

Endangered Species Act - Section 7 Consultation
Biological Opinion, Conference Opinion,
Unlisted Species Analysis,
Section 10(a)(2)(B) Findings

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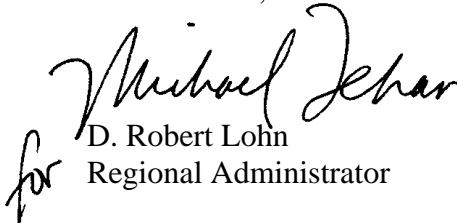
Magnuson-Stevens Fisheries Conservation and
Management Act
Essential Fish Habitat Consultation

For issuance of an Incidental Take Permit to the Washington State Department of Natural Resources for Commercial Sub-Tidal Geoduck Harvest activities in Puget Sound, the Strait of Juan de Fuca and the San Juan Archipelago, Washington

Action Agency: National Marine Fisheries Service
Northwest Region

Consultation
Conducted by: National Marine Fisheries Service
Northwest Region

Date Issued: December 15, 2008

Issued by: 
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NMFS Tracking Number: 2008/01972

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ACRONYM GLOSSARY

ALEA	Aquatic Lands Enhancement Account
BRT	Biological Review Team
CH	Critical Habitat
COB	City of Bellingham Public Works Department
DQA	Data Quality Act
DPS	Distinct Population Segments
EFH	Essential Fish Habitat
ESA	Endangered Species Act
ESU	Evolutionarily Significant Units
Findings	Statement of Findings
FPHCP	Forest Practices Habitat Conservation Plan
HAPC	Habitat Areas of Particular Concern
HC	Hood Canal
HCP	Habitat Conservation Plan
ITP	Incidental Take Permit
IUCN	International Union for the Conservation of Nature
LWD	Large Woody Debris
MLLW	Mean Lower Low Water
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEPA	National Environmental Policy Act
NFH	National Fish Hatchery
NMFS	National Marine Fisheries Service
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
Opinion	Biological Opinion
PDO	Pacific Decadal Oscillation
PCE	Primary Constituent Element
PFMC	Pacific Fishery Management Council
PS	Puget Sound
PSSBRT	Puget Sound Steelhead Biological Review Team
RMCA	Resource Management Cost Account
SAIC	Science Applications International Corporation
SEPA	State Environmental Policy Act
Services	USFWS and NMFS
TAC	Total Allowable Catch
TSS	Total Suspended Solids
USFWS	United States Fish and Wildlife Service
WDF	Washington Department of Fisheries
WDFW	Washington Department of Fish and Wildlife
WDNR	Washington State Department of Natural Resources
WDOE	Washington State Department of Ecology

INTRODUCTION

The Washington State Department of Natural Resources (WDNR) has prepared a Habitat Conservation Plan (HCP) supporting its application for an Incidental Take Permit (ITP or Permit) under section 10(a)(1)(B) of the Endangered Species Act (ESA) of 1973, as amended, 16 U.S.C. 1531, et. seq. Issuing an ITP is a Federal action that triggers the National Marine Fisheries Service's (NMFS) responsibility to comply with Endangered Species Act (ESA) section 7(a)(2). In addition, authorizing incidental take enables activities that are likely to adversely affect Essential Fish Habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Therefore, NMFS has completed consultations under both the ESA and MSA, and this document contains the results of both consultations. In addition, this document reports NMFS' Statement of Findings (Findings) on each of the ITP issuance criteria stated in ESA section 10(a)(2)(B).

The consultations and Findings are based on NMFS' review of the HCP, as it describes the underlying geoduck commercial harvest program WDNR administers. The geographic HCP coverage area includes certain portions of the submerged lands of Puget Sound, the Strait of Juan de Fuca, and areas north to the Canadian border, within the geographic range of Evolutionarily Significant Units (ESUs) of threatened Puget Sound (PS) Chinook salmon (*Oncorhynchus tshawytscha*) and Hood Canal (HC) summer-run chum salmon (*O. keta*), the Distinct Population Segments (DPSs) of threatened PS steelhead (*O. mykiss*), threatened Southern DPS North American green sturgeon (southern DPS green sturgeon; *Acipenser medirostris*), and endangered Southern Resident killer whales (*Orcinus orca*), as well as unlisted coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), Pacific herring (*Clupea harengus pallasii*), Pinto abalone (*Haliotis kamtschatkana*), and Olympia oyster (*Ostrea conchaphila*).¹ The covered area also contains Critical Habitat (CH) for PS Chinook salmon, HC summer-run chum salmon, Southern Resident killer whales and EFH for a number of groundfish, coastal pelagic, and Pacific salmon species (see Table 1). The HCP covered area also contains proposed CH for southern DPS green sturgeon (September 8, 2008, 73 FR 52084).

Background and Consultation History

In December 2000, the WDNR initiated discussions with NMFS on pursuing ESA compliance for the State's commercial geoduck fishery program. From 2001 through 2004, the U.S. Fish and Wildlife Service (USFWS) and NMFS (together, the Services) provided technical and policy assistance to the WDNR in development of a conservation plan for listed and unlisted species likely to be affected by the underlying harvest program. In 2006, WDNR renewed the effort to complete the HCP process, sharing a draft HCP with the Services. The "final draft" HCP, dated July 2007, and accompanying ITP application, signed August 15, 2007, were submitted to the Services in September 2007. This consultation is based on the WDNR's Geoduck Fishery HCP (WDNR 2008).

¹ An 'evolutionarily significant unit' (ESU) of Pacific salmon (Waples 1991) and a 'distinct population segment' (DPS) of steelhead (September 2, 2005; 70 FR 52630) are considered to be 'species,' as defined in Section 3 of the ESA.

The Services review of the HCP allowed them to categorize the effort as a “low-effect” HCP. Low effect HCPs are a special category of HCPs that address activities with relatively minor or negligible effects, but that still might cause some level of incidental take. The procedural purpose for the categorization is that NMFS can invoke a streamlined administrative process when considering the application, especially with respect to National Environmental Policy Act (NEPA) compliance as low effect HCPs are categorically excluded from NEPA environmental reviews requiring environmental assessments or impact statements. For this proposed action, the underlying activities have inherently low impacts on the affected species' distribution, abundance, and the habitats they depend upon. Finally, issuing the ITP based on the proposed HCP would contribute to the long-term survival of the covered species.

After the initiation of consultation, NMFS proposed CH for the Southern DPS of North American green sturgeon. The NMFS conducted a conference on proposed CH to ensure the proposed action would not adversely modify or destroy proposed CH (50 CFR 402.10). The NMFS determined that the proposed action would not adversely modify CH proposed for southern DPS green sturgeon. In fact, NMFS determined that the proposed action is unlikely to even adversely affect CH such that when the proposed designation is finalized, NMFS need not revisit the action’s affects on that CH, based on the analysis conducted for the conference. This document provides NMFS’ conference opinion for green sturgeon CH.

The NMFS determined that the proposed action may affect, but is not likely to adversely affect Southern Resident killer whales and their designated CH (Appendix A). Conservation measures minimize the potential for disturbance of Southern Residents as found in Chapter 5 of the Geoduck HCP and summarized below.

Description of the Proposed Action

The NMFS proposes to issue an ITP covering incidental take of threatened PS Chinook salmon (*Oncorhynchus tshawytscha*), threatened PS steelhead (*O. mykiss*), threatened HC summer-run chum salmon (*O. keta*), and threatened Southern DPS North American green sturgeon (*Acipenser medirostris*). The proposed permit has provisions for adding certain presently unlisted species to the ITP as they are covered as though they are listed by the HCP (February 23, 1998; 63 FR 8859). These include coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), Pacific herring (*Clupea harengus pallasi*), Pinto abalone (*Haliotis kamtschatkana*), and Olympia oyster (*Ostrea conchaphila*). In treating these species as though they are listed, they are analyzed in this Opinion, enabling ITP coverage of incidental take of those animals should they be listed during the ITP term.

The HCP addresses WDNR’s administration sub-tidal commercial geoduck harvest activities in the covered areas, described in the HCP on pages 36 to 45 (summarized below). The HCP describes conservation measures on pages 63 to 69 (also summarized below). The proposed ITP term is 50 years from the date of issuance. Unlisted species addressed in the HCP would be covered by the ITP at the time they become listed during the permit term.

The commercial geoduck fishery is co-managed by state and tribal entities and there is joint responsibility for the scientific oversight of the fishery. The Washington Department of Fish and

Wildlife (WDFW) and the Tribes conduct pre-harvest surveys on all tracts to support the scientific oversight of the fishery. The WDFW sets the sustainable level of harvest each year. The pre-harvest surveys identify aquatic flora and fauna, including features such as herring spawning and holding areas, and sand lance and surf smelt occurrences. Based on data gathered during pre-harvest surveys, the State and Tribes agree on harvest boundaries and conditions to protect fish and wildlife.

Tracts that are fished down to 65 percent of the pre-harvest geoduck biomass estimate are placed in recovery status and may not be fished again until pre-fishing geoduck densities are achieved, as determined through post-harvest surveys.

The WDNR auctions the right to harvest geoducks from state-owned aquatic lands. The quotas are managed under legally-binding harvesting agreements between the WDNR and purchaser companies. The harvesting agreement establishes the harvest area boundaries and identifies harvest ceilings, measured in pounds. The agreement also establishes the duration of harvest and specifies harvest times (days and hours of operations), conditions for vessel use, the number of vessels, noise restrictions, the number of divers, and other aspects of harvest activities.

Commercial geoduck harvest is carried out by dive harvesters, licensed by the WDFW, who are hired by the purchaser companies. Geoducks are harvested individually by divers using hand-operated water jets. The water jet is a pipe about 18 to 24 inches long with a nozzle on the end. The nozzle releases water at a pressure of approximately 40 to 60 pounds per square inch; about the same pressure as from a standard garden hose. The water jet is controlled by the diver. It is inserted into the substrate next to the exposed geoduck siphon or in the hole left when the siphon is retracted. The pressurized water loosens the sediment and the clam is removed by hand.

Each diver carries a mesh bag to collect the harvested geoducks. Divers periodically surface to unload the bags. A diver can harvest about 800 geoducks per day on a high-density commercial tract with good digging conditions.

Intakes for supplying water to the onboard pumps are positioned about 10 to 20 feet below the water surface. Intake openings are 4 to 6 inches in diameter and are screened to prevent debris from stalling the pump.

The fishery operates year-round, but harvest activities on a particular tract do not occur year-round because harvest is intentionally rotated around the different regions. In addition, water quality deterioration or paralytic shellfish poisoning occurrence can cause termination or suspension of the harvest on a specific tract. Harvest stops when the tract has been “fished down” to the thresholds identified in annual management plans; generally about 30 percent of the estimated pre-harvest tract density. Tribal sharing agreements can also limit the biomass taken from a given tract.

The biomass harvested each year fluctuates, but remains within the amount allowed to maintain a sustainable geoduck resource. The management of the fishery at conservative, sustainable biomass levels limits the amount of harvest allowed each year and limits the WDNR’s ability to expand the fishery.

The WDNR proposes to limit total harvest to a maximum of 6,000 acres per year. The actual amount of tract area harvested would be less because harvest activities are focused on smaller areas where geoducks are concentrated in patches. Harvesters return to the same tracts for several years such that some already-harvested areas are affected again in a subsequent season. In addition to pre-harvest sampling done to ensure water quality and shellfish safety, sampling occurs throughout the year for a variety of research efforts including stock assessment, geoduck aging, and geoduck genetics. When performed or managed by the WDNR, these activities occur within the commercial tracts and will follow the same restrictions as those for commercial harvest.

To minimize possible direct and indirect effects on covered species, the HCP includes the following protective measures to minimize the effects of harvest activities on species covered by the ITP, and avoid effects on Southern Resident killer whales:

- 1) Minimize noise disturbance. The WDNR will reduce the likelihood of disturbing species vulnerable to surface noise by limiting surface noise levels to 50 decibels at a distance of 200 yards (600 feet) from each vessel;
- 2) Protect eelgrass beds. Eelgrass beds adjacent to geoduck harvest tracts are protected by establishing a 2-foot vertical or 180-foot horizontal (on very gradual slopes) buffer between geoduck tracts and the deepest occurrence of nearby eelgrass;
- 3) Protect herring spawning habitat. Herring spawning habitat and macroalgae habitat will be protected by performing pre-fishing eelgrass surveys (under contract with the WDFW). The WDNR will avoid disturbing herring during spawning times by establishing seasonal shoreward harvest boundaries. On tracts adjacent to documented herring spawning areas (eelgrass, macroalgae, or other substrate), the shoreward harvest boundary will be restricted to waters deeper than minus 35 feet below Mean Lower Low Water (MLLW) during spawning season and deeper than minus 25 feet during the remainder of the year;
- 4) Buffer effectiveness monitoring and assessment. Within one year after obtaining the Permit, the WDNR will contact appropriate WDFW and Tribal biologists and arrange a meeting for the purposes of assessing and reaffirming that the above buffers are adequate to protect nearshore environments, eelgrass, and herring spawning areas. Results and recommendations from the meeting will be reported to the Services at annual meetings;
- 5) Buffer nearshore habitat. Nearshore habitats will be protected by locating the closest shoreward harvest boundary at or deeper than the minus 18-foot MLLW water depth contour on all tracts;
- 6) Harvest volume limitation. Annual harvest will be limited to the State's half of a total allowable catch (TAC) of 2.7 percent of the commercial biomass in each region, which is 2 to 3 million pounds. The area from which annual harvest occurs will be no more than 1,500 acres per management area and no more than a total of 6,000 acres;

- 7) Reduce risk of toxic spills. Harvest vessels will be inspected and prohibited from harvesting if they show signs of leaks of toxic or hazardous materials. Harvesters will be required to notify WDNR of hazardous, toxic, or harmful substances. Harvest vessels will carry pollution liability insurance. The WDNR compliance staff will be familiar with the guidance of vessel spill contingency plans;
- 8) Compliance monitoring. The WDNR compliance staff will conduct daily on-site monitoring and compliance;
- 9) Reporting. The WDNR will submit reports on the above monitoring items to NMFS and the USFWS at yearly meetings;
- 10) Measures specific to killer whales. Harvesters will reduce or eliminate the possibility of disturbing Southern Resident killer whales by avoiding potential interactions between Southern Resident killer whales, people, and harvest activities by invoking the “diver recall” system to get divers out of the water and turning off the vessel engines when Southern Resident killer whales are sighted near the tract being harvested.

Description of the Action Area

The action area is defined at 50 CFR 402 to mean “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” For the purposes of this consultation, NMFS recognizes the action area to include submerged lands of Puget Sound, Hood Canal, the Strait of Juan de Fuca and the San Juan archipelago north to the Canadian border. Within this broad area, commercial geoduck harvest occurs sub-tidally in areas that have been surveyed between depth contours of –18 and –70 feet (corrected to MLLW) and found to contain geoducks at sufficient densities. Detailed descriptions of the action area are provided in the HCP (WDNR 2008).

Commercial harvest activities occur mostly in mud-sand and sand substrate because this is where geoducks tend to concentrate and have better market quality. A particular tract might contain rocky areas, but these are either eliminated from the harvest area, or are avoided by harvesters because geoduck clams occur in low densities or are absent from these habitats.

Commercial harvest occurs in those tracts which are shown to have geoducks in commercial quantities (normally more than four geoducks per 100 square feet), contain market-quality geoducks, present no practical difficulties for harvest, and do not conflict with existing uses such as ferry routes. The tracts also must be certified by the Washington Department of Health as meeting state and national health standards. This information is gathered annually via surveys and is summarized in the state’s Geoduck Atlas.

Currently, commercial tracts are located in nearshore substrate adjacent to nine counties (Clallam, Island, Jefferson, King, Kitsap, Mason, Pierce, Snohomish and Thurston). Surveys may result in additional tracts being designated “commercial.” Future surveys or changes in tract status could result in some currently identified commercial tracts being removed from the list. Based on changes in the status of commercial harvest tracts and the number of identified

commercial tracts, the actual amount of harvest varies and is limited by the equilibrium harvest rate to assure a sustainable fishery.

For management purposes, the waters of Puget Sound, the Strait of Juan de Fuca and the San Juan Islands are divided into six management regions (Figure 1). The extent of surveyed geoduck resources potentially available for harvest across all management regions is in Figure 2.

Figure 1: Six Current Geoduck Management Regions in Washington

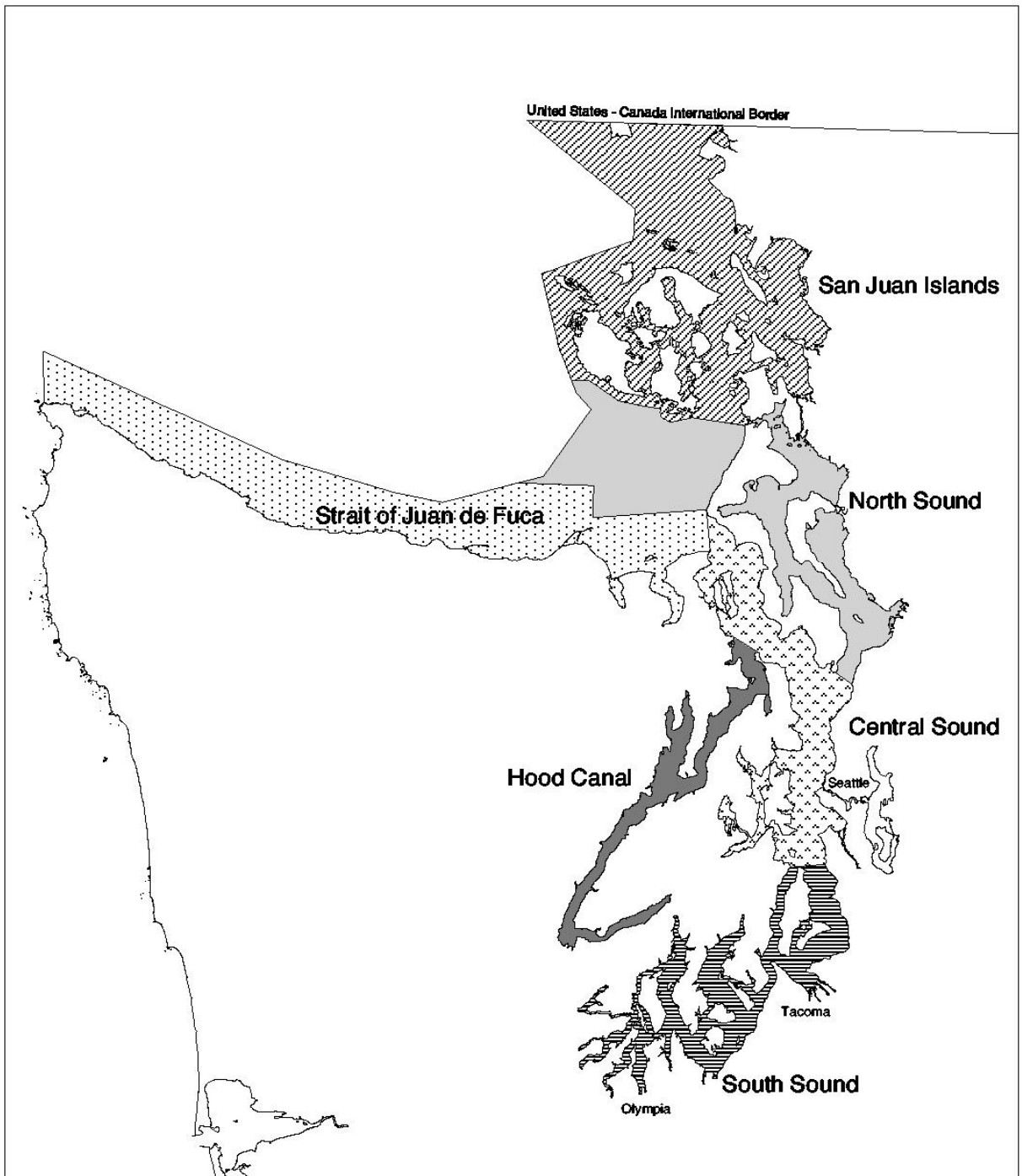
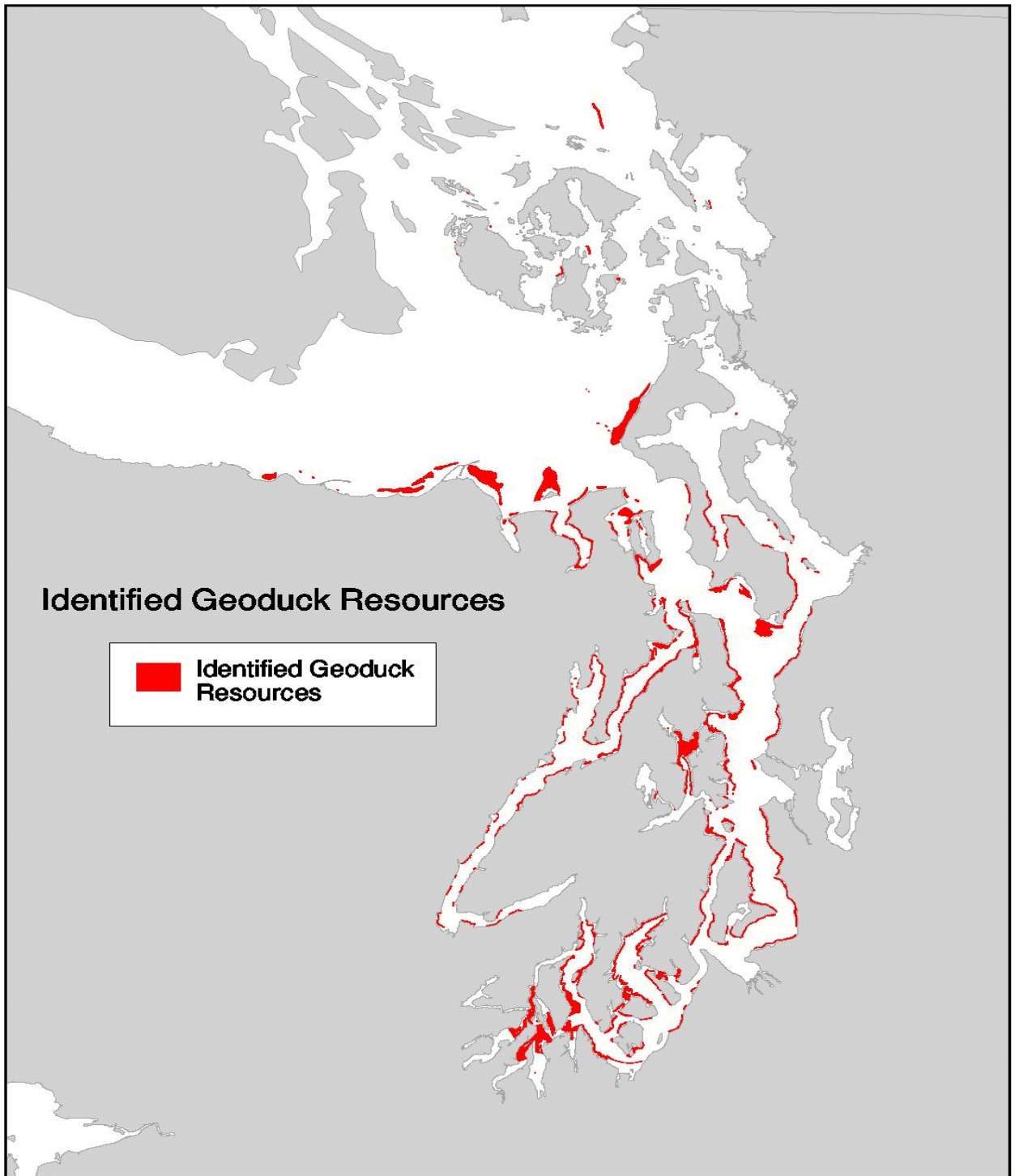


Figure 2: Map of Identified Geoduck Tracts in Washington



ENDANGERED SPECIES ACT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the USFWS, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated CH. Section 7(b)(4) requires the provision of an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

Biological Opinion

This Opinion presents NMFS' review of the status of the PS Chinook salmon ESU, HC summer-run chum salmon ESU, PS steelhead DPS, Pacific herring, coho salmon, pink salmon, pinto abalone, Olympia oysters, and the condition of designated CH, the environmental baseline in the action area, the effects of the proposed action, and cumulative effects (50 CFR 402.14(g)). For the jeopardy analysis, NMFS analyzes those combined factors to conclude whether the proposed action is likely to appreciably reduce the likelihood of both the survival and recovery of the affected listed species.

The CH analysis determines whether the proposed action will destroy or adversely modify designated CH for listed species by examining any change in the conservation value of the essential features of that CH. The regulatory definition of "destruction or adverse modification" at 50 CFR 402.02 is not used in this analysis. Instead, the analysis relies on statutory provisions of the ESA, including those in section 3 that define "critical habitat" and "conservation," in section 4 that describe the designation process, and in section 7 that sets forth the substantive protections and procedural aspects of consultation, and on agency guidance for application of the "destruction or adverse modification" standard².

Status of the Species

This section describes the status of each species and designated CH. Listed species facing a high risk of extinction and CHs with degraded conservation value are more vulnerable to the aggregation of effects of the environmental baseline, the effects of the proposed action, and cumulative effects.

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

Table 1. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed and unlisted species considered in this consultation. (Listing status: ‘T’ means listed as threatened under the ESA; ‘E’ means listed as endangered).

Species	Listing Status	Critical Habitat	Protective Regulations
Puget Sound Chinook Salmon	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Hood Canal Summer-run Chum Salmon	T 6/28/05; 70 FR 37160	9/02/05; 70 FR 52630	6/28/05; 70 FR 37160
Puget Sound/Strait of Georgia Coho Salmon	Unlisted; 4/15/04; 69 FR 19975	Not applicable	Not applicable
Pink Salmon: Even year	Unlisted	Not applicable	Not applicable
Pink Salmon: Odd year	Unlisted	Not applicable	Not applicable
Puget Sound Steelhead	T 5/11/07; 72 FR 26722	Under development	9/25/08; 73 FR 55451
Pacific Herring	Unlisted; 6/0705; 70 FR 33116	Not applicable	Not applicable
Pinto Abalone	Unlisted; 4/15/04; 69 FR 19975	Not applicable	Not applicable
Olympia Oyster	Unlisted	Not applicable	Not applicable

For salmon and steelhead considered in this consultation, NMFS describes the status of the species using criteria for a viable salmonid populations (McElhany et al. 2000). Attributes associated with a viable salmonid population include abundance, productivity, spatial structure, and genetic diversity at levels that maintain its capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. These attributes are influenced by survival, behavior, and experiences throughout the entire life cycle, characteristics that are influenced, in turn, by habitat and other environmental conditions. Factors bearing on the status of the salmon and steelhead ESUs and DPSs considered in this consultation include diminished habitat quantity and quality, and interactions between native and hatchery fish. These factors variably affect the productivity, abundance, genetic diversity, and spatial structure of the populations comprising the affected ESUs and DPSs, as described below.

Puget Sound Chinook Salmon

The PS Chinook salmon ESU includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca from the Elwha River, eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington (March 24, 1999, 64 FR 14208). The PS Chinook salmon ESU is composed of 31 historically quasi-independent populations, 22 of which are believed to be extant currently (PSTRT 2001, 2002).

Eight of 26 existing artificial propagation programs are directed at conserving PS Chinook salmon. The remaining programs considered to be part of the ESU are operated primarily for fisheries harvest augmentation purposes (some of which also function as research programs) using transplanted within-ESU-origin Chinook salmon as broodstock. The NMFS determined

that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the ESU (NMFS, 2005a).

Abundance. Despite the conservation programs, the PS Chinook salmon ESU populations have not experienced the dramatic increases in abundance in recent years that have been evident in many other ESUs, more populations have shown modest increases in escapement in recent years than have declined (13 populations versus nine). Most populations have a recent five-year mean abundance of fewer than 1,500 natural spawners, with the Upper Skagit population being a notable exception (the recent five-year mean abundance for the Upper Skagit population approaches 10,000 natural spawners). The most extreme short-term declines in natural spawner abundance have occurred in the upper Sauk, Cedar, Puyallup, and Elwha populations. Of these populations, only the upper Sauk is likely to have a low fraction of hatchery fish in escapements (Good et al., 2005). When change in abundance is calculated assuming the reproductive success of hatchery fish is equivalent to that of natural-origin fish, the biggest estimated short-term population declines are in the Green, Skykomish, North Fork Stillaguamish, and North Fork Nooksack populations (Good et al., 2005).

Currently observed abundances of natural spawners in the ESU are several orders of magnitude lower than estimated historical spawner capacity, and well below peak historical abundance (approximately 690,000 spawners in the early 1900s).

Productivity. Recent five-year and long-term productivity trends remain below replacement for the majority of the 22 extant populations of PS Chinook salmon. The Biological Review Team (BRT) was concerned that the concentration of the majority of natural production in just a few subbasins represents a significant risk. Natural production areas, due to their concentrated spatial distribution, are vulnerable to extirpation due to catastrophic events. The BRT was concerned by the disproportionate loss of early run populations and its impact on the diversity of the PS Chinook salmon ESU. Past hatchery practices that transplanted stocks among basins within the ESU and present programs using transplanted stocks that incorporate little local natural broodstock represent additional risk to ESU diversity. In particular, the BRT noted that the pervasive use of Green River stock, and stocks subsequently derived from the Green River stock, throughout the ESU may reduce the genetic diversity and fitness of naturally spawning populations.

In terms of productivity, these hatchery programs collectively do not substantially reduce the extinction risk of the ESU in-total (NMFS, 2004d). However, long-term trends in abundance for naturally spawning populations of Chinook salmon in Puget Sound indicate that approximately half the populations are declining, and half are increasing in abundance over the length of available time series. The median (over all populations) long-term trend in abundance is 1.0 (range 0.92–1.2), meaning that most populations are just replacing themselves. Over the long term, the most extreme declines in natural spawning abundance have occurred in the combined Dosewallips and Elwha populations. Those populations with the greatest long-term population growth rates are the North Fork Nooksack and White rivers. All populations reported above are likely to have a moderate to high fraction of naturally spawning hatchery fish, so it is not possible to say what the trends in naturally spawning, natural-origin Chinook salmon might be in those populations. White River spring Chinook salmon (among others) are unique because their life history is adapted to glacial runoff patterns. This life history distinguishes the White River spring Chinook salmon from most of the other PS Chinook salmon populations increasing their

importance to recovery of PS Chinook salmon for their contribution to life history diversity within the ESU.

Fewer populations exhibit declining trends in abundance over the short term than over the long term—4 of 22 populations in the ESU declined from 1990 to 2002 (median = 1.06, range = 0.96–1.4) (Good et al., 2005). In contrast, estimates of short-term population growth rates suggest a very different picture when the reproductive success of hatchery fish is assumed to be 1.

The populations with the most positive short-term trends and population growth rates are the combined Dosewallips and White river populations. Both of these populations are thought to have a moderate fraction of naturally spawning hatchery fish, but because such estimates are not available, estimating the trends in natural-origin spawners is not possible (Good et al., 2005).

Spatial Structure and Diversity. The populations presumed to be extinct are mostly early returning fish; most of these are in mid- to southern Puget Sound or Hood Canal and the Strait of Juan de Fuca. The ESU populations with the greatest estimated fractions of hatchery fish tend to be in mid- to southern Puget Sound, Hood Canal, and the Strait of Juan de Fuca.

Habitat throughout the PS Chinook salmon ESU has been blocked or degraded (NMFS and USFWS 2005). In general, forest practices impacted upper tributaries, and agriculture or urbanization impacted lower tributaries and mainstem rivers. The Washington Department of Fisheries (WDF) (WDF et al. 1993) cited diking for flood control, draining and filling of freshwater and estuarine wetlands, and sedimentation due to forest practices and urban development as problems throughout range of the ESU. Blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in several basins. Bishop and Morgan (1996) identified a variety of CH issues for streams in the range of this ESU, including changes in flow regime (all basins), sedimentation (all basins), high temperatures (Dungeness, Elwha, Green/Duwamish, Skagit, Snohomish, and Stillaguamish rivers), streambed instability (most basins), estuarine loss (most basins), loss of large woody debris (LWD) (Elwha, Snohomish, and White rivers), loss of pool habitat (Nooksack, Snohomish, and Stillaguamish rivers), and blockage or passage problems associated with dams or other structures (Cedar, Elwha, Green/Duwamish, Snohomish, and White rivers).

Hood Canal Summer-run Chum Salmon

The HC summer-run chum salmon includes all naturally spawned populations of summer-run chum salmon in Hood Canal and its tributaries as well as populations in Olympic Peninsula rivers between Hood Canal and Dungeness Bay, Washington (March 25, 1999, 64 FR 14508). Eight artificial propagation programs are considered to be part of the ESU: The Quilcene National Fish Hatchery (NFH), Hamma Hamma Fish Hatchery, Lilliwaup Creek Fish Hatchery, Union River/Tahuya, Big Beef Creek Fish Hatchery, Salmon Creek Fish Hatchery, Chimacum Creek Fish Hatchery, and the Jimmycomelately Creek Fish Hatchery summer-run chum hatchery programs. The NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the ESU (NMFS, 2005a). Each of the hatchery programs includes research, monitoring, and evaluation activities designed to determine success in recovering the propagated populations to viable levels, and to determine the demographic, ecological, and

genetic effects of each program on target and non-target salmonid populations. All the HC summer-run chum salmon hatchery programs will be terminated after 12 years of operation.

Abundance. Adult returns for some populations in the HC summer-run chum salmon ESU showed modest improvements in 2000, with upward trends continuing in 2001 and 2002. The recent five-year mean abundance is variable among populations in the ESU, ranging from one fish to nearly 4,500 fish. Hood Canal summer-run chum salmon are the focus of an extensive rebuilding program developed and implemented since 1992 by the state and tribal co-managers. Two populations (the combined Quilcene and Union River populations) are above the conservation thresholds established by the rebuilding plan. However, most populations remain depressed. Estimates of the fraction of naturally spawning hatchery fish exceed 60 percent for some populations, indicating that reintroduction programs are supplementing the numbers of total fish spawning naturally in streams. Of the eight programs releasing summer chum salmon that are considered to be part of the HC summer chum salmon ESU, six of the programs are supplementation programs implemented to preserve and increase the abundance of native populations in their natal watersheds. These supplementation programs propagate and release fish into the Salmon Creek, Jimmycomelately Creek, Big Quilcene River, Hamma Hamma River, Lilliwaup Creek, and Union River watersheds. The hatchery programs are reducing risks to ESU abundance by increasing total ESU abundance as well as the number of naturally spawning summer-run chum salmon. Several of the programs have likely prevented further population extirpations in the ESU. Despite the current benefits provided by the comprehensive hatchery conservation efforts for HC summer-run chum salmon, the ESU remains at low overall abundance with nearly half of historical populations extirpated.

Productivity. Long-term trends in productivity are above replacement for only the Quilcene and Union River populations. Buoyed by recent increases, seven populations are exhibiting short-term productivity trends above replacement.

The contribution of ESU hatchery programs to the productivity of the ESU in-total is uncertain. The NMFS' assessment of the effects of artificial propagation on ESU extinction risk concluded that these hatchery programs collectively do not substantially reduce the extinction risk of the ESU in-total (NMFS 2004d).

Collectively, artificial propagation programs in the ESU presently provide a slight beneficial effect to ESU abundance, spatial structure, and diversity, but uncertain effects to ESU productivity. The long-term contribution of these programs after they are terminated is uncertain. Informed by the BRT's findings (NMFS 2003) and our assessment of the effects of artificial propagation programs on the viability of the ESU, the Artificial Propagation Evaluation Workshop concluded that the HC summer-run chum salmon ESU in-total is "likely to become endangered in the foreseeable future" (NMFS, 2004d).

Spatial Structure and Diversity. Of an estimated 16 historical populations in the ESU, seven populations are believed to have been extirpated or nearly extirpated. Most of these extirpations have occurred in populations on the eastern side of HC, generating additional concern for ESU spatial structure. The widespread loss of estuary and lower floodplain habitat was noted by the BRT as a continuing threat to ESU spatial structure and connectivity. There is some concern that the Quilcene NFH stock is exhibiting high rates of straying, and may represent a risk to historical population structure and diversity. However, with the extirpation of many local populations,

much of this historical structure has been lost, and the use of Quilcene NFH fish may represent one of a few remaining options for HC summer-run chum salmon conservation. Two hatchery programs use transplanted summer-run chum salmon from adjacent watersheds to reintroduce populations into Big Beef Creek and Chimacum Creek, where the native populations have been extirpated. The hatchery programs are benefiting ESU spatial structure by increasing the spawning area utilized in several watersheds and by increasing the geographic range of the ESU through reintroductions. These programs also provide benefits to ESU diversity. By bolstering total population sizes, the hatchery programs have likely stemmed adverse genetic effects for populations at critically low levels. Additionally, measures have been implemented to maintain current genetic diversity, including the use of native broodstock and the termination of the programs after 12 years of operation to guard against long-term domestication effects.

Puget Sound Steelhead

General information on PS steelhead ecology is available in the BRT report (PSSBRT 2005) and draft assessment by DFW (2006). Steelhead use most rivers and many coastal streams in Puget Sound for spawning and rearing. In the Skagit River, the largest river in Puget Sound, the three winter-run populations (Mainstem Skagit Tributaries, Cascade River, Sauk/Suiattle), are among the most abundant populations in the Distinct Population Segment (DPS).

Factors affecting PS steelhead status include present or threatened habitat modification and curtailed range. Habitat use by PS steelhead has been affected by manmade passage barriers in six river basins (Nooksack, Skagit, White, Nisqually, Skokomish, and Elwha), some of which have long eliminated access to upstream habitat. In addition to the effects of the presence of dams, various upper watershed land uses, especially forestry have reduced the function of the watershed processes that make and maintain habitat. Typical urban land use in other locations has altered water quality and quantity in local streams, reducing their performance as places for spawning and rearing life histories. In fact, the continued destruction of steelhead habitat is considered the principal factor limiting the viability of PS steelhead into the foreseeable future (March 29, 2007; 71 FR 15666, 15673).

Abundance. Overall, the PS Steelhead Biological Review Team (PSSBRT) determined that the risk to the viability of PS steelhead due to declining abundance throughout the DPS is high. While populations in several basins throughout the DPS are critically low, the Skagit River populations are relatively healthy. Historical commercial data from 1889 to 1920 estimated peak run size for Puget Sound would range from 327,592 and 545,987 fish (PSTRT 2002). Within four decades, the population crashed to fewer than 10,000 fish before commercial harvest was banned by the Washington State Game Commission in 1932. In the 1990s the total run size for major stocks in the PS steelhead DPS was greater than 45,000, with total natural escapement of about 22,000. Busby et al. (1996) estimated 5-year average natural escapements for streams with adequate data range from less than 100 to 7,200, with corresponding total run sizes of 550-19,800.

The Skagit and Snohomish River winter-run populations have been approximately three to five times larger than the other populations in the DPS, with average annual spawning of

approximately 5,000 and 3,000 total adult spawners respectively (March 29, 2006, 71 FR 15671).

Productivity. The PSSBRT concluded that the risk to the viability of PS steelhead due to declining productivity is high. Nearly all steelhead populations in the DPS exhibited diminished productivity as indicated by below-replacement population growth rates, and declining short and long-term trends in natural escapement and total run size. Once considered one of the strongholds of the DPS, the Skagit River populations now are showing downward trends in escapement, total run size, recruitment, and population growth rate.

Spatial Structure. The PSSBRT concluded that the viability of PS steelhead is at moderate risk due to the reduced spatial complexity of, and connectivity among, populations.

The majority of the relatively abundant populations are in the northern regions of the DPS. The Lake Washington population, in the center of the DPS is functionally extinct. This disconnects the abundant Snohomish River populations from the depressed south sound populations, making recovery difficult. The PSSBRT also suggested that the loss of a centrally located population within the last decade could contribute to the recent declines in abundance of the Snohomish and Skagit populations.

Diversity. The PSSBRT concluded that the viability of PS steelhead is at moderate risk due to the reduced life history diversity of populations and the potential threats posed by artificial propagation and harvest in Puget Sound. All summer-run populations are depressed and concentrated in northern Puget Sound. Another major diversity concern is the homogenization of genetic diversity throughout the DPS by hatchery produced steelhead. Large production of “out-of-DPS” hatchery runs (Chambers Creek winter-run and Skamania River summer-run) and “out-of-basin origin” hatchery runs largely outnumber naturally-produced steelhead in many basins throughout Puget Sound.

Since 1990, 535,000 winter-run steelhead smolts are released yearly at several locations throughout the Skagit River system (PSSBRT 2005). The origin of the steelhead hatchery stock at the Marblemount hatchery is from Chambers Creek, south of Tacoma. Some native run stock was mixed in with the Chambers Creek stock until 1995, when production returned to using Chambers Creek exclusively.

Pink Salmon - Even Year Evolutionarily Significant Unit

The NMFS reviewed the status of pink salmon in 1995 (unpublished), describing two ESUs of pink salmon present in Puget Sound. The two ESUs include 12 populations that spawn only in odd-numbered years (odd year pink salmon) and one population that spawns only in even-numbered years (even year pink salmon).

A single population of even-year pink salmon occurs in the United States south of Alaska—in the Snohomish River in Washington. Genetically, this population is much more similar to even-year pink salmon from British Columbia and Alaska than it is to odd-year pink salmon from Washington. In addition, a similar pattern is found in phenotypic and life-history traits such as

body size and run timing. This result is consistent with numerous studies that have found large genetic differences between even and odd-year pink salmon from the same area (e.g., Aspinwall, 1974; Beacham et al., 1985; Kartavtsev 1991). The Snohomish River even-year pink salmon population is geographically isolated by several hundred kilometers from other even-year pink salmon populations of appreciable size. However, life-history features of the Snohomish River even-year population are similar to those in other even-year populations from central British Columbia. For example, time of peak spawning of even-year pink salmon in the Snohomish River is comparable to that of even-year British Columbia pink salmon and 3–4 weeks earlier than that of odd-year pink salmon in the Snohomish River. Genetic analyses are highly dependent upon standardization between laboratories, but available data indicate that even-year Snohomish River pink salmon are among the most distinctive of any pink salmon sample from the United States or southern British Columbia.

At the present time, the Snohomish River even-year pink salmon ESU (October 4, 1995, 60 FR 51928) is relatively small, on the order of a few thousand adults per generation. In defining the term “species” as it applies to Pacific salmon, NMFS has previously stated that a population should not be considered an ESU if the historic size (or historic carrying capacity) is too small for it to be plausible to assume the population has remained isolated over an evolutionarily important time period (Waples 1991). The fact that small spawning populations are regularly observed may reflect the dynamic processes of extinction, straying, and recolonization (Waples 1991). Therefore, the small size of the current Snohomish River even-year pink salmon population suggests that it may be part of a larger geographic unit on evolutionary time scales (hundreds or thousands of years). The odd-year Snohomish River pink salmon population, which has the same spawning habitat available, is one to two orders of magnitude larger; therefore, it is possible that the even-year population was once much larger in the past. If that were the case, long-term persistence of this population in isolation would be easier to explain, since larger, isolated populations are likely to be more resilient to extinction than a small population such as this one.

Pink Salmon - Odd Year Evolutionarily Significant Unit

Genetic information indicates that odd-year pink salmon from southern British Columbia and Washington are from evolutionary lineages that are clearly different from nearby even-year populations and more northerly odd-year populations. Within the southern British Columbia-Washington pink salmon group, there is also evidence of geographic population genetic structure, with detectable differences among groups of populations from the Dungeness River, Hood Canal, Puget Sound, and Fraser River, and southern and central British Columbia, Canada. In some analyses, Nisqually and Nooksack River populations in Puget Sound are genetic outliers dissimilar to each other. Even so, none of the genetic differences within the southern British Columbia-Washington pink salmon group is very large in absolute magnitude. Based on available information (Hard et al. 1996), NMFS concluded that the northern boundary of the odd-year ESU corresponds to the Johnstone Strait region of British Columbia, Canada. The ESU does not include northern British Columbia, Alaskan, or Asian populations of pink salmon. In Washington, westernmost populations in this ESU are found in the Dungeness River, but the ESU presumably would also include the Elwha River population (Hard et al. 1996), if a remnant still exists (see Status of West Coast Pink Salmon ESUs). Some uncertainty exists whether

populations in the Dungeness River (and possibly the Elwha River in Washington and southern Vancouver Island in British Columbia) belong in a separate ESU. Furthermore, given the uncertainty associated with the presence of populations outside this range, NMFS believes that insufficient information presently exists to determine whether other populations of pink salmon on the Olympic Peninsula or locations further south should be included in this ESU.

In considering whether these ESUs are threatened or endangered according to the ESA, NMFS evaluated both qualitative and quantitative information. Qualitative evaluations considered recent, published assessments by agencies or conservation groups of the status of pink salmon within the geographic area. Quantitative assessments were based on current and historical abundance information and time series data compiled from a variety of Federal, state, and tribal agency records.

Nehlsen et al. (1991) considered salmon stocks throughout Washington, Idaho, Oregon, and California and enumerated all stocks that they found to be extinct or at risk of extinction. Pink salmon stocks in the Klamath and Sacramento Rivers, located in California, were considered extinct. Three stocks were considered to be at high risk of extinction (Russian River, CA; Elwha River, WA; and Skokomish River, WA) and one at moderate risk of extinction (Dungeness River, WA). Pink salmon stocks that do not appear in their summary were either not considered to be at risk of extinction or there was insufficient information to classify them.

The WDF and Western Washington Treaty Indian Tribes (WWTIT) (1993) categorized all salmon stocks in Washington on the basis of stock origin, production type, and status (healthy, depressed, critical, or unknown). Of the 15 pink salmon stocks identified by the WDF et al. (1993), nine were classified as healthy, two as critical (lower Dungeness and Elwha Rivers), two as depressed (upper Dungeness and Dosewallips Rivers), and two as unknown (North and Middle Fork Nooksack, and South Fork Nooksack River). All runs were classified as wild production and all except those in the North and Middle Forks of the Nooksack River, were reported to be of native origin. The Elwha River pink salmon maybe extinct since no adult fish have been observed since 1989 despite extensive annual surveys (Hard et al. 1996). Based on available data, it is difficult to ascertain with any degree of certainty the extent of the ESU that contains the Snohomish River even-year pink salmon population. The small size of the current Snohomish River even-year population suggests that it may be part of a larger geographic unit over evolutionary time.

The Snohomish River even-year population is geographically isolated by several hundred kilometers from other even year populations of appreciable size; however, similar life history characteristics, such as time of peak spawning, are similar to that of even year British Columbia pink salmon. Results of genetic data are heavily dependent on whether an adjustment is made for possible differences in methods for recording data. Further, it is not clear which analyses should be preferred, those with or without adjustment for possible bias. Given the uncertainty associated with the extent of the even-year ESU, NMFS considered the status of this ESU under two scenarios: (1) the ESU is composed solely of the Snohomish River pink salmon population, and (2) the ESU contains populations of even-year pink salmon from British Columbia in addition to the Snohomish River population. Under both scenarios, NMFS was unable to demonstrate that this ESU is currently at risk of extinction or endangerment. Available information indicates that the Snohomish River pink salmon population is relatively small with,

generally, an increasing trend in abundance in recent years. Further, even-year pink salmon populations in British Columbia are generally stable or increasing. Therefore, under both ESU scenarios, NMFS has concluded that even-year pink salmon do not presently warrant listing under the ESA.

Similar to the even-year ESU, uncertainty remains regarding the extent of the odd-year pink salmon ESU. Environmental and ecological characteristics generally show a strong north-south trend. But, NMFS was unable to identify any substantial differences that consistently differentiate Washington and British Columbia odd-year pink salmon populations. Although odd-year pink salmon show considerable variation in body size among populations in Washington, the range of variation does not exceed that found in British Columbia. Genetic information shows a clear distinction between nearby even year pink salmon and more northerly odd-year populations. Within the southern British Columbia and Washington pink salmon group, evidence of geographic population structure exists; however, none of the genetic differences is very large in absolute magnitude. Even though genetic differences among odd-year pink salmon are relatively small, the consistent genetic differences among geographically isolated groups of populations suggest that there has been some degree of reproductive isolation among pink salmon populations in this region. Most populations in the odd-year pink salmon ESU appear to be healthy, and overall abundance appears to be close to historic levels. The two most distinctive Puget Sound populations, the Nooksack and Nisqually River populations, both show non-significant trends in recent abundance. No other factors were identified by NMFS which would threaten the near-term survival of these populations. However, the two populations on the northern Olympic Peninsula (both of which occur in the Dungeness River and one of which, in the lower river, was petitioned for listing) appear to be at the greatest risk of extinction in this ESU. Nevertheless, because (1) most of the populations in this ESU are stable or increasing and (2) the two populations at greatest risk are not consistently differentiated from other populations in the ESU with regard to genetic or life history characters, NMFS concludes that the odd-year pink salmon ESU is not presently at risk of extinction or endangerment. Furthermore, NMFS concluded that the geographic boundaries of the even- and odd-year pink salmon ESUs should be regarded as provisional (October 4, 1995, 60 FR 51932). As such, these geographic boundaries are subject to revision should substantial new information become available.

Herring

Pacific Herring are unlisted. In response to a petition (Wright 1999) to list Pacific herring (*Clupea pallasii*) under the ESA, NMFS initiated a status review and formed a BRT composed of Federal scientists with expertise in herring. In 2001, NMFS determined that the petitioned Pacific herring populations were part of a larger DPS that qualified as a species under the ESA but did not warrant listing as threatened or endangered at that time (April 3, 2001, 66 FR 17659).

A majority of the BRT favored the Georgia Basin (extending from the southern end of Puget Sound proper to the northern end of the Strait of Georgia near Discovery Passage and westward to Cape Flattery) as the most likely DPS. The BRT concluded, by a large majority, that the Georgia Basin DPS of Pacific herring was neither at risk of extinction, nor likely becoming so. The BRT also concluded that the Georgia Basin DPS of Pacific herring did not meet the

International Union for the Conservation of Nature (IUCN) criteria to be considered "vulnerable" (Musick et al. 2000). However, most members expressed concern that they could not entirely rule out the possibility that the Georgia Basin DPS was likely to become in danger of extinction, especially because some stocks within the Georgia Basin, such as Cherry Point and Discovery Bay, had declined to such an extent that they could meet the IUCN criteria to be considered "vulnerable." However, because of the moderate to high productivity of herring populations and the tendency of herring to stray among spawning sites, the BRT felt that there were reasonable possibilities for recolonization of depleted populations associated with specific spawning sites (April 3, 2001, 66 FR 17659).

Pinto Abalone

Pinto abalone are unlisted. Abalone are found in kelp beds along outer well-exposed coasts from Sitka, Alaska along the coast of Canada to Point Conception, California. In Washington, pinto abalone range from Admiralty Inlet to the San Juan Islands, throughout the Strait of Juan de Fuca to the north coast of the Olympic Peninsula. They are generally found on rocky shores between the low intertidal zone, down to 60 feet, but they can be found to 330 feet (100 m) depth. They are herbivorous.

Abalone broadcast spawn from April to June. Larval dispersal is limited. Their lifespan is about 15 years. The Pinto abalone population size has declined due to overharvest, illegal harvest, predators, and disease. Because of concerns about its status, the Northern Abalone is a U.S. NMFS Species of Concern. The State of Washington never permitted commercial harvest and recreational take was outlawed in 1994. Populations have continued to decline (NMFS 2007).

Olympia Oysters

The Olympia oyster is unlisted. Oysters inhabit estuaries, small streams, and rivers from Southeast Alaska to Baja California. The Olympia oyster is the only oyster that is native to Washington. Once abundant, the Olympia oyster was an important food source for many coastal Native American tribes. Oysters usually inhabit low tidelands or estuaries that remain inundated with water during low tide, although they also can be found on the undersides of floats and on pilings. They are typically found at depths of 0 to 71 meters (Hertlein 1959).

The life history of the Olympia oyster is similar to that of other oysters of the genus *Ostrea*. The oyster initially spawns as a male then alternates its functional gender between each spawning cycle (Coe 1932).

Spawning begins at water temperatures of 13 to 16 degrees C. In the southern portion of the oysters' range, spawning occurs from spring to fall, peaking in spring and to a lesser extent in fall (Coe 1932). In the central part of its range, spawning may be a prolonged period or may consist of one or two spawning periods in mid-summer (Hopkins 1937; Bonnot 1938). In the northern portion, there may be only one or two spawning periods in mid-summer (Hopkins 1937).

By 1870, overharvesting had significantly depleted oyster stocks in both Willapa Bay and Puget Sound. Water pollution was another factor that had, and continues to have, profound effects on oyster populations. As filter-feeders, oysters take in huge quantities of seawater (about 20 to 30

quarts an hour), to extract phytoplankton. However, any pollutants or pathogens that are present are also extracted and quickly become concentrated in the oyster's tissues. Though oyster growers strove to maintain and enhance the water quality of the tidelands that sustained their oyster-beds, unregulated effluent from surrounding pulp and paper mills before the 1950's played a large part in the decline of the Olympia oyster. To augment their ailing stocks, oystermen began importing the larger and faster-growing Japanese or Pacific oyster in large numbers, which soon displaced the Olympia oyster in their cultivated beds. Non-native oyster predators, such as the Japanese oyster drill (*Ocenebra japonica*), and a parasitic flatworm (*Mytilicola orientalis*) were accidentally introduced along with their hosts and exacerbated the Olympia oyster's decline.

Olympia oyster populations continue to be threatened by pollution from motorboats, pulp mills and wastewater discharge. Additionally, silt from highway construction projects has smothered a large proportion of the oyster population in the more shallow areas. Despite increases in some local oyster populations due to water quality improvements, Olympia oyster stocks in Washington have never reached pre-exploitation levels. Currently, the PS Restoration Fund is looking to re-introduce Olympia oysters in at least seven different sites throughout Puget Sound and Hood Canal.

Puget Sound/Strait of Georgia Coho Salmon

Puget Sound/ Strait of Georgia coho salmon are unlisted. In 1996, NMFS asked the West Coast Coho Salmon BRT to conduct a status review for coho salmon from Washington, Oregon, and California (WCCSBRT 1996). According to the BRT status review (1996), the artificial propagation of coho salmon in this ESU was widespread and involved the release of tens of millions of fry and smolts annually. This total included several million smolts released from net-pens, which were documented to stray to streams in the general vicinity of the pens. However, natural production areas had generally received no or very restricted releases of hatchery fish, consistent with WDFW's management policies.

Overall abundance of coho salmon, including both natural and artificial production, was much higher in this ESU than in any of the other coho salmon ESUs examined in the BRT status review (1996). In the US portion alone, estimated run size was approximately a half million fish, with a geometric mean escapement over 150,000.

On the other hand, the BRT (1996) expressed several reasons for concern about the health of natural populations of coho salmon in this ESU. First, data indicated that natural populations in British Columbia had undergone substantial declines. Second, extensive artificial propagation of coho salmon in both the US and Canadian portions of the ESU overwhelmed natural production in much of Puget Sound (BRT 1996). Finally, the decline in adult size of coho salmon was dramatically sharper in Puget Sound than in other areas of the Pacific Northwest.

After considering existing conditions and risks to the ESU, the majority of the BRT concluded that these coho salmon were neither at risk of extinction, nor likely to become so in the foreseeable future. A key factor was the presence of several relatively large populations in natural production areas in north Puget Sound, which suggested that the ESU as a whole was not at significant extinction risk.

North American Green Sturgeon - Southern Distinct Population Segment

The Southern DPS of the North American green sturgeon was listed as threatened on April 7, 2006 (71 FR 17757). The BRT concluded that the DPS is threatened throughout all of its range because: (1) the Sacramento River contains the only known green sturgeon spawning population in this DPS, and the concentration of spawning adults in one river places this DPS at risk; (2) there was a substantial loss of spawning habitat in the upper Sacramento and Feather Rivers and the loss of this spawning habitat contributed to the overall decline of the Southern DPS; (3) recent studies (since 2002) have indicated that the Sacramento River and Delta System face mounting threats with regard to maintenance of habitat quality and quantity and the Southern DPS is directly dependent upon this ecosystem for its long-term viability; and (4) fishery-independent data collected at the State and Federal salvage facilities indicate a decrease in observed numbers of juvenile green sturgeon collected from 1968 to 2001.

Green sturgeon spend a large portion of their lives in coastal marine waters as subadults and adults between spawning episodes. Subadult male and female green sturgeon spend at least approximately six and 10 years, respectively, at sea before reaching reproductive maturity and returning to freshwater to spawn for the first time. Adult green sturgeon spend as many as 2–4 years at sea between spawning events. Particularly large aggregations of green sturgeon occur in the Columbia River estuary and Washington estuaries and include green sturgeon from all known spawning populations (Moser and Lindley, 2007). Although adult and subadult green sturgeon occur in coastal marine waters as far north as the Bering Sea, green sturgeon have not been observed in freshwater rivers or coastal bays and estuaries in Alaska.

Within bays and estuaries, adults and subadults inhabit a wide range of environmental conditions. Adult and subadult green sturgeon in the Columbia River estuary, Willapa Bay, and Grays Harbor feed on crangonid shrimp, burrowing thalassinidean shrimp (primarily the burrowing ghost shrimp (*Neotrypaea californiensis*), but possibly other related species), amphipods, clams, juvenile Dungeness crab (*Cancer magister*), anchovies, sand lances (*Ammodytes hexapterus*), lingcod (*Ophiodon elongatus*), and other unidentified fishes. Burrowing ghost shrimp made up about 50 percent of the stomach contents of green sturgeon sampled in 2003.

Status of Critical Habitat

The ESA requires the Federal government to designate CH for any species it lists under the ESA. Critical habitat is defined as: (1) Specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and whether those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

The NMFS reviews the status of designated CH affected by the proposed action by examining the condition and trends of primary constituent elements (PCEs) throughout the designated area. The PCEs are the physical and biological features identified as essential to the conservation of the listed species in the documents that designate CH. Presently, CH is designated for PS

Chinook salmon and HC Summer-run chum salmon. Designation of PS Steelhead CH is not yet complete.

Status of Salmonid Critical Habitat in Puget Sound and Hood Canal

Critical habitat has been designated for PS Chinook salmon and HC summer-run chum salmon. Major tributary river basins in the Puget Sound Basin include the Nooksack, Samish, Skagit, Sauk, Stillaguamish, Snohomish, Lake Washington, Cedar River, Sammamish River, Green River, Duwamish River, Soos Creek, Puyallup River, White River, Carbon River, Nisqually River, Deschutes, Skokomish, Duckabush, Dosewalips, Big Quilcene, Elwha, and Dungeness Rivers.

The various PCEs supporting all salmon life history stages have been affected by natural and man-made influences. Diking, agriculture, revetments, railroads and roads in lower stream reaches have caused significant loss of secondary channels in major valley floodplains in this region. Confined main channels create high-energy peak flow events that remove smaller substrates and LWD. The loss of side-channels, oxbow lakes, and backwater habitats results in a significant loss of juvenile salmonid rearing and refuge habitat (WSCC 2000).

For freshwater sites, water quality, water quality, floodplain connectivity, and riparian cover PCEs have been diminished by loss of riparian and floodplain habitat, elevated water temperatures, elevated levels of nutrients, increased nitrogen and phosphorus, and higher levels of turbidity, presumably from road runoff, wastewater treatment, failing septic systems, and agriculture or livestock impacts, have been documented in many Puget Sound tributaries. Peak stream flows have increased over time due to paving (roads and parking areas), reduced percolation through surface soils on residential and agricultural lands, simplified and extended drainage networks, loss of wetlands, and rain-on-snow events in higher elevation clearcuts.

Freshwater migration PCEs have been negatively affected by blockages by dams, water diversions, and shifts in flow regime due to hydroelectric development and flood control projects are major habitat problems in many Puget Sound tributary basins.

Nearshore and marine PCEs have been disrupted by human activities, the effects of which can persist for varying lengths of time. In these environments many stressors can co-occur because these areas have been the focus of much human development and activity over the past 150 years. Effects of the multitude of human-induced stressors on salmon are compounded in estuarine and nearshore areas because the fish are naturally stressed as they use and pass through these areas due to physiological changes associated with the transition from living in fresh to salt water environments (from Aitken 1998, cited in Redman et al. 2005).

Stressors in estuaries and the nearshore marine environment include:

- Loss and/or simplification of deltas and delta wetlands;
- Alteration of flows through major rivers;
- Modification of shorelines by armoring, overwater structures and loss of riparian vegetation;

- Contamination of nearshore and marine resources, including degradation of water quality;
- Alteration of biological populations and communities;
- Transformation of land cover and hydrologic function of small marine discharges via urbanization; and
- Transformation of habitat types and features via colonization by invasive plants.

Degradation of the near-shore environment has occurred in the southeastern areas of Hood Canal in recent years, resulting in late summer marine oxygen depletion and significant fish kills. Circulation of marine waters is naturally limited, and partially driven by freshwater runoff, which is often low in the late summer. However, human development has increased nutrient loads from failing septic systems along the shoreline, and from use of nitrate and phosphate fertilizers on lawns and farms. Shoreline residential development is widespread and dense in many places. The combination of highways and dense residential development has impacted both physical and chemical characteristics of the near-shore environment (WSCC 2003).

In summary, PCEs of salmonids' CH throughout the Puget Sound basin has been degraded by numerous management activities, including hydropower development, loss of mature riparian forests, increased sediment inputs, removal of LWD, intense urbanization, agriculture, alteration of floodplain and stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, dredging, armoring of shorelines, marina and port development, road and railroad construction and maintenance, marine vessel traffic, oil spills, chemical contamination, timber harvest, and mining. Changes in habitat quantity, quality, availability, and diversity; forage quality, quantity and availability; passage conditions; and flow, temperature, sediment load and channel instability are common limiting factors in areas of CH. The degradation to multiple PCEs throughout CH of both PS Chinook salmon and HCSR chum indicate that the conservation potential of the CH is not being reached, even in areas where the conservation value of habitat is ranked high because of how important the areas are in serving survival and recovery needs of the listed species.

Status Critical Habitat of Southern Distinct Population Segment of Green Sturgeon in Puget Sound

Critical habitat was proposed for green sturgeon on September 8, 2008 (FR 73:52084). One of the proposed coastal marine areas includes the Strait of Juan de Fuca, west of Point Wilson near the City of Port Townsend. Within the nearly 800 square miles of the Strait of Juan de Fuca proposed for CH lie 8.7 square miles of commercially available geoduck tracts, located mostly within 1 mile or up to 3 miles from the coast.

The review team recognized that the different systems occupied by green sturgeon at specific stages of their life cycle serve distinct purposes and thus may contain different PCEs. Based on the best available scientific information, the team identified PCEs for freshwater riverine systems, estuarine areas, and nearshore marine waters. The PCEs proposed for coastal marine waters are migratory corridors (within marine and between estuarine and marine habitats), water quality, and food resources.

Migration. Unimpeded passage within coastal marine waters is critical for subadult and adult green sturgeon to access overwintering habitats within coastal bays and estuaries and overwintering habitat within coastal waters between Vancouver Island, BC, and southeast Alaska. Access to and unimpeded movement within these areas is also necessary for green sturgeon to forage for prey and make lengthy migrations necessary to reach other foraging areas. Passage is also necessary for subadults and adults to migrate back to San Francisco Bay and to the Sacramento River for spawning. Acoustically tagged green sturgeons have been observed during their coastal migrations to travel at depths of 130 to 230 feet, and no greater than 360 feet.

Water Quality. Based on studies of tagged subadult and adult green sturgeon in the San Francisco Bay estuary, CA, and Willapa Bay, WA, subadults and adults may need a minimum dissolved oxygen level of at least 6.54 mg O₂/l

Food Resources. The scant information about their marine food indicates that small fishes and benthic invertebrates typical of silty/sand substrates of the continental shelf, in addition to benthic fauna (i.e., burrowing shrimp and sand lance) of shallow coastal bays with mud/silt bottoms. Sturgeon are particularly adapted for feeding in silty substrates in low light conditions.

Environmental Baseline

The 'environmental baseline' includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). The following discussion provides the foundation for our analysis of the likely effects the proposed action will have on the species covered by the HCP.

The NMFS describes the environmental baseline in terms of the habitat features and processes necessary to support all life stages of each listed species within the action area. Each listed species considered in this Opinion resides in or migrates through the action area. Thus, for this action area, the biological requirements for the covered species are the habitat characteristics that support successful completion of rearing and migration. These can be found described in more detail in the CH section of this document, above.

Environmental Contaminants

Contaminants enter marine and fresh waters and sediments from numerous sources, but are typically concentrated near populated areas of high human activity and industrialization. Toxic chemicals in the sediments of Puget Sound can expose salmon and other organisms to unhealthy concentrations of contaminants. Toxic contamination of nearshore and marine ecosystems in Puget Sound can reduce the ability of the nearshore and marine ecosystems to provide high quality prey items for juvenile and adult Chinook salmon and chum salmon, and bull trout.

Oil spills have occurred in action area in the past, and there is potential for spills in the future. Oil can be discharged into the marine environment in any number of ways, including shipping

accidents, refineries and associated production facilities, and pipelines. Despite many improvements in spill prevention since the late 1980s, much of the action area remains at risk from serious spills because of the heavy volume of shipping traffic and proximity to petroleum refining centers in inland waters. Numerous oil tankers transit through the action area throughout the year. The magnitude of the risks posed by oil discharges in this area is difficult to precisely quantify or estimate, but may be decreasing because of new oil spill prevention procedures in the state of Washington (WDOE 2007).

Habitat Modification

Human activities have degraded extensive areas of spawning and rearing habitat in Puget Sound. Watershed development and associated urbanization throughout the Puget Sound, Hood Canal, and Strait of Juan de Fuca regions have increased sedimentation, raised water temperatures, decreased LWD recruitment, significantly altered hydrologic and erosional rates and processes by creating impermeable surfaces (roads, buildings, parking lots, sidewalks etc.), polluted waterways, and dredged and filled estuarine rearing areas (Bishop and Morgan 1996). Large areas of lower river meanders (formerly mixing zones between fresh and salt water) have been channelized and diked for flood control and to protect agricultural, industrial and residential development (Shared Strategy Development Committee 2007).

There are substantial habitat blockages by dams in the Skagit and Elwha River basins, and minor blockages, including impassable culverts, throughout the region. In general, habitat has been degraded from its pristine condition, and this trend is likely to continue with further population growth and resultant urbanization in the Puget Sound region.

None of the pioneers and their followers who were drawn to Puget Sound to farm, produce lumber, or build communities and jobs came with the intent of destroying salmon, but incrementally and collectively these activities degraded the habitat and caused long term declines in fish abundance, productivity, spatial distribution and diversity (Shared Strategy Development Committee 2007).

Sound

Human-generated sound in the range of salmon includes oil and gas exploration, construction activities, vessels and military operations. The concerns about potential effects of exposure to human-generated sounds include impacts on communication with conspecifics (members of the same species), effects on stress levels and the immune system, temporary or permanent loss of hearing, damage to body tissues, mortality, and mortality or damage to eggs and larvae. Moreover, concerns not only include immediate effects, but also potential long-term effects that might now show up for hours, days, or even weeks after exposure to sounds (Hastings and Popper 2005).

The results in the peer-reviewed and gray literature on the effects of sound on fishes are variable and, as yet, give no clear-cut “rules” as to what sounds will affect fish and how they will be affected. A limited number of quantitative and qualitative studies and provide some data pertaining to the effects of sound on fishes. Results based on sound signals other than pile

driving indicate that some exposures to sound will cause a change in the hearing capabilities of some test fish species or actually damage the sensory structures of the inner ear. There is also a very limited body of evidence that leads to the suggestion that exposure to sound has the potential for affecting other aspects of the physiology of fish, and that these effects may range from the macro (destruction of the swim bladder) to the cellular and molecular (Hastings and Popper 2005).

Scientific Research

The NMFS issues authorizations for scientific research purposes under various sections of the ESA. Under section 10(a)(1)(A) of the ESA, NMFS may issue a permit for scientific research, which exempts the permit holder from the take prohibitions of ESA section 9. Permitted activities must not operate to the disadvantage of the listed species and must provide a bona fide and necessary or desirable scientific purpose or enhance the propagation or survival of the listed species. Permits include conditions necessary to mitigate and monitor the impacts of the proposed activities. Examples of current section 10 permits for scientific research include:

- 1) Permit 10114 to Science Applications International Corporation (SAIC). The SAIC is authorized to take listed salmonids while characterizing bay sediments and identifying contaminated areas for future cleanup in Puget Sound. The study will ultimately benefit listed salmonids by helping to minimize their exposure to contaminants during cleanup of impacted sediments. The SAIC proposes to capture (using beach seining and otter trawling), identify, measure, enumerate, and release juvenile and adult fish. The SAIC does not intend to kill any of the fish being captured, but a few may die as an unintended result of the activities.
- 2) Permit 10020 to the City of Bellingham Public Works Department (COB). The COB is authorized to annually take PS Chinook salmon while assessing the effectiveness of habitat restoration measures implemented as part of the Whatcom Creek long-term Restoration Plan. In June of 1999, aquatic and wetland habitats in Whatcom Creek were severely affected by a fuel leak and subsequent explosion. The research will benefit listed salmonids by helping resource managers evaluate the effectiveness of the habitat restoration efforts. The COB is authorized to capture fish using a smolt trap. Listed fish will be captured, identified, measured, and released.

The WDFW coordinates with NMFS to evaluate and authorize annual research activities under the ESA 4(d) Rule's Research Limit [50 CFR 223.203(b)(7)] These activities are either conducted by or coordinated with the State fishery agencies. Under the 4(d) Rule's Research Limit, ESA take prohibitions do not apply to scientific research activities submitted by a State fishery agency. The NMFS approved Washington State programs for 2008 include determining the abundance, distribution, growth rate, and condition of adult and juvenile fish, conducting disease and genetic studies, determining diet composition, evaluating salmonid production (i.e., smolt-to-adult survival rates), determining stock composition, population trends, and life history patterns, evaluating habitat restoration projects, evaluating salmon carcass nutrient restoration and enhancement projects, assessing effectiveness of mine cleanup activities and the bioaccumulation of contaminants, evaluating the effects artificial production and

supplementation have on listed fish, investigating migration timing and migratory patterns, moving fish beyond impassable barriers, evaluating fish passage facilities, screens and other bypass systems, investigating fish behaviors in reservoirs and off channel areas, evaluating salmon spawning below dams, monitoring and mitigating effects of modifying or removing a dam, assessing potential impact of a proposed hydroelectric project on fishery resources, assessing point-source discharge effects on fish communities, removing non-native fish and excluding hatchery fish to create wild fish sanctuaries, and monitoring the effects of non-lethal pinniped deterrence methods.

A third authorization for scientific research comes under the ESA's Tribal Plan Limit [50 CFR 223.204.] The Tribal Plan is consistent with the 4(d) limit for Tribal plans (50 CFR 223.204) and adequately minimizes the risk to PS Chinook salmon, HC summer-run chum salmon, and PS steelhead. The NMFS authorized the Northwest Indian Fisheries Commission's Tribal Plan for research activities in the Puget Sound region for the period January 1, 2007 to December 31, 2016. The activities entail: (1) observation activities (such as snorkeling, spawning surveys, and habitat surveys) that may harass listed fish; (2) capturing fish with traps, nets, hook and line, and backpack electrofishing equipment; (3) anesthetizing and handling fish to obtain biometric samples, mark or tag fish, and document existing marks and tags; (4) non-lethal sampling for stomach contents and tissue samples; and (5) lethal tissue sampling. Much of the proposed research activity would take place in designated PS Chinook salmon and HC summer-run chum salmon CH.

Effects of the Environmental Baseline

Aquatic species covered by the HCP are exposed to the effects of a wide variety of past and present actions in the coastal and inland waters area considered, as well as Federal projects in this area that have already undergone formal section 7 consultation, and state or private actions that are contemporaneous with this consultation. Some of the baseline conditions and activities discussed in the above section are likely to have some level of negative effect on covered species when they are in the action area.

Effects of the Action

'Effects of the action' means the direct and indirect effects of an action on the listed species or CH, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). The NMFS identified no interrelated or interdependent actions during consultation.

The sub-tidal commercial geoduck harvesting activities will increase water turbidity, increase sediment transported and deposited down-current, alter physical habitat, disturb benthic forage (food), and increase noise while the boats and dive support equipment are operating. The WDNR worked very closely with NMFS during the development of the HCP to ensure the plan includes measures to minimize these adverse effects to the maximum extent practicable.

Water Quality - Increased Turbidity

Geoduck harvest causes temporary, localized increases in turbidity levels by disturbing sediments, weakening sediment stability and changing grain size distribution (Willner 2006). Sediment particles suspended by the water jetting and clam removal settle in ways that make them susceptible to further resuspension and erosion by nearshore currents and waves. Turbidity plumes can last for hours or days, depending on currents and type of substrate. Suspended sediment and turbidity influences on fish range from beneficial to detrimental.

Elevated total suspended solids (TSS) have been reported to enhance cover conditions, reduce piscivorous fish/bird predation rates, and improve survival, but elevated TSS have also been reported to cause physiological stress, reduce growth, and adversely affect survival among fish, and can cause short-term reductions in habitat quality for some benthic species. Primary producers (diatoms and aquatic vegetation) and consumers (epibenthic organisms) can be smothered as the sediments settle back to the bottom. Short and Walton (1992, cited in WDNR 2008) found that most suspended material settles within the harvest area. Tarr (1977, cited in WDNR 2008) found no significant effect on dissolved oxygen, organic and inorganic phosphates, suspended solids, or turbidity beyond 450 feet down-current from a clam harvester.

Although fish that remain in turbid waters experience a reduction in predation from piscivorous fish and birds (Gregory and Levings 1998), chronic exposure can cause physiological stress responses that can increase maintenance energy and reduce feeding and growth (Redding et al. 1987, Lloyd et al. 1987, Servizi and Martens 1991). Of key importance in considering the detrimental effects of TSS on fish are the frequency and the duration of the exposure, the TSS concentration, the sediment size, water temperature, and the salmonid lifestages exposed. Since the harvest activities will occur in marine water, the listed salmonids that are present there are at a lifestage that can avoid turbid areas, and those that are exposed to turbid conditions do not experience the same degree of stress, growth effects, gill abrasion as young fish in freshwater.

Taking a conservative approach, NMFS believes the harvest activities will have some minor, unavoidable, short-term adverse impacts such as increased sediment resuspension and turbidity. The NMFS worked closely with the WDNR to incorporate conservation measures into the proposed action to minimize these impacts. Daily harvest activities occur between the hours of 8:00 am and 4:30 pm. Upon completion of daily geoduck harvest activities, studies show that sediment plumes dissipate within in a couple of hours (WDNR 2008). Assuming that geoduck harvest occurs on 540 to 1140 acres of seafloor annually, the Services estimate that approximately 2.16 to 4.56 acres of seafloor are disturbed during an average day's harvest. This relatively small annual harvest area may not seem significant, but using a conservative approach and considering the 50-year term of the permit, NMFS has determined that the proposed activity when taken as a whole, will have adverse effects among covered species and their CH, where designated.

The NMFS also evaluated the effects of sediment/turbidity impacts on forage fish. Forage fish rear along naturally turbid shorelines and are frequently exposed to natural freshwater sediment plumes entering Puget Sound via tributary streams (pers comm. Pentilla 2008). Turbidity levels from geoduck harvest activities are not expected to be greater than levels forage fish are exposed

to naturally during high tributary outflows. Temporary displacement of forage fish, if it occurs, is likely to be of short duration and of short horizontal or vertical distances. Fish may avoid sediment plumes, but extended movements over long distances away from the active harvest are not anticipated.

Ultimately, the displaced materials that create turbidity and suspended solids eventually settle out to rest on the bottom. Suspended sediments are dispersed down-current and form a thin film on the seafloor. Short and Walton (1992, cited in WDNR 2008) estimated that the cumulative thickness of material deposited over one area in a year of typical geoduck harvest was 0.16 inches. Goodwin (1978) and Breen and Shields (1983), found no difference in the average median sediment grain size between harvested areas and control plots.

Water Quality - Contaminants

Although Willner (2006) concluded that harvest-related sediment disturbance could release contaminants, pollutants and dissolved metals into the water column, the likelihood of this occurring under the State's geoduck fishery management plan is extremely unlikely. The Washington Department of Health certifies that all tracts meet state and Federal health standards; geoduck harvest will never occur in contaminated sediments.

Exposure to petroleum hydrocarbons released into the marine environment from oil spills and other discharge sources represents another potentially serious health threat for covered species. The likelihood of exposure to a toxic spill is small because the applicant will implement measures (section 5-2.5 of the HCP) to reduce the risk of a spill and to lessen the effects of a spill, should one occur.

Substrate Modification

According to Short and Walton (1992) commercial geoduck harvesting has "minimal impact on the physical environment and in the harvest tract and adjacent areas, including intertidal areas." Geoduck harvest leaves behind a series of depressions, where geoducks are extracted, sediments are displaced, and fine particles settle. The fate of these depressions depends on the substrate composition and tidal currents. The time for them to refill can range from several days to seven months (Goodwin 1978). Most of the material removed falls back into the hole. Larger sediment particles settle quickly and finer materials are carried further away by the current (Willner 2006). The result is a harvest hole with a larger sediment grain composition with a lower concentration of nutrients, which may affect the diversity of species that will recolonize the hole. The average harvest hole volume (Goodwin 1978, cited in WDNR 2008) is about 0.32 cubic feet, or about 2.5 gallons of displaced material.

Potential direct (e.g., removal) and indirect (e.g., suspended material) effects to eelgrass and other forage fish spawning substrate are reduced by buffers between harvest locations and eelgrass beds. Geoduck harvest is limited to depths below minus 18 feet MLLW to avoid the majority of herring and other forage fish spawning habitats. On tracts adjacent to documented herring spawning areas (eelgrass, macroalgae, or other substrate), the shoreward harvest boundary will further be restricted to waters deeper than minus 35 feet MLLW during the spawning season and deeper than minus 25 feet MLLW during the remainder of the year. Most egg deposition occurs from plus 3 feet to minus 15 feet in tidal elevation, but in some areas spawning is known to occur as deep as minus 40 to minus 60 feet (WDNR and WDFW 2001). Fifty-five of the 371 identified geoduck tracts are known to have spawning on or near them at depths greater than minus 15 feet MLLW. On these tracts, geoduck harvest allowed during the herring spawning season could preclude herring from spawning in the immediate vicinity of the divers, deposited eggs could be dislodged by divers and equipment, spawning substrate could be damaged, and eggs could be covered by suspended sediments. Even with the additional depth restrictions to address known spawning areas in or adjacent to geoduck tracts, spawning and deposited eggs below minus 35 feet MLLW could be adversely affect by harvest activities.

The WDNR incorporated conservation measures into the proposed action to minimize these adverse effects. However, short-term effects are not completely avoidable and some are still reasonably certain to occur. Even temporary effects may persist for some period of time, but due to the dynamic nature of the substrate in the action area and the small area involved, we expect take related to substrate alterations to be relatively short in duration and limited in geographic scope

Spawning and spawning habitat of other forage fish will not be affected by the project, because Pacific sand lance and surf smelt spawn generally higher than plus 5 feet in tidal elevation. Northern anchovy (*Engraulis mordax*) are pelagic schooling fish that spawn and incubate eggs in open water. Eulachon or Columbia River smelt (*Thaleichthys pacificus*) and longfin smelt (*Spirinchus thaleichthys*) spawn in freshwater gravels.

Damage and Displacement of Benthic Fauna

A recent study (Hewitt et al. 2005, cited in Willner 2006) identified that commercial geoduck harvesting may homogenize the area by breaking up structures and disturbing benthic materials, reducing the structural complexity of the area. Soft-bodied animals and tubeworms may be damaged and displaced by the water jets (Coull 1988 and Somerfield et al. 1995, cited in WDNR 2008). Willner (2006) concluded that because benthic processes and patterns are likely to affect pelagic processes and patterns (Raffaelli et al, 2003, cited in Willner 2006), removal of geoduck and incidental removal of other species may cause functional and/or feeding pattern changes in ecosystem. However, although commercial sub-tidal geoduck harvesting activities will temporarily dislocate and bury deposit feeders, suspension/deposit feeders, and suspension feeders in the action area, forage fish will not be affected because they consume planktonic (e.g., calanoid copepods), as opposed to benthic, organisms (Simenstad et al. 1977 cited in Penttila 2007, and Penttila pers. comm. April 29, 2008).

Soft-bodied benthic fauna (prey items for some covered species) may be damaged and displaced from within the substrate by the water jets. Those brought to the surface are exposed to predation by fish, crab, and other predators and scavengers. Tubeworms may be broken apart, while very small animals may be suspended and carried away by currents.

Because harvest only affects a portion of the geoduck tract, recolonization of most marine organisms from surrounding sources within and adjacent to the tract is expected to occur in a short time (a few months). After seven months, Goodwin (1978, cited in WDNR 2008)) did not find a difference in total infaunal biomass compared to un-harvested tracts.

Subadult and adult green sturgeon spend most of their time in coastal marine and estuarine water, and rely on areas of Puget Sound for migration to and from oversummering and overwintering habitat areas, and to and from spawning areas. While in the Puget Sound habitat, green sturgeon are likely to include benthic fauna in its prey base. Damage to substrate and benthic fauna that result from geoduck harvest activities may cause some degree of disruption to sturgeon prey resource, and may reduce feeding opportunities in areas of recent geoduck harvest.

Vessel Activities and Sound

Potential effects to salmon from vessel activities (engine noise and compressors) include, effects on stress levels and the immune system, temporary or permanent loss of hearing, damage to body tissues, mortality, and mortality or damage to eggs and larvae.

Sound levels generated by geoduck harvest activities are not expected to be sufficient to cause physical impacts to salmon because the most vulnerable life stages of salmon are not expected to occur within the affected area. However, it is possible that older/larger salmon could exhibit avoidance behaviors to minimize exposure to these sounds. The WDNR has incorporated conservation measures (observation, shutting-off engines, and diver recall) to avoid and minimize these effects.

Effects on Critical Habitat

Salmon Critical Habitat

Effects on CH are a subset of the habitat-based effects described immediately above. The CH analysis begins with a summary of the effects of the activities on CH PCEs. An evaluation of how changes in PCEs affect conservation value at the watershed scale and then the species-wide scale follows. The PCE of salmonid CH most relevant for the action area is described in Table 2.

Table 2. Types of sites and essential physical and biological features named as salmonid PCEs in the action area.

Site	Essential Physical and Biological Features	Species Life Stage
Nearshore marine areas	Free of obstruction, water quality and quantity, natural cover ^a , and forage ^b	Growth and maturation, survival

^a Natural cover includes shade, large wood, log jams, beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

^b Forage includes aquatic invertebrate and fish species that support growth and maturation.

Passage Conditions Free of Obstructions to Allow for Migration, Resting, and Foraging. Sub-tidal geoduck harvest is not expected to affect passage conditions.

Water Quality Sufficient to Support Growth and Development. Water quality will decrease during harvesting activities, as the result of the suspension of sediments that increase water turbidity. After harvesting, water quality will recover quickly as sediment settles out of the water column down-current.

Prey Species of Sufficient Quantity, Quality, and Availability to Support Individual Growth, Reproduction, and Development, as well as Overall Population Growth. Harvesting activities may temporarily displace forage fish and aquatic invertebrate. Displacement is likely to be of short duration and of short horizontal or vertical distances. Geoduck harvest allowed during the herring spawning season could preclude herring from spawning in the immediate vicinity of the harvesting activities, deposited eggs could be dislodged by divers and equipment, spawning substrate could be damaged, and eggs could be covered by suspended sediments.

Natural Cover. Commercial geoduck tracts commonly encompass soft sand or sand and silt substrate, outside the zone of influence of shoreline vegetation. Relatively few species of submerged aquatic vegetation or macroalgae grow in abundance on these substrates. The NMFS does not anticipate impacts to natural cover.

Relevance of Action Area Effects on Primary Constituent Elements to Designated Critical Habitat. When designating critical habitat, NMFS assembled teams to assess and rate the conservation value of freshwater, estuarine and marine areas within the geography of the rangewide designation of CH for PS Chinook salmon and HC Summer-run chum salmon. The nearshore marine area includes the zone from extreme high water out to a depth of 30 meters and adjacent to watersheds occupied by these ESUs. This area generally encompasses photic zone habitats supporting plant cover (e.g., eelgrass and kelp) important for rearing, migrating, and maturing Chinook salmon and chum salmon and their prey. The teams concluded that habitat areas in all 19 nearshore zones of Puget Sound (including areas adjacent to islands), Hood Canal, and the Strait of Juan de Fuca (to the mouth of the Elwha River) warranted a high rating for conservation value to the ESUs. These habitat areas are found along approximately 2,376 miles of shoreline within the range of these ESUs.

As summarized above, the proposed sub-tidal commercial geoduck fishery will have limited short-term effects to the CH marine nearshore PCE in the action area. The temporal and spatial limitation of decreased function effectively diminishes the importance of these changes relative to their level of function in the action area. The adverse effects to the PCE are expected to be minor and persist for a short time. Upon completion of daily geoduck harvest activities, studies show that sediment plumes dissipate within in a couple of hours (WDNR 2008). Assuming that geoduck harvest occurs on 540 to 1140 acres per year in the marine nearshore, the Services estimate that approximately 2.16 to 4.56 acres of seafloor are disturbed during an average day's harvest. The PCE will recover its function quickly, such that the proposed action neither diminishes the conservation value of CH at the specific harvest locations, nor influences the conservation role of CH in the action area. Furthermore, the effects in the action area would not combine synergistically with any past or ongoing actions to influence the conservation role of those watersheds. Therefore, the action area changes will not influence the conservation value of CH at the designation scale.

Proposed Critical Habitat for Southern Distinct Population Segment Green Sturgeon

See, Conference Opinion, below.

Cumulative Effects

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur (50CFR 402.02). Cumulative effects that reduce the ability of a listed species to meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of a designated CH. The present consultation was conducted at a large scale, covering Puget Sound, Hood Canal, and the Straits of Juan de Fuca. For such a large scale consultation, actions considered within the cumulative effects definition is somewhat coarse grained. For this consultation, NMFS identified two general groups of actions to conduct the cumulative effects analysis. These groups include the environmental results of climate change and tribal, state, and local government actions as related to salmon recovery planning.

Climate and Sea Level Change

One of the likely cumulative effects on salmon and their associated aquatic habitat throughout the Puget Sound is ongoing and future climate change. Fluctuations in climate and sea level play a role in determining the suitability of Puget Sound aquatic habitats through their influence on circulation and water properties. Given the increasing certainty that climate change is occurring and is accelerating, climate conditions in the future will not resemble those in the past. The following discussion is based on "Uncertain Future: Climate Change and its Effects on Puget Sound", prepared for the Puget Sound Action Team by the Climate Impacts Group (Snover et al. 2005).

Climate warming will shape the Puget Sound ecosystem from both the bottom-up (via impacts on phytoplankton and other marine plants that comprise the base of the food web) and the top-

down (via direct impacts on top predators such as salmon and marine mammals). Taken together, these changes can be dramatic. In the coastal ocean, for example, broad reorganizations of the marine ecosystem have been associated with the subtle decade-to-decade changes in climate associated with the Pacific Decadal Oscillation (PDO). This has resulted in salmon in the coastal waters of Washington, Oregon, California, British Columbia and Alaska returning in relatively large or small numbers, depending on the phase of the PDO.

Future climate-related changes in the environment will be accompanied by changes in other factors such as human activities that are also very difficult to predict. The ultimate impact on each individual species that calls Puget Sound home will depend on how each of these changes reverberates across the food web, how each change interacts with every other change, and on the ecosystem's ability to adapt to a rapidly changing chain of estuarine and oceanic conditions.

Fish and other animals will be affected by climate change in many ways—directly via changes in habitat and indirectly via changes in the availability of food. Temperature is a dominant controlling factor of growth rates of most cold-blooded marine organisms. Increasing water temperatures can increase growth rates, providing many benefits, but only to a certain point. Temperatures that are too warm can stress an organism, causing decreased growth and survival and weakened immune systems, which have been linked to disease epidemics in marine populations (e.g., sea urchins) and seabirds and disease-related marine mammal strandings.

The consequences of warmer temperatures may be especially severe for species unable to seek out cooler temperatures, especially at vulnerable life stages. For this reason, increasing water temperatures above the optimum level for stationary shellfish, for example, could have more severe impacts than increasing water temperatures above the optimum level for salmon that could presumably move to pockets of cooler water.

The Shared Strategy for Puget Sound

The Puget Sound community has a rich history of success in addressing natural resource challenges, and the people of the Puget Sound region are committed to protect and restore the land and waters that define their quality of life. This was demonstrated by the development of The Shared Strategy for Puget Sound, a collaborative initiative built on the foundation of local efforts, supported by leaders from all levels of government and community sectors, and guided by the Puget Sound Technical Recovery Team's regional recovery criteria. Despite the fact that warmer temperatures are predicted for Puget Sound and over a million more people are projected to live in Puget Sound in the next 15 years and, the Shared Strategy (Shared Strategy Development Committee, January 19, 2007) aspires to increase salmon abundance by twenty percent.

To accomplish that goal the Shared Strategy outlines the following strategies for the next ten years:

- Gaining a better understanding of how protection programs protect identified key habitats and processes into the future;

- Specifically understanding the results that can be expected from existing land-use programs and identifying and resolving gaps;
- Encouraging management at the scale of the processes that support key habitats (sub-basin, drift cell, etc.);
- Protecting water quality in areas susceptible to degradation and where there is high population use;
- Integrating information generated through the salmon recovery planning process into oil response plans, Critical Area Ordinances, Shoreline Master Programs and instream flow updates;
- Ensuring an adequate quantity of freshwater exists to support nearshore and marine systems; and
- Containing existing invasive species and preventing introductions of new species.

Future tribal, state and local government actions will likely to be in the form of legislation, administrative rules, or policy initiatives and fishing permits. These actions may include changes in policy and increases and decreases in the types of activities currently seen in the action area, including changes in fishery management, land use regulations, vessel traffic, dredging and disposal, submarine cable/pipeline installation and repair, oil and gas exploration, pollutant discharge, oil spill prevention and response, military operations, research, or designation of marine protected areas, any of which could impact listed species or their habitat.

Conclusion

After reviewing the status of the listed species and their designated CHs, the environmental baseline for the action areas, the effects of the proposed actions, and cumulative effects, NMFS concludes that the action, as proposed, is not likely to contribute to or worsen extant risk factors affecting the species considered in this consultation. The species addressed in this consultation, although currently well below historic levels, are distributed widely enough and are presently at high enough abundance levels that any short-term adverse effects resulting from commercial subtidal geoduck harvest activities will not have an observable effect on the spatial structure, productivity, abundance, and diversity of PS Chinook salmon, HC summer-run chum salmon, and PS steelhead, or the reproduction, numbers, or distribution of Pacific herring, coho salmon, pink salmon, pinto abalone, or Olympia oysters. Therefore, the combined effects on covered species is unlikely to be of a magnitude, extent, duration, or frequency that would reach a level that would reduce appreciably the likelihood for survival and recovery for any of the subject ESUs. Therefore, the proposed action will not jeopardize the continued existence of these species.

Negative effects to the PCE (i.e., growth, maturation, and survival)) will occur as a result of implementing these actions, but not at a scale or in a manner that impinges conservation values. Also, the conservation measures and design criteria proposed by the WDNR as part of this action

ensure that these effects remain minor. Furthermore, the proposed action will not influence the conservation role of the designated CH considered in this consultation. Therefore, the proposed action will not destroy or adversely modify designated CH. These conclusions are based on the following considerations.

Reinitiation of Consultation

Consultation must be reinitiated if the extent of taking specified in the Incidental Take Statement is exceeded, or is expected to be exceeded; new information reveals effects of the action may affect listed species in a way not previously considered; the action is modified in a way that causes an effect on listed species that was not previously considered; or, a new species is listed or habitat is designated that may be affected by the action (50 CFR 402.16).

In the event that after Permit issuance, unforeseen circumstances arise or new information becomes available, and such circumstances or information lead NMFS to believe that the effects of the permittee's activities on a covered species will be sufficiently more severe than originally analyzed under the present ESA section 7 consultation, such that a covered species could be jeopardized by the covered activities, NMFS shall proceed as follows. First, it shall utilize its resources to conserve the species. Second, it shall work with the permittee to voluntarily reduce the effects of covered activities on the species. Third, NMFS shall reinitiate section 7 consultation on the Permit and shall document its analysis of the new effects in a biological opinion. Conservation efforts undertaken by NMFS or the permittee shall be considered in the analysis, as well as any information provided by the permittee regarding the probability of jeopardy. If reinitiation of consultation results in a finding that covered activities are likely to jeopardize the species, then NMFS will: (1) consult with the permittee to identify a reasonable and prudent alternative (RPA) and modify the Plan accordingly; or (2) remove that species from the Permit, after which any prohibitions against take would apply.

Incidental Take Statement

Section 9(a) (1) of the ESA prohibits the taking of endangered species without a specific permit or exemption. Protective regulations adopted pursuant to section 4(d) extend the prohibition to threatened species. Among other things, an action that harms a listed species or harms by altering habitat in a way that significantly impairs its essential behavioral patterns is a taking (50 CFR 222.102). Incidental take refers to takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(o) (2) exempts any taking that meets the terms and conditions of a written incidental take statement from the taking prohibition.

The proposed action, issuing an ITP, does not cause incidental take; it authorizes the incidental take occurring during other activities conducted according to the provisions of the HCP. The ITP itself does not permit the underlying activities that cause incidental take so much as provide an authorization that lifts the prohibition against take in ESA section 9 (and extended to threatened species through ESA section 4(d)).

The incidental take that is the subject of the proposed permit and addressed in the HCP occurs mostly in the form of harm, where habitat modification, despite minimization and mitigation in

the HCP, will impair normal behavior patterns of listed salmonids to an extent that actually injures or kills them. The activities that cause the habitat modification and the extent of anticipated habitat modification are summarized below.

Amount of Extent of Anticipated Take

The proposed action is the issuance of an ITP authorizing the incidental take of covered listed species. The anticipated take is reasonably certain to occur as the result of some extent of co-occurrence of the covered animals and the effects of the underlying activities described in the HCP. Although not all instances of exposure will result in take, the modification of habitat by the underlying activities will likely result in some level of changed, even impaired normal behavioral patterns for those animals, leading to their injury or even death (“harm” 50 CFR 222.102).

For highly mobile animals like salmon and steelhead that reside in dynamic habitats in which the functional processes that create and maintain habitat are fluid and continuous, estimating the amount of anticipated take of individuals from habitat modification is difficult, if not impossible. In parts, if not all of the action area, it would be impossible to discern the number of animals injured or killed as the result of habitat modified during implementation of the WDNR’s commercial geoduck fishery program, and separately identify that number from the take caused by habitat modified from any of the habitat-affecting actions identified in the environmental baseline and in cumulative effects. The problem of estimating the amount of anticipated take is further complicated, if not rendered impossible, when the scale of the proposed action is considered. In instances where the number of individual animals to be taken cannot be reasonably estimated, NMFS relies on the relationship between fish and their habitat (in the form of the extent of habitat likely to be modified under the proposed action) to identify indicators of the extent of take. Geoduck harvest activities occurring on approximately 40,000 acres of commercially available geoduck tracts in Puget Sound might cause take at any given point of time at a harvest location, in the 50 years following ITP issuance.

Take of protected PS Chinook salmon and HC Summer-run chum salmon will occur in the form of “harm” from habitat modified during geoduck harvest activities. Because the relationship between habitat conditions and the distribution and abundance of covered species wherever these activities will occur over the permit term is unpredictable, a specific number of individuals taken cannot be practically estimated, as mentioned above. In such circumstances, NMFS uses the predicted extent of habitat modification to describe the extent of take. The prediction is based on the general relationship between habitat function and the extent to which normal behaviors can be expressed relative to habitat function. Thus, the extent of incidental take anticipated and exempted in this incidental take statement is the amount of geoduck harvest-related habitat modification that will occur as prescribed in the HCP. Reinitiation of formal consultation is triggered when habitat modifications exceed those evaluated in this Opinion.

Take in the form of harm will result from the reduced function of processes that create and maintain habitat meeting the ecological needs of the covered species. Harm will accrue from the environmental effects of geoduck harvest activities in the areas of Puget Sound described as the action area for the foregoing Opinion. Specifically, take will occur in the form of:

(1) harm from the damage and displacement of benthic fauna -- expected to be short in duration and limited to less than 300 acres per year.

(2) harm from substrate alterations, including sediment composition and harvest holes is limited in geographic scope to less than 300 acres per year; and

(3) harm from increased turbidity will occur within a zone of 450 feet down current of the specific harvest sites, and will persist for a period of hours at each site.

Until protective regulations under section 4(d) of the ESA specific to PS steelhead and the Southern Resident DPS of green sturgeon have been promulgated, "take" of these listed species will not occur. At such time as protective regulations identifying causes or sources of take are promulgated, the above described extent of take will serve as the limit of anticipated take for these species as well.

If during the period of this HCP other species described in this document become listed and protective regulations are promulgated, the above described extent of take will serve as the limit of anticipated take for those species also.

Reasonable and Prudent Measures

The applicant will minimize the extent of incidental take by implementing the following Term and Condition.

Term and Condition

All conservation measures described in the final HCP (WDNR 2008), together with the associated section 10(a)(1)(B) permit issued with respect to the HCP, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take Statement. Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply. If the permittee fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) permit and section 7(o)(2) may lapse. The amount or extent of incidental take anticipated under the proposed HCP, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the HCP and its accompanying section 10(a)(1)(B) permit.

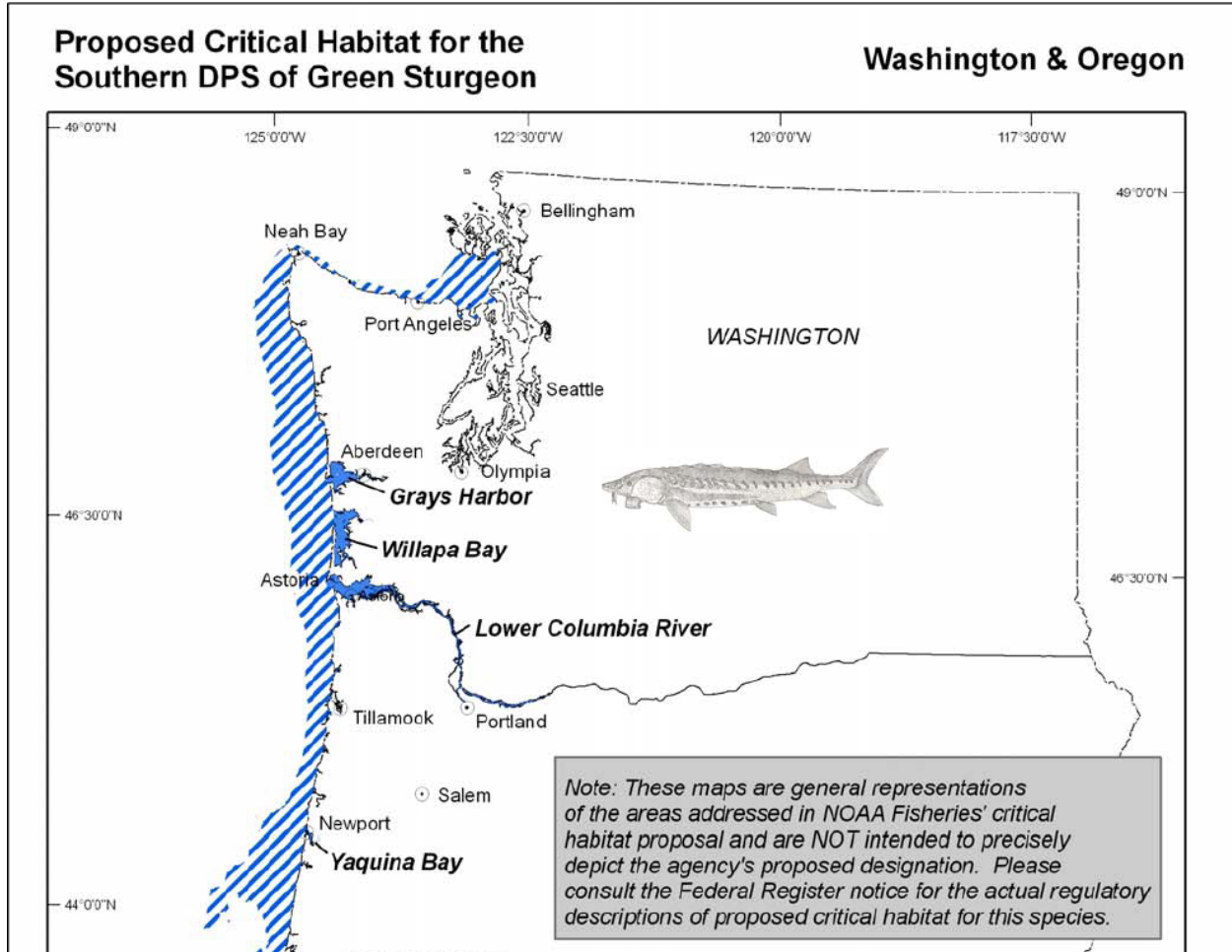
NOTICE. If a sick, injured or dead specimen of a threatened or endangered species is found in the project area, the finder must notify NMFS through the contact number identified in the Incidental Take Permit number 1608 provision 11, or through NMFS Office of Law Enforcement at 1-800-853-1964, and follow any instructions. If the proposed action may worsen the fish's condition before NMFS can be contacted, the

finder should attempt to move the fish to a suitable location near the capture site while keeping the fish in the water and reducing its stress as much as possible. Do not disturb the fish after it has been moved. If the fish is dead or dies while being captured or moved, report the following information: (1) The NMFS consultation number (found on the top left of the transmittal letter for this Opinion), (2) the date, time, and location of discovery, (3) a brief description of circumstances and any information that may be relevant to the cause of death, and (4) photographs of the fish and where it was found. The NMFS also suggests that the finder coordinate with local biologists to recover any tags or other relevant research information. If the specimen is not needed by local biologists for tag recovery or by NMFS for analysis, the specimen should be returned to the water in which it was found, or otherwise discarded.

Conference Opinion on Green Sturgeon Proposed Critical Habitat

The NMFS proposed designating CH for the Southern DPS of North American green sturgeon on September 8, 2008 (73 FR 52084). The proposed area includes coastal U.S. marine waters within 110 meters depth in Washington State, including the Strait of Juan de Fuca, to its United States boundary, and estuaries in Puget Sound. Figure 3, below, depicts the marine and estuarine areas within Washington State that are proposed for CH designation.

Figure 3.



Patterns of telemetry data suggest that Southern DPS fish use oversummering grounds in coastal bays and estuaries along northern California, Oregon, and Washington and overwintering grounds between Vancouver Island, BC, and southeast Alaska. The best available data indicate coastal marine waters are important for seasonal migrations from southern California to Alaska to reach distant foraging and aggregation areas. Green sturgeon occur primarily within the 110 meter depth bathymetry. Green sturgeon tagged in the Rogue River and tracked in marine waters typically occupied the water column at 40–70 m depth. According to the HCP, geoduck tracts are characterized by (1) depths of water from 18 to 70 feet; (2) mud-sand and sand substrate; (3) the absence of eelgrass, herring spawning areas or large areas of rocky substrate. Some of the geoduck tracts are located offshore from streams and rivers in which green sturgeon have been infrequently observed (Dungeness, Elwha, and Discovery Bay).

Other WDNR background documents provide additional characterizations of observed biota and typical sediment grain size. While 83 biota species or groups are noted for the Strait of Juan de

Fuca management area, including 13 types of fish, green sturgeon have never been reported during dozens of observational dives.

The listing notice indicates that green sturgeon prey resources likely include species similar to those fed on by green sturgeon in bays and estuaries (*e.g.*, burrowing ghost shrimp, mud shrimp, crangonid shrimp, amphipods, isopods, Dungeness crab), and these prey resources are known to occur within the marine specific areas. Activities that can affect these prey resources include: Commercial shipping and activities generating point source pollution (subject to National Pollutant Discharge Elimination System requirements) and non-point source pollution that can discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that can bury prey resources; and bottom trawl fisheries that can disturb the bottom (but may result in beneficial or adverse effects on prey resources for green sturgeon). There are two items listed as observed biota at geoduck tracts that could be prey for sturgeon, namely sand lance and annelid worms. These biota are common as infauna and near benthic fauna across a wide range of habitat conditions in the Strait of Juan de Fuca. Average grain sizes of substrate in geoduck tracts in another management area in Puget Sound was eight percent fine sediment (silts and clays) with 92 percent coarse or fine sand. These percentages of silt appear low for preferred sturgeon foraging. Therefore, geoduck tracts typically contain some but not all of the preferred features that would be ranked as high conservation value for the PCEs.

The depths of geoduck tracts appears to contribute to low conservation value for migratory use of proposed green sturgeon CH, while food resources at geoduck tracts could be used by green sturgeon at a low to moderate level. There is no indication that water quality of proposed green sturgeon CH would be adversely affected by commercial geoduck harvest.

In light of all the biological information about the potential overlap of commercial geoduck tracts and the PCEs for proposed green sturgeon CH, NMFS has determined that the proposed action would not adversely affect proposed green sturgeon CH. Potential effects are insignificant because migratory habitat is deeper than commercial geoduck harvest tracts. In addition, food resources for green sturgeon on commercial geoduck harvest tracts would be available to some degree, with preferred foraging habitats expected to be siltier substrates than provided by typical commercial geoduck harvest tracts.

Endangered Species Act section 10(a)(2)(B) Statement of Findings

Section 10(a)(2)(B) Issuance Considerations. In determining whether to issue a permit, the Assistant Administrator will consider the following:

- (i) *The status of the affected species or stocks.* The NMFS evaluated the status of all species to be included in the HCP. The status of covered listed and unlisted species is described at status section of the Opinion, above. The baseline conditions of the action area covered by the HCP were also considered, and the evaluation can be found at environmental baseline section of the Opinion.

- (ii) *The potential severity of direct, indirect, and cumulative impacts on the species or stocks and habitat as a result of the proposed activity.* The Opinion includes NMFS' analysis of effects to species that are covered by the HCP, as well as an analysis of effects to the designated CH of species currently listed under the ESA. The effects analysis evaluated the direct and indirect effects of activities covered by the HCP, (see Biological Opinion Effects of the Action section). The NMFS also evaluated the cumulative effects from other non-Federal activities that are reasonably likely to occur in the action area.
- (iii) *The availability of effective monitoring techniques.* The WDNR maintains a commercial dive team whose primary responsibility is the daily on-water management, enforcement, and compliance of the tract harvest. The WDNR compliance boat will be on the tract at all times during harvest. Enforcement staff will ensure that WDFW laws and regulations, WDNR contract conditions, and the conservation measures of the HCP are followed. The compliance boat contains spill containment materials and can respond to fuel spills and other emergencies. Compliance staff will also monitor the condition and operation of harvest vessels.

The commercial geoduck fishery generates revenue through the public auction of harvest quotas. The amount fluctuates, but is in the range of \$6 million to \$10 million annually. Beyond funding the management of the fishery, this revenue pays for other programs and projects related to state-owned aquatic lands. The Aquatic Lands Enhancement Account (ALEA) receives one-half of the revenue and the Resource Management Cost Account (RMCA)-Aquatics account receives the other half. This revenue is sufficient to support the management and monitoring of the fishery, scientific studies related to geoduck harvest, and other programs and activities. The annual amount dedicated to the management and monitoring of the geoduck fishery is approximately \$850,000 to \$1.2 million.

Therefore, effective monitoring appears to be securely funded for the 50 year term of the HCP. Monitoring of HCP implementation and the effectiveness of the HCP prescriptions is a critical feature of this HCP. Monitoring reports will be completed and submitted annually to the Services according to the schedule described in Section 5-5.7 of the HCP.

- (iv) *The use of the best available technology for minimizing or mitigating impacts.* The prescriptions established in this HCP represent the most recent developments in science and technology in minimizing and mitigating impacts to aquatic habitats and species. Further, revenue generated through the public auction of harvest quota will be used, in part, to fund other aquatic conservation programs, including the control of invasive species, establishing aquatic reserves, geoduck research, aquatic lands acquisition, and salmon enhancement programs.
- (v) *The views of the public, scientists, and other interested parties knowledgeable of the species or stocks or other matters related to the application.* The NMFS formally announced the availability of the HCP for review through a Notice of Availability (NOA) in the Federal Register on September 17, 2007 (72 FR 52860). This NOA announced a 30-day public comment period, during which other agencies, Tribes, and the public were invited to provide comments and suggestions regarding issues in the HCP. The NMFS sent letters to the Tribes

requesting their cooperation in the review of the HCP in May 2007. During the review period announced in the NOA two comment letters were received.

One set of comments questioned the Geoduck HCP's conservation strategy requiring certain shoreward harvest boundaries designed to protect herring spawning and macroalgae habitat. Specifically, the commenter suggested that the required harvest buffers provide little additional protection to herring spawning potential, while removing a substantial portion of the commercial geoduck biomass from the annual TAC.

The second set of comments recommended shortening the permit period to five years, requiring work windows to protect covered species and forage fish from noise and sediment impacts, establishing contingency funding mechanisms for downturns in geoduck wholesale prices, restricting nighttime lighting on offshore boats, and prohibiting geoduck harvest by harvesters involved in un-permitted shellfish activities.

The NMFS did not prepare responses to these comments. Instead, NMFS has addressed them in the Opinion and Findings.

The State has undertaken many State Environmental Policy Act (SEPA) analyses on individual geoduck harvest tracts as well as the geoduck harvest program. The SEPA analyses are subject to public comments, and there has been no pattern of controversy associated with these geoduck harvest actions. Therefore, it is anticipated that the proposed action under review would not be controversial because it is similar in scope, methods, and geographic area to actions previously approved under ESA Section 7 and SEPA.

Section 10(a)(2)(B) Issuance Findings. Having considered the above, NMFS must make certain findings under section 10(a)(2)(b) of the ESA, with regard to the adequacy of the HCP meeting the statutory and regulatory requirements for an ITP under section 10(a)(1)(B) of the ESA and 50 CFR section 222.307. To issue the permit, NMFS must find that:

(i) *The taking will be incidental.* The NMFS concluded in its Opinion that take in the form of harm and harassment is likely to occur incidentally to the geoduck harvest and related activities covered by the HCP. Harm is the significant modification of habitat that impairs the listed species' behavior patterns (breeding, feeding, and sheltering) in such a way as to cause injury or death. Geoduck harvest activities will affect fish habitat, as described in the effects analysis above, but are not intended to kill, injure, or harm fish. Thus, NMFS finds that any take that occurs is incidental to the activities authorized under the HCP.

(ii) *The applicant will, to the maximum extent practicable, monitor, minimize, and mitigate the impacts of such taking.* The NMFS finds that the State and harvesters to whom the Permit coverage extends will minimize and mitigate the impacts of take of the covered species to the maximum extent practicable. Under the provisions of the HCP, the impacts of take will be minimized, mitigated, and monitored in accordance with the requirements of the Permit through the following measures:

- (a) Avoiding potential interactions between Southern Resident killer whales, people and harvest activities by invoking the “diver recall” system and by turning off vessel engines when Southern Resident killer whales are sighted near the harvest tract.
- (b) Minimizing possible disruptions to covered species from noise related to geoduck harvest by limiting surface noise levels.
- (c) Protecting the nearshore prey base of species covered in this HCP establishing buffers adjacent to eelgrass beds and by avoiding disturbing herring during spawning times.
- (d) Minimizing impacts to covered species caused by disturbances to benthic sediment and benthic flora and fauna by limiting harvest areas and enforcing harvesting agreements.
- (e) Protecting covered species from direct mortality associated with toxic spills implementing a fuel spill risk management program.
- (f) Ensuring funding to fully implement the Geoduck HCP and the Permit. (described below).

The NMFS views the HCP, like most other habitat-based conservation plans, as having integrated its minimization and mitigation measures with the other activities for which the applicant seeks incidental take authorization. In other words, the environmental effects of covered activities are, for the most part, not identifiable separately from the effects of measures intended to minimize those effects. A site-scale example of such integration is the designation of protective buffers of around certain ecological features (e.g., eelgrass) used by Covered Species. Incidental take does not result from the leaving of a buffer. Instead, leaving the buffer minimizes the effects within the landscape in which the harvest occurs. However, it is important to remember that the assessment of whether this criterion for issuance of an ITP has been met is conducted for the plan as a whole, not for individual activities or measures.

In consideration of all the above facts, NMFS finds that: (a) the mitigation is commensurate with the impacts; (b) the HCP is consistent with the long-term survival and recovery of Covered Species (also see (iii) below); and (c) the HCP minimizes and mitigates the effects of take to the maximum extent practicable. These findings are based on the fact that benefits to the species will be demonstrable, especially compared to existing conditions or those conditions expected to occur absent the FPHCP.

(iii) *The taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.* The NMFS, using the best available science, has evaluated the anticipated extent of take that will be incidental to the practices covered by the HCP, throughout the term of the Geoduck HCP (summarized in Incidental Take Statement, above), and has concluded that the incidental takings likely to occur will not appreciably reduce the likelihood of survival and recovery. This conclusion can be found in the conclusion section of the Opinion. The section

7(a)(2) “no jeopardy” standard is identical to the section 10(a)(2)(B) “no jeopardy” standard.

(iv) *The applicant has amended the conservation plan to include any measures (not originally proposed by the applicant) that the Assistant Administrator determines are necessary or appropriate.* The NMFS identified no additional conservation. The Geoduck HCP, and ITP incorporate all elements determined by NMFS to be necessary for approval of the HCP and issuance of the permit.

(v) *There are adequate assurances that the conservation plan will be funded and implemented, including any measures required by the Assistant Administrator.* The NMFS finds that the Permittee will ensure funding adequate to implement the HCP. The following mechanisms were considered that demonstrate the State has the ability and commitment to fully implement the Geoduck HCP and the Permit:

The WDNR is committed to funding the Geoduck HCP conservation strategy. The source of funds to implement the HCP will come from revenue generated by the commercial geoduck fishery that is appropriated and allotted to the geoduck fishery program from the State’s RMCA-Aquatics account.

The commercial geoduck fishery generates revenue through the public auction of harvest quotas. The amount fluctuates, but is in the range of \$6 to \$10 million annually. Beyond funding the management of the fishery, this revenue pays for other aspects of the management and protection of state-owned aquatic lands and resources. Half the revenue goes to programs and projects paid for by the Aquatic Lands Enhancement Account (ALEA). The other half goes into the RMCA-Aquatics account.

The geoduck fishery has been able to generate revenue to support the management of the fishery, fund scientific studies related to geoduck harvest, and fund other programs and activities. The annual amount of revenue dedicated to management of the geoduck fishery fluctuates, but in recent years has been between \$850,000 and \$1.2 million (Table 3). Funding of the HCP is assured because the conservation measures will be integrated into the fishery through existing management mechanisms, and essentially already are.

Table 3. Amount budgeted for management of the geoduck wild stock fishery.

Biennium	Fiscal Year *	Annual Amount
2001-2003	2002	\$ 846,260
	2003	870,600
2003-2005	2004	1,080,500
	2005	1,107,100
2005-2007	2006	1,160,700
	2007	1,193,100

* Fiscal years for Washington State government begin on July 1 and end on June 30. For example, FY 2006 runs July 1, 2005 through June 30, 2006.

Implementation of the Geoduck HCP and its Conservation Objectives and Strategies will be funded through the annual RMCA-Aquatics allotment to WDNR for management of the

geoduck fishery program. No additional funds are needed to implement the HCP because mechanisms are in place within the existing management structure to implement the plan. Specific costs of implementing the objectives and strategies in the HCP cannot be separated from the costs of managing the geoduck fishery.

Administration of the Fishery Program. Administering the program includes holding auctions for harvest quotas at a level consistent with that described in HCP Section 5-2.2. The program includes establishing contractual harvest agreements with purchasers that incorporate necessary restrictions to meet HCP requirements.

Biennial Interagency Agreements with the Washington Department of Fish and Wildlife (WDFW). These agreements are described in HCP Sections 3-1.2, 5-2.1 and Appendix D. Through these agreements, tract-specific Environmental Assessments, eelgrass surveys and tract resource inventories will be carried out by WDFW through funding from the WDNR.

The WDNR will fund the interagency agreements that require Environmental Assessments, eelgrass surveys and tract resource inventories to be performed.

Harvest Methods. No new funding is needed to continue using the harvest method established in WAC 220-52-019(2a).

Harvest Activity Restrictions. The WDNR will fund management of the fishery, which includes establishing general operating restrictions, establishing tract boundaries, avoidance measures for Southern Resident killer whales, and noise restrictions. Restrictions needed to meet the requirements of the HCP will be incorporated into the management of individual tracts.

Fuel Spill Risk Management. These practices will occur within the existing funded program. The WDNR will fund general administration of the fishery, including funding for compliance staff that will manage fuel spill risk on the tracts.

Harvest Compliance. The WDNR's compliance staff and their duties are funded as part of the geoduck fishery program.

MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for Pacific groundfish (PFMC 1998a), coastal pelagic species (PFMC 1998b), and Pacific salmon (PFMC 1999 and 2000). The proposed action and covered area are detailed above in the Introduction Section of this document. The WDNR is the applicant for the ITP. The covered area includes habitats designated as EFH for various life-history stages of Pacific salmon, groundfish, and coastal pelagic species (Table 4). In addition, the covered activities will occur in, or adjacent to, habitats designated as Habitat Areas of Particular Concern (HAPC) for Pacific groundfish (PFMC 2005). These HAPCs include estuaries, canopy kelp, seagrasses, rocky reefs, and the coastal waters and substrates of Washington from the mean higher high water line seaward to the three nautical mile boundary of the territorial sea.

Based on information provided in the HCP and the analysis of effects presented in the Effects of the Action section of this document, commercial subtidal geoduck harvest may result in adverse impacts to a variety of habitat parameters important to salmon, groundfish and coastal pelagic species.

The HCP identifies anticipated impacts to the EFH for Pacific salmon, groundfish, and coastal pelagic species that are likely to result from the proposed activities and the measures that are necessary and appropriate to minimize those impacts. These effects include sediment re-suspension and habitat modification.

The NMFS determined that the action will have adverse effects on EFH for Pacific salmon, groundfish, and coastal pelagic species due to (a) the short-term degradation of water quality (turbidity) from sediment re-suspension caused by hand-operated water jets; and (b) the short-term modification of the substrate and associated flora and fauna caused by breaking up structures and disturbing benthic materials.

All of these effects influence the ability of affected areas to support spawning, incubation, larval development, juvenile growth and mobility, and adult mobility. For a more detailed description and analysis of these effects, see Effects of the Action section of this document.

Essential Fish Habitat Conservation Recommendations

The conservation measures included in the HCP as part of the proposed activities are adequate to avoid, minimize, or otherwise offset the potential adverse effects, described above, from these activities to designated EFH for Pacific salmon, groundfish and coastal pelagic species. The NMFS understands that the WDNR intends to implement these conservation measures to minimize potential adverse effects to the maximum extent practicable. Consequently, NMFS has no additional conservation recommendations to make at this time.

Statutory Response Requirement

Federal agencies are required to provide a detailed written response to NMFS' EFH conservation recommendations within 30 days of receipt of these recommendations (50 CFR 600.920(j)(1)). However, since NMFS did not provide conservation recommendations for this action, a written response to this consultation is not necessary.

Supplemental Consultation

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

Table 4. Fish species with designated Essential Fish Habitat in the Puget Sound non-rocky shelf composite.

Groundfish Species	rougeye rockfish <i>S. aleutianus</i>	rock sole <i>Lepidopsetta bilineata</i>
spiny dogfish <i>Squalus acanthias</i>	sharpchin rockfish <i>S. zacentrus</i>	sand sole <i>Psettichthys melanostictus</i>
big skate <i>Raja binoculata</i>	splitnose rockfish <i>S. diploproa</i>	starry flounder <i>Platichthys stellatus</i>
California skate <i>R. inornata</i>	stripetail rockfish <i>S. saxicola</i>	
longnose skate <i>R. rhina</i>	vermilion rockfish <i>S. miniatus</i>	
ratfish <i>Hydrolagus colliei</i>	yellowtail rockfish <i>S. flavidus</i>	Coastal Pelagic Species
lingcod <i>Ophiodon elongatus</i>	shortspine thornyhead <i>Sebastolobus alascanus</i>	anchovy <i>Engraulis mordax</i>
Pacific cod <i>Gadus macrocephalus</i>	arrowtooth flounder <i>Atheresthes stomias</i>	Pacific sardine <i>Sardinops sagax</i>
sablefish <i>Anoplopoma fimbria</i>	butter sole <i>Isopsetta isolepis</i>	Pacific mackerel <i>Scomber japonicus</i>
black rockfish <i>Sebastes melanops</i>	curlfin sole <i>Pleuronichthys decurrens</i>	market squid <i>Loligo opalescens</i>
bocaccio <i>S. paucispinis</i>	Dover sole <i>Microstomus pacificus</i>	
darkblotched rockfish <i>S. crameri</i>	English sole <i>Parophrys vetulus</i>	
greenstriped rockfish <i>S. elongatus</i>	flathead sole <i>Hippoglossoides elassodon</i>	Pacific Salmon Species
Pacific Ocean perch <i>S. alutus</i>	Pacific sanddab <i>Citharichthys sordidus</i>	chinook salmon <i>Oncorhynchus tshawytscha</i>
redbanded rockfish <i>S. babcocki</i>	petrale sole <i>Eopsetta jordani</i>	coho salmon <i>O. kisutch</i>
rosethorn rockfish <i>S. helvomaculatus</i>	rex sole <i>Glyptocephalus zachirus</i>	Puget Sound pink salmon <i>O. gorbuscha</i>

DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the Opinion addresses these DQA components, documents compliance with the Data Quality Act, and certifies that this Opinion has undergone pre-dissemination review.

Utility: Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The information used in the underlying consultation represents the best available scientific and commercial information and has been improved through interaction with the State agencies and Indian Tribes participating in the underlying action. The intended user is the WDNR and citizens of the State of Washington interested in the conservation of threatened and endangered species.

Individual copies were provided to the above-listed entity. This consultation will be posted on the NMFS Northwest Region website (<http://www.nwr.noaa.gov>). The format and naming adheres to conventional standards for style.

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

Objectivity: Information Product Category: Natural Resource Plan.

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding Essential Fish Habitat, 50 CFR 600.920(j).

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

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

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

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Appendix A. Southern Resident Killer Whales

During the course of the development of the HCP, NMFS and the WDNR discussed technical issues related to effects of the underlying fishery practices on the Southern Resident killer whale. Through this discussion, the WDNR developed practices they incorporated in the HCP to avoid affects on Southern Resident killer whales. Based on the WDNR's commitment to these practices, and NMFS' analysis conducted during the subsequent ESA section 7 consultation on the proposed issuance of the requested ITP, NMFS was able to determine that the proposed action is not likely to adversely affect Southern Resident killer whales. The NMFS provides the following information describing that determination.

Species Determination:

The Southern Resident killer whale DPS composed of J, K, and L pods was listed as endangered under the ESA on November 18, 2005 (70 FR 69903). The final rule listing Southern Resident killer whales as endangered identified several potential factors that may have caused their decline or may be limiting recovery. These are: quantity and quality of prey, toxic chemicals which accumulate in top predators, and disturbance from sound and vessels. The rule also identified oil spills as a potential risk factor for this species. The final recovery plan for Southern Residents (January 24, 2008, 73 FR 4176) includes more information. The potential effects of the proposed geoduck harvest activities relate to disturbance from sound and vessels and quantity of salmonid prey.

Southern Residents spend considerable time in the Georgia Basin, with concentrated activity in the inland waters of Washington State around the San Juan Islands from May to September, with movement extending south into Puget Sound in early autumn. Pods also make frequent trips to the outer coast of Washington State during this season. Although less is known about their distribution during winter and early spring, they less predictably occur within inland waters, and have been sighted in coastal waters off central California, Oregon, and Washington, as far north as the Queen Charlotte Islands in British Columbia. While these are seasonal patterns, Southern Resident killer whales have the potential to occur anywhere in the action area (inland waters of Washington State) across the year.

Vessel activity associated with geoduck harvest will not significantly affect Southern Resident killer whales because the vessels used during harvest activities do not target whales and should be easily detected by passing whales. Vessel strikes are extremely unlikely and therefore discountable and any potential encounters with Southern Resident killer whales are expected to be sporadic and transitory in nature and any effects would be insignificant. The action includes two conservation measures to further minimize the potential for disturbance of Southern Residents from divers and vessels used in geoduck harvest activities. The measures are a diver recall system and noise restrictions. The WDNR will avoid potential interactions between Southern Residents, people and harvest activities by invoking the diver recall system to get divers out of the water when killer whales are sighted near the tract being harvested. The WDNR regulations will require divers and harvesters to remain out of the water, and turn off vessel engines until the killer whales have left the area. Additionally, WDNR will reduce the likelihood of disturbing species vulnerable to surface noise disruptions by limiting surface noise

levels to 50 decibels at a distance of 200 yards (600 feet) from each vessel. Although the intent of WDNR's noise reduction measure is focused on reducing surface noise, reduced surface noise may result in reduced noise produced by vessels underwater.

While the activities contemplated in this HCP are expected to have minor or negligible effects on both listed and unlisted salmonids, they may result in a small number of incidental takes of salmonids. Salmon are the primary prey of Southern Residents. Because approval of this HCP will have inherently low impacts on salmonids, it will have insignificant effects on prey available to Southern Residents.

Based on these factors, the action may affect, but is not likely to adversely affect Southern Resident killer whales.

Critical Habitat Determination:

Critical habitat for Southern Resident killer whales was designated in three specific areas: 1) Summer Core Area in Haro Strait and waters around the San Juan Islands; 2) Puget Sound; and 3) the Strait of Juan de Fuca on November 29, 2006 (71 FR 69054). Critical habitat includes approximately 2,560 square miles of Puget Sound, excluding areas with water less than 20 feet deep relative to extreme high water. The PCEs for Southern Resident killer whale CH are: (1) Water quality to support growth and development; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction and development, as well as overall population growth; and (3) passage conditions to allow for migration, resting, and foraging.

The potential effects of the project relate to the following PCEs identified: prey, and interference with passage. The potential for the proposed action to interfere with Southern Resident killer whale passage is expected to be insignificant, because of conservation measures described above, and vessels used during harvest activities do not target whales and should be easily detected by passing whales. The proposed action will have inherently low impacts on salmonids, with insignificant effects on prey available to Southern Residents.

Based on these factors, the action may affect, but is not likely to adversely affect the designated CH of Southern Resident killer whales.