Appendix G

Draft Biological Evaluation

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Draft Biological Evaluation

BP Cherry Point Marine Terminal

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Prepared for
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Acronyms

μPa	micropascal unit
°C	Celsius
°F	Fahrenheit
AIS	U.S. Coast Guard Nationwide Automatic Identification System
ARCO	Atlantic Richfield Company
ATBs	Articulated Tugs-and-Barges
Bbls	barrels
BE	Biological Evaluation
CCG	Canadian Coast Guard
CFR	Code of Federal Regulations
CHUs	critical habitat units
cm	cubic meter
DO	dissolved oxygen
DPS	distinct population segment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act

ESUs	Evolutionary Significant Units
FR	Federal Register
FWS	(U.S.) Fish and Wildlife Service
Kcfs	thousands of cubic feet per second
kg	kilogram
KGB	Kelp, Gopher, and Black rockfish
kHz	kilohertz
km	kilometer
LIBI	Lummi Intertidal Baseline Inventory
MLLW	mean low low-water
ms	millisecond
msl	mean sea level
MTBE	methyl tert-butyl ether
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ODFW	Oregon Fish and Wildlife Service
PNW Forest Plan	Pacific Northwest Forest Plan
ppt	parts per thousand
PSRCP	Puget Sound Rockfish Conservation Plan
SaSI	Salmonid Stock Inventory
SE	Standard Error
SPL	Sound Pressure Level
TSS	Traffic Separation Scheme
TTS	temporary threshold shift
USACE	U.S. Army Corps of Engineers
U.S.C	United States Code
USCG	United States Coast Guard
VEAT	Vessel Entries and Transits for Washington Waters
VTRA	Vessel Traffic Risk Analysis
WDFW	Washington Department of Fish and Wildlife

Chapter 1

Introduction

1.1 Background and Consultation History

The BP Cherry Point Refinery[1] currently holds a Rivers and Harbors Act Section 10 permit (33 U.S.C. 403) issued on March 1, 1996 (Department of the Army permit number 92-1-00435) for the construction of a pier extension (North Wing) to the existing Cherry Point Marine Terminal. The purpose of the extension was to improve the efficiency of unloading crude oil for processing at the refinery and loading and unloading of refined products for distribution to markets in the Puget Sound Region and West Coast of the U.S. Prior to the expansion; unloading and loading operations were performed at a single berth (South Wing). The addition of the second berth (North Wing) allows the South Wing to be largely dedicated to unloading crude oil and the North Wing to be dedicated to loading and unloading refined products. This separation of task improves the efficiency and safety of operations. The North Wing was constructed and became operational in 2001.

In November 2000, Ocean Advocates filed a lawsuit in the U.S. District Court challenging the issuance of the 1996 permit. The district court ruled in favor of the U.S. Army Corps of Engineers (USACE) finding an Environmental Impact Statement (EIS) is not required and the permit did not violate the Magnuson Amendment of the Marine Mammal Protection Act (33 US.C.§ 476). Ocean Advocates filed an appeal at the U.S. Court of Appeals for the Ninth Circuit. As part of its March 2005 ruling, the Ninth Circuit required the USACE to prepare a full EIS considering the impact of reasonably foreseeable increases in tanker traffic and reevaluate the dock extension's potential violation of the Magnuson Amendment. The USACE has prepared a draft EIS, and the Proposed Action is for BP to continue to operate the North and South Wings in their present configuration, but USACE would modify a DA permit for the continued operation and maintenance of the dock, with limitations including prohibiting the use of the North Wing for unloading or loading crude oil. Due to the Proposed Action of modifying the 1996 permit, USACE would like to re-initiate consultation under the Endangered Species Act (ESA). 50 CFR § 402.16(c).

As part of the original USACE Section 10 permit issuance process, ARCO[1] with the assistance of Berger/ABAM Engineers Inc., submitted a biological evaluation (BE) on March 31, 2000 to assist the USACE in fulfilling its obligation to consult with National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (FWS) (each individually referred to as a "Service" and together as the "Services") under section 7(a)(2) of the ESA. The 2000 BE reached the following conclusions for the species noted:

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[1] The BP Cherry Point refinery was previously owned by Atlantic Richfield Company (ARCO); the facility, including the marine terminal was acquired by BP in April 2000 and became operational in 2001. The names ARCO and BP are used in this document as appropriate to reflect ownership.

- Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) –Threatened, NMFS, may affect but is not likely to adversely affect.
- Puget Sound/Strait of Georgia Coho (*O. kisutch*) – Candidate, NMFS, may affect but is not likely to adversely affect.
- Bull trout (*Salvelinus confluentus*) – Threatened, FWS, may affect but is not likely to adversely affect.
- Humpback whale (*Megaptera novaeangliae*) – Endangered, NMFS, no effect.
- Leatherback sea turtle (*Dermochelyes coriacea*) – Endangered, NMFS, no effect.
- Bald eagle (*Haliaeetus leucocephalus*) – Endangered, FWS, no effect.
- Marbled murrelet (*Brachyramphus marmoratus*) – Threatened, FWS, no effect.

Based on the analysis in the 2000 BE, the USACE requested informal consultation with NMFS on May 24, 2000, and with the FWS on May 25, 2000. In both cases, the USACE sought concurrence with its "not likely to adversely affect" findings for listed Chinook and bull trout. [2] On June 13, 2000, FWS concurred with the "may affect but is not likely to adversely affect" finding for bull trout and on June 19, 2000, NMFS concurred with the "may affect but is not likely to adversely affect" finding for Puget Sound Chinook salmon.

Since the project was constructed and informal consultation was concluded in 2000, additional species have been listed and critical habitats have been either designated or proposed under the ESA in the Action Area (defined in Section 1.3). These species are listed in Table 1.1-1.

In addition, during those intervening years, bald eagles and the Eastern DPS for Steller sea lion have been removed from the ESA species list, and Puget Sound coho salmon, which was a candidate species in 2000, is now considered a Species of Concern, which does not require ESA Section 7 consultation.

Because the USACE is evaluating the effects of the Proposed Action, and in accordance with 50 CFR § 402.16(c), this BE has been prepared in support of the USACE's re-initiation of consultation with FWS and NMFS.

[2] Consultation is required when a federal agency determines an action it intends to authorize, fund, or carry out is likely to affect a listed species or designated critical habitat (50 CFR §402.14). Consultation may be concluded informally if FWS or NMFS, as appropriate, concurs that the Proposed Action is "not likely to adversely affect" listed species or designated critical habitat (50 CFR §402.13). Consultation or concurrence is not required if the action agency (here, the USACE) concludes that the Proposed Action will have "no effect" on listed species or designated critical habitat. In addition, consultation is not required for candidate species.

Table 1.1-1 ESA-listed Species and Critical Habitat Designated/Proposed Post Project Construction.

Species	Listing	Critical Habitat
Southern Resident Killer whale	Endangered (70 FR 69903)	Designated (71 FR 69054)
Green Sturgeon Southern DPS	Threatened (71 FR 17757)	Designated (74 FR 52300)
Puget Sound Steelhead	Threatened (72 FR 26722)	Proposed (78 FR 2725)
Eulachon	Threatened (75 FR 13012)	Designated (76 FR 65324)
Bocaccio Puget Sound/Georgia Basin DPS	Endangered (75 FR 22276)	Proposed (78 FR 47635)
Canary Rockfish Puget Sound/Georgia Basin DPS	Threatened (75 FR 22276)	Proposed (78 FR 47635)
Yelloweye Rockfish Puget Sound/Georgia Basin DPS	Threatened (75 FR 22276)	Proposed (78 FR 47635)

1.2 Proposed Action

1.2.1 Federal Action

The USACE proposes to modify Department of the Army permit number 92-1-00435 for the continued operation and maintenance of the BP Marine Terminal with conditions including prohibiting the use of the North Wing for unloading or loading crude oil. BP has limited the use of the North Wing to loading and unloading of refined petroleum product only since the North Wing became operational in 2001.

1.2.2 Scope of Analysis

This BE provides an analysis of the effects of ongoing operations of the North Wing of the BP Marine Terminal, including anticipated changes in vessel traffic to and from the existing facility as currently operated by BP. The effects analyzed result from the change in environmental risk between operation of the BP Marine Terminal at maximum capacity with a single berth (the South Wing) and the dock operating with two berths (following construction of the North Wing) at a level of utilization projected for the year 2030. The future year 2030 was selected for consistency with a vessel traffic study prepared to support the Draft EIS. In that study, forecasts of future traffic were made to analyze the cumulative effects of future vessel traffic growth over a baseline of vessel traffic in the year 2010. Given that BP was only able to forecast traffic levels for vessels calling at the BP Cherry Point dock to a 20 year future time horizon, the USACE determined that a forecast beyond a 20-year time horizon (2030) was unlikely to yield reliable results.

The currently permitted project has two components[3]:

- Vessel traffic –tanker, tug and barge traffic to and from the BP Marine Terminal, including the marine route through the Strait of Juan de Fuca and the San Juan Archipelago, and moorage at the dock facility during loading and unloading;

[3] The Biological Evaluation does not include an analysis of catastrophic oil spills as they are not reasonably certain to occur. Activities that would occur if a catastrophic spill were to occur are under the regulatory authority of the Washington Department of Ecology and the U.S. Coast Guard. An analysis of the potential effects of a catastrophic oil spill is included in the draft EIS.

- Operation and maintenance of the BP Marine Terminal's North Wing – consisting of a ship berth, loading and unloading equipment, control and metering equipment for refined product loading and unloading, and oil spill preparedness and response which includes the staging and deployment of work boats for pre-booming operations; deployment of oil spill containment booms for pre-booming during loading and unloading operations; and the staging of additional oil spill boom, sorbent pads, and an oil spill skimmer in the event of an oil spill at the dock. Regular oil spill drills are conducted to ensure a quick and appropriate response to an unintentional release.

The operation of the refinery, tank farm, and interconnecting piping between these facilities and the South Wing of the BP Marine Terminal are part of the environmental baseline, as is the existence of the North Wing and its connection to onshore facilities. Effects of these components are included as part of the environmental baseline when analyzing the effects of this action. The existence of the North Wing is included in the environmental baseline because it has already been constructed.

1.2.3 Description of Project Components

1.2.3.1 Vessel Traffic to BP Marine Terminal

Under potential future business development scenarios in which marine transportation continues to be the predominate mode of transportation, the construction and operation of the North Wing could result in an incremental increase in vessel calls at the BP Marine Terminal. However, there are future business development scenarios in which increasing volumes of oil are moved by rail and pipeline. Under these scenarios, the number of calls at the BP Marine Terminal would decline (Figure 1.2.1). BP has prepared a forecast of vessel traffic through 2030 for the current configuration of the BP Marine Terminal that considers vessel size, crude availability, refinery operations, and market conditions.

The 2030 forecast predicts that under the maximum predicted future vessel traffic growth conditions, the BP Marine Terminal could receive between 350 and 420 vessel calls per year through 2030. This represents a potential increase of 15 to 85 vessel calls a year above the baseline capacity of 335 vessel calls per year for operation of the South Wing only (see Chapter 3 Environmental Baseline). This would result in a 4.5 percent to 25.3 percent increase in vessel calls over baseline conditions. Vessels would likely be a mix of tank vessels carrying crude oil and refined products and barges carrying refined product. It also represents a change in the proportion of calls for unloading crude oil versus loading and unloading refined product. Under current conditions, 40 to 50 percent of vessel calls are for delivery of crude oil and 50 to 60 percent are for loading and unloading refined product. Under the future growth scenario for marine transportation, the proportion of vessels calls for unloading crude oil would decline to 30 to 40 percent of total vessel calls and the proportion of calls for loading and unloading refined product would increase to 60 to 70 percent of total vessel calls. Under business development scenarios in which crude oil delivery by rail and pipeline would increase, vessel calls would likely decline from current numbers and the proportion of calls for loading and unloading refined product would increase to 90 to 95 percent of all vessel calls, and the remaining 5 to 10 percent would be for unloading crude oil.

Vessels transiting to the BP Marine Terminal from Alaska, Oregon, California and international origins would enter the Strait of Juan de Fuca, utilize the U.S. Coast Guard (USCG) Vessel

Traffic Service Puget Sound and abide by the USCG requirements for the Strait of Juan de Fuca and Puget Sound traffic Separation Scheme (described more completely in Chapter 3 Environmental Baseline). Likewise, tank vessels and barge traffic calling at the BP Marine Terminal from, or departing to, other destinations with the greater Puget Sound must participate in and abide by the requirements of the USCG vessel traffic management provisions.

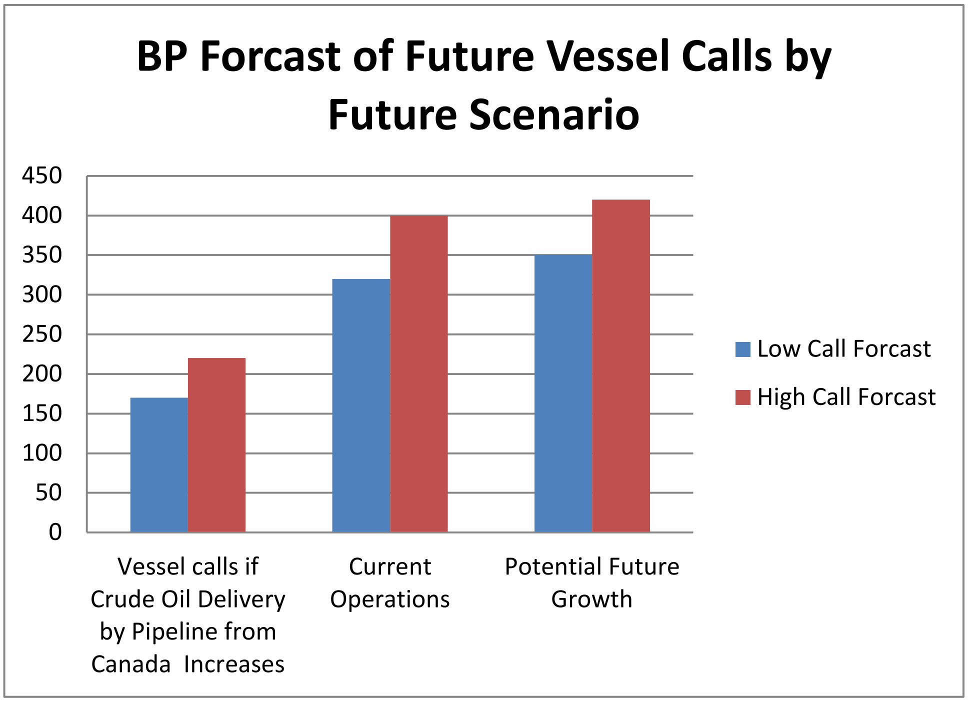

Figure 1.2-1 BP Forecast of Future Vessel Calls by Future Scenario.

1.2.3.2 Dock Operations

Dock operations would increase proportionately to the changes in vessel calls predicted by BP. These operations are discussed in more detail in Chapter 3 Environmental Baseline. With the North Wing in place, the tasks of crude oil unloading and refined product handling have largely been separated. The pipelines connecting the dock facility to the BP Cherry Point Refinery tank farm are configured so that crude oil can only be unloaded in commercially sustainable quantities at the South Wing. The North Wing is used exclusively for loading and unloading refined petroleum products. While the South Wing retains the capability to load and unload refined petroleum product, such operations on this wing now rarely occur.

Between 2001 when the North Wing became operational and 2010, throughput at the BP Marine Terminal has averaged 102,773,473 barrels (bbls) per year, consisting of 70,457,034 bbls of crude oil and 32,316,438 bbls of refined product. With operations at both wings underway, all crude deliveries occurred at the South Wing and most product loading occurred at the North Wing.

The existing oil spill prevention plan and response measures currently in place at the BP Marine Terminal are discussed in Chapter 3 Environmental Baseline. Implementation and adherence to these requirements would continue with the increase in vessel calls at the BP Marine Terminal.

1.3 Action Area

The Action Area is defined as all areas that may be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.20). The Proposed Action is broken into two major components: Vessel Traffic and Operation and Maintenance of the BP Marine Terminal's North Wing (Section 1.2.1). Each of these activities has its effects, some of which overlap. For example, vessels have the potential to displace larval fish as they move through the water; noise from vessels and dock operations can disturb animals causing them to become alert, temporarily suspend behaviors, or temporarily leave areas. The most far-reaching effects of the Proposed Action derive from the increase in vessel traffic likely to occur. Therefore, the Action Area for the project is defined as the area encompassed by and adjacent to the Vessel Traffic Service System, beginning eight miles west of J Buoy at the entrance to the Strait of Juan de Fuca to the BP Marine Terminal, by vessel routes from the BP Marine Terminal to refineries near March Point, and vessels departing to the north (Figure 1.3-1)[4]. In addition, the area within 1 km (0.6 mile) around the BP Marine Terminal is included in the Action Area based on the analysis of area likely to be affected by terminal operations in the previous BE (Berger/Abram Engineers Inc. 2000).

1.4 Presence of Federally Listed Species in the Project Action Area

This BE addresses potential effects of the Proposed Action on the federal ESA listed species and designated critical habitat that are likely to occur in the project Action Area. It addresses direct and indirect effects of the action. Based on previous agency consultation and a review of species lists available from USFWS and NMFS, USACE, and state agencies including Washington Department of Fish and Wildlife (WDFW) and Washington Department of Natural Resources (WDNR), the species list in Table 1.3-1 was developed. In addition, critical habitat is proposed for three species and has been designated for eight species (Table 1.3-1). Species on which continued operation of the North Wing dock will have “no effect” are discussed in Section 1.5 below.

1.5 Species Considered and Determined to Have “No Effect” from Project

The following species may occur in the general vicinity of the project (e.g., Puget Sound), and were evaluated and determined not to be affected by the Proposed Action: Canada lynx (*Lynx Canadensis*), northern spotted owl (*Strix occidentalis caurina*), short-tailed albatross (*Phoebastria albatrus*), loggerhead sea turtle (*Caretta care4-1, tta*), olive ridley sea turtle (*Lepidochelys olivacea*), green sea turtles (*Chelonia mydas*), sei whale (*Balaenoptera borealis*), and sperm whale (*Physeter macrocephalus*). A summary for each of these species is provided below:

[4] The J buoy was selected as the westward extent of the Action Area because the effects of the Proposed Action beyond this point would not be distinguishable from the effects of other actions.

- **Canada lynx** are found in coniferous and hardwood forests, at high elevations with cold winters that have deep (1 meter [3.3 feet]), fluffy snow for extended periods (Stinson 2001 and 78 FR 56430). Canada lynx den in mature or old timber forests with large woody debris, such as downed logs and windfalls, which provide denning sites with security and thermal cover for kittens. No lynx have been found nor does suitable habitat for Canada lynx occur within the Action Area. Critical habitat was designated for the lynx in 2006, and revised in 2009 and 2013. Under all iterations, critical habitat was not designated within the Action Area, therefore neither this species, nor its critical habitat, would be affected by ongoing operation of the BP Marine Terminal.
- **Northern spotted owls** occur primarily on the eastern and western slopes of the Cascade Mountains and the Olympic Peninsula. Historic records show it used to occupy the Puget Trough (which runs the length of Washington, between the Cascade Mountains on the east and the Olympic Mountains and Willapa Hills on the west). But occurrence here is now rare (Buchanan and Swedeen 1995). In addition, WDFW surveys conducted over the last 35 years 1976-2011) did not find any occurrences within the Action Area (WDFW 2012). Where present, spotted owls nest in mature, coniferous forests and hunt in forest habitat, neither of which are present in the Action Area. Therefore, it is not anticipated that spotted owls would be affected by continued operation of the BP Marine Terminal. No Northern Spotted Owl critical habitat has been designated within the Action Area and so it would not be affected by ongoing operations of the BP Marine Terminal.
- **Short-tailed albatross** may occur in the Action Area, but it is unlikely that continued operation of the BP Marine Terminal would have an effect on this species. The marine range of short tailed albatross covers most of the northern Pacific Ocean, but it occurs in highest densities in areas of upwelling along shelf waters of the Pacific Rim, particularly along the coasts of Japan, eastern Russia, the Aleutians and Alaska (Piatt et al. 2006, Suryan et al. 2007). Satellite tracking has indicated that during the post-breeding period, females spend more time offshore of Japan and Russia, while males and juveniles spend greater time around the Aleutian Islands, Bering Sea and off the coast of North America (Suryan et al. 2008). Juveniles have been shown to travel twice the distances per day and spend more time within continental shelf habitat than adult birds (Suryan et al. 2008, BirdLife International 2013). Based on this pattern of distribution, migration and the apparent preference for shelf waters, short tailed albatross are not likely to occur in the Action Area. Additionally, the operation of the BP Marine Terminal and ongoing vessel traffic associated with the terminal would not disrupt albatross normal migrations or reduce the availability of prey for albatross that could forage in the area. Critical habitat has not been designated for the short-tailed albatross.
- **Sea Turtles** loggerhead, olive ridley, and green sea turtles rarely occur in Puget Sound and near the coast of Washington. The Action Area is considered beyond the normal range of species occurrences and contain unsuitable habitat due to cold water temperatures. Most hard-shell turtles seek optimal seawater temperatures near 18°C (65°F) and are cold-stressed at seawater temperatures below 10°C (50°F) (Mrosovsky 1980 and Schwartz 1978). Water temperatures recorded at various locations throughout the Action Area are under 10°C (50°F) the majority of the year and do not approach 18°C (65°F) (NOAA 2014). Loggerhead, olive ridley, and green sea turtles would not be expected to occur within the Action Area, and therefore would not be affected by ongoing operation of the BP Marine Terminal. Critical habitat has been designated for green sea turtles but occurs outside of the Action Area and

therefore green sea turtle critical habitat would not be affected by ongoing operations of the BP Marine Terminal. Critical habitat has not been designated for loggerhead and olive ridley turtles.

- **Sei whales** typically occur over deep waters on the continental shelf edge and slope and rarely appear off the U.S. west coast. Extensive ship and aerial surveys conducted over 18 years between 1989 and 2008 resulted in only nine confirmed sightings of sei whales in California, Oregon, and Washington waters (WDFW 2011b). Sei whales would not be expected to occur within the Action Area, and therefore would not be affected by ongoing operation of the BP Marine Terminal. Critical habitat has not been designated for the sei whale.

  Sperm whales typically occur far from land in waters with a depth of 600 meters (1,968 feet) or greater and are uncommon in waters less than 300 meters (984 feet) deep (NMFS 2012a). Extensive ship surveys conducted off the Washington, Oregon and California coast between 1991 and 2008 did identify sperm whales off the Washington coast; however, documented occurrences were well outside of the Action Area (NMFS 2012a). Sperm whales would not be expected to occur within the Action Area, and therefore would not be affected by ongoing operation of the BP Marine Terminal. Critical habitat has not been designated for the sperm whale.

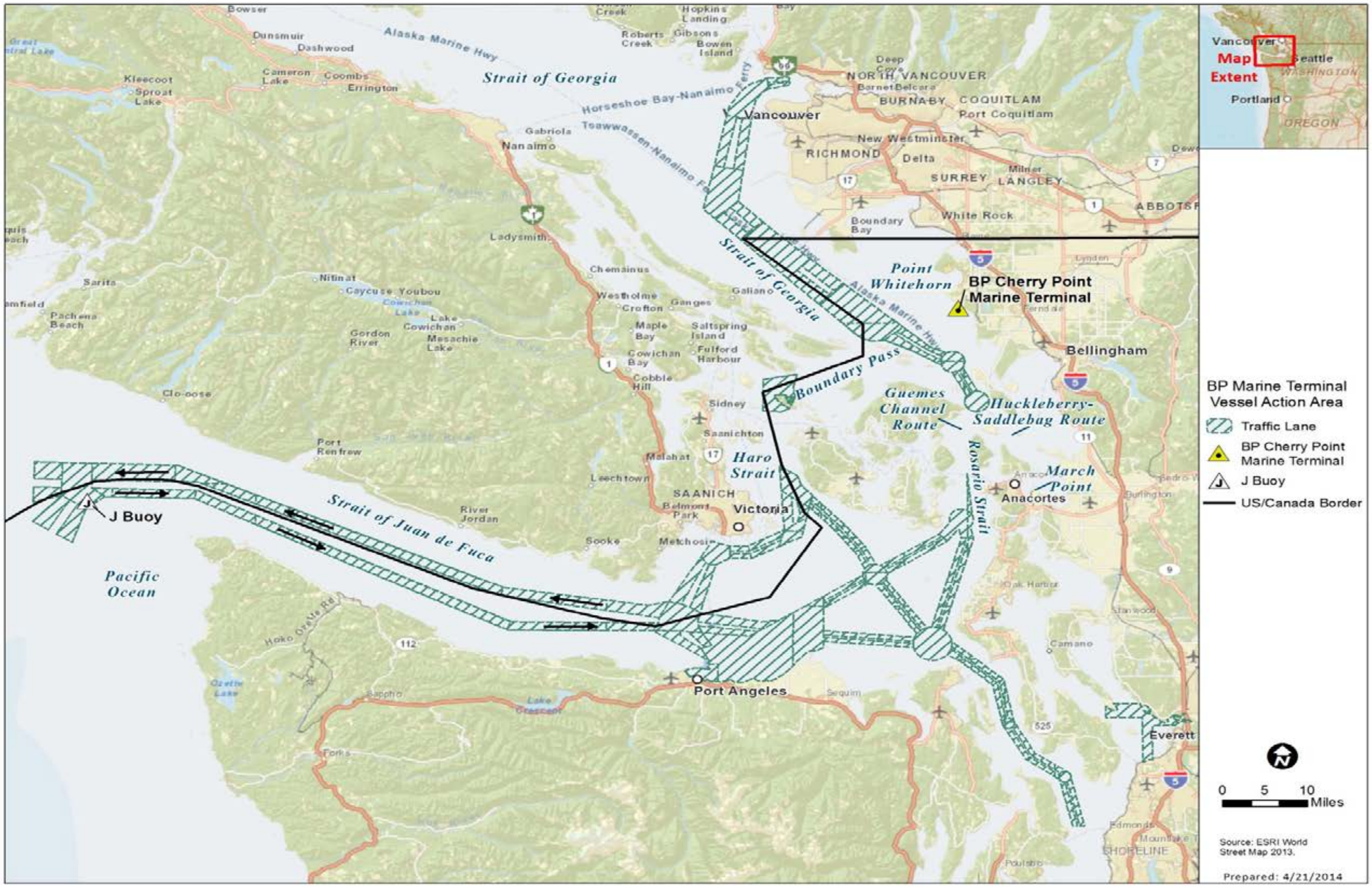

Figure 1.3-1 BP Cherry Point Action Area

Table 1.3-1 ESA-listed Species Potentially in the Action Area, their Status and whether Critical Habitat has been Formally Designated by the Services

Species	Status	Critical Habitat
Mammals		
Humpback whale (*Megaptera novaeangliae*)	Endangered	No
Blue Whale (*Balaenoptera musculus*)	Endangered	No
Fin Whale (*Balaenoptera physalus*)	Endangered	No
Southern Resident killer whale (*Orcinus orca*)	Endangered	Yes
Fish		
Eulachon (Southern DPS) (*Thaleichthys pacificus*)	Threatened	Yes
Green sturgeon (Southern DPS) (*Acipenser medirostris*)	Threatened	Yes
Salmonids		
Bull Trout (*Salvelinus confluentus*)	Threatened	Yes
Chinook salmon (Puget Sound ESU) (*Oncorhynchus tshawytscha*)	Threatened	Yes
Chum salmon (Hood Canal summer-run) (*Oncorhynchus keta*)	Threatened	Yes
Puget Sound steelhead (*Oncorhynchus* mykiss)	Threatened	Proposed
Groundfish		
DPS Bocaccio (*Sebastes pauispinis*)	Endangered	Proposed
DPS Canary rockfish (*Sebastes pinniger*)	Threatened	Proposed
DPS Yelloweye rockfish (*Sebastes ruberrimus*)	Threatened	Proposed
Birds		
Marbled Murrelet (*Brachyramphus marmoratus*)	Threatened	Yes
Reptiles		
Leatherback Turtle (*Dermochelys coriacea*)	Endangered	Yes

1.6 Interrelated and Interdependent Actions

An interrelated activity is an activity that is part of the Proposed Action and depends on the Proposed Action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. At this time, no actions have been identified that are considered interrelated or interdependent with the Proposed Action.

Chapter 2
Status of Listed Species

2.1 Humpback Whale

The humpback whale is in the Balaenopteridae Family but are distinguished from other whales of that family by extraordinarily long flippers, a more robust body, fewer throat groves, more variable dorsal fin, and utilization of very long, complex, repetitive vocalizations during courtship (NMFS 1991).

2.1.1 Distribution

Humpback whales are distributed worldwide in all ocean basins though they are less common in Arctic waters. In winter, most humpbacks are found in temperate and tropical waters of both hemispheres. In summer, most humpbacks are in waters of high biological productivity, usually in the higher latitudes. Humpbacks generally inhabit waters over continental shelves, along their edges, and around some ocean islands (NMFS 1991). Primary humpback whale habitat is located in offshore waters; they utilize both continental shelves and seaward. Some humpbacks have been spotted in coastal bays. Humpback whales can be seen off Washington’s coast, where some spend their summers feeding. When winter arrives, humpbacks migrate to Mexico or Hawaii. They may travel 8,047 km (5,000 miles) or more to warmer waters to breed.

2.1.2 Life History

Humpback whales mate during their winter migration. They become sexually mature at 6 to 8 years of age or when males reach the length of 11.6 meters (30.6 feet) and females reach 12 meters (39.37 feet) in length. Each female typically calves every 2 to 3 years and the gestation period is 12 months. A humpback whale calf is between 3 and 4.5 meters (9.8-14.8 feet) long at birth, and weighs up to 907 kg (2,000 pounds). It nurses frequently on the mother's rich milk, which has a 45 to 60 percent fat content. The mother must feed her newborn about 45 kg (99.2 pounds) of milk each day for a period of 5 to 7 months until it is weaned; calves may stay with the mother for up to one year. After weaning, the calf has doubled in length and increased in weight by 5 times, attaining a size of about 8.2 meters (27 feet) and 9,072 kg (20,000 pounds). Scientists estimate the average life span of humpbacks in the wild to be between 30 and 40 years (NFMS 1991).

2.1.3 Prey

Humpback whales’ diet consists primarily of krill and schooling fish such as herring, sandlance, and capelin. As they are filter feeders, they use lunge feeding or bubble netting to capture their prey, often in cooperative groups. Each whale eats up to one and a half tons of food a day in their summer feeding grounds. Humpbacks are thought to feed only during summer months, losing 25 to 40 percent of their body mass during migration to winter breeding grounds.

2.1.4 Threats

Humpback whales were once on the brink of extinction due to commercial whaling practices. Their tendency to frequent coastal waters and their habitual return to the same regions each year made humpback whales vulnerable to exploitation by commercial whalers. Current anthropogenic (or human-induced) threats to humpback whales include, entanglement in fishing gear, ingestion of marine debris, chemical pollution, and vessel strikes.

2.1.5 Regulatory Status

The humpback whale was classified as an endangered species under the Endangered Species Conservation Act (predecessor to the current Act) and was transferred to the current list of endangered species when the ESA was passed in 1973. It remains listed as an endangered species today, however, NMFS is currently performing a status review of the species to determine if Humpback whales should be delisted (78 FR 53391). Critical habitat has not been designated for the humpback whale.

2.2 Blue Whale

The blue whale is in the Balaenopteridae Family and is the largest mammal known to inhabit the Earth. Blue whales have a long-body and comparatively slender shape, a broad, flat rostrum (beaklike prolongation) when viewed from above, a proportionally smaller dorsal fin than other baleen whales, and a mottled gray color patter that appears light blue when seen through the water.

2.2.1 Distribution

Although blue whales inhabit and feed in both coastal and pelagic environments, they are thought to occur more offshore than other whale species (NMFS 1998). Little information is available to evaluate stock differences in the North Pacific, however, whaling and sighting data indicates at least five subpopulations exist in the North Pacific, with an unknown degree of mixing among them. The Eastern stock is thought to spend winters off Mexico and Central America, and feed during the summer off the U.S. West Coast, and to a lesser extent in the Gulf of Alaska and central North Pacific waters (NMFS 1998).

2.2.2 Life History

On average blue whales are between 23-24.5 meters (75.5-80-4 feet) long and weigh approximately 99,800 kg (220,021 lbs.) with females being larger than males of the same age. Though they may be found singly or in small groups, it is more common to observe them in pairs and are sometimes seen in larger groups. Blue whales are thought to reach sexual maturity between 5-15 years; however, the actual age is unknown. Most reproductive activity, including births and mating, occurs during the winter with an average calving interval of two to three years and a gestation of 12 months. Weaning probably occurs on or en route to, the summer feeding areas.

2.2.3 Prey

Blue whales in the North Pacific prey almost entirely on euphausiid (krill) with their diet consisting mainly of North Pacific krill (*Euphausia pacifica*) and *Thysanoessa spinifera*.

2.2.4 Threats

Anthropogenic (or human-induced) threats to blue whales include collisions with vessels, entanglement in fishing gear, reduced zooplankton production due to habitat degradation, and disturbance from low-frequency noise.

2.2.5 Regulatory Status

The blue whale is listed as endangered throughout its range under the ESA of 1973, and is therefore listed as “depleted” throughout its range under the Marine Mammal Protection Act of 1972. Recovery of the blue whale is managed under the NMFS’ 1998 Recovery Plan. In 2012 NMFS published a Notice of Intent to update the current recovery plan (77 FR 22760). An updated plan has not yet been released for public comment. Critical habitat has not been designated for the blue whale.

2.3 Fin Whale

The fin whale is in the Balaenopteridae Family and is the second largest species of whale, behind the blue whale.

2.3.1 Distribution

Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes (north of approximately 30° N latitude), and less commonly in the tropics (NFMS 2010c). They are a pelagic species, seldom found in waters less than 200 meters (656 feet). Fin whales are migratory, moving seasonally into and out of high-latitude feeding areas. Migration patterns are complex and specific routes have not been documented. Acoustic signals from fin whales have been detected year-round off northern California, Oregon and Washington with a concentration of activity between September and February (Carretta et al. 2013).

2.3.2 Life History

Fin whales are thought to migrate seasonally. They feed intensively at high latitudes during the summer and reduce their food intake at lower latitudes during the winter. Fin whales in a population near carrying capacity may not reach sexual maturity until ten years of age or older while exploited populations can reach sexual maturity as early as 6-7 years of age (NMFS 2010c). Most reproductive activity occurs in the winter with a gestation period of somewhat less than a year. The average calving interval is approximately two years.

2.3.3 Prey

In the North Pacific, fin whales prefer euphausiids (mainly *E. pacifica*, *Thysanoessa longipes*, *T. spinifera*, and *T. inermis*) and large copepods (mainly *Calanus cristatus*), followed by schooling fish such as herring, walleye pollock (*Theragra chalcogramma*), and capelin (NMFS 2010c).

2.3.4 Threats

Harvest of fin whales, although rare today, was the main cause of the initial depletion of the species. Current anthropogenic (or human-induced) threats to fin whales include injury from marine debris, entanglement in fishing gear, coastal development, chemical pollution, noise exposure and vessel strikes. Among all species of large whales, fin whales are most often reported as struck by vessels, with one strike reported off Cherry Point in 2002 (Jensen and Silber 2004).

2.3.5 Regulatory Status

The fin whale was classified as an endangered species under the Endangered Species Conservation Act (predecessor to the current Act) and was transferred to the current list of endangered species when the ESA was passed in 1973. It remains listed as an endangered species today. Critical habitat has not been designated for fin whales.

2.4 Southern Resident Killer Whale

Killer whales are the world's largest dolphin. The sexes show considerable size dimorphism, with males attaining maximum lengths of 9.0 meters (30 feet) and weight of 5,568 kg (12,275 pounds). Females are somewhat smaller at 7.7 meters (25 feet) in length and 3,810 kg (8,400 pounds) in weight. Adult males develop larger pectoral flippers, dorsal fins, tail flukes, and girths than females. Maximum life span is estimated to be 80-90 years for females and 50-60 years for males. Animals are black dorsally and have a white ventral region extending from the chin and lower face to the belly and anal region. Each whale has a uniquely shaped and scarred dorsal fin and saddle patch, which permits animals to be recognized on an individual basis (NMFS 2008a).

2.4.1 Distribution

Killer whales occur in all oceans, but are generally most common in coastal waters and at higher latitudes. Fewer sightings occur in tropical regions. In the North Pacific, killer whales are found in waters off Alaska, including the Aleutian Islands and Bering Sea , and range southward along the North American coast and continental slope. Populations are also present along the northeastern coast of Asia from eastern Russia to southern China. Northward occurrence in this region extends into the Chukchi and Beaufort seas. Sightings are generally infrequent to rare across the tropical Pacific, extending from Central and South America westward to much of the Indo-Pacific region. Killer whales occur broadly in the world's other oceans, with the exception of the Arctic Ocean (NMFS 2008a).

There are three distinct forms of killer whales recognized in the northeastern Pacific Ocean; resident, transient, and offshore. Although there is considerable overlap in the ranges of these three forms, they display significant genetic differences due to a lack of interchange between member animals. Important differences in ecology, behavior, morphology, and acoustics also exist (NMFS 2008a).

2.4.1.1 Resident Killer Whales

Resident killer whales in the U.S. are distributed from California to Alaska, with four distinct communities recognized: Southern, Northern, Southern Alaska, and Western Alaska. The Southern Resident distinct population segments (DPS) consists of three pods, identified as J, K, and L pods. These pods reside for part of the year in the inland waterways of Washington State and British Columbia (Strait of Georgia, Strait of Juan de Fuca, and Puget Sound), principally during the late spring, summer, and fall (NMFS 2008a). Pods visit coastal sites off Washington and Vancouver Island (Ford et al. 2000), but may travel as far south as central California and as far north as the Queen Charlotte Islands. Offshore movements and distribution are largely unknown for the Southern Resident DPS.

2.4.2 Movement and Dispersal

Southern Resident killer whales spend most of the year in the inland waterways of the Strait of Georgia, Strait of Juan de Fuca, and Puget Sound, particularly during the spring, summer, and fall (NMFS 2008a). Southern Residents also occur in coastal waters off Washington, Oregon, and Vancouver Island and are known to travel as far south as central California and as far north as the Queen Charlotte Islands, British Columbia (NMFS 2006).

2.4.3 Life History

Most mating in the North Pacific is believed to occur from May to October (Olesiuk et al. 1990, Matkin et al. 1997). However, small numbers of conceptions apparently happen year-round, as evidenced by births of calves in all months (NMFS 2008a). Gestation periods in captive killer whales average about 17 months. Mean interval between the births of viable calves is 4 years. Newborns measure 2.2-2.7 meters (7.2-8.6 feet) long and weigh about 200 kg (441 pounds [Olesiuk et al. 1990; Clark et al. 2000; Ford 2002]). Calves remain close to their mothers during their first year of life, often swimming slightly behind and to the side of the mother's dorsal fin. Weaning age remains unknown, but nursing probably ends at 1-2 years of age. Mothers and offspring maintain highly stable social bonds throughout their lives and this natal relationship is the basis for the matrilineal social structure. (Ford et al. 2000, NMFS 2008a).

2.4.4 Prey

As top-level predators, killer whales feed on a variety of marine organisms ranging from fish to squid to other marine mammal species. Cooperative hunting, food sharing, and innovative learning are notable foraging traits in killer whales (NMFS 2008a). Cooperative hunting presumably increases hunting efficiency and prey capture success of group members, and may enhance group bonds. Additionally, group living facilitates knowledge of specialized hunting skills and productive foraging areas to be passed from generation to generation. Some foraging styles require extensive practice and learning (Ford et al. 1998, NMFS 2008a).

Southern Resident killer whales show a strong preference for Chinook salmon (78 percent of identified prey) during late spring to fall (Ford and Ellis 2006; NMFS 2008a). Chum salmon (11 percent) are also taken in significant amounts, especially in autumn. Other fish species eaten include coho (5 percent), steelhead (*O. mykiss*, 2 percent), sockeye (*O. nerka*, 1 percent), and non-salmonid fish species (e.g., Pacific herring and quillback rockfish [*Sebastes maliger*] 3 percent combined).

2.4.5 Threats

NMFS 2009 Recovery Plan for Southern Resident Killer Whales cites three primary factors that threaten killer whales: toxic pollution, vessel activity and sound, and the quantity and quality of prey.

Exposure to contaminants may result in harm to the species. The presences of high levels of persistent organic pollutants such as polychlorinated biphenyls and dichlorodiphenyltrichloroethane have been documented in Southern Resident killer whales. Because of their long life span, position at the top of the food chain, and their blubber stores, killer whales are capable of accumulating high concentrations of fat-soluble contaminants. This contaminant load may be associated with reproductive failure or mortality.

Commercial shipping, whale watching, ferry operations, and recreational boat traffic have increased in recent decades. Several studies have linked vessels with short-term behavioral changes in northern and Southern Resident killer whales (NMFS 2008a and 76 FR 20870). Although the potential impacts from vessels and the sounds they generate are poorly understood, these activities may affect foraging efficiency, communication, and/or energy expenditure through their physical presence, increased underwater sound level, or both. Collisions with vessels are another potential source of serious injury and mortality and have been recorded for both Southern and Northern Resident killer whales.

Southern Resident killer whale survival and fecundity are correlated with Chinook salmon abundance (NMFS 2008a). Many salmon populations are themselves at risk, with 9 ESUs of Chinook salmon listed as threatened or endangered under the ESA. Southern Resident killer whales have been found to have a strong preference for Chinook salmon during late spring to fall, chum are also consumed in significant amounts. Little is known about winter and early spring dietary preferences (NMFS 2008a).

Since completing the Recovery Plan, NMFS has prioritized actions to address threats to killer whales according to their potential benefits to whales. The 5-Year review of the Southern Resident Killer Whales (NMFS 2011g) has identified the following management and research actions as priorities:

- Finalizing and implementing regulations to protect killer whales from vessel impacts, including an effectiveness analysis of the regulations in reducing vessel impacts;
- Continuing preparations for a major oil spill, including developing response protocols, training personnel, and securing equipment;
- Synthesizing existing information, filling data gaps, and evaluating potential effects of salmon harvest and hatchery actions on the prey base of killer whales;
- Conducting research on the health status of individual whales, including health assessments in different seasons to determine when and where prey limitation may affect reproduction and survival, conducting full examinations of stranded animals, and examining links between contaminant levels and health; and
- Data collection of coastal distributions, habitat use, and prey consumption to inform critical habitat determination, identify any unknown threats, and assess and minimize impacts of ongoing and new coastal activities.

2.4.6 Regulatory Status

The Southern Resident killer whale was listed as an endangered species on November 18, 2005 (NMFS 2005a). NMFS' recent 5-Year Review concluded that the species remains in danger of extinction and should remain listed as endangered (NMFS 2011g). As early as 2003, NMFS determined that the Southern Resident stock was below its optimum sustainable population and designated it as depleted under the Marine Mammal Protection Act in May 2003 (NMFS 2003). After the listing in 2005, NMFS released a Proposed Conservation Plan for Southern Resident killer whales (NMFS 2005b) and designated critical habitat for Southern Resident killer whales in 2006. Critical habitat includes all waters relative to a contiguous shoreline delimited by the line at a depth of 6.1 meter (20 feet) relative to extreme high water. Some of these areas overlap with military sites, which are not designated as critical habitat because they were determined to have national security impacts that outweigh the benefit of designation and are therefore excluded under ESA section 4(b)(2). Coastal and offshore areas have not been designated as critical, though they are recognize as important for the Southern Resident killer whales (NMFS 2006).

Based on the natural history and habitat needs of Southern Resident killer whales, the following primary constituent elements of critical habitat were identified as essential to conservation: (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.

From observed sightings and other data, three "specific areas" were identified as containing important physical or biological features. The designated areas are: (1) the Summer Core Area in Haro Strait and waters around the San Juan Islands; (2) Puget Sound; and (3) the Strait of Juan de Fuca, which comprise approximately 4,120 square km (2,560 square miles) of marine habitat within the area occupied by Southern Resident killer whales in Washington.

In April 2011, NMFS established regulations under the ESA and MMPA to prohibit vessels from approaching within 200 yards of a killer whale and intercepting the path of any killer whale in inland waters of Washington State (76 FR 20870). Cargo vessels transiting in the shipping lanes are exempt from these regulations.

2.5 Bull Trout

Bull trout occur in the Pacific Northwest in Washington, Oregon, Idaho, Nevada, Montana, and Canada. Compared to other salmonids, bull trout have more specific temperature requirements. They occur in cold water streams, and are rarely found in waters where temperatures exceed 15 to 18 degrees Celsius (°C), (59 to 64 degrees Fahrenheit [°F]). They also require stable stream channels, clean spawning and rearing gravel, complex and diverse cover, as well as migration corridors (McPhail and Baxter 1996). Populations of bull trout are often distributed in watersheds based on available habitat and may not be connected (Rieman and McIntyre 1995). Bull trout are identified by several characteristics: spots never appear on the dorsal (back) fin, and the spots that rest on the fish's olive green to bronze back are pale yellow, orange or salmon-colored. The bull trout's tail is not deeply forked. Bull trout exhibit two forms: resident and migratory. Resident bull trout range up to 25.4 cm (10 inches) long and migratory forms may range up to 89 cm (35 inches) and up to 14.5 kg (32 pounds) [McPhail and Baxter 1996]).

2.5.1 Distribution

The historic range of bull trout includes major river basins in the Pacific Northwest from Canada to northern California, and inland the Jarbridge River in Nevada, as well as Puget Sound and the Columbia and Snake River Basins (USFWS 2002).

Although both resident and migratory forms of bull trout are present in the Coastal/Puget Sound bull trout population segment, it is the only known segment of bull trout in the United States that includes the anadromous life history form (spawns in freshwater, migrates to saltwater and returns to freshwater to spawn). These sub-adult bull trout move into marine waters and return to freshwater to take advantage of seasonal forage opportunities to feed on salmonid eggs, smolts, or juveniles. Bull trout in the Coastal/Puget Sound distinct population segment also move through the marine areas to gain access to independent streams to forage or take refuge from high water flows.

The Olympic Peninsula bull trout management unit is thought to differ from those in the Puget Sound management unit, which originate in watersheds on the western slopes of the Cascade

Mountains. Although the two units are connected by marine waters, there is currently no evidence that bull trout from Puget Sound migrate to the Strait of Juan de Fuca or Hood Canal.

2.5.2 Life History

Bull trout exhibit two basic life history strategies: resident and migratory, but there are several variations including an anadromous form which spawns in rivers and streams but rears young in the ocean. Most bull trout are migratory. Migratory bull trout live in larger river and lake systems where juvenile fish usually rear from one to four years before migrating to either a larger river or lake where they spend their adult life, returning to the tributary stream to spawn (Fraley and Shepard 1989). In general, migratory fish are larger than resident fish. Stream-resident bull trout complete their entire life-cycle in the tributary streams where they spawn and rear (Rieman and McIntyre 1993). Research indicates that resident and migratory forms may be found together, and interbred at times, which helped maintain viable populations throughout the range (Rieman and McIntyre 1993).

An anadromous form of bull trout exists in the Coastal-Puget Sound population. Unlike strictly anadromous species, such as Pacific salmon, bull trout are better termed amphidromous species since they often return seasonally to fresh water as subadults, sometimes for several years, before returning to freshwater to spawn. The amphidromous life history form of bull trout is unique to the Coastal–Puget Sound population (64 FR 58921; November 1, 1999).

Bull trout typically spawn from late July to December, with peak spawning in September and October. Bull trout eggs incubate over the winter and hatch in the late winter or early spring. Emergence usually requires an incubation period up to 210 days. Anadromous populations spend the early portion of their life in streams, grow to adulthood in the ocean, and eventually return to the tributaries in which they were born to spawn.

2.5.3 Prey

Resident and juvenile bull trout prey on invertebrates and small fish. Adult migratory bull trout primarily eat fish.

2.5.4 Threats

The factors that have contributed to the decline of bull trout include: restriction of migration routes; forest management practices; grazing; agricultural practices; road construction; mining; introduction of non-native species (including brook trout); and residential development (USFWS 2002). Changes in stream temperature and other water quality attributable to land and water use resulted in habitat loss. Poaching is also considered a significant threat and misidentification of bull trout as brook trout or lake trout result in some fish being killed accidentally.

Predation on bull trout by non-native species may exacerbate stresses on bull trout from habitat degradation, fragmentation, and isolation (Rieman and McIntyre 1993). Brook trout readily spawn with bull trout creating a hybrid that is often sterile (Markel 1992). Lake trout have out-competed and replaced adfluvial populations of bull trout in some lakes.

2.5.5 Regulatory Status

On June 10, 1998, FWS listed bull trout as threatened under the ESA (63 FR 31647). On October 18, 2010, FWS designated critical habitat for bull trout throughout their U.S. range (75 FR 63898) in streams, lakes and reservoirs in Idaho, Oregon, Washington, Montana, and Nevada. In Washington, portions of marine shoreline were also designated.

Bull trout have more specific habitat requirements than most other salmonids (75 FR 63898). The predominate habitat components influencing their distribution and abundance include water temperature, cover, channel form and stability, spawning and rearing substrate conditions, and migratory corridors. The primary constituent elements of bull trout critical habitat are: (1) adequate freshwater quantity, (2) quality and connectivity; migration habitats; (3) an abundant food base, including riparian organisms, aquatic macroinvertebrates, and forage fish; (4) complex freshwater and marine shoreline aquatic environments with features such as large wood, side channels, pools, undercut banks and unembedded substrates; (5) water temperatures ranging from 2 to 15 °C (36 to 59 °F), with adequate thermal refugia available for temperatures that exceed the upper end of this range; (6) suitable substrate in spawning and rearing areas; a natural hydrograph; sufficient water quality and quantity; and (7) sufficiently low levels of occurrence of nonnative predatory, interbreeding, or competing species that, if present, are adequately isolated from bull trout (75 FR 63898).Coastal marine waters designated as critical habitat for bull trout in the Coastal Puget Sound and the Olympic Peninsula areas extend from the mean high high-water (MHHW) line inland (including the tidally influenced freshwater heads of estuaries) to 10 meters (33 feet) below the mean low low-water (MLLW) elevation line offshore. This zone equates to the photic zone where most bull trout activity occurs.

The Olympic Peninsula critical habitat unit (CHU) is located in northwestern Washington. Bull trout populations inhabiting the Olympic Peninsula comprise the coastal component of the Coastal–Puget Sound population. The unit includes approximately 748.7 km (465.2 miles) of stream, 3,064.2 hectares (7,571.8 acres) of lake surface area, and 529.2 km (328.8 miles) of marine shoreline designated as critical habitat. This CHU is bordered by Hood Canal to the east, Strait of Juan de Fuca to the north, the Pacific Ocean to the west, and the Lower Columbia River Basins and Puget Sound CHUs to the south. It extends across portions of Grays Harbor, Clallam, Mason, Pacific, and Jefferson Counties. All of the major river basins initiate from the Olympic Mountains. The Olympic Peninsula CHU is sub-divided into 10 critical habitat subunits. Although delta areas and small islands are difficult to map and may not be specifically identified by name, they are included within the critical habitat. The subunits within the Olympic Peninsula CHU provide spawning, rearing, foraging, migratory, and overwintering habitat.

The Puget Sound CHU includes approximately 1,840.2 km (1,143.5 miles) of streams; 16,260.9 hectares (40,181.5 acre) of lake surface area; and 684.0 km (442.5 mile) of marine shoreline designated as critical habitat. The CHU is bordered by the Cascade Range to the east, Puget Sound to the west, Lower Columbia River Basins and Olympic Peninsula CHUs to the south, and the U.S. – Canada border to the north. The Puget Sound CHU extends across Whatcom, Skagit, Snohomish, King, Pierce, Thurston, and Island Counties in Washington. The major river basins initiate from the Cascade Range and flow west, discharging into Puget Sound, with the exception of the Chilliwack River system, which flows northwest into British Columbia, discharging into the Fraser River. The Puget Sound CHU is sub-divided into 13 critical habitat subunits. The subunits within the Puget Sound CHU provide spawning, rearing, foraging, migratory, connecting, and overwintering habitat.

2.6 Chinook Salmon (Puget Sound ESU)

Chinook salmon is the largest species of salmon with adults often exceeding 18 kg (40 pounds). They, along with steelhead exhibit the most diversity in terms of life history. Populations in Puget Sound have dropped precipitously in the last few decades, due to a combination of direct overharvest, pollution, habitat losses, possible interspecific competition, and negative effects of hatchery production, changing ocean conditions, and other indirect outcomes of human activities. Chinook smolts are very dependent upon nearshore marine and estuary habitats to provide them critical conditions to grow during their early marine life history stage. Chinook at sea look similar to coho salmon (blue-green back with silver flanks), but are distinguishable by their large size, small black spots on both lobes of the tail, and black pigment along the base of their teeth.

2.6.1 Distribution

The Puget Sound ESU is a composite of 22 individual populations of naturally spawning and hatchery Chinook stocks (NMFS 2007b). The boundary of this ESU extends from the Nooksack River in the north to southern Puget Sound, includes Hood Canal, and extends westerly out the Strait of Juan de Fuca to the Elwha River. The Skagit River and its tributaries constitute the historically predominant system in Puget Sound containing naturally spawning populations.

Some Puget Sound Chinook are thought to spend their entire life within Puget Sound; however, most migrate to the ocean and north along the Canadian coast. There appears to be a substantial difference in migratory patterns from Chinook that originate from Puget Sound Rivers and those from the Washington coast. Chinook from the northern rivers of Puget Sound, particularly the Nooksack, tend to utilize the Strait of Georgia more than other Puget Sound Chinook. Migratory return routes appear to vary from year to year, with Chinook migrating along the west Coast of Vancouver Island or though Johnston Strait and the Strait of Georgia (NMFS 2007b).

2.6.2 Life History

Chinook salmon exhibit considerable variation in their size and age of maturity. Coast-wide, Chinook salmon remain at sea for one to 6 years (more commonly 2 to 4 years), with the exception of a small proportion of yearling males (called “jacks”) which mature in freshwater or return after two or three months in salt water. Puget Sound Chinook tend to mature at ages 3 and 4.

Chinook salmon typically spawn in larger streams and higher velocity areas with larger gravels than those areas utilized by the other salmon species. Some Chinook salmon may select spawning areas close to or even within estuaries, but their size and strength enable them to travel for hundreds of miles upstream in some river systems. Once the adult fish have arrived at the spawning grounds and “ripened,” a female Chinook will dig a redd (nest) with her tail and deposit her eggs into four or five nesting pockets. The number of eggs for each Chinook female can range from fewer than 2,000 eggs to more than 17,000 eggs, but in Puget Sound it is estimated that 2,000 to 5,500 per female is typical. The eggs are fertilized by one or more males, and the female Chinook will guard the redd from 4 to 25 days before dying. Males may seek other spawning opportunities before they too, expire. Depending on the water temperature, Chinook eggs will hatch between 32 to 159 days after deposition. Alevins (newly hatched salmon with attached yolk sacs) will remain in the gravel for another 14 to 21 days before emerging. Water quality, depth, velocity, and temperature are all critical for the survival of eggs. Shallow water may make eggs more vulnerable to predators and disturbance. High velocity can cause scouring of the stream bed, dislodging the eggs from their redds. Puget Sound Chinook tend to have relatively large eggs, greater than 8.0 mm (0.3 inch) in diameter on average. (Croot and Margolis 1991) (63 FR 11482).

The majority of Puget Sound Chinook leave the freshwater environment during their first year, making extensive use of the protected estuary and nearshore habitats. However, each of the populations exhibits a great deal of variation in the pattern of outmigration by juveniles. For example, Chinook native to the Skagit Basin exhibit at least four different strategies in terms of the time they enter and the duration of their stay in estuaries and near-shore marine waters. Nearshore ecosystems provide areas for the young Chinook to forage and hide from predators. Juvenile salmon experience the highest growth rates of their lives while in the highly productive estuaries and nearshore waters. These estuarine habitats are ideal for juvenile salmon to undergo the physiological transition to saltwater, and to readjust to freshwater when they return to spawn as adults. Nearshore areas serve as the migratory pathway to ocean feeding areas. The vegetation, shade, and insect production along river mouth deltas and protected shorelines help to provide food, cover, and the regulation of temperatures in shallow channels. Forage fish spawn in large aggregations along protected shorelines, thus generating a base of prey for the migrating salmon fry. Salmon often utilize “pocket estuaries”-small estuaries located at the mouths of streams and drainages, where freshwater input helps them to adjust to the change in salinity, food production is high, and where the shallow waters protect them from predation. As the juvenile salmon grow and adjust, they move out to more exposed shorelines such as eelgrass, kelp beds, and rocky shorelines where they continue their transition to the ocean environment.

2.6.3 Prey and Predators

In freshwater juveniles feed opportunistically on terrestrial and aquatic insects, in salt water juveniles eat crustaceans as well as other bottom invertebrates. Adult Chinook eat mostly other fish including sandlance, herring, surf smelt (*Hypomesus pretiosus*), and squid.

Sharks, killer whales, seals, sea lions and other marine mammals prey on adult Chinook salmon. Terrestrial predators include bears, coyotes, and eagles. Young salmon face a variety of predators including other fish species, otters, aquatic snakes, and a variety of birds.

2.6.4 Threats

Chinook salmon are one of the predominant sport and commercial fisheries in the PNW. In general, populations of Chinook throughout their entire range have been drastically reduced from historic abundance, especially in Puget Sound, the Columbia Basin and California’s Central Valley rivers.

Freshwater, estuarine, and marine habitat loss or degradation is thought to be the primary reason for declining populations, although nearly a century of over-fishing by commercial and sport fisheries has made a significant contribution to these declines. Cumulative development of land and water use, including expansion of agricultural, mining, hydropower development, water withdrawals, urbanization, transportation infrastructure expansion and broad-scale pollution have significantly contributed to these losses (Good et al. 2005). Chinook salmon’s spawning range is limited by degradation and loss of habitat in the headwaters of many Washington Rivers (Wydoski and Whitney 2003).

2.6.5 Regulatory Status

Puget Sound Chinook salmon were listed as a threatened species on March 24, 1999 with the status reaffirmed on June 28, 2005 and July 26, 2011. A final ESA 4(d) rule adopting regulations to conserve Puget Sound Chinook was issued on July 10, 2000 (65 FR 42422). Critical habitat was designated for this species on September 2, 2005 (70 FR 52630). The specific geographic area of the designated critical habitat includes portions of the Nooksack River, Skagit River, Sauk River, Stillaguamish River, Skykomish River, Snoqualmie River, Lake Washington, Green River, Puyallup River, White River, Nisqually River, Hamma Hamma River and other Hood Canal watersheds, the Dungeness/ Elwha Watersheds, and nearshore marine areas of the Strait of Georgia, Puget Sound, Hood Canal and the Strait of Juan de Fuca. This designation includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high water line.

Designated critical habitat for this species includes freshwater and marine sites necessary to support one or more Chinook salmon life stages. These areas are important for the species' overall conservation by protecting quality growth, reproduction, and feeding. Specific primary constituent elements include (1) freshwater spawning sites, (2) freshwater rearing sites, (3) freshwater migration corridors, (4) offshore marine areas, (5) nearshore marine habitat, and (6) estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity.

2.7 Chum Salmon (Hood Canal Summer Run)

Chum salmon, also known as dog salmon, are usually the last of the Pacific salmon to enter fresh water, generally spawning in early winter. Chum salmon are known for the striking calico pattern of spawning males, which exhibit a bold, jagged reddish and black line along their flank. Chum salmon are second only to Chinook salmon in adult size, with individuals reported up to 1.1 meter (43 inches) in length and 20 kg (46 pounds) in weight. The average size for the species is around 3.6-6.8 kg (8-15 pounds).

2.7.1 Distribution

The Hood Canal summer chum salmon ESU includes all naturally spawned populations (eight existing runs) of summer-run chum in tributaries to the Hood Canal, and in Discovery Bay, Sequim Bay, and the Dungeness River on the Strait of Juan de Fuca (NMFS 2007b). Most of the historical summer chum stocks on the east side of Hood Canal have been extirpated.

2.7.2 Life History

Chum salmon spend more of their life history in marine waters than any other Pacific salmonid species. Juvenile chum migrate to saltwater almost immediately after emerging from gravel, thus their early marine survival depends substantially on estuarine conditions (unlike other salmonid species that depend extensively on freshwater habitat). Also unlike other salmon species, chum salmon form schools, a characteristic that is presumed to help them reduce predation.

Eggs are deposited in the gravel of freshwater natal streams from December to February with the fry emerging in the spring. Chum fry are long, slim, and silvery, with a blue-green iridescence quite distinct from the fry of other Pacific salmon, and go directly to sea with no hold-over residence in either stream or lake. Chum salmon reach maturity at 3 to 5 years of age, with 60 to 90 percent of the fish maturing at four years of age.

Chum salmon usually spawn in the lower reaches of rivers, probably due to their lack of persistence in overcoming blockages and falls. Although chum may migrate upstream for over 160 km (100 miles) on some river systems, most of these rivers are low gradient and without substantial blockages. Redds are usually dug in the mainstem or in side channels of rivers beginning just above tidal influence. Some chum salmon even spawn in intertidal zones of streams at low tide, particularly where groundwater upwelling is present.

Some scientific observations of chum suggest that the returning adults have a greater tendency to stray to other river systems than other salmonids. This is thought to be due to a number of possible factors such as their spawning location near the mouths of rivers, which does not afford the juveniles the long downstream migration undertaken by other species during the process of imprinting. Additionally, chum salmon enter streams when they are sexually mature and may not be able to endure a delay, leading them to spawn at the first available location. Additional studies on straying by chum have been inconclusive and are affected by hatchery releases.

The timing of hatching and the young fry’s emergence from gravel varies by stream temperature, dissolved oxygen level, gravel size, salinity, and nutritional conditions. Summer chum eggs and alevins (juveniles with egg-sac attached) develop in the redds for approximately 18 to 20 weeks before emerging as fry between February and the last week of May. Outmigration to saltwater may take only hours or days where the spawning sites are close to the river mouth. Estuarine residency is the most critical phase in the life history of chum. They remain close to the surface, rearing in shallow eelgrass beds, tidal creeks, sloughs or other productive estuarine areas for several weeks between January and July.

Although migratory information on chum is limited, both Asian and North American chum are found in the North Pacific and Bering Sea. North American chum salmon are rarely found west of the mid-Pacific ocean, while Asian-origin chum have been shown to migrate eastward of that point. After two to four years in the northeast Pacific ocean, Puget Sound-origin chum reaching maturity follow a southerly migration path parallel to the coastline of southeast Alaska and British Columbia.

In Washington State, fall-timed runs of chum predominate, generally returning to their streams of origin from October to November. However, distinct summer runs of chum in Hood Canal and the eastern Strait of Juan de Fuca spawn from late August to mid-October. Hood Canal summer chum spawn soon after they enter freshwater in the lowest reaches of their natal streams. Ninety percent of summer chum in the Quilcene River spawn in the lowest mile. In Salmon Creek the summer chum also spawn within the lowest mile, and in Snow and Jimmycomelately Creeks they spawn in the lowest one-half mile.

Genetic data indicate a strong and long-standing reproductive isolation between Hood Canal summer chum and other chum populations in the United States and British Columbia. Summer chum populations are rare in the southern portion of the specie’s range. The high water temperatures and low stream flows in the late summer and early fall are unfavorable for salmonids south of northern British Columbia. The ability of Hood Canal Summer Chum to persist in the face of such hostile conditions led the NMFS Biological Review Team to conclude that these populations contribute to the ecological and genetic diversity of the species as a whole (Good et al. 2005). Although a few summer-run populations are also present in southern Puget Sound, the genetic data indicate that the summer-run populations of Hood Canal and the eastern Strait of Juan de Fuca are part of a much more ancient lineage.

2.7.3 Prey and Predators

In fresh water juveniles feed on Diptera larvae, diatoms, and cyclops; in salt water juveniles feed on a variety of zoo plankton. Adults feed on polychaetes, pteropods, squid, crustacean larvae, copepods, amphipods, and fish (NatureServe 2010). A variety of fish and birds prey upon juvenile chum salmon; sharks, sea lions and seals, and orcas eat adults.

2.7.4 Threats

Chum salmon are the least commercially valuable species. Hood Canal summer run chum migrate through the study area. The chum salmon’s minimal dependence on freshwater for rearing could be a main reason why the impacts to their runs are not as widespread as other salmon species.

Freshwater, estuarine, and marine habitat loss or degradation is thought to be the primary reason for declining populations. Instream flow abundance during summer and rapidly rising hydrograph in urbanizing areas are impacts associated with watershed management issues that can influence population abundance.

Degradation and loss of habitat in the headwaters of many Washington rivers now limits their spawning range (Wydoski and Whitney 2003).

2.7.5 Regulatory Status

Hood Canal summer-run chum salmon were listed as threatened on March 25, 1999 and reaffirmed on June 28, 2005 and July 26, 2011. A final ESA 4(d) rule adopting regulations to conserver Hood Canal summer-run chum was issued on July 10, 2000 (65 FR 42422). Critical habitat for this species was designated on September 2, 2005 (70 FR 52630). The specific geographic area includes the Skokomish River, Hood Canal subbasin, which includes the Hamma Hamma and Dosewallips rivers and others, the Puget Sound subbasin, Dungeness/Elwha subbasin, and nearshore marine areas of Hood Canal and the Strait of Juan de Fuca from the line of extreme high tide to a depth of 30 meters (98 feet).

The specific primary constituent elements identified for Hood Canal summer-run chum salmon are (1) freshwater spawning sites, (2) freshwater rearing sites, (3) freshwater migration corridors, (4) offshore marine areas, (5) nearshore marine habitat, and (6) estuarine areas. The physical or biological features that characterize these sites include water quality and quantity, natural cover, forage, adequate passage conditions, and floodplain connectivity.

2.8 Puget Sound Steelhead

Steelhead are the sea-going or anadromous form of rainbow trout and perhaps the most acclaimed sport fish on the West Coast of North America. As a member of the taxonomic genus

Oncorhynchus, they exhibit the most diversity in life history of perhaps any other species of salmon, which is expressed both within and between distinct populations. This diversity makes steelhead possibly the most difficult of all Pacific salmonid species to protect and manage. Steelhead and resident rainbow trout are genetically identical, and resident forms typically retain the ability to revert to their anadromous life history form if environmental circumstances are favorable, and vice versa if conditions are unfavorable.

2.8.1 Distribution

The Puget Sound steelhead DPS includes more than 50 stocks of summer- and winter-run fish, with winter-run being the most widespread and numerous of the two runs (NMFS 2007c). This DPS includes all naturally spawned anadromous winter-run and summer-run populations in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, bounded to the west by the Elwa River and to the north by the Nooksack River and Dakota Creek. The Green River natural run and Hamma Hamma winter-run hatchery stock are also included.

2.8.2 Life History

Steelhead occupy both mainstem rivers and tributary streams throughout Puget Sound, and are known for their use of the uppermost reaches of headwater streams, when accessibility allows. The life history diversity of steelhead populations is expressed in a variety of ways, including multiple return times (i.e., a “winter” run and a “summer” run) within a given year to their natal streams, varying periods of freshwater and ocean residency, and distinct changes in life history strategy between generations even within a distinct population. The life history of steelhead also differs from many *Oncorhynchus* species in several fundamental way including; the frequent concurrent presence of resident forms of *O. mykiss* (often referred to as rainbow or redband trout) as well as the ability to complete more than one cycle of spawning This diversity enables the species to persist in highly variable environments and historically was highly distributed across the landscape of Puget Sound.

Winter and summer run are the two major life history types expressed by steelhead, which are related to the degree of sexual development at the time of adult freshwater entry (Smith 1969, Burgner et al. 1992). The winter run of steelhead is the predominant run in Puget Sound, in part because there are relatively few basins in the Puget Sound ESU with the geomorphological and hydrological characteristics necessary to establish the summer run life history. The summer run steelhead’s extended freshwater residence prior to spawning results in higher pre-spawning mortality levels relative to winter run steelhead.

2.8.2.1 Winter Run Steelhead

In general, winter run, or ocean maturing, steelhead return as adults to the tributaries of Puget Sound from December to April (WDF et al. 1973). Spawning occurs from January to mid- June, with peak spawning occurring from mid-April through May. Prior to spawning, maturing adults hold in pools or in side channels to avoid high winter flows. Steelhead tend to spawn in moderate to high gradient sections of streams. In contrast to semelparous (death after spawning) Pacific salmon, steelhead females do not guard their redds, or nests, but return to the ocean following spawning (Burgner et al. 1992). Spawned out females that return to the sea are referred to as “kelts.”

2.8.2.2 Summer Run Steelhead

The life history of summer run steelhead is highly adapted to specific environmental conditions. Because these conditions are not common in Puget Sound, the relative incidence and size of summer run steelhead populations is substantially less than that for winter run steelhead. Summer run steelhead also have not been widely monitored, in part, because of their small population size and the difficulties in monitoring fish in their headwater holding areas.

2.8.2.3 Juvenile Life History

The majority of steelhead juveniles reside in fresh water for two years prior to emigrating to marine habitats with limited numbers emigrating as 1- or 3-year-old smolts. Smoltification and seaward migration occur principally from April to mid-May (WDF et al. 1973). Two-year-old naturally produced smolts are usually 140 to 160 mm (5.5 to 6.3 inches) in length (Wydoski and Whitney 1979, Burgner et al. 1992). While the inshore migration pattern of steelhead in Puget Sound is not well understood, it is generally thought that steelhead smolts move quickly offshore (Hartt and Dell 1986 as cited in Hard et al. 2007).

Juvenile steelhead will often reside in freshwater for a longer period of time than juveniles of pink, chum, Chinook, and coho salmon, and are thus, more susceptible to changes in habitat quality that may lower their freshwater survival rate (Scott and Gill 2008). Steelhead also typically spawn in the winter through spring months, rather than late summer early fall spawning exhibited by other species.

2.8.2.4 Ocean Migration

Steelhead oceanic migration patterns are poorly understood. Puget Sound steelhead feed in the ocean for 1 to 3 years before returning to their natal stream to spawn. Evidence from tagging and genetic studies indicates Puget Sound steelhead travel to the central North Pacific Ocean (French et al. 1975; Burgner et al. 1992; Hartt and Dell 1986 as cited in Hard et al. 2007). Typically, Puget Sound steelhead spend two years in the ocean although, notably, Deer Creek summer run steelhead spend only a single year in the ocean before spawning.

2.8.3 Prey

In streams, steelhead feed primarily on drift organisms and may ingest aquatic vegetation (likely for attached invertebrates), while their ocean diet consists of fish and crustaceans. (NatureServe 2013)

2.8.4 Threats

Degradation of riverine, estuarine, and nearshore habitat has resulted in the loss of an average of 83 percent of the potential production of the 42 steelhead populations assessed in Washington (Scott and Gill 2008).

Habitat utilization by steelhead has been primarily affected by reductions in habitat quality and fragmentation. The mechanisms that have contributed to significant decline in native steelhead populations in Puget Sound are varied and cumulative, and are largely the same as those leading to the decline of other native salmon stocks. Over-harvesting by sport and commercial fisheries, loss of significant portions of freshwater habitats from 150 years of land development and water uses, deterioration in water quality, intraspecific and interspecific conflicts with hatchery produced salmonids planted to freshwater habitats, and a wide variety of other cumulative and synergistic effects. The loss of freshwater and nearshore marine habitats are among the most pervasive and insidious causes in the decline of steelhead, including those resulting from agricultural practices, expansion of urban areas into tributary rivers, mining, hydropower development, alteration of river corridors, expansion of transportation corridors, discharge of pollutants from industrial, municipal sources and stormwater runoff (Hard et al. 2007).

A number of large water supply and hydropower dams in the Puget Sound basin have affected steelhead. In addition to eliminating accessibility to habitat, dams affect habitat quality through changes in river hydrology, temperature profile, and channel form affects sediment supply and routing, and the recruitment and movement of large woody debris. Nearly all of the lower reaches of Puget Sound rivers and their tributaries in Puget Sound have been dramatically altered by urban development, including the expansion of transportation corridors and its associated runoff of polluted stormwater associated with large areas of impervious surfaces including, buildings, roads and parking lots (Hard et al. 2007, Collins et al. 2003).

The loss of wetland and riparian habitat has dramatically changed the hydrology of many urban streams, with increases in flood frequency and peak flow during storm events and decreases in groundwater-driven summer flows. Flood events result in gravel scour, bank erosion, and sediment deposition. Land development for agricultural purposes has also altered the historical land cover; however, because much of this development took place in river floodplains, there has been a direct impact on river morphology. River braiding and sinuosity have been reduced through the construction of dikes, hardening of banks with riprap, and channelizing the main stem. Where rivers are constrained by levees, there is an increased risk of gravel bed scour of redds and dislocation of rearing juveniles during high flow events.

2.8.5 Regulatory Status

Steelhead was first listed as threatened in 2007 and relisted in 2011(FR 76, No. 157 / Monday, August 15, 2011 / Proposed Rules). In the Puget Sound region, NMFS listed 44 stocks for protection under federal ESA in May 2007. In Puget Sound, the DPS of this species includes all naturally spawned anadromous winter-run and summer-run steelhead populations, in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive), and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks. On September 25, 2008, NMFS issued a final ESA 4(d) rule adopting protective regulations for threatened West Coast salmon and steelhead to this DPS of steelhead in Puget Sound (73 FR 55451). Critical habitat has been proposed by NMFS (January 2013) and would include approximately 1,880 stream miles (3,026 km) that are currently occupied by steelhead and contain physical and biological features essential to the conservation of the species (NMFS 2013). However, the proposed critical habitat does not include marine waters, so it would not be affected by the proposed action.

Primary constituent elements of steelhead critical habitat include (1) freshwater spawning, rearing and migration sites, (2) estuarine areas, (3) nearshore marine areas, and (4) offshore marine areas. The physical or biological features that characterize these sites include water quality, natural cover, adequate passage conditions, floodplain connectivity, and forage including aquatic invertebrates and fishes.

2.9 Pacific Eulachon

Eulachon are a short lived, high fecundity, high mortality forage fish, and tend to have extremely large population sizes. Eulachon abundance exhibits considerable year-to-year variability. Eulachon typically spend 3 to 5 years in saltwater before returning to freshwater to spawn from late winter through mid-spring.

2.9.1 Distribution

Pacific eulachon is an anadromous fish that occurs in the lower portions of certain rivers draining into the northeastern Pacific Ocean, ranging from Northern California to the southeastern Bering Sea in Bristol Bay, Alaska (Hubbs 1925, Schultz and DeLacy 1935, McAllister 1963, Scott and Crossman 1973, Willson et al. 2006). Beacham (2005) identified 33 eulachon spawning rivers in British Columbia, 14 of these were classified as supporting regular yearly spawning runs. The southern population of Pacific eulachon consists of populations spawning in rivers south of the Nass River in British Columbia, Canada, to, and including, the Mad River in California (74 FR 10857). Eulachon have been found in numerous coastal rivers in northern California, Oregon, and Washington (including the Quinault and Elwha Rivers) (Emmett et al. 1991, Willson et al. 2006).

2.9.2 Life History

Eulachon eggs average 1 mm (0.04 inch) in size and are broadcast into the water column, attaching to a variety of substrates from sand to pea-sized gravel. Eggs are fertilized in the water column. After fertilization, the eggs sink and adhere to the river bottom, typically in areas of gravel and coarse sand. Most eulachon adults die after spawning. Eulachon eggs hatch in 20 to 40 days with incubation time depending on water temperature (Howell et al. 2001). Newly hatched young, which are transparent, and 4 to 7 mm (0.2 to 0.3 inch) in length are carried to the sea with the current (Hay and McCarter 2000). It is not known how long larval eulachon remain in the estuary before entering the ocean (NMFS 2010a). Similar to salmon, juvenile eulachon are thought to imprint on the chemical signature of their natal river basins. However, because juvenile eulachon spend less time in freshwater environments than do juvenile salmon, researchers hypothesize that this short freshwater residence time may cause returning eulachon to stray between spawning sites at higher rates than salmon (Hay and McCarter 2000).

Once juvenile eulachon enter the ocean, they move from shallow nearshore areas to deeper areas over the continental shelf. Larvae and young juveniles become widely distributed in coastal waters, where they are typically found near the ocean bottom in waters 20 to 150 meters deep (66 to 292 feet) (Hay and McCarter 2000) and sometimes as deep as 182 meters (597 feet) (Barraclough 1964). There is currently little information available about eulachon movements in nearshore marine areas and the open ocean. However, eulachon occur as bycatch in the pink shrimp fishery (Hay et al. 1999; Olsen et al. 2000; NWFSC 2008; Hannah and Jones 2009), which indicates that the distribution of these organisms overlaps in the ocean.

Historically, eulachon runs in northern California were thought to start as early as December and January and peak in abundance during March and April. Historically, large numbers of eulachon migrated upstream in March and April to spawn, but they rarely moved more than 13 km (8 miles) inland (NAS 2004). Spawning occurs in gravel riffles, with hatching about a month later. The larvae generally move downstream to the estuary following hatching.

Eulachon rear in the pelagic zone and return to freshwater to spawn. Spawning grounds are typically in the lower reaches of larger rivers fed by snowmelt (Hay and McCarter 2000). Willson et al. (2006) concluded that the age distribution of eulachon in a spawning run varies considerably, but typically consists of fish that are between 2 and 5 years old. Eulachon eggs commonly adhere to sand (Langer et al. 1977) or pea-sized gravel (Smith and Saalfeld 1955), though eggs have been found on a variety of substrates, including silt, gravel to cobble sized rock, and organic detritus (Smith and Saalfeld 1955; Langer et al. 1977; Lewis et al. 2002). Eggs found in areas of silt or organic debris reportedly suffer much higher mortality than those found in sand or gravel (Langer et al. 1977). The sexes must synchronize their activities closely, unlike some other group spawners such as herring, because eulachon sperm remain viable for only a short time, perhaps only minutes (Hay and McCarter 2000).

Eulachon spawn once and then die. During spawning, males have a distinctly raised ridge along the middle of their bodies. Eulachon generally spawn in rivers that are either glacier or snowpack fed and that experience spring freshets (flooding). Spawning grounds are typically in the lower reaches of larger rivers fed by snowmelt and spawning typically occurs at night. In many rivers, spawning is limited to the part of the river that is influenced by tides (Lewis et al. 2002), some exceptions exist. In the Berners Bay system of Alaska, the greatest abundance of eulachon is observed in tidally-influenced reaches, but some fish ascend well beyond the tidal influence (Willson et al. 2006). In addition, eulachon once ascended more than 160 km (100 mile) in the Columbia River system (Smith and Saalfeld 1955).

Spawning occurs at between 0 and 10 °C (32 and 50 °F) throughout the range of the species, and is largely limited to the part of the river that is tidally influenced (Lewis et al 2002). Entry into spawning rivers appears to be related to water temperature and the occurrence of high tides (Smith and Saalfeld 1955; Spangler 2002). Spawning generally occurs in January, February, and March in the Columbia River, Klamath River, and the coastal rivers of Washington and Oregon, and April and May in the Fraser River. It has been argued that because these freshets rapidly move eulachon eggs and larvae to estuaries, it is likely that eulachon imprint and home to an estuary into which several rivers drain rather than to individual spawning rivers (Hay and McCarter 2000). There is some evidence that water velocity greater than 0.4 meters/second (1.3 feet per second) begins to limit the upstream movements of eulachon (Lewis et al. 2002).

Eulachon runs in central and northern British Columbia typically occur in late February and March or late March and early April. However, attempts to characterize eulachon run timing are complicated by marked annual variation in timing. Willson et al. (2006) give several examples of spawning run timing varying by a month or more in rivers in British Columbia and Alaska. Water temperature at the time of spawning varies across the distribution of the species. Although spawning generally occurs at temperatures from 4 and 7 °C (39 and 45° F) in the Cowlitz River (Smith and Saalfeld 1955), and at a mean temperature of 3.1 °C (37.6 °F) in the Kemano and Wahoo Rivers, peak eulachon runs occur at noticeably colder temperatures (between 0 and 2 °C [32 and 36 °F]) in the Nass River. The Nass River run is also earlier than the eulachon run that occurs in the Fraser River, which typically has warmer temperatures than the Nass River (Langer et al. 1977).

2.9.3 Prey and Predators

Eulachon adults feed on zooplankton, chiefly eating crustaceans such as copepods and euphausiids, including *Thysanoessa* spp. (Hay and McCarter 2000, WDFW and ODFW 2001), unidentified malacostracans (NMFS 2011c), and cumaceans (Smith and Saalfeld 1955). Eulachon larvae and juveniles eat a variety of prey items, including phytoplankton, copepods, copepod eggs, mysids, barnacle larvae, worm larvae, and eulachon larvae (WDFW and Oregon Fish and Wildlife Service [ODFW] 2001). Adults and juveniles commonly forage at moderate depths (20-150 meter [66-292 feet]) in nearshore marine waters (Hay and McCarter 2000). Eulachon adults do not feed during spawning (McHugh 1939; Hart and McHugh 1944).

Eulachon have a very high lipid content (Iverson et al. 2002), and their historical large spawning runs made them an important part of the Pacific coastal food web. They have numerous avian predators, including sea birds such as harlequin ducks (*Histrionicus histrionicus*), pigeon guillemots (*Cepphus Columba*), common murres *(Uria aalge*), mergansers, cormorants, gulls, and eagles (NMFS 2010a). Marine mammals such as baleen whales, orcas, dolphins, pinnipeds, and beluga whales (*Delphinapterus leucas*) are known to feed on eulachon. Fish that prey on eulachon include white sturgeon (*A. transmontanus*), spiny dogfish (*Squalus acanthias*), sablefish (*Anoplopoma fimbria*), salmon sharks (*Lamna ditropis*), arrowtooth flounder (*Atheresthes stomias*), Pacific hake (*Merluccius productus*), salmon, Dolly Varden (*S.malma malma*), Pacific halibut (*Hippoglossus stenolepis*), and Pacific cod (*Gadus macrocephalus*) (NMFS 2010a). In particular, eulachon and their eggs seem to provide a significant food source for white sturgeon in the Columbia and Fraser rivers (McCabe et al. 1993; NMFS 2010a).

2.9.4 Threats

Habitat loss and degradation threaten eulachon, particularly in the Columbia River basin. Hydroelectric dams block access to historical eulachon spawning grounds and affect the quality of spawning substrates through flow management, altered delivery of coarse sediments, and siltation. The release of fine sediments from behind a USACE sediment retention structure on the Toutle River has been negatively correlated with Cowlitz River eulachon returns 3 to 4 years later and is thus implicated in harming eulachon in this river system, though the exact cause of the effect is undetermined. Dredging activities in the Cowlitz and Columbia rivers during spawning runs may entrain and kill eulachon or otherwise result in decreased spawning success.

Eulachon have been shown to carry high levels of chemical pollutants, and although it has not been demonstrated that high contaminant loads in eulachon result in increased mortality or reduced reproductive success, such effects have been shown in other fish species. Eulachon harvest has been curtailed significantly in response to population declines. However, existing regulatory mechanisms may be inadequate to recover eulachon stocks.

Global climate change may threaten eulachon, particularly in the southern portion of its range where ocean warming trends may be the most pronounced and may alter prey, spawning, and rearing success.

2.9.5 Regulatory Status

On March 13, 2009, NMFS proposed listing the Southern DPS of eulachon as a threatened species (74 FR 10857). This DPS encompasses all populations within the states of Washington, Oregon, and California, and extends from the Skeena River in British Columbia (inclusive) south to the Mad River in Northern California (inclusive). The DPS is divided into four sub-areas: Klamath River, Columbia River, Fraser River, and British Columbia coastal rivers south of the Nass River. Adult eulachon to have been recorded from several locations on the Washington and Oregon coasts and were previously common in Oregon's Umpqua River and the Klamath River in northern California (Hay and McCarter 2000; Willson et al. 2006; NMFS 2010a).

On March 18, 2010, NMFS listed the southern DPS of eulachon as threatened under the ESA (75 FR 13012). NMFS determined that the species is comprised of at least two DPS units:

- A southern DPS consisting of populations spawning in rivers south of the Nass River in British Columbia, Canada, to, and including, the Mad River in California; and
- At least one (and perhaps several) additional DPS from the Nass River to the northern and western extent of the species' range.

The southern DPS listing as "threatened" is based on an evaluation of its status and of existing efforts to protect the species. The current abundance of eulachon is low and declining in all surveyed populations throughout the DPS. Eulachon populations spawning in the Klamath River, lower Columbia River Basin, and Fraser River have declined substantially and the southern DPS will likely become endangered in the near future if ongoing threats are not addressed. Past and ongoing Federal, state, and local protective efforts (many of them habitat-based) have contributed to the conservation of the southern DPS, but these efforts alone do not sufficiently reduce the extinction risks faced by the southern DPS. On July 3, 2013 NMFS issued a Notice of Intent to prepare a recovery plan for Pacific eulachon for the conservation and survival of the species (78 FR 40104). To date, no recovery plan has been released.

Specific threats for the Klamath River and lower Columbia River Basin portions of the southern DPS (NMFS 2010a; 75 FR 13012, March 18, 2010), as identified by NMFS(2010) are listed below:

- Climate change impacts on ocean conditions;
- Eulachon by-catch;
- Climate change impacts on freshwater habitat;
- Dams / water diversions;
- Water quality; and
- Dredging.

NMFS designated critical habitat for eulachon on October 20, 2011 (76 FR 65324) including approximately 539 km (335 miles) of riverine and estuarine habitat in California, Oregon, and Washington within the geographical area occupied by southern DPS eulachon. These critical habitat areas contain one or more of the physical or biological features essential to the conservation of the species; tribal land is excluded from this listing. Unoccupied areas have not been designated as critical habitat at this time.

The physical or biological features essential to the conservation of the southern DPS eulachon fall into three major categories reflecting key life history phases:

- Freshwater spawning and incubation sites with water flow, quality and temperature conditions and substrate supporting spawning and incubation, and with migratory access for adults and juveniles.
- Freshwater and estuarine migration corridors associated with spawning and incubation sites that are free from obstruction and with water flow, quality and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeing after the yolk sac is depleted.
- Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival.

2.10 Green Sturgeon (Southern DPS)

Green sturgeon is a long-lived, slow-growing fish and the most marine-oriented of the sturgeon species.

2.10.1 Distribution

Green sturgeon is a widely-distributed and marine-oriented species found in nearshore waters from Baja, California to Canada. Green sturgeon are anadromous, spawning in the Sacramento, Klamath, and Rogue rivers in the spring. Adults enter their natal river and spawn in the spring, and typically leave the river the following autumn (NMFS 2007a). Green sturgeon inhabit certain estuaries on the northern California, Oregon, and Washington coasts during the summer, and inhabit coastal marine waters along the central California coast and between Vancouver Island, B.C. and southeast Alaska over the winter (NMFS 2007a).

2.10.2 Life History

Green sturgeon have a complex anadromous life history, spending more time in the ocean than any other sturgeon species. The majority of green sturgeon are thought to spawn in the Klamath River, but spawning also occurs in the Columbia River, Sacramento, and Rogue rivers. Green sturgeon is a long-lived, slow-growing species. First spawning occurs at 15 years for males and 17 years for females. Female green sturgeon are thought to spawn only every 5 years. Adults migrate into rivers to spawn from April to July with a May to June peak. Eggs are spawned among rocky bottom substrates and juveniles spend 1 to 4 years in freshwater. After green sturgeon enter the ocean, they make northern migrations. Green sturgeon concentrate in coastal estuaries, particularly the Columbia River estuary and coastal Washington estuaries during the late summer and early fall. Neither feeding nor spawning occurs in association with these concentrations. Grays Harbor is the northern most estuary with green sturgeon summer concentrations. A few green sturgeon have been recovered in Puget Sound as incidental harvest (Adams et al. 2002).

2.10.3 Prey

The only feeding data collected on adult green sturgeon indicates that they are consuming benthic invertebrates including shrimp, mollusks, amphipods, and small fish (Moyle et al. 1992 as cited in NMFS 2007a).

2.10.4 Threats

Green sturgeon face several threats, including the loss of spawning habitat, degradation of water quality in occupied areas, fisheries harvest, and poaching. The freshwater habitat used by green sturgeon for spawning has been affected by habitat alteration from water development and land-use practices causing sedimentation (NMFS 2007a and 75 FR 30714).

2.10.5 Regulatory Status

There are two DPSs defined for green sturgeon – a northern DPS with spawning populations in the Klamath and Rogue rivers and a southern DPS that spawns in the Sacramento River (NMFS 2008c). The southern DPS includes all spawning populations of green sturgeon south of the Eel River in California, of which only the Sacramento River currently contains a spawning population. The southern DPS of green sturgeon has been listed as a threatened species under the ESA (71 FR 17757), whereas the northern DPS is a Species of Concern.

On April 7, 2006 NMFS listed the Southern DPS of green sturgeon threatened under the Endangered Species Act (71 FR 17757). A final ESA 4(d) rule adopting regulations to conserve the southern DPS of green sturgeon was issued on June 2, 2010 (75 FR 30714). On October 24, 2012, NMFS initiated a 5-year review of the southern DPS to ensure the accuracy of the listing classification of the species.

Critical habitat for the southern DPS was designated on October 9, 2009 (74 FR 52300). The specific geographic area includes coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor). This rule designates approximately 515 km (320 miles) of freshwater river habitat, 2,323 km^2(897 $mile^2$) of estuarine habitat, 29,581 km^2(11,421 $mile^2$) of marine habitat, 784 km (487 miles) of habitat in the Sacramento-San Joaquin Delta, and 350 km^2(135 $miles^2$) of habitat within the Yolo and Sutter bypasses (Sacramento River, CA).

The specific primary constituent elements identified for green sturgeon in costal marine areas include (1) migratory corridor, (2) water quality, and (3) food resources.

2.11 Rockfish (Bocaccio Rockfish, Canary Rockfish, Yelloweye Rockfish)

At least 63 species of rockfishes (Family Scorpaenidae: Genus *Sebastes*) inhabit waters of the northeast Pacific, from the Gulf of Alaska to California (Robins et al. 1980 as cited in Love et al. 1990). Once supporting an important commercial and sport fishery, numbers of some species have become severely depleted in recent decades. Of the many species of rockfish, there are three native to Northern Puget Sound listed on the endangered species list: bocaccio, canary, and yelloweye rockfish. Washington State has recently completed a conservation management strategy that attempts to protect remaining populations and rebuild depleted stocks (WDFW 2011a).

2.11.1 Distribution

Rockfish as a group are among the most common species of fish found in Puget Sound. They are year-round residents and can be found in nearly every area, depth, and habitat type. The three listed rockfish species (bocaccio, canary, and yelloweye) are all considered members of the "deep water" assemblage of this species, and are not typically found in nearshore marine areas, but rather, prefer rocky, deep water habitat.

2.11.2 Life History

Rockfish are some of the longest lived fish known in Puget Sound, with some individuals living to beyond 50 years. Some species of rockfish may mature as early as age two, but it is more common for these species take from 6 to 11 years to reach sexual maturity, while the yelloweye rockfish may not become sexually mature until age 22 (Palsson et al. 2009). Old, large female fish produce exponentially more offspring than younger fish. Rockfishes are unusual among the bony fishes in that fertilization and embryo development is internal and female rockfish give birth to live larval young (timing provided in Table 2.10-1). Larvae are found in surface waters and may be distributed over a wide area extending several hundred miles offshore. Larvae and small juvenile rockfish may remain in open waters for several months being passively dispersed by ocean currents. Juvenile rockfish "settling-out" or recruiting to nearshore habitats in Puget Sound move along specific "recruitment pathways" that include many types and a succession of habitats. Early in the recruitment process, each successive habitat is occupied for short periods, varying from days to weeks, or one to two months. These recruitment pathways end at specific nursery habitats that are benthic, usually composed of rock substrate, and have abundant food resources. Juvenile rockfish usually occupy nursery habitats for several months (Palsson et al 2009). A dominant feature of rockfish reproduction is a pattern of infrequent and irregular successful recruitment and many years with poor recruitment (WDFW 2011a). Reproductive success may occur only during narrow spatial and temporal windows when conditions are favorable for larval survival.

Table 2.10-1 Life History Timing

Deep-water Assemblage Rockfish Species listed under ESA	Timing of Larvae Release	Size of Larvae	Transform into Pelagic Juveniles @ Size	Time Interval till Juveniles Settle to Shallow Areas	Age at Sexual Maturity (years)	Lifespan (years)
Bocaccio (S. *paucispinis*)	January thru April	4.0 – 5.0mm at release	1.5 – 3.0 cm	3.5 to 5 months @ 3 to 4 cm in length	4-6	54
Canary rockfish (S. *pinniger*)	Winter	4.0 – 5.0 mm	19 – 40 mm	~ 4 months	5-(8	84
Yelloweye rockfish (S. *ruberrimus*)	February thru September	--	--	NA[1]	6-22	118

Source: 74 FR 18516; Palsson et al 2009

NA – data not available, expected to be similar or lower than for bocaccio or canary rockfish

At various times during their life history, members of this genus are found from the shallow intertidal zone to at least 768 meters (2,520 feet) in depth, over almost every bottom type and throughout much of the water column. Most rockfish species have small home territories as adults, making larvae the primary mode of dispersal (Berkely et al. 2004). Juveniles and subadults tend to be more common than adults in shallower water, and are associated with rocky reefs, kelp canopies, and artificial structures such as piers and oil platforms. Adults generally move into deeper water as they increase in size and age, but usually exhibit strong site fidelity to rocky bottoms and outcrops (Palsson et al. 2009; Drake al. 2010).

2.11.2.1 Bocaccio Rockfish

Bocaccio are large Pacific coast rockfish that reach up to 1 meter (3 feet) in length. They have a distinctively long jaw extending to at least the eye socket. Their body ranges in color from olive to burnt orange or brown as adults. Young bocaccio are light bronze in color and have small brown spots on their sides.

Bocaccio rockfish are found throughout the coastal waters of the eastern Pacific Ocean from the Gulf of Alaska south to Baja California Mexico. Two tagging studies conducted off the coast of California suggest that bocaccio movement occurs during the first few years of life and they become more sedentary as they age. The amount of movement appears to drop off after they reach a length of 47 cm (18.5 inches). The depth of catch is slightly shallower during summer than winter, with median depth of catch in the trawl fishery of 110 meters (361 feet) in summer to 180 meters (591 feet) in winter (Groundfish Atlas 2011).

Bocaccio rockfish bear live young and produce between 20,000 and 230,000 eggs. Fecundity tends to increase with the size of a female. Copulation occurs early in the fall with larval release over the winter. Off Washington and Oregon, larval release begins in January and runs through April and February, respectively (Lyubimova 1965; Moser 1967; Westrheim 1975; Wyllie-Echeverria 1987, and Love et al. 2002 all as cited in Drake et al. 2010). The larvae are 4-5 mm (0.16-0.20 inch) in length at parturition and metamorphose into pelagic juveniles at 19 - 40 mm (0.75- 1.57 inch) over a period of several months. The growth of juveniles is rapid at around 0.56 - 0.97 mm (0.02-0.04 inch) per day. They can reach 24 cm (9.45 inches) in length by the end of the first year. The juveniles settle into littoral and demersal habitat from late spring throughout the summer. Young-of-the-year live near the surface for a few months and then settle in nearshore areas where they form schools over bottom depths of 30-120 meters (98-394 feet). Adults may be semi-pelagic and are found over a variety of bottom types between depths of 60-300 meters (197-984 feet) [Groundfish Atlas 2011]) Maximum age is estimated at 54 years (Ralston and Ianelli 1998 as cited in Drake et al. 2010).

Demographically, this species demonstrates some of the highest recruitment variability among rockfish species, with many years of failed recruitment being the norm (Tolimieri and Levin 2005). High fecundity and episodic recruitment events, largely correlated with environmental conditions, mean that bocaccio populations do not follow consistent growth trajectories. Zabel et al. (2011) modeled the effect of climate variability and density of recruitment rates and demonstrated the climate indices accounted for 52 percent of the variability in recruitment, whereas density only explained 1.4 percent of the variance.

2.11.2.2 Canary Rockfish

Canary rockfish, (*Sebastes pinniger*) are distributed in the northeast Pacific Ocean from the western Gulf of Alaska to northern Baja California; however, the species is most common off the coast of central Oregon. Canary rockfish primarily inhabit waters 50-250 meters (160-820 feet) deep but may be found up to 425 meters (1,400 feet). Juveniles and sub-adults tend to be more common than adults in shallow water and are associated with rocky reefs, kelp canopies, and artificial structures, such as piers and oil platforms. Adults generally move into deeper water as they increase in size and age but usually exhibit strong site fidelity to rocky bottoms and outcrops where they hover in loose groups just above the bottom (NMFS 2011a).

Very little is known about the early life history strategies of canary rockfish, but limited research indicates larvae are strictly pelagic (near ocean surface) for a short period of time, begin to migrate to demersal waters during the summer of their first year of life, and develop into juveniles around nearshore rocky reefs, where they may congregate for up to three years (Methot and Piner 2001). Like all rockfish, they give birth to live young that drift in the surface layers as larvae for a few months, before growing into juveniles that begin to settle to deeper water and more structurally complex habitats (WDFW 2011a). Evaluations of length distributions by depth developed from NMFS shelf trawl survey data generally supports research that suggests this species is characterized by an increasing trend in mean size of fish with depth (Boehlert 1980, Archibald et al. 1981). Female canary rockfish generally grow faster and reach slightly larger sizes than males, but do not appear to live longer than males.

Canary rockfish off the U.S. Pacific coast exhibit a protracted spawning period from September through March, probably peaking in December and January off Washington and Oregon (Johnson et al. 1982, Hart 1988). Female canary rockfish reach sexual maturity at roughly eight years of age. Like many members of *Sebastes*, canary rockfish are ovoviviparous, whereby eggs are internally fertilized within females, and hatched eggs are released as live young (Bond 1979, Golden and Demory 1984, Kendall and Lenarz 1987). Canary rockfish are a relatively fecund species, with egg production correlated with size, e.g., a 49 cm (19.3 inch) female can produce roughly 0.8 million eggs and a female that has realized maximum length (say 60 cm [23.6 inches]) produces approximately 1.5 million eggs (Gunderson et al. 1980). Maximum age of canary rockfish is at least 84 years although 6 to 75 years is more common (Cailliet et al. 2000 as cited in Drake et al. 2010).

2.11.2.3 Yelloweye Rockfish

Yelloweye Rockfish range from northern Baja California to the Aleutian Islands, Alaska, but are most common from central California northward to the Gulf of Alaska. Juveniles and subadults tend to be more common than adults in shallower water, and are associated with rocky reefs, kelp canopies, and artificial structures such as piers and oil platforms. An inshore to offshore ontogenetic movement of yelloweye rockfish is documented, with juveniles moving from shallow rock reefs to deeper pinnacles and rocky habitats. Yelloweye rockfish adults do not move much and are generally considered to be site-attached (Love 1978, Coombs 1979, DeMott 1983 all cited in Drake et al. 2010). Yelloweye rockfish occur in waters 25 to 475 meters (80 to 1560 feet) deep, but are most commonly found between 91 to 180 meters (300 to 590 feet) [NMFS 2011a]).

Female yelloweye rockfish can produce from 1.2 million to 2.7 million eggs over a reproductive season, with a mean eggs per gram of body weight of 300 (MacGregor 1970, Hart 1973). Reports on maturity for yelloweye rockfish vary among areas and are ambiguous, given the use of whole otoliths for ageing in some studies, but generally seem to reach 50 percent maturity at around 40 to 50 cm and ages of 15 to 20 years (Rosenthal et al. 1982; Wyllie-Echeverria 1987; Yamanaka and Kronlund 1997).

2.11.3 Prey and Predator

Larval rockfish feed on diatoms, dinoflagellates, tintinnids, and cladocerans; while juveniles consume copepods and euphausiids of all life stages. Adults eat demersal invertebrates and small fishes, including other species of rockfish, associated with kelp beds, rocky reefs, pinnacles, and sharp drop-offs (Groundfish Atlas 2011).

Rockfish are important prey for several species of marine birds, marine mammals, and lingcod (WDFW 2011a). The main predators of juvenile rockfish are seabirds including the least tern. The main predators of adults are marine mammals such as harbor seals and northern elephant seals (Groundfish Atlas 2011).

2.11.4 Threats

Rockfish are fished directly and are often caught as bycatch in other fisheries, including those for salmon. Adverse environmental factors led to recruitment failures in the early-to-mid-1990s. These declines were largely caused by historical fishing practices, although other stress factors have also played a part in their decline. Rockfish in urban areas are exposed to high levels of chemical contamination, which may be affecting their reproductive success. Poor water quality in Hood Canal has resulted in massive periodic kills of rockfish as well as other species. In addition, lost or abandoned fishing nets trap and kill large numbers of rockfish.

2.11.5 Regulatory Status

On July, 27, 2010 NMFS listed the Puget Sound/Georgia DPSs of yelloweye and canary rockfish as threatened, and bocaccio rockfish as endangered under the ESA (75 FR 22276). Proposed protective regulations for yelloweye and canary rockfish under ESA section 4(d) will be addressed in a separate rulemaking. In 2011, WDFW released a Final EIS for the Puget Sound Rockfish Conservation Plan (PSRCP), which aims to maintain and improve rockfish abundance, distribution, diversity, and long-term productivity in their natural habitats. The plan also provides a framework for state managers to follow when developing regulations, establishing priorities, and providing guidance.

Critical habitat was proposed for these three rockfish species on August 6, 2013 (78 FR 47635). The specific areas proposed for designation for canary rockfish and bocaccio include approximately 1,184.75 sq. miles (3,068.5 sq. km) of marine habitat in Puget Sound, including 610.0 sq. miles of nearshore habitat for canary rockfish and bocaccio, and 574.75 sq. mi (1,488.6 sq. km) of deepwater marine habitat. Specific areas for yelloweye rockfish are the same 574.75 sq. mi (1,488.6 sq. km) of deepwater marine habitat in Puget Sound. Critical habitat for yelloweye rockfish does not include nearshore areas.

The primary constituent elements identified for proposed rockfish critical habitat are described in the following two major categories reflecting key life history phases (NOAA 2013):

Adult canary rockfish and bocaccio, and adult and juvenile yelloweye rockfish: Benthic habitats or sites deeper than 30 meters (98 feet) that contain rock or highly uneven habitat features to provide the structure needed for rockfish to avoid predation, seek food and persist for decades. The quality of the habitat is dependent upon the quantity, quality, and availability of prey species, water quality and sufficient levels of dissolved oxygen (DO), and the type and amount of habitat structure and rugosity.

Juvenile canary rockfish and bocaccio only: Juvenile settlement habitats located in the nearshore[5] with substrates such as sand, rock and/or cobble compositions that also support kelp to enable forage opportunities and refuge from predators, and also enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats. The quality of the habitat is dependent upon the quantity, quality, and availability of prey species, and the water quality and sufficient levels of DO to support growth, survival, reproduction, and feeding opportunities.

2.12 Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*) is a small diving seabird in the Alcidae Family. It is distinguishable by its chubby compact body, very short neck, thin black bill, and dark sooty upper feathers, and white marbled under belly. In the summer months the feathers molt and turn to a mottled brown. They display no sexual dimorphism and both sexes have identical plumages; juvenile marbled murrelet plumage closely resembles adult birds during the summer molting season (Marshall 1988). The small wings and rear-placed legs have adapted these birds to excel at diving and underwater maneuvering to hunt for prey (Murphy 1988).

2.12.1 Distribution

North American populations of marbled murrelet are found along the Pacific coast, ranging from south-central California up to Alaska. During the summer months their range extends further north to Alaska’s Kodiak Peninsula and the Aleutian Islands. Some wintering birds have been found as far south as northern Baja California, Mexico (USFWS 1997). They primarily colonize the ocean coasts and saltwater bays and sounds, but have also been found inhabiting rivers and lakes within close proximity to the ocean. During breeding and nesting season they fly inland to mature forests up to 80 km (50 miles) from the coast, with rare instances of occupation recorded slightly further inland (Marshall 1988 and USFWS 1997).

2.12.2 Life History

Marbled murrelets are generally solitary or paired, but have been found to interact in small groups or loose flocks. They do not reach sexual maturity until at least 2 years of age and females do not lay eggs until they are at least 3 years old. Marbled murrelets nest once a year on the limbs of large trees in old-growth forests, using a small depression in existing moss or other materials on the tree limbs as a nest to lay a single egg (Marshall 1988 and USFWS 1997). The nesting season is late March to late September, with the highest activity from early May through early August in Washington (Nature Serve 2014a). Both sexes incubate the egg in alternating 24-hour periods for about a month, and the young stay in the nest for another 28 days (Marshal 1998 citing Hirsch et al. 1981, Nelson and Hamer 1995a, Simons 1980). Marbled murrelets are estimated to live an average of 10 years (USFWS 1997).

[5] Most nearshore areas are contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters (98 feet) relative to mean lower low water. Several nearshore areas proposed as critical habitat are not associated with a beach, but are shallower than 30 meters and can support kelp and rearing habitat. They include areas of Hein Bank, Partridge Bank, Coyote Bank, and Middle Bank, and several areas north of Orcas Island.

2.12.3 Prey

Marbled murrelet subsists mostly on small fish and the occasional crustacean. They dive for prey in nearshore open waters up to 80 meters (260 feet) deep, and have been known to dive up to 30 meters (98 feet) below the surface for food (Nature Serve 2014a). In the Pacific Northwest, the main fish prey include Pacific sand lance (*Ammodytes hexapterus*), Pacific herring (*Clupea harengus*), northern anchovy (*Engraulis mordax*), and smelts (*Osmeridae*). Adults and foraging subadults, feed primarily on smaller larval or juvenile fish, whereas nestlings are most commonly brought large adult or subadult fish. The Pacific sand lance is the most common food of the species across its range and appears to be the most significant prey species in a fledgling's diet (USFWS 1997). Sardines and rockfish (Scorpaenidae) may also make up important dietary components, particularly at the southern range of the marbled murrelets habitat. In Washington and Canada, murrelets have been observed foraging in inland lakes for salmonid species during the breeding and nesting season (USFWS 1997 citing Carter and Sealy 1986). Crustaceans are not a common part of the marbled murrelets diet during the summer, but have been observed as a supplemental prey for populations during the winter and early spring months (USFWS 1997).

2.12.4 Threats

The primary anthropogenic threat to marbled murrelets is the historical and continued logging of old-growth and mature coastal coniferous forests, which reduces critical nesting areas and creates greater vulnerability of nest-predation due to fragmented tree cover. Aquatic threats include marine pollution, entanglement in fishing gear and changes in prey availability linked to fishing pressures (USFWS 1997 and USFWS 2009).

The 2009 5-year review indicates that murrelets in the Pacific Northwest have been in decline over the past decade (7 percent per year; Pearson et al. 2011) with the most recent population estimated at 4,300 birds (USFWS 2009). The primary factor contributing to the decline of murrelets is loss of nesting habitat (USFWS 1997).

2.12.5 Regulatory Status

On September 28, 1992 the USFWS listed marbled murrelet as threatened under the ESA(57 FR 45328), and is state listed as threatened in Oregon and Washington and as endangered in California. On January 21, 2010, a petition to delist the marbled murrelet was rejected (75 FR 3424) in a determination that removing the species from the endangered species list was not warranted, and it reaffirmed that the marbled murrelet continues to meet the definition of a threatened species under the ESA (USFWS 2011).

Critical habitat was designated for the marbled murrelet in Washington, Oregon, and California on May 24, 1996 (61 FR 26256) and included approximately 3,887,800 acres of terrestrial land. A revised rule was adopted on November 4, 2011 (76 FR 61599) and reduced the critical habitat acreage in northern California and southern Oregon by approximately 189,671 acres (USFWS 2011). Primary constituent elements for marbled murrelet include trees with potential nesting platforms and forested areas within 0.8 km (0.5 mile) of potential nest trees with a canopy height of at least half of the site potential tree height (USFWS 2009).

2.13 Leatherback Turtle

The leatherback turtle is the only extant member of the taxonomic family Dermochelyidae, distinguishable by their unique slightly-flexible, leathery, barrel-shaped carapace (top shell), while other sea turtle species have bony, plated carapaces and belong to the Cheloniidae family. Leatherbacks are the largest sea turtle; they can grow to be 1-2.5 meters (4-8 feet) long, and weigh up to around 900 kg (2,000 lbs.) Their skin is predominately black with varying small white spots. A leatherback's ridged carapace is made up of tough, oil-saturated connective tissue, their front flippers are long with no scales or claws, and their back flippers are paddle-shaped (Nature Serve 2014b). With adaptations that help self-regulate body temperature, a stream-lined body shape, and powerful large flippers, leatherbacks are well-adapted to quickly navigate oceans of varying depths and temperatures. They have been known to dive to depths > 1200 meters (4,000 feet), although they typically remain closer to the surface (Eckert 2012, citing Hays et al. 2004 and Doyle et al. 2008). Leatherbacks are highly pelagic, specialized for life at sea and are capable of undertaking exceptionally long-distance migrations between nesting and foraging areas.

2.13.1 Distribution

Leatherbacks are found circumglobally in tropical and temperate oceans, but smaller numbers of migratory, foraging adults can range up to cooler waters of the Gulf of Alaska and northern Europe, and south to the Cape of Good Hope and Australia. While they are more densely populated in tropical regions—such as south Pacific islands, Costa Rica, and the west coast of Mexico, and in the Atlantic along the coast of Florida, the Caribbean islands, and the western African coast—the leatherback's foraging behavior expands their range considerably. This ocean-going turtle is the most migratory and widely distributed turtle species on the planet.

Despite its wide range, leatherback nesting habitat is confined to sandy tropical/sub-tropical beaches, with quick, easy access to the water's edge from the sand. In the U.S. nesting sites are primarily found in Puerto Rico, the Virgin Islands and southeast Florida (NMFS 2013). Leatherbacks are generally considered to be a pelagic (open ocean) species, but more recent research has shown they also rely upon productive coastal regions for food (NMFS 2013). In the less temperate waters off the U.S. west coast, Pacific populations are known to forage along coastal regions with wind-driven upwelling, or eddies and fronts, that host phytoplankton blooms feeding on nutrient-rich waters rising to the surface (NMFS 2013). The Juan de Fuca eddy, which is active from spring through fall, and the mouth of the Columbia River, both provide a temporal nutrient-rich coastal environment preferred by leatherbacks (NMFS 2013, WDFW 2012). Appearances along the Pacific Northwest coast generally occur seasonally, and are likely correlated with the higher ranges of sea temperature (14-16 °C; 57-61°F) (NMFS 2013 and WDFW 2012).

2.13.2 Life History

Research on leatherbacks typically delineates five different life stages: (1) egg/hatchling, (2) post-hatchling, (3) juvenile, (4) sub-adult, and (5) adult. Uncertainties remain, due to a lack of data, about when leatherbacks reach sexual maturity; estimates range from 2 to 13-14 to 29 years of age (NMFS 2013 citing Pritchard and Trebbau 1984, Dutton et al. 2005, Avens et al. 2009). Nesting season lasts 3-6 months (in the U.S. from March to July), and the females typically lay about six clutches per season. Individual nesting seasons can have intervals of 2-4 years (Eckert et al. 2012). Females lay nests of around a hundred 5-cm (2-inch) eggs, and hatchlings emerge after approximately two months of incubation (Nature Serve 2014b). Sex is strongly determined by incubation temperature. Male hatchling are generally dominate during cooler, wet seasons while females are dominate during dryer, warmer temperatures, however the pivotal temperature that will generate a 1:1 ratio of male to female differs by locale (Eckert et al. 2012). Hatchling's emergence success is generally about 50 percent (Eckert et al. 2012), and the hatchlings then face a high risk of predation on their journey to the sea. Data indicates leatherbacks follow a similar life history strategy as other long-lived reptile species, having lower survival rates of eggs and juveniles, delayed age of maturity, and then a relatively constant and high annual survival rate after reaching the subadult stage (NMFS 2013). It has been documented that that most leatherbacks populations have some degree of nesting site fidelity, and adults generally migrate to the region where they were born to lay their eggs (Eckert et al. 2012). Lifespan of the leatherback sea turtle is largely unknown, average estimates range around 40 years of age; some leatherbacks alive today have been tagged for close to 20 years (Eckert et al. 2012).

2.13.3 Prey

Leatherback turtles subsist almost entirely upon jellyfish, but have also been known to opportunistically forage on other gelatinous organisms and small invertebrates. They generally consume 20-30% of their body weight daily to gain their required nutritional value (Eckert et al. 2012).

2.13.4 Threats

Leatherbacks face the highest threat at their nesting beaches from worldwide, illegal harvest of eggs and incidental take in commercial fishing gear (WDFW 2012). Floating plastic debris, often resembling their staple diet of jelly fish is commonly found to be accidentally ingested, and is responsible for higher rates of mortality. Leatherbacks also face nesting and foraging habitat loss, the disorientation of hatchlings from artificial lighting, and natural nest-predation (WDFW 2012).

2.13.5 Regulatory Status

The leatherback turtle was listed under the Endangered Species Act as an endangered species throughout its range in 1970 and was transferred to the current list of endangered species when the ESA was passed in 1973. It remains listed as an endangered species today. In 2012, NMFS designated leatherback critical habitat areas (50 CFR 226.207) off the coast of Washington and Oregon, these areas serve as important nearshore foraging areas for the species (NMFS 2012b). Designated critical habitat include waters 0-80 meters (0-260 feet) deep extending to the 2,000 meter (6,562 foot) depth contour and bound within the U.S. Exclusive Economic Zone (EEZ) from Cape Blanco, Oregon north along the shoreline to Cape Flattery, Washington (WDFW 2012). Primary constituent elements of leatherback critical habitat include (1) migratory pathway conditions and (2) quality and quantity of prey.

Chapter 3
Environmental Baseline

The environmental baseline is 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 an Action Area that have already undergone formal or early section 7 consultation, and the impact of State or private actions that are contemporaneous with the consultation in process. [50 CFR §402.02] It identifies the effects of past and ongoing human and natural factors leading to the status of the species, its habitat, and ecosystem within the Action Area.

The currently permitted project is included in the baseline because it was subject to a prior consultation, it was constructed and it has been operational and has been affecting the baseline since 2001. The project as it is currently being operated has two components:

- Vessel traffic –tanker, tug and barge traffic to and from the BP Marine Terminal, including the marine route through the Strait of Juan de Fuca and the San Juan Archipelago, and moorage at the dock facility during loading and unloading;
- Operation and maintenance of BP Marine Terminal including North Wing – consisting of a ship berth, loading and unloading equipment, control and metering equipment for refined product loading and unloading, and oil spill preparedness and response which includes the staging and deployment of work boats for pre-booming operations; deployment of oil spill containment booms for pre-booming during loading and unloading operations; and the staging of additional oil spill boom, sorbent pads, and an oil spill skimmer in the event of an oil spill at the dock. Regular oil spill drills are conducted to ensure a quick and appropriate response to an unintentional release.

In addition, the operation of the refinery, tank farm, and interconnecting piping between these facilities and the South Wing of the BP Marine Terminal are part of the environmental baseline, as is the existence of the North Wing and its connection to onshore facilities. Effects of these components are included as part of the environmental baseline when analyzing the effects of this action because they have already been constructed. Effects from the Proposed Action, which are related to the North Wing and not considered part of baseline, are associated with an incremental increase in vessel traffic expected as part of the Proposed Action.

3.1 Vessel Traffic

Since 2000, Ecology has maintained data and produced an annual report entitled ‘Vessel Entries and Transits for Washington Waters’ (VEAT) to provide information about commercial vessel traffic in Washington waters. These annual reports include relevant classifications of Cargo and Passenger vessels (C&P), Tank Ships and Tank Barges that travel along the routes likely to be used by the tank vessels calling at the North Wing of the BP Marine Terminal. The VEAT reports show that overall vessel traffic in Puget Sound has experienced a slight decline over the past 11 years (Table 3.1-1; Figure 3.1-1). The 2011 sum annual traffic, of relevant classification, in the Action Area was 16,789 transits (Table 3.1-1) which is based on two transits per call (a vessel must make a trip in and a trip out of Puget Sound to complete a "call").

Table 3.1-1 Puget Sound Shipping Traffic 2000-2011

Vessel Entries and Transits for Washington Waters — Total Traffic (Transits)												
Traffic Type	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
C&P	9,260	9,616	9,208	9,348	8,948	9,542	9,074	8,376	8,936	8,182	8,220	9,038
Tank Ships	1,182	2,646	1,234	1,286	1,350	1,250	1,442	1,690	1,464	1,680	1,640	1,322
Tank Barges	7,928	5,712	5,436	6,014	6,372	7,826	6,250	4,944	5,934	7,138	6,446	6,192
Fishing Vessels	652	748	672	574	566	506	414	464	496	386	340	246
Sum of Traffic	19,022	18,722	16,550	17,222	17,236	19,124	17,180	15,474	16,830	17,386	16,646	16,798

Source: Ecology 2000-2011

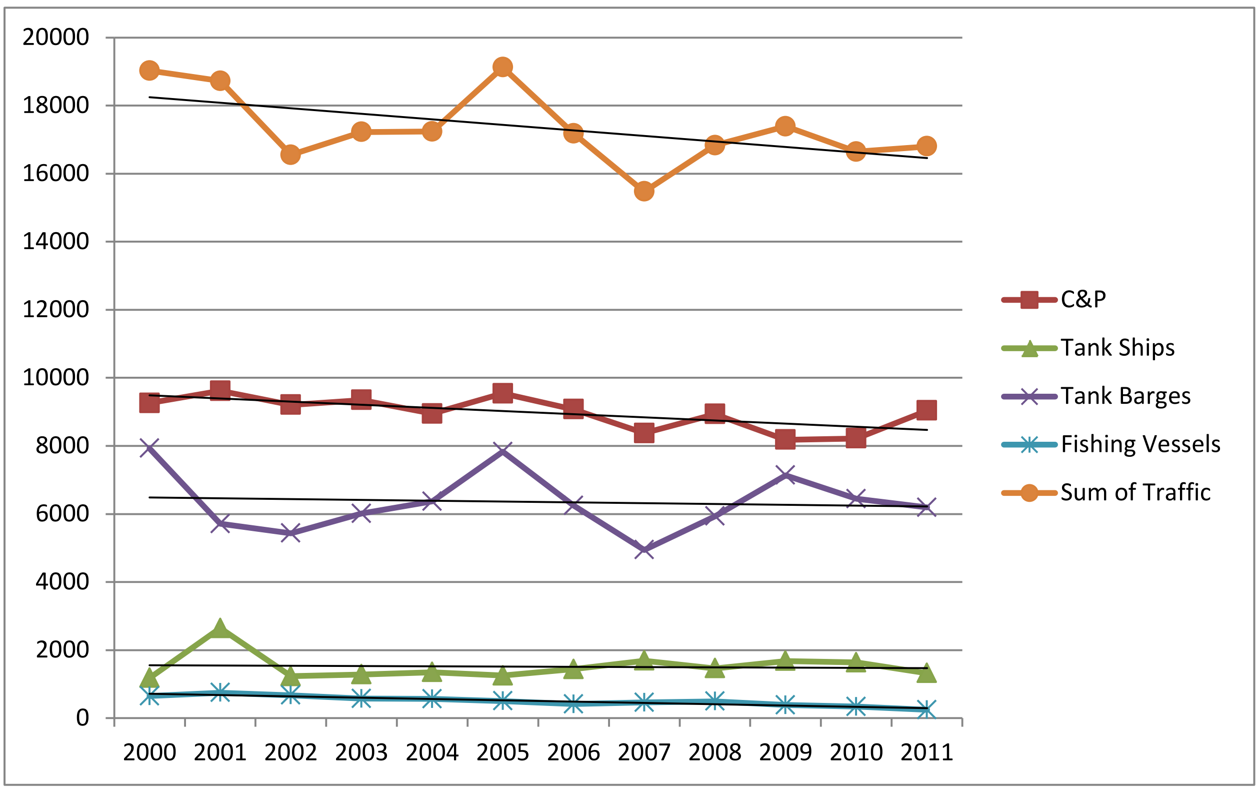

Figure 3.1-1 Puget Sound Shipping Traffic 2000-2011

Source Ecology 2000-2011

3.1.1 Vessel Traffic to BP Marine Terminal

Vessels transiting to the BP Marine Terminal from Alaska, Oregon, California, and international origins enter the Strait of Juan de Fuca and travel to Port Angeles, Washington, where a pilot comes onboard. Tankers (except double hull tankers less than 40,000 deadweight [DWT]) carrying oil or oil products are required to pick-up two escort tugs between buoy "R," north of New Dungeness Lighthouse, before transiting to the BP Marine Terminal. Most vessels then transit through Rosario Strait to the southern reach of the Strait of Georgia and onto the BP Marine Terminal at Cherry Point. In Rosario Strait large commercial vessels – typically laden tankers, are limited to one-way traffic by USCG vessel traffic rules. Thus, no large commercial ship may enter Rosario Strait for passage if another large commercial ship is transiting in the opposite direction. In rare instances, vessels transiting to the BP Marine Terminal may travel north through Haro Strait then north east through Boundary Pass to the BP Marine Terminal at Cherry Point. Vessels check-in with the joint USCG/Canadian Coast Guard (CCG) Cooperative Vessel Traffic Service prior to entering the Strait of Juan de Fuca and remain under either USCG or CCG control the entire time they are transiting to/from ports within the Strait of Juan de Fuca, Puget Sound, or the Georgia Strait. Transits of vessels to and from the BP Marine Terminal occur primarily within a Traffic Separation Scheme (TSS; Figure 3.1-2) operated jointly by the USCG and CCG.

Articulated Tugs-and-Barges (ATBs) and traditional barges (collectively referred to as barges), and some tank ships may transit to the BP Marine Terminal from Puget Sound (generally Seattle and Tacoma). From Puget Sound, these vessels transit westbound through Admiralty Inlet then turn north and pursue a course in the traffic separation lane along the western side of Whidbey Island to its intersection with Rosario Strait. They then enter Rosario Strait and transit north to the BP Marine Terminal.

Vessels approaching the BP Marine Terminal at Cherry Point may be required to come to anchor at the designated temporary anchorage offshore of Vendovi Island if the berths are already in use (Figure 3.1-2).

Vessels departing from the BP Marine Terminal at Cherry Point would take the routes described above in reverse utilizing the southbound or outbound traffic separation lanes as appropriate. Tank ships and barges having called at the BP Marine Terminal at Cherry Point may transit to the refineries located at March Point in Padilla Bay adjacent to Anacortes. There are two routes to Anacortes; the Huckleberry-Saddlebag Route and the Guemes Channel Route. To use the Huckleberry-Saddlebag Route vessels depart the traffic separation lane adjacent to Lummi Island and enter the channel between Lummi Island and Sinclair Island. Passing Vendovi Island, they navigate between Huckleberry and Saddlebag Islands to enter Padilla Bay. The second route makes use of the one-way traffic lane south through Rosario Strait past Cypress Island. The route then turns eastward into Guemes Channel and enters Padilla Bay (Figure 3.1-2).

Prior to construction of the North Wing, the highest number of calls to the BP Marine Terminal occurred in 2000 with 303 vessels calls to the South Wing. However, this number of calls does not reflect the estimated maximum capacity of the BP Marine Terminal with only the South Wing operating. Based on an allocation of dock time between crude and cargo vessels, BP estimates that the South Wing could accommodate up to 335 vessel calls per year when the North Wing is not operational. This value was calculated based on the assumptions shown in Table 3.1-2, and identifies the baseline level of vessel calls at the BP Marine Terminal.

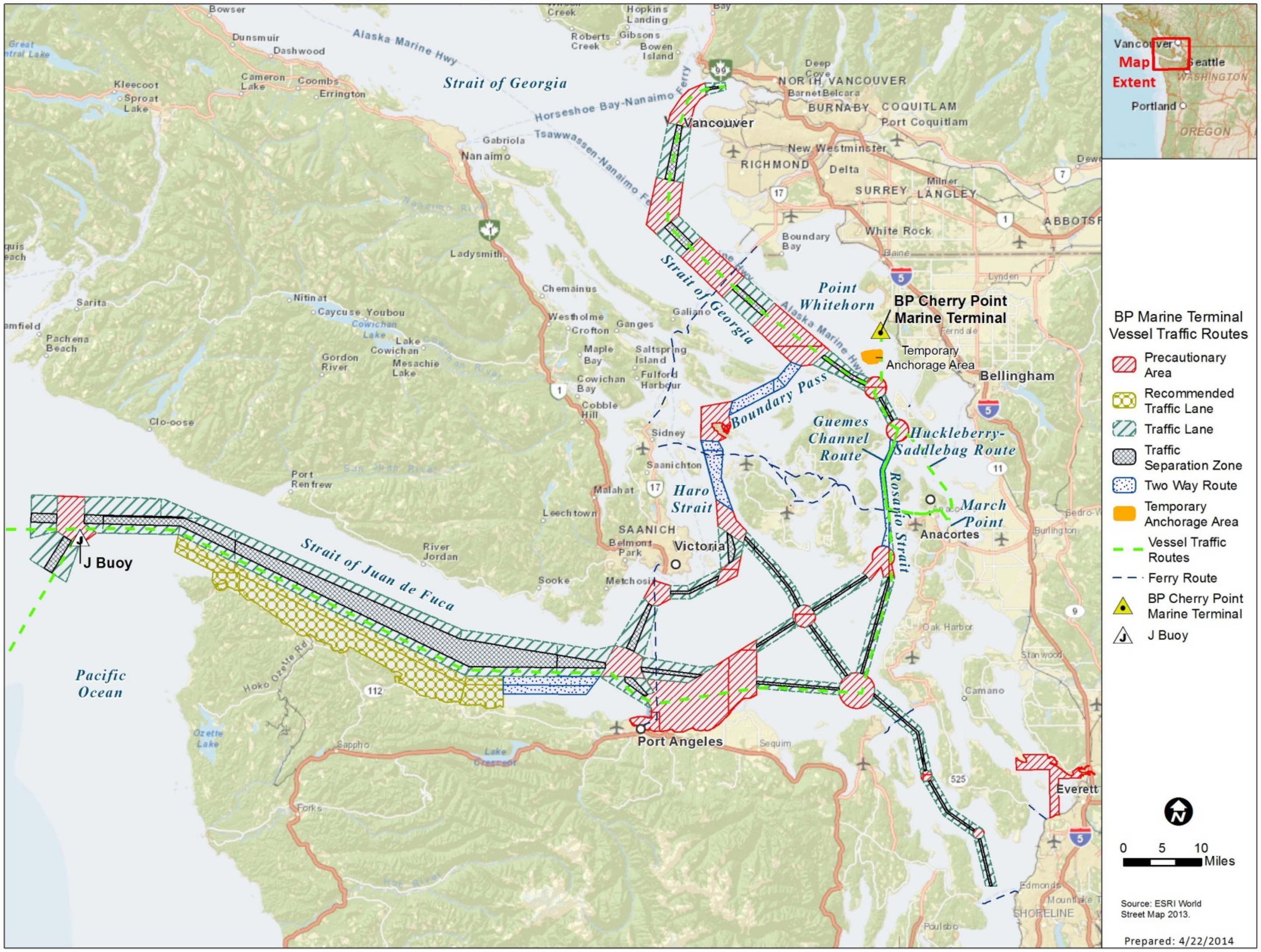

Figure 3.1-2 BP Marine Terminal Vessel Traffic Routes and Temporary Anchorage Area

Table 3.1-2 Maximum Single Wing Dock Capacity Calculation

Out of Service for Maintenance (days/year)	5.5
Out of Service for Weather (days/year)	2.1
Available for Operation (days/hours per year)	357.4 / 8,577.6
Average Time per Call - Excluding Loading/Unloading (hours)[1]	5.2
Average Crude Oil Cargo Size (bbl)	620,000
Average Crude Oil Unloading Rate (barrels per hour)	28,100
Average Crude Oil Unloading Time (hos)	22.06
Number of Crude Oil Vessels/Total Volume (bbl)	138 / 85,560,000
Total Time at Dock – Crude Oil Vessels (hours)	3,762
Average Refined Petroleum Product Cargo Size (barrels)	194,000
Average Refined Petroleum Product Loading Rate (bbl per hour)	10,100
Average Product Unloading Time (hours)	19.21
Number of Refined Petroleum Product Vessels/Total Volume (bbl)	197 / 38,218,000
Total Time at Dock – Refined Petroleum Product Vessels (hours)	4,809.
Total Dock Utilization Time (hours per year)	8,571.

[1]Includes mooring and unmooring, connecting and testing loading and unloading equipment, setting booms, etc.

Between 2001 and 2010, the number of vessel calls exceeded BP's low-range estimate of future calls (170-220 calls) every year, exceeded the medium-range forecast (320–400) in 2007, but did not exceed the high-range estimate of future calls (350–420) in any year. Since the North Wing became operational in 2001, the number of calls has averaged approximately 321 vessels per year, which is within the range of the current conditions scenario.

A Vessel Traffic Risk Assessment (VTRA) study was conducted by The George Washington University (2008) that evaluated the incremental environmental risk of: (1) the vessel traffic associated with the BP Marine Terminal operating with both crude and product transfers occurring only at the South Wing; and (2) the terminal operating with both wings at current and forecasted future vessel traffic levels, with the future year specified as 2025 (The George Washington University 2008). The VTRA notes that tank ship traffic calling at the BP Marine Terminal accounts for 1.1 percent of all traffic in Puget Sound (normalized for time spent in transit) and 2.6 percent of all traffic in Puget Sound when adding barges calling at Cherry Point. Since the majority of the barge traffic is on routes to the southern reaches of Puget Sound, it can be inferred that approximately 1.1 percent of the traffic entering Puget Sound and transiting the Strait of Juan de Fuca is traffic destined for the BP Marine Terminal.

3.1.2 Vessel Sound

Existing underwater sound levels in the Action Area can serve as a baseline from which to measure potential impacts associated with the Proposed Action on ESA listed species. Ambient noise conditions in the marine environment are dependent on source, propagation, and absorption conditions. Commercial shipping traffic, ferry vessel traffic, wind, rain, and biological organisms are the main contributors to ambient noise levels in Puget Sound. Oceanic traffic influences sound spectral levels from 10 Hz to beyond 10 kHz (Bassett 2010) with the dominant components occurring at low frequencies (5 to 500 Hz; Hildebrand 2004). Ships generate noise primarily by (a) propeller action, (b) propulsion machinery, and (c) hydraulic flow over the hull. The broadband and tonal components produced by cavitation account for 80-85 percent of ship-radiated noise power (Ross 1987 as cited in Hildebrand 2005). Additional vessel noise results from propulsion machinery such as diesel engines and gears, and major auxiliaries such as diesel generators. Likewise, Bassett (2010) states that the source level of sound from commercial ships varies based on ship speed, condition of the vessel, vessel load, and on board activities. While true, the received sound levels recorded in various studies on the effects of sound on marine mammals in Puget Sound (Bassett 2010, Bassett *et al*., 2012, and Veirs and Veirs 2005) record the integrated output from all these sources. Given these available studies do not analyze the component contributions to vessel sounds and the overwhelming component is cavitation, the component contributions to underwater sound levels are not consider further in this analysis.

The fact that information on the component contributions to vessel noise is not available in the cited studies is not a limitation of this analysis because no changes in the fleet calling at BP's Marine Terminal are expected under the Proposed Action. The vessels size, speed, and condition are regulated by the U.S. Coast Guard as part of Puget Sound Vessel Traffic Service (VTS User's manual 2013 Edition, available online http://www.uscg.mil/d13/psvts/). Therefore, other than frequency of vessel calls, no changes in ship speed, condition of the vessels, vessel loads, and on board activities are expected as a result of the Proposed Action.

The most common source of anthropogenic noise in Admiralty Inlet is vessel traffic (Bassett et al. 2012). Background sound data has not been collected specific to the Proposed Action. However, Bassett et al. (2010) analyzed ambient noise sources at a location in eastern Admiralty Inlet, just west of Admiralty Head at Fort Casey State Park and identified permanent noise (noise present when all identifiable sources have been removed, lowest level of background recurring noise) at the site as 98 dB re 1 μPa. Further, from May 2010 to May 2011, Bassett *et al*. (2012) conducted an assessment of ambient noise at a location in northern Admiralty Inlet and prepared a sound budget in which sound energy levels are attributed to various source levels. The study area for the 2012 study included the contiguous waters within a 20 km (12.4 mile) radius of a point 700m (0.43 mile) to the southwest of Admiralty Head. As in Bassett (2010) the major contributor to sound was vessel traffic, but unlike Bassett (2010), Bassett et al .(2012) included vessel traffic in their definition of ambient sound levels. The sound recordings were paired with information from the U.S. Coast Guard Nationwide Automatic Identification System[6] (AIS), which allowed for the association of a specific vessel with its recorded signal. Over the course of their study, Bassett *et al.* (2012) collected data on 1,363 unique AIS transmitting vessels. The AIS data allowed them to calculate source sound level for each of the vessels observed.

Bassett et al. (2012) found, based on overall presence, container ships, passenger ferries and tugs, were the most common vessel types in their study area. As expected the larger faster ships

[6] The Maritime Transportation Security Act of 2002 §70114 requires that all self-propelled commercial vessels of at least 65 ft. overall in length to be equipped with and operate an automatic identification system. These systems transmit vessel identification, course, and speed; similar to transponders used by the aircraft industry.

were the loudest. They estimated the source levels (re 1 µPa at 1 meter) for each of the vessel types as 186 dB_{rms} for containerships, 185 dB_{rms} for bulk carriers, 180 dB_{rms} for vehicle carriers, 180 dB_{rms} for general cargo ships, 181 dB_{rms} for oil and chemical tankers, 173 dB_{rms} for ferries, and 172 dB_{rms} for tugs. Larger fishing vessels (trawlers) and fishing vessels with diesel engines were estimated to generate a source level of 165 dB_{rms} re 1 µPa at 1 meter. Basset et al. (2012) also estimated that total sound energy input in their study area by vessel traffic was over the course of the year of their study was 438 mega joules and of that container ships were responsible for 57% of the input, followed by bulk carriers at 16%. Oil/chemical tankers were responsible for 2% of the energy input.

As in 2010, Bassett *et al.* (2012) found large commercial vessels, including vehicle carriers and bulk carriers, were also common. An AIS-transmitting vessel was found to be present within the study area 90% of the time, and multiple vessels were present 68% of the time. The mean broadband sound pressure level (SPL[7]) at the recording site was 119.2 ± 0.2 dB re 1 µPa (95% confidence interval), and the maximum was 140 dB_{rms} re 1 µPa associate with the passage of container ships transiting at a speed of 23.4 knots at a distance of 2.7 km at its closest approach to the recorder. These measured noise levels are comparable to values from Haro Strait off of the west coast of San Juan Island, reported by Veirs and Veirs (2006), indicating they are likely representative of baseline conditions within the Action Area. Veirs and Veirs (2006) also found that recreational vessels can increase background noise on average 5-10 dB higher than the average large commercial ships.

Given the relatively small contribution oil/chemical carriers made to the energy budget at Admiralty Inlet and assuming that it is representative of the Action Area, the small increase in vessel calls at BP Marine Terminal would not be expected to increase ambient noise levels. The noise from these vessels would be transient and therefore would not result in long term effects to biological organisms. Short-term effects due to an increase in noise from close approaches of passing vessels could be experienced by both baleen and toothed whales and may include temporary call masking and potential changes in diving and foraging behavior (NRC 2005).

3.1.3 Regulatory Context for Assessing the Effects of Sound

All threatened and endangered marine mammals are protected by the Marine Mammal Protection Act, as well as, the ESA. Both statutes prohibit the "take" of covered animals. Although the definitions of the term "take" differ between the statutes, they share comment elements of harassment and killing. In addition, the MMPA defines "harassment" as any act of pursuit, torment, or annoyance which a) has the potential to injure a marine mammal or marine mammal stock in the wild; or b) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing a disruption of behavioral patterns, including but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. This definition is relevant because NMFS uses it in the administration of the ESA as it applies to listed marine mammals. NMFS currently uses conservative thresholds of received sound pressure levels from broad band sounds that may cause behavioral disturbance and injury (interim guidance):

[7] Meaning, the received sound pressure level was that loud or quieter 50% of the time.

- Level A Harassment (potential injury) from all non-explosive sound sources: 180 and 190 dB re 1 µPa (rms) received level for cetaceans and pinnipeds, respectively.
- Level B Harassment (behavioral harassment) from impulsive sound sources (e.g., seismic air guns): 160 dB re 1 µPa (rms) received level for all species.
- Level B Harassment (behavioral harassment) from continuous sound sources (e.g., drilling): 120 dB re 1 µPa (rms) received level for all species.

With respect to the effects of noise on marine mammals, NMFS considers the onset to permanent threshold shift (PTS) as Level A harassment under the MMPA and harm under the ESA and the onset of temporary threshold shift (TTS) as Level B harassment under the MMPA and harassment under the ESA.

In December 2013, NMFS, published: Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals – Acoustic Threshold levels for Onset of Permanent and Temporary Threshold Shifts. NMFS proposed this new guidance to reflect the increasing understanding of marine mammal hearing. The proposed guidance recognizes that hearing sensitivity varies among marine mammal groups and organizes marine mammal species into five groups: low frequency cetaceans, which are the baleen whales; mid-frequency cetaceans which are most dolphins, including killer whales, and beaked whales; high frequency cetaceans, which include true porpoise, and pygmy sperm whales; pinnipeds in water; and pinnipeds on land. The guidance also presents dual criteria for each group: one measure in dB_{peak} re 1µPa, and one in dB SEL_{cum}. This latter criterion was developed to take into account that exposures to a sound source over extended periods of time can accumulate as much energy as exposure to a louder sound source for shorter period of time. That is to say the exposure to sound levels that would cause TTS for extended periods of time could result PTS. In addition to the interim guidance discussed above, this draft guidance will be considered below in Chapter 4, as it reflects the best scientific and commercial data available.

3.2 Dock Operations

The BP Marine Terminal consists of a dock with two wings (south and north) that are connected to the shore and the BP Cherry Point Refinery Tank Farm with a trestle and pipelines. The general configuration of the terminal is shown on Figure 3.2-1 BP Marine Terminal – Plan View. The figure shows a "Y" shaped facility that is located approximately 655 meters (2,150 feet) offshore where water depths are approximately 15 to 21 meters (49 to 69 feet) mean sea level (msl). The existing trestle connecting both wings of the dock is approximately 548.64 meters (1,800 feet) long and includes a roadway and piping. Each wing consists of a single vessel berth, a loading platform, and a connecting trestle. The loading platform for the North Wing is 58.67 meters (192.48 feet) long and 27.43 meters (90 feet) wide. It is positioned at the center of the 296-meter (971 foot) long berth, which has mooring positions that allow for both tankers and barges to call at the BP Marine Terminal for unloading and loading operations. Water depth at the loading platform is 18.28 meters (60 feet) msl. The connecting trestle is 290 meters (951 feet) long and includes a platform for vehicle maneuvering, oil spill response equipment, and two hoists for support vessels (workboats/oil spill response vessels).

All mooring dolphins and piles supporting the loading platform and connecting trestle that were constructed as part of the North Wing are steel caissons that have been coated with Tideguard® to prevent corrosion. The coating material is non-ablative and not toxic to marine life.

Figure 3.2-1 BP Cherry Point Refinery and Marine Terminal showing “Y” shaped North and South wings of dock

The pipelines connecting the dock facility to the BP Cherry Point Refinery tank farm are configured so that crude oil can only be loaded or unloaded in commercially sustainable quantities at the South Wing. The North Wing is used exclusively to load or unload refined petroleum product, and BP has stipulated that the North Wing will not be used for the transfer or crude oil cargoes. While the South Wing retains the capability to load or unload refined petroleum product, such operations are rare and the South Wing is used almost exclusively for unloading or loading crude oil.

Ships approach the BP Marine Terminal under the direction of the ships master and harbor pilot and are assisted to the dock by a tug. After docking and securing all lines, an oil spill containment boom is placed against the vessel to enclose the loading area of the vessel. An additional containment boom is deployed surrounding the ship during loading/unloading operations when it is safe and effective to do so.

Vessels only conduct loading/unloading operations in calm and moderate wind/wave conditions as set forth in the Oil Handing Facility Operations Manual. When winds reach a predetermined strength of 35 mph, a precursor to increased wave height, the Dock Operations personnel and the Vessel Captain determine whether to cease transfer operations and unmoor the vessels. If winds reach a sustained level of 40 mph and waves are estimated at five feet, operations must cease and the vessels are unmoored. After unmooring, vessels move to a temporary anchorage as directed by the USCG to wait for winds/waves to subside to a safe level.

Loading and unloading occurs through large overhead loading arms, which consist of an articulated pipe that connects transfer pipelines to a shipboard manifold. After the loading arm is connected and the connection is leak tested, crude oil or refined products are pumped from/to storage tanks ashore through dedicated pipelines that run across the trestle to the loading/unloading area. The loading arms include safety equipment for rapid shutdown in the event of premature disconnect or failure of the loading arm, or failure at the vessel manifold, that results in loss of primary containment of the material being transferred.

All areas on the dock that contain piping, control valves, and loading arms are confined within containment curbs that drain to an oily-water collection system. All liquids collected within this system are piped ashore and processed by the refinery. The dock also has a roadway that provides vehicle access to the trestle and docks. Spill records at the dock for the period from 1990 through 2010 indicate that incidents are infrequent (typically average two per year), and the volume of spills is usually very small. Many of the incidents reported were in quantities of drops or sheen on the water, and with an average spill volume of 37 liters (9.8 gallons). Since the North Wing became operational in 2001, the average spill volume at the BP Marine Terminal has decreased to 2.5 liters (0.65 gallons).

The BP Marine Terminal has the capacity to receive ballast water from product tankers; however, no ballast water has been received at the BP Marine Terminal since early 2001. If a vessel does wish to discharge ballast water at the BP Marine Terminal, the ballast water must undergo laboratory analysis prior to discharge. The laboratory test results must be received by Cherry Point prior to acceptance of ballast water. This requirement often makes it impractical for vessels to unload ballast water during the short period they are at dock. Vessels arriving with segregated ballast that will be discharged into harbor waters must follow federal and Washington State laws concerning ballast water exchanges before entering state waters. The BP Marine Terminal does not handle bilge water and oily slops.

Annual maintenance of dock equipment occurs in the summer and consists of equipment inspection, replacement, cleaning, painting, and repair, as appropriate. Major maintenance projects are conducted periodically. These projects may involve a large number of workers and include work in the water from workboats. Annual preventive maintenance activities involving in-water, on-water and underwater work are conducted under permits issued by the USACE and other appropriate state and federal agencies. Project-specific activities or other maintenance activities that fall outside the scope of the permits for annual dock maintenance are permitted separately. During in-water work, such as the recent installation of mooring dolphins for the vessel containment boom system, monitoring vessels stand off the dock to monitor the presence of killer whales in the vicinity and to require shutdown of work that would affect killer whales while they are in the immediate vicinity of the dock.

The year with highest throughput at the BP Marine Terminal was 2000, which was prior to the North Wing coming online. In that year, 115,282,883 bbls of crude and product crossed over the South Wing: 64,624,712 bbls of crude oil and 50,658,171 of refined product. Scenarios for possible changes in the numbers of vessels calling at the BP Marine Terminal are presented in Table 1.2-1.

3.2.1 Oil Spill Prevention and Response Measures:

The BP Marine Terminal is equipped with containment booms and clean-up equipment, which can be readily deployed in the case of an oil spill. The vessel master is responsible for ensuring that adequate precautions have been taken to so that pollution incidents are avoided or minimized. The following measures are checked prior to the vessels arrival at the dock:

- All deck scuppers and drains shall be plugged and sealed.
- An adequate supply of absorption material shall be available on deck for instant use.
- A pumping system shall be in place to draw-off all deck water contaminated by oil or grease, and transfer to a containment tank
- If pumping system cannot keep up with rainwater, dock supervision may authorize pulling of scuppers under direct supervision of deck crew, with absorption pads using a “decant” procedure.
- A pumping system shall be in place to draw-off all oil or oily liquid from the cargo manifold containment pan, with associated pipeline arrangement, for prompt transfer to a cargo or slop tank.
- All sea suctions (pipeline from sea chest which sea water flows into a ship for cooling engines, ballasting, or other shipboard needs) shall be closed and sealed (except the segregated ballast system).
- No bilge water of any composition or from any compartment shall be discharged overboard while in US waters.
- No sewage from any compartment shall be discharged in US waters.
- No garbage or refuse shall be discharged overboard while in US waters.
- There shall be no blowing of boiler tubes or stack (funnel) uptakes.
- Engine watch is advised that no stack (funnel) emission; white or black smoke, be allowed.

A curb-type barrier surrounds the area of the dock containing the piping system manifolds and loading arms. All surface runoff from the curbed dock areas, including rainwater and oil from drips and leaks, is drained into an oily water tank and pumped ashore via the ballast water line to be processed thorough the refinery’s wastewater treatment system. A floating oil containment boom is placed beneath the loading area prior to the beginning of cargo transfers to contain any releases during transfer operations.

In the event of a spill, the Master or designee immediately stops oil transfer operations, notifies the Dock Operator, and secures the vessel. Notifications and clean-up action are implemented immediately and oil transfer between ship and shore does not resume until the USCG grants permission to resume the transfer.

Vessels are limited to thirty hours at the dock including the time taken for: handling ballast, connecting/disconnecting transfer hoses, and mooring/unmooring.

3.2.2 Sound

Murray (2007) monitored and reported marine and terrestrial sound levels during pile driving at a ConocoPhillips petroleum refinery in the vicinity of Cherry Point. During cessations in construction activities ambient sound levels were recorded at a distance of 30.5 meters (100 feet) from the construction site and a depth of 6.1 meters (20 feet). Ambient sound ranged from 117 dB_{rms} to 139 dB_{rms} re 1 μPa with a mean of 130 dB_{rms} re 1 μPa, this ambient level included routine activities at the dock as well as nearby tug traffic. This likely is a reasonable representation of ambient conditions at the BP Marine Terminal. Taken together with the Bassett (2010) and Bassett et al. (2012) studies discussed in Section 3.1.2, Puget Sound has a high level of underwater ambient background noise, punctuated by frequent high levels associated with large commercial traffic. Therefore, the additional vessel calls and operations to serve them are not likely to result in a meaningful increase in sound levels in the Action Area.

3.3 Status of ESA-Listed Species in the Action Area

3.3.1 Humpback Whale

Humpback whales were common in Puget Sound and the Georgia Strait in the early 1900s. However, there have been few sightings of humpback whales in Puget Sound in the last 20 years (Calambokidis et al. 1990). While humpback whales have been recovering from commercial whaling (Carretta et al. 2011), they are still are rare visitor to Puget Sound and Georgia Strait. Sightings, however, have been reported in recent years and anecdotal evidence indicates that five whales have been observed in Puget Sound and Georgia Strait in recent years (PWWA 2013). A study by Calambokidis et al. (2004) found humpback whale sightings were concentrated between the Juan de Fuca Canyon and the outer edge of the continental shelf, in an area known as “the Prairie” (Figure 3.3-1). A small area east of the mouth of Barkley Canyon and north of Nitnat Canyon where water depth was 125-145 meters (410-476 feet) had the highest density of sightings all year (Calambokidis et al. 2004). These areas are outside of the projects Action Area; therefore humpback whale occurrences are not expected to be common in the Action Area.

3.3.2 Blue Whale

The Eastern North Pacific population of blue whales is the population occurring within the closest proximity to the Action Area. They feed in Californian waters in the summer/fall (from June to November) and migrate south to productive areas off Mexico in the winters (Carretta et al. 2007). Historically blue whales were not common along the coast of Washington; however, they did occasionally occur (Calambokidis et al.2004). Vessel surveys conducted in Washington waters in 1996 and 2001 did not detect blue whale presence (Carretta et al. 2013; Figure 3.3-2). Consequently, blue whales may occur, but are not expected to be common in the Action Area.

3.3.3 Fin Whale

Fin whales are year-round residents off the coast of California and are summer residents off Oregon and possibly pass through Washington. Aerial surveys conducted by Brueggeman et al. (1992) off the Oregon and Washington coasts observed 13 groups of 27 fin whales between June and January. All of the fin whales were observed off Oregon, with all but five whales in waters on the continental slope (200 to 2,000 meters [656- to 6,562 feet] deep). The whales not observed in slope waters included a group of two about 200 km (124 miles) offshore in November and a group of three on the shelf just south of the Columbia River in January. The former group was traveling south, suggesting they were migrating back to the wintering grounds. Except for these two groups, all of the other whales were observed during June and July. No calves were observed with any of the whales. Green et al. (1993) reported sighting two fin whales during aerial surveys off Oregon and Washington between March and May in 1992 but did not report the location. An estimated 2,636 fin whales occur off the coasts of California, Oregon, and Washington during summer/fall based on shipboard surveys in 2001 and 2005 (NMFS 2010c) (Figure 3.3-3). These areas are outside of the projects Action Area; therefore fin whale occurrences are not expected to be common in the Action Area.

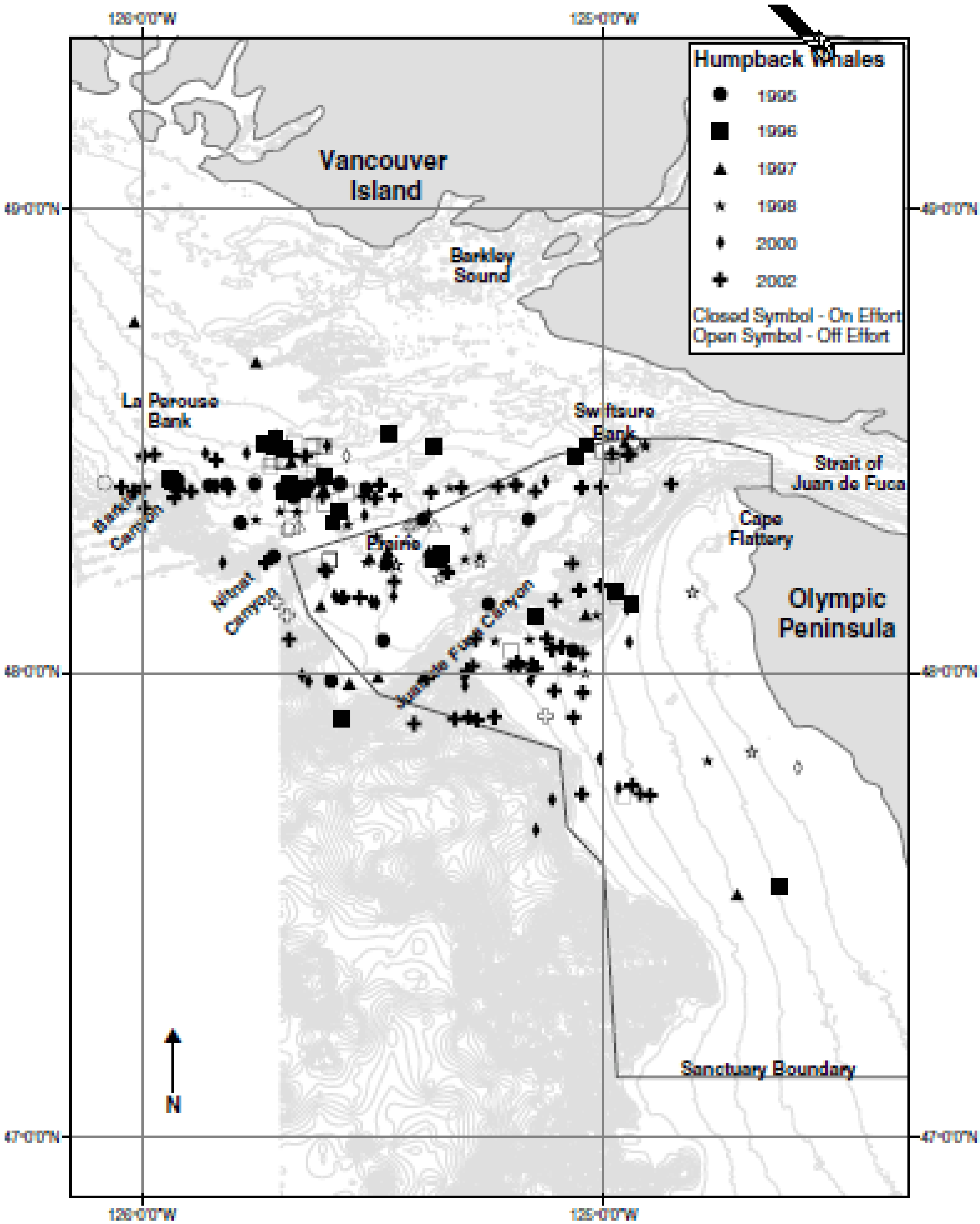

Figure 3.3-1 Locations (by year) for humpback whales seen during ship surveys off the northern Washington coast between 1995 and 2002

Source: Calambokidis et al. 2004

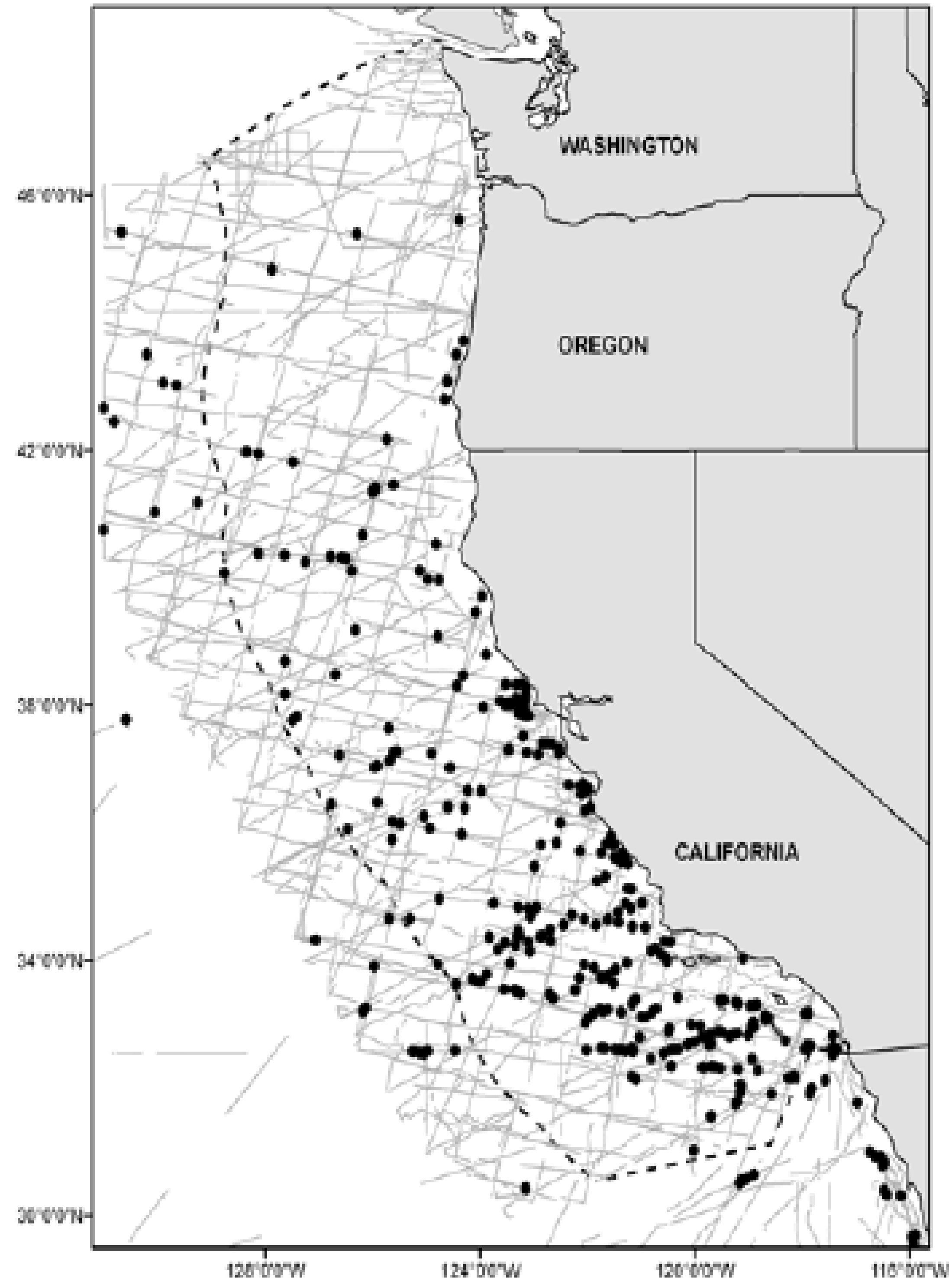

Figure 3.3-2 Blue whale sighting locations based on aerial and summer/autumn shipboard surveys (1991-2008).

Source: Carretta et al. 2013

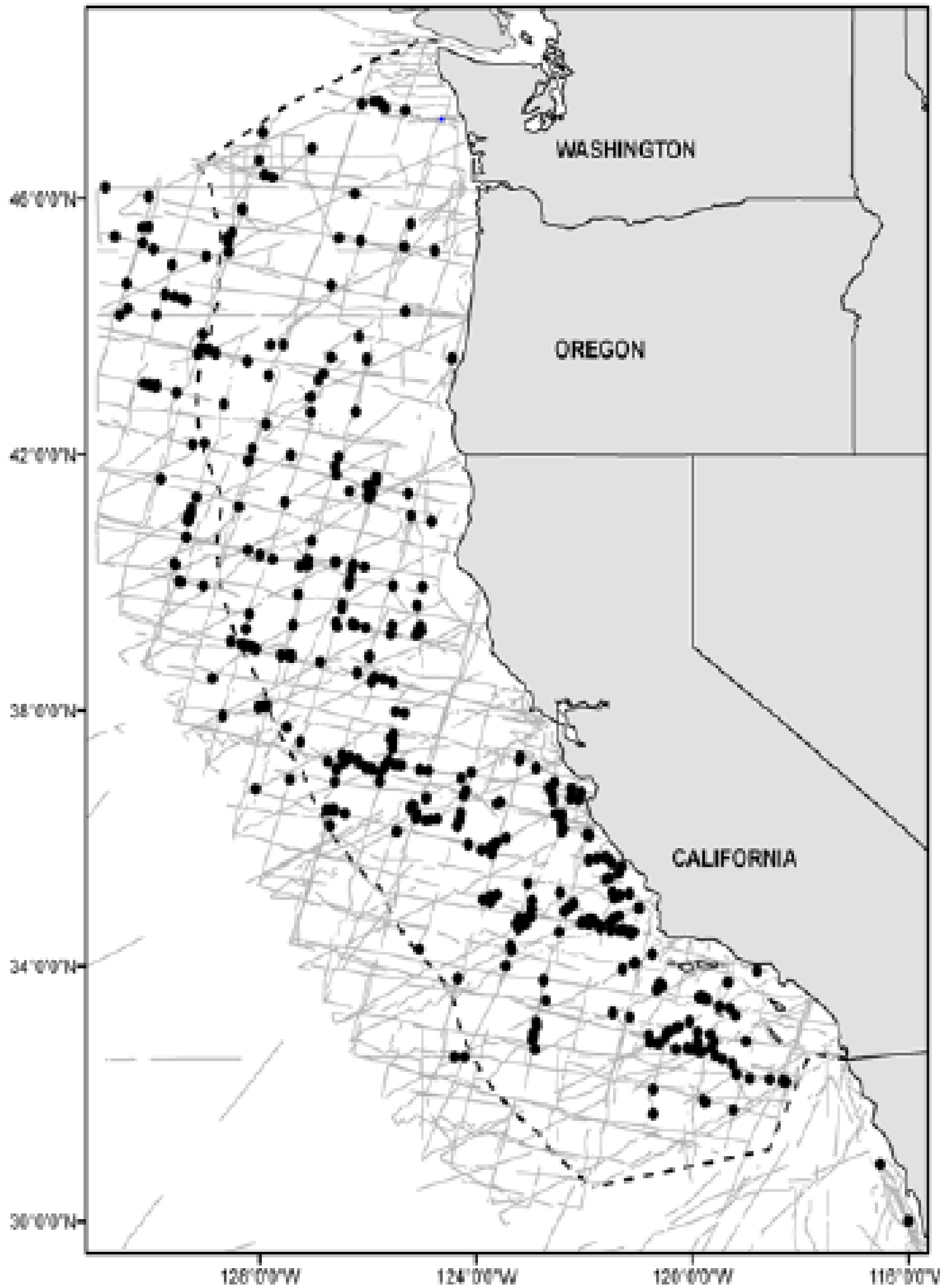

Figure 3.3-3 Fin whale sighting locations based on shipboard surveys (1991-2008).

Source: Carretta et al. 2013

3.3.4 Southern Resident Killer Whale

The Southern Resident killer whale DPS is a trans-boundary population comprised of 89 animals split among three pods (J, K, and L) which are considered one stock under the Marine Mammal Protection Act. Southern Resident killer whales reside for part of the year in the protected inshore waters of the Strait of Georgia and Puget Sound (especially in the vicinity of Haro Strait, west of San Juan Island, and off the southern tip of Vancouver Island). Southern Resident killer whales occur in the area principally during the late spring, summer, and fall (May through October) (NMFS 2006). Winter movements and range are poorly known for this stock; however, the J pod is more commonly sighted in inland waters, while Pods K and L spend more time offshore during winter (Ford et al. 2000). The Southern Resident stock is differentiated from the Northern and Southern Alaska Resident stocks, which do not inhabit waters off Washington. Distribution of Southern Resident DPS killer whales within Puget Sound is shown in Figure 3.3-4.

Two critical habitat areas have been designated for Southern Resident killer whales within the Action Area; Area 1 - Summer Core Area and Area 3 – Strait of Juan de Fuca (Figure 3.3-5). Southern Resident killer whales are expected to occur in the Action Area.

The Summer Core Area is bordered to the North and West by the US/Canadian border, and includes waters surrounding the San Juan Islands, the U.S. portion of the Southern Strait of Georgia, and areas directly offshore of Skagit and Whatcom counties. This area is important for all pods (J, K, and L [NMFS 2006]). Vessels calling at the BP Marine Terminal would pass through the Summer Core Area designated as critical habitat.

The Strait of Juan de Fuca Area is bordered on the southeast by the entrance to Admiralty Inlet, Deception Pass Bridge, San Juan, and Skagit Counties to the northeast, the U.S. Canadian border to the north, and Bonilla Point/Tatoosh line to the west. All pods regularly use the Strait of Juan de Fuca as a passage from the Summer Core Area and Puget Sound to access oceanic waters, however, the whales are not known to spend long periods of time in localized areas in the Strait and sightings of Southern Residents in the Strait are limited (NMFS 2006). Vessels calling at the BP Marine Terminal would pass within the Strait of Juan de Fuca Area designated as critical habitat.

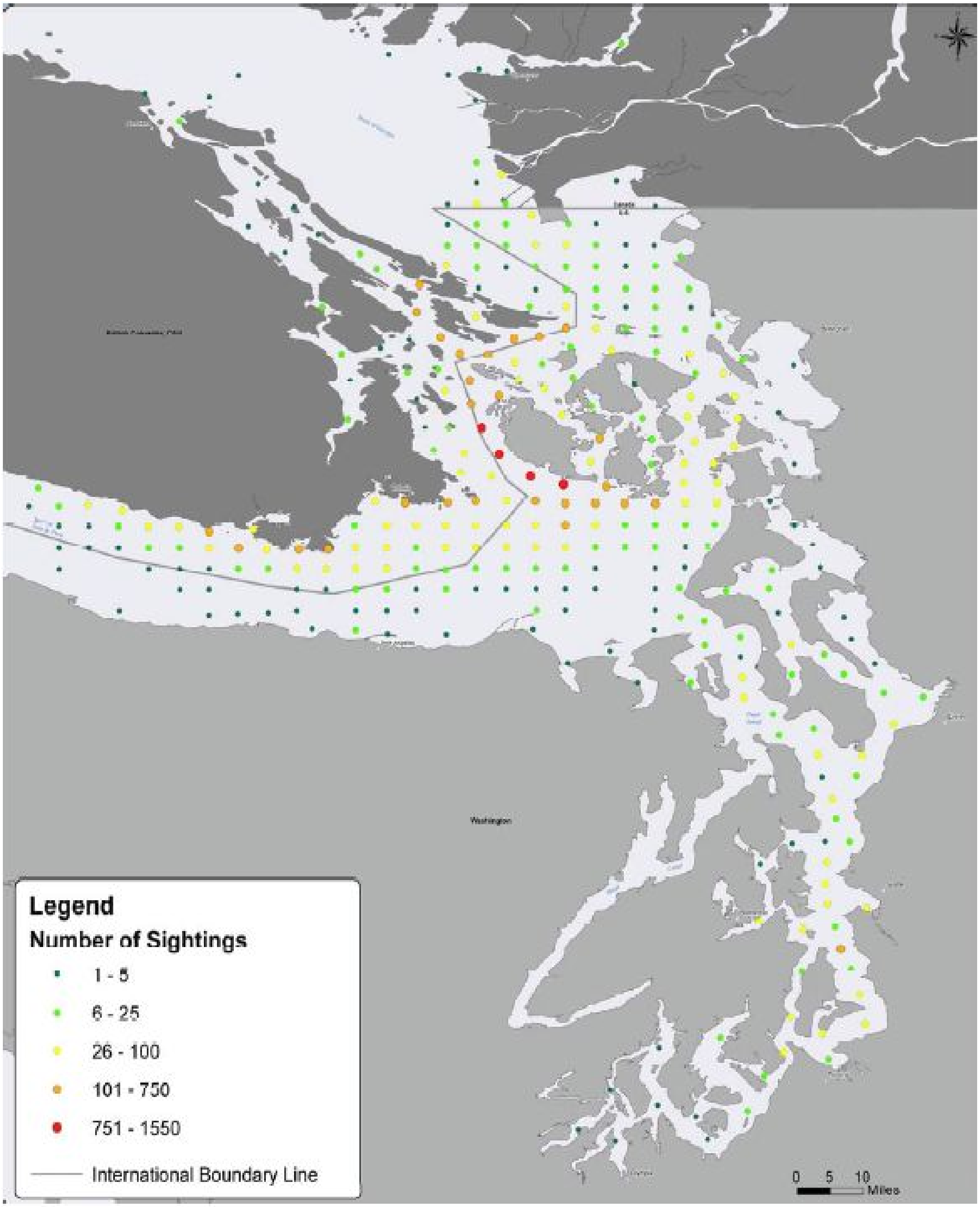

Figure 3.3-4 Distribution of Southern Resident killer whale sightings from 1990-2005

(The Whale Museum 2005, as cited in NMFS' Recovery Plan for Southern Resident Killer Whales, NMFS 2008a)

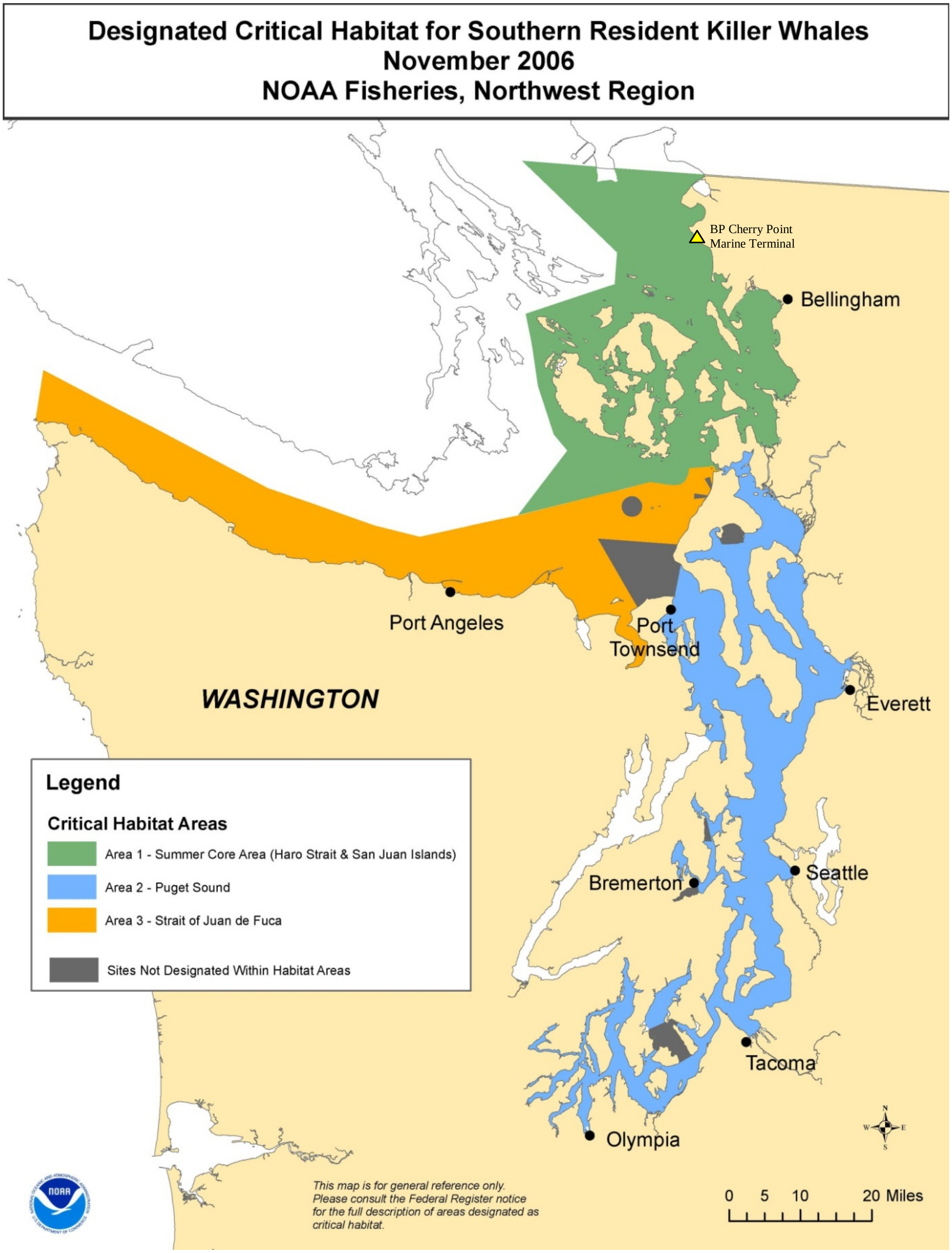

Figure 3.3-5 Designated Critical Habitat for Southern Resident Killer Whales

Source: NOAA 2006

3.3.5 Bull Trout

Bull trout rely on foraging, migration, and overwintering habitat to complete extensive and important parts of their life cycle. The anadromous life history form of bull trout migrates to saltwater during the spring. They use the nearshore marine ecosystem during the spring and late summer months, and the outer coast year-round. Juvenile bull trout rear in the nearshore ecosystem with preference for unconsolidated habitats that may include eelgrass and kelp beds. The nearshore area provides critical foraging habitat as well as stable overwintering habitat for bull trout. Adults also feed in this area and then migrate into freshwater rivers and streams to spawn. Temperature is a major factor influencing bull trout distribution, since spawning, egg incubation, and juvenile rearing all need specific temperatures. Since the bull trout range includes the Strait, as well as inland marine and fresh waters of Clallam County (USFWS 2005), it is possible that this species would be present in the Action Area.

Coastal marine waters designated as critical habitat for bull trout in the Coastal Puget Sound and Olympic Peninsula areas occur within the Action Area and extend from the MHHW line inland to 10 meters (33 feet) below the MLLW elevation line offshore. Vessels calling at the BP Marine Terminal would not pass through areas designated as bull trout critical habitat.

3.3.6 Chinook Salmon

The Puget Sound Chinook salmon ESU is a composite of many individual populations of naturally spawning Chinook salmon, and a number of hatchery stocks. The boundary of the Puget Sound Chinook salmon ESU extends from the Nooksack River in the north to southern Puget Sound, includes Hood Canal, and extends westerly out the Strait of Juan de Fuca to the Elwha River. The Skagit River and its tributaries constitute what was historically the predominate system in Puget Sound containing naturally spawning populations. There are two independent populations of Puget Sound Chinook salmon in the Nooksack basin: North Fork Nooksack River (including Middle Fork), and South Fork Nooksack River. These salmon are distinctive from Chinook salmon in the rest of Puget Sound in their genetic attributes, life history, and habitat characteristics. They are the only populations in the Strait of Georgia region, and they are two of only six Chinook runs left in Puget Sound that return to their rivers in spring (as opposed to fall spawners). For these reasons, the Nooksack populations are considered essential to the recovery of the Puget Sound Chinook ESU (Puget Sound TRT 2006).

Critical habitat has been designated within the Action Area for the Strait of Juan de Fuca from the line of extreme high tide to a depth of 30 meters (98 feet). Vessels calling at the BP Marine Terminal would likely pass through areas designated as Chinook salmon critical habitat. Adult Chinook migrate through the Action Area en route to spawning tributaries throughout the Washington north coast, Straits of Georgia and Juan de Fuca, Puget Sound, and Hood Canal. The Puget Sound Chinook salmon ESU includes waters that are part of the Action Area; therefore it is possible that this species would be present in the Action Area.

3.3.7 Chum Salmon (Hood Canal Summer Run)

While the range of chum salmon along the Pacific coast extends from the Bering Sea to the Sacramento River in California, the range of summer chum salmon is highly restricted and extends only to discrete portions of the eastern portion of the Olympic Peninsula and south into

Hood Canal. These include spawning adult returning to Snow Creek (Discovery Bay), Chimicum Creek (near Port Townsend) and many drainages in Hood Canal.

Critical habitat has been designated within the Action Area for the Strait of Juan de Fuca from the line of extreme high tide to a depth of 30 meters (98 feet). Vessels calling at the BP Marine Terminal would likely pass through areas designated as chum salmon critical habitat. Adult chum could migrate through the Action Area en route to spawning tributaries. Therefore, it is possible that this species would be present within the Action Area

3.3.8 Puget Sound Steelhead

The Skagit and Nooksack rivers, which discharge into the general vicinity of Cherry Point, do support populations of native steelhead. Juvenile steelhead move rapidly out of freshwater and into offshore marine areas and recent studies in steelhead migratory behavior suggest that juveniles spend very little time in nearshore areas (NMFS 2013).The nearshore benthic survey conducted by the Lummi Nation found few (n=3) steelhead juveniles in their extensive beach seining sampling during the 2008 to 2009 survey effort, representing a 1.5 percent occurrence in all sets (Dolphin et al 2010). In addition to the limited occurrence of steelhead documented in the vicinity of the BP Marine Terminal, this species also migrate through the Strait of Juan de Fuca en route to spawning tributaries throughout Washington’s north coast. It is possible that this species would be present within the Action Area.

No proposed critical habitat for Puget Sound steelhead occurs in the Action Area.

3.3.9 Pacific Eulachon

Outside of the Columbia River Basin, eulachon have been occasionally reported from other coastal Washington rivers including Willapa Bay, Gray’s Harbor, and at the mouth of various small streams of the coast (Swan 1881 as cited in Moody 2008). Spawning runs outside the Columbia River Basin have been documented at Willapa Bay (North, Naselle, Nemah, Bear, and Willapa rivers), Grays Harbor (Humptulips, Chehalis, Aberdeen, and Wynoochee rivers), and the Copalis, Moclips, Quinault, Queets, and Bogachiel rivers (WDFW and ODFW 2001 and Willson et al. 2006).

Shaffer et al. (2007) reported on the capture of 58 adult eulachon in the Elwha River on Washington’s Olympic Peninsula between March 18 and June 28, 2005. This was the first formal documentation of eulachon in the Elwha River, although anecdotal observations suggest that eulachon “were a regular, predictable feature in the Elwha until the mid-1970s” (Shaffer et al. 2007). Other Olympic Peninsula rivers draining into the Strait of Juan de Fuca have been extensively surveyed over many years for salmonid migrations; however, eulachon have not been observed in any of these other systems (Shaffer et al. 2007).

A recent WDFW technical report entitled “Marine Forage Fishes in Puget Sound” (Pentilla 2007) presents detailed data on the biology and status and trends of surf smelt and longfin smelt in Puget Sound, but states that “there is virtually no life history information within the Puget Sound Basin” available for eulachon. Similarly, detailed notes provided by WDFW and ODFW as part of this review, do not provide evidence of spawning stocks of eulachon in Puget Sound rivers.

Monaco et al. (1990) described eulachon as “rare” in Skagit Bay and, in addition to a personal communication, cited Miller and Borton (1980) as a supporting reference. Miller and Borton (1980) report on a total of 20 eulachon specimens collected in the San Juan Islands, southern Strait of Georgia, and Strait of Juan de Fuca and recorded in boat logs and museum collection records; however, samples from Skagit Bay were not included in this list.

The Nooksack River has frequently been listed as supporting a run of eulachon (WDFW and ODFW 2001, Wydoski and Whitney 2003, Willson et al. 2006; Moody 2008); however, there seems to be some confusion as to the exact species encountered. The Nooksack River is known to support a run of longfin smelt [*Spirinchus thaleichthys*], which are sometimes mistaken for eulachon. The run of longfin smelt into the Nooksack occurs in November, which is outside the normal spawning time for eulachon. Additionally, mid-water trawl surveys thought the Strait of Juan de Fuca routinely collected longfin smelt juveniles, while eulachon were rarely encountered (Anchor Environmental 2003).

Freshwater critical habitat does not occur in the Action Area and there have been no nearshore or offshore foraging sites in the Pacific Ocean identified as meeting the definition of critical habitat under section 3(5)(A)(i) of ESA. Pacific eulachon critical habitat does not occur within the Action Area.

3.3.10 Green Sturgeon (Southern DPS)

Southern DPS green sturgeon were first determined to occur in Oregon and Washington waters in the late 1950s when tagged San Pablo Bay green sturgeon were recovered in the Columbia River estuary (CDFG 2002). A few green sturgeon have been recovered in Puget Sound as incidental harvest from trawl fishers; the reason for their occurrence in the Action Area is unknown as they are not known to spawn, rear, or feed in coastal Washington or Puget Sound (Adams et al. 2002). The presence of green sturgeon in Puget Sound is rare (Lindley et al. 2011), but the species could occur in the Action Area. Critical habitat for Southern DPS green sturgeon has been designated in the Action Area and includes waters in the Strait of Juan de Fuca and a portion of Rosario Strait (Figure 3.3-6; 74 FR 52300). Puget Sound has been excluded from designation because the economic benefits of exclusion outweigh the benefits of inclusion and exclusion will not result in extinction of the species. Vessels calling at the BP Marine Terminal would not pass through areas designated as green sturgeon critical habitat.

Figure 3.3-6 Designated Critical Habitat for Southern DPS Green Sturgeon

Source: 74 FR 52300

3.3.11 Rockfish (Bocaccio Rockfish, Canary Rockfish, Yelloweye Rockfish)

The WDFW considers the north Puget Sound area to be one of the most productive areas for groundfish. This area extends from the Canadian border to Deception Pass out to the center of the Strait of Juan de Fuca, including all of the San Juan Islands. Within this area, production data in the vicinity of Cherry Point are not kept distinct. Bocaccio, yelloweye, and canary rockfish populations and for conservation purposes, are managed as two distinct stocks, one stock occupying areas west of Port Angeles and a separate stock unit east of Port Angeles.

Information on actual distribution of these three listed rockfish species in the vicinity of the Cherry Point facility is vague at best. Rockfish adults tend to prefer rocky, deeper water habitats of the kind that are not common in the vicinity of the BP Marine Terminal dock facility (see Figure 3.3-6). Bocaccio has been found to occur in Central Puget Sound, Tacoma Narrows, Ports Gardner and Susan, and along the Strait of Juan de Fuca, with the most common occurrences recorded south of the Tacoma Narrows (NMFS 2010b) . Detection of adult yelloweye and canary rockfish indicate they do occur in the broader vicinity of the San Juan Islands near suitable habitat, but do not occur near Cherry Point (Figure 3.3-7 and 3.3-8). Yelloweye rockfish have been reported by anglers to occur off Middle Bank in Haro Strait, Waldron Island, Hood Canal, Foulweather Bluff, Jefferson Head, Mukilteo, and Bainbridge Island (Washington 1977, Palsson et al. 2009). Canary rockfish have been documented as part of the assemblage of fishes in the Puget Sound region for as long as there have been formal fisheries surveys, dating back to at least the 1930s (NMFS 2010b).

A 2011 study (Greene and Godersky 2012) of larval rockfish presence in Puget Sound surface waters indicate there is a difference in densities between deepwater and nearshore sites. Based on this preliminary study, the highest relative abundance of rockfish larva would be expected to occur in the Action Area during August and September.

Table 3.3-1 identifies the most likely factors limiting rockfish populations in Puget Sound. Critical habitat for rockfish has been proposed in the Action Area and includes waters east of Port Angeles north to the BP Marine Terminal (78 FR 47635) (Figure 3.3-9) Vessels calling at the BP Marine Terminal would pass through areas designated as rockfish critical habitat.

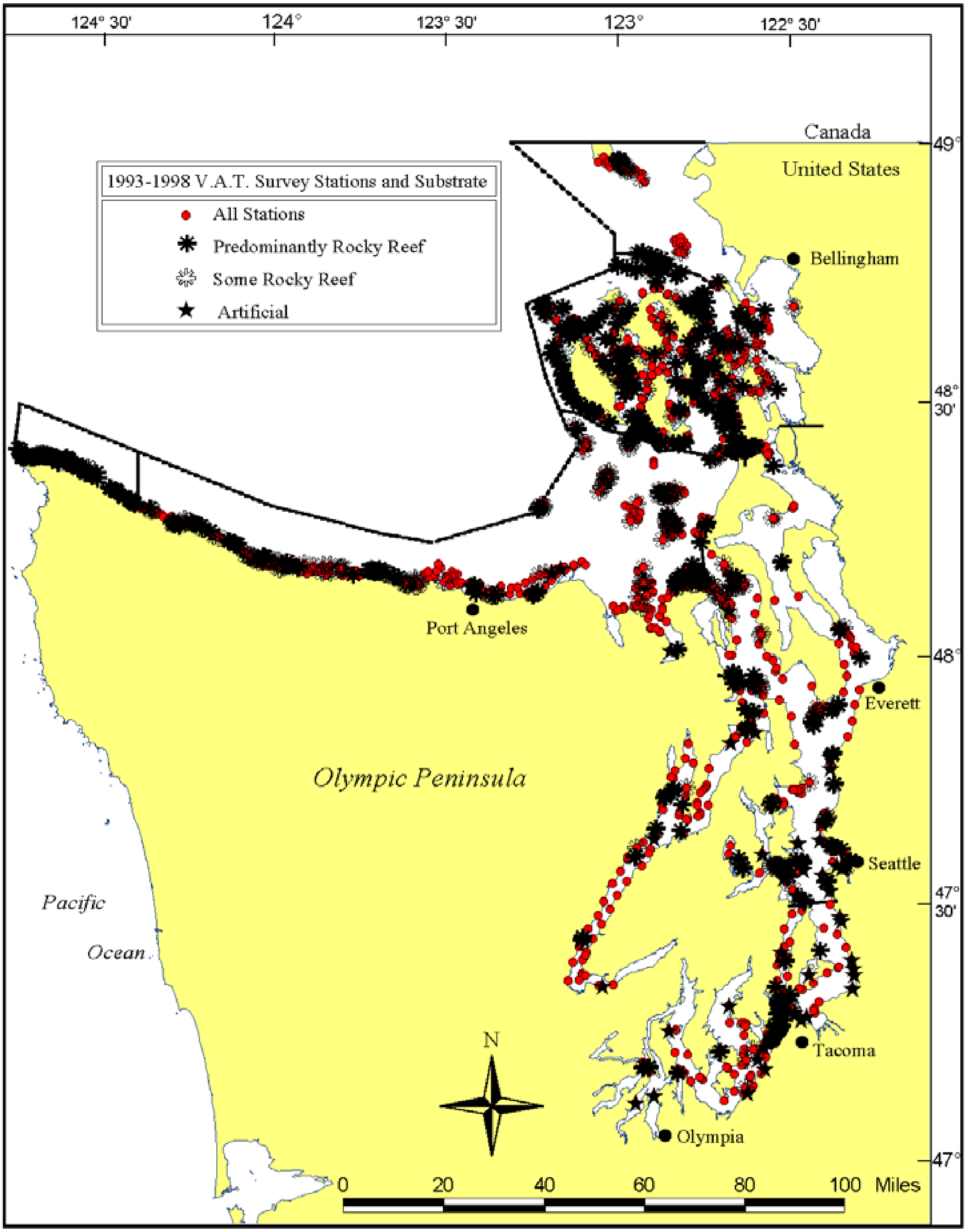

Figure 3.3-7 Distribution of Nearshore Rocky Habitats in Puget Sound

Source: Palsson et al. 2009

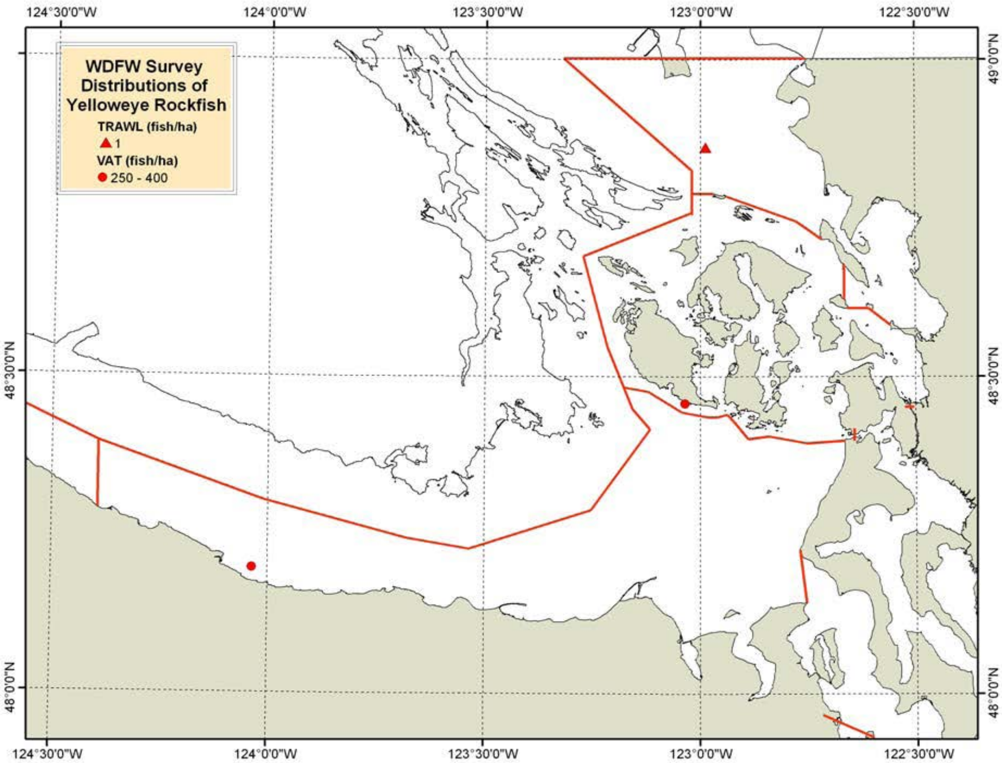

Figure 3.3-8 Distribution of Yelloweye Rockfish in North Puget Sound determined from Trawl, Video, and Scuba Surveys[8]

[8] Limitations of rockfish surveys methods are described below:

Trawl: this species finds refuge in high-relief habitat where bottom trawl surveys are ineffective (Jones et al. 2012).

Video: provides a better mechanism than trawls to quantify species abundance for bottom-oriented rockfish (Jones et al. 2012).

Scuba: distribution includes depths that exceed the safe scuba diving depth (Haggarty 2014)

Table 3.3-1 Likely Stressors Limiting Rockfish Populations in Puget Sound

FACTOR	LIKELY IMPACT
Past Fishery Removals	High
Habitat Disruption	Low
Derelict Gear	High
Climate Change	Low
Water Quality	
Dissolved oxygen	Moderate
Nutrients	Low
Chemical Contamination	Moderate
Species Interactions	
Food Web	Moderate
Competition	Low
Salmon Hatchery Practices	Low
Diseases	Low
Genetic Changes	Low

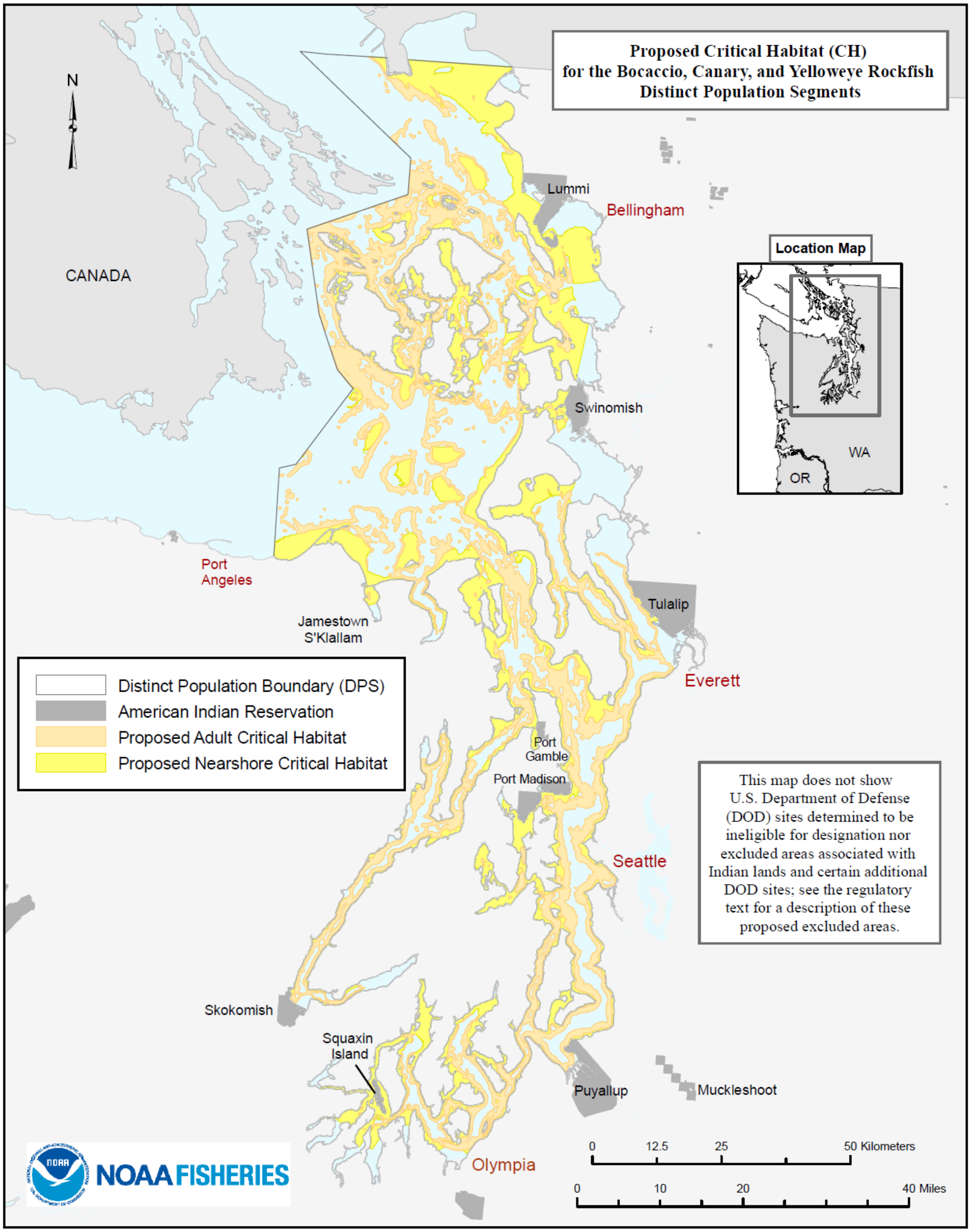

Figure 3.3-9 Proposed Critical Habitat for the Bocaccio, Canary, and Yelloweye Rockfish Distinct Population Segments
Source: NOAA 2013

3.3.12 Marbled Murrelet

There are six marbled murrelet conservation zones (WDFW 2014), one of which occurs in the Action Area. Zone 1 includes the Strait of Juan de Fuca, Hood Canal, and the San Juan Islands and is monitored by the Pacific Northwest Research Station, and the United States Department of Agriculture Forest Service. The most recent murrelet population estimate for Zone 1 is 4,393 birds, with the majority occurring around the south end of the San Juan Islands and along the northern coast of the Olympic Peninsula (WDFW 2014). Primary fish prey of marbled murrelets includes Pacific sand lance, Pacific herring, northern anchovy, and smelts. Documented smelt and sand lance spawning locations occur throughout the Strait of Juan de Fuca and in the vicinity of the BP Marine Terminal. Herring and smelt spawning occur along the shoreline from Blaine, WA south to Bellingham and the BP Marine Terminal falls within these areas (WDFW 2014b). Sand lance spawning occurs within the Action Area, but has not been documented in close proximity to the terminal (WDFW 2014b). While the presence of forage fish suggests that marbled murrelets may feed within the Action Area, nesting habitat is limited by a lack of the required old-growth forests. No critical habitat has been designated for marbled murrelet within the Action Area (USFWS 2013) Therefore; it is possible that marbled murrelets will be present within the Action Area, but only for foraging.

3.3.13 Leatherback Turtle

Leatherbacks regularly occur off the coast of Washington, especially off the mouth of the Columbia River during the summer and fall when large aggregations of jellyfish form (WDFW 2012). Observations, telemetry data, and gillnet captures of leatherbacks off the Washington coast, identified turtles south of Cape Flattery and in deeper offshore water (WDFW 2012). Leatherback turtles could occur in the Action Area; however, occurrences are not expected to be common.

Critical habitat for leatherback turtle has been designated at the western extent of in the Action Area in the vicinity of J Buoy (Figure 3.3-10; 77 FR 4170). Critical habitat does not extend into the Strait of Juan de Fuca or Puget Sound; therefore, vessels calling at the BP Marine Terminal would only pass through a small portion of leatherback turtle critical habitat.

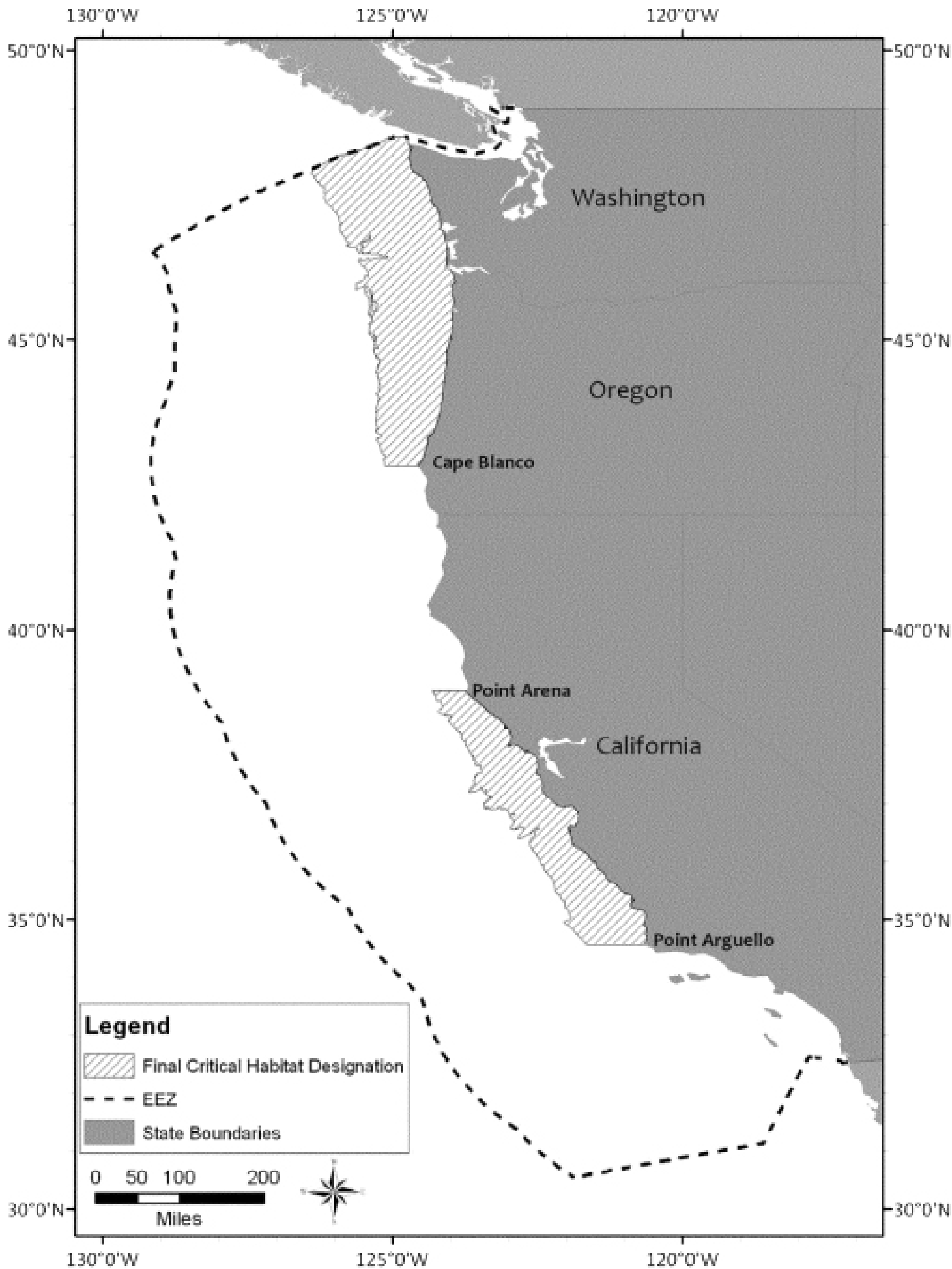

Figure 3.3-10 Designated Critical Habitat for U.S. West Coast Leatherback Turtle
Source: 77 FR 4170

Chapter 4

Effects of the Proposed Action on ESA-Listed Species

The federal action under consideration in this BE is the USACEs' modification of the current Department of the Army permit number 92-1-00435 for the continued operation and maintenance of the BP Marine Terminal. The project is broken into two major components: vessel traffic and marine terminal operations. Each of these activities has its effects to listed species, some of which overlap.

This section addresses effects of the Proposed Action. The regulations implementing the ESA define "effects of the action" as "the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline" (50 CFR §402.02). Direct effects are the immediate effects of the project on the species or its critical habitat. Direct effects result from the Proposed Action and include the effects of interrelated and interdependent actions, of which there have been none identified for this BE (Section 1.5). The primary direct effects of the Proposed Action derive from the nature, extent, and duration of the activities on humpback whales, Southern Resident DPS killer whales, Steller sea lions, and ESA-listed fish species. Indirect effects are those effects that are caused by or would result from the Proposed Action and are later in time, but are still reasonably certain to occur. Potential effects of the action are summarized in table 4.1-1.

Table 4.1-1 Potential Effects of the Action

Project component	Stressor	Potential Effect
Vessel traffic	Noise	Startle, disruption of behavior, temporary change of habitat for marine mammals
	Introduced species/pollution	Change of habitat for all listed species
	Intake of cooling water	Injury and/or mortality of larva rockfish
	Vessel strikes	Injury and/or mortality of marine mammals
Terminal Operations	Noise	Startle, disruption of behavior, temporary change of habitat all listed species
	Pollution	Change of nearshore habitat could affect all listed salmonids

Since the North Wing has already been constructed and has been in operation since 2001, the effects of the Proposed Action are already part of the environmental baseline, these effects will continue into the future. The effects of the Proposed Action analyzed in this BE focus on the ongoing effects of current operations and vessel traffic levels and potential increased vessel traffic up to 420 calls per year.

4.1 Marine Mammals

4.1.1 Humpback Whale, Blue Whale and Fin Whale (Baleen Whales)

Humpback, blue and fin whales do not commonly occur within the Action Area. Calambokidis et al. (2003) reports five humpback individuals identified in the Puget Sound from 1986-2003. Humpback whales presence in the Action Area, if at all, would be during the summer and fall months when humpback whales are foraging off of the Washington and British Columbia coasts. Vessel surveys conducted in 1996 and 2001 did not detect blue or fin whales in Washington waters (Carretta et al. 2013).

Potential effects on baleen whales associated with the BP Marine Terminal would include interactions with vessels in transit, effects due to increased background noise, effects from discharge of hazardous materials into the marine environment and catastrophic oil spills.

4.1.1.1 Effects of Vessel Traffic

Vessel Strikes

A study reviewing ship strikes on whales in Washington State reviewed 130 records from 1980-2006 and found only one incident of a possible ship-struck humpback, two possible ship-struck fin whales and no known ship-struck blue whales despite the known presence of these species in the shipping lanes in the region (Douglas et al. 2008). Although vessel strikes of humpback, blue and fin whales have been recorded in NMFS' Large Whale Ship Strike Database (Jensen and Silber 2004), the probability of a whale strike occurring as a result of the Proposed Action is unlikely for the following reason. The vessel traffic calling at the BP Marine Terminal currently comprise about 1 percent of the commercial traffic in the Action Area and the increase in vessel traffic attributable to the Proposed Action is very small. The low likelihood that a humpback, blue or fin whale will be present it the Action Area combined with the small potential increase in vessel traffic calling at the BP Marine Terminal makes a measurable increase in the probability of a vessel strike over baseline conditions unlikely.

Sound

Humpback, blue and fin whale calls occur at predominately low frequencies from 0.03 to 8 kHz and their hearing is presumed good at corresponding frequencies (NMFS 2010c). Unlike toothed whales, baleen whales have not been shown to use echolocation to detect the size and nature of objects. However, baleen whales use sound as a long-range acoustic communication system to facilitate mating and social interactions. The auditory system of baleen whales is presumed to be more sensitive to low-frequency sounds than those of small-to-moderate-sized toothed whales (NMFS 2010c). Baleen whales are thought to be most sensitive to a range of low-frequency sounds occurring in the 0.01 to 1 kHz range. (Okeanos 2008).

Vessel sounds attributed to large ships, tankers, and tugs traveling to the BP Marine Terminal would generate low frequency sound in the 5Hz to several hundred kHz range (NRC 2003). Noise from increased vessel traffic associated with the Proposed Action has the potential to mask biologically significant sounds baleen whales use to communicate, avoid predators, and gain awareness of the environment. Although there are many documented, clearly discernable responses of marine mammals to anthropogenic sound, reactions are typically subtle, consisting of shorter surfacing intervals, shorter dives, fewer blows per surfacing, longer intervals between blows, ceasing or increasing vocalizations, shortening or lengthening duration of vocalizations, and changing frequency or intensity of vocalizations. While some of these changes may be statistically significant, it is unknown if they have an effect on whales at the individual or population level (NRC 2003).

A review of past industrial activities indicates that these activates do have some impact on whales. For example, in the calving lagoon of Guerrero Negro, Baja California Sur, Mexico, daily dredging and vessel traffic caused gray whales to abandon the area for ten years, from 1957 to 1967. Whales did not return to the area until six years after the industrial operations ceased (Gard 1974 and Bryant and Lafferty 1980, cited in Rice et al. 1984). While separating the effect of noise from the other stimuli present in the lagoon is not possible, the increase in noise likely played a role in this habitat abandonment. Likewise, Borggaard et al. (1999) observed temporary changes in habitat use during marine construction activities involving dredging, blasting, and increased vessel traffic in Trinity Bay, Newfoundland, Canada. Given these whales would primarily occur on the periphery of the Action Area, and in the case of humpback whales, who are infrequent visitor to the Action Area, habitat abandonment associated with increased vessel traffic and associated noise would not be expected under the Proposed Action.

Exposure to anthropogenic sounds may increase stress levels and affect the fitness of individuals by lengthening migration, increasing the duration of foraging bouts, or limiting foraging opportunities before long periods of fasting and migration begin (NRC 2003). The North Pacific populations of all three species are increasing (Carretta et al., 2011). Although, small numbers of individual humpback whales could venture through the Strait of Juan de Fuca into Georgia Basin, none of these populations are expected to be affected by stress reactions from increased vessel traffic.

As discussed in section 3.1.2, and 3.2.2 the incremental increase in vessel traffic due to calls of oil tankers and oil barges at the BP Marine Terminal could result in exposing these whales to increased sound levels from a transiting vessel. Basset et al. (2012) estimate the source level for oil/chemical tankers to be 181 dBrms re 1 µPa at 1 m and tugs at 173rms dB re 1 µPa at 1 m. These levels are likely representative of the vessels calling at the BP Marine Terminal including those vessels contributing to the increase in calls as a result of the operation of the North Wing, because no change is expected in the ship speed, condition of the vessel, vessel load, and on board activities of the vessels calling at the marine terminal other than a small incremental increase in frequency of calls.

While the source level for tankers transiting to the BP Marine Terminal approach NMFS interim criterion for injury of 180 dBrms re 1 µPa at 1 m, no whales are likely to occur within 1 m of a vessel, and given their tendency to avoid vessels upon detection, the received level experienced by these whales is likely to be well below the interim injury criterion. Some individuals could be exposed to received levels that exceed the 120 dB_{rms} re 1 µPa at 1 m for defining disturbance (i.e. level B harassment) under the MMPA. The effect of this disturbance is likely to involve avoidance behaviors, such as adjusting migration paths to avoid close approach to a vessel. These responses are not expected to result in adverse effect to the fitness of any of the individuals exposed.

With respect to NMFS 2013 proposed guidelines for potential injury or harassment to marine mammals, humpback, blue and fin whales are in NMFS low frequency hearing group with a functional hearing range of 7 Hz to 30 kHz, a range that overlaps with the frequency range of sound generated by commercial vessel traffic. NMFS proposed dual criteria for TTS are received levels of 224 dBpeak re 1 µPa and 198 dB SELcum re 1 µPa2-s. While NMFS cautions against comparing these criteria to the interim criteria because dBrms, dBpeak, and dB SELcum are all based on different metrics, as a rule of thumb dBpeak is generally a few dB higher than dB_{rms}. Thus, the estimated source levels for oil/chemical carriers in Bassett et al. (2012), even if adjusted to peak levels, would be well below NMFS proposed TTS criterion for peak received level.

The SELcum measurement is indeterminate in this case because it requires knowing how long an animal is exposed to a sound level. In the case of whale/vessel interactions, whales are likely to begin moving away from the vessel when they hear the vessel (Richardson et al. 1995), reducing the whale's exposure to sound both in time and intensity. Given the source level of vessel calling at the BP Marine Terminal is considerably below the TTS peak criterion and whales are unlikely to remain in the vicinity of vessels for an extended period of time, the SEL_{cum} criterion is not likely to be violated either. Even though these proposed criteria currently have no regulatory effect, consideration of them indicate that the incremental increase in exposure to vessels calling at the BP North Wing is not likely to result in TTS or level "B" harassment. . And as discussed in section 3.1.2 and 3.2.2 the overall increase in sound energy contributed to the sound budget by the increase in vessels calls at the BP Marine Terminal is expected to be minimal and likewise is not likely to adversely affect humpback, blue and fin whales.

4.1.1.2 Operations of the Marine Terminal

Ongoing operation and maintenance activities at the BP Marine Terminal could result in accidental spills of oil or other hazardous materials (e.g., hydraulic fluid). Instances of spills associated with the operation of the BP Marine terminal, described in Section 3.2, is very small and unlikely to adversely affect the species.

It is possible that baleen whales could be present in the vicinity when ships are arriving or departing from the BP Marine Terminal. The low likelihood that a humpback, blue or fin whale will be present in the Action Area combined with the small potential increase in vessel traffic calling at the BP Marine Terminal makes a measurable increase in the probability of a vessel strike over baseline conditions unlikely.

Measures to reduce potential effects on whales include observers at the dock during maintenance activities, when required. If, in these circumstances a whale is observed near the terminal, maintenance activities are suspended until the whale moves away from the area.

4.1.1.3 Conclusion

Should humpback, blue or fin whales occur in the Action Area, the ongoing operation and maintenance activities of the BP Marine Terminal would be unlikely to result in increased collisions in the shipping lanes, or increased effects due to noise exposure or water pollution. Because ongoing operation and maintenance of the terminal is unlikely to adversely affect humpback, blue and fin whales, the Proposed Action may affect, but is not likely to adversely affect humpback, blue and fin whales.

4.1.2 Southern Resident DPS Killer Whale

Southern Resident killer whales could be present in the Action Area from May to October. Their range and movements during the late fall, winter, and early spring are less well known, but they are thought to spend less time in inland waters during these months (NMFS 2008a). Therefore the six months between May and October represent the time when the greatest potential for effects from the project would occur. Potential effects of the Proposed Action on killer whales associated with the BP Marine Terminal would include potential interactions with vessels in transit, effects due to increased noise, and effects from discharge of hazardous materials into the marine environment.

4.1.2.1 Effects of Vessel Traffic

Commercial shipping, ferry operations, military vessels, and recreational vessels all occur within the Action Area. Several studies (NMFS 2008a) in the inland waters of Washington State and British Columbia have linked interactions of vessels and Southern Resident killer whales with short-term behavioral changes. Effects from vessels and the sounds they generate include effects to foraging efficiency, communication, and/or energy expenditure though their physical presence, increased underwater sound level, or both.

Vessel Strikes

Collisions of killer whales with vessels are rare, but remain a potential source of serious injury or mortality. Shipping vessels and tugboats proceed in a usually predictable straight path toward the BP Marine Terminal at relatively low speeds. Such vessels do not target whales and are likely detected and avoided by Southern Residents (NMFS 2008a). Vessels and barges bound for the BP Marine Terminal utilize Rosario Strait almost exclusively. Killer whale densities are lower in Rosario Strait compared to Haro Strait (Figure 3.3-2); therefore, there would be a lower probability of killer whales encountering vessels in the Rosario Strait route, as compared to the Haro Strait route. Known collisions of vessels, of any type, with Southern Resident killer whales in the lower British Columbia region (near Vancouver Island) was limited to three observations between the 1960s and 2006 (NMFS 2008a). Given the composition of vessel types and numbers of vessel are comparable to levels in northern Puget Sound, vessel collisions would be likely to be similarly infrequent with all traffic utilizing the Cherry Point area and Rosario Strait. Since vessel traffic calling at the BP Marine Terminal represents only a small portion of all shipping traffic (approximately one percent), the likelihood of a vessel collision with killer whales attributed to BP Marine Terminal vessel traffic would be expected to be very low.

Sound

Killer whales produce a wide variety of clicks, whistles, and pulsed calls. Their clicks are relatively broadband, short (0.1 to 25 milliseconds), and range in frequency from 8 to 80 kHz with an average center frequency of 50 kHz and an average bandwidth of 40 kHz (Au et al. 2004). Killer whales use these signals to sense objects in their environment, such as prey; whales foraging on salmon produce these signals at peak-to-peak source levels ranging from 195 to 225 dB re 1 μPa at 1 meter (Holt 2008).

Killer whale whistles are tonal signals that have longer duration (0.06 to 18 seconds) and frequencies ranging from 0.5 to 10.2 kHz (Holt 2008). Killer whales are reported to whistle most often while they have been engaged in social interactions rather than during foraging and traveling (Holt 2008).

Killer whale pulsed calls are the most commonly observed type of signal. With Southern Resident killer whales, these signals are relatively long (600 to 2,000 milliseconds [ms]) and range in frequency between 1 and 10 kHz; but may contain harmonics up to 30 kHz. The variable calls of killer whales have source levels ranging from 133 to 165 dB 1 μPa at 1 meter (3.3 feet) while stereotyped calls have source levels ranging from 135 to 168 dB re 1 μPa at 1 meter. Killer whales use these calls when foraging and traveling. (Holt 2008)'

Killer whales are classified by NMFS as belonging to the mid-frequency hearing group, with a functional hearing range of 150Hz to 160 KHz. Bassett et al. (2012) reported that below 1 kHz, where the majority of acoustic energy associated with commercial ships is concentrated, ship traffic regularly increases noise levels by 25 dB re 1 µPa above background levels, but that mid-frequency cetaceans are about 5 db less sensitive to sounds in this range than in the more sensitive parts of their hearing range. However, at higher frequencies (extending up to 30 kHz), which are more biologically important, one-third octave band SPLs regularly increase by 10–20 dB re 1 µPa, which has the potential to mask biologically significant sounds killer whales use to communicate, forage, and otherwise gain awareness of the environment. While there are many documented, clearly discernable responses of marine mammals to anthropogenic sound, reactions are typically subtle, consisting of shorter surfacing intervals, shorter dives, fewer blows per surfacing, longer intervals between blows, ceasing or increasing vocalizations, shortening or lengthening duration of vocalizations, and changing frequency or intensity of vocalizations. While some of these changes become statistically significant in given exposures, it remains unknown when and how these changes translate into biologically significant effects at either the individual or the population level (NRC 2003).

Whale displacement by acoustic ‘‘pollution’’ has been difficult to document, even in cases where it is strongly suspected, because noise effects can rarely be separated from other stimuli. However, Morton and Symonds (2002) report a significant decline in sightings of killer whales during a 5-year period when acoustic-harassment devices were operated in an area of water about 10 km × 10 km in Boughton Archipelago, British Columbia, Canada. The acoustic-harassment devices emitted a 10 kHz signal at 194 dB_{peak} re 1 µPa at1 m, which was estimated to reach ambient noise levels 50 km (31 miles) from the source. These devices were designed to be loud enough to deter pinnipeds from breaking into fish farms to feed, but they had the unintended consequences of excluding inshore cetaceans from the area. Williams *et al.* (2002) investigate the effect of "leapfrogging" whale watch vessels on killer whales in Johnstone Strait, British Columbia, Canada. They observed whales engaging in avoidance behavior in response to increase noise levels as vessels speed up to overtake another whale watch vessel for a closer approach to the whales. While these studies document cause for concern for the endangered southern resident killer whales, they are distinguishable from the effects anticipated as a result of the Proposed Action. Source levels from dock operations and vessel transits are much lower in frequency and intensity than the signal generated by the acoustic harassment devices in the Boughton Archipelago. And the vessels transiting to the BP Marine Terminal would be moving slowly (likely < 15 knots) on consistent and predicable courses, unlike leapfrogging whale watch vessels.

Exposure to anthropogenic sounds may increase stress levels and affect the fitness of individuals by lengthening migration, increasing the duration of foraging bouts, or limiting foraging opportunities before long periods of fasting and migration begin (NRC 2003). In 2011, NMFS published "Protective Regulations for Killer Whales in the Northwest Region Under the Endangered Species Act and Marine Mammal Protection Act" (76 FR 20870), to address the effects of vessels on killer whales. However, in recognitions of the fact that vessels such as government vessels, commercial and tribal fishing boats, cargo ships, tankers, tug boats, and ferries represent a small proportion (typically 5–7 percent in most years) of the vessels within one-quarter mile of the whales, NMFS provided an exception for vessels participating with the VTS and following a Traffic Separation Scheme or complying with a VTS Measure of Direction. This exception also includes support vessels escorting vessels in the traffic lanes, such as tug boats (76 FR 20870). All of the vessels calling at BPs Marine Terminal would qualify for this exception. The incremental increase in vessel traffic resulting from the Proposed Action is not anticipated to result in adverse effects to southern resident killer whales, as it is a small incremental increase in an already small component of the vessel traffic that occurs in the vicinity of the whales.

As discussed in section 3.1.2, and 3.2.2 the incremental increase in vessel traffic due to vessel calls at the BP Marine Terminal could result in exposing killer whales to increased sound levels from a transiting vessel. Basset et al. (2012) estimate the source level for oil/chemical tankers to be 181 dB re 1 µPa at 1 m and tugs at 173 dB re 1 µPa at 1 m. These are likely representative levels for the vessels calling at BP's Marine Terminal and for the vessels contributing to the increase in calls as a result of the operation of the North Wing, because no change is expected in the ship speed, condition of the vessel, vessel load, and onboard activities of the vessels calling at the marine terminal other than a small incremental increase in frequency of calls.

While the source level for tankers approach NMFS interim criterion for injury of 180 dB_{rms} re 1 µPa at 1 m, no killer whales are likely to occur within 1 m of a vessel, and given their tendency to avoid vessels upon detection, the received level experienced by these whales is likely to be well below the interim injury criterion. They are likely though to be exposed to received levels that exceed the 120 dB_{rms} re 1 µPa at 1 m for defining disturbance (i.e. level B harassment) under the MMPA. The effect of this disturbance is likely to involve avoidance behaviors which are not expected to result in adverse effect to the fitness of any of the individuals exposed.

With respect to NMFS 2013 proposed guidelines for potential injury or harassment, killer whales fall in NMFS mid-frequency hearing group and while there are overlaps with the frequency range of sound generated by commercial shipping traffic, much of the energy contributed by vessels calling at BP's terminal and operations at the terminal fall in frequency ranges not particularly important to killer whales. NMFS proposed dual criteria for TTS are received levels of 224 dB_{peak} re 1 µPa and 198 dB SEL_{cum} re 1 µPa2-s. While NMFS cautions against comparing these criteria to the interim criteria because dB_{rms}, dB_{peak}, and dB SEL_{cum} are all based on different metrics, as a rule of thumb dB_{peak} is generally a few dB higher than dB_{rms}. Thus, the estimated source levels for oil/chemical carriers in Bassett et al. (2012), even if adjusted to peak levels, would be well below NMFS propose TTS criterion for peak received level.

The SEL_{cum} measurement is indeterminate in this case because it requires knowing how long an animal is exposed to a sound level. In the case of whale/vessel interactions, whales are likely to begin moving away from the vessel when they hear the vessel (Richardson et al. 1995), reducing the whale's exposure to sound both in time and intensity. Given the source level of vessel calling at the BP Marine Terminal is considerably below the TTS peak criterion and whales are unlikely to remain in the vicinity or vessels for an extended period of time, the SEL_{cum} criterion is not likely to be violated either. Even though these proposed criteria currently have no regulatory effect, consideration of them indicate that the incremental increase in exposure to vessels calling at the BP North Wing is not likely to result in TTS or level "B" harassment. . And as discussed in section 3.1.2 and 3.2.2 the overall increase in sound energy contributed to the sound budget by the increase in vessels calls at the BP terminal is expected to be minimal and likewise is not likely to adversely affect killer whales.

4.1.2.2 Operations of the Marine Terminal

Effects to killer whales from operations of the BP Marine Terminal would be similar to those described above in Section 4.1.1.2. The effects would be limited in duration and magnitude, and would not be expected to result in population-level effects to Southern Resident killer whales.

4.1.2.3 Effects to Critical Habitat

Vessel traffic moving to and from the BP Marine Terminal would transit through Southern Resident killer whale critical habitat and would increase mixing of the surface and subsurface layers of the water column in the area immediately surrounding the vessel path and wake. This mixing of the layers would not be expected to affect water quality since the increase in vessel traffic attributable to the Proposed Action would be very small and those vessels would stay within the Coast Guards VTS, which is an area that is already disturbed by vessel traffic; therefore increased vessel traffic would not be expected to have an effect on killer whale critical habitat. Fish and marine mammals as prey species would also avoid areas where vessels are present, but would otherwise be unaffected by vessels in terms of sufficient quantity, quality and availability.

An accidental spill of oil during oil transfer from the vessel to the refinery could threaten killer whale critical habitat by decreasing prey population, thereby reducing food availability. However, the probability of a spill of oil or other hazardous material at the dock is slight (small spills occurring less than once per year), and would not be expected to affect killer whale critical habitat.

The primary constituent element of passage conditions to allow for migration, resting, and foraging would be affected by the passage of vessels. Whales would move away from the source of the noise, temporarily displacing them from the area. However, the passage of watercraft in the area is an existing, temporary and common occurrence. Overall, the Proposed Action may affect, but is not likely to adversely affect, designated critical habitat for the Southern Resident killer whale.

4.1.2.4 Conclusion

The ongoing operation and maintenance activities of the BP Marine Terminal would be unlikely to result in increased collisions with killer whales in the shipping lanes, or increased effects due to noise exposure or water pollution. Because ongoing operation and maintenance of the terminal would be unlikely to adversely affect killer whales or their critical habitat, the Proposed Action may affect, but is not likely to adversely affect killer whales.

The Action Area includes killer whale critical habitat occurring in the Strait of Juan de Fuca and the Summer Core Area (Haro Strait and San Juan Islands). The effects of vessel traffic on the primary constituent elements Southern Resident killer whale critical habitat would be limited to temporary displacement of whales and their prey species. In addition, these critical habitat units could be impacted by the Proposed Action if there is a discharge of oil or other hazardous material into the aquatic environment that leads to a decrease in prey population, thereby reducing food availability. As discussed above, such incidents would not be expected to occur in a large enough magnitude or frequent enough to affect killer whale critical habitat.

4.2 Fish Species

There are nine fish species listed as threatened or endangered under the federal ESA that could be affected by ongoing operations at the BP Marine Terminal and associated increases in vessel traffic. ESA-listed fish, species that could be affected include bocaccio, canary and yelloweye rockfish, green sturgeon, Pacific eulachon, bull trout, Chinook salmon, chum salmon, and Puget Sound steelhead. Effects to these species and their critical habitat from the Proposed Action are described below.

4.2.1 Rockfish

4.2.1.1 Effects of Vessel Traffic

Noise

Adult fish are able to detect vessel noise over a large range of frequencies, ten to several hundred Hz, when the noise level is greater than about 30 dB above their hearing threshold (Mitson 1995). Fish within a few hundred meters of passing ships (e.g., tankers) may exhibit avoidance behaviors (Mitson 1995). A study on the behavior of larval fish in response to exposure to varying levels of sound found no significant effect on behavior or fish tissue (Jorgensen et al. 2005 as cited in Popper and Hastings 2009). An increase in vessel traffic due to the operation of the BP Marine Terminal would lead to a small incremental increase in noise; the increase in noise would be unlikely to affect larval rockfish as sound does not have a negative effect on larval fish, or adult rockfish as they are a deepwater assemblage that would not commonly occur within the vicinity of transiting vessels. Since the overall increase in noise, relative to background conditions, would be relatively small, and rockfish would not be likely to occur in the vicinity of vessel traffic, the Proposed Action would result in an insignificant effect to fish present in the Action Area.

Entrainment

Adverse effects to listed fish species from increased vessel traffic would primarily be limited to larval stages of rockfish, as they have limited swimming capability, may occupy the nekton layer of the water column for several months (primarily in the spring) and are therefore subject to currents and unable to avoid vessel traffic.

Vessel traffic of all types and sizes presents a persistent, if small, risk to larval rockfish populations. All rockfish species, including the three distinct population segments present in Puget Sound are viviparous giving birth to well-developed larvae with limited abilities to swim, maintain buoyancy in the water column, and feed. These larvae are pelagic for several months and occur in the water column from near the surface to depths of 100 meters (328 feet) or more.

Those near the surface and in the shipping lanes may to be injured or killed by encounters with vessel traffic. In addition, those near docks and mooring facilities may be subject to entrainment in vessel engine cooling systems.

A literature review, including NMFS' status review, listing documents, and several relevant biological opinions, did not reveal any analysis of the level of risk vessel traffic presents to the survival and abundance of rockfish populations. For example, vessel traffic or interactions with vessels is not identified as a threat in the Status review document NMFS relied upon in considering its decision to list the Georgia Strait/Puget Sound DPSs of bocaccio, canary, and yelloweye rockfish. Presumably, this is related to the view that reduction in adult population levels due to overfishing by commercial and recreational anglers has been the major driver in the decline of rockfish along the Pacific Coast (Zabel et al. 2011) and in Puget Sound in particular (NMFS 2010b; Palsson et al. 2009). Other risk factors considered in the NMFS status review include habitat loss, water quality, predation, competition, derelict fishing gear, climate change, and hatcheries. Of those, loss of habitat and competition from other rockfish and hatchery fish were identified as factors that could be impeding recovery of the listed DPSs of rockfish, but even those impacts are discussed in the context of effects on juvenile rather than larval rockfish.

Several biological opinions (NMFS 2011d-f; 2012) cover the effects of in-water construction and in-water dredge disposal; NMFS analyzed the effects of sound, habitat destruction, and sedimentation, however, there has been no analysis of the effect of vessel operations associated with those actions on larval fish. In each of these opinions NMFS concluded that although larval fish were likely to be killed by exposure to the effects of the actions, the numbers of mortalities were small compared to the number of larvae produced by these species. Given that recruitment of larvae to settled juvenile is an infrequent event and that larval rockfish experience high natural mortality, the NMFS's conclusion in the biological opinion (NMFS 2011d) was that the loss of larval rockfish was not likely to jeopardize the continued existence of the species.

A similar analysis is appropriate to determine the effect of the Proposed Action on rockfish. No studies examining the effects of vessel traffic on larval rockfish where found, however, two studies were identified that examine the effect of commercial vessel traffic on larval and juvenile assemblages or riverine species. Huckstorf et al. (2011) reported that effects of intense commercial navigation in large low land river system in Germany affected fish assemblages primarily through the hydraulic disturbances along the banks. Roach (*Rutilus rutilus*) larvae, which tend to remain in the littoral zone declined as traffic increase, but perch (*Perca fluviatilis*) larvae did not. They also reported the total zooplankton biomass was highest in the high traffic intensity reach. Odom et al. (1992) investigated barge-associated mortality of larval fishes in Kanawha River (a tributary to the Ohio River) and found the percent of live larvae in samples taken before and after barge passage did not differ significantly for either sampling period.

While these studies were conducted on different species in different environments, they demonstrate that adverse effects of commercial barge traffic on pelagic larval fish in large riverine transportation corridors may be minimal. Even if these studies are not considered relevant, information on distribution of rockfish larvae in the water column indicates most larvae are likely to escape an encounter.

Moser and Boehlert (1991) reviewed the ecology of pelagic larvae and juveniles of the genus Sebastes. They reported vertical larval distribution of at two CalCofi sampling sites of Southern California: one 2.4 nautical miles offshore over a bottom depth of 350 meters (1,148 feet) and one 38.4 nautical miles offshore over a bottom depth of 1,200 meters (4,000 feet). About 90 percent of the larvae occurred at depths shallower than 80 meters (262 feet) at both stations. The largest proportion of the larvae occurred in the 20 to 30 meter (66 to 98 foot) depth at the nearshore site and at 30 to 40 meters (98 to 130 feet) at the offshore site. They attribute the difference to the deeper depth of the thermocline at the offshore site. Relatively small numbers of larvae occurred in the 0 to 20 meter (0 to 66 foot) range at both sites. They suggest that the relative rarity of larvae in the shallow Ekman layer (that layer subject to wind generated currents) may be a mechanism to reduce offshore transport during periods of upwelling keeping larvae closer to benthic habitat where juveniles will ultimately settle. Ross and Larson (2003) examined vertical distribution of pelagic juveniles in 15 species of rockfishes off central California. In depth-stratified midwater trawls made at night, pelagic juveniles of most species were equally distributed throughout the water column. Notable exceptions were bocaccio, which was significantly more abundant in 10 meter and 30 meter (33 to 98 foot) deep tows. For most species examined (13 of 15), increased stratification of the water column led to a tendency for deeper centers of density and smaller rockfishes (≤25 mm standard length) occurred primarily below the thermocline. Since Puget Sound is estuarine in character, its waters stratify according to salinity and temperature. Assuming rockfish larvae behave like larvae in central California, they likely will be distributed below the depths of transiting vessel traffic. The draft of a millennium tanker, the type likely to call on the BP Marine Terminal is about 17 meters (56 feet), and tugs and barges have shallower drafts generally less than 10 meters (33 feet). In addition, larvae are widely distributed in low densities by currents in Puget Sound (Weiss 2004), so even those that are at a shallow depth are likely to escape an encounter with a vessel. Therefore, even though the effect of vessel traffic on larval fish cannot be quantified, most larvae would be likely to escape encounters; the few that do not would not affect the recruitment dynamics of these three species of rockfish.

Larval rock fish are also susceptible to entrainment (the direct uptake of aquatic organisms by the suction field generated by water intakes) in the vessel sea water intakes for engine cooling, fire suppression units, other ship board uses of sea water, and ballast water management. Adverse effects to listed fish species from entrainment would primarily be limited to larval stages of rockfish, as they have limited swimming capability, may occupy the nekton layer of the water column for several months (primarily in the spring), and are therefore subject to currents and unable to avoid the approach velocities near intake structures. Puget Sound wide assessments of larval rockfish are rare. Greene and Godersky (2012) documented seasonal trends in abundance with peaks in spring and summer, and geographic trends with lower densities in northern basins compared Central and South Sound. Waldron (1972, cited in Greene and Godersky 2012) sampled only in the spring and found a different distribution with Central and Rosario Basins having higher densities than Whidbey basin and South Sound. Weis (2004) was limited to only sampling around San Juan Island, but documented the seasonality observed by Greene and Godersky (2012). While none of these studies included Cherry Point, they do document the wide distribution both vertically and horizontally (Weis 2004) indicating that only a small fraction of the larval population is likely to be exposed to the risk of entrainment in vessel cooling systems during spring and summer.. All other life stages of rockfish inhabit deeper water and would avoid the vessels intakes.

There have been a number of studies of coastal power plants in California that use sea water in cooling systems to condense steam. The largest of these is the Diablo Canyon nuclear plant in central California. When operating at full capacity it uses about 3.8 Kcfs in its cooling system (Tetra Tech 2008). Ehrler et al. (2002) and Steinbeck et al. (2007) estimated the number of kelp, gopher, and black rockfish complex larvae entrained in the vicinity of the power plant annually for two periods. Their estimates, adjusted to the long-term average intake cove surface plankton tow index, were:

- October 1996 through September 1997 – 275,000,000 (Standard Error [SE] = 24,700,000) larvae; and
- October 1997 through September 1998 – 222,000,000 (SE = 28,900,000) larvae.

Based on three impact assessment approaches, in conjunction with additional adult abundance data, Ehrler et al. (2002) concluded that kelp, gopher, and black rockfish in the vicinity of Diablo Canyon Power Plant were not adversely impacted by power plant entrainment, and the results supported a conclusion that potential impacts to rockfish were relatively small. Combining these results with the observation of a fairly stable adult rockfish population confirms the conclusion of no adverse environmental impact to kelp, gopher, and black rockfish.

The Diablo Canyon study was performed on thriving rockfish populations compared to the listed Puget Sound rockfish, and demonstrates that populations can sustain high levels of larval mortality without adverse environmental impact. The capacity of vessel cooling systems is orders of magnitude smaller than the capacity of a coastal power plant (10cfs v. 1000s of cfs) and although the amount of larval rock fish entrainment associated with the incremental increase in vessel traffic associated with this action cannot be meaningfully measured, detected, or evaluated, it would not likely adversely affect the reproduction, population size, or distribution on the three listed rockfish populations.

In years when larval production is good, climatic conditions are just right, and currents deliver larval fish to juvenile rearing habitat, a strong cohort recruit to the juvenile and adult populations would be expected. For bocaccio this generally occurs on the frequency once every 13 years (Tolimieri and Levin 2005). Canary and yelloweye rockfish likely have similar patterns of mostly poor years interspersed with occasional good years of larval production and survival. The increment of larval mortality that occurs in those years is unlikely to be large enough to reduce the production of a strong cohort, which will contribute to recovery. Therefore, vessel traffic (including entrainment) would not likely have an adverse effect on the reproduction, numbers, or distribution of these three rockfish populations. And, in any case, any impact would be so negligible it could not be meaningfully measured, detected or evaluated.

4.2.1.2 Operation of the Marine Terminal

Effects to rockfish from the operation of the BP Marine Terminal include increased lighting, accidental release of ballast water, and minor releases of oil and other contaminants.

Most fish utilize vision to orient and perform activities such as foraging, breeding, and avoiding predators. Fish behavior can be affected by artificial light stimuli; a common reaction of fish groups in the presences of artificial light is to school and move towards the light source. Levels of aggregation and attraction to light varies by species (Marchesan et al. 2004). Artificial lighting at the dock may facilitate nocturnal predation by visual aquatic predators and piscivorous birds.

BP records, from 1971 to 2005, indicate that ballast water from cargo tanks has been spilled twice (<1 percent occurrence). While these accidents are outside the scope of Coast Guard regulations, they are a rare event and of such a size to not create an additional risk of invasive species introduction. Vessels calling at BP's Marine Terminal would comply with Coast Guard regulations. Should vessels require discharge of ballast from their cargo tanks, the BP Marine Terminal has reception facilities available. Any cargo ballast water received by the BP Marine Terminal would go through laboratory testing to ensure it contains no chemicals or toxins which could not be appropriately treated in the on-site wastewater treatment plant prior to treatment and subsequent discharge into the marine environment. The BP Marine Terminal would not accept ballast containing MTBE. NMFS has consulted with the Coast Guard on the implementation of the ballast water management regulations and concluded that the minimal potential for introduction on invasive species is not likely to jeopardize the existence of listed species (NMFS 2012c).

Ongoing operation and maintenance activities at the BP Marine Terminal could result in accidental spills of oil or other hazardous materials (e.g., hydraulic fluid). Spill records at the dock for the period from 1990 through 2010 indicate that incidents are infrequent (typically average 3.5 per year), and the volume of spills is usually very small. Many of the incidents reported were in quantities of drops or sheen on the water, and with an average spill volume of 37 liters (9.8 gallons). Between 2001 (when the North Wing became operational) and 2010, the average spill volume at the BP Marine Terminal decreased to 2.5 liters (0.65 gallons).If an accidental spill of oil or other hazardous material were to occur, a small number of individual rockfish larvae near the dock could be adversely affected. Such incidents are not part of the normal operations and maintenance activities, and would not be expected to occur in a large enough magnitude or enough frequency to adversely affect rockfish.

4.2.1.3 Effects to Critical Habitat

Critical habitat for adult canary and bocaccio and adult and juvenile yelloweye rockfish is designated in waters deeper than 30 meters (98 feet) within the Action Area. The draft of a millennium tanker is about 17 meters (56 feet) which would not impact deepwater habitat. Vessels transiting through the Action Area would increase mixing of the surface and subsurface layers of the water column in the area immediately surrounding the vessel path and wake which could have a minor impact on surface water quality including DO, however, these impacts at the surface would be unlikely to affect deepwater habitat.

Juvenile canary rockfish and bocaccio critical habitat is designated in nearshore areas where increased vessel traffic could increase water turbidity, however this would be a temporary and localized effect. Minor shading of the nearshore habitat in the vicinity of the dock could impact aquatic vegetation present in the area which could alter physical habitat conditions; however, shading would be minimal and would not be expected to result in lasting habitat alterations. Rockfishes primary prey species include sand lance and surf smelt and other species that spawn in intertidal areas. Intertidal areas are located outside of the vessel traffic routes, and would not be affected by vessels transiting to the BP Marine Terminal. Overall, vessels transiting through the Action Area would not likely have an adverse effect on the primary constituent elements identified for rockfish.

An accidental spill of oil during oil transfer from the vessel to the refinery poses the greatest potential threat to rockfish critical habitat because a release is likely to affect nearshore areas or sensitive habitats. Impacts could include alteration of habitat complexity (e.g., loss of aquatic vegetation providing cover) and destruction of prey organisms. However, the probability of a spill of oil or other hazardous material at the dock is slight (small spills occurring less than once per year), and would not be expected to affect rockfish critical habitat. Overall, the Proposed Action may affect, but is not likely to adversely affect, proposed critical habitat for canary rockfish, yelloweye rockfish and bocaccio.

4.2.1.4 Conclusion

All three of the listed rockfish species are deep dwelling species associated with rocky habitat, which is extremely limited in Puget Sound. Only about 10 km^2 (6 mi^2) of such habitat occurs in Puget Sound (i.e., south of Admiralty Inlet), and about 207 km^2 (129 mi^2) is present in Northern Puget Sound (Palsson et al. 2009). There is no adult rockfish habitat in the vicinity of the BP Marine Terminal. Because adults of these species are distributed in habitats at some distance (likely hundreds of meters to tens of kilometers), they are not likely to be exposed the effects of routine operations of the BP Marine Terminal, including occasional small (a few spoonfuls to a few gallons) oil spills. Nor are they likely to be affected by vessel encounters (collisions) as their depth ranges are well below the draft of any tanker or tug and barge likely to transit in the Sound and call at the terminal. Effects to rockfish would be limited to the larval stage. While the Proposed Action may have some negligible effect on the species' abundance at the larval stage, it would be unlikely to kill juveniles using the nearshore or benthic habitats of the Action Area, or kill any adults, and thus it would not likely have an appreciable effect on the survival and recovery of the species due to effects on their productivity, diversity, or structure within the Puget Sound/Georgia Basin. Because effects from the ongoing operation and maintenance of the terminal would be limited to the larval stage and, in any case, could not be meaningfully measured, detected or evaluated, the Proposed Action may affect, but is not likely to adversely affect bocaccio, canary, and yelloweye rockfish.

The Action Area includes proposed critical habitat for canary, bocaccio and yelloweye rockfish. The effects of vessel traffic on the primary constituent elements of canary, bocaccio and yelloweye rockfish critical habitat would be limited to increased water turbidity and shading in nearshore areas, although these effects would be minimal and would not be expected to result in lasting habitat alterations. Impacts could also occur from an accidental spill of oil, although this is unlikely. The Proposed Action may affect, but is not likely to adversely affect bocaccio, canary, and yelloweye rockfish critical habitat.

4.2.2 Green Sturgeon

Southern DPS green sturgeon were first determined to occur in Oregon and Washington waters in the late 1950s when tagged San Pablo Bay green sturgeon were recovered in the Columbia River estuary (CDFG 2002). A few green sturgeon have been recovered in Puget Sound as incidental harvest from trawl fishers. Lindley et al. (2008) tagged 213 subadult and adult green sturgeon in spawning rivers and summer aggregation areas with uniquely coded ultrasonic pingers and observed their coastal movements with arrays of automated hydrophones deployed along the West Coast of North America from southeast Alaska to Monterey Bay, California. Based on the pattern of detections, they suggest that important overwintering grounds for green sturgeon may occur north of Vancouver Island and south of Cape Spencer, Alaska. Although they reported that during this migration a few sturgeon were detected at the San Juan de Fuca station, based on apparent migration rates between detection locations they hypothesize that most green sturgeon migrating between Canadian and U.S. waters cross the Strait of Juan de Fuca over deep water to the west of the Strait of Juan de Fuca line. Lindley et al. 2008 and Lindley et al. 2011 are consistent with a view that green sturgeon presence in Puget Sound is transitory and more likely to occur in the western part of the Action Area.

4.2.2.1 Effects of Vessel Traffic

Noise

Adult fish are able to detect vessel noise over a large range of frequencies, tens to several hundred Hz, when the noise level is greater than about 30 dB above their hearing threshold (Mitson 1995). Fish within a few hundred meters of passing ships (e.g., tankers) may exhibit avoidance behaviors (Mitson 1995). An increase in vessel traffic due to the operation of the BP Marine Terminal would lead to a small incremental increase in noise, which could cause green sturgeon to avoid areas where vessels are present. Since the overall increase in noise, relative to background conditions, would be relatively small, it would result in an insignificant effect to fish present in the Action Area.

Entrainment

Entrainment or the direct uptake of aquatic organisms by the suction field generated by water intakes on the vessels could occur. Sources of potential entrainment could include engine cooling, ballast water, and utility water used at the terminal. Potential impacts from entrainment could include physical stress due to pressure changes and/or abrasions or contact with screens and pump impellers. The change in pressure may burst swim bladders.

The potential for entrainment would primarily affect larval fish as larger adult fish have been found to escape by avoiding large vessels (Dettmers et al. 1998). Young sturgeons utilize freshwater habitat and would not be present in the Action Area. Adult and subadult green sturgeon could be present in the Action Area; however occurrence is rare (Lindley et al. 2011). Therefore, entrainment would not pose a hazard to this species because the presence of green sturgeon in the Action Area would be limited to subadults and adults and green sturgeon would be large enough during these life stages to avoid large vessels.

4.2.2.2 Operation of the Marine Terminal

Effects related to ongoing operation of the BP Marine Terminal would be similar to those described above in Section 4.2.1.2, would be limited in duration and magnitude, and would not be expected to result in population-level effects to southern DPS green sturgeon.

4.2.2.3 Effects to Critical Habitat

Green sturgeon critical habitat occurs along the Strait of Juan de Fuca and the southern portion of Rosario Strait, it does not extend north to the BP Marine Terminal. Therefore, effects to green sturgeon critical habitat from the Proposed Action would be limited to the increase in vessel traffic transiting to the BP Marine Terminal.

Vessel traffic transiting to the BP Marine Terminal would move through green sturgeon critical habitat. Transiting vessels could cause fish to temporarily move away from the source of the noise until the vessel has passed through the area. The overall increase in noise, relative to background conditions, would be relatively small; it would result in an insignificant effect to green sturgeon migration routes in the Action Area.

Increased vessel traffic would increase mixing of the surface and subsurface layers of the water column in the area immediately surrounding the vessel path and wake. This mixing of the layers would not be expected to affect water quality since the increase in vessel traffic attributable to the Proposed Action would be very small and those vessels would stay within the designated shipping lanes, which is an area that is already disturbed by vessel traffic. Therefore, the incremental increase in vessel traffic would not be expected to have an effect on water quality in designated critical habitat.

Green sturgeon generally are benthic feeders, and their critical habitat is located in coastal waters less that 60 fathoms (109.7 m) deep along the U.S. coast of the San Juan de Fuca Strait to the entrance of Rosario Strait. Given the general deep bathymetry of the strait, vessel transits would avoid most of the critical habitat; where they do cross critical habitat, vessels underway would not be likely to affect the benthic communities sturgeon may use for forage. Overall, the Proposed Action may affect, but is not likely to adversely affect, designated critical habitat for southern DPS green sturgeon.

4.2.2.4 Conclusion

Southern DPS green sturgeon would not likely experience long term effects as a result of ongoing operation of the BP Marine Terminal. As described above, individuals of these species could potentially experience habitat disturbance related to maintenance activities at the BP Marine Terminal, as a consequence of tanker vessels in transit to the docking facilities, and while unloading and loading cargo. Green sturgeon present in the Action Area would not be spawning, rearing, or foraging and project activities are limited in duration and magnitude; therefore, the likelihood of population effect from the Proposed Action is remote and is considered insignificant. Because ongoing operation and maintenance of the terminal would be unlikely to adversely impact southern DPS green sturgeon, the Proposed Action may affect, but is not likely to adversely affect southern DPS green sturgeon.

The Action Area includes critical habitat for green sturgeon. Given the location of critical habitat, effects from the Proposed Action would be limited to the increase in vessel traffic transiting through the Strait of Juan de Fuca to the BP Marine Terminal. Migratory corridors and water quality would not be expected to be affected by the Proposed Action because the increase in vessel traffic attributable to the Proposed Action would be very small and those vessels would stay within the designated shipping lanes, which is an area that is already disturbed by vessel traffic. Since green sturgeon do not forage within the Action Area, there would be no effects from the Proposed Action on prey availability. The Proposed Action may affect, but is not likely to adversely affect, designated critical habitat for southern DPS green sturgeon.

4.2.3 Pacific Eulachon

In its status review report, NMFS reviewed available literature on the distribution and abundance of eulachon in Puget Sound (Gustafson et al. 2010). Historically, there was confusion over the identification of species and several early references to eulachon were subsequently determined to be longfin or surf smelt (See discussion of historical references in Gustafson et al. 2010). This is the case for the reported run in the Nooksack River (G. Bargmann, WDFW, and Olympia, Washington. Pers. com., June 2008; cited in NMFS' status review [Gustafson et al. 2010]). WDFW and ODFW (2008) indicate there is virtually no life history information within the Puget Sound Basin available for eulachon, nor is there evidence of spawning stocks of eulachon in Puget Sound Rivers. However, an irregular but apparently persistent run was documented in the Elwha River in 2005.

4.2.3.1 Effects of Vessel Traffic

Noise

Adult fish are able to detect vessel noise over a large range of frequencies, tens to several hundred Hz, when the noise level is greater than about 30 dB above their hearing threshold (Mitson 1995). Fish within a few hundred meters of passing ships (e.g., tankers) may exhibit avoidance behaviors (Mitson 1995). An increase in vessel traffic due to the operation of the BP Marine Terminal would lead to a small incremental increase in noise, which could cause eulachon to avoid areas where vessels are present. Since the overall increase in noise, relative to background conditions, would be relatively small, it would result in an insignificant effect to fish present in the Action Area.

Entrainment

Once juvenile eulachon enter the ocean, they move from shallow nearshore areas to deeper areas over the continental shelf where they are typically found near the ocean bottom in waters 20 to 150 meters (65 to 490 feet) deep (NMFS 2011c). There is currently little information available about eulachon movements in nearshore marine areas and the open ocean. Eulachon could be present in the Action Area but would generally occur at depths greater than the draft a millennium tanker (17 meters [56 feet]) so that entrainment would not be an issue.

4.2.3.2 Operation of the Marine Terminal

Effects related to ongoing operation of the BP Marine Terminal would be similar to those described above in Section 4.2.1.2, would be limited in duration and magnitude, and would not be expected to result in population-level effects to Pacific eulachon.

4.2.3.3 Conclusion

Eulachon are not likely to be adversely affected by the Proposed Action because relative to their distribution and abundance they are rare visitors to Puget Sound and its tributaries. The irregular but persistent run in the Elwha River is an exception, but it is protected by its remoteness from the BP Marine Terminal with respect to any effects associated with those operations. Since there are so few eulachon in the Action Area and the interaction with the small increase in vessel traffic would likely be discountable, the Proposed Action may affect, but is not likely to adversely affect eulachon.

Pacific eulachon critical habitat does not occur within the Action Area and therefore would not be affected by the Proposed Action.

4.2.4 Bull Trout, Chinook Salmon, and Chum Salmon

Bull trout use the nearshore marine ecosystem during the spring and late summer months. Juvenile bull trout rear in the nearshore ecosystem with preference for unconsolidated habitats that may include eelgrass and kelp beds, which is found in the vicinity of Cherry Point. The nearshore area is critical foraging habitat for this species group. Adults also feed in this area and then migrate into freshwater rivers and streams to spawn. Critical habitat has been designated for bull trout within the Action Area in the Coastal Puget Sound and the Olympic Peninsula that extends from the line of extreme high tide to a depth of 10 meters (33 feet).

Adult and juvenile Chinook and chum migrate through the Action Area en route to spawning tributaries and when they are headed out to sea, respectively. Critical habitat for Chinook salmon has been designated within the Action Area for nearshore marine areas of the Strait of Georgia, Puget Sound, Hood Canal and the Strait of Juan de Fuca from the line of extreme high tide to a depth of 30 meters (98 feet). Critical habitat has been designated for chum salmon within the Action Area for the Strait of Juan de Fuca from the line of extreme high tide to a depth of 30 meters (98 feet).

4.2.4.1 Effects of Vessel Traffic

Noise

Adult fish are able to detect vessel noise over a large range of frequencies, ten to several hundred Hz, when the noise level is greater than about 30 dB above their hearing threshold (Mitson 1995). Fish within a few hundred meters of passing ships (e.g., tankers) may exhibit avoidance behaviors (Mitson 1995). An increase in vessel traffic due to the operation of the BP Marine Terminal would lead to a small incremental increase in noise, which could cause salmon to avoid areas where vessels are present. Since the overall increase in noise, relative to background conditions, would be relatively small, it would result in an insignificant effect to fish present in the Action Area.

Entrainment

Chinook salmon, chum salmon and bull trout present in the Action Area would be large enough and possess swimming capabilities so that entrainment would not be an issue (Dettmers et al. 1998).

4.2.4.2 Operation of the Marine Terminal

Effects related to the ongoing operation of the BP Marine Terminal would be similar to those described above in Section 4.2.1.2; they would be limited in duration and magnitude, and would not be expected to result in long term effects to Chinook salmon, chum salmon and bull trout. Fish could potentially experience habitat disturbance related to maintenance activities at the terminal dock, as a consequence of tanker vessels in transit to the docking facilities, and while unloading and loading cargo.

Chinook and chum salmon are generally only present in the Action Area as they migrate to their natal streams while bull trout could be present in the nearshore habitat around the BP Marine Terminal, particularly in the patches of eelgrass found in the sandy patches in the vicinity of the dock. Should an accidental spill occur, a small number of individual fish near the BP Marine Terminal could be adversely affected. However, such incidents are not part of the normal operations and maintenance activities, and would not be expected to occur in a large enough magnitude or enough frequency to result in population level effects to bull trout, Chinook salmon or chum salmon.

4.2.4.3 Effects to Critical Habitat

Many of the primary constituent elements of Pacific salmon and bull trout critical habitat are relevant to freshwater and estuarine environments and as such are not discussed further. Those applicable to the Action Area include migration habitats with minimal impediments, nearshore marine areas, water quality, natural cover and an abundant food base including aquatic macroinvertebrates and forage fish.

Vessel traffic moving to and from the BP Marine Terminal would not transit through bull trout critical habitat and would therefore have no impact. However, vessels would pass through critical habitat designated for Chinook and chum salmon. Transiting vessels could cause these fish to temporarily move away from the source of the noise until the vessel has passed through the area, however it would not directly block migration routes. Increased vessel traffic could increase water turbidity, which could affect nearshore aquatic habitat and macroinvertebrates. However, vessels would move at low speeds which would minimize this temporary and localized effect. Moving vessels would also increase mixing of the surface and subsurface layers of the water column in the area immediately surrounding the vessel path and wake. This mixing of the layers would not be expected to affect water quality since the increase in vessel traffic attributable to the Proposed Action would be very small and those vessels would stay within the Coast Guards VTS, which is an area that is already disturbed by vessel traffic.

Increased lighting at the Marine Terminal would be associated with vessels unloading at night and would not affect nearshore critical habitat due to its temporary nature as lights would only be on during unloading. Minor shading of the nearshore habitat in the vicinity of the dock could impact natural aquatic vegetation cover in the area; however, shading would be minimal and would not be expected to result in lasting habitat alterations. Ongoing operation and maintenance activities at the BP Marine Terminal could result in accidental spills of oil or other hazardous materials (e.g., hydraulic fluid or contaminated ballast) which may affect nearshore critical habitat including its food base. However, given the spill history at the BP Marine Terminal and BP’s oil spill avoidance and response measures (Section 3.2.1), it is unlikely the that operation of the BP Marine Terminal would have long-term impacts to Pacific salmon and bull trout critical habitat. Overall, the Proposed Action may affect, but is not likely to adversely affect, designated critical habitat for bull trout, Chinook salmon and chum salmon.

4.2.4.4 Conclusion

Chinook, chum salmon and bull trout would not be likely to experience long term effects as a result of ongoing operation of the BP Marine Terminal. As described above, individuals of these species could potentially experience habitat disturbance related to maintenance activities at the terminal dock, as a consequence of tanker vessels in transit to the docking facilities, and while unloading and loading cargo. The accidental release of oil or hazardous materials at the dock would have the greatest potential effect to these fish, however such incidents are not part of the normal operations and maintenance activities, and would not be expected to occur in a large enough magnitude or enough frequency to adversely affect bull trout, Chinook salmon or chum salmon. The likelihood of effects at a population level from the Proposed Action would be remote and are considered insignificant. Because ongoing operation and maintenance of the terminal would be unlikely to adversely impact bull trout, Chinook salmon and chum salmon, the Proposed Action may affect, but is not likely to adversely affect bull trout, Chinook salmon and chum salmon.

The Action Area includes critical habitat for all three species. The effects of vessel traffic on the primary constituent elements of bull trout, Chinook salmon and chum salmon critical habitat would be limited to increased water turbidity and shading in nearshore areas, although these effects would be minimal and would not be expected to result in lasting habitat alterations. These critical habitat areas could also be impacted by the Proposed Action if there is a discharge of oil or other hazardous material into the aquatic environment that leads to a decrease in prey population, thereby reducing food availability. As discussed above, such incidents would not be expected to occur in a large enough magnitude or frequently enough to affect critical habitat. The Proposed Action may affect, but is not likely to adversely affect critical habitat for bull trout, Chinook salmon or chum salmon.

4.2.5 Puget Sound Steelhead

Out-migrating smolts of this species use the intertidal and nearshore marine habitats for early rearing and to adjust to the saline environment. In addition to smolts occurring in the vicinity of the BP Marine Terminal, steelhead migrate through the Strait of Juan de Fuca en route to spawning tributaries throughout Washington’s north coast. It is possible that this species would be present within the Action Area.

4.2.5.1 Effects of Vessel Traffic

Noise

Adult fish are able to detect vessel noise over a large range of frequencies, tens to several hundred Hz, when the noise level is greater than about 30 dB above their hearing threshold (Mitson 1995). Fish within a few hundred meters of passing ships (e.g., tankers) may exhibit avoidance behaviors (Mitson 1995). An increase in vessel traffic due to the operation of the BP Marine Terminal would lead to a small incremental increase in noise, which could cause Puget Sound steelhead to avoid areas where vessels are present. Since the overall increase in noise, relative to background conditions, would be relatively small, it would result in an insignificant effect to fish present in the Action Area.

Entrainment

Entrainment or the direct uptake of aquatic organisms by the suction field generated by water intakes on the vessels could occur. Sources of potential entrainment could include engine cooling, ballast water, and utility water used at the terminal. Potential impacts from entrainment could include physical stress due to pressure changes and/or abrasions or contact with screens and pump impellers. The change in pressure may burst swim bladders.

The potential for entrainment would primarily affect larval fish as larger adult fish have been found to escape by avoiding large vessels (Dettmers et al. 1998). The presence of Puget Sound steelhead in the Action Area would be limited to smolts in the nearshore area and adults migrating through on their way to their natal streams. Puget Sound steelhead would be large enough during these life stages to avoid large vessels and entrainment would not pose a hazard.

4.2.5.2 Operation of the Marine Terminal

Effects related to ongoing operation of the BP Marine Terminal would be similar to those described above in Section 4.2.1.2, would be limited in duration and magnitude, and would not be expected to result in population-level effects to Puget Sound steelhead. Puget Sound steelhead smolts could be present in the nearshore habitat around the dock, and should an accidental spill occur, a small number of individual fish in the area could be adversely affected. However, such incidents are not part of the normal operations and maintenance activities, and would not be expected to occur in a large enough magnitude or enough frequency to result in population level effects.

4.2.5.3 Conclusion

Puget Sound steelhead would not likely experience long term effects as a result of ongoing operation of the BP Marine Terminal. As described above, individuals of these species could potentially experience habitat disturbance related to maintenance activities at the BP Marine Terminal, as a consequence of tanker vessels in transit to the docking facilities, and while unloading and loading cargo. Project activities are limited in duration and magnitude; therefore the likelihood of population effect from the Proposed Action is remote and is considered insignificant. Because ongoing operation and maintenance of the terminal would be unlikely to adversely impact Puget Sound steelhead, the Proposed Action may affect, but is not likely to adversely affect Puget Sound steelhead.

Proposed critical habitat for Puget Sound steelhead does not occur within the Action Area and therefore would not be affected by the Proposed Action.

4.3 Birds

4.3.1 <u>Marbled Murrelet</u>

There are six marbled murrelet conservation zones (WDFW 2014), one of which occurs in the Action Area. Zone 1 includes the Strait of Juan de Fuca, Hood Canal, and the San Juan Islands and is monitored by the Pacific Northwest Research Station, and the United States Department of Agriculture Forest Service. The most recent murrelet population estimate for Zone 1 is 4,393 birds, with the majority occurring around the south end of the San Juan Islands and along the northern coast of the Olympic Peninsula (WDFW 2014). Primary fish prey of marbled murrelets include Pacific sand lance, Pacific herring, northern anchovy, and smelts. Documented smelt and sand lance spawning locations occur throughout the Strait of Juan de Fuca and in the vicinity of the BP Marine Terminal. Herring and smelt spawning occur along the shoreline from Blaine, WA south to Bellingham and the BP Marine Terminal falls within these areas (WDFW 2014b). Sand lance spawning occurs within the Action Area, but has not been documented in close proximity to the terminal (WDFW 2014b). While the presence of forage fish suggests that marbled murrelets may feed within the Action Area, nesting habitat is limited by a lack of the required old-growth forests. No critical habitat has been designated for marbled murrelet within the Action Area (USFWS 2013). Therefore, it is possible that marbled murrelets will be present within the Action Area, but likely only for foraging.

4.3.1.1 Effects of Vessel Traffic

Disturbance by ships can be a threat to birds through effects on behavior, reproduction, and fitness of individuals in colonies as well as on foraging or resting habitats (Schwemmer et al.

2011). Increased vessel traffic could result in increased noise and physical disturbance of marbled murrelets present in the Affected Area. Some evidence suggests that marbled murrelets are capable of habituating to heavy vessel traffic, such as that near Juneau, Alaska and around the San Juan Islands (Ralph et al. 1995; Speckman et al. 2004). Flushing (avoidance behavior) is energetically costly to birds and increased vessel traffic could affect marbled murrelets; however, the relatively small increase in vessels (<1 per day) at the maximum forecast is not expected to increase the disruptions to the behavior of marbled murrelets in a biologically meaningful way.

Increased habitat disturbance for marbled murrelets could occur with the presence of additional vessels, although the effect would be temporary. Ships would continue to follow established shipping lane pathways and marbled murrelets would likely avoid these areas or become habituated, thus reducing potential disturbance effects. Fish (including prey fish for piscivorous birds) are unlikely to be affected by the small increase in vessel traffic; therefore, effects to birds via food chain disturbance are expected to be minimal and discountable.

Marbled murrelets sometimes respond to vessel disturbance by swallowing prey held in their beaks (Speckman et al. 2004). This behavior could result in starvation of chicks if the adults cannot return with fish; however, murrelet foraging areas lie outside of established shipping lanes so disturbance to feeding is expected to be minimal. Although marbled murrelets may forage within the Action Area, the incremental increase in vessel traffic attributed to the Proposed Action would not be expected to have an effect on marbled murrelet distribution, abundance, or reproduction.

Vessel Strikes

Marbled murrelet typically forage in relatively shallow waters between 20 and 80 meters (66 to 131 feet) in depth within 2 km (1.24 mile) of the shoreline (Ralph et al 1995). Vessels transiting through the Action Area would stay within the designated shipping lanes, outside of known spawning areas and prey species habitat; therefore, murrelets would be unlikely to forage in their path. Since vessel traffic calling at the BP Marine Terminal represents only a portion of all shipping traffic (approximately one percent), and murrelets would be able to move out of the vessel’s path, the likelihood of a vessel collision with marbled murrelets attributed to BP Marine Terminal vessel traffic would be expected to be very low.

Noise

Vessel movement to and from the BP Marine Terminal would occur within existing designated shipping lanes, which are characterized by high levels of use by both commercial and recreational vessels. Noise associated with BP bound traffic would likely be indistinguishable from baseline levels. Vessel sounds associated with traffic traveling to the BP Marine Terminal traffic would be attributed to large ships, tankers, and tugs.

Birds are very sensitive to sound, but little is known about the effects of underwater noise on diving birds. Some species of birds are more sensitive to noise than others (SAIC 2011). Rapid changes in underwater sound pressure levels can cause a range of effects to birds including physical injury in the form of sublethal injuries, lethal injuries, and auditory effects, as well as non-physical behavioral effects (SAIC 2011). There is a wide variability in susceptibility to noise-related injury among bird species and the effects to marbled murrelets are unknown. The USFWS considers the cumulative sound exposure level (SEL) of 183 dB re 1µPa2-sec and the single-strike criterion of 206 dB re 1µPa2 (peak) to be the thresholds for inner ear hair cell damage, which is the point at which injury occurs. Large commercial vessels such as crude oil tankers produce relatively loud and predominately low frequency sound that is unlikely to exceed the injury thresholds for birds or forage fish. For example, at a distance of 3 km SELs for bulk carriers traveling at 7.4 ms-1 were 127 dB re 1 µPa2 s (McKenna et al. 2012). An increase in vessel traffic due to the operation of the BP Marine Terminal could lead to a slight increase in low-frequency noise associated with the project but would be unlikely to adversely affect marbled murrelets due to the transient nature of the vessels, which would not cause long-term alteration of background noise levels.

4.3.1.2 Operations of the Marine Terminal

Effects to marbled murrelet from operation of the BP Marine Terminal include accidental release of ballast water, interruption of feeding activities, and minor releases of oil and other contaminants.

Ongoing operation and maintenance activities at the BP Marine Terminal could result in accidental spills of oil or other hazardous materials (e.g., hydraulic fluid). If an accidental spill of oil or other hazardous material were to occur, prey species such as herring and smelt which spawn near the dock could be adversely affected. Such incidents are not part of the normal operations and maintenance activities, and would not be expected to occur in a large enough magnitude or enough frequency to adversely affect marbled murrelet.

Vessels approaching the BP Marine Terminal would pass through a documented herring pre-spawning holding area located just offshore from the BP Marine Terminal (WDFW 2014b) which could disrupt murrelet feeding opportunities. Vessels approaching the terminal would be travelling slowly and foraging murrelets are expected to move away. The area of disturbance from approaching vessels is small relative to the herring habitat and minimal impact to marbled murrelets foraging would be expected from disturbance near the terminal.

Birds could be affected if prey items become more or less abundant due to the presence of invasive species through accidental release of ballast water. BP records, from 1971 to 2005, indicate that ballast water from cargo tanks has been spilled twice (<1 percent occurrence). In addition, NMFS has consulted with the Coast Guard on the implementation of the ballast water management regulations and concluded that the minimal potential for introduction on invasive species is not likely to jeopardize the existence of listed species (NMFS 2012b).

4.3.1.3 Conclusion

Marbled murrelets may forage within the Action Area because established populations of their prey fish species occur throughout the area. Marbled murrelets typically forage in shallow water outside of established shipping lanes and tend to move away when approached by vessels. Increased vessel traffic and operations of the BP Marine Terminal associated with the Proposed Action may affect, but are not likely to adversely affect marbled murrelets.

4.4 Reptiles

4.4.1 Leatherback Turtle

Adult leatherbacks turtles could be present in the Action Area during the summer and fall when jellyfish aggregate, however, this species is more common in waters off the coast of Washington, outside the Action Area.

4.4.1.1 Effects of Vessel Traffic

Vessel Strikes

Vessel traffic calling to the BP Marine Terminal have the potential to strike or disturb leatherback turtles feeding or swimming at or below the surface of the water. However, vessels would be moving at low speeds and leatherbacks would be able to detect them and move out of their path (Hazel 2007). Vessel traffic calling at the BP Marine Terminal currently comprise about 1 percent of the commercial traffic in the Action Area and the increase in vessel traffic attributable to the Proposed Action is very small. The low likelihood that leatherback turtles would be present it the Action Area, combined with the small potential increase in vessel traffic calling at the BP Marine Terminal, makes a measurable increase in the probability of a vessel strike over baseline conditions unlikely.

Noise

Leatherback auditory sensitivity is not well studied, but would likely follow that of other sea turtles. A few investigations suggest that their hearing is limited to low frequency bandwidths (Lenhardt 1994 and Moein et al. 1994). Sea turtles respond to low-frequency sounds, but with less sensitivity than mammals (McCauley et al. 2000 and URI 2013), It is currently believed that the range of maximum sensitivity for sea turtles is 0.20 to 0.80 kHz, with hearing below 0.080 kHz being less sensitive but potentially usable to the animal (Lenhardt 1994 and Moein et al. 1994). Vessel sounds attributed to large ships, tankers, and tugs traveling to the BP Marine Terminal would generate low frequency sound in the 0.005 to 0.5 kHz range (NOAA 2008). The role of underwater hearing in sea turtles is unclear (URI 2013); however, it is possible that noise from increased traffic associated with the Proposed Action could mask biologically significant sounds. Should leatherback turtles be present in the Action Area, the increase in vessel traffic due to the ongoing operation of the BP Marine Terminal would not significantly alter the background noise level (sea state -139-159 dB; ConocoPhillips 2007). The incremental increase in vessel traffic due to the operation of the BP Marine Terminal could lead to a slight increase in low-frequency noise associated with the project but would be unlikely to adversely affect leatherback turtles due to the transient nature of the vessels, which would not cause long-term alteration of background noise levels.

4.4.1.2 Operations of the Marine Terminal

Ongoing operation and maintenance activities at the BP Marine Terminal could result in accidental spills of oil or other hazardous materials (e.g., hydraulic fluid). Instances of spills associated with the operation of the BP Marine terminal, described in Section 3.2, is very small and unlikely to adversely affect leatherback turtles.

It is possible that leatherback turtles could be present in the vicinity when ships are arriving or departing from the BP Marine Terminal. The low likelihood that they will be present in the Action Area combined with the small potential increase in vessel traffic calling at the BP Marine

Terminal makes a measurable increase in the probability of a vessel strike over baseline conditions unlikely.

4.4.1.3 Effects to Critical Habitat

Vessel traffic moving to and from the BP Marine Terminal would transit through a small portion of leatherback critical habitat in the vicinity of J Buoy. This area contains the Juan de Fuca Eddy, which develops offshore of northern Washington and the mouth of the Strait of Juan de Fuca as a result of wind-driven current interaction with the continental slope (NMFS 2009). Leatherbacks could be using this eddy current for migration as well as foraging. As vessels pass though designated critical habitat turtles could move away from the source of the noise, temporarily displacing them from the area. However, the passage of watercraft in the area is an existing, temporary and common occurrence. Overall, the Proposed Action may affect, but is not likely to adversely affect, designated critical habitat for leatherback turtles.

4.4.1.4 Conclusion

Should leatherback turtles occur in the Action Area, the ongoing operation and maintenance activities of the BP Marine Terminal would be unlikely to result in increased collisions in the shipping lanes, or increased effects due to noise exposure or water pollution. Because ongoing operation and maintenance of the terminal is unlikely to adversely affect leatherback turtles, the Proposed Action may affect, but is not likely to adversely affect leatherback turtles.

The Action Area includes leatherback turtle critical habitat in the vicinity of J Buoy. The effects of vessel traffic on the primary constituent elements leatherback turtle critical habitat would be limited to temporary displacement of turtles and their prey species. However, the passage of watercraft in the area is an existing, temporary and common occurrence, the Proposed Action may affect, but is not likely to adversely affect, designated critical habitat for leatherback turtles.

4.5 Cumulative Effects

Cumulative effects under the ESA are the effects of non-federal actions (i.e., future state, tribal, local, or private actions) that are reasonably certain to occur in the Action Area. At this time, no actions have been identified that are considered cumulative with the Proposed Action. The proposed Gateway Pacific Terminal would be located in Whatcom County, and may affect similar fish and wildlife species as the BP Marine Terminal; however, the Gateway Pacific Terminal will require federal authorizations and will undergo separate Section 7 consultation. Therefore, the proposed Gateway Pacific Terminal is not a “cumulative effect” as defined by the Service’s consultation regulations and is not evaluated here.

Chapter 5

Summary and Conclusion of Effects on Federally-Listed Species

In fulfilling its obligations under Section 7(a)(2) of the ESA, the information presented in this BE represents the best data currently available to assess the potential effect of effects of ongoing operations of the North Wing of the BP Marine Terminal on fifteen listed species which occur within the Action Area.

Table 5.1-1 provides a summary of the listing status and the determination of the potential project effect for each species based on a review of the current status of the listed species, the environmental baseline for each, including past and present impacts of all federal, state, or private actions and other human activities in the Action Area; the anticipated future impacts of all proposed federal projects in the Action Area that have undergone consultation; and the cumulative effects of non-federal actions (i.e., future state, tribal, local, or private actions that are reasonable certain to occur in the Action Area) contemporaneous to this consultation.

Table 5.1-1 Conclusion of effects of the Proposed Action on Federally listed species within the Action Area

Species Common Name	Species Scientific Name	Status	Critical Habitat Status	Project Effect
Mammals				
Humpback Whale	*Megaptera novaeangliae*	E	None	May Affect; Not Likely to Adversely Affect
Blue Whale	*Balaenoptera musculus*	E	None	May Affect; Not Likely to Adversely Affect
Fin Whale	*Balaenoptera physalus*	E	None	May Affect; Not Likely to Adversely Affect
Southern Resident DPS Killer Whale	*Orcinus orca*	E	Designated	May Affect; Not Likely to Adversely Affect
Bird				
Marbled Murrelet	*Brachyramphus marmoratus*	T	Designated	May Affect; Not Likely to Adversely Affect
Reptiles				
Leatherback Turtle	*Dermochelys coriacea*	E	Designated	May Affect; Not Likely to Adversely Affect
Fish				
Bull trout	*Salvelinus confluentus*	T	Designated	May Affect; Not Likely to Adversely Affect
Chinook salmon (Puget Sound ESU)	*Oncorhynchus tshawytscha*	T	Designated	May Affect; Not Likely to Adversely Affect
Chum salmon (Hood Canal summer-run)	*Oncorhynchus keta*	T	Designated	May Affect; Not Likely to Adversely Affect
Puget Sound steelhead	*Oncorhynchus mykiss*	T	Proposed	May Affect; Not Likely to Adversely Affect
Eulachon (Southern DPS)	*Thaleichthys pacificus*	T	Designated	May Affect; Not Likely to Adversely Affect
Green sturgeon (Southern DPS)	*Acipenser medirostris*	T	Designated	May Affect; Not Likely to Adversely Affect
Groundfish				
DPS Bocaccio	*Sebastes paucispinis*	E	Proposed	May Affect; Not Likely to Adversely Affect
DPS Canary rockfish	*Sebastes pinniger*	T	Proposed	May Affect; Not Likely to Adversely Affect
DPS Yelloweye rockfish	*Sebastes ruberrimus*	T	Proposed	May Affect; Not Likely to Adversely Affect

T – Threatened
E - Endangered

Chapter 6

Magnuson Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) established a management system for national marine and estuarine fishery resources. Pursuant to section 305(b)(2), all federal agencies are required to consult with National Marine Fisheries Service (NMFS) regarding any action permitted, funded, or undertaken that may adversely affect "essential fish habitat" (EFH). Effects on habitat managed under any relevant Fishery Management Plans must also be considered. EFH is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." This includes migratory routes to and from anadromous fish spawning grounds. The phrase "adversely affect" refers to the creation of any impact that reduces the quality or quantity of essential fish habitat. Federal activities that occur outside of an EFH but that may, nonetheless, have an impact on EFH waters and substrate must also be considered.

6.1 Essential Fish Habitat Background

EFH is designated for commercially-fished species managed under the Magnuson-Stevens Act. The Magnuson-Stevens Act requires federal fishery management plans developed by NMFS and the Pacific Fisheries Management Council to describe the habitat essential to the fish species being managed and describes threats to that habitat from both fishing and non-fishing activities. To protect EFH, federal agencies are required to consult with the NMFS on activities that may adversely affect EFH.

The purpose of this EFH assessment is to determine whether the Proposed Action may adversely affect designated EFH for relevant federally-managed commercial fisheries species within the Action Area (Figure 6.1-1). EFH designated for 3 species of salmon, 83 groundfish species, and six pelagic species is described below.

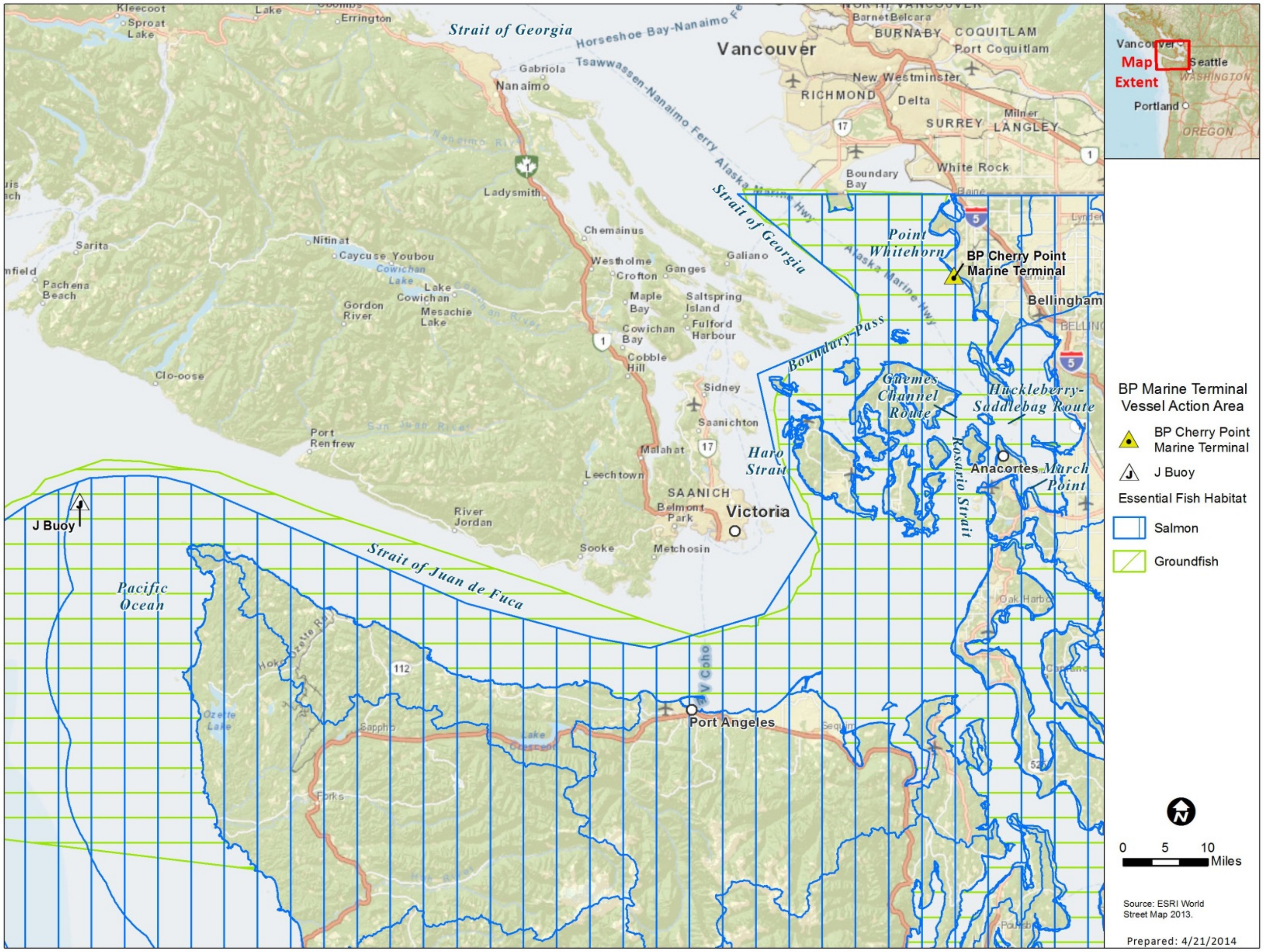

Figure 6.1-1 Essential Fish Habitat (EFH) in the BP Cherry Point Action Area
Source: NMFS 2013
Note: Data was unavailable for pelagic EFH.

6.1.1 Pacific Salmon (Chinook, Coho and Pink)

EFH for the Pacific coast salmon includes all streams, lakes, ponds, wetlands, and other currently viable water bodies and most of the habitat historically accessible to salmon in Washington, Oregon, Idaho, and California. In the estuarine and marine areas, salmon EFH extends from the nearshore and tidal submerged environments within state territorial waters out to the full extent of the EEZ (370.4 km) offshore of Washington, Oregon, and California north of Point Conception. Freshwater EFH for Pacific salmon includes all those streams, lakes, ponds, wetlands, and other water bodies currently, or historically accessible to salmon in Washington, Oregon, Idaho, and California, except areas upstream of certain impassable man-made barriers (as identified by the Pacific Fishery Management Council Fishery Management Plan [PFMC 1999a]), and longstanding, naturally-impassable barriers (i.e., natural waterfalls in existence for several hundred years).

6.1.2 Groundfish

NMFS defined EFH for Pacific groundfish (CFR 660.395; 5/11/2006) to include those waters and substrate necessary to groundfish for spawning, breeding, feeding or growth to maturity (16 U.S.C. 1802 (10)). EFH for Pacific Coast groundfish includes all waters and substrate within areas with a depth less than or equal to 3,500 meters (11,483 feet) shoreward to the mean higher high water level or the upriver extent of saltwater intrusion (defined as upstream and landward to where ocean-derived salts measure less than 0.5 parts per thousand (ppt) during the period of average annual low flow).

6.1.3 Pelagic Species

EFH for coastal pelagic species including finfish (northern anchovy, Pacific sardine, Pacific (chub), mackerel, and jack mackerel) and market squid occurs from the shorelines of California, Oregon, and Washington westward to the exclusive economic zone and above the thermocline where sea surface temperatures range between 10°C (50°F) and 26°C (79°F). During colder winters, the northern extent of EFH for coastal pelagic species may be as far south as Cape Mendocino (California), and during warm summers it may extend into Alaska's Aleutian Islands (PFMC 1998). In 2006, the Coastal Pelagic Species: Fishery Management Plan (FMP) was amended to include all krill species, to prohibit their harvest, and to identify EFH for them. EFH for *Thysanoessa spinifera* includes waters from the baseline from which the shoreline is measured to the 500 fm (914 meters [3,000 feet]) isobath, from the U.S.- Mexico north to the U.S.-Canada border, from the surface to 100 meters deep. EFH for *Euphausia pacifica* and other krill species includes waters from the baseline from which the shoreline is measured seaward to the 1000 fm (1,829 meters [6,207 feet]) isobath, from the U.S.- Mexico north to the U.S.-Canada border, from the surface to 400 meters (1,312 feet) deep.

6.2 Description of the Proposed Action

Refer to Section 1.2 for a description of the Proposed Action

6.3 Essential Fish Habitat Requirements

6.3.1 Pacific Salmon (Chinook, Coho and Pink)

The Pacific salmon management unit includes Chinook, coho, and pink salmon. EFH for Pacific salmon in the Action Area include those elements associated with adult migration pathways and marine habitat. Important marine elements of Pacific salmon EFH include adequate water quality, water temperature, prey species and forage base, and adequate depth, cover, marine vegetation, and algae in estuarine and near-shore habitats.

Limited information exists on Chinook and coho salmon habitat use in marine waters (PFMC 1999a). Ocean-type juvenile Chinook appear to utilize different marine areas for rearing than stream-type juvenile Chinook and are believed to migrate to ocean waters further offshore early in their ocean residency. Many stream-type Chinook populations do not appear to be as heavily exploited as ocean-type Chinook, indicating that stream-type fish may be vulnerable to costal fisheries for a short period during their spawning migrations (PFMC 1999a). In the open ocean, juvenile and maturing coho are found in the highest concentrations in more productive waters associated with the continental shelf within 60 km of the Washington coastline (PFMC 1999a). The essential marine habitat for Chinook and coho includes all marine waters within the EEZ north of point Conception, CA and the marine areas off Alaska designated as salmon EFH by the North Pacific Fishery Management Council. Puget Sound is critical to the early marine survival of pink salmon. Therefore, essential marine habitat for pink salmon includes all nearshore marine waters north and east of Cape Flattery, Washington, including Puget Sound, the Strait of Juan de Fuca and Strait of Georgia. (PFMC 1999a)

6.3.2 Groundfish

The 83 groundfish species managed under the federal FMP occupy diverse habitats at all stages of their life histories (PFMC 1999b). Some species are widely distributed during certain life stages, particularly those with pelagic eggs and larva, therefore the EFH for these species is correspondingly large. However, some species/life stages occupy comparatively small habitat ranges (i.e., adults of nearshore groundfish) as they show affinity to particular substrates and/or locations. Consequently, the large number of species and diverse habitat association of the entire EEZ becomes EFH when individual EFHs for all species are combined.

EFH for Pacific coast groundfish includes all waters from the mean higher water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California seaward to the boundary of the U.S. EEZ. Groundfish EFH is grouped into seven units (called composites) which are defined below:

- **Estuarine**: Those waters, substrates and associated biological communities within bays and estuaries of the coasts of Washington, Oregon, and California, seaward from the high tide line or extent of upriver saltwater intrusion
- **Rocky Shelf**: Those waters, substrates and associated biological communities living on or within ten meters (33 feet) overlying rocky areas, including reefs, pinnacles, bounders and cobble, along the continental shelf, excluding canyons, from the high tide line to the shelf break.

- **Non-Rocky Shelf**: Those waters, substrates, and associated biological communities living on or within ten meters (33 feet) overlying the substrates of the continental shelf, excluding the rocky shelf and canyon composites, from the high tide line to the shelf break.
- **Canyon**: Those waters, substrates, and associated biological communities living within submarine canyons, including the walls, beds, sea floor, and any outcrops or landslide morphology, such as slump scarps and debris fields.
- **Continental Slope/Basin**: Those waters, substrates, and associated biological communities living on or within 20 meters (66 feet) overlying the substrate of the continental slope and basin below the shelf break and extending to the westward boundary of the EEZ.
- **Neritic Zone**: Those waters and biological communities living in the water column more than 20 meters (66 feet) above the continental shelf.
- **Oceanic Zone**: Those waters and biological communities living in the water column more than 20 meters (66 feet) above the continental slope and abyssal plain, extending to the westward boundary of the EEZ.

6.3.3 Pelagic Species

Coastal pelagic species EFH accommodates the fact that the geographic range of covered species varies widely over time and in response to temperature of the upper mixed layer of the ocean, particularly in areas north of Point Arena, California. Adult finfish are generally not found at temperatures colder than 10°C (50°F) or warmer than 26°C (79°F). Preferred temperatures and minimum spawning temperatures are generally above 13°C (55°F), with spawning most commonly occurring at 14°C to 16°C (57°F to 59°F). The geographic boundary is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline. Table 6.3-1identifies species and life stages that could be present in the Action Area.

Table 6.3-1 Coastal Pelagic Species Potentially Present in the Action Area

Common Name (Scientific Name)	Lifestage
Northern anchovy (*Engraulis mordax*)	Eggs/Larvae/Juveniles/Adults
Pacific sardine (*Sardinops sagax*)	Eggs/Larvae/Juveniles/Adults (warm environment/high abundance)
Pacific mackerel (*Scomber japonicus*)	Eggs/Larvae/Juveniles/Adults (warm environment/high abundance)
Jack mackerel (*Trachurus symmetricus*)	Adults
Market squid (*Loligo opalescens*)	Adults (no information available for Eggs/Larvae/Juveniles)

Source: PFMC 1998

6.4 Potential Adverse Effects of Proposed Action

The EFH implementing regulations, 50 CFR 6000.810(a), define "adverse effect" as:

> "any impact that reduces the quality and/or quantity of EFH. Adverse effects may include 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 and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions."

6.4.1 Pacific Salmon (Chinook, Coho and Pink)

Pacific salmon EFH occurs throughout the Action Area. The primary threat to the habitat for these species from the ongoing operation and maintenance of the North Wing could result from an increase in vessel traffic in the shipping lanes (a potential increase of 15 to 85 vessel calls/year) and operation of the BP Marine Terminal. The effects to Pacific salmon EFH from these activities are described below.

6.4.1.1 Effects of Vessel Traffic

Vessels transiting to the Marine Terminal at Cherry Point enter the USCG VTS at J buoy, travel through the Strait of Juan de Fuca into Rosario Strait, and then into the southern reach of the Strait of Georgia and then onto the BP Marine Terminal at Cherry Point. Increased vessel traffic could increase water turbidity, which could affect nearshore aquatic habitat. However, due to the controlled route and low speeds of the moving vessels, no long-term impacts are anticipated to occur to EFH from vessel traffic.

Noise

An increase in vessel traffic due to the operation of the BP Marine Terminal could adversely affect Pacific salmon EFH by temporarily increasing noise levels near the transiting vessels. As a consequence of increased noise, salmon near the vessel may move away temporarily displacing them from an area they would otherwise occupy. Fish are able to detect vessel noise over a large range of frequencies, tens to several hundred Hz (Mitson 1995). Fish may alter their behavior in response to the noise; typically, they would move away from the source of the noise (Mitson 1995). Avoidance reactions in fish occur at a distance of approximately 100-200 meters (328-656 feet) from the vessel, but could occur at distances up to 400 meters (1,312 feet) in louder vessels (Mitson 1995). Due to the short magnitude and duration of noise created by a moving vessel the adverse effects to Pacific salmon EFH that would be created by the Proposed Action would be temporary and minimal.

6.4.1.2 Operation of the Marine Terminal

Effects of operation of the Marine Terminal include increased lighting, minor shading of shallow water nearshore habitat, accidental release of ballast water, and minor releases of oil and other contaminants. Increased lighting at the Marine Terminal would be associated with vessels unloading at night and could temporarily attract fish to the area, however, there would be no affect to EFH from increased lighting . Minor shading of the nearshore habitat in the vicinity of the dock could affect primary production and impact aquatic vegetation present in the area, however, shading would be minimal and would not be expected to result in lasting habitat alterations.

Ongoing operation and maintenance activities at the BP Marine Terminal could result in accidental spills of oil or other hazardous materials (e.g., hydraulic fluid or contaminated ballast). If an accidental spill of oil or other hazardous material where to occur water quality near the BP Marine Terminal could be affected. Records at the dock for the period from 1971 through 2005 indicate that incidents are infrequent (typically less than one per year), and the volume of spills is usually small. Many of the incidents reported were in quantities of drops or a sheen on the water, and some of them were 1-2 gallons. If a spill were to occur, the BP Marine Terminal is equipped with containment booms and clean-up equipment, which can be readily deployed.

Eelgrass beds occur within the vicinity of the Marine Terminal and could be impacted by an accidental spill, however, given the spill history at the BP Marine Terminal and BP's oil spill avoidance and response measures (Section 3.2.1); it is unlikely the that operation of the BP Marine Terminal would have long-term impacts to Pacific salmon EFH.

6.4.1.3 Conclusion

Habitat concerns associated with the Proposed Action would primarily be centered on effects to water quality. The Proposed Action is not expected to result in an increase in sedimentation or result in a decrease in water quality. No permanent adverse effects on Pacific salmon EFH would occur as a result of this project. Therefore, the project will not adversely affect EFH for Pacific salmon.

6.4.2 Groundfish

Groundfish species are widely distributed and could potentially occur in the shipping lanes throughout the Action Area (Figure 6.4-1). The primary threat to these species from the ongoing operation and maintenance of the North Wing could result from an increase in vessel traffic in the shipping lanes (a potential increase of 15 to 85 vessel calls/year). This increase in traffic could potentially cause an increase in the probability of an oil spill and increased noise. The effects to groundfish EFH from these activities are described below.

6.4.2.1 Effects of Vessel Traffic

Vessels anchoring over hard bottom substrates could crush, remove or bury substrate used by groundfish for feeding or shelter. Vessels approaching the BP Marine Terminal at Cherry Point may be required to come to anchor at the designated temporary anchorage offshore of Vendovi Island if the docks are in use. This area does not contain rocky substrate (Figure 6.4-1) and would therefore not be affected by anchorage. No impacts are anticipated to occur to groundfish EFH from increased vessel traffic.

Noise

The effects of noise to groundfish EFH would be the same as those described in Section 6.4.1.1.

6.4.2.2 Operation of the Marine Terminal

Effects of operation of the BP Marine Terminal include increased lighting, minor shading of shallow water near shore habitat, accidental release of ballast water, and minor releases of oil and other contaminants. Increased lighting at the Marine Terminal would be associated with vessels unloading at night and could temporally attract fish to the area, however there would be no affect to EFH from temporary lighting. Minor shading of the nearshore habitat in the vicinity of the dock could affect primary production thereby affecting aquatic vegetation present in the area; however, the shading would be minimal and would not be expected to result in lasting habitat alterations. If an accidental spill of oil or other hazardous material where to occur submerged aquatic vegetation sites including eelgrass and kelp beds, which are utilized by groundfish and other fish species for food, shelter and protection from predators could be impacted.

Accidental spills of oil or other hazardous material at the BP Marine Terminal is infrequent and the volume of spills is usually small; additional spill history information for the BP Marine Terminal is provided in Section 6.4.1.2.

Give the spill history at the BP Marine Terminal, BP’s oil spill avoidance and response measures (Section 3.2.1), and the lack of groundfish habitat (rocky relief and deeper waters), it is unlikely that the operation of the BP Marine Terminal would have a long-term impacts on groundfish EFH.

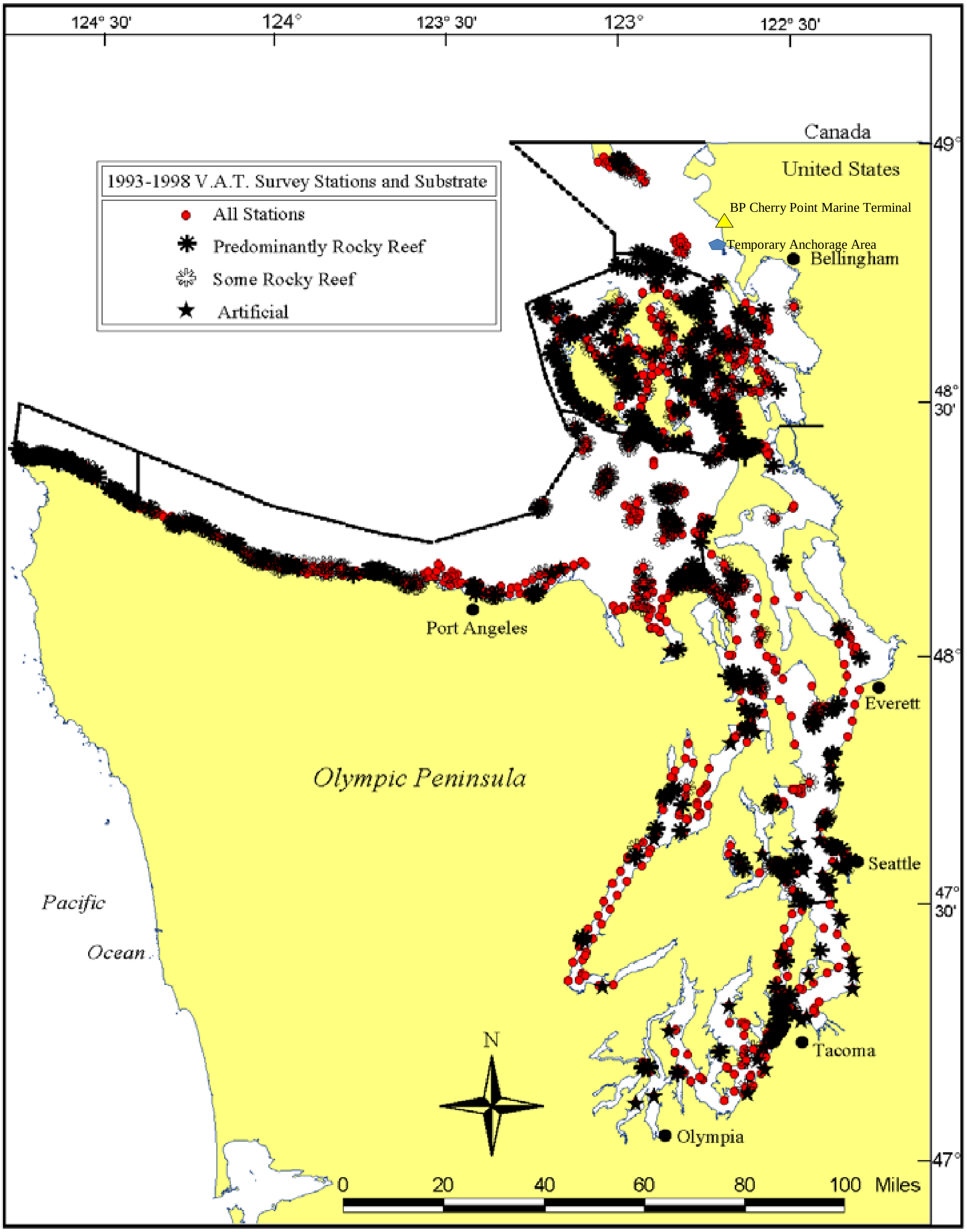

Figure 6.4-1 BP Cherry Point Temporary Anchorage and the Distribution of Nearshore Rocky Habitats in Puget Sound

Source: Palsson et al. 2009

6.4.2.3 Conclusion

The Proposed Action is not expected to adversely affect the seven groundfish composites (Section 6.3.2) and therefore would not adversely affect EFH for groundfish.

6.4.3 Pelagic Species

Coastal pelagic species generally live nearer the surface than the seafloor and could potentially occur in the shipping lanes throughout the Action Area. Anchovies are the only species in the Coastal and Pelagic Species Fishery Management Plan report that are common in Puget Sound and may be associated with the neritic portion of the nearshore environment, in spite of their pelagic habitat (Penttila 2007 and Burke Museum 2013). The primary threat to these species EFH from the ongoing operation and maintenance of the North Wing could result from an increase in vessel traffic in the shipping lanes (a potential increase of 15 to 85 vessel calls/year). This increase in traffic could potentially cause an increase in the probability of exposure to noise and an oil spill. The effects to pelagic species from these activities are described below.

6.4.3.1 Effects of Vessel Traffic

Vessels transiting to the Marine Terminal at Cherry Point enter the USCG VTS at J buoy, travel through the Strait of Juan de Fuca into Rosario Strait, and then into the southern reach of the Strait of Georgia and then onto the BP Marine Terminal at Cherry Point. The transiting of vessels would not be expected to affect the EFH of coastal pelagic species given their transient nature. Therefore, no long-term effect to coastal pelagic EFH would be expected as a result of increased vessel traffic.

Noise

The effects of noise to coastal pelagic EFH would be the same as those described in Section 6.4.1.1.

6.4.3.2 Operation of the Marine Terminal

Effects from operation of the Marine Terminal include the accidental release of ballast water and minor releases of oil and other contaminants. Accidental release of ballast water, oil and other contaminants could introduce a localized source of pollutants detrimental to estuarine and marine habitats utilized by coastal pelagic species near the BP Marine Terminal.

Accidental spills of oil or other hazardous material at the BP Marine Terminal is infrequent and the volume of spills is usually small; additional spill history information for the BP Marine Terminal is provided in Section 6.4.1.2.

Give the spill history at the BP Marine Terminal, and BP's oil spill avoidance and response measures (Section 3.2.1); it is unlikely that the operation of the BP Marine Terminal would have a long-term impact on pelagic species EFH.

6.4.3.3 Conclusion

Since the overall increase in traffic is relatively small (one percent of Puget Sound traffic) and the probability of a spill of oil or other hazardous material at the dock is slight (small spills occurring less than once per year), the Proposed Action would not adversely affect EFH for coastal pelagic species.

Chapter 7

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