Attachment D

Threatened and Endangered Species: 1990 Programmatic EIS Update

Attachment D to SEPA Checklist

1990 Programmatic EIS *Fish Culture in Floating Net Pens* Update:

Federally-Listed Threatened and Endangered Species and Species of Concern, and Washington State-Listed Species and Candidate Species

Cooke Aquaculture Pacific Marine Aquaculture Permit Application to Transition from Growing Atlantic Salmon to Growing All-Female Triploid Rainbow Trout/steelhead at the Cooke Existing Marine Net Pen Sites in Puget Sound, Washington

A. INTRODUCTION

The Washington Department of Fish & Wildlife (WDFW) plans to adopt the *Final Programmatic Environmental Impact Statement (PEIS): Fish Culture in Floating Net-Pens* (WDFW January 1990), or incorporate the PEIS by reference into the SEPA determination for the Cooke Aquaculture proposal to convert the species farmed at its existing Puget Sound marine net pens from Atlantic Salmon to farming an all-female triploid Rainbow Trout/steelhead (*Oncorhynchus mykiss*). The PEIS does not address threatened or endangered species that occur within the Puget Sound area, as these were listed after the PEIS was prepared. This additional information document has been prepared by the Cooke Aquaculture consultant team to address the potential effects of the species change proposal on Federally-listed threatened and endangered species, and Federal species of concern; and Washington State-listed species and candidates for listing.

PROPOSED ACTION

Cooke Aquaculture Pacific, LLC (Cooke) proposes to change the fish species being cultured at its seven (7) existing, permitted marine net pen aquaculture sites from Atlantic Salmon (*Salmo salar*) to domesticated stocks of mono-sex (all-female) sterile (triploid) Rainbow Trout/steelhead (*O. mykiss*).[1] All-female triploid Rainbow Trout/steelhead proposed to be raised in the net pen facilities is a sterile, mono-sex stock of fish that reduces the risk of genetic interference with native populations. Sterile fish stocks have also been used in numerous public agency recreational fish stocking programs for many years for this very same reason.

The existing Cooke Aquaculture Puget Sound marine net pen sites operate under the conditions of all required State agency permits for the commercial rearing of Atlantic Salmon in marine net pens. The farms have been raising almost exclusively Atlantic Salmon for the past 30 years. A recent change in Washington law (RCW 77.125.050), however, requires phasing out non-native finfish in marine net pen aquaculture. This change means that commercial marine finfish production in Washington will have to find a commercially viable and native species to farm in order stay in the business of growing seafood for human consumption. Rainbow Trout/steelhead are a native species to the Pacific Northwest region and have been commercially raised in Washington, primarily in freshwater facilities, for more than 80 years if not longer. Cooke is requesting re-approval of their Marine Finfish Aquaculture Permit (WAC 220-370-100) from the Washington Department of Fish and Wildlife (WDFW) that will allow the company to start raising domesticated stocks of all-female triploid Rainbow Trout/steelhead (*O. mykiss*) at their marine farms. Other than transitioning to the commercial cultivation of a different species of fish, the company is not planning

[1] While the common names Rainbow Trout and steelhead are often used interchangeably, this document refers to Rainbow Trout, which is the single official common name given to the species (*O. mykiss*) by the American Fisheries Society several years ago.

any alteration to the existing fish pen physical structures, site locations, supporting equipment, or general current practices, methods and cultivation techniques currently used for growing Atlantic Salmon in net pens. Domesticated stocks of all-female triploid Rainbow Trout/steelhead have very similar physiological and metabolic requirements to those of domesticated stocks of Atlantic Salmon. The basic difference is that all female, triploid (three chromosomes) Rainbow Trout/steelhead have been found to be reproductively sterile,[2] and thus convert their energy almost entirely to growth. By comparison, diploid populations of Rainbow Trout/steelhead eventually begin to sexually mature at certain age (maturation), and begin to expend energy toward the development of reproductive organs.

The company will use local stocks of all-female triploid Rainbow Trout/steelhead produced by Troutlodge hatcheries in Pierce County. Troutlodge brood stock are cultivated in Washington specifically for the production of ova to supply both private and public aquaculture operations. Troutlodge, a Washington-based company, has been producing Rainbow Trout/steelhead eggs for sale to private fish farms and public enhancement hatcheries throughout the world since 1945. Brood fish are raised in regulated pathogen-free conditions for their entire life cycle. The company utilizes a comprehensive health testing and disease-free certification program that exceeds World Organization of Animal Health (OIE) standards at their Washington facilities, allowing them to export live salmonid eggs throughout the world.

Troutlodge has been producing mono-sex (all-female) populations of Rainbow Trout/steelhead eggs since the mid-1990s. The all-female (XX only) ova are subsequently fertilized with X-only mono-milt. Triploidy is induced by mechanical pressure shock. For a short period of time, a high-pressure hydrostatic shock is applied to the newly fertilized eggs at a specified time point post-fertilization. The post-fertilization pressure treatment forces the fertilized egg to retain the third set of chromosomes that is normally ejected at this time. Pressure is then released and the triploid (3n) eggs are allowed to continue development. Ploidy is confirmed using a fluorescent nucleic acid label on either embryo or blood tissue using a flow cytometer at the Washington State University School of Veterinary Medicine. Testing results of Troutlodge triploid fish and eggs over a period of five (5) years (from 2013 to 2018) demonstrate a high rate of success in triploid induction (99.83% − 2,950 of 2,955 fish and/or eggs sampled); see SEPA Checklist Attachment A.

Cooke operates two freshwater hatcheries in the Scatter Creek area of Thurston County. The hatcheries raise and produce the juvenile fish that are eventually transferred to Cooke's Puget Sound marine net pens for final cultivation to the desired harvest size. Eyed all-female triploid Rainbow Trout/steelhead eggs would be supplied to the Cooke hatcheries from the Troutlodge hatchery under a WDFW Fin Fish Transport permit. The eggs would be hatched and cultured to a certain size in the Cooke hatcheries, and then transferred to the marine net pens after undergoing the necessary fish pathogen screening protocols, subject to review and approval by WDFW. Thereafter, a Fin Fish Transport Permit would be required from WDFW for each specified lot of fish to be transferred from Cooke hatcheries to the marine net pens.

Marine net pen cultivation and production protocols for Rainbow Trout/steelhead are basically the same as those used for Atlantic Salmon. Maximum cage density levels are expected to be managed at the same levels (approximately 0.9 to 1.2 lb/ft^3 or 15 to 20 kg/m^3), resulting in comparable maximum biomass levels that have historically been attained at each of the existing Cooke Aquaculture sites. Depending upon Rainbow Trout/steelhead size at harvest (targeted mean weights of approximately 7 to 9 lbs or 3.5 to 4.2 kg); the fish population sizes at each marine net pen site are expected to be similar to stocking levels for Atlantic Salmon. The fish feed composition for marine-reared trout diets will be the same or similar to

[2] Less than 1% (0.17%) of Troutlodge triploid fish and eggs tested over a period of five (5) years (from 2013 to 2018) were found to have the potential to still be reproductive; see discussion below and SEPA Checklist Attachment A.

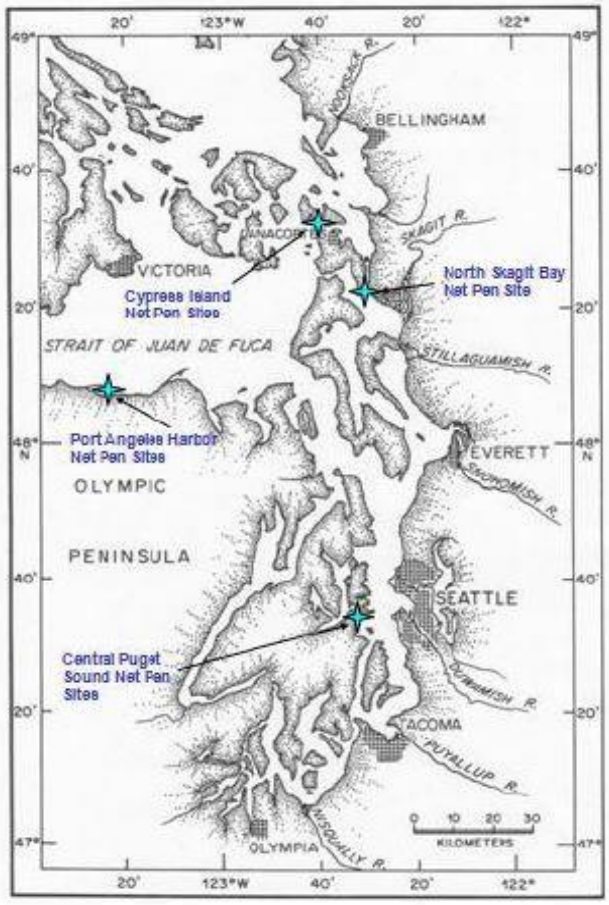
the currently-used marine salmon diets. Modern salmon and trout feeds are composed of highly digestible ingredients that are specifically formulated for optimal growth and feed conversion rates. No differences in water quality or sediment quality are expected to result from this change in species or the accompanying Rainbow Trout-specific feeds that would be used. Additional information on feed composition, expected feed conversion rates, projected growth rates, projected pen densities and production cycles is provided in SEPA Checklist Attachment B (Additional Information) in response to Information Request D.2.

All net pen support structures, stock nets, and predator exclusion nets will be the same types of equipment as that used for Atlantic Salmon production. Rainbow Trout/steelhead produced in this manner will be harvested, processed, packaged and shipped fresh to seafood customers throughout the United States.

PROJECT ACTION AREA

Existing Cooke Aquaculture marine net pen facilities with current, valid lease for State-owned aquatic lands are located at Fort Ward, Orchard Rocks, Clam Bay and Hope Island (see Vicinity Map). NPDES permits for these four facilities were recently renewed (on July 11, 2019) for these four facilities. Application materials for a modification to the NPDES permits to allow the cultivation of Rainbow Trout/steelhead in the net pens are currently being reviewed by the Washington Department of Ecology (Ecology). Cooke Aquaculture Pacific is working with the Washington Department of Natural Resources (WDNR) to resolve lease issues with existing marine net pen locations at Cypress Island (Site 1 and Site 3), and Port Angeles. If the situation is resolved, permits will also be pursued for these net pen sites to transition to native species aquaculture.

The project action area for the Cooke Aquaculture species conversion proposal corresponds to the location of the company's existing marine net pens which occur primarily within or adjacent to Central Puget Sound, North Puget Sound, the Strait of Juan de Fuca, and the Strait of Georgia. Literature indicates that potential effects of aquaculture are limited to 100 meters or less from the edge of net pens (Chamberlain and Stucchi 2007; Rooney and Podemski 2009; Noakes 2014). Minimum water depths of the existing net pens range from 35 feet to 95 feet below MLLW. Six pen sites are deeper than 55 feet, which is near the lower depths of nearshore salmon habitat (NMFS 2011). Likewise, fishes using deeper habitats (such as Pacific Cod, Pollock, and rockfishes) seldom occur within the shallower habitat where the existing net pens occupy a small amount of the available habitat.



Vicinity Map

EFFECTS ANALYSIS REQUESTED BY WDFW[3]

WDFW requested that the Federal- and State-listed species effects analysis take into consideration the extent to which changes in Puget Sound baseline light, sound, effluent (water quality), boat traffic, disease transmission, and escaped fish producing potential genetic and ecological effects (e.g., predation and competition) may affect listed species. The effects analysis for each listed species described in this Attachment D addresses these issues to the extent that they are applicable, and includes subsections specific to the species conversion proposal (see Attachment D, Section F below).

WDFW renewed the Cooke Aquaculture Marine Finfish Aquaculture permit to continue raising Atlantic Salmon *(S. salar)* for all existing net pen facilities that have a valid State-owned Aquatic Land lease (through the remaining term of those leases), and Ecology reissued the Section 402 NPDES permits for these sites on July 11, 2019. The SEPA Checklist prepared for this proposed action describes little to no change in the effect of the species conversion proposal overall on Puget Sound light (SEPA Checklist Section B.11), sound (SEPA Checklist Section B.7.b), water quality (SEPA Checklist Section B.3.a.6), or vessel traffic (SEPA Checklist Section B.14.f) because it will utilize existing marine net pens that have

[3] Additional information request sent to Cooke Aquaculture by 5/21/19 e-mail communication from Ken Warheit, Ph.D., Supervisor, Washington Department of Fish & Wildlife Fish Health Section.

been installed and operational since the mid-1970s and mid-1980s.[4] No new facility siting or expansion is proposed. Consistent with the SEPA Guidelines, no global updates (1990 to 2019) to the 1990 Programmatic EIS have been prepared for light, sound, water quality, or vessel traffic since "*Elements of the environment that are not significantly affected need not be discussed"* (WAC 197-11-440(6)(a).

WDFW information requests regarding disease transmission, and regarding the potential for escaped Rainbow Trout/steelhead to cause genetic or ecological effects such as predation and competition, are thoroughly discussed in the Additional Information document (Attachment B) submitted with the July 2019 revised SEPA Checklist.

C. REGULATORY UPDATE SINCE 1990

Operational permits, approvals, and authorizations are required from multiple local, State, and Federal agencies for commercial finfish aquaculture. These permits and approvals are designed to protect ESA-listed species and habitats; protect historic and ongoing shoreline uses; assure compliance with Washington State sediment and water quality standards; regulate aquatic animal cultivation; and implement food safety regulations. This section describes current regulations involved with finfish aquaculture in Washington State, and provides a brief overview of the current requirements of these permits and approvals.

Local Jurisdiction Shoreline Substantial Development Permit (SSDP) or Shoreline Conditional Use Permit (SCUP). Washington State statute considers Aquaculture a water-dependent and preferred use of the shoreline environment and of statewide interest: *"This activity (Aquaculture) is of statewide interest. Properly managed, it can result in long-term over short-term benefit and can protect the resources and ecology of the shoreline. Aquaculture is dependent on the use of the water area and, when consistent with control of pollution and prevention of damage to the environment, is a preferred use of the water area"* ([RCW 90.58.020, WAC 173-26-201[2][d] and WAC 173-26-241[3][b][i][A]). Cities and Counties have jurisdiction over certain types of water-dependent uses within their boundaries. In addition, State-owned aquatic lands also fall under multiple State and Federal agency controls, authorities and regulations (described below). Marine aquaculture is unique and unlike upland land use permitting in many ways. Shoreline permits are issued under the regulations of the local jurisdiction Shoreline Master Program. Conditions are imposed through a SSDP or SCUP for construction and operation of new facilities. Shoreline Management Act (SMA) regulations provide for reasonable use of State shorelines and aquatic lands that facilitate public commerce while taking into consideration Statewide interests. The local jurisdiction Shoreline permitting process also requires compliance with Critical Area regulations, including protection standards for fish and wildlife habitat conservation areas and preparation of site-specific technical reports, and addresses land use issues such as light and glare, noise, view impacts, and compatibility with existing uses. Since there will be no new construction with the Cooke Aquaculture species change proposal, no Shoreline permits will be required.

State Environmental Policy Act (SEPA) Review and Determination. Cooke Aquaculture has prepared and submitted to WDFW an Environmental Checklist consistent with the SEPA Guidelines (WAC 197-11-315). The Checklist with Additional Information attachments constitutes an "expanded" SEPA Checklist. While not specifically defined in the State Guidelines, an expanded Checklist is accompanied by technical studies and/or additional information to address issues identified by the SEPA lead agency in

[4] Clam Bay approximately 1977; Fort Ward approximately 1975; Orchard Rocks 1977; Hope Island approximately 1985; Ediz Hook approximately 1985; Cypress Island Site 1 approximately 1985; Cypress Island Site 3 1986.

more detail, and to formulate proposed mitigation measures. After reviewing the SEPA Checklist and supporting documentation, WDFW will issue its SEPA Threshold Determination consistent with WAC 197-11-330 through -350. This proposed determination will be circulated for review by the Department of Ecology (Ecology), Department of Agriculture (DOA), Department of Natural Resources (WDNR) and other agencies with jurisdiction, affected Tribes, and interested groups and individuals for a public comment period.

Joint Aquatic Resource Permit Application. New finfish aquaculture facilities are required to submit a Joint Aquatic Resources Permit Application (JARPA) to all agencies involved in issuing permits and approvals related to the use of State or Federal waters. These include State and Federal agencies and Tribal governments in addition to the local Shoreline permit jurisdiction. The JARPA process provides for inter-agency coordination to address the overall features of the proposed action and its potential effects. The JARPA application describes the proposed project in specific detail regarding the project location, proposed construction methods, timing, dimensional characteristics, facility operational plans and any proposed mitigation measures. Mitigation measures can be incorporated by each agency with jurisdiction, through conditions of the various permits. There are also public involvement opportunities associated with the JARPA process. Since there will be no new construction with the Cooke Aquaculture species change proposal, no JARPA process will be required.

U.S. Army Corps of Engineers (USACE), Rivers and Harbors Act (RHA) Section 10 Permit, ESA Consultation, and Tribal Consultation. New projects (e.g., new net pen siting and construction) require a Section 10 Rivers and Harbors Act Authorization from the U.S. Army Corps of Engineers (USACE) for work and structures placed within the navigable waters of United States. Permit authorization is dependent on a thorough evaluation of potential effects to Endangered Species Act (ESA)-listed species and critical habitats found in the project vicinity. A project-specific Biological Evaluation (BE) to address new construction evaluates potential effects on ESA-listed species and critical habitats, and identifies proposed measures to minimize effects. The National Marine Fisheries Service (NMFS) and U.S. Fish and Service (USFWS) provide ESA Section 7 consultation to the Corps regarding potential effects to listed species under their jurisdiction, and describe mitigation measures to be included in the Section 10 permit. The Corps also seeks input from local Tribal governments with respect to treaty fishing rights and natural resources within their Usual and Accustomed (U&A) harvest area. Since there will be no new construction with the Cooke Aquaculture species change proposal, no RHA Section 10 permit will be required.

Washington Department of Ecology (Ecology) − Coastal Zone Management (CZM) Compliance. The Federal *Coastal Zone Management Act* requires all projects within coastal zones of the State of Washington to be certified for compliance by Ecology before any Federal agency (e.g., USACE) issues a permit authorization. State certification ensures that Federally-permitted projects are consistent with the State Coastal Zone Management Program, which has Federal approval. This applies to all shoreline activities in or affecting 15 coastal counties in Washington. Since there will be no new construction with the Cooke Aquaculture species change proposal, no CZM compliance determination is required.

Ecology − National Pollutant Discharge Elimination System (NPDES) Permit. Since 1996, Ecology has required aquaculture operators to obtain a National Pollutant Discharge Elimination System (NPDES) Individual permit for commercial net pen facilities within the State. This Clean Water Act permit requires monitoring, reporting, operational guidelines, Best Management Practices (BMPs), and Best Available Technology (BAT) for the facility to minimize pollution. NPDES measures are in addition to the monitoring and reporting requirements of other permits.

A key component of the NPDES permit for commercial net pen facilities is definition of a Sediment Impact Zone (SIZ) and Total Organic Carbon (TOC) monitoring. Organic carbon compounds are the main discharge of nutrients from salmonid net pen farm operations including Atlantic Salmon or Rainbow Trout/steelhead. The NPDES permit requires that the organic carbon levels of the sediments sampled at the 100-ft perimeter around the net pen facility (the Sediment Impact Zone boundary) be no higher than the normal organic carbon levels found in reference sample data collected at undisturbed locations throughout Puget Sound. These standards are set for the protection of benthic organisms and the surrounding marine environment. Sampling is carried out by a third-party consultant, and the analysis is conducted by a certified, independent laboratory. If a farm is out of balance with the natural assimilative properties of bottom sediments, such that carbon enrichment is identified, active mitigation will be required at the site. These measures may include additional TOC monitoring, a possible reduction in feeding amounts, reduction in fish stocking biomass, fallowing the site to allow recovery time of the sediments, possible reorientation/relocation of the site to change the hydrodynamics of a farm, or the complete removal and closure of the site if remediation does not cure the sediment standard exceedance. TOC tests will be carried out annually each summer, and additionally during the peak biomass period as the fish population is starting to be harvested from the facility if it occurs outside of the annual summer sampling period.

NPDES Individual permits for Cooke Aquaculture existing marine net pen operations in Puget Sound are based on current (2019) Ecology regulations. Specific conditions, restrictions, and monitoring and reporting procedures are designed to protect public health and safety, and to meet water and sediment quality standards that protect the environment. NPDES Individual permits for the Cooke Aquaculture Atlantic Salmon net pen facilities at Clam Bay, Fort Ward, Orchard Rocks, and Hope Island were recently reissued (July 11, 2019), conditionally authorizing discharges associated with commercial rearing of Atlantic Salmon, subject to closing out non-native fish rearing after the Washington Department of Natural Resources (WDNR) State-owned aquatic land leases expire in 2022. The renewed permits indicate that if the company elects to raise native fish at these locations in the future, Ecology will consider a permit modification and may apply the discharge limits and requirements of the existing NPDES permits to native finfish. The reissued permits become effective on August 10, 2019 and expire on August 9, 2024.

Washington Department of Fish and Wildlife (WDFW) Aquatic Farm Permit and Registration. Cooke Aquaculture existing marine net pen operations in Puget Sound are all registered with WDFW, as required by this permit. The Aquatic Farm Permit is specific to each individual aquatic farm location, and defines the type of species being reared at the facility. WDFW Aquatic Farm registration requires annual renewal by the Department. Cooke has requested the addition of Rainbow Trout/steelhead (*O. mykiss*) to their Aquatic Farm Permits for the facilities and the Department has made this modification to the permit.

WDFW Marine Finfish Aquaculture Permit. WDFW has the authority to approve, deny or approve with conditions the Marine Finfish Aquaculture Permit (MFAP). An aquatic farmer must have a valid MFAP that approves the species, stock and race of finfish being reared at that specific location. On March 19, 2019, WDFW approved the renewal of the Marine Finfish Aquaculture Permits for rearing Atlantic Salmon *(Salmo salar)* at the Cooke Aquaculture facilities. WDFW conditioned those permits to the Cooke net pen sites that have a valid existing WDNR lease for State-owned aquatic lands. These facilities include the Hope Island site in Skagit County, and the Clam Bay, Orchard Rocks and Fort Ward net pen sites in Kitsap County. Cooke also applied for renewal of the MFAP for the Port Angeles and Cypress Island net pen sites to raise both Atlantic Salmon and Rainbow Trout/steelhead; however, these sites do not currently have a valid lease for State-owned aquatic lands. The status of the WDNR lease agreement with these two locations is pending appeal.

The Aquaculture Finfish permit requires development of a plan of operation; accidental fish release prevention, response and reporting procedures; and other components. Copies of these plans and a Plan of Operation for a Finfish Permit Application were originally sent to the Department on January 18, 2019. Cooke is requesting approval of a Marine Finfish Aquaculture Permit from WDFW to allow the company to begin growing a native species, Rainbow Trout/steelhead, at their marine net pen facilities. These will be domesticated stocks of mono-sex (all-female) sterile (triploid) Rainbow Trout/steelhead, described above under the Proposed Action.

WDFW Finfish Transport Permit. Smolt transport from the Cooke Aquaculture hatchery near Olympia to existing marine net pen operations requires a WDFW Finfish Transport Permit to authorize the movement of live fish within Washington State. WDFW has regulatory authority and is responsible for enforcing the fish health laws and disease control regulations of Washington. Private finfish aquaculture facilities are subject to the same laws and regulations as State, Federal and Tribal fish hatcheries and fish enhancement facilities. Any findings of regulated pathogens at private or public finfish aquaculture facilities must be reported to WDFW fish health authorities within 24 hours. WDFW requires fish hatcheries to perform routine disease screening of adult brood fish as well as the offspring from spawning events. WDFW issues Finfish Transport permits based on the ability to verify that the brood fish and offspring tested free of any ecologically- or economically-important fish pathogens or parasites.

Additional Ecology and WDFW Regulatory Oversight. Ecology under the NPDES permit, and WDFW under the Finfish Aquaculture and Finfish Transport permits, require that accidental fish escapement be reported to them within 24 hours of knowledge of the event. As part of these State permits, the aquaculture industry has developed Fish Escape Prevention Plans and Accidental Fish Escape Response and Reporting Plans, as well as implemented other safeguards to minimize the risks of escapement. New laws became effective on June 7, 2018 with regard to non-native marine aquaculture. Those new laws phase out the growing of non-native marine fish in marine net pens over the next several years, which means that if there is any new marine finfish aquaculture to continue in Washington, native finfish species would have to be raised. The law also requires inspections of the physical net pen structures every two years by a licensed engineering firm with reports submitted to WDNR and WDOE. The industry has worked with the various agencies since the Cypress Island net pen collapse that occurred in August 2017 to implement various programs for routine inspections of the facilities by agency personnel and routine reporting to the agencies by the industry. The farmers have a financial interest in ensuring that all fish raised in a marine net pen facility make it to the market place. With this objective, companies engaged in the aquaculture industry have invested significantly to improve rearing equipment and cultivation practices to ensure that this occurs.

Since 2002, aquatic farmers have been required to mark each fish as identifiable to the individual aquatic farmer that grows it. Otolith (ear bone) marking of farmed stocks was developed in conjunction with WDFW technicians. Thermal otolith marking is also used by public enhancement hatcheries to identify the hatchery origins of the Pacific salmon they release into the wild. When these salmon return to spawn in Washington rivers, the hatchery origin of commercially- and recreationally-caught fish can be identified by WDFW.

Per Washington regulations also passed in 2002, no genetically-modified (trans-species) fish can be raised in commercial marine net pens in Washington State (WAC 220-370-100). No transgenic fish have ever been raised by the Washington marine net pen industry.

Washington Department of Natural Resources (WDNR) Aquatic Use Authorization. As mentioned above, the Cooke Aquaculture Hope Island, Clam Bay, Fort Ward and Orchard Rocks marine net pen operations have valid existing Aquatic Use Authorization and State-owned Aquatic Land Leases issued

by WDNR. The status of the leases at the Cypress Island and Port Angeles net pen sites are being appealed, and until resolved, these sites do not have a valid aquatic use permit. Washington State owns the aquatic lands, and WDNR leases aquatic lands for water-dependent uses. These leases have conditions and rules for the allowable activities within the lease boundary areas, and are written to protect natural resources while creating economic activity from a public resource. Any vacated lease must have all physical improvements completely removed from them so that the lease area is returned to prior conditions. A certainty bond is required within the terms of the lease. Cooke Aquaculture prepares and submits quarterly harvested fish production reports to WDFW and WDNR. Lease payments are based on a flat annual rate and an additional royalty amount based on the harvest production each year.

U.S. Coast Guard Private Aids to Navigation (PATON) Permit. Operators of floating structures permanently moored in the navigable waters of the U.S. must obtain a Private Aids to Navigation (PATON) permit for placement of navigational warning lights on the structure. The exact latitude and longitudinal coordinates for each light and the light specifications are registered with the U.S. Coast Guard. These are entered onto updated navigational charts. Fish farm structures are required to install two or more 6-second flashing yellow navigation lights. Cooke Aquaculture existing marine net pen operations in Puget Sound have current PATON permits.

U.S. Food and Drug Agency (USFDA). Aquaculture facilities must comply with rules and regulations pertaining to the production of food fish for human consumption. Only USFDA-approved disease control chemicals are allowed to be used. Periodic random inspections of aquaculture products are carried out by the USFDA. Fish processing plants are periodically inspected by USFDA for compliance with current food safety regulations. USFDA requires a Hazards Analysis and Critical Control Points (HACCP) plan and strict record keeping to be licensed to process and sell fish products.

Siting Standards. Ecology, in conjunction with WDNR and WDFW, prepared *Recommended Interim Guidelines for Management of Salmon Net Pen Culture in Puget Sound* (1986) when commercial salmon pens were first being developed in Puget Sound in the mid-1980s. The *Interim Guidelines* initiated environmental standards and procedures for the proper location of fish pens in Puget Sound. Among other things, the *Guidelines* require that net pen sites be located in areas that meet minimum current velocity standards. By establishing minimum velocities, the standards ensure that re-suspension, oxygenation and assimilation of organic salmon farming waste products will occur so as to minimize potential benthic impacts.

Recommendations for Managing Commercial Net Pen Aquaculture in Washington's Straits and Estuaries. While the 1986 siting standards are generally still considered sound practices for locating new net pen aquaculture facilities, Ecology wanted to update these standards with state-of-the-art knowledge and best management practices, and to write recommendations to address operational issues for which there is now a performance history in Washington since commercial net pen aquaculture began in the mid-1970s. These issues included salmon interactions, marine life and other protected species interactions, disease management, sensitive habitats, water quality, feeds, predator control, antifoulants, transfer and transportation, escapes, marine debris, and emerging issues: climate change, ocean acidification, cumulative impacts, cultivation of non-salmonid finfish, and integrated multi-trophic aquaculture. A Planning Team was assembled in 2015, and a management recommendations outline was prepared for the guidance document.

The Washington State Legislature responded to the Cypress Island net pen collapse in August 2017 that resulted in the escapement of Atlantic Salmon to Puget Sound by passing Engrossed House Bill 2957, phasing out the remaining Atlantic Salmon net pens by 2022. The bill specifically directs Ecology WDFW, WDNR, and the Department of Agriculture (DOA) to complete the guidance effort initiated in

2015 for more State oversight of commercial net pen aquaculture. This effort receives substantial technical assistance from the NOAA National Centers for Coastal Ocean Science, the Northwest Indian Fisheries Commission, tribal governments, and academic institutions listed in the bill as project partners. The guidance project is designed to deliver recommendations for future consideration by State managers, and will not directly change State laws or regulations.

D. FEDERALLY-LISTED SPECIES AND SPECIES OF CONCERN

WDFW (May 21, 2019) identified the Federally-listed species to be addressed in the update of the 1990 *Programmatic EIS: Fish Culture in Floating Net Pens*, and in the SEPA analysis of the Cooke Aquaculture Puget Sound net pen species conversion proposal from rearing Atlantic Salmon to rearing Rainbow Trout/steelhead. Information provided in this section about each Federally-listed marine mammal, bird, fish and mollusc also includes the State species status; species description, distribution and habitat information; threats within the project action area; and, where applicable, a description of critical habitat. Additional State-listed species and candidate species are described in Section E. The effects of Atlantic Salmon marine net pen aquaculture, and of the Cooke Aquaculture species conversion proposal to rear all-female triploid Rainbow Trout/steelhead in the company's existing marine net pen facilities, is provided in Section F for both Federally-listed and State-listed species.

Common Name	Federal Species Status	State Species Status
Humpback Whale	Endangered	Endangered
Southern Resident Killer Whale	Endangered	Endangered
Northern Sea Otter	None[5]	Endangered
Stellar Sea Lion	None[6]	None
Bald Eagle	None[7]	None
Marbled Murrelet	Threatened	Threatened
Chinook Salmon (Puget Sound ESU)	Threatened	Candidate
Chum Salmon (Hood Canal Summer-run)	Threatened	Candidate
Chum Salmon (Puget Sound/Strait of Georgia ESU	None[8]	Candidate
Coho Salmon	Species of concern	None
Steelhead (Puget Sound ESU)	Threatened	Candidate
Bull Trout	Threatened	Candidate
Eulachon	Threatened	Candidate
Flathead Sole	Species of concern	None

[5] Northern Sea Otter presently have no Federal listing status. They are protected under the Marine Mammal Protection Act (https://www.fws.gov/wafwo/articles.cfm?id=149489657).

[6] Stellar Sea Lion presently have no Federal or State listing status. They are protected under the Marine Mammal Protection Act (WDFW, August 2008 [updated January 2019]: Priority habitats and species list).

[7] Bald Eagle presently have no Federal or State listing status. They are protected under the Bald and Golden Eagle Protection Act (WDFW, August 2008 [updated January 2019]: Priority habitats and species list).

[8] WDFW, August 2008 (updated January 2019).

Common Name	Federal Species Status	State Species Status
Green Sturgeon	Threatened	None
Pacific Cod	Species of concern	Candidate
Pacific Hake	Species of concern	Candidate
Pacific Lamprey	None[9]	None
River Lamprey	Species of concern	Candidate
Canary Rockfish	None[10]	Candidate
Bocaccio Rockfish	Endangered	Candidate
Yelloweye Rockfish	Threatened	Candidate
Pinto Abalone	Species of concern	Candidate

HUMPBACK WHALE (*Megaptera novaeangliae*)[11,12]

Status and Description

Humpback Whale were listed as endangered throughout their entire range under the Endangered Species Act on June 2, 1970 (35 FR 8491). They are also State-listed as endangered.[13] The Central North Pacific population has increased in abundance between the early 1980s and early 1990s; but the status of this population relative to its optimum sustainable population size is unknown (NOAA Fisheries. 2019a).

Humpback Whale are often identified by their large size, songs that can be heard many miles away, and their ability to breach in the water in spite of their large body size. Adults can grow to an average length of 40 to 60 feet and weigh as much as 44 tons.

Humpback Whale are filter feeders; they have no teeth. Their baleen plates have bristles that capture various small prey, and separate water and debris from their prey. Their only known natural predator is a pack of killer whales, though successful attacks are believed to be rare.

They hunt and feed during the summer months in cold waters, and migrate toward warmer tropical areas during the winter months to mate and bear offspring. They are known to travel as far as 16,000 miles. They are generally very solitary and non-social creatures that prefer traveling alone or in small groups of two to three, excepting when hunting or mating when they may be observed in large groups. Female Humpback Whale will bear a single offspring once every 2 to 3 years with the average gestation period lasting 11 to 12 months. This gestation period allows the female whale to return to warmer waters for birthing, where the calf can mature and prepare for the long migration back to the feeding grounds.

Distribution and Habitat

Surveys indicate that Humpback Whale occupy habitats around the world, with three major distinct populations: the North Atlantic, the North Pacific, and the southern oceans. These three populations do

[9] WDFW, August 2008 (updated January 2019).

[10] Genetic information collected by NMFS found that Canary Rockfish in the Puget Sound/Georgia Basin are not distinct from coastal Canary Rockfish, and therefore are not a Distinct Population Segment (DPS). To qualify for Federal ESA protections, a species must be discrete from the remainder of the species (NOAA Fisheries 2017).

[11] USEPA 2010.

[12] https://www.whalefacts.org/humpback-whale-facts/

[13] WDFW 2008 (updated January 2019).

not interbreed. Humpbacks generally feed for 6 to 9 months of the year on their feeding grounds in Arctic and Antarctic waters. The animals then fast and live off their fat layer for the winter period while on the tropical breeding grounds (NOAA Fisheries 2019a). The North Pacific herd of Humpback Whale that typically occupies southeastern Alaska waters also migrates to Hawaii and Mexico in the winter months for breeding. Humpback Whale in the North Pacific are seasonal migrants feeding on zooplankton, and small schooling fish in coastal waters off the coastal waters of the western United States and Canada (NOAA Fisheries 2019a).
Humpback Whale are not expected to be routinely present in Washington waters or in the waters potentially affected by existing Puget Sound commercial net pens.

Threats within the Project Action Area
The most significant threats to the survival of Humpback Whale include entanglements in fishing gear, collisions with ship traffic, and pollution of their coastal habitat from human settlements (NOAA Fisheries 2019a). Noise pollution (e.g., sonar) is also a growing concern.

SOUTHERN RESIDENT KILLER WHALE (*Orcinus orca*)[14,15]

Status and Description
The distinct population segment (DPS) of Southern Resident Killer Whale (SRKW) was Federally-listed as endangered on November 18, 2005 (70 FR 69903). Prior to the ESA listing, NMFS determined that the SRKW stock was below its optimum sustainable population and designated it as depleted under the Marine mammal Protection Act in May 2003 (68 FR 31980). SRKW are also State-listed as endangered.[16]

Southern Resident Killer Whale use echolocation during foraging and feed primarily on salmonids. Based on a study that included both Northern and Southern DPS whales, salmon were found to represent more than 96% of the prey during summer and fall. Chinook Salmon were the preferred prey species comprising 70% of the species taken despite the relatively low abundance of Chinook in these areas compared to other species. Chum Salmon were consumed extensively in the fall. Other prey species of Southern Resident Killer Whale include flatfish, lingcod, greenling, and squid.

The SRKW population has fluctuated considerably over the 30 years that it has been studied. In 1974, it comprised 71 whales, peaked at 97 animals in 1996, and then declined to 79 in 2001. The population now numbers 76 individuals.

Distribution and Habitat
Resident killer whales in U.S. waters are distributed from Alaska to California, with four distinct communities recognized: Southern, Northern, Southern Alaska, and Western Alaska. The Southern Resident DPS consists of three pods named J, K, and L. These pods reside for part of the year in the inland waterways of Washington State and British Columbia (Strait of Georgia, Strait of Juan de Fuca, and Puget Sound), principally during late spring, summer, and fall. Pods visit coastal sites off Washington and Vancouver Island. Offshore movements and distribution are largely unknown for this DPS.

Critical Habitat
The final Critical Habitat Rule for the SRKW Distinct Population Segment (DPS) was issued 11/29/06 (50 CFR Part 226). SRKW critical habitat includes approximately 2,560 square miles of Puget Sound,

[14] USEPA 2010.
[15] NMFS 2008.
[16] WDFW 2008 (updated January 2019).

excluding areas with water less than 20 feet deep relative to extreme high water. The Primary Constituent Elements (PCEs) for SRKW critical habitat are: 1) water quality to support growth and development; 2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and 3) passage conditions to allow for migration, resting, and foraging (NMFS 2011). Three specific areas are designated: the summer core area in Haro Strait and waters around the San Juan Islands; Puget Sound; and the Strait of Juan de Fuca, excluding 18 military sites for national security purposes (approximately 112 square miles).

Threats within the Project Action Area

The SRKW population is at risk for both incremental small-scale impacts over time (e.g. reduced fecundity or sub-adult survivorship) or to major catastrophe (e.g. oil spill or disease outbreak). The small size of this DPS makes it potentially vulnerable to allele effects (e.g., inbreeding depression) that could cause decline.

There are limited numbers of reproductive-age SRKW males and several females of reproductive age are not having calves. The factors causing the decline of SRKWs are not well known. Some of the possible causes of decline are: reduced quantity and quality of prey; persistent pollutants that could cause immune or reproductive system dysfunction; oil spills; acoustic effects and disturbance from vessels.

NORTHERN SEA OTTER (*Enhydra lutris*) [17,18,19,20]

Status and Description

The Northern Sea Otter is protected from hunting and harassment by the Marine Mammal Protection Act of 1972 but has no Federal listing under ESA. They were State-listed as endangered in 1981, due to the small population size, restricted distribution, and vulnerability of the population in Washington State.

WDFW issued their Sea Otter Recovery Plan in December 2004, the goals of which are to implement strategies that will ensure a self-sustaining Sea Otter population in Washington through the foreseeable future, and to manage the Washington Sea Otter stock in a manner that is consistent with the Marine Mammal Protection Act, other Federal and State laws, court rulings, and Federal treaties with Native American tribes.

Between 1740 and 1900, Russian and American fur traders harvested Sea Otter almost to extinction. The International Fur Seal Treaty halted commercial hunting of Sea Otter in 1911, after which their populations rebounded and they re-colonized much of their former range between Prince William Sound, Alaska west to the Kuril Islands. However, by the 1950s, they became extinct along the Pacific coast from Prince William Sound south to Baja California, with the exception of one remnant population in California. During the 1960s and 1970s, the Alaska Department of Fish and Game, in collaboration with other State and Provincial wildlife management agencies, reintroduced Sea Otter into former habitat in Alaska, Canada, Washington and Oregon. Due to these efforts, Sea Otter populations in southeast Alaska, British Columbia, and Washington are currently stable and increasing, but have not yet rebounded to pre-commercial harvest levels.

Studies have found that genetic exchange between the British Columbia and Washington Sea Otter populations is occurring, but to an unknown degree. Given a steady and substantial increase in numbers

[17] http://www.marinemammalcenter.org/education/marine-mammal-information/sea-otter.html
[18] https://www.fws.gov/wafwo/sea_otters_history.html
[19] https://www.fws.gov/wafwo/articles.cfm?id=149489657
[20] https://www.eopugetsound.org/articles/sea-otter-enhydra-lutris

between 2015 and 2017, and this evidence of genetic exchange with the British Columbia Sea Otter population, Sea Otter are no longer *"seriously threatened with extinction throughout all or a significant portion of its range within the state,"* which is the definition of an endangered species. It has been recommended that the sea otter be reclassified to a State threatened species in Washington (Sato 2018).

Sea Otter are members of the weasel (Mustelid) family. The have very thick fur, the thickest of any mammal. Their fur consists of two layers, an undercoat and longer guard hairs. This system traps a layer of air next to their skin to keep their skin dry. Adult sea otters average 4.5 feet (1.4 m) in length. Their average life span is approximately 15 to 20 years.

Sea Otter capture prey from the sea bottom, then carry it to the surface for handling and feeding. In Washington, prey items include urchins, clams, mussels, crabs, snails and chitons. Adult Sea Otter can eat 25% to 30% of their body weight in one day.

Distribution and Habitat

Sea Otter once ranged from Mexico to Alaska and even to Japan. They inhabit nearshore waters up to 20 fathoms deep, and seldom venture more than 1 to 2 km from land. They typically inhabit rocky habitats with kelp beds, but also occur at lower densities in soft-sediment areas without kelp. Kelp is generally considered an important element of their habitat, used for foraging and resting.

In Washington, Sea Otter historically occurred in estuarine and sandy habitats from the Columbia River to Point Grenville, along the rocky outer Olympic Peninsula coast, and into the Strait of Juan de Fuca. Few reached the San Juan Islands or Discovery Bay, and none were present in Puget Sound. The species was extirpated from the State by about 1910 (Scheffer 1940, Kenyon 1969).

Sea Otter were reintroduced to Washington in 1969 and 1970, when 59 animals were translocated from Amchitka Island, Alaska. The population grew by approximately 7.6% per year between 1991 and 2012 to 1,105 animals (Jameson and Jeffries 2013). At present, Sea Otter occur primarily in rocky habitats along the Olympia Peninsula coast from Destruction Island northward to Tatoosh Island. Colonization of the western Strait of Juan de Fuca has not yet occurred despite the presence of groups of animals using the area during fall and winter months until the year 2000 (Laidre et al. 2009).

Population growth increased to a 3-year running average of 1,753 individuals between 2015 and 2017. This exceeds the down-listing objective in the 2004 Recovery Plan of 1,640 Sea Otter over a three-year period (Sato 2018).

The distribution pattern of the Washington Sea Otter population has gradually changed in recent years with an increasing and larger proportion of the population now occurring south of La Push. In 2012, 73% of the population was south of La Push and 27% was north. Annual surveys do not extend east of Tongue Point, although credible sightings of scattered individual Sea Otter have come from the San Juan Islands and Puget Sound in recent years. No groups of multiple animals have been noted in these areas. In 2012, one individual was reported in South Puget Sound.[21] Currently there is no consensus on why Sea Otter are not clearly expanding into available habitat. [22]

Threats within the Project Action Area

Sea Otter are vulnerable to oil spills. They lack the blubber layer of other marine mammals, therefore relying on their fur to keep warm. If their fur is oiled, it loses its insulating qualities. Otters are also

[21] https://www.eopugetsound.org/articles/sea-otter-enhydra-lutris

[22] https://wdfw.wa.gov/publications/01965

affected by oil fumes or poisoned by eating food exposed to oil. Other threats to Sea Otter include infectious diseases, parasites, boat strikes, entanglements in fishing nets, marine biotoxins, loss of kelp habitat, and reduced genetic diversity.

EASTERN POPULATION STELLER SEA LION (*Eumetopias jubatus*)[23]

Status and Description
Steller Sea Lion currently have no Federal listing status.[24] Neither are they listed in Washington State.[25]

In 1997, NMFS classified Steller Sea Lion into two distinct population segments divided by the 144°W latitude. The eastern population segment occupies habitat including southeastern Alaska and Admiralty Island. Currently, NMFS has classified the western population segment as endangered, while classifying the eastern population segment as threatened (62FR24345). Although the Steller Sea Lion population has declined steadily for the last 30 years, scientists have yet to identify the cause of the decline (NOAA Fisheries 2019b).

The worldwide Steller Sea Lion population is estimated at just under 200,000, with the majority occurring in Alaska. The range of the Steller Sea Lion extends around the North Pacific Ocean rim from northern Japan, the Kuril Islands and Okhotsk Sea, through the Aleutian Islands and Bering Sea, along Alaska's southern coast, and south to California (Kenyon and Rice 1961, Loughlin et al. 1984).

Steller Sea Lion are opportunistic feeders and consume a variety of fishes such as flatfish, code, and rockfish; and invertebrates such as squid and octopus. Demersal and off-bottom schooling fishes predominate (Jones 1981). Steller Sea Lion along the coasts of Oregon and California have eaten rockfish, hake, flatfish, cusk-eel, squid, and octopus (Fiscus and Baines 1966, Jones 1981, Treacy 1985); rockfish and hake are considered to be consistently important prey items (NMFS 1992). Feeding on lamprey in estuaries and river mouths has also been documented at sites in Oregon and California (Jones 1981, Treacy 1985). Spalding (1964) and Sinclair and Zepplin (2002) have documented Steller Sea Lion feeding on salmon.

Distribution and Habitat
Steller Sea Lion are polygamous and use traditional territorial sites for breeding and resting. Breeding sites, also known as rookeries, occur on both sides of the North Pacific, but the Gulf of Alaska and Aleutian Islands contain most of the large rookeries. Adults congregate for purposes other than breeding in areas known as haul-outs (University of Alaska 2019). Steller Sea Lion haul-out sites in Puget Sound include: Bangor Naval Base; east of Marrowstone Island; Toliva Shoals buoy; docks on Saltair Marina; navigation buoys and net pen floats near Orchard Rocks/NMFS Manchester;[26] old shipwreck on north side of Nisqually River Delta; and navigation buoys between Point Wilson and Point No Point.[27] Other

[23] USEPA 2010.
[24] https://www.fisheries.noaa/gov/species/steller-sea-lion
[25] WDFW 2008 (updated January 2019).
[26] A WDFW site-specific Priority Habitats and Species database search maps priority seal and sea lion haul-outs in a relatively large area along the south side of Rich Passage that includes the existing Cooke Aquaculture Clam Bay marine net pens, and at Orchard Rocks near the existing Cooke Aquaculture Orchard Rocks marine net pen (WDFW July 10, 2019). The database documents the presence of Steller Sea Lion and Harbor Seal at these locations.
[27] Personal communication between Matthew Szelag, EPA and Teresa Mongillo, NOAA. September 22, 2010. Provided information from Jeffries et al. 2000: Navy; WDFW; NMML.

rocks, reefs, and beaches as well as floating docks, navigational aids, jetties, and breakwaters are also used as haul-out areas (NOAA Fisheries 2019b).

Steller Sea Lion may be observed in Puget Sound year-around, but they are most abundant during the fall and winter months. No breeding rookeries have been identified in Washington waters (NOAA Fisheries 2019b).

Critical Habitat
Steller Sea Lion critical habitat has been designated in Alaska, California, and Oregon and includes a 20-nautical-mile buffer around all major haul-outs and rookeries, as well as associated terrestrial, air, and aquatic zones, and three large offshore foraging areas. No critical habitat has been designated in Washington.

Threats within the Project Action Area
Responses to various types of human-induced disturbances have not been specifically studied. Close approach by humans, boats, or aircraft will cause hauled-out Steller Sea Lion to go into the water. Disturbances that cause stampedes on rookeries may cause trampling and abandonment of pups (Lewis 1987). Areas subjected to repeated disturbance may be permanently abandoned (Kenyon 1962), and/or the repeated disturbance may negatively affect the condition or survival of pups through interruption of normal nursing cycles. Low levels of occasional disturbance may have little long-term effect (NOAA Fisheries 2019).

BALD EAGLE (*Haliaeetus leucocephalus*)

Status and Description
The U.S. Fish and Wildlife Service removed Bald Eagle from the ESA threatened and endangered species list in 2007, but they remain protected under the Bald and Golden Eagle Protection Act, the Migratory Bird Act, and the Lacey Act which prohibit the killing, selling, or otherwise harming of eagles, their nests, and their eggs. The Washington Fish and Wildlife Commission changed the State status of Bald Eagle from "threatened" to "sensitive" in 2011, thereby eliminating many of the State's special protective measures. The Washington Department of Fish & Wildlife recommended in 2016 that the "sensitive" status for Bald Eagle is no longer appropriate and that the species be removed from the State list of endangered species (Kalasz and Buchanan 2016). The U.S. Fish and Wildlife Service now has primary responsibility for managing Bald Eagle under the provisions of the Federal regulations listed above.[28]

A review of all known Bald Eagle territories in the Washington Species Data Management system indicates that the number of territories has increased by an average of 28 per year since 2005 when the species was down-listed to "sensitive" in the State of Washington. As of 2015, the total number of known territories in the State was 1,334, though this total reflects the cumulative number of sites and not the number that are known to be active in any particular year (Kalasz and Buchanan 2016).

Distribution and Habitat
Bald Eagles are well distributed in Washington, but the majority of the population is found west of the Cascade Mountain Range. They are found in association with marine environments and nearly all major waterways, inland lakes, and reservoirs. They are largely piscivorous (fish eaters), and also take birds and mammals. They also commonly practice scavenging.

[28] https://wwwwdfw.wa.gov/species-habitats/at-risk/species-recovery/bald eagle

Threats within the Project Action Area
When Bald Eagle was first listed as endangered under the Federal ESA in 1978, the primary reason for its imperiled status was due to the effects of chemical contaminants and, to a lesser extent, habitat loss. With the restrictions placed on the use of DDT and the decline in use of other environmental contaminants, the Bald Eagle population has rebounded. While there are still threats to Bald Eagles, including the presence of environmental contaminants, none of the threats that previously impacted them are presently having known deleterious effects. Current population analyses indicate that Bald Eagle populations will continue to grow despite these effects (Kalaz and Buchanan 2016).

MARBLED MURRELET (*Brachyramphus marmoratus*)[29,30,31]

Status and Description
Marbled Murrelet were declared by the U.S. Fish and Wildlife Service to be a threatened species in California, Oregon and Washington under the Endangered Species Act in 1992. Marbled Murrelet were State-listed as threatened in 2013. Due to the magnitude of population decline since State listing in 1993, WDFW recently recommended that Marbled Murrelet be listed as a State endangered species (Desimone 2016).

In Washington, nesting habitat losses due to timber harvest since 1993 have been substantial, with an estimated loss on non-Federal lands of 30%. At-sea population monitoring from 2001 to 2015 indicated a 4.4% decline annually, which represents a 44% reduction of the population since 2001. The 2015 population estimate for Washington is about 7,500 birds.

Marbled Murrelet are members of the seabird family Alcidae. Like other alcids, they forage by diving, using their wings for underwater propulsion. The typical flight speed of a Marbled Murrelet is 43 mph (70 km/hr) or faster (Burger 1997). They feed primarily on a variety of forage fishes, and sometimes on larger zooplankton. Their main prey items include immature Pacific herring, northern anchovy, Pacific sand lance, capelin, surf smelt, juvenile rockfish, and immature salmon. They will also prey upon squid and pelagic crustaceans (amphipods, mysids, and euphausiids), especially during the non-breeding season (Sealy 1975, Carter 1984, Burkett 1995, Nelson 1997).

Distribution and Habitat
In Washington, Marbled Murrelet are found in nearshore marine areas (within 1.2 mi [2 km] of shoreline), with the greatest concentrations in North Puget Sound (WDW 1993). Marbled Murrelet spend most of their lives in or near marine waters, except during nesting. Nests are located in large branches or other large platforms in conifer trees, but the species prefers mature, old-growth forests (Nelson et al. 2006, WDFW 2012). Terrestrial nesting habitat distribution includes western Washington within 55 miles of marine waters (Falxa and Raphael 2016). Nest locations in Washington have been documented from near sea level to 4,200 feet elevation and inland to 36.5 miles from the nearest marine water. Parent Marbled Murrelet will travel between the nests sites and coastal marine forage areas to exchange incubation or chick-rearing duties. They exhibit strong site fidelity to nesting areas, appear to nest in alternate years, on average, and have a naturally low reproductive rate.

Threats within the Project Action Area
The largest threat to Marbled Murrelet populations is deforestation and loss of old-growth forests used for nesting habitat. Fragmented forests are more vulnerable to excessive wind at the edges, and more exposed

[29] RPS ASA 2016.
[30] Hamer Environmental 2016.
[31] Desimone 2016.

to predation from jays, ravens and crows, making the loss of thickly settled forests unfavorable for the Marbled Murrelet (WDW 1993). Oil pollution has also posed a threat to Marbled Murrelet and their coastal environment, with the *Seagate* (1956), *Arco Anchorage* (1985), *Nestucca* (1988) and *Tenyu Maru* (1991) oil spills resulting in oiled Murrelets (WDW 1993). Marbled Murrelet entanglement and mortalities in gill nets and hook-and-line fisheries have been observed but not quantified. Irrespective of the risk, the low reproductive rate of the Marbled Murrelet species limits the ability of the population to recover after an episodic or chronic threat. A nest success rate in Washington of 20% for the period 2004-2008 was attributed to nestling starvation or adults abandoning eggs before completing incubation, suggesting low prey availability.

CHINOOK SALMON (*Oncorhynchus tshawytscha*)[32]

Chinook Salmon are easily distinguished from other *Oncorhynchus* species by their large size. Adults weighing over 120 pounds have been caught in North American waters. Chinook Salmon are very similar to Coho Salmon in appearance while at sea (blue-green back with silver flanks), except for their large size, small black spots on both lobes of the tail, and black pigment along the base of the teeth. Chinook Salmon are anadromous and semelparous; i.e., adults, they migrate from a marine environment into the freshwater streams and rivers of their birth (anadromous) where they spawn and die (semelparous).

Juvenile stream-type and ocean-type Chinook Salmon have adapted to different ecological niches. Ocean-type Chinook Salmon tend to utilize estuaries and coastal areas more extensively for juvenile rearing. The brackish water areas in estuaries also moderate physiological stress during parr-smolt transition. The development of the ocean-type life history strategy may have been a response to the limited carrying capacity of smaller stream systems and glacially-scoured, unproductive watersheds, or a means of avoiding the impact of seasonal floods in the lower portion of many watersheds.

Puget Sound Chinook Salmon[33]

Status and Description
Puget Sound Chinook Salmon are Federally-listed as threatened. This Evolutionary Significant Unit (ESU) is a candidate species for listing in Washington State.[34]

Distribution and Habitat
The boundaries of the Puget Sound Chinook Salmon evolutionarily significant unit (ESU) correspond with the Puget Lowland Ecoregion. This ESU encompasses all runs of Chinook Salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula, including Hood Canal.

Chinook Salmon in this area all exhibit an ocean-type life history. Although some spring-run Chinook Salmon populations in the Puget Sound ESU have a high proportion of yearling smolt emigrants, the proportion varies substantially from year to year and appears to be environmentally mediated rather than genetically determined. Puget Sound stocks all tend to mature at ages 3 and 4 and exhibit similar, coastally-oriented, ocean migration patterns (Meyers et al. 1998).

Chinook Salmon prefer to spawn and rear in the mainstem of rivers and larger streams (Healey 1991). Although the incubation period is determined by water temperatures, fry typically hatch in about 8 weeks

[32] USEPA 2010.
[33] USEPA 2010.
[34] WDFW 2008 (updated January 2019).

(Wydoski and Whitney 1979, Healey 1991). After emergence, Puget Sound juvenile Chinook Salmon migrate to the marine environment during their first year.

Rearing and development to adulthood occurs primarily in estuarine and coastal waters (NOAA Fisheries 2019c). The amount of time juvenile Chinook Salmon spend in estuarine areas depends upon their size at downstream migration and rate of growth. While residing in upper estuaries, juvenile prey mainly on benthic and epibenthic organisms such as amphipods, mysids, and cumaceans. Juveniles typically move into deeper waters when they reach approximately 65 to 75 mm in fork length. As the juveniles grow and move to deeper waters with higher salinities, their main prey changes to pelagic organisms such as decapod larvae, larval and juvenile fish, drift insects, and euphausids (Simenstad et al. 1977).

Hatchery Influence

Hatchery fish are known to spawn in the wild and are not considered discrete stocks from the wild fish (WDFW and WWTIT 1994). State-run and Federally-run Chinook Salmon hatcheries were operating in the Puget Sound Chinook Salmon ESU by 1908. Transfers of Chinook Salmon eggs to Puget Sound from other regions, especially the Lower Columbia River, were common practices of early hatcheries (Myers et al. 1998). By the 1920s, several million Chinook Salmon had been released into Puget Sound tributaries (Cobb 1930). Recently, stock integrity and genetic diversity have become important objectives. New policies have been initiated to reduce the impact of hatchery fish on natural populations (Levin and Williams 2002). The abundance of Chinook Salmon in watersheds throughout this ESU has been closely related to hatchery efforts (Myers et al. 1998).

WDFW classified 11 out of 29 stocks in this ESU as being sustained, in part, through artificial propagation. Nearly 2 billion fish have been released into Puget Sound tributaries since the 1950s. The vast majority of these have been derived from local returning fall-run adults. Returns to hatcheries have accounted for 57% of the total spawning escapement, although the hatchery contribution to spawner escapement is probably much higher than that, due to hatchery-derived strays on the spawning grounds (Good et al. 2005, NMFS-NWFSC-66).

Critical Habitat

Critical habitat designation for Puget Sound Chinook (PS Chinook) and Hood Canal Summer Run (HCSR) Chum Salmon was finalized September 2, 2005 (70 FR 52630) and includes Puget Sound marine areas − the South Sound, Hood Canal, and North Sound to the international boundary at the outer extent of the Strait of Georgia, Haro Strait, and the Strait of Juan de Fuca to a straight line extending north from the west end of Freshwater Bay, inclusive. Critical habitat consists of the water, substrate, and the adjacent riparian zone of accessible estuarine and riverine reaches. Cooke Aquaculture existing Puget Sound net pens sited in less than 98 feet depth (below MLLW) fall within designated critical habitat for PS Chinook and HCSR Chum Salmon. Six of the existing seven net pens are sited in less than 98 feet of water, with one near that depth at low tide. The applicable primary constituent element (PCE) for the PS Chinook and HCSR Chum Salmon designated critical habitat in this action area is: nearshore marine areas free of obstruction and excessive predation with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation, and natural cover such as submerged and overhanging large wood, aquatic vegetation, etc.[35]

Threats within the Project Action Area

Chinook Salmon were abundant in Washington State near the turn of the century, when estimates based on peak cannery pack suggested peak runs of near one million fish in the Oregon Coast, Washington Coast, and Puget Sound ESUs. However, Chinook Salmon in this region has been strongly affected by

[35] NMFS 2011.

losses and alterations of freshwater habitat. Timber harvesting and associated road building have occurred throughout this region. Agriculture is also widespread in the lower portions of river basins and has resulted in widespread removal of riparian vegetation, rerouting of streams, degradation of streambanks, and summer water withdrawals. Urban development has substantially altered watershed hydrodynamics and affected stream channel structure in many parts of Puget Sound.

Widespread stream blockages have reduced available spawning habitat, and widespread release of hatchery fish from limited stocks has increased the risks of loss of genetic diversity and fitness to natural populations. In addition, the large numbers of hatchery releases masks natural population trends, making it difficult to determine their sustainability. Forestry practices, farming and urbanization have blocked or degraded fresh water habitat (Myers et al. 1998).

HOOD CANAL SUMMER-RUN CHUM SALMON (*Oncorhynchus keta*)[36]

Chum Salmon have the widest natural geographic distribution of all Pacific salmon species, ranging in Asia from Korea to the Russian Arctic coast and west to the Lena River, and in North America from Monterey, California, to the Arctic coast and east to the Mackenzie River (Beaufort Sea). Historically, they may have constituted up to 50% of the annual biomass of the seven species of Pacific salmon in the North Pacific Ocean (Sato et al. 2009).

Chum Salmon spawn successfully in streams of various sizes, and the fry migrate directly to the sea soon after emergence. Immature chum distribute themselves widely over the North Pacific Ocean, and maturing adults return to the home streams at various ages, usually at 2 through 5 years, and in some cases up to 7 years (Groot and Margolis 1991). Common to virtually every region of the Chum Salmon's area of distribution is the occurrence of early and late returning stocks to the natal stream. In North America, the only true summer Chum Salmon may be in the Yukon River, where summer Chum have the distinguishing characteristics of the Asian summer Chum. From western Alaska south to British Columbia and Washington, there are runs referred to as "summer" Chum that spawn from June to early September; these Chum are characterized by large body size, older age composition, and high fecundity, and are probably early autumn Chum (Groot and Margolis 1991).

In general, early-run Chum Salmon spawn in stream main stems, while late spawners seek out spring water that has more favorable temperatures through the winter. The timing of the runs varies from north to south, as does age at maturity and absolute (and probably, relative) fecundity (Groot and Margolis 1991).

Hood Canal Summer-run Chum Salmon

Status and Description

The Hood Canal Summer-run Chum Salmon (HCSR) ESU was Federally-listed as threatened on August 2, 1999. The Puget Sound/Strait of Georgia ESU is not Federally-listed, but is a candidate species for listing in Washington State.[37]

Most Hood Canal Summer-run Chum spawn in early September to mid-October. The Union River Summer-run Chum is an exception as they have an earlier spawning timing (September – early October). Fry emerge from February to June. In Washington, Chum may reside in freshwater for as long as a month before migration to estuarine habitats where they remain for about a month before migrating to deeper water (Johnson et al. 1997).

[36] USEPA 2010.

[37] WDFW 2008 (updated January 2019).

Distribution and Habitat
This ESU includes Summer-run Chum Salmon populations in Hood Canal in Puget Sound and in Discovery and Sequim Bays on the Strait of Juan de Fuca. It may also include summer-run fish in the Dungeness River, but the existence of that run is uncertain. Distinctive life-history and genetic traits were the most important factors in identifying this ESU. Hood Canal Summer-run Chum Salmon are defined as fish that spawn from mid-September to mid-October in the mainstems of rivers (Johnson et al. 1997).

Hatchery Influence
Very few Summer-run Chum Salmon have been artificially propagated in Hood Canal, and the only releases in recent years have been from newly established restoration programs. These recent releases totaled about 241,000 Chum Salmon fry into Hood Canal in 1993 and 1994 and about 85,000 fry into Discovery Bay on the Strait of Juan de Fuca in 1992.

Critical Habitat
Critical habitat for Hood Canal Summer-run Chum Salmon was designated September 2, 2005 (70 FR 52630), concurrent with critical habitat designation for Puget Sound Chinook Salmon, as described above.

Threats within the Project Action Area
This ESU is in danger of extinction. Of 12 streams in Hood Canal identified as recently supporting spawning populations of summer Chum Salmon, five may already have become extinct, six of the remaining seven showed strong downward trends in abundance, and all were at low levels of abundance. Threats to the continued existence of these populations include degradation of spawning habitat, low water flows, and incidental harvest in salmon fisheries in the Strait of Juan de Fuca and Coho Salmon fisheries in Hood Canal (Johnson et al. 1997).

COHO SALMON (*Oncorhynchus kisutch*)

Status and Description
The Puget Sound/Strait of Georgia population of Coho Salmon are Federally-listed as a species of concern. They have no special status listing in Washington State.[38] A NMFS Biological Review Team found in 1995 that population abundance was near historical levels, and recent trends in overall population abundance had not been downward; however, there was substantial uncertainty relating to several of the risk factors considered (described below under Threats within the Project Action Area).

Coho have a very regular life history. Eggs are deposited in stream gravel in the fall, alevins emerge from the gravel the next spring, and in their second spring juveniles go to sea, about 18 months after hatching. Adults range in size from 6 to 12 pounds, and up to 31 pounds.

Distribution and Habitat
The Coho Salmon Puget Sound/Strait of Georgia ESU utilizes drainages in Puget Sound and Hood Canal, the eastern Olympic Peninsula (east of Salt Creek), and the Strait of George from the eastern side of Vancouver Island and the British Columbia mainland (north to and including Campbell River and Powell River), excluding the upper Fraser River above Hope (Weitkamp, L. et al. 1995).

This species uses coastal streams and tributaries, and can even be found in urban settings if their needs for cold, clean, year-around water are met. Coho spawn in small coastal streams and in the tributaries of larger rivers. They prefer areas of mid-velocity water with small to medium-sized gravels. Because they

[38] WDFW 2008 (updated January 2019).

use small streams with limited space, they must use many such streams to successfully reproduce. Returning Coho often gather at the mouths of streams and wait for the water flow to rise, such as after a rain storm, before heading upstream. The higher flows and deeper water enable the fish to pass obstacles, such as logs across the stream or beaver dams that would otherwise be impassable.[39]

The WDFW Priority Habitats and Species (PHS) database (July 10, 2019) maps Coho Salmon as a priority fish presence in Beaver Creek that discharges to Clam Bay in the vicinity of the Cooke Aquaculture existing marine net pen site at this location in Rich Passage. The PHS database also maps Coho Salmon as a priority fish presence in Tumwater Creek that discharges to Port Angeles Harbor approximately 1.5 miles south of the Cooke Aquaculture existing net pen location near the eastern terminus of Ediz Hook within Port Angeles Harbor.

Threats within the Project Action Area

Threats to the Coho Salmon Puget Sound/Strait of Georgia population include widespread and intensive artificial propagation, high harvest rates, extensive habitat degradation, and unfavorable ocean conditions (Weitkamp, L. et al. 1995).

STEELHEAD (*Oncorhynchus mykiss*)[40]

Steelhead are the anadromous form of the Rainbow Trout (*O. mykiss*), which occurs in two subspecies, *O. mykiss irideus* and *O. mykiss gaidneri*. Whereas stream-resident Rainbow Trout may complete their life cycle in a limited area of a small stream and attain a length of only 8 inches or so, steelhead generally spend half their lives at sea, roaming for thousands of miles in the North Pacific Ocean. Steelhead return to spawn at sizes ranging from about 24 inches and 5 pounds to about 36 to 40 inches or more and 20 pounds or more (Behnke 2002).

Biologically, steelhead can be divided into two reproductive ecotypes, based on their state of sexual maturity at the time of river entry. These two ecotypes are termed "stream-maturing" and "ocean-maturing." Stream-maturing steelhead enter fresh water in a sexually immature condition and require from several months to a year to mature and spawn. These fish are often referred to as "summer-run" steelhead. Ocean-maturing steelhead enter fresh water with well-developed gonads and spawn shortly after river entry. These fish are commonly referred to as "winter-run" steelhead. Ocean-maturing fish are the predominate ecotype in coastal streams within the action area.

Puget Sound populations begin spawning in February or March, with summer-run steelhead spawning from March into June.

Juvenile steelhead generally spend two years in freshwater before smolting and migrating to the ocean at lengths of about 6 to 8 inches. Most steelhead return to their natal rivers to spawn after spending 15 to 30 months in the ocean. Unlike other Pacific salmonids, steelhead do not all die soon after spawning, but the rate of survival to repeat spawning is generally low − about 10% (Behnke 2002).

[39] https://wdfw.wa/gov/species-habitats/species/oncorhynchus-kisutch
[40] USEPA 2010.

Puget Sound Steelhead ESU[41]

Status and Description
The Puget Sound steelhead ESU was officially listed as "threatened" by NOAA Fisheries Service on March 11, 2007. This species is a candidate for listing in Washington State.[42] The Puget Sound distinct population segment (DPS) of steelhead originates downstream from natural and manmade impassable barriers from rivers flowing into Puget Sound from the Elwha River eastward, including rivers in Hood Canal, the South Sound, the North Sound and the Strait of Georgia. Numerous juvenile steelhead are also produced at six artificial hatchery facilities.

In the 1980s, the Puget Sound steelhead run size was estimated as 100,000 winter-run and 20,000 summer-run. In the 1990s, the total run size for major stocks in this ESU was greater than 45,000 with natural escapement estimates of 22,000 steelhead.

Distribution and Habitat
The Puget Sound steelhead DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations in streams of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, basins. This area is bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks.

Hatchery Influence
Releases of hatchery-propagated steelhead into Puget Sound waters began in the 1900s. By the 1940s, extensive hatchery rearing programs were developed. Hatchery fish were widespread, spawning naturally throughout the region, and were largely derived from a single stock (Chambers Creek). In the 1980s, the hatchery portion of the population based on ocean catches was 70%. During the two decades that followed, release levels of hatchery steelhead remained relatively constant. Hatchery-produced winter steelhead were released in nearly every basin in the ESU, except for the Cedar River and some smaller tributaries.

The risk posed by artificial production programs to natural production in the Puget Sound steelhead ESU is not clear as definitive information is not available. However, the genetic and life-history relationships between the Chambers Creek Hatchery and Skamania Hatchery and the naturally-spawning populations indicate that these hatchery effects could be substantially detrimental. Approximately six million hatchery-produced steelhead have been released in Washington waters annually during recent years (WDFW web site). These planted fish are diploid steelhead capable of natural reproduction and degradation of wild steelhead populations.

Critical Habitat
Puget Sound steelhead Distinct Population Segment (DPS) critical habitat was designated by the National Marine Fisheries Services on March 25, 2016 (81 FR 9251: 9251-9325). Specific areas include approximately 2,031 miles of freshwater and estuarine habitat in Puget Sound. A number of particular areas (e.g., military properties) are excluded from the critical habitat designation because the benefits of exclusion outweigh the benefits of inclusion, and exclusion will not result in extinction of the species. Much of the designated critical habitat is fresh water spawning, rearing, and migratory habitat. This includes estuarine areas free of obstruction with water quality and salinity conditions that support juvenile

[41] NMFS 2005.
[42] WDFW 2008 (updated January 2019).

and adult physiological transitions between fresh water and saltwater, and juvenile and adult forage habitat that support growth and maturation.

Threats within the Project Action Area
Habitat loss, hatchery steelhead introgression, and harvest are the major contributors to the decline of steelhead in this ESU. Habitat utilization by steelhead has been affected by a number of large dams in Puget Sound basins. Besides eliminating access to habitat, dams affect habitat quality by changing river hydrology, temperature profiles, gravel recruitment, and large woody debris movement and stability. Urban development and suburbanization have resulted in the loss of historical land cover, often replacing it with imperious surface. Combined with loss of wetland/riparian habitat, hydrology of many urban streams has changed dramatically. Flood frequency and peak flow during storm events has increased and groundwater derived summer flows have decreased. Land development for agriculture has also altered historical land cover. Diking, riprapping of banks, and channelization have resulted in river constriction which increases gravel scour, decreases habitat complexity, and alters amplitude of high flow events.

BULL TROUT (*Salvelinus confluentus*)

Status and Description
Bull Trout are Federally-listed as threatened. They are a candidate species for listing in Washington State.[43] Bull Trout are members of the char subgroup of the family Salmonidae that are native to waters of western North America.

Distribution and Habitat
Bull Trout have more specific habitat requirements than most salmonids. Habitat characteristics that particularly influence their distribution and abundance include water temperature, cover, channel form and stability, spawning and rearing substrate conditions, and migratory corridors. Juvenile Bull Trout usually rear from 1 to 4 years in their natal stream before migrating to either a larger river (fluvial) or lake (adfluvial). Some Bull Trout (amphidromous) produced in Puget Sound streams migrate to estuarine waters for rearing prior to returning to their natal stream to spawn or for additional rearing.

Critical Habitat
The U.S. Fish and Wildlife Service designated 19,729.0 miles (31,750.8 km) of streams including 754.0 miles (1,213.2 km) of marine shoreline) as Bull Trout critical habitat (Federal Register 2010/Vol. 75, No. 200) in Washington, Oregon, Nevada, Idaho, and Montana. Bull Trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that particularly influence their distribution and abundance include water temperature, cover, channel form and stability, spawning and rearing substrate conditions, and migratory corridors (Fraley and Shepard 1989; Goetz 1989; and Watson and Hillman 1997). The Primary Constituent Elements (PCE) of Bull Trout critical habitat are: space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, or rearing (or development) of offspring; and habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species (USFWS 2010, FR 75(20): 63898-64070).[44]

[43] WDFW 2008 (updated January 2019).
[44] USEPA 2010.

Threats within the Project Action Area
The decline in Bull Trout populations is primarily due to fresh water habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species.

EULACHON (*Thaleichthys pacificus*)[45]

Status and Description
Eulachon (also known as Columbia River smelt or hooligan) are Federally-listed as threatened. They are State-listed as a candidate species for further status designation at a later time. Eulachon are a small anadromous fish, typically weighing 2.4 ounces (0.07 kg) with a length of 8.5 in (0.22 m; NOAA 2014d). The maximum reported age for the species is 5 years, spending 3 to 5 years at sea before returning to rivers for spawning (Hugg 1996, NOAA 2014d). Most Eulachon are semelparous[46], dying soon after spawning. Eggs hatch in 20 to 40 days, and larvae are transported downstream for dispersion in estuary and ocean bottom waters (NOAA 2011b; NOAA 2014d). Larvae feed on phytoplankton, copepod eggs, mysid shrimp, barnacle larvae, and worm larvae (NOAA 2011b). They also feed on large zooplankton, krill, and small crustaceans. Adults will not feed while they are spawning (Hart and McHugh 1944).

Distribution and Habitat
Eulachon live in nearshore waters over the continental shelf (up to a maximum depth of 980 ft [300 m] but often shallower), except for when the species returns to its natal river to spawn (NOAA 2014d). Eulachon occur along the eastern Pacific Ocean, extending from northern California to the southeast Bering Sea (Gustafson et al. 2010). In U.S. waters, most Eulachon originate from the Columbia River basin and its tributaries (NOAA 2011b). Eulachon have been occasionally reported in coastal Washington rivers.

Threats within the Project Action Area
The greatest threat to Eulachon is reduction in suitable habitat availability, particularly in the Columbia River basin (NOAA 2014d). The major threats to Eulachon habitat include damn construction, which prevents spawning runs and degrades demersal spawning habitat, and dredging, which exposes the water column to sediment particulates. Global climate change is likely to pose a threat to Eulachon, with increasing water temperatures making presently-occupied spawning grounds and rivers unsuitable habitat. While fishing pressure has been reduced, by-catch and specific fishing methods may still pose a threat to eulachon.

FLATHEAD SOLE (*Hippoglossoides elassodon*)[47]

Status and Description
Flathead Sole are Federally-listed as a species of concern. They have no State-listing status.[48] They are a right-eyed flatfish with a very flat, oval body shape. They have a medium to large mouth with one row of sharp conical teeth in both jaws. The Flathead Sole is very similar to the Petrale Sole, with the distinguishing factors of Petrale Sole being two rows of teeth in the upper jar and a rounded rear ridge on the lower jaw.

45 RPS ASA 2016.
46 A species is considered semelparous if it is characterized by a single reproductive episode before death.
47 WDFW 2019.
48 WDFW 2008 (updated January 2019).

Flathead Sole can grow up to 22 inches (56 cm) in length, and approximately 3.4 pounds (1.56 kg) in weight. Maximum age is at least 27 years for females and 30 years for males.

Distribution and Habitat
Flathead Sole range from the seas of Japan and Okhotsk, across the Bering Sea and to the coast of North America as far south as Point Reyes, California. This species lives on soft, silty or muddy bottoms at depths of up to approximately 3,500 feet (1,050 m). They are most commonly encountered within the water depth range of approximately 325 to 800 feet (100 to 247 m). Flathead Sole are occasionally caught off the Washington coast by commercial harvesters using otter-trawls and long-line gear. They are rarely caught by recreational fishermen within Puget Sound.

Threats within the Project Action Area
The action area is in the southern end of the Flathead Sole range. Flathead Sole in the Gulf of Alaska are not overfished and are not subject to overfishing. Flathead sole are quite abundant in Alaska, and populations are well above target levels. On the West Coast, Flathead Sole make up only a small percentage of groundfish harvests. They are part of the "other flatfish" complex on the West Coast, and are not subject to overfishing (NOAA 2019c).[49] The normal depth distribution of Flathead Sole is 325 feet and deeper, which is not within the more shallow range of depths potentially affected by the proposed action.

GREEN STURGEON (*Acipenser medirostris*)[50]

Status and Description
Green Sturgeon are Federally-listed as threatened, but do not have a priority status in Washington State. They are an anadromous fish with olive green dorsal coloring and yellowish green-white coloring underside. They are more marine-oriented than salmonids or any other sturgeon species (Adams et al. 2002), and live primarily at sea or in estuaries, except when spawning. Unlike salmon, they can spawn several times within their lifetime and will return to natal rivers every 2 to 5 years to do so (Moyle 2002). They are a long-lived, slow-growing species, reaching maturity around age 15, with a reported maximum rage between 60 and 70 years old. Prey items include shrimp, mollusks, amphipods, and small fish. The only known spawning locations are the Klamath, Rogue, and Sacramento Rivers along the U.S. west coast. Within rivers, adults will spawn in cool waters with deep, turbulent flow and hard clean substrate (Moyle et al. 1992).

Distribution and Habitat
Green Sturgeon range from nearshore Mexico waters north to the Bering Sea, with the majority of Green Sturgeon occurring in U.S. waters located from Monterey, California north to Puget Sound. The species is separated into two distinct population segments. The northern DPS (nDPS) includes sturgeon that spawn from the Klamath River in Northern California through the Rogue River in Oregon (NOAA 2015). This nPDS has been listed by NOAA as a species of concern. The southern DPS (sDPS) consists of Green Sturgeon that spawn in the Sacramento River. These are Federally-listed as threatened (NOAA 2015). Green Sturgeon use both marine and freshwater habitats throughout their life cycle and are believed to migrate long distances after leaving estuarine waters.

Critical Habitat
The northern range of Green Sturgeon critical habitat includes the southern portion of the Strait of Juan de Fuca and coastal Port Angeles waters. While the Puget Sound region is not a spawning area for Green

[49] NOAA 2019c. https://www.fisheries.noaa.gov/species/flathead-sole
[50] RPS ASA 2016.

Sturgeon, the species spends significant time in coastal regions of Washington and open ocean waters (NOAA 2014e). Thus, the relatively shallow Puget Sound waters where existing marine net pen sites are located are unlikely to provide habitat used by Green Sturgeon for feeding or migration.

Threats within the Project Action Area

Some of the greatest threats to Green Sturgeon are impediments to migration up or down rivers, and larval survival in river systems. Some of these threats include low freshwater flow from dams, contaminants introduced to river waters, poor water quality, entrainment from water projects, and impassable barriers. By-catch and fishing mortality are other sources of concern, as historical overfishing of a small population has contributed to their low population numbers today. With changes in climate, increased water temperatures and introduction of invasive exotic species to natal grounds could also be detrimental. Reduction in spawning area within the Sacramento River has been a great concern for the sDPS stock.

PACIFIC COD (*Gadus macrocephalus*)[51]

Status and Description

Pacific Cod are Federally-listed as a species of concern, and State-listed as a candidate species for further status designation at a later time. An Endangered Species Act status review for Pacific Cod (Gustafson et al. 2000, NOAA 2011c) stated that the population structure for this species includes a distinct population segment (DPS) along the West Coast of North America including Puget Sound and coastal British Columbia north to at least Dixon Entrance.

Pacific Cod are a commercially-important fish species in some parts of their size range (NOAA 2011c). They feed on krill, shrimp, sand lance and crabs and are prey for seals, halibut and other fishes (Love 1996, NOAA 2011c).

Distribution and Habitat

The Salish Sea population of Pacific Cod is found in Puget Sound, the Strait of Juan de Fuca, and the Strait of Georgia in the northwestern U.S. and southeastern Canada (NOAA 2011c).

Pacific Cod are schooling fish that live near the ocean bottom (NOAA 2011c). In the Salish Sea, they can be found over sand and mixed coarse bottom substrates (Palsson 1990, NOAA 2011c). Adult Pacific Cod occur as deep as 2,870 ft (875 m), but the vast majority occurs between 160 and 980 ft (50 to 300 m) (WDWF and NMFS 2005). In recent years, Pacific Cod have become rare or extinct in most Puget Sound waters, in part due to slight increases in water temperatures at this southern edge of their North Pacific range.

Threats within the Project Action Area

The primary threats for Pacific Cod within the project action area include small population size due to past overfishing (NOAA 2011c). While they were once an abundant species important in the sport and commercial fisheries in the Salish Sea, they became overfished in the early 1990s and the population has still not rebounded (Palsson 1990, NOAA 2011c). Other threats to this population of Pacific Cod include warmer waters due to global climate change, and predation (Gustafson et al. 2000, Beamish 2008, NOAA 2011c).

[51] RPS ASA 2016.

PACIFIC HAKE (*Merluccius productus*)[52]

Status and Description
Pacific Hake are Federally-listed as a species of concern, and State-listed as a candidate species for further status designation at a later time. They are a groundfish of the order Gadiformes. They can reach up to 36 inches (91 cm) in length and 15 years of age (NOAA 2009). Pacific Hake larvae prey on calanoid[53] copepod eggs, nauplii[54], and adults (McFarlane and Beamish 1986, Sumida and Moser 1984, Gustafson et al. 2000). Juveniles and small adults mostly prey on euphausiids[55] (NOAA 1990, Gustafson et al. 2000). Large adults also eat amphipods, squid, Pacific Herring, smelt, crabs, shrimp, and sometimes juvenile Pacific Hake (Dark and Wilkins 1994, McFarlane and Beamish 1986, NOAA 1990, Gustafson et al. 2000).

Distribution and Habitat
There are three recognized stocks of Pacific Hake, one of which is the Georgia Basin DPS, which include both the Puget Sound and Strait of Georgia stocks (NOAA 2009). They are found near the bottom or in the water column to depths of 3,000 feet (914 m); however, they are most common in water shallower than 750 feet (229 m) (WDWF 2016c). There are several spawning locations for Pacific Hake in Puget Sound (Gustafson et al. 2000).

Threats within the Project Action Area
One of the major factors for the decline of Pacific Hake within the Puget Sound area is overfishing (NOAA 2009). Other threats for this species include pinniped predation, habitat alteration or loss, and environmental changes (Gustafson et al. 2000). Though the potential effects of habitat loss or degradation are unknown, it has been speculated that juvenile Hake survival could be reduced through loss or degradation of nearshore nursery habitats (West 1997, Gustafson et al. 2000).

PACIFIC LAMPREY (*Entosphenus tridentatus*)[56]

Status and Description
Pacific Lamprey have no current Federal or State listing status.[57]

Lampreys belong to a primitive group of fishes that are eel-like in form and lack the jaws and paired fins of true fishes. Pacific Lamprey have a round, sucker-like mouth, no scales, and gill openings. Lamprey identification depends largely on the number, structure, and position of teeth in adults. Adult Pacific Lamprey have three large anterior teeth and many smaller posterior teeth on the oral disc.

As adults in the marine environment, Pacific Lamprey are parasitic and feed on a variety of marine and anadromous fish, including Pacific salmon, flatfish, rockfish, and pollock. They are preyed upon by sharks, sea lions, and other marine animals.

After spending 1 to 3 years in the marine environment, Pacific Lamprey cease feeding and migrate to freshwater between February and June. Most upstream migration takes place at night. They are thought to overwinter and remain in freshwater habitat for approximately 1 year before spawning. During that time,

52 RPS ASA 2016.
53 Calanoid copepods are a kind of zooplankton in the order Calanoida.
54 Nauplii are the first larval stage of many crustaceans, with an unsegmented body and a single eye.
55 Euphausiids are a type of small, shrimp-like crustaceans (e.g., krill).
56 https://www.fws.gov/oregonfwo/articles.cfm?id=149489457
57 WDFW 2008 (updated January 2019).

they may shrink in size by up to 20%. Spawning occurs between March and July, depending on location within their range.

Distribution and Habitat
Historically, Pacific Lamprey were thought to be distributed wherever salmon and steelhead occurred. However, recent data indicate that the distribution of the Pacific Lamprey has been reduced in many river drainages. They no longer exist upstream from many dams and other impassable barriers in west coast streams, including many larger rivers throughout coastal Washington, Oregon, and California. In the marine environment, they have been caught at depths ranging from 300 to 2,600 ft, and as far off the west coast as 62 miles in ocean-haul nets.

Pacific Lamprey spawn in habitat similar to that of salmon: gravel-bottomed streams at the upstream end of riffle habitat. The degree of homing is unknown, but adult Lamprey cue in on ammocoete areas that release pheromones that are thought to aid adult migration and spawning location.

Threats within the Project Action Area
Pacific Lamprey face a variety of threats to various life history stages, including barriers to upstream and downstream passage; dewatering and reduced stream flows; poisoning from accidental spills or chemical treatments; poor water quality; dredging activities; stream and floodplain degradation due to channelization, loss of side channel habitat, and scouring; changes in ocean conditions such as prey reduction and an increase in predators; and predation by non-native fish species.

RIVER LAMPREY (*Lampetra fluviatilis*)[58]

Status and Description
River Lamprey presently have no Federal listing status, but are State-listed as a candidate species for further status designation at a later time . Available information on the abundance of River Lamprey indicates some potential local declines; however, data are lacking to substantiate a significant decline in abundance or distribution.

Like the Pacific Lamprey described above, the River Lamprey is a member of a primitive group of fishes that are eel-like in form and lack jaws and paired fins. They have a round, sucker-like mouth (oral disc), no scales, and breathing holes instead of gills. Adult River Lamprey have two teeth (cusps) and no posterior teeth on the oral disc. Their life span is 6 to 7 years.

Similar to Pacific Lamprey, River Lamprey spawn in gravel-bottomed streams, at the upstream end of riffle habitat. Both sexes construct the nests, often moving stones with their mouths. River Lamprey lay approximately 11,000 to 37,000 eggs per adult female. Adults typically die after the eggs are deposited and fertilized. After the eggs hatch, young ammocoetes drift downstream to areas of low velocity and silt or sand substrate. They remain burrowed in the stream bottom, living as filter feeders on algae and detritus for 2 to 7 years. Metamorphosis from the ammocoete to macropthalmia life stage occurs between July and April. At this time, macropthalmia are thought to live deep in the river channel, which may explain why they are rarely observed. As adults, their oral disc develops just before they enter the ocean between May and July. They are at sea for approximately 10 weeks in a parasitic phase. During this time, they remain close to shore, feeding primarily on smelt and herring near the surface. After the adult feeding phase, River Lamprey migrate to spawning areas and stop feeding. Their degree of fidelity to their natal streams is unknown.

[58] https://www.fws.gov/wafwo/species/Factsheets/Riverlampreyfinal.pdf

Distribution and Habitat
River Lamprey are found from just north of Juneau, Alaska, to San Francisco Bay, California; however, detailed information on their distribution and abundance is lacking. River Lamprey are associated with large river systems such as the Fraser, Columbia, Klamath, Eel, and Sacramento Rivers, and tend to occur only in the lower portions of these rivers.

In Washington, this species probably historically occurred in most major rivers. The current distribution of River Lamprey in the State includes rivers and streams along the coast from the mouth of the Columbia River to the mouth of the Hoh River (though not elsewhere on the Olympic Peninsula), throughout Puget Sound, and in the Lake Washington basin. Adults feed in nearshore marine and estuarine habitat.

Threats within the Project Action Area
Potential threats to River Lamprey include artificial barriers to migration; poor water quality; harvest; predation by non-native species; stream and floodplain degradation; loss of estuarine habitat; decline in prey, ocean conditions, dredging and dewatering.

CANARY ROCKFISH (*Sebastes pinniger*)[59,60]

Status and Description
Canary Rockfish of the Puget Sound/Georgia Basin were determined by the National Marine Fisheries Service (NMFS) in 2010 to be a DPS. NMFS subsequently collected genetic information to better understand the Yelloweye Rockfish, Canary Rockfish, and Bocaccio listed under ESA, and found that Puget Sound/Georgia Basin Canary Rockfish are not discrete from coastal Canary Rockfish. For this reason, Puget Sound/Georgia Basin Canary Rockfish do not qualify for protection under ESA, and they were delisted on January 23, 2017.[61] Though NMFS does not know the abundance of Canary Rockfish in the Puget Sound/Georgia Basin, the overall population has improved dramatically.[62]

Canary Rockfish are a candidate for listing in Washington State. WDFW rockfish regulations in-place since 2010 to protect all species of rockfish are independent of the Federal de-listing of Canary Rockfish. Recreational anglers currently may not target, possess, or retain any type of rockfish in Puget Sound, including the San Juan Islands area, and there still are no commercial fisheries that may target any species of rockfish in Puget Sound.

Rockfishes are unusual among the bony fishes in that fertilization and embryo development is internal and female rockfish give birth to live larval young. Larvae are found in surface waters and may be distributed over a wide area extending several hundred miles offshore. Fecundity in female Canary Rockfish ranges from 260,000 to 1.9 million eggs, considerably more than many other rockfish species. Larvae and small juvenile rockfish may remain in open waters for several months, being passively dispersed by ocean currents.

Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids of all life stages. Adults eat demersal invertebrates and small fishes, including other species of rockfish, associated with kelp beds, rocky reefs, pinnacles, and sharp dropoffs. Approximately 50% of adult Canary Rockfish are mature at 14 inches (36 cm) total length (about 5 to 6 years of age). They can live to be 75 years old.

59 NOAA 2019b. http://www.nmfs.noaa.gov/pr/species/fish/canaryrockfish.htm
60 NOAA Fisheries, West Coast Region 2017.
61 http://www.westcoast.fisheries.noaa.gov/publications/fm/2017/82fr7711.pdf
62 http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2015/2015_status_of_stocks_updated.pdf

Distribution and Habitat
Canary Rockfish range between Punta Colonett, Baja California, and the Western Gulf of Alaska. Within this range, Canary Rockfish are most common off the coast of central Oregon.

Canary Rockfish primarily inhabit waters 160 to 820 feet (50 to 250 m) deep, but may be found to 1,400 feet (425 m). Juveniles and sub-adults tend to be more common than adults in shallow water and are associated with rocky reefs, kelp canopies, and artificial structures, such as piers and oil platforms. Adults generally move into deeper water as they increase in size and age, but usually exhibit strong site fidelity to rocky bottoms and outcrops where they hover in loose groups just above the bottom.

Critical Habitat
A final rule designating critical habitat for Yelloweye Rockfish, Canary Rockfish, and Bocaccio was issued by NOAA on February 11, 2015 (79 FR 68041). However, since Canary Rockfish were subsequently de-listed on January 23, 2017, critical habitat is no longer applicable to this species.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Canary Rockfish are fished directly and are often caught as by-catch in other fisheries, including those for salmon. Adverse environmental factors led to recruitment failures in the early- to mid-1990s. Because this species is slow growing, late to mature, and long-lived, recovery from threats will take many years, even if the threats are no longer affecting the species.

BOCACCIO ROCKFISH (*Sebastes paucispinis*)[63]

Status and Description
Bocaccio Rockfish are Federally-listed as endangered, and are currently State-listed as a candidate species for further status designation at a later time.[64]

Recreational catch and effort data spanning 12 years from the mid-1970s to mid-1990s suggests possible declines in abundance in Washington. Additional data over this period show the number of angler trips increased substantially and the average number of rockfish caught per trip declined. Taken together, these data suggest declines in the population over time. Currently there are no survey data being taken for this species, but few of these fish are caught by fishermen and none have been caught by Washington State biological surveys in 20 years, suggesting a very low population abundance. They are thought to be at less than 10% of their unfished abundance.

A 2005 stock assessment by NOAA Fisheries, however, suggests that Bocaccio have higher populations than was thought to be the case.

Current regulations in Washington State, where the species is most at risk, limit the daily rockfish catch to three rockfish total (of any species, except as noted below in the discussion of Washington State rockfish species of concern).

Rockfishes are unusual among the bony fishes in that fertilization and embryo development is internal, and female rockfish give birth to live larval young. Larvae are found in surface waters, and may be distributed over a wide area extending several hundred miles offshore. Fecundity in female Bocaccio

63 NOAA 2019a. http://www.nmfs.noaa.gov/pr/species/fish/bocaccio.htm
64 WDFW 2008 (updated January 2019).

ranges from 20,000 to more than 2 million eggs, considerably more than many other rockfish species. Larvae and small juvenile rockfish may remain in open waters for several months, being passively dispersed by ocean currents.

Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids of all life stages. Adults eat demersal invertebrates and small fishes (including other species of rockfish) associated with kelp beds, rocky reefs, pinnacles, and sharp dropoffs. Approximately 50% of adult Bocaccio mature within 4 to 6 years. They are difficult to age but are suspected to live as long as 50 years.

Distribution and Habitat
Bocaccio range from Punta Blanca, Baja California, to the Gulf of Alaska off Krozoff and Kodiak Islands. They are most common between Oregon and northern Baja California. Bocaccio were once common on steep walls in portions of Puget Sound, now they are very rare.

Bocaccio commonly occur at depths between 160 and 820 ft (50 to250 m). Adults generally move into deeper water as they increase in size and age but usually exhibit strong site fidelity to rocky bottoms and outcrops. Juveniles and sub-adults may be more common than adults in shallower water, and are associated with rocky reefs, kelp canopies, and artificial structures, such as piers and oil platforms.

Critical Habitat
A final rule designating critical habitat for Yelloweye Rockfish, Canary Rockfish,[65] and Bocaccio was issued by NOAA on February 11, 2015 (79 FR 68041). Specific locations within five DPS basins have been mapped: the San Juan/Strait of Juan de Fuca basin; Whidbey Basin, Main Basin (areas between Point Wilson near Port Townsend and the Tacoma Narrows), South Puget Sound and Hood Canal. The specific areas in the final designation include 590.4 square miles of nearshore habitat for Bocaccio, and 414.1 square miles of deep-water habitat for Bocaccio and Yelloweye Rockfish. Areas essential to the conservation of Bocaccio include benthic habitats or sites deeper than 98 ft (30 m) that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat. These features support growth, survival, reproduction, and feeding opportunities by providing the structure for rockfishes to avoid predation, seek food, and persist for decades.[66]

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Bocaccio are fished directly and are often caught as by-catch in other fisheries, including those for salmon. Adverse environmental factors led to recruitment failures in the early- to mid-1990s. Because Bocaccio Rockfish are so slow-growing, late to mature, and long-lived, recovery from the above threats will take many years, even if the threats are no longer affecting the species.

[65] No longer applicable to Canary Rockfish; see the Status and Description of Canary Rockfish above.
[66] https://www.federalregister.gov/documents/2014/11/13/2014/endangered-and-threatened-species-designation-of-critical-habitat-for-the-puget-soundgeorgia-basin.

YELLOWEYE ROCKFISH (*Sebastes ruberrimus*)[67]

Status and Description
The Puget Sound/Georgia Basin DPS of Yellow Rockfish in Washington State is Federally-listed as threatened, and State-listed as a candidate species for further status designation at a later time (WDFW 2008, updated January 2019).

Recreational catch and effort data spanning 12 years from the mid-1970s to mid-1990s suggests possible declines in abundance. While catch data are generally constant over time, the number of angler trips increased substantially, and there was a decline in the average number of rockfish caught per trip. Taken together, these data suggest declines in the population over time. Currently there are no survey data being taken for Yelloweye Rockfish, but few of these fish are caught by fishermen, suggesting a low population abundance.

Various Washington State restrictions on fishing have been put in place over the years leading to the 2003 ban on retention of Yelloweye Rockfish. Because this species is slow-growing, late to mature, and long-lived, recovery from these threats will take many years, even if the threats are no longer affecting the species.

Yelloweye Rockfish are very large rockfish that reach up to 3.5 feet (approximately 1 m) in length.

Rockfishes are unusual among the bony fishes in that fertilization and embryo development is internal and female rockfish give birth to live larval young. Larvae are found in surface waters and may be distributed over a wide area extending several hundred miles offshore. Fecundity in female Yelloweye Rockfish ranges from 1.2 to 2.7 million eggs, considerably more than many other rockfish species. Larvae and small juvenile rockfish may remain in open waters for several months being passively dispersed by ocean currents.

Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids of all life stages. Adults eat demersal invertebrates and small fishes, including other species of rockfish, associated with kelp beds, rocky reefs, pinnacles, and sharp dropoffs. Approximately 50% of adult Yelloweye Rockfish are mature by 16 inches (41 cm) total length (about 6 years of age). They are among the longest-lived of rockfishes, living up to 118 years old.

Distribution and Habitat
Yelloweye Rockfish range from northern Baja California to the Aleutian Islands, Alaska, but are most common from central California northward to the Gulf of Alaska.

Juveniles and sub-adults tend to be more common than adults in shallower water, and are associated with rocky reefs, kelp canopies, and artificial structures such as piers and oil platforms. Adults generally move into deeper water as they increase in size and age, but usually exhibit strong site fidelity to rocky bottoms and outcrops. Yelloweye Rockfish occur in waters 80 to 1,560 feet (25 to 475 m) deep, but are most commonly found between 300 to 590 feet (91 to 180 m).

Critical Habitat
A final rule designating critical habitat for Yelloweye Rockfish, Canary Rockfish,[68] and Bocaccio was issued by NOAA on February 11, 2015 (79 FR 68041). Specific locations within five DPS basins have

[67] NOAA 2019d. http://www.nmfs.noaa.gov/pr/species/fish/yelloweyerockfish.htm
[68] No longer applicable to Canary Rockfish; see the Status and Description of Canary Rockfish above.

been mapped: the San Juan/Strait of Juan de Fuca basin; Whidbey Basin, Main Basin (areas between Point Wilson near Port Townsend and the Tacoma Narrows), South Puget Sound and Hood Canal. The specific areas in the final designation include 414.1 square miles of deep-water habitat for yelloweye rockfish and bocaccio. Areas essential to the conservation of Yelloweye Rockfish include benthic habitats or sites deeper than 98 ft (30 m) that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat. These features support growth, survival, reproduction, and feeding opportunities by providing the structure for rockfishes to avoid predation, seek food, and persist for decades.[69]

Threats within the Project Action Area

Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Yelloweye Rockfish are fished directly and are often caught as by-catch in other fisheries, including those for salmon. Adverse environmental factors led to recruitment failures in the early- to mid-1990s.

Rockfish are vulnerable to overfishing because many species do not begin to reproduce until they are 5 to 20 years old, and very few of their young survive to adulthood. They are also susceptible to overfishing and habitat degradation as a result of their long life-span.[70]

PINTO ABALONE (*Haliotis kamtschatkana*)[71,72]

Status and Description

Pinto Abalone was Federally-listed as a species of concern in 2004 (WDFW 2008, updated January 2019). WDFW identified Pinto Abalone as a candidate species for further status designation at a later time. WDFW recommends in the April 2019 status report that Pinto Abalone be listed as endangered in Washington State (Carson and Ulrich 2019).

There was no historical commercial fishing for Pinto Abalone in Washington State, and the recreational fishery was closed in 1994 due to declines in abundance. Densities at all but one site are below or within the minimum range for successful fertilization (NOAA/NMFS 2007).

WDFW regularly monitors the abundance of Pinto Abalone at 10 index stations throughout the San Juan Archipelago. Because Pinto Abalone are highly patchy, cryptic and frequently associate with microhabitats such as rock crevices or patches of coralline algae that may themselves be sparsely distributed, total abundances are not measured. Repeated surveys at a system of index sites are conducted in order to detect temporal trends in abalone abundance. These surveys indicate an 83% decline in abalone abundance between 1992 and 2009 (Rothaus et al. 2008).

Known for their large, muscular foot and the pearlescent oval shell, Pinto Abalone are slow-growing, long-lived marine snails. Pinto (or Northern) Abalone is the only species found in Washington State.

Rothaus et al. (2008) found an increase in mean shell length of 10.4 mm between 1992 and 2006, indicating a substantial shift in the size distribution of abalone populations. This signifies a shift in abalone population age structure from younger to older animals, indicative of repeated recruitment

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69 https://www.federalregister.gov/documents/2014/11/13/2014/endangered-and-threatened-species-designation-of-critical-habitat-for-the-puget-soundgeorgia-basin.

70 https://www.westcoast.fisheries.noaa.gov/protected_species/rockfish/rockfish_in_puget_sound

71 NOAA/NMFS. 2007. https://www.westcoast.fisheries.noaa.gov/publications/SOC/pintoabalone_detailed.pdf

72 Encyclopedia of Puget Sound. https://www.eopugetsound.org/science-review/2-pinto-abalone

failure. Many aspects of abalone biology and ecology not yet well understood may be important in explaining both the decline and the recovery potential for Pinto Abalone in the Puget Sound region (Encyclopedia of Puget Sound).

Since 2004, a program of hatchery-based rearing and out-planting aimed at restoring abalone populations in Washington State has been led by the Puget Sound Restoration Fund and several local partners. In the summer of 2000, nearly 2,000 abalone were out-planted near Anacortes and Port Angeles (Encyclopedia of Puget Sound).

Pinto Abalone broadcast spawn from April to June. The larvae are planktonic and settle after approximately 7 to 10 days in response to cues from both crustose coralline algae and from adults. Limited larval dispersal seems to make abalone species in general difficult to manage. There may be an unusual genetic form in the Puget Sound/Strait of Georgia region (Jamieson 1999).

Pinto Abalone are important herbivores in nearshore habitats, feeding primarily on drift macroalgae such as kelp and benthic diatom films. They can structure subtidal communities through the maintenance of substrata dominated by crustose coralline algae and through the facilitation of conspecific settlement.

Distribution and Habitat

Pinto Abalone were once widely distributed throughout the waters of British Columbia and Washington State. In recent decades, populations have undergone sharp declines, likely in response to the combined stressors of overharvest, poaching, and sub-optimal environmental conditions (Campbell 2000).

Pinto Abalone are typically found in nearshore rocky habitats in semi-exposed or exposed coastal regions. They typically occupy the low intertidal zone to a depth of 30 ft (9 m), but may be found as deep as 330 feet (100 m). In Washington State, they range from Admiralty Inlet to the San Juan Islands and the Strait of Juan de Fuca, and are typically found at depths of about 60 feet (20 m) (Buoma 2007).

Representative Pinto Abalone habitat at the WDFW San Juan Archipelago index station sites is primarily comprised of bedrock and boulders encrusted with coralline algae, supporting assemblages of kelp and other macroalgae (Rothaus et al. 2008).

Threats within the Project Action Area

Threats to the population success of Pinto Abalone include overharvest, suspected illegal harvest, and predation by reintroduced and recovering sea otter (*Enhydra lutris*).

E. STATE-LISTED SPECIES AND CANDIDATE SPECIES[73]

WDFW provided the table below to identify Washington State-listed species and candidates for listing to be addressed in the update of the 1990 *Programmatic EIS: Fish Culture in Floating Net Pens,* and in the SEPA analysis of the Cooke Aquaculture Puget Sound net pen species conversion proposal from rearing Atlantic Salmon to rearing all-female triploid Rainbow Trout/steelhead. The proposed action, project action area, and elements of the effects analysis are the same for State-listed species as described in Section A preceding the effects analysis for Federally-listed species. Information provided in this section about each State-listed marine mammal, fish and mollusc includes species status and description, distribution and habitat, and threats within the project action area. The effects of Atlantic Salmon marine net pen aquaculture, and of the Cooke Aquaculture species conversion proposal to rear all-female triploid

[73] Some State-listed species are described above in Section D, Federally-Listed Species and Species of Concern.

Rainbow Trout/steelhead in the company's existing marine net pen facilities, is provided in Section F for both State-listed and Federally-listed species.

Common Name	Animal Type	State Species Status
Pacific Harbor Porpoise	Mammals	Candidate
Gray Whale	Mammals	Sensitive
Pacific Herring	Fish	Candidate
Black Rockfish	Fish	Candidate
Brown Rockfish	Fish	Candidate
China Rockfish	Fish	Candidate
Copper Rockfish	Fish	Candidate
Quillback Rockfish	Fish	Candidate
Redstripe Rockfish	Fish	Candidate
Tiger Rockfish	Fish	Candidate
Yellowtail Rockfish	Fish	Candidate
Walleye Pollock (South Puget Sound)	Fish	Candidate
Olympia Oyster	Molluscs	Candidate

PACIFIC HARBOR PORPOISE (*Phocoena phocoena*)[74]

Status and Description
The Washington Department of Fish and Wildlife lists Pacific Harbor porpoises as a "candidate" species (WDFW 2015). This status refers to species that are to be reviewed by the State for possible listing as endangered, threatened, or sensitive. NOAA has not listed harbor porpoises, but they are protected under the Marine Mammal Protection Act.

Harbor Porpoise may weigh up to 170 pounds (77 kg) and measure 5 feet in length. Their diet includes schooling fish (e.g., herring, capelin) and invertebrates (e.g., cephalopods). The species general travels in small groups of one to eight individuals. Sexual maturity is reached in 3 to 4 years, and females may give birth every year for several years in a row. Lifespan is approximately 24 years.

Distribution and Habitat
In the eastern North Pacific Ocean, Harbor Porpoise range from Point Barrow in northern Alaska south to Point Conception in California. The species is distributed in coastal and inland waters. Harbor Porpoise are known to occur year-around in the Strait of Juan de Fuca and Puget Sound (NOAA 2011a). The species is most commonly found in bays, estuaries and harbors less than 650 feet (200m) deep.

Threats within the Project Action Area
The 2003 estimated abundance of the inland Washington waters stock of Harbor Porpoise was 10,682 individuals, with a minimum population estimate of 2,545 (NOAA 2011a). There is no more recent abundance estimate available for this stock, and there are no reliable data on long-term population trends on the Harbor Porpoise.

[74] RPS ASA 2016.

Threats to Harbor Porpoise include by-catch in fishing gear (particularly gillnets, trawls, and herring weirs) and boat strikes. Additionally, Unusual Mortality Events (UME) have been recorded for this species in Puget Sound, including 114 strandings in 2006 (NOAA 2011a).

GRAY WHALE (*Eschrichtius robustus*)[75]

Status and Description
The Washington Department of Fish and Wildlife lists Gray Whale as "sensitive" (WDFW 2008, updated January 2019). This status refers to species that are vulnerable or declining, and likely to become endangered or threatened in significant portions of their range if threats persist or if cooperative management does not occur. While the Western Pacific population of Gray Whale is Federally-listed as endangered, the U.S. Fish and Wildlife Service delisted the Eastern Pacific population in 1994; therefore, it does not currently have a Federal listing status. However, Gray Whale, like all marine mammals, are protected under the Marine Mammal Protection Act (MMPA).

Gray Whale roll on their sides and swim slowly along the sea floor to feed. They filter amphipods from bottom sediments using their baleen plates. They reach sexual maturity at an average of 8 years old and give birth to single calves after 12 to 13 months of gestation.

Distribution and Habitat
Gray Whale are found mainly in shallow coastal waters in the North Pacific Ocean. Genetically distinct Eastern North Pacific (ENP) and Western North Pacific (WNP) populations are recognized. Most of the ENP population feeds in the Chukchi and Bering Seas, but some gray whales have also been reported feeding along the Pacific coast during the summer, in waters off of Southeast Alaska, British Columbia, Washington, Oregon, and northern California. In the fall, gray whales migrate south along the coast of North America from their summer feeding grounds to winter bear calves in areas off the coast of Baja California. The most recent population estimate of the ENP is about 27,000 whales (NOAA 2019e).

Threats within the Project Action Area
General nearshore threats to Gray Whale include vessel collisions, entanglement in fishing gear, and disturbance from ecotourism, noise, and whale-watching. Collisions with all sizes and types of vessels are one of the primary threats to marine mammals, particularly large whales. Gray whales are one of the most vulnerable species to vessel strikes because they feed and migrate along the U.S. west coast, which has some of the world's heaviest vessel traffic associated with some of the largest ports in the country.

Entanglement in fishing gear can result in fatigue, compromised feeding ability, or severe injury, which would ultimately lead to death.

Underwater noise threatens whale populations, interrupting their normal behavior and driving they away from areas important to their survival.

PACIFIC HERRING (*Clupea pallasii*)[76]

Status and Description
Pacific Herring are State-listed in Washington as a candidate species for further status designation at a later time.

[75] https://www.fisheries.noaa.gov/species/gray-whale
[76] https://www.fisheries.noaa.gov/Alaska/endangered-species-conservation/pacific-herring.

Distribution and Habitat
Pacific Herring is a coastal schooling species found on both the eastern and western sides of the Pacific Ocean at depths ranging from the surface to 1,300 ft (400 m). Adult Pacific Herring migrate inshore, entering estuaries to breed once per year, with timing varying by latitude. Herring spawn in shallow areas along shorelines, between the subtidal and intertidal zones. Eggs are deposited on kelp, eelgrass (*Zostera marina*), and other available structures. Herring feed on phytoplankton and zooplankton in nutrient-rich wasters associated with oceanic upwelling.

Threats within the Project Action Area
Threats for Pacific Herring include destruction of herring spawning grounds, juvenile and feeding habitat and rearing/foraging habitat. None of these habitat requirements occur directly within areas where Cooke Aquaculture existing marine net pens are located. Global climate change, recovering populations of predators and fishing exploitation in Southeast Alaska are also threats to Pacific Herring.

BLACK ROCKFISH (*Sebastes melanops*)[77]

Status and Description
Black Rockfish are State-listed as a candidate species for further status designation at a later time. Recreational harvest within Puget Sound has been closed, with the exception of restricted fishing in the Strait of Juan de Fuca. They can grow up to approximately 27 inches (69 cm) in length, and weigh up to 11 pounds (5 kg). Maximum age is 50 years old.

Distribution and Habitat
Black Rockfish range from Amchitka and Kodiak Islands, Alaska, to Huntington Beach in southern California. They have been found at water depths up to 1,200 feet (366 m), but are most commonly found in waters shallower than 180 feet (55 m). Black Rockfish are known to form large schools in and around kelp and artificial structures. They are commonly caught by recreational harvesters off the Washington coast.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Rockfish species are often caught as by-catch in other fisheries. Because they are slow growing, late to mature, and long-lived, recovery from threats take many years, even if the threats are no longer affecting the species.

BROWN ROCKFISH (*Sebastes auriculatus*)[78]

Status and Description
Brown Rockfish are State-listed as a candidate species for further status designation at a later time. Recreational harvest within Puget Sound has been closed. In Puget Sound, the apparent hybridization of Quillback, Copper and Brown Rockfish makes species identification difficult. Brown Rockfish can grow up to 22 inches (56 cm) in length. Maximum age is at least 34 years old.

Distribution and Habitat
Brown Rockfish range from Prince William Sound, Alaska, to southern Baja California. They were once abundant in central and South Puget Sound. They range in depth from shallow inshore waters to approximately 400 feet (135 m) deep. They are most commonly distributed above 400 feet (120 m).

[77] WDFW 2019.
[78] WDFW 2019.

Brown Rockfish can be found a few meters off the bottom, and are common on both low and high relief areas, and occasionally within eelgrass or other marine vegetation. They are rarely caught by recreational harvesters off the Washington coast.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Rockfish species are often caught as by-catch in other fisheries. Because they are slow growing, late to mature, and long-lived, recovery from threats take many years, even if the threats are no longer affecting the species.

CHINA ROCKFISH (*Sebastes nebulosus*)[79]

Status and Description
China Rockfish are State-listed as a candidate species for further status designation at a later time. Recreational harvest within Puget Sound has been closed. They can grow up to 18 inches (45 cm) in length and have a relatively small mouth. Maximum age is at least 79 years old.

Distribution and Habitat
China Rockfish are found from Kechemak Bay, Cook Inlet, Alaska, to San Nicolas Island in southern California. They are found at water depths between approximately 10 and 420 feet (3 and 128 m). This is a solitary species inhabiting high-energy, high relief rocky outcrops with numerous crevices. They are very territorial and rarely move more than about 30 feet (10 m) from their home site. China Rockfish are commonly caught by recreational harvesters off the northern Washington coast.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Rockfish species are often caught as by-catch in other fisheries. Because they are slow growing, late to mature, and long-lived, recovery from threats take many years, even if the threats are no longer affecting the species.

COPPER ROCKFISH (*Sebastes caurinus*)[80]

Status and Description
Copper Rockfish are State-listed as a candidate species for further status designation at a later time. Recreational harvest within Puget Sound has been closed. Hybridization between Brown, Copper and Quillback Rockfish occurs in Puget Sound, sometimes making species identification difficult. Copper Rockfish can grow up to approximately 26 inches (66 cm) in length. Males grow larger than females. Maximum age is at least 50 years old.

Distribution and Habitat
Copper Rockfish range from the northern Gulf of Alaska to Isla San Benito, near the center of Baja California. They are found from subtidal waters to about 600 feet (183 m) in depth. Adults are found primarily in boulder fields and over high-relief rocks, either in schools or as single individuals. They are commonly caught by recreational harvesters off the northern Washington coast and occasionally by recreational fishermen in the Strait of Juan de Fuca.

[79] WDFW 2019.
[80] WDFW 2019.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Rockfish species are often caught as by-catch in other fisheries. Because they are slow growing, late to mature, and long-lived, recovery from threats take many years, even if the threats are no longer affecting the species.

QUILLBACK ROCKFISH (*Sebastes maliger*)[81]

Status and Description
Quillback Rockfish are State-listed as a candidate species for further status designation at a later time. Recreational harvest within Puget Sound has been closed. Hybridization between Brown, Copper and Quillback Rockfish occurs in Puget Sound, sometimes making species identification difficult. Quillback Rockfish can grow up to approximately 24 inches (61 cm) in length. Maximum age is 95 years old.

Distribution and Habitat
Quillback Rockfish range from Kenai Peninsula in the Gulf of Alaska to Anacapa Passage in southern California. They can be found from subtidal waters to a depth of 900 feet (approximately 275 m). Juveniles are usually shallower than adults, and can be found on bull kelp-covered rocky outcrops, while adults tend to live in deeper water as solitary individuals. They are bottom dwellers that prefer high-relief, broken rock with flat-bladed kelps. In Puget Sound, Quillback Rockfish living on high-relief areas have a very limited home range and have high fidelity to their home sites. They are commonly caught off the Washington coast by recreational harvesters and occasionally caught by recreational fishermen in the Strait of Juan de Fuca.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Rockfish species are often caught as by-catch in other fisheries. Because they are slow growing, late to mature, and long-lived, recovery from threats take many years, even if the threats are no longer affecting the species.

REDSTRIPE ROCKFISH (*Sebastes proriger*)[82]

Status and Description
Redstripe Rockfish are State-listed as a candidate species for further status designation at a later time. Recreational harvest within Puget Sound has been closed. They can grow up to approximately 20 inches (51 cm) in length. Maximum age is at least 55 years old.

Distribution and Habitat
Redstripe Rockfish range from the Bering Sea and Amchitka Island, Alaska, to southern Baja California. They are found at water depths from 40 to 1,400 feet (12 to 425 m), and are most commonly found between approximately 500 and 900 feet (150 to 275 m). This species usually lives over high-relief, rugged bottoms, and may form dense schools that rise off the bottom during the day and disperse at night. They are occasionally caught off the Washington coast by commercial otter-trawls and longline gear. They are rarely caught by recreational fishermen within Puget Sound.

[81] WDFW 2019.
[82] WDFW 2019.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Rockfish species are often caught as by-catch in other fisheries. Because they are slow growing, late to mature, and long-lived, recovery from threats take many years, even if the threats are no longer affecting the species.

TIGER ROCKFISH (*Sebastes nigrocinctus*)[83]

Status and Description
Tiger Rockfish are State-listed as a candidate species for further status designation at a later time. Recreational harvest within Puget Sound has been closed. They can grow up to 24 inches (61 cm) in length. Maximum age is 116 years old.

Distribution and Habitat
Tiger Rockfish range from Kodiak Island and Prince William Sound, Alaska, to Tanner and Cortes Banks in southern California. They occur at water depths between approximately 60 and 1,000 feet (18 to 298 m). Adult Tiger Rockfish live on rock outcrops that have caves and crevices. They are rarely observed in the open during the day. They are occasionally caught off the Washington coast by commercial harvesters using otter-trawls and longline gear. They are rarely caught by recreational fishermen in Puget Sound.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Rockfish species are often caught as by-catch in other fisheries. Because they are slow growing, late to mature, and long-lived, recovery from threats take many years, even if the threats are no longer affecting the species.

YELLOWTAIL ROCKFISH (*Sebastes flavidus*)[84]

Status and Description
Yellowtail Rockfish are State-listed as a candidate species for further status designation at a later time. Recreational harvest within Puget Sound has been closed. Under water, Yellowtail Rockfish resemble Olive Rockfish, making identification somewhat difficult. Yellowtail Rockfish can grow up to approximately 26 inches (66 cm) in length. Maximum age is at least 64 years old.

Distribution and Habitat
Yellowtail Rockfish range from Unalaska Island, Alaska, to San Diego, California. Only juvenile yellowtails have been found in Puget Sound. Older juveniles and adults are usually found over high relief, such as boulders and sheer rock walls, although they are seen rarely over cobble-mud bottoms. Yellowtail Rockfish are a schooling species, sometimes swimming well off the bottom in schools of thousands. They can be found from the surface to approximately 1,800 feet (549 m) in water depth. They are commonly caught by commercial harvesters off the Washington coast, and occasionally caught in the Strait of Juan de Fuca by recreational fishermen.

Threats within the Project Action Area
Primary stressors to rockfish populations include fishery removals, derelict fishing gear, hypoxia and food web interactions (Palsson et al. 2009). Rockfish species are often caught as by-catch in other fisheries.

[83] WDFW 2019.
[84] WDFW 2019.

Because they are slow growing, late to mature, and long-lived, recovery from threats take many years, even if the threats are no longer affecting the species.

SOUTH PUGET SOUND WALLEYE POLLOCK (*Theragra chalcogramma*)[85]

Status and Description
Walleye Pollock are State-listed as a candidate species for further status designation at a later time.

Walleye Pollock adults are generally a semi-demersal species. Quinnell and Schmidtt (1991) found that the mean length of Walleye Pollock collected in North Puget Sound was approximately 5.5 inches (14 cm), suggesting they were largely young-of-the-year. Walleye Pollock collected in South Puget Sound had a mean length of 6.3 inches (16 cm), which suggests the presence of a spawning population in or near South Puget Sound (Gustafson et al. 2000). Early-stage Walleye Pollock feed on copepod nauplii (Nakatani 1988, Canino et al. 1991, Gustafson et al. 2000), and juveniles mostly feed on euphausiids, copepods, decapod[86] larvae, and larvaceans[87] (Grover 1990, Merati and Brodeur 1996, Bailey et al. 1999, Gustafson et al. 2000). Predators of Walleye Pollock eggs and larvae include a variety of invertebrates and fish. Juvenile Walleye Pollock are preyed upon by seabirds (e.g., common murre) and marine mammals (e.g., harbor seals) (Bailey et al. 1999, Hunt et al. 1996, Lowry et al. 1996, Gustafson et al. 2000).

Distribution and Habitat
Various life stages of Walleye Pollock inhabit nearshore areas, large estuaries (including Puget Sound), coastal embayments and open ocean basins. Adults occur as deep as 1,160 feet (366 m), but the vast majority occurs in depths between 330 and 980 feet (100 to 300 m). Juvenile pollock have been found in a variety of habitat types, including eelgrass (over sand and mud), gravel and cobble; however, because of their pelagic mode, they are not thought to consistently associate with many types of substrates. The nearest known spawning ground to the project action area is to the east in Port Townsend, Jefferson County (Gustafson et al. 2000).

Threats within the Project Action Area
The threats for Walleye Pollock are similar to those for Pacific Cod and include destruction of herring spawning grounds, juvenile and feeding habitat, and rearing/foraging habitat, which do not directly occur within the project action area. Global climate change, recovering populations of predators, and fishing exploitation are additional identified threats.

OLYMPIA OYSTER (*Ostrea lurida*)

Status and Description
Olympia Oyster are State-listed as a candidate species for further status designation at a later time (WDFW 2008, updated January 2019).

Native populations of Olympia Oyster were initially decimated by human harvest. By 1870, overharvesting had depleted native oyster stocks in both Willapa Bay and Puget Sound. Olympia. Oyster populations were maintained at low levels by water pollution, particularly effluent discharge from pulp

[85] RPS ASA 2016.
[86] Decapods are an order of crustaceans including many familiar groups, such as crayfish, crabs, lobsters, prawns and shrimp.
[87] Larvaceans are solitary, free-swimming tunicates (transparent marine invertebrates) found throughout the world's oceans.

and paper mills that severely limited reproductive success extending into the 1970s. Non-native oyster predators, particularly the Japanese oyster drill (*Ocenebra japonica*) and a parasitic crustacean (*Mytilicola orientalis*) were accidentally introduced along with the Pacific oysters early in the 1900s (Pacific Biodiversity Institute 2019).

Olympia Oysters usually inhabit low tidelands that remain inundated during low tides. Improving water quality over the past 40 years with the closure of all but two of pulp mills in Puget Sound, and recent restoration efforts, have failed to restore Olympia Oyster populations.

Distribution and Habitat

The historic range of the Olympia Oyster extended along the coast of North America from southeast Alaska to Baja California. They usually inhabit low tidelands or estuaries that remain inundated with water during low tide, although they can also be found on anthropogenic surfaces such as the undersides of floats an on pilings (Pacific Biodiversity Institute 2019).

Native Olympia Oyster beds created complex, three-dimensional habitat and foraging locations for invertebrates and fish, including salmonids and Dungeness crab (*Metacarcinus magister*). Olympia Oyster are filter feeders that filter phytoplankton, bacteria, excess nutrients, pathogens, and other pollutants from the water at a rate of 5 gallons per hour. Historic Olympia Oyster beds would thereby provide a substantial clean water benefit and provide the water quality necessary to allow for healthy eelgrass and kelp growth (Northwest Straits Commission. 2019, Blake and Bradbury 2013, Pacific Biodiversity Institute 2019).

Overall, Olympia Oyster are thought to occur throughout the extent of their historic range in low densities. In the Pacific Northwest, Olympia Oyster populations have been classified as poor or functionally extinct, with 90 to 99% of the population lost. Less than 4% of the historic core populations remain in Salish Sea (Peabody and Davis 2013).

Threats within the Project Action Area

According to the 2013 WDFW report on rebuilding Olympia Oyster populations in the Salish Sea (Blake and Bradbury 2013), this species is sensitive to the presence of non-native, invasive predators, including the Japanese oyster drill (*Ocinebrellus inornatus*); shoreline and tideland modifications, including nearshore or estuarine restoration projects; by-catch mortality from Pacific Oyster commercial harvest; turbidity, siltation, and increased nutrient inputs from upland practices; and genetic fitness impacts from unrestricted distribution of generic hatchery-origin native oysters.

Extreme temperatures from storm and freezing events that exceed the tolerance range of Olympia Oyster, and water pollution in the form of heavy metals, oils, pesticides and other chemicals may also impact the recovery of Olympia Oyster (Capital Regional District 2019).

The recovery and reestablishment of historic levels of the Olympia Oyster is restricted by a lack of suitable habitat where beds once occurred. The lack of habitat is mostly due to presence of eelgrass or aquaculture in tideland areas, loss of tidelands due to filling or diking, and the diminished densities that would allow for effective reproduction (Blake and Bradbury 2013).

F. EFFECTS ANALYSIS

The potential effects of floating net pen culture on Federally-listed species and State-listed species and candidate species are described in this section based on features and operations of Cooke Aquaculture existing marine net pens in Puget Sound in which primarily Atlantic Salmon have been raised since the 1980s. These effects have been described in hundreds of technical studies performed by Federal agencies and independent researchers, some of which are cited here. Other than transitioning to the commercial cultivation of a different species of fish, the company is not planning any alteration to the existing fish pen physical structures, site locations, supporting equipment, or general current practices, methods and cultivation techniques used for growing Atlantic salmon in net pens.

The effects analysis in this section addresses two scenarios for each species: the effects of Atlantic Salmon net pen culture (to update the 1990 Programmatic EIS), followed by the effects of the species conversion proposal to transition the species reared in Cooke Aquaculture net pens from Atlantic Salmon to all female triploid Rainbow Trout/steelhead. Concerns about the potential effects of escapement of domesticated stocks of mono-sex sterile Rainbow Trout/steelhead are discussed in SEPA Checklist Attachment B, Additional Information.

Features and Operations of Cooke Aquaculture Floating Net Pens Considered in the Effects Analysis of Threatened and Endangered Species, Candidate Species, and Species of Concern

Fish Containment (Stock Nets) and Predator-Exclusion Nets. Cooke Aquaculture floating marine net pens use three different net types:

- Fish containment or stock nets are the primary containment net the fish are reared in. The net extends from above the surface of the water (approx., 5 feet) where it is attached to the hand railing and walkway attachment points around the inside perimeter of each pen. The net then extends below the surface from approximately 25 to 50 feet, where it is attached to a heavy pipe frame weighting system. The stock nets are made of a strong nylon/polypropylene blend material approximately one-eighth inch in diameter and the webbing is approximately 1-inch mesh on the square. The containment nets are pulled taught by a weighted pipe frame that helps to keep the shape of the growing environment uniform in tidal currents, and to maintain the physical separation between the fish growing nets and the predator exclusion barrier netting. Fish containment nets have high visibility due to their bright colors and thick twine diameters (compared to gillnet monofilament, for example). Following harvest, the containment nets are lifted from each net pen site to the surface and then transported by boat to a land-based facility for cleaning and repairs. The predation exclusion or barrier net are either removed or maintained in place between generations. The same procedure would occur if there was a scheduled removal of the predator barrier net (lifted to the surface at the pens, put onto a vessel and then transported on the deck of a boat to a shore facility for unloading and shipping to a net maintenance facility). None of the nets are towed through the water, to or from shore, when they are being transported.
- Marine mammal predator exclusion/barrier nets (4-inch mesh on the square with a twine diameter of one-quarter inch) are attached around the outside perimeter of the entire net pen facility walkway and to the pipe weight frame below the surface (varies by site from approximately 30 to 60 feet deep). The predation barrier net surrounds the entire net pen structure and is lashed to the subsurface pipe weight frame, creating a rigid wall and floor panel that protects the fish from seals and sea lions attacks and reaching the fish through the barrier. The predation net is attached to poles that extend approximately 5 to 6 feet above the surface of the water around the entire perimeter of the net pen system. This jump fence keeps marine mammals such as seals and sea

lions from jumping onto the net pen floats and accessing the fish containment nets located on the inside perimeter of the walkway. Like the fish containment nets, predator exclusion nets are stretched taught with a heavy steel pipe frame that maintains the distance (approximately 4 to 8 feet) between the containment net and barrier net. These nets are also made of brightly-colored, thick-diameter twine that provides high visibility.

- Avian exclusion nets (2-inch mesh on the square with a twine diameter of one-eighth inch) are tied securely to the inner perimeter hand railing of each fish containment pen and stretched tightly across the top of the net, 4 feet high at the point of attachment to the hand railings. These nets are used primarily to keep gulls and scavenger birds from trying to reach the fish food pellets as they are being distributed to the surface of each fish pen while the fish are being fed.

Stocking, Grow-out and Harvest. Fish rearing units (farm sites) are planted with a single-stock (generation) of cultured smolts delivered from a company-owned freshwater hatchery near Olympia. The all-female triploid Rainbow Trout/steelhead smolts would be fed and reared in the marine net pens for approximately 12 to 18 months before reaching their targeted harvest weight. The fish are harvested and transported by a marine fishing vessel directly to an existing land-based fish processing facility. Harvesting a generation of fish would take approximately 2 to 6 months to complete depending on growing conditions, market demands and other operational factors. Once the fish stock has been completely harvested out, the marine net pen facility would be fallowed (no fish stocks on site) for a minimum of 30 days from the date that the last fish containment net was removed from the farm facility. Fish containment nets are removed by boat and transported to an approved upland facility for routine cleaning and maintenance repairs. The clean nets would then be reinstalled into the net pens and the site is prepared for restocking with the next generation of smolts.

Feeding and Fish Health Maintenance. Cultivated fish stocks are fed daily using mechanical feeding equipment. Detailed records are kept on feeding behavior, fish mortalities and the daily food consumption within each pen. Trained staff feed the fish, and fish health technicians conduct routine inspections of the fish to monitor the health status of the fish stocks. Size and temperature dependent feeding rates and digestion rates for the most efficient feed conversion into fish biomass growth has been extensively researched by the aquaculture industry and are incorporated into the feed management strategy of the farm sites. Feed usage is tracked daily and tracked in a database that calculates expected growth rates. Periodic fish weight samples are used to verify growth rates and feed conversion rates are following projected biological budgets. Underwater cameras in each pen allow technicians to closely monitor feeding behavior and feeding technicians adjust the feed delivery rate to meet the specific appetite of each fish pen population and to minimize loss of uneaten feed.

Routine diving and fish mortality removal occurs at each fish farm each week. Fish mortalities removed from the pens are transferred to sealed containers (plastic fish totes) and are transported to an approved, land-based top-soil composting facility. The plastic fish mortality totes are cleaned and disinfected at the off-site composting facility before being returned to the individual farms. Mortalities are recorded and checked carefully by trained fish health technicians to determine and document the cause of mortality. Should a fish disease occur within a net pen operation, treatment may be carried out using medicated fish feed. Veterinary guidelines are closely followed to ensure proper treatment and dosage to the fish population. Medicated feed usage (if any) is recorded in the feed database, and a monthly summary report of feed usage (including any medicated feed) is sent to the Washington Department of Ecology (Ecology), Washington Department of Fish and Wildlife and the Washington Department of Natural Resources.

Water Quality and Sediment Quality Compliance. Since 1996, Ecology has required marine net pen aquaculture operations to obtain a National Pollutant Discharge Elimination System (NPDES) Individual

permit for commercial net pen facilities within the State. This Clean Water Act permit requires monitoring, reporting, operational guidelines, Best Management Practices (BMPs), and Best Available Technology (BAT) for the operation of a facility to minimize pollution. NPDES measures are in addition to the monitoring and reporting requirements of other permits.

A key component of the NPDES permit is definition of a Sediment Impact Zone (SIZ) and Total Organic Carbon (TOC) monitoring. Organic carbon compounds are the main discharge of nutrients from a salmon net pen operation. The NPDES permit requires that organic carbon levels of the sediments sampled at the 100-ft perimeter around a net pen facility (the SIZ boundary) meet sediment management standards and be the same as or less than the natural organic carbon levels that are found in sediments from Puget Sound reference locations. These sediment standards are set for the protection of benthic organisms and the surrounding marine environment. Sampling is carried out by a third-party consultant, and the analysis is conducted by a certified, independent laboratory. If a farm is out of balance with the natural assimilative capacity of nutrients by the surrounding benthic environment, active mitigation is required. These measures would include additional TOC monitoring, a possible reduction in feeding amounts, a reduction in fish stocking biomass, further fallowing of the site to allow additional sediment recovery time, or possible reorientation/relocation of the site into more oxygenated waters, or the complete removal and closure of the site if remediation measures do not cure the exceedance of sediment standards.

NPDES permits are renewed and updated every 5 years based on the most current Ecology regulations. Specific conditions, restrictions, and monitoring and reporting procedures incorporated into each Individual permit are designed to protect public health and safety, and to meet water and sediment quality standards protective of the environment. NPDES Individual permits for the Cooke Aquaculture Atlantic Salmon net pen facilities at Clam Bay, Fort Ward, Orchard Rocks, and Hope Island were recently reissued (July 11, 2019), conditionally authorizing discharges associated with commercial rearing of Atlantic Salmon, subject to closing out non-native fish rearing after the Washington Department of Natural Resources (WDNR) State-owned Aquatic Land leases expire in 2022. The renewed permits indicate that if the company elects to raise native fish at these locations in the future, Ecology will consider a permit modification and may apply the discharge limits and requirements of the existing NPDES permits to native finfish. The reissued permits become effective on August 10, 2019 and expire on August 9, 2024.

Potential Effects on Federally-Listed Species and Species of Concern

Species are listed below in the same order in which they are described above in Sections D and F, with Federally-listed species described first, followed by State-listed and State candidate species. The effects analysis for existing Atlantic Salmon floating net pen culture on Federally-listed species and species of concern has been summarized from various sources, for the purpose of updating the *Final Programmatic EIS: Fish Culture in Floating Net Pens* (WDF 1990). These paragraphs have been reviewed and edited by Don Weitkamp, Ph.D., Aquatic Biologist and Water Quality Expert, who was one of the original authors of the 1990 Programmatic EIS. Dr. Weitkamp is also the author of all statements of effect (below) for the Cooke Aquaculture proposal to convert the species reared in existing marine net pens from Atlantic Salmon to sterile (triploid) all-female Rainbow Trout/steelhead. Don's curriculum vitae (CV) is provided in SEPA Checklist Attachment E, along with the CV for Dr. Walton Dickhoff who also reviewed and contributed to the analysis of potential effects of the Cooke Aquaculture species conversion proposal in the Additional Information document (SEPA Checklist Attachment B).

HUMPBACK WHALE

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[88]

Humpback Whale are not often found in Washington, especially within Puget Sound. They are more common off the Pacific Coast of Washington, which is a primary migratory corridor. Existing Cooke Aquaculture Puget sound marine finfish rearing facilities do not impact the major migratory corridor of Humpback Whale since there are no existing floating marine net pens on Washington's Pacific Coast. In addition, Humpback Whale do not rely heavily on benthic feeding, so effects to the benthic environment are considered minimal. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Humpback Whale (NMFS 2011).

Potential Effects from the Proposed Net Pen Species Conversion

Conversion of the net pen facilities from Atlantic Salmon to triploid all-female Rainbow Trout/steelhead will not change significant threats to Humpback Whales through entanglement in fishing gear, collisions with ship traffic, pollution, or any other means. Therefore, the action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Humpback Whales.

SOUTHERN RESIDENT KILLER WHALE

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[89]

Southern Resident Killer Whale (SRKW) are regular inhabitants of Puget Sound. Marine net pens are insignificant in their overall size and are therefore not expected to impact SRKW habitat. Vessels that service these facilities may cause short-term and localized disturbances but are not expected to have any lasting effects. There is adequate space to accommodate SRKW passage around the existing net pen facilities so that any effects on passage are expected to be insignificant (Thom 2010).

No outbreaks of parasites related to net pen operations have been observed in Puget Sound. Therefore, NMFS concludes that the operation of net pen facilities would have insignificant and discountable effects on salmonids regarding sea lice infestation. In addition, NMFS anticipates discountable effects on prey quality because net pen operators comply with NPDES permit requirements related to maintaining water quality and sediment quality. A Not Likely to Adversely Affect (NLAA) determination was supported for listed salmonids in Puget Sound; therefore, SRKW are also not likely to be adversely affected since salmonids are a primary prey base (NMFS 2011).

Other than limited and non-lethal predator control permitted by NMFS, the technical memorandums do not state any concerns of adverse effects to marine mammals in Puget Sound in relation to Atlantic Salmon rearing facilities (Nash 2001). Furthermore, the Washington Pollution Control Hearings Board (PCHB) specifically noted in its 1997 ruling that the operation of net pen facilities in Puget Sound does not have a negative impact on marine mammals (Ecology 2007). Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Southern Resident Killer Whale.

NMFS also concurs with the EPA effect determination of May Affect, Not Likely to Adversely Affect SRKW critical habitat. Existing Cooke Aquaculture Puget Sound marine net pens are required to comply with Washington State water quality standards through NPDES permit compliance. NMFS anticipates effects on prey quantity and quality will be discountable or insignificant within the action area and within designated critical habitat of SRKW. And the potential for vessels or the net pens themselves to interfere with passage

[88] USEPA 2010.
[89] USEPA 2010.

within SRKW critical habitat is expected to be short-term and localized, and therefore insignificant (NMFS 2011).

Potential Effects from the Proposed Net Pen Species Conversion

Conversion of the net pen facilities from Atlantic Salmon to triploid all-female Rainbow Trout/steelhead will not change significant threats to Southern Resident Killer Whales through reduced quantity and quality of prey; persistent pollutants that could cause immune or reproductive system dysfunction; oil spills; and noise disturbance from vessels or any other means. Therefore, the action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Southern Resident Killer Whales.

NORTHERN SEA OTTER

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

Northern Sea Otter utilize nearshore habitat, commonly away from human activity. They are commonly found in areas of bull kelp or other floating macroalge where they anchor themselves to rest. Northern Sea Otter are marine mammals that primarily prey on marine invertebrate resources but, they will consume any easily available prey. If provided access to concentrated fish in net pens they are likely to include this food resource in their diet. However, marine mammal exclusion nets installed around the outside of net pens effectively exclude otter access to fish inside the net pens. Thus, net pens offer no useful habitat to Sea Otter and do not occupy habitat that Sea Otter require. The soft substrate at depths of 50 feet and more under net pens is not likely to support the prey organisms (sea urchins, sea stars, crabs) that Otters commonly prefer.

Potential Effects from the Proposed Net Pen Species Conversion

The action of converting the net pen facilities from Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing will not change significant threats to Sea Otters within the action area. The action will not increase the risk of oil spills, diseases, parasites, boat strikes, entanglements in fishing nets, marine biotoxins, loss of kelp habitat, reduced genetic diversity or any other potential effect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Sea Otters.

STELLER SEA LION

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[90]

Steller Sea Lion occur in Washington but there are no breeding rookeries in the State. They have been observed around floating marine net pens in Rich Passage. Vessels servicing these net pens may cause short-term and localized disturbances, but they are not expected to have any lasting effects. There is adequate space to accommodate sea lion passage around the existing net pen facilities so that any effects on passage are expected to be insignificant. Steller Sea Lion typically feed on fish and large invertebrates such as squid and octopus, so effects to the benthic environment are considered minimal to the Steller Sea Lion prey base. Other than limited and non-lethal predator control permitted by NMFS, the technical memorandums do not state any concerns of adverse effects to marine mammals in Puget Sound in relation to Atlantic Salmon rearing facilities (Nash 2001). Furthermore, the Washington Pollution Control Hearings Board (PCHB) specifically noted in its 1997 ruling that the operation of net pen facilities in Puget Sound does not have a negative impact on marine mammals (Ecology 2007). Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Steller Sea Lion (NMFS 2011).

[90] USEPA 2010.

Potential Effects from the Proposed Net Pen Species Conversion

The action of converting the net pen facilities from Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing will not change significant threats to Steller Sea Lions within the action area. The eastern DPS of the Steller Sea Lion has increased at a rate of 4.76% per year since 1989 (NOAA Fisheries 2019b). No rookeries exist within the action area. The action will not increase the risk of oil spills, disturbance of rookeries, or any other potential effect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Steller Sea Lions.

BALD EAGLE

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[91]

The most likely impact to Bald Eagle from marine net pen aquaculture could be increased risk of shoreline oiling and pollution from increased vessel traffic. In general, for bird species, the interaction with fish pen cages and predator exclusion nets is likely to be insignificant, as the nets cover the pens themselves in order to reduce potential bird interactions with the fish in rearing cages. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Bald Eagle.

Potential Effects from the Proposed Net Pen Species Conversion

The action to convert the net pen facilities from Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing will not change significant threats to Bald Eagles within the action area. The action will not increase shoreline development, clearcutting, chemical pollution, loss of prey, and illegal killing or any other potential effect. The availability of salmonid prey from the net pens is not expected to increase with the proposed action. Therefore, the action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Bald Eagles.

MARBLED MURRELET

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[92]

Marbled Murrelets could be attracted to forage near salmon net pen complexes if their primary forage fish were attracted to these sites either due to the presence of overhead cover from the net pens, foraging availability from fish feed, or availability of suitable substrate for the forage on the seafloor below the pens. However, Marbled Murrelets are likely to avoid net pen complexes due to the visual presence (disturbance) of the structures, noise and associated human activity. They would be unlikely to be attracted to farmed salmon smolts within the net pens as prey items due to their larger size and weight in relation to their preferred prey items.

There are no known documented instances of Marbled Murrelet entrapment, entanglement, or mortality in nets used in aquaculture sites (Rueggeburg and Booth 1989). The 4-inch square mesh size of marine mammal predator exclusion netting is likely too small to entangle Marbled Murrelets since these birds have a total wing span of 11 to 12.5 inches and would be "flying" underwater with wings somewhat outstretched to catch prey. Since avian exclusion nets are highly visible, stretched taught and flat across net pens, extending only 6 feet above the surface of the water, and surrounded by a visible hand railing, it is extremely unlikely that Marbled Murrelets would collide with these nets, and Marbled Murrelets do not perch on structures like these. The small mesh size of the avian exclusion nets meets the recommendations by Ruggeberg and Booth (1980) that nets have a mesh size no greater than approximately 4 inches (10 cm) after stretching to avoid entangling birds. Unlike the invisible mono-filament gillnets used for commercial fishing that can cause seabird entanglements, salmon net pen

[91] RPS ASA 2016.
[92] Hamer Environmental 2016.

facilities use a brightly-colored thick polypropylene twine that is both a visual and physical deterrent to flying and diving sea-birds. The net transport process to an upland facility for cleaning and repair after a net pen site is harvested-out avoids any risk of colliding or interacting with diving or foraging Marbled Murrelets.

The overall conclusion of the Marbled Murrelet specialist (Tom Hamer, Hamer Environmental) is that Cooke Aquaculture Atlantic Salmon net pen operations May Affect but are Not Likely to Adversely Affect Marbled Murrelet.

Potential Effects from the Proposed Net Pen Species Conversion

Converting the net pen facilities from Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is not an action that will change significant threats to Marbled Murrelets within the action area. The action will not increase deforestation, oil spill, entanglement in gill nets or hook-and-line fisheries, or illegal killing or any other potential effect. No aspect of the action is expected to adversely affect the low reproductive rate of Marbled Murrelets. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Marbled Murrelets.

CHINOOK SALMON

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[93]

Sub-adult salmonid consumption of benthic organisms near net pen facilities is expected to be insignificant since facility siting by WDNR is restricted to deeper waters to limit negative impacts to benthic communities. Since Cooke Aquaculture existing marine net pens with permits to rear Atlantic Salmon are restricted to deeper waters to minimize benthic community impacts, effects on juvenile salmonid nearshore habitat (less than 66 feet MLLW) are also expected to be insignificant. Potential impacts to the migration corridors of listed salmonids is considered to be low since the number and size of net pens in Puget Sound is insignificant in relation to the width and/or water surface area of the channels or bays where they are located, and in relation to the total water surface area of Puget Sound. NOAA technical memorandums do not mention any migration concerns related to the location of existing net pen facilities. For these reasons, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Chinook Salmon.

NMFS concurs with EPA that the potential impacts of Atlantic Salmon marine net pens on sediment quality in Puget Sound will be insignificant because existing net pens are located mostly in water that is more than 66 feet deep. While nutrient enrichment may occur in beneath the pens, nearshore Chinook Salmon migration, feeding, rearing and predator avoidance will not be affected by sediment quality beneath net pens, because there is no overlap between sediment quality and these PCE (NMFS 2011). NPDES permits issued by Ecology for each of the existing marine net pen operations designate an explicit sediment impact zone (SIZ) 100 feet from the outer edge of the net pen rearing area, and a total organic carbon (TOC) standard used as a screening tool for determining compliance with Washington State Sediment Management Standards (Chapter 173-204 WAC). Organic carbon compounds (from uneaten feed and fish wastes) are the main discharge of nutrients from a salmon net pen operation. If routine sediment monitoring indicates a violation of listed standards, exceedance monitoring and benthic infaunal abundance analysis is required. If these limitations are not met, enhanced monitoring is required and additional mitigation such as a reduction in biomass, fallowing or other measures may be required.

Potential Effects from the Proposed Net Pen Species Conversion

Converting the existing net pen facilities from rearing Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is not an action that will change significant threats to Chinook Salmon within the

[93] USEPA 2010.

action area. The action will not occur in fresh water habitats where Chinook spawn and undergo initial rearing. The proposed action will not alter shoreline marine habitat used by Chinook for early marine rearing. No aspect of the action is expected to adversely affect the reproduction or early rearing of young Chinook prior to their offshore migration. Therefore, the action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Puget Sound Chinook Salmon.

In the event of an inadvertent release of as many as 250,000 Rainbow Trout/steelhead (such as occurred with the Cypress Site 2 collapse in 2017), there is no direct evidence that this would produce an adverse effect on a local Chinook Salmon population. See the response to Escapement Issues and Potential Interactions in Sections A and B of the Additional Information document (SEPA Checklist Attachment B).

- Many, perhaps half of the escaped triploid Rainbow Trout/steelhead would be harvested within the first few days following escapement because they would tend to remain in the vicinity of the rearing pens.
- Many of the triploid Rainbow Trout/steelhead would be trapped in the netting of a collapsed pen or incur physical damage as they egress the pen structure, suffering injuries to the point that their survival time outside of the pens would be reduced.
- Triploid Rainbow Trout/steelhead escaped from marine net pens have essentially no predator experience with the natural prey of Chinook Salmon, placing the triploid Rainbow Trout/steelhead at a competitive disadvantage.
- Steelhead provide no reproductive competition to Chinook since they use different substrate and hydraulic conditions (e.g., smaller gravel, shallower depths, lower water velocities).
- Inadvertent release of 200,000 to 250,000 triploid Rainbow Trout/steelhead would result in far fewer released steelhead than the number annually stocked by State, Federal and Tribal hatcheries (more than 6,000,000 per year) that are available to compete or mate with wild steelhead (due to recapture, poor survival, predation, lack of a homing instinct).
- Inadvertent release of a relatively small number of triploid Rainbow Trout/steelhead (200,000 to 250,000 fish) is unlikely to produce a detectable adverse effect to Washington's Chinook Salmon population in the presence of the intentional (i.e., hatchery) release of approximately 6,000,000 diploid steelhead per year into waters of the State from WDFW, Federal and Tribal hatcheries.
- If a major escapement of triploid Rainbow Trout/steelhead (200,000 to 250,000 fish) were to occur once in 20 years, this would constitute approximately 0.2% of hatchery steelhead released by from State, Tribal and Federal hatcheries during the same time period at the current rate of releases.

CHUM SALMON (Hood Canal Summer-Run)

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

NMFS concurs with EPA that the potential impacts of Atlantic Salmon marine net pens on Chum Salmon are unlikely to be different from those assessed above for Chinook Salmon. While nutrient enrichment may occur in these areas, nearshore HCSR Chum Salmon migration, feeding, rearing and predator avoidance will not be affected by sediment quality beneath net pens, because there is no overlap between sediment quality and these PCE (NMFS 2011). Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Hood Canal Summer-run Chum Salmon.

Potential Effects from the Proposed Net Pen Species Conversion

Conversion of the existing net pen facilities from Atlantic Salmon rearing to triploid all-female Rainbow Trout/steelhead rearing is not an action that will change significant threats to Hood Canal Chum Salmon within the action area. The action will not increase degradation of spawning habitat, low water flows, or incidental harvest in salmon fisheries or any other potential adverse effect. No aspect of the action is expected to adversely affect the low reproductive rate of Chum Salmon in Hood Canal tributaries. Therefore, the action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Hood Canal Chum Salmon.

COHO SALMON

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

Since salmonids migrate over long distances, and their most sensitive habitats are the riverine systems in which they spawn, off-shore Atlantic Salmon marine net pen operations likely have little direct impact on their physical habitat. There is unlikely to be an adverse effect due to decrease dissolved oxygen in the vicinity as such conditions would be self-limiting on the concentrated Atlantic Salmon being reared in the net pens. Also, these pens are sited in areas with good circulation, and it is a requirement of the NPDES permit for each marine net pen site that DO monitoring be performed during the critical summer period (August 15 − September 30). Therefore, water quality impacts are unlikely to be an issue. Fish pens could act as an attraction to juvenile salmon during their migration out to sea, but this effect is mitigated through careful feeding practices. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Coho Salmon.

Potential Effects from the Proposed Net Pen Species Conversion

Converting the existing net pen facilities from rearing of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is not an action that will change threats to Coho Salmon within the action area. The action will not occur in fresh water habitats where Coho spawn and undergo initial rearing. The proposed action will not alter shoreline marine habitat used by Coho for early marine rearing. No aspect of the action is expected to adversely affect the reproduction or early rearing of young Coho prior to their offshore migration. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Puget Sound Coho Salmon.

STEELHEAD

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

The potential effects of Atlantic Salmon floating net pen culture on steelhead are based on features and operations of Cooke Aquaculture existing marine net pens in Puget Sound in which primarily Atlantic Salmon have been raised since the 1990s. The effects to naturally-produced steelhead from Atlantic Salmon floating net pen aquaculture would be the same as for the other species of Pacific salmon.

The risk posed by artificially-produced Atlantic Salmon to naturally-produced steelhead in the Puget Sound steelhead ESU is only through potential competition of accidentally released Atlantic Salmon for prey resources or spawning habitat. However, cultured Atlantic Salmon would only have experienced pellet food and not fish prey, making them poor competitors for naturally-produced steelhead. Any surviving Atlantic Salmon that reach sexual maturity would likely spawn at different times than native steelhead, thereby minimizing or avoiding competition for spawning habitat. Native steelhead populations are currently at a very low level in Puget Sound making it unlikely that Atlantic Salmon would sufficiently reduce available spawning habitat even if there was overlap in their spawning times. Thus, Atlantic Salmon floating net pen culture May Affect but Not Likely Adversely Affect the genetics of naturally-produced steelhead.

Potential Effects from the Proposed Net Pen Species Conversion

Conversion of the existing net pen facilities from rearing of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to steelhead within the action area. The action will not occur in fresh water habitats where steelhead spawn, undergo initial rearing and migrate to estuarine waters. The proposed action will not alter shoreline marine habitat used by steelhead for early marine rearing and migration. No aspect of the action is expected to adversely affect the reproduction or early rearing of juvenile steelhead prior to their offshore migration. Therefore, the action to convert from Atlantic Salmon to Rainbow Trout rearing is Not Likely to Adversely Affect Puget Sound Steelhead.

Also see the description of potential effects to Chinook Salmon (above) in the event of inadvertent release of triploid Rainbow Trout/steelhead due to escapement. Potential effects to wild steelhead would be similar, though it is possible that a small number of the overall all-female triploid Rainbow Trout/steelhead population would have reproductive potential. (See the C.4 response in the Additional Information document, SEPA Checklist Attachment B.) Given the reduced population of wild steelhead, it is unlikely that a small number of reproductive Rainbow Trout/steelhead that might successfully escape from a net pen failure would compete with wild steelhead for spawning habitat. However, if any of the escaped Rainbow Trout/steelhead were successful in spawning with wild steelhead, the survival fitness of the offspring would be reduced, as is the case with a much larger number of hatchery diploid steelhead intentionally released by the State each year.

BULL TROUT

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

Some Bull Trout (amphidromous) produced in Puget Sound streams migrate to estuarine waters for rearing prior to returning to their natal stream to spawn or for additional rearing. Bull Trout occurring in estuarine waters tend to be large juveniles and adults. The decline in Bull Trout populations is primarily due to fresh water habitat degradation and fragmentation, blockage of migratory corridors, poor water quality, past fisheries management practices, impoundments, dams, water diversions, and the introduction of nonnative species. Effects for estuarine habitat are the same as described above for Coho Salmon. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Bull Trout.

Potential Effects from the Proposed Net Pen Species Conversion

Conversion of the existing net pen facilities from rearing of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Bull Trout and their estuarine habitat within the action area. The action will not occur in fresh water habitats where most Bull Trout spawn, undergo initial rearing and migrate. The proposed action will not alter shoreline marine habitat used by Bull Trout for early marine rearing and migration of the amphidromous life form. No aspect of the action is expected to adversely affect the Bull Trout. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Puget Bull Trout or their estuarine habitat.

EULACHON

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[94]

Eulachon prey (primarily phytoplankton and zooplankton) could be affected by changes in water quality from nutrient enrichment; however, no significant adverse water quality effects are expected from

[94] RPS ASA 2016.

Atlantic Salmon net pen aquaculture because existing Cooke Aquaculture Puget Sound facilities are located in areas with good circulation, and discharges are regulated by site-specific NPDES permits and monitored for compliance. No significant adverse effect is anticipated on phytoplankton levels in the areas surrounding existing marine net pens. For these reasons, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Eulachon.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Eulachon and their access to spawning habitat within the action area. The action will not occur in fresh water habitats where Eulachon spawning occurs. The proposed action will not alter access or degrade spawning habitat. No aspect of the action is expected to adversely affect Eulachon or their habitat. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Eulachon.

FLATHEAD SOLE

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

The existing net pens are located in Puget Sound which is on the southern extreme of the Flathead Sole range. Flathead Sole in the Gulf of Alaska are not overfished and are not subject to overfishing. Flathead sole are quite abundant in Alaska, and populations are well above target levels. On the West Coast, Flathead Sole make up only a small percentage of groundfish harvests. Flathead sole are part of the "other flatfish" complex on the West Coast, and are not subject to overfishing (NOAA 2019c). The normal depth distribution of Flathead Sole is 325 ft and deeper, which is not within the shallow range of depths potentially affected by Cooke Aquaculture existing Atlantic Salmon net pens in Puget Sound. Net pen rearing of Atlantic Salmon is Not Likely to Adversely Affect Flathead sole.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Flathead Sole or any of their habitat within the action area. The action will occur in estuarine water habitats where Flathead Sole spawning is not likely to occur. The proposed action will not alter access or degrade any aspect of Flathead Sole habitat. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Flathead Sole. Nutrient enrichment and increased benthic invertebrate production in sediments under net pens is likely to include an area that is too small to produce any effect on the Flathead Sole population of the NE Pacific.

GREEN STURGEON

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[95]

The benthic prey of Green sturgeon (shrimp, clams, amphipods, and Dungeness crabs), sand lance and other small fishes could be affected by adverse impacts to water quality and/or sediment quality. No significant adverse water quality effects are expected from Atlantic Salmon net pen aquaculture because discharges are regulated by site-specific NPDES permits and monitored for compliance. No significant adverse sediment impacts are expected from Atlantic Salmon net pen culture because existing Cooke Aquaculture facilities are located in areas with good circulation, and each site is monitored for organic enrichment of the substrate within a Sediment Impact Zone (a 100-ft perimeter around the net pen array) for compliance with site-specific NPDES permits. Potential sediment impacts are further mitigated by the fallow period following each 18-month grow-out period. Green sturgeon critical habitat could be

[95] RPS ASA 2016.

impacted if net pen arrays and/or vessel traffic to/from marine net pens were to impede their migration routes. Green sturgeon use multiple water depths in coastal areas. Potential conflict with net pen arrays and/or aquaculture-related vessel traffic is not likely to be significant due to the relatively small footprint of the marine net pen sites, and the tendency of Green Sturgeon to occur in coastal waters more than 330 feet from shore. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Green Sturgeon.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Green Sturgeon or access to their spawning habitat. The action will not occur in fresh water habitats where Green Sturgeon spawn. The proposed action will not alter access to or degrade spawning habitat. No aspect of the proposed action is expected to adversely affect Green Sturgeon or their habitat. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Green Sturgeon.

PACIFIC COD

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[96]

The pelagic prey of Pacific Cod (krill, shrimp and sand lance) could be affected by changes in water quality; however, no significant adverse water quality effects are expected from Atlantic Salmon net pen aquaculture because discharges are regulated by site-specific NPDES permits and monitored for compliance. The demersal prey of Pacific Cod (crabs) could potentially be affected by sediment impacts; however, no significant adverse sediment impacts are expected from Atlantic Salmon net pen culture because existing Cooke Aquaculture facilities are located in areas with good circulation, and each site is monitored for organic enrichment of the substrate within a Sediment Impact Zone (a 100-ft perimeter around the fish pen array) for compliance with site-specific NPDES permits. Pacific Cod primarily occupy deeper waters than the existing Cooke Aquaculture marine net pen sites. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Pacific Cod.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Pacific Cod or access to their habitat. The action will not occur in deep-water (50 to 300 m) habitats where Pacific Cod spawn. The proposed action will not alter access to or degrade spawning habitat. No aspect of the action is expected to adversely affect Pacific Cod or their habitat. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Pacific Cod.

PACIFIC HAKE

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[97]

The pelagic prey of Pacific Hake (zooplankton, fish, and squid) could be affected by changes in water quality; however, no significant adverse water quality effects are expected from Atlantic Salmon net pen aquaculture because discharges are regulated by site-specific NPDES permits and monitored for compliance. The demersal prey of Pacific Hake (crustaceans) could potentially be affected by sediment impacts; however, no significant adverse sediment impacts are expected from Atlantic Salmon net pen culture because existing Cooke Aquaculture facilities are located in areas with good circulation, and each site is monitored for organic enrichment of the substrate within a Sediment Impact Zone (a 100-ft

[96] RPS ASA 2016.
[97] RPS ASA 2016.

perimeter around the fish pen array) for compliance with site-specific NPDES permits. Since Pacific hake primarily occupy deeper waters than the floating marine net pens, it is unlikely that Atlantic Salmon net pen culture has a significant impact to this species. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Pacific Hake.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Pacific Hake. The action will occur in open water of Puget Sound that includes a very small portion of the lightly populated habitat occupied by Pacific Hake. The proposed action will not alter access to or degrade spawning habitat. No aspect of the action is expected to adversely affect Pacific Hake or their habitat. The action to convert from Atlantic Salmon to Rainbow Trout rearing is Not Likely to Adversely Affect Pacific Hake.

PACIFIC LAMPREY

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

Historically, Pacific Lamprey were thought to be distributed wherever salmon and steelhead occurred. However, recent data indicate that the distribution of Pacific Lamprey has been reduced in many river drainages. They no longer exist upstream from many dams and other impassable barriers in west coast streams, including many larger rivers throughout coastal Washington, Oregon, and California. In the marine environment, they have been caught at depths ranging from 300 to 2,600 ft, and as far off the west coast as 62 miles in ocean-haul nets.

Pacific Lamprey face a variety of threats to various life history stages, including barriers to upstream and downstream passage; dewatering and reduced stream flows; poisoning from accidental spills or chemical treatments; poor water quality; dredging activities; stream and floodplain degradation due to channelization, loss of side channel habitat, and scouring; changes in ocean conditions such as prey reduction and an increase in predators; and predation by non-native fish species.

The potential effects of Atlantic Salmon floating net pen culture on Pacific Lamprey are based on features and operations of Cooke Aquaculture existing marine net pens in Puget Sound in which primarily Atlantic Salmon have been raised since the 1980s. These effects have been described in numerous technical studies, some of which are cited in this document. Pacific Lamprey in estuarine and marine waters tend to generally occupy greater depths (>300 ft) then the net pens which are all under 180 feet in maximum depth. The existing rearing of Atlantic Salmon in net pens does not result in any adverse effects to Pacific Lamprey, although escaped Atlantic Salmon may provide a small amount of prey for Pacific Lamprey. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Pacific Lamprey.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to Rainbow Trout/steelhead rearing is an action that will not change threats to Pacific Lamprey or access to their freshwater spawning habitat. The action will not occur in deep-water (300 to 2,600 ft) marine habitats where Pacific Lamprey reside. The proposed action will not alter their freshwater spawning habitat. No aspect of the action is expected to adversely affect Pacific Lamprey or their habitat. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Pacific Lamprey.

RIVER LAMPREY

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

In Washington, this species probably historically occurred in most major rivers. The current distribution of River Lamprey in the State includes rivers and streams along the coast from the mouth of the Columbia River to the mouth of the Hoh River (though not elsewhere on the Olympic Peninsula), throughout Puget Sound, and in the Lake Washington basin. Adults feed in nearshore marine and estuarine habitat.

Potential threats to River Lamprey include artificial barriers to migration; poor water quality; harvest; predation by non-native species; stream and floodplain degradation; loss of estuarine habitat; decline in prey, ocean conditions, dredging and dewatering.

The potential effects of Atlantic Salmon floating net pen culture on River Lamprey are based on features and operations of Cooke Aquaculture existing marine net pens in Puget Sound in which primarily Atlantic Salmon have been raised since the 1990s. These effects have been described in numerous technical studies, some of which are cited in this document. River Lamprey tend to remain in fresh water and estuarine habitats where the net pens are not located. The existing rearing of Atlantic Salmon in net pens does not result in any adverse effects to River Lamprey, although escaped Atlantic Salmon could provide a small amount of prey for River Lamprey. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect River Lamprey.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to Rainbow Trout/steelhead rearing is an action that will not change threats to River Lamprey or access to their freshwater spawning habitat. The action will not occur in deep-water marine habitats where River Lamprey are likely to reside during their marine rearing. The proposed action will not alter their freshwater spawning habitat. No aspect of the action is expected to adversely affect River Lamprey or their habitat. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect River Lamprey.

CANARY ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[98]

Canary Rockfish inhabit waters at depths between 160 and 820 feet which is deeper, overall, than the waters under existing Cooke Aquaculture Puget Sound Atlantic Salmon net pens. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Canary Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Canary Rockfish or access to their marine spawning habitat. The action will not occur in deep-water (160 to 820 ft) marine habitats where Canary Rockfish tend to reside. The proposed action will occur in relatively shallow habitat where they are rarely found. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish

[98] http://www.nmfs.noaa.gov/pr/speces/fish/canaryrockfish.htm. In USEPA 2010.

feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Canary Rockfish.

BOCACCIO ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[99]

Bocaccio Rockfish are typically found at depths between 160 and 820 feet which is deeper, overall, than the waters under existing Cooke Aquaculture Puget Sound Atlantic Salmon marine net pens. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Bocaccio Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Bocaccio or access to their marine spawning habitat. The action will not occur in deep-water (160 to 820 ft) marine habitats where Bocaccio tend to reside. The proposed action will occur in relatively shallow habitat where they are rarely found. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Bocaccio.

YELLOWEYE ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[100]

Yelloweye Rockfish are typically found at depths between 80 and 1,560 feet, but more commonly at 300 to 590 feet, which is deeper overall than the waters under existing Cooke Aquaculture Puget Sound Atlantic Salmon marine net pens. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Yelloweye Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Yelloweye Rockfish or access to their marine spawning habitat. The action will not occur in deep-water (300 to 590 ft) marine habitats where

[99] http://www.nmfs.noaa.gov/pr/speces/fish/bocaccio.htm. In USEPA 2010.
[100] http://www.nmfs.noaa.gov/pr/speces/fish/yelloweyerockfish.htm. In USEPA 2010.

Yelloweye Rockfish are commonly found. The proposed action will occur in relatively shallow habitat where they are rarely found. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Yelloweye Rockfish.

PINTO ABALONE

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

There was no historical commercial fishing for Pinto Abalone in Washington State, and the recreational fishery was closed in 1994 due to low abundance. WDFW regularly monitors the abundance of Pinto Abalone at 10 index stations throughout the San Juan Archipelago.

Because Pinto Abalone are highly patchy, cryptic and frequently associate with microhabitats such as rock crevices or patches of coralline algae that may themselves be sparsely distributed, total abundances are not measured. Repeated surveys at a system of index sites are conducted in order to detect temporal trends in abalone abundance. These surveys indicate an 83% decline in abalone abundance between 1992 and 2009 (Rothaus et al. 2008). Densities at all but one site are below or within the minimum range for successful fertilization (NOAA/NMFS 2007).

The existing rearing of Atlantic Salmon in net pens does not result in any adverse effects to Pinto Abalone. The abalone reside in hard substrate habitats with irregular surface that are not suitable for net pens. The algae consumed by Pinto Abalone do not occur in the soft bottom habitats where net pens are sited. Atlantic Salmon culture in floating marine net pens is Not Likely to Adversely Affect Pinto Abalone.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Pinto Abalone or their habitat. The action will occur in areas of soft bottom habitat where Pinto Abalone are not found. Pinto Abalone are found in nearshore rocky habitats in semi-exposed or exposed coastal regions. They typically occupy the low intertidal zone to a depth of 30 feet (9 m), but may occur as deep as 330 feet (100 m). The existing net pens are not present in or adjacent to habitats of this nature. Therefore, the action to convert from Atlantic Salmon to Rainbow Trout rearing is Not Likely to Adversely Affect Pinto Abalone.

Potential Effects on State-Listed Species and Candidate Species

The effects analysis for existing Atlantic Salmon floating net pen culture on State-listed species and candidate species has been summarized from various sources, for the purpose of updating the *Final Programmatic EIS: Fish Culture in Floating Net Pens* (WDF 1990). All of these paragraphs have been reviewed by Don Weitkamp, Ph.D., Aquatic Biologist and Water Quality Expert, who was one of the original authors of the 1990 Programmatic EIS. Dr. Weitkamp is also the author of all statements of effect (below) for the Cooke Aquaculture proposal to convert the species reared in existing marine net pens from Atlantic Salmon to sterile (triploid) all female Rainbow Trout/steelhead.

PACIFIC HARBOR PORPOISE

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[101]

Pacific harbor porpoise prey includes schooling fish (e.g., herring, capelin) and invertebrates (e.g., cephalopods). Pelagic prey such as these species could be affected by changes in water quality; however, no significant water quality changes are expected from Atlantic Salmon net pen aquaculture because discharges are regulated by site-specific NPDES permits and monitored for compliance.

The chance of disturbance by vessels traveling to and from net pen sites to transport workers and provide services to the net pens is considered discountable due to the low number of trips (two to four round trips per day). Harbor porpoise echolocation, agile swimming capabilities, and being accustomed to vessel traffic in Puget Sound waters make the risk of vessel strikes unlikely to occur.

The risk of direct interaction with fish pen cages or predator exclusion nets is considered discountable.

The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Pacific Harbor Porpoise.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Harbor Porpoise access to their marine habitat. Although the action will occur in bays, estuaries and harbors less than 200m (650 ft) deep habitats where Harbor Porpoise are commonly found, the existing physical, water quality, and prey conditions will not change. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Pacific Harbor Porpoise.

GRAY WHALE

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[102]

Gray whales feed primarily on small crustaceans and other organisms living within soft, shallow water sediment. The depth of predator exclusion nets hanging from the net pens are likely to discourage Gray Whale from feeding under the pens, which occur in a small portion of the available habitat. Potential nutrient enrichment due to fish pen discharges is not expected to alter the benthic community beneath Atlantic Salmon net pens because existing Cooke Aquaculture facilities are located in areas with good circulation, and each site is monitored for organic enrichment of the substrate within a Sediment Impact Zone (a 100-ft perimeter around the net pen array) for compliance with site-specific NPDES permits. Therefore, sediment quality and benthic impacts are unlikely to be an issue. Sediments are also allowed to rest after each grow-out period during the fallow period that follows each 18-month grow-out. Gray Whales are unlikely to interact with the net pen array and can avoid vessels in transit if disturbed. For these reasons, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Gray Whale.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Gray Whale access to estuarine habitat in Puget Sound where only small numbers of Gray Whales occur during their migration between Alaska and Mexico. Although the action will occur in near-shore habitats where Gray Whales that enter Puget

[101] RPS ASA 2016.
[102] RPS ASA 2016.

Sound occur, the existing physical, water quality, and prey conditions of these habitats will not change due to the proposed action. General nearshore threats to Gray Whale include vessel collisions, entanglement in fishing gear, and disturbance from ecotourism, noise, and whale-watching. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Gray Whale.

PACIFIC HERRING

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[103]

The pelagic prey of Pacific Herring (zooplankton, fish, and larvae) could be affected by changes in water quality; however, the Cooke Aquaculture floating marine net pens are sited in areas with good circulation, and it is a requirement of the NPDES permit for each site that water quality monitoring be performed. Therefore, water quality impacts are unlikely to be an issue. Since Pacific Herring only temporarily occur as a schooling coastal fish around floating marine net pens, it is unlikely that direct impacts would occur. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Pacific Herring.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Pacific Herring or access to their shoreline spawning habitat or juvenile rearing habitat. The action will occur in moderate depth shoreline habitats where Pacific Herring migrate and rear. However, the proposed action will not change conditions affecting Pacific Herring spawning and rearing in Puget Sound. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Pacific Herring.

BLACK ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[104]

Rockfish generally use habitat deeper than the areas over which net pens are located. Juvenile rockfish commonly inhabit nearshore areas with structures that offer protection. Young rockfish may include net pens as habitat they use during their transition from shorelines to deep-water habitats. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Black Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Black Rockfish or access to their marine spawning habitat. The action will not occur in deep-water (180 to 1,200 ft) marine habitats where Black Rockfish are commonly found. The proposed action will occur in relatively shallow habitat where they are rarely found. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens.

[103] RPS ASA 2016.
[104] USEPA 2010.

However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Black Rockfish.

BROWN ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[105]
Rockfish generally use habitat deeper than the areas over which net pens are located. Juvenile rockfish commonly inhabit nearshore areas with structures that offer protection. Young rockfish may include net pens as habitat they use during their transition from shorelines to deep-water habitats. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Brown Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion
Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Brown Rockfish or access to their marine spawning habitat. The action will occur in water less than 400 ft deep where Brown Rockfish commonly occur. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Brown Rockfish.

CHINA ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[106]
Rockfish generally use habitat deeper than the areas over which net pens are located. Juvenile rockfish commonly inhabit nearshore areas with structures that offer protection. Young rockfish may include net pens as habitat they use during their transition from shorelines to deep-water habitats. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect China Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion
Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to China Rockfish or access to their marine spawning habitat. The action will occur in water less than 420 ft deep where China Rockfish commonly occur. Juveniles and sub-adults tend to be more common than adults in shallow water where

[105] USEPA 2010.
[106] USEPA 2010.

they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect China Rockfish.

COPPER ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[107]

Rockfish generally use habitat deeper than the areas over which net pens are located. Juvenile rockfish commonly inhabit nearshore areas with structures that offer protection. Young rockfish may include net pens as habitat they use during their transition from shorelines to deep-water habitats. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Copper Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Copper Rockfish or access to their marine spawning habitat. The action will occur in water less than 600 deep where Copper Rockfish commonly occur. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Copper Rockfish.

QUILLBACK ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[108]

Rockfish generally use habitat deeper than the areas over which net pens are located. Juvenile rockfish commonly inhabit nearshore areas with structures that offer protection. Young rockfish may include net pens as habitat they use during their transition from shorelines to deep-water habitats. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Quillback Rockfish.

[107] USEPA 2010.
[108] USEPA 2010.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Quillback Rockfish or access to their marine spawning habitat. The action will occur in water less than 900 ft deep where Quillback Rockfish commonly occur. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Quillback Rockfish.

REDSTRIPE ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[109]

Rockfish generally use habitat deeper than the areas over which net pens are located. Juvenile rockfish commonly inhabit nearshore areas with structures that offer protection. Young rockfish may include net pens as habitat they use during their transition from shorelines to deep-water habitats. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Redstripe Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Redstripe Rockfish or access to their marine spawning habitat. The action will not occur in water 500 to 900 ft deep where Quillback Rockfish commonly occur. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Redstripe Rockfish.

TIGER ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[110]

Rockfish generally use habitat deeper than the areas over which net pens are located. Juvenile rockfish commonly inhabit nearshore areas with structures that offer protection. Young rockfish may include net pens as habitat they use during their transition from shorelines to deep-water habitats. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of

[109] USEPA 2010.
[110] USEPA 2010.

negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Tiger Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion

Habitat preferred by Tiger Rockfish does not occur at Cooke Aquaculture commercial net pen sites in Puget Sound. Further, the WDFW Priority Habitats and Species database mapping for the occurrence of this species excludes the marine waters of Island, King and Pierce Counties (WDFW 2008, updated January 2019).

YELLOWTAIL ROCKFISH

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[111]

Rockfish generally use habitat deeper than the areas over which net pens are located. Juvenile rockfish commonly inhabit nearshore areas with structures that offer protection. Young rockfish may include net pens as habitat they use during their transition from shorelines to deep-water habitats. Due to the deficiency of scientific evidence that existing salmon net pen facilities in Puget Sound harm rockfish species through escape, disease transfer, or other indirect effects; the overall lack of an overlap between existing net pen facilities and primary rockfish habitat; and the small quantity of net pen operations in Puget Sound, EPA has concluded that the existing net pen facilities carry an insignificant risk of negatively affecting rockfish. Therefore, Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Yellowtail Rockfish.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Yellowtail Rockfish or access to their marine spawning habitat. The action will occur in relatively shallow water depths from the shoreline to about 1,800 ft deep where Yellowtail Rockfish commonly occur. Juveniles and sub-adults tend to be more common than adults in shallow water where they are commonly associated with rocky reefs, kelp canopies, and artificial structures. Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans, and juveniles consume copepods and euphausiids that are commonly produced as fouling organisms on the substrate provided by net pens. However, the net pens are a sufficiently small part of the available habitat that they are not likely to produce a detectable positive affect. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Yellowtail Rockfish.

WALLEYE POLLOCK (South Puget Sound)

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture[112]

The pelagic prey of Walleye Pollock (zooplankton like copepod nauplii, euphausiids, copepods, decapod larvae, and larvaceans) could be affected by changes in water quality within the area of affect around an Atlantic Salmon net pen; however, these pens are sited in areas with good circulation, and it is a requirement of the NPDES permit for each marine net pen site that water quality monitoring be performed. Therefore, water quality impacts are unlikely to be an issue. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Walleye Pollock.

111 USEPA 2010.
112 RPS ASA 2016.

Potential Effects from the Proposed Net Pen Species Conversion

Changing the existing net pen facilities operation of Atlantic Salmon to triploid all-female Rainbow Trout/steelhead rearing is an action that will not change threats to Walleye Pollock or access to their marine spawning habitat. The action will occur in relatively shallow water depths above the 330 to 980 ft depth range preferred by most Walleye Pollock. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Walleye Pollock.

OLYMPIA OYSTER

Potential Effects from Atlantic Salmon Floating Net Pen Aquaculture

The potential effects of floating net pen culture on Olympia Oyster are based on features and operations of Cooke Aquaculture existing marine net pens in Puget Sound in which primarily Atlantic Salmon have been raised since the 1990s. These effects have been described in hundreds of technical studies performed by Federal agencies and independent researchers, some of which are cited in this document. The existing marine net pens are not located in shallow nearshore waters where Olympia Oysters once commonly occurred. Atlantic Salmon culture in floating marine net pens May Affect but is Not Likely to Adversely Affect Olympia Oyster.

Potential Effects from the Proposed Net Pen Species Conversion

Other than transitioning to the commercial cultivation of a different species of fish, Cooke Aquaculture is not planning to alter the existing fish pen physical structures, site locations, supporting equipment, or general current practices, methods and cultivation techniques used for growing Atlantic Salmon in net pens. The action to convert from Atlantic Salmon to Rainbow Trout/steelhead rearing is Not Likely to Adversely Affect Olympia Oysters.

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