juvenile PS salmonids and GB bocaccio caused by stranding due to existence of parking curbs.

When take is in the form of harm from habitat degradation, it is often impossible to enumerate the take that would occur because the number of fish likely to be exposed to harmful habitat conditions is highly variable over time, influenced by environmental conditions that do not have a reliably predictable pattern, and the individuals exposed may not all respond in the same manner or degree. Where NMFS cannot quantify take in terms of numbers of affected individuals, we instead consider the likely extent of changes in habitat quantity and quality to indicate the extent of take as surrogates. The best available indicators for the extent of take, proposed actions are as follows.

For take of PS Chinook, PS steelhead, and GB bocaccio resulting from reduced forage and increased predation risk we use the area (acres) of clam culture (where gravel placement would occur) and on-bottom oyster culture as the surrogate take indicator – this area is approximately .63 acre. This area functions as a surrogate for take because it is an easily observable measure and the harm is causally related to physical changes in habitat, and the response of fish.

For take of juvenile PS Chinook, PS steelhead, and GB bocaccio from the retention of 63 parking curbs we use the area (in square feet) of the in-water structures as the surrogate take indicator – this area is approximately 252 square feet. This area functions as a surrogate for take because it is an easily observable measure and the harm is causally related to physical changes in habitat, and the response of fish.

For take of PS Chinook salmon, PS steelhead, and GB bocaccio from loose cover nets we adopt the number used in the WA Shellfish Aquaculture Programmatic Biological Opinion (WCR-2014-1502) which is 5 times over the life of the permit. As such, a total of five entanglements of PS salmonids and/or PS/GB bocaccio is the limit of take, and any visually confirmed entanglements beyond five will trigger reinitiation.

2.8.2 Effect of the Take

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

2.8.3 Reasonable and Prudent Measures

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

The Corps and/or its applicant shall:

1. Minimize take (harm) of PS Chinook, PS steelhead, and PS/GB bocaccio from the parking curbs.

2. Minimize take (injury or death) of PS Chinook salmon, PS steelhead, and PS/GB bocaccio from entanglement with shellfish cover nets.

3. Monitor and report as incidents occur, any loose nets, and any entangled fish, regardless of species, and collect specimens of the entangled fish.

2.8.4 Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. 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. The following terms and conditions implement reasonable and prudent measure 1: Broken curbs must be removed from the substrate, and lost or broken curbs shall not be replaced. No new curbs or similar alternative structures may be installed.
2. The following terms and conditions implement reasonable and prudent measures 2: Ensure clam and other shellfish cover nets are secured to the extent practicable, this could include burying the net's edges or weighed with a lead line.
3. The following terms and conditions implement reasonable and prudent measure 3: Report and loose cover nets regardless of whether fish were entangled.
    a. If fish are entangled, record and report the time, and location of entanglement, and the number of fish entangled.
    b. Collect dead specimens of fish entangled shall and preserve them in a freezer; Contact the NMFS' Lacey Office in order to determine appropriate steps to ascertain species identification.
    c. Report details of entanglement above, and species so entangled. Reports should be provided to projectreports.wcr@noaa.gov

2.9 "Not Likely to Adversely Affect" Determinations

The NMFS anticipates the proposed action will have only insignificant or discountable effects on the species named in Table 4. Additionally, the proposed action will not take any of the species listed in Table 2. To reach this determination we reviewed the potential effects of all aspects of the proposed activity.

The applicable standard to find that a proposed action is NLAA listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial.[1] Discountable effects cannot be reasonably expected to occur. Insignificant effects are so mild that the effect cannot be meaningfully measured, detected, or evaluated. Beneficial effects are contemporaneous positive effects without any adverse effect to the listed species or critical habitat, even if the long-term effects are beneficial. NMFS concurs with the COE's NLAA determinations to the species in Table 4.

Table 4. NLAA Species

ESA-Listed Species	**Status**	**Is Action Likely to Adversely Affect Species or Critical Habitat?**
PS/GB Yelloweye Rockfish (*S. ruberrimus*)	Threatened	No
Southern Resident Killer Whale (*Orcinus orca*)	Endangered	No

As discussed above in Section 2.4, potential effects to listed species from the proposed action include suspended sediment, substrate disturbance/forage reduction, entanglement in cover nets, impaired ability to migrate/potential stranding behind curb structures. We present here if exposure to these effects is discountable or if not discountable, if response is insignificant.

Yelloweye Rockfish and its Critical Habitat

Yelloweye rockfish larvae are produced two times per year in Puget Sound, and float within the water column for approximately 2 months. Unlike bocaccio, juvenile yelloweye rockfish are not typically found in intertidal waters (Love et al. 1991; Studebaker et al. 2009), but are most frequently observed in waters deeper than 30 meters (98 ft) near the upper depth range of adults (Yamanaka et al. 2006). The depths at the project site are shallower than preferred by adult and juvenile yelloweye rockfish, therefore it is unlikely that adult or juvenile rockfish would be found in the project vicinity. Based on this, exposure of yelloweye rockfish is considered discountable.

Similarly, critical habitat for yelloweye is in areas deeper than the proposed action. Effects of the action are unlikely to extend to areas of critical habitat, and therefore we consider the effects on critical habitat discountable.

Southern Resident Killer Whales and their Critical Habitat

Southern Resident killer whales do not inhabit the intertidal area where the proposed shellfish cultivation would occur. As such, the only potential effect would be from noise impacts related to aquaculture. The activities associated with the proposed action are not expected to create a noise impact on the listed species. In-water noise impacts from the proposed action are expected to be discountable because the work in water entails nothing louder than motorized boat noise or a small pressurized water sprayer on occasion, with most work being completed with hand tools. Further, the project will have minimal take on PS Chinook salmon, the primary forage base of SRKW. The effects to Chinook salmon will not cause population-level effects that will measurably reduce the quantity and availability of SRKW forage. Based on the information contained above, the potential for effects SRKW from the action is insignificant.

Southern Resident killer whale has designated critical habitat within Case Inlet, but at depths greater than 20 feet, excluding the project area from being considered as designated critical habitat. While some effects may extend to areas of critical habitat, effects would be either discountable or insignificant. This includes effects on prey (predominantly PS Chinook salmon) which will occur (see section 2 of this document) but at a level that is not expected to significantly affect any Chinook populations overall viability.

2.10 Conservation Recommendations

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

1. The USACE should provide a condition that the applicant remove all parking curbs from the action area.

2. The USACE should provide a condition that the applicant avoid harvesting and placing gravel or shell to enhance substrate for shellfish activities where kelp (rooted/attached brown algae in the order *Laminariales*) is present.

2.11 Reinitiation of Consultation

This concludes the ESA consultation for Glaser Shellfish Farm After-the-Fact Project.

Under 50 CFR 402.16(a): "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: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If 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 written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

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

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

This analysis is based, in part, on the EFH assessment provided by the COE and that conducted by NMFS, and descriptions of EFH for Pacific Coast groundfish (Pacific Fishery Management Council (PFMC 2022a), coastal pelagic species (CPS) (PFMC 2023), and Pacific Coast salmon (PFMC 2022b) in the fishery management plans developed by the PFMC and approved by the

Secretary of Commerce. In this case, NMFS concluded the proposed action would not adversely affect EFH for highly migratory species.

3.1 Essential Fish Habitat Affected by the Project

As part of the information provided in the request for ESA concurrence, the USACE determined that the proposed action may have an adverse effect on EFH designated for Pacific Coast salmon, groundfish, and coastal pelagic species. The effects of the proposed action of EFH are the same as those described above in the ESA portion of this document. The action area also contains Habitat Areas of Particular Concern (HAPC) for Pacific Coast groundfish.

3.2 Adverse Effects on Essential Fish Habitat

The proposed action is issuance of a permit that will enable the continuation of ongoing shellfish aquaculture activities. Several adverse effects are described more fully in part two of this document and we reiterate them briefly here:

The proposed action will adversely affect EFH within the action area via the following mechanisms:

1. The proposed harvest methods and gravel placement would temporarily reduce water quality by creating occasional pulses of suspended sediments.

2. The proposed harvest activities, gravel placement, and anti-predator netting would disturb benthic habitat and reduce the quantity and quality of prey communities.

3. The parking curbs and anti-predator netting would create enduring incremental diminishment migration conditions and settlement habitat for Pacific Coast salmon and groundfish.

3.3 Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH.

1. The COE/permittees should remove the parking curbs from the action area.

2. The COE/permittees should avoid harvesting and placing gravel or shell to enhance substrate for shellfish activities where kelp (rooted/attached brown algae in the order *Laminariales*) is present.

Fully implementing these EFH conservation recommendations would protect, by avoiding or minimizing the adverse effects described in section 3.2, above, for Pacific Coast salmon, Pacific Coast groundfish, coastal pelagic species.

3.4 Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the 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 the 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 the USACE. Other interested users could include the applicant, the WDFW, and the citizens of Harstine Island. Individual copies of this opinion were provided to the USACE. The document will be available at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2 Integrity

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

4.3 Objectivity

Information Product Category: Natural Resource Plan

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

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

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

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

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