APPENDIX A

DESCRIPTIONS OF THE ENDANGERED SPECIES ACT (ESA) LISTED SPECIES THAT OCCUR IN THE SEATTLE DISTRICT CORPS MAINTENANCE DREDGING PROJECTS AND DISPOSAL SITE AREAS.

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BIRDS

MARBLED MURRELET (*Brachyramphus marmoratus*)

Status: The Washington, Oregon, and California marbled murrelet populations were listed as threatened by the U.S. Fish and Wildlife Service (USFWS) on 28 September 1992 (57 FR 45328). USFWS identified 6 geographic zones for marbled murrelets in the Marbled Murrelet Recovery Plan (USFWS 1997). Two of these zones, Puget Sound (Zone 1) and Western Washington Coast Range (Zone 2), are in Washington.

Threats: Cutting of old growth forests directly affects marbled murrelets due to the loss of nesting habitat. Fragmentation of old-growth forest resulting from this cutting has an indirect effect on the health of marbled murrelet populations by creating more edges to the forest. Increased fragmentation provides favorable conditions for predation by birds that use the forest edge, such as jays, crows, ravens, and great-horned owls. A compilation of records of 65 marbled murrelet nests studied in the past 20 years revealed that 72% of the nests were unsuccessful. The major cause of nest failure (57%) was predation (Nelson and Hamer 1995).

Habitat: In the past, marbled murrelets in Puget Sound were considered common (Rathbun 1915), abundant (Edson 1908), or numerous (Miller et al. 1935). Recent estimates of the total breeding population of Washington marbled murrelets is approximately 5,000 birds (Speich et al. 1992; Speich and Wahl 1995). These estimates were based on counts of birds on the water during the spring-summer breeding period. Based on boat surveys conducted in 1978, 1979, and 1985, Speich et al. (1992) estimated the total population (adults, subadults, and juveniles) of marbled murrelets on the outer coast of Washington to be less than 2,400 birds. Using 2-day aerial surveys in September 1993 and 1994, Varoujean and Williams (1994) estimated the outer coast Washington population of marbled murrelets to be 1,700 to 2,400. Because Speich et al. (1992) and Varoujean and Williams (1994) used different methods to estimate the murrelet population in Washington, their data cannot be compared, and no conclusion should be drawn about the trend of the marbled murrelet population from these data.

Part of the recovery planning process involved development of a demographic model to help understand marbled murrelet population dynamics (Beissinger and Nur in Appendix B, USFWS 1997). The demographic model predicted that murrelet populations are likely declining at an estimated rate that varied from 1 to 14% per year, depending on the parameter used for estimates. The authors estimated that the most likely rate of decline is around 4 to 7% per year. Predicting or estimating population trends for marbled murrelets is difficult because their population dynamics and demography have not been well described. Ralph et al. (1995) summarized some of the reasons for the variability in population estimates among researchers including differences in methodology, assumptions, spatial coverage, and survey and model errors. Nevertheless, both Ralph et al. (1995) and the Marbled Murrelet Recovery Team (USFWS 1997) have concluded that the listed population appears to be in a long-term downward trend.

Range: The North American subspecies (*B. m. marmoratus*) ranges from Alaska south to California. In Washington State marbled murrelets have, occupied forest stands as far as 52 miles (84 km) inland.

Habitat Requirements: Marbled murrelets are semi-colonial seabirds and are dependent upon old-growth forests, or forests with an older tree component, for nesting habitat (Hamer and Nelson 1995; Ralph et al. 1995). Booth (1991) concluded that 82 to 87% of the old-growth forests that existed in western Washington and Oregon prior to the 1840s is now gone. Sites occupied by murrelets tend to have a higher proportion of mature forest classes than do unoccupied sites (Raphael et al. 1995). These forests are characterized by multi-layered canopies and high composition of low elevation conifer trees, and typically occur on the lower two-thirds of forested slopes (Hamer and Nelson 1995).

Nests are located on large branches and platforms such as mistletoe brooms. Nesting occurs over an extended period from late March to late September (Carter and Sealy 1987; Hamer and Nelson 1995). Attendance at breeding sites during the non-breeding season may enhance pair bond maintenance, facilitate earlier breeding, or reinforce familiarity with flight paths to breeding sites (Naslund and O'Donnell 1995; O'Donnell et al. 1995).

Marbled murrelets forage predominantly within 1.25 mile (2 km) of shore (Strachan et al. 1995), although the species appear further offshore (Piatt and Naslund 1995; Ralph and Miller 1995). Ainley et al. (1995) reported that most marbled murrelets sighted in central California occurred within 7 kilometers (km) of shore with a median value of less than 5 km, but with 1 individual bird being sighted 24 km offshore. Thompson (1996) found that in Washington State, murrelets were most numerous within 200 meters of shore, and rarely found at or beyond 1,200 meters from shore. Speich and Wahl (1995) observed that murrelets tend to be most abundant over eelgrass and substrate, on shorelines with broad shelves, and along shorelines with narrow shelves where kelp is present in the Strait of Juan de Fuca and Puget Sound. They reported that significant numbers of murrelets can occur in areas of tidal activity. Murrelets feed primarily on fish and invertebrates (Burkett 1995).

Designated Critical Habitat: Critical habitat for the marbled murrelet was designated on 4 October 2011 (61 FR 26256). Critical habitat was identified only in the terrestrial environment and not in the marine environment. The USFWS identified 32 critical habitat units in Washington, Oregon and California, with 11 units in Washington.

Approximately 1,631,300 acres (660,180 hectares) of habitat were designated as critical habitat in Washington, with approximately 74% of the area on Federal lands, primarily in Late Successional Reserves as established in the Northwest Forest Plan (USFWS 1997 Appendix A).

Within areas essential for successful marbled murrelet nesting, only those areas that contain 1 or more primary constituent elements (PCEs) are, by definition, critical habitat. The PCEs are

PCE 1. Individual trees with potential nesting platforms.

PCE 2. Forested areas within 0.8 km (0.5 miles) of individual trees with potential nesting platforms, and with a canopy height of at least one-half the site-potential tree height[1]. This includes all such forest, regardless of contiguity.

These PCEs are essential to provide and support suitable nesting habitat for successful reproduction of the marbled murrelet (USFWS 1996).

WESTERN SNOWY PLOVER (*Charadrius alexandrinus nivosus*)

Status: The Pacific coast population of the western snowy plover was listed as threatened on 5 march 1993 (58 FR 12864). Based on recent surveys, 28 snowy plover breeding areas occur on the Pacific coast of the United States (U.S.), with 20 (71%) in California, 6 (21%) in Oregon, and

[1] The site-potential tree height is the average maximum height for trees given the local growing conditions, and is based on species-specific site index tables.

2 (7%) in Washington, a reduction from 87 sites in the 3 states (WDFW 1995). Historically, at least 5 sites in Washington supported nesting snowy plovers, but presently the species is restricted to 2 or possibly 4 sites (WDFW 1995; Grettenberger; pers. comm. 1999). In recent years, snowy plovers have nested at Damon Point and Oyhut Wildlife Area at Ocean Shores, Grays Harbor County; and Leadbetter Point in Willapa National Wildlife Refuge, Pacific County. In 1998, nesting plovers were located for the first time at South Beach in Pacific County (Grettenberger, pers. comm. 1999). Surveys in 1994 documented up to 6 adults and 4 nests at Damon Point and Oyhut Wildlife Area and up to 13 adults and 4 nests at Leadbetter Point (WDFW 1995). The Oregon Department of Fish and Wildlife (ODFW) reported an annual 7% decline of snowy plovers at coastal breeding areas between 1981 and 1992 (ODFW 1994). A similar decline may be occurring in Washington (WDFW 1995).

Threats: Threats to snowy plovers include shoreline modifications and dune stabilization projects for recreational, urban and industrial development; human disturbance from recreational activities such as off-road vehicles and beach combing; loss of nesting habitat to encroachment of introduced European beachgrass and predation (USFWS 1993; WDFW 1995).

Range: The western snowy plover breeds along the Pacific Coast from southern Washington to southern Baja California, Mexico with the majority of birds breeding along the California coast (USFWS 1993). In Washington, nesting snowy plovers are only present at Damon Point and Oyhut Wildlife Area at Ocean Shores, South Beach north of Willapa Bay, and Leadbetter Point in Willapa National Wildlife Refuge. Wintering snowy plovers are regularly observed at Leadbetter Point and have been found only rarely on other beaches (WDFW 1995).

Habitat Requirements: Coastal populations of snowy plovers nest on sand spits, dune-backed beaches, unvegetated beach strands, open areas around estuaries, and beaches at river mouths; using areas with little or no vegetation above the high tide line (Stenzel et al. 1981; Wilson-Jacobs and Meslow 1984; Warriner et al. 1986). Plovers nest less extensively in saltpans, lagoons, dredge spoils, and salt evaporators along the coast (Warriner et al. 1986). Most adults arrive in Washington during late April with maximum numbers present in mid-May to late June. Nest initiation and egg laying occurs from late April to late June with fledging occurring from late June through August (WDFW 1995).

The diet of Washington snowy plovers has not been studied, but it is assumed similar to plovers elsewhere on the west coast (WDFW 1995). Snowy plovers eat larval and adult forms of marine and terrestrial invertebrates, including crabs, polychaetes, flies, beetles, and other insects (WDFW 1995). They forage on the coast along the surf line, on mud flats, in decaying algae at the high tide line and on dry sand (Stern et al. 1990).

Critical Habitat: Critical habitat was designated on 19 June 2012 (77 FR 36728; USFWS 1999a) for approximately 6,077 acres (2,460 hectares) in 4 units within Washington, approximately 2,112 acres (855 hectares) in 9 units within Oregon, and 16,337 acres (6,612 hectares) in 47 units within California.

Physical or Biological Features In accordance with section 3(5)(A)(i) and 4(b)(1)(A) of the ESA and regulations at 50 CFR 424.12, in determining which areas within the historical range and geographical area occupied by the species as critical habitat. The physical or biological features essential to the conservation of the species include, but are not limited to the following:

1. Space for individual and population growth and for normal behavior.

2. Food, water, air, light, minerals, or other nutritional or physiological requirements.

3. Cover or shelter.

4. Sites for breeding, reproduction, or rearing (or development) of offspring.

5. Habitats that are protected from disturbance or are representative of the historical, geographical, and ecological distributions of a species.

Primary Constituent Elements for the Pacific Coast Western Snowy Plover: The PCEs are the elements of physical or biological features that provide for a species' life history processes and are essential to the conservation of the species. Critical habitat was designated within the geographical areas that were occupied by the species at the time of listing and continue to be occupied, that contain the PCEs in the quantity and spatial arrangement to support life history functions essential for the conservation of the species. Areas outside the geographical area occupied by the species at the time of listing were included and are essential for the conservation of the species. Designating areas of critical habitat provide some or all of the elements of physical or biological features essential for the conservation of this species.

Based on the best available information, the PCEs essential to the conservation of the Pacific Coast western snowy plover are sandy beaches, dune systems immediately inland of an active beach face, salt flats, mud flats, seasonally exposed gravel bars, artificial salt ponds and adjoining levees, and dredge spoil sites, with the following:

PCE 1. Areas that are below heavily vegetated areas or developed areas and above the daily high tides.

PCE 2. Shoreline habitat areas for feeding, with no or very sparse vegetation, that are between the annual low tide or low water flow and annual high tide or high water flow, subject to inundation but not constantly under water, that support small invertebrates, such as crabs, worms, flies, beetles, spiders, sand hoppers, clams, and ostracods, that are essential food sources.

PCE 3. Surf- or water-deposited organic debris, such as seaweed (including kelp and eelgrass) or driftwood located on open substrates that supports and attracts small invertebrates.

PCE 4. Minimal disturbance from the presence of humans, pets, vehicles, or human-attracted predators, which provide relatively undisturbed areas for individual and population growth and for normal behavior.

PCE 5. For food, and provides cover or shelter from predators and weather, and assists in avoidance of detection (crypsis) for nests, chicks, and incubating adults.

Critical habitat does not include human-made structures (such as buildings, roads, paved areas, boat ramps, and other developed areas) and the land on which such structures are directly located and existing within the legal boundaries on the effective date of this rule.

STREAKED HORNED LARK (*Eremophila alpestris caurina*)

Status: The streaked horned lark was listed as threatened on 3 October 2013 (78 FR 61451).

Threats: Threats to the physical or biological features that are essential to the conservation of the subspecies and that may warrant special management considerations or protection include, but are not limited to 1) loss of habitat from conversion to other uses; 2) control of nonnative, invasive species; 3) development; 4) construction and maintenance of roads and utility corridors;

and 5) habitat modifications due to succession of vegetation from the lack of disturbance, both small and large scale. These threats have potential to affect the PCEs if they are conducted within or adjacent to designated units.

Range contraction appears to be the largest habitat-related threat to the existence of the streaked horned lark. The streaked horned lark's habitat has many other ongoing threats throughout its remaining range from conversion to agriculture and industry, loss of natural disturbance processes, such as fire and flooding, followed by encroachment of woody vegetation, invasion of coastal areas by nonnative beachgrasses, and incompatible management practices. The continued loss and degradation of its scarce habitat could push the subspecies closer to rangewide extinction.

Other threats include inbreeding depression, low reproductive success, and declining population size, which occur in the Puget lowlands population; without substantial efforts to stem the decline, larks may disappear from the Puget lowlands. Other ongoing threats from aircraft strikes and training activities at airports have been documented, and put lark populations at risk of further population declines throughout the range of the subspecies.

Description: The streaked horned lark is endemic to the Pacific Northwest, and is a subspecies of the wide-ranging horned lark. Horned larks are small, ground-dwelling birds, approximately 16 to 20 centimeters (6 to 8 inches) long. The streaked horned lark has a dark brown back, yellowish underparts, a walnut brown nape and yellow eyebrow stripe and throat. This subspecies is conspicuously more yellow beneath and darker on the back than almost all other subspecies of horned lark. The combination of small size, dark brown back, and yellow on the underparts distinguishes this subspecies from all adjacent forms.

Historical Status and Current Trend: Historically, the streaked horned lark's breeding range extended from southern British Columbia Canada, south through the Puget lowlands and outer coast of Washington, along the lower Columbia River, through the Willamette Valley, the Oregon coast and into the Umpqua and Rogue River Valleys of southwestern Oregon.

The streaked horned lark has been extirpated throughout much of its range, including all of its former range in British Columbia Canada, the San Juan Islands, the northern Puget lowlands, the Washington coast north of Grays Harbor, the Oregon coast, and the Rogue and Umpqua Valleys in southwestern Oregon.

The current range of the streaked horned lark can be divided in to 3 regions: 1) the Puget lowlands in Washington; 2) the Washington coast and lower Columbia River islands (including dredge spoil deposition sites near the Columbia River in Portland, Oregon); and 3) the Willamette Valley in Oregon.

An analysis of recent data estimates the current rangewide population of streaked horned larks to be about 1,170 to 1,610 individuals (Altman 2011). There are about 900 to 1,300 breeding streaked horned larks in the Willamette Valley (Altman 2011). The largest known populations of streaked horned larks breed in the southern Willamette Valley at the Corvallis Municipal Airport and on the USFWS's Willamette Valley National Wildlife Refuge Complex.

Habitat: Horned larks are birds of wide-open spaces with no trees and few or no shrubs. The streaked horned lark nests on the ground in sparsely vegetated sites dominated by grasses and forbs. Historically, this type of habitat was present in prairies in western Oregon and Washington, in dune habitats along the coast of Washington, on the sandy beaches and spits along the Columbia and Willamette Rivers, and in grasslands, estuaries, and sandy beaches in British Columbia. Today the streaked horned lark nests in a broad range of habitats, including native prairies, coastal dunes, fallow and active agricultural fields, wetland mudflats, sparsely-vegetated edges of grass fields, recently planted Christmas tree farms with extensive bare ground, moderately- to heavily-grazed pastures, gravel roads or gravel shoulders of lightly-traveled roads, airports, and dredge deposition sites in the lower Columbia River. Wintering streaked horned larks use habitats that are very similar to breeding habitats.

A key attribute of habitat used by larks is open landscape context. Data indicate that larks use sites found in open (i.e., flat, treeless) landscapes of 120 hectares (300 acres) or more. Some patches with the appropriate characteristics (i.e., bare ground, low stature vegetation) may be smaller if the adjacent fields provide the required open landscape context. This situation is common in agricultural habitats and on sites next to water. For example, many of the sites used by larks on the islands in the Columbia River are small, but are adjacent to open water, which provides the landscape context needed. Streaked horned larks persist at many airports within the range of the subspecies; as native prairies and scoured river beaches in the Pacific Northwest have declined, airports, with their large area requirements and treeless settings, have become magnets for streaked horned larks.

Life History: Nesting begins in late March and continues into late July. The nest consists of a shallow depression built in the open or near a grass clump and lined with fine dead grasses. The female commonly lays 4 greenish or grayish eggs speckled with brown. Incubation is only 11 days and the young are able to fly within 9 to 12 days after hatching.

Food: Larks eat a wide variety of seeds and insects, and appear to select habitats based on the structure of the vegetation rather than the presence of any specific food plants.

Conservation Measures: An interagency group, the Streaked Horned Lark Working Group, has been active for the past several years; the focus of the group has been to develop a better understanding of the streaked horned lark's biology and the current threats facing the subspecies. Members of the Working Group have worked with landowners and managers throughout the range of the lark to encourage measures to improve habitat quality and minimize activities that could reduce nesting success. Land managers are encouraged to maintain open habitats with low stature vegetation, and to avoid disruptive management activities during the breeding season. Measures to protect streaked horned larks have been incorporated into the Comprehensive Conservation Plans for the Willamette Valley National Wildlife Refuge Complex and the Willapa National Wildlife Refuge.

Critical habitat: Critical habitat was designated on 3 October 2013 (78 FR 61505). Occupied areas at the time of the listing were designated as critical habitat and that contain sufficient elements of physical or biological features to support life-history processes essential to the conservation of the streaked horned lark. Critical habitat areas are describe below and constitute the best current assessment of areas that meet the definition of critical habitat. The Washington Coast and Columbia River Unit totals 2,900 acres (1,173 hectares) and includes 564 acres (228 hectares) of Federal ownership, 2,209 acres (894 hectares) of State-owned lands, and 126 acres (51 hectares) of private lands. The Willamette Valley Unit totals 1,729 acres (700 hectares) and is entirely composed of Federal lands.

The streaked horned lark has been documented nesting on all of the subunits within the last few years, and all subunits are therefore considered occupied at the time of listing. All of the subunits have 1 or more of the physical or biological features essential to the conservation of the streaked horned lark, and which may require special management considerations or protection.

On the Washington coastal sites, the streaked horned lark occurs on sandy beaches and breeds in the sparsely vegetated, low dune habitats of the upper beach. The physical or biological features essential to the conservation of the streaked horned lark may require special management considerations or protection to reduce human disturbance during the nesting season, and the continued encroachment of invasive, nonnative plants requires special management to restore or retain the open habitat preferred by the streaked horned lark.

Primary Constituent Elements for the Streaked Horned Lark: Based on knowledge of the physical or biological features and habitat characteristics required to sustain the subspecies' life-history processes, the PCEs specific to the streaked horned lark are areas having a minimum of 16% bare ground that have sparse, low-stature vegetation composed primarily of grasses and forbs less than 13 in (33 cm) in height found in the following:

PCE 1. Large (300-acres or 120-hectares), flat (0 to 5% slope) areas within a landscape context that provides visual access to open areas such as open water or fields.

PCE 2. Areas smaller than described in PCE 1 (above), but that provide visual access to open areas such as open water or fields.

Critical habitat does not include human-made structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on 4 November 2013.

MARINE MAMMALS

BLUE WHALE (*Balaenoptera musculus*)

Status: The blue whale was listed as endangered on 2 December 1970 (35 FR 18319) throughout its entire range.

Threats: Blue whales originally underwent a dramatic population decline due to intensive commercial whaling during the 20th century prior to 1966. While such hunting is outlawed now, blue whale recovery is still impeded by human activities such as entanglement of whales in fishing gear, collisions with ships, acoustic disturbance, habitat degradation, and competition for resources with humans (NMFS 1991a, NMFS 2012).

Range: The blue whale occurs in all the world's oceans. Presumably, they follow a migration pattern of seasonal north-south movements between summering and wintering areas, but some evidence suggests that individuals in certain areas remain in low latitudes year-round (Donovan 1984; Yochem and Leatherwood 1985; Reilly and Thayer 1990). The location of wintering areas is still speculative (Jonsgård 1966; Mackintosh 1966), whereas known summer feeding areas are in the relatively high latitudes. Migratory routes are not well known, mainly because blue whales occur primarily in the open ocean; however, the National Marine Fisheries Service (NMFS) is developing new technology to track whales to determine population size and migration routes (NMFS 2016).

Blue whales are found along the coastal shelves of North America and South America in the Pacific Ocean (Rice 1974; Clarke 1980; Donovan 1984). The International Whaling Commission

(IWC) Scientific Committee recognized 1 blue whale stock in the North Pacific (Donovan 1991). However, there is increasing evidence suggesting that more than 1 stock exists within this ocean basin (Ohsumi and Wada 1974; Mizroch et al. 1984a; Barlow 1994). One such tentative stock designation is for blue whales occurring during winter off Baja California and in the Gulf of California. Photo-identification studies have shown that individuals from these concentrations travel in summer and fall to waters off California (Calambokidis et al. 1990; Barlow et al. 1997; Sears 1987). Nishiwaki (1966) noted the occurrence of blue whales near the Aleutian Islands and in the Gulf of Alaska. However, as of 1987, there have been no blue whale sightings in these waters (Leatherwood et al. 1982; Stewart et al. 1987). No distributional information exists for the western North Pacific Ocean.

Habitat Requirements: Blue whale distribution is likely linked to nutritional requirements (Reilly and Thayer 1990; Schoenherr 1991; Kawamura 1994). Areas of cold, upwelling currents (i.e. eastern sides of the oceans) provide large quantities of euphausiid crustaceans (krill) which is a primary prey item of blue whales. Areas of dense prey aggregations may be seasonal, year-round, or strongly influenced by the occurrence of El Niño Southern Oscillation (ENSO) events (Reilly and Thayer 1990; Schoenherr 1991; Gendron and Sears 1993). In the North Pacific, the krill species on which these whales rely include *Euphausia pacifica, Thysanoessa inermis, T. longipes,* and *T. spinifera* (Schoenherr 1991) in the North Pacific. Off the Pacific coast of Baja California, blue whales feed on concentrations of the pelagic red crab; however, blue whales have been observed between February and April within the Gulf of California feeding on surface swarms of euphausiid species (Sears 1990; Gendron and Sears 1993). Sears (1990) regarded the latter species as the principal prey of blue whales in the region. Some researchers have speculated that a critical factor influencing blue whale recovery in the Southern Hemisphere may be interspecific competition with minke and nonwhale krill predators (Fraser et al. 1992). However, scientists can make no conclusions about this type of competition until further behavioral and distributional information is available (Mizroch et al. 1984a). Natural mortality rates are unknown, but they are likely to be similar to those of the fin whale, about 4% per year in adult whales (Allen 1980).

Critical Habitat. Critical habitat is not designated.

FIN WHALE (*Balaenoptera physalus*)

Status: The fin whale was listed as endangered on 2 December 1970 (35 FR 18319) throughout its entire range.

Threats: Fin whales originally underwent a dramatic population decline due to intensive commercial whaling during the 20th century prior to 1966. While such hunting is outlawed now, Fin whale recovery is still impeded by human activities such as entanglement of whales in fishing gear, collisions with ships, acoustic disturbance, habitat degradation, and competition for resources with humans (NMFS 1991a, NMFS 2012).

Range: Fin whales inhabit a wide range of latitudes between lat. 20–75ºN and 20– 75ºS (Mackintosh 1966). Most migrate seasonally from relatively high-latitude Arctic and Antarctic feeding areas in the summer to relatively low-latitude breeding and calving areas in winter. Arrival time on the summer feeding areas may differ according to sexual class, with pregnant females arriving earlier in the season than other whales (Mackintosh 1965). The location of winter breeding areas is still uncertain. These whales tend to migrate in the open ocean, and therefore migration routes and the location of wintering areas are difficult to determine.

Habitat Requirements: Fin whales spend the summer feeding in the relatively high latitudes of both hemispheres, particularly along the cold eastern boundary currents in the North Pacific and North Atlantic Oceans and in Antarctic waters of the Southern Hemisphere. They are most abundant in offshore waters where their primary prey (e.g. euphausiids) is concentrated in dense shoals. Fin whales may have a significant impact on marine ecosystems. As an example, the total annual (spring and summer) prey consumption by fin whales along the northeast U.S. continental shelf is approximately 664,000 tons per year (Hain et al. 1992). By biomass, fin whales in this area probably consume more food than any other cetacean species. Fin whales likely undergo a partial or complete fast while traveling to lower latitudes in the fall and throughout the winter (Mizroch et al. 1984b).

The predominant prey of fin whales varies greatly in different geographical areas depending on what is locally abundant (IWC 1992). For instance, in the Northern Hemisphere they consume schooling fishes, such as capelin, anchovies, herring, and sand lance. (Mitchell 1975; Overholtz and Nicolas 1979; Kawamura 1982). Thus, they may be less prey selective than blue, humpback, and right whales. However, fin whales do depend largely on the small euphausiids and other zooplankton species. In the Antarctic, they feed on krill, which occurs in dense near-surface schools (Nemoto 1959). In the North Pacific, schooling fishes are the primary prey items. The natural mortality rate for fin whales ranges from 4 to 6% (Clark 1982; De la Mare 1985).

Critical Habitat. Critical habitat is not designated.

HUMPBACK WHALE (*Megaptera novaeangliae*)

Status: The humpback whale was listed as endangered by NMFS and USFWS on 2 December 1970 (35 FR 18319) throughout its entire range.

Threats: Humpback whales originally underwent a dramatic population decline due to intensive commercial whaling during the 20th century prior to 1966. While such hunting is outlawed now, humpback recovery is still impeded by human activities such as subsistence hunting, entrapment and entanglement of whales in fishing gear, collisions with ships, acoustic disturbance, habitat degradation, and competition for resources with humans (NMFS 1991a, NMFS 2012).

Range: Humpback whales inhabit all major ocean basins from the equator to sub-polar latitudes. They follow a predictable migratory pattern in both hemispheres, feeding during the summer in the higher near-polar latitudes and then during the winter migrating to the lower latitudes where calving and breeding take place. The IWC has designated 1 stock of humpback whales in the North Pacific Ocean (Donovan 1991). These whales range widely across the entire North Pacific during the summer months, south to Point Conception, Calif., and north into the Bering Sea (Johnson and Wolman 1984). Feeding grounds exist off California, Oregon, and Washington, in the Bering Sea, along the Aleutian Islands, and in southeastern Alaska.

Habitat Requirements: Humpback whales in the Northern Hemisphere could be classified as generalists when it comes to their diet. They have been known to prey upon krill (eupausiids), copepods, juvenile salmonids, Arctic cod, walleye pollock, pollock, pteropods, and some cephalopods (Johnson and Wolman 1984). In New England waters of the North Atlantic, 95% of their diets consist of fish species. The most common prey item is the Atlantic herring, capelin, Atlantic mackerel, and other schooling species (Kenney et al. 1985). On the Alaska feeding grounds in the North Pacific, krill, herring, and capelin make up the majority of prey items in the stomachs of humpback whales (Bryant et al. 1981; Dolphin and McSweeney 1983). Humpback whales generally do not feed when on their wintering grounds (Slijper 1962; Lockyer 1981).

Humpback whales use a wide range of feeding techniques, at times involving more than 1 individual and resembling a form of cooperative participation. The 2 most observable techniques are lob-tail feeding (Weinrich et al. 1992) and bubble-cloud feeding (Ingebrigtsen 1929; Jurasz and Jurasz 1979; Hain et al. 1982). Recently, there has been documentation of bottom-feeding by humpback whales on Stellwagen Bank off Massachusetts and near the mouth of Chesapeake Bay (Swingle et al. 1993; Hain et al. 1995)

Natural mortality rates have rarely been estimated for humpback whales and the causes of natural mortality in this species are not well known.

Critical Habitat. Critical habitat is not designated.

SEI WHALE (*Balaenoptera borealis*)

Status: The sei whale was listed as endangered on 14 April 1970 (35 FR 6069) throughout its entire range.

Threats: Sei whales originally underwent a dramatic population decline due to intensive commercial whaling during the 20th century prior to 1966. While such hunting is outlawed now, Sei whale recovery is still impeded by human activities such as entanglement of whales in fishing gear, collisions with ships, acoustic disturbance, habitat degradation, and competition for resources with humans (NMFS 1991a, NMFS 2012).

Range: Sei whales occur in all oceans. These whales migrate long distances from high-latitude summer feeding areas to relatively low-latitude winter breeding areas. For the most part, the location of these winter areas remains a mystery. Compared to other balaenopterids, sei whales appear restricted to the more temperate waters and occur within a smaller range of latitudes (Mizroch et al. 1984b). They do not associate with coastal features, but instead they inhabit deeper waters associated with the continental shelf edge (Hain et al. 1985). Evidence from catch data of differential migration patterns by reproductive class reveals females arrive at and depart from feeding areas earlier than males (Matthews 1938; Gambell 1968).

Habitat Requirements: Sei whales spend the summer feeding in the relatively high latitudes of both hemispheres, particularly along the cold eastern currents of the North Pacific and North Atlantic Oceans and in the Antarctic waters of the Southern Hemisphere. They range farther offshore than fin whales in search of prey concentrations. Sei whales are less prey-selective than fin whales. Sei whales consume primarily copepods, but they also prey on euphausiids and small schooling fishes when these species are locally abundant (Mizroch et al. 1984b). This species seems to have the greatest flexibility relative to other balaenopterids in their feeding strategies, using both “engulfing” and “skimming” to capture prey (Nemoto 1959). In the Southern Hemisphere, there is some evidence that sei whales may minimize direct interspecific competition with the blue, fin, and minke whales by foraging in warmer waters than do the latter species, by consuming a relatively wider variety of prey, and by arriving later on the feeding grounds than other baleen whales (Kawamura 1978, 1980, 1994; IWC 1992). Estimated annual natural mortality is 7.5%.

Critical Habitat. Critical habitat is not designated.

SPERM WHALE (*Physeter macrocephalus*)

Status: The sperm whale was listed as endangered on 2 December 1970 (35 FR 18319) throughout its entire range.

Threats: Sperm whales originally underwent a dramatic population decline due to intensive commercial whaling during the 20th century prior to 1966. While such hunting is outlawed now, Sperm whale recovery is still impeded by human activities such as entanglement of whales in fishing gear, collisions with ships, acoustic disturbance, habitat degradation, and competition for resources with humans (NMFS 1991a, NMFS 2012).

Range: Sperm whales inhabit all ocean basins, from equatorial waters to the polar regions. In general, their distribution varies by gender and age composition of groups and is related to prey availability and certain oceanic conditions. Mature females, calves, and immature whales of both sexes occur in social groups in temperate and tropical waters year round. Female/immature groups rarely occur higher than lat. 50ºN and lat. 50ºS (Reeves and Whitehead 1997). Male sperm whales lead a mostly solitary life after reaching sexual maturity between 9 and 20 years of age and travel into regions as high as lat. 70ºN in the North Atlantic and lat. 70ºS in the Southern Ocean (Reeves and Whitehead 1997).

General migration patterns vary between males and females. In summer, all sperm whales inhabit the highest latitudes of their range. In winter, female/immature groups migrate closer to equatorial waters in both hemispheres, possibly following warmer sea-surface temperatures (Kasuya and Miyashita 1988; Waring et al. 1993). Sexually mature males join these female immature groups throughout the winter. The genetic homogeneity of sperm whales worldwide, suggests that genetic exchange occurred between Northern and Southern Hemisphere populations at some time in their evolutionary history.

Sperm whales occur throughout the North Pacific. Female and immature whales appear year round in temperate and tropical waters from the Equator to around lat. 45ºN. During summer, mature male sperm whales move north into waters off the Aleutian Islands, Gulf of Alaska, and the southern Bering Sea.

Large-scale oceanographic events, such as El Niño, seem to affect the distribution and movements of sperm whales, creating annual and seasonal geographic variability.

Habitat Requirements: In general, the sperm whale's primary prey consists of larger mesopelagic cephalopod and fish species, including giant squid. Sperm whales consume approximately 40 species of cephalopods worldwide. In the North Pacific, the 4 most common prey items of sperm whales off central California are all cephalopod species (Fiscus et al. 1989). In the Indian Ocean, the cephalopod species most commonly eaten by sperm whales are of the Histioteuthid family (Gordon 1991). Sperm whales in the high latitudes of the North Atlantic (i.e. Norwegian Sea and Iceland) feed on deep-dwelling fish species lumpsuckers and rockfishes. Fish prey comprises almost half of the total biomass eaten by sperm whales in this region, while the other half is comprised of cephalopods (Martin and Clarke 1986; Christensen et al. 1992).

Critical Habitat. Critical habitat is not designated.

SOUTHERN RESIDENT KILLER WHALE (*Orcinus orca*)

Status: The Puget Sound Southern Resident killer whale was listed as endangered on 18 November 2005 (70 FR 69903).

Threats: Historically, the Southern Resident killer whale population in the action area suffered from direct harvest of whales by whaling operations. More recently, capture of whales for display in aquaria and deliberate killings of whales have caused mortalities and affected the age/sex ratios within the southern resident killer whale population. Injury or mortality to Southern Resident killer whales can be due to collisions with vessels, but such strikes are rare. Other factors contributing to the decline of Southern Resident killer whale are reduced quantity or quality of prey, the presence of persistent pollutants that cause immune or reproductive system dysfunction, oil spills, and noise and disturbance from vessel traffic (NMFS 2008).

Range: Killer whales occur in all the oceans, but are most common in coastal waters and at higher latitudes. In Washington State, most killer whales inhabit the inland waters around the San Juan Islands and in the eastern portion of the Strait of Juan de Fuca.

Habitat Requirements: Killer whales tolerate a wide range of water temperatures and do not appear to be constrained by water depth, temperature, or salinity. Although the species occurs widely as an ocean inhabitant, many pods spend much of their time in shallower coastal and inland marine waters.

Resident killer whales spend more time in deeper water than transients and only rarely enter water less than 5 meters deep. Distribution is strongly associated with areas of greater salmon abundance. Some studies have reported that the Southern Residents feed heavily in areas characterized by high-relief underwater topography. Other studies show no correlation between bottom topography and feeding behavior.

Critical Habitat: On 29 November 2006, NMFS designated critical habitat in Washington for the Southern Resident killer whale (71 FR 69054). As designated, this critical habitat includes approximately 2,560 square miles (6,630 square km) of the inland waterways of Washington State. The area defined as critical habitat is within the geographical area occupied by the species and contains PCEs required by killer whales. The designation excludes 18 military sites due to national security impacts.

The shallow waters of Puget Sound (waters less than 20 feet (6.1 meters) deep relative to extreme high tide) are not considered to be within the geographical area occupied by the species. Because of their large size, killer whales may experience limited maneuverability in water less than 20 feet deep and they are seldom observed in such conditions. However, due to a lack of information regarding Southern Resident killer whale use of shallow habitat and the fact that transient and Northern Resident killer whales are both known to use shallow waters, NMFS requested further information, but received insufficient data to support designation of shallow water habitat (<20 feet deep).

NMFS did not include coastal and offshore areas in the Pacific Ocean or waters inside Hood Canal as part of Southern Resident killer whale critical habitat. While coastal and offshore areas are part of the geographical area occupied by the species, there is not enough information regarding Southern Resident killer whale distribution, behavior, or habitat usage in those areas to determine PCEs. Therefore, while NMFS recognizes the importance of coastal or offshore areas, they are not proposing to designate them at this time. There is not sufficient evidence of Southern Resident killer whales in Hood Canal to consider it within the geographical area occupied by the species.

The PCEs used to determine critical habitat are composed of those physical and biological components deemed essential for the conservation and recovery of the species:

PCE 1. Water quality to support growth and development.

PCE 2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development as well as overall population growth.

PCE 3. Passage conditions to allow for migration, resting, and foraging (71 FR 69061).

TURTLES

GREEN SEA TURTLE (*Chelonia mydas*)

Status: Green sea turtle was listed as threatened on 28 July 1978 (43 FR 32800).

Threats: The principal cause of the historical, worldwide decline of the green turtle is long-term harvest of eggs and adults on nesting beaches and juveniles and adults on feeding grounds. These harvests continue in some areas of the world and compromise efforts to recover this species. Incidental capture in fishing gear, primarily in gillnets, but also in trawls, traps and pots, longlines, and hopper dredges is a serious ongoing source of mortality that adversely affects the species' recovery. Green turtles are threatened, in some areas of the world, by the disease fibropapillomatosis.

Range: Green sea turtles primarily nest in the state of Michoacan, Mexico and in the Galapagos Islands, Ecuador. This species has no known nesting in the U.S. or in any territory under U.S. jurisdiction. Green sea turtles have appeared in waters as far north as British Columbia (Carl 1955) and in either gillnets or strandings along the Washington coastline (Eckert 1993). San Diego Bay, California is home of the northernmost green sea turtle resident population. The population is concentrated around warm water effluent discharged by the San Diego Gas and Electric Company power plant (Stinson 1984).

Habitat Requirements: Green sea turtles forage primarily on sea grasses and algae as adults. Diet varies among feeding grounds and may include a variety of marine animals. Specific foraging grounds for green sea turtles are undocumented, but are most likely located along the coast of Baja California (Mexico) and southern California (U.S.). Foraging grounds include bays and inlets (NMFS and USFWS 1998a). There are no data on foraging areas along the west coast of the U.S. (McDonald and Dutton 1990; McDonald et al. 1995). The feeding habits of juveniles and hatchlings are unknown.

Critical Habitat: was designated on 28 July 1998 (77 FR 45571) for green turtles in coastal waters around Culebra Island, Puerto Rico.

LEATHERBACK SEA TURTLE (*Dermochelys coriacea*)

Status: The leatherback sea turtle was listed as endangered on 2 June 1970 (35 FR 8491).

Threats: Leatherback sea turtles face threats on both nesting beaches and in the marine environment. The greatest cause of decline and the continuing primary threat to leatherback sea turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and hopper dredges.

Range: Leatherback sea turtles forage off the coast of Oregon and Washington and may enter bays and estuaries during the summer months. Leatherback sea turtles nest in the tropics and subtropics and do not nest on the west coast of the U.S. (NMFS and USFWS 1998b).

Habitat Requirements: Leatherback turtle nesting grounds occur between 40 degrees North and 35 degrees South (Plotkin 1995); therefore, no nesting areas are located in Washington. This species may use oceanic areas off the coast of Washington as foraging grounds during the summer and fall months. Aerial surveys indicate that when off the U.S. Pacific coast, leatherbacks usually occur in continental slope waters (NMFS and USFWS 1998b). Nesting areas of Loggerhead turtles are located in the subtropics, primarily in the western Pacific (NMFS and USFWS 1998b). Eastern Pacific waters may serve as foraging grounds and migratory corridors; however, sightings in this area occurred only in the summer months off southern California (NMFS and USFWS 1998b). Primary nesting sites for the Green turtle (*Chelonia mydas*) are located in Mexico and the Galapagos Islands, although a resident population is also present in San Diego Bay (NMFS and USFWS 1998b). Beach strandings and gillnet captures occurred off the Washington coast, but researches suggested these individuals were vagrants that strayed northward with El Nino currents (NMFS and USFWS 1998b). No regular occurrences off the coast of Washington were noted in a 1998 draft recovery plan for this species.

Critical Habitat: Critical habitat for leatherback sea turtle in the northeastern Pacific Ocean was designated on 26 January 2012 (77 FR 4170) and encompasses the nearshore area from Cape Flattery, Washington, to Umpqua River (Winchester Bay), Oregon and offshore to a line approximating the 2,000 meter isobath. This area is the principal Oregon/Washington foraging area and includes important habitat associated with Heceta Bank, Oregon. The greatest densities of a primary prey species *Cyanea fuscescens* occur north of Cape Blanco, Oregon and in shallow inner shelf waters.

The PCEs that NMFS identified as essential for the conservation of leatherback sea turtles when it proposed to revise critical habit to include marine waters off the U.S. West Coast, including the action area, are the following:

PCE 1. Occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (*Chrysaora, Aurelia, Phacellophora,* and *Cyanea*) of sufficient condition, distribution, diversity, and abundance to support individual as well as population growth, reproduction, and development.

PCE 2. Migratory pathway conditions to allow for safe and timely passage and access to/from/within high use foraging areas.

The migratory pathway would include areas within the action area.

LOGGERHEAD SEA TURTLE (*Caretta caretta*)

Status: The loggerhead turtle was listed as threatened throughout its range on 28 July 1978 (43 FR 32800).

Threats: Loggerheads face threats on nesting beaches and in the marine environment. The greatest cause of decline and the continuing primary threat to loggerhead turtle populations worldwide is incidental capture in fishing gear, primarily in longlines and gillnets, but also in trawls, traps and pots, and hopper dredges. Directed harvest of loggerheads still occurs in many places (e.g. the Bahamas, Cuba, and Mexico) and is a serious, continuing threat to loggerhead recovery.

Range: Most nesting grounds of the loggerhead sea turtle occur in sub-tropical and warm temperate regions. The largest nesting colonies appear along the Atlantic Coast of Florida, U.S. and on Masirah Island, Oman (Groombridge 1982). There is no nesting on the Pacific Coast of the U.S., Hawaii, or in any U.S. unincorporated island territories of the Pacific (Balazs 1982). Most sightings of loggerhead sea turtles in northern U.S. waters consist of juveniles. There have been several sightings from the coast of Washington (Hodge 1982) and as far north as Alaska (Bane 1992).

Habitat Requirements: Important developmental habitats for juvenile loggerhead sea turtles are in coastal waters of the U.S. and Mexico. Benthic invertebrates constitute the primary diet of adult loggerheads, but it occasionally includes fish and plants.

Critical Habitat: No marine areas meeting the definition of critical habitat were identified within the jurisdiction of the U.S. for the North Pacific Ocean loggerhead sea turtle DPS, and therefore critical habitat for that DPS was not proposed.

OLIVE RIDLEY SEA TURTLE (*Lepidochelys olivacea*)

Status: The Olive Ridley sea turtle was listed as threatened on 28 July 1978 (43 FR 32800).

Threats: The principal cause of the historical, worldwide decline of the Olive Ridley sea turtle is long-term collection of eggs and killing of adults on nesting beaches. Because arribadas (i.e. synchronized, large-scale nesting) concentrate females and nests in time and space, they allow for mass killing of adult females as well as the taking of an extraordinary number of eggs. These threats continue in some areas of the world today, compromising efforts to recover this species. In the eastern Pacific Ocean, killing sea turtles and collecting their eggs has occurred for hundreds of years. Little data exist on historical egg taking in Mexico, but egg collection has previously reached nearly 100% at solitary nesting sites. In many places, egg collecting continues at this level (Plotkin 2007). Additionally, incidental captures in fishing gear, primarily in longlines and trawls, but also in gill nets, purse seines, and hook and line, is a serious ongoing source of mortality that adversely affects the species' recovery.

Range: Olive Ridley turtles occur in tropical and warm temperate ocean waters. Eastern Pacific populations nest in southern Mexico and northern Costa Rica (NMFS and USFWS 1998c). There is evidence that they undergo regular migrations from breeding areas to feeding areas in the south. Occasionally, they move north with warm water associated with El Nino events (NMFS and USFWS 1998c), but they are unlikely to occur in coastal bays.

Olive Ridley sea turtles nest primarily along the northeast coast of India (Nmosovsky 2001) and along the west coast of Mexico and Central America. There is no recorded nesting by Olive Ridley sea turtles in the U.S. or any U.S. incorporated territories. There are records of Olive Ridley sea turtles having been killed by boat collisions, gillnets, and cold-water stunning off the coast from Washington and Oregon (NMFS and USFWS 1998c).

Habitat Requirements: The diet and feeding habits of the Olive Ridley sea turtle have no substantial data. Benthic crustaceans seem to constitute the majority of the prey items. It appears that hatchlings and juveniles have a pelagic phase in their development where they are often found associated with floating objects southwest of Acapulco. Researchers assume the turtles remain in these areas until they have grown to a safe size to feed in the nearshore feeding grounds with the adults. The most important areas are along the Central American coast.

Critical Habitat. Critical habitat is not designated.

FISH

For each species, several different evolutionarily significant units (ESUs) and distinct population segments (DPSs) are listed as threatened or endangered.

BULL TROUT (*Salvelinus confluentus*)

Status: The Columbia River DPS was listed as threatened on 10 June 1998 (63 FR 31647)). The Puget Sound/Coastal DPS was listed as threatened on 4 November 1999 (64 FR 17110).

Threats to bull trout include habitat degradation and fragmentation from past and ongoing land management activities such as mining, road construction and maintenance, timber harvest, hydropower, water diversions and withdrawals, agriculture, and grazing. Other detriments occur from interactions with introduced non-native fishes such as brook trout and lake trout.

Bull trout occupied about 60% of the Columbia River basin, but presently occur in only 45% of the estimated historical range (Quigley and Arbelbide 1997). Bull trout have declined in overall range and numbers of fish. Though still widespread, there have been numerous local extirpations reported throughout the Columbia River basin. Although some strongholds still exist, bull trout generally occur as isolated sub-populations in headwater lakes or tributaries where migratory fish populations have been lost.

Although the bull trout distribution in the Coastal/Puget Sound DPS is less fragmented than the Columbia River DPS, bull trout subpopulation distribution within individual river systems has contracted and abundance has declined.

Range: Bull trout, members of the family Salmonidae, are char native to the Pacific Northwest and western Canada. Bull trout historically occurred in major river drainages in the Pacific Northwest from about 41°N to 60°N latitude, from the southern limits in the McCloud River in northern California and the Jarbidge River in Nevada to the headwaters of the Yukon River in Northwest Territories, Canada (Cavender 1978; Bond 1992). To the west, bull trout range includes Puget Sound, various coastal rivers of Washington, British Columbia, and southeast Alaska (Bond 1992; McPhail and Carveth 1992; Leary and Allendorf 1997). Bull trout are widespread throughout tributaries of the Columbia River basin in Washington, Oregon, and Idaho, including its headwaters in Montana and Canada. Bull trout occur in the Klamath River basin of south-central Oregon as well. East of the Continental Divide, bull trout are found in the headwaters of the Saskatchewan River in Alberta, and the MacKenzie River system in Alberta and British Columbia (Cavender 1978; McPhail and Baxter 1996; Brewin and Brewin 1997).

Habitat Requirements: Bull trout exhibit resident and migratory life-history strategies through much of their current range (Rieman and McIntyre 1993). Resident bull trout complete their life cycles in the tributary streams in which they spawn and rear. Migratory bull trout spawn in tributary streams where juvenile fish rear from 1 to 4 years before migrating to either a lake (adfluvial), river (fluvial), or in certain coastal areas, to saltwater (anadromous), where maturity is reached in 1 of the 3 habitats (Fraley and Shepard 1989; Goetz 1989).

Bull trout have relatively specific habitat requirements compared to other salmonids (Rieman and McIntyre, 1993). Habitat components that appear to influence bull trout distribution and abundance include water temperature, cover, channel form and stability, valley form, spawning and rearing substrates, and migratory corridors (Oliver 1979; Pratt 1984, 1992; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Howell and

Buchanan 1992; Rieman and McIntyre 1993, 1995; Rich 1996; Watson and Hillman 1997). Watson and Hillman (1997) concluded that watersheds must have specific physical characteristics to provide the necessary habitat requirements for bull trout to successfully spawn and rear, and that the characteristics are not necessarily ubiquitous throughout watersheds in which bull trout occur. Because bull trout exhibit a patchy distribution, even in pristine habitats (Rieman and McIntyre 1993), they should not be expected to simultaneously occupy all available habitats (Rieman et al. 1997).

Bull trout inhabit primarily in colder streams, although individual fish are often found in larger river systems (Fraley and Shepard, 1989; Rieman and McIntyre 1993, 1995; Buchanan and Gregory 1997; Rieman et al. 1997). Water temperature above 15ºC (59ºF) limits bull trout distribution, which partially explains their patchy distribution within a watershed (Fraley and Shepard 1989, Rieman and McIntyre, 1995). Spawning areas are often associated with cold-water springs, groundwater infiltration, and the coldest streams in a given watershed (Pratt 1992; Rieman and McIntyre 1993; Rieman et al. 1997).

All life history stages of bull trout are closely associated with complex forms of cover, including large woody debris, undercut banks, boulders, and pools (Oliver 1979; Fraley and Shepard 1989; Goetz 1989; Hoelscher and Bjornn 1989; Sedell and Everest 1991; Pratt 1992; Thomas 1992; Rich 1996; Sexauer and James 1997; Watson and Hillman 1997). Jakober (1995) observed bull trout over-wintering in deep beaver ponds or pools containing complex large woody debris in the Bitterroot River drainage, Montana, and suggested that suitable winter habitat may be more restrictive than summer habitat. Maintaining bull trout populations requires high stream channel stability and relatively stable stream flows (Rieman and McIntyre 1993). Juvenile and adult bull trout frequently inhabit complex cover associated with side channels, stream margins, and pools (Sexauer and James 1997). These areas are sensitive to activities that directly or indirectly affect stream channel stability and alter natural flow patterns. For example, altered stream flow in the fall may disrupt bull trout during the spawning period, and channel instability may decrease survival of eggs and young juveniles in the gravel during winter through spring (Fraley and Shepard 1989; Pratt 1992; Pratt and Huston 1993).

Preferred spawning habitat consists of low gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989) and water temperatures of 5º to 9º C (41 to 48ºF) during the late summer and early fall months (Goetz 1989). Pratt (1992) summarized information indicating that increases in fine sediments are related to reduced egg survival and emergence. High juvenile densities appeared in the Swan River, Montana, and its tributaries where there was a diverse cobble substrate and a low percentage of fine sediments (Shepard et al. 1984). Juvenile bull trout in 4 streams in central Washington occupied slow-moving water less than 0.5 m/sec (1.6 ft/sec) over a variety of sand to boulder size substrates (Sexauer and James 1997).

The size and age of maturity for bull trout vary depending upon life history strategy. Growth of resident fish is generally slower than migratory fish; resident fish tend to be smaller at maturity and less fecund (Fraley and Shepard 1989; Goetz 1989). Individuals normally reach sexual maturity in 4 to 7 years. Bull trout can live as long as 12 years. Repeat and alternate year spawning occurs, although repeat spawning frequency and post-spawning mortality are not well known (Leathe and Graham 1982; Fraley and Shepard 1989; Pratt 1992; Rieman and McIntyre 1996).

Bull trout typically spawn from August to November during periods of decreasing water temperatures. However, adult migratory bull trout frequently begin spawning migrations as early as April and move upstream as far as 250 km (155 mi) to spawning grounds (Fraley and Shepard 1989). In the Blackfoot River, Montana, bull trout began migrations to spawning areas in response to increasing temperatures (Swanberg 1997). Temperatures during spawning range from 4 to 10ºC (39 to 51ºF), with redds often constructed in stream reaches fed by springs or near other sources of cold groundwater (Goetz 1989; Pratt 1992; Rieman and McIntyre 1996). Depending on water temperature, incubation is normally 100 to 145 days (Pratt 1992), and after hatching, juveniles remain in the substrate. Time from egg deposition to emergence may surpass 200 days. Fry normally emerge from early April through May depending upon water temperatures and increasing stream flows (Pratt 1992; Ratliff and Howell 1992).

Growth varies depending upon life history strategy. Resident adults range from 150 to 300 mm (6 to 12 inches) total length and migratory adults commonly reach 600 mm (24 inches) or more (Pratt 1985; Goetz 1989).

Bull trout are opportunistic feeders with food habits primarily a function of size and life history strategy. Resident and juvenile migratory bull trout prey on terrestrial and aquatic insects, macrozooplankton, amphipods, mysids, crayfish, and small fish (Wyman 1975; Rieman and Lukens 1979 in Rieman and McIntyre 1993; Boag 1987; Goetz 1989; Donald and Alger 1993). Adult migratory bull trout are primarily piscivorous, feeding on fish such as trout, salmon, whitefish, yellow perch, and sculpin (Fraley and Shepard 1989; Donald and Alger 1993).

Puget Sound/Coastal Bull Trout DPS

The Coastal/Puget Sound bull trout DPS encompasses all Pacific Coast drainages within the coterminous U.S. north of the Columbia River in Washington, including those flowing into Puget Sound. This population segment is discrete because the Pacific Ocean and the crest of the Cascade Mountain Range geographically segregate it from other subpopulations. The population segment is significant to the species as a whole because it is thought to contain the only anadromous forms of bull trout in the coterminous U.S., thus, occurring in a unique ecological setting. In addition, the loss of this population segment would significantly reduce the overall range of the taxon (USFWS 1999b).

Critical Habitat: Critical habitat was designated on 18 October 2010 (75 FR 63898) and further defined in 67 FR 71236. Critical habitat includes 985 miles of marine shoreline, 2,290 miles of streams along with 52,540 acres of lakes and reservoirs in western Washington.

The USFWS determined the PCEs for bull trout from studies of their habitat requirements, life-history characteristics, and population biology. These PCEs are the following:

PCE 1. Permanent water having low levels of contaminants such that normal reproduction, growth, and survival are not inhibited.

PCE 2. Water temperatures ranging from 2º to 15º C (36º to 59º F), with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade, such as that provided by riparian habitat, and local groundwater influence.

PCE 3. Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and instream structures.

PCE 4. Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.63 cm (0.25 in) in diameter and minimal substrate embeddedness are characteristic of these conditions.

PCE 5. A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations.

PCE 6. Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.

PCE 7. Migratory corridors with minimal physical, biological, or chemical barriers between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.

PCE 8. An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.

PCE 9. Few or no predatory, interbreeding, or competitive nonnative species present.

Critical habitat extends from the bankfull elevation on 1 side of the stream channel to the bankfull elevation on the opposite side. If bankfull elevation is not evident on either bank, the ordinary high-water line as defined by the U.S. Army Corps of Engineers in 33 CFR 329.11 shall be used to determine the lateral extent of critical habitat.

Adjacent floodplains are not proposed as critical habitat. However, the quality of aquatic habitat within stream channels is intrinsically related to the character of the floodplains and associated riparian zones, and human activities that occur outside the river channels can have demonstrable effects on physical and biological features of the aquatic environment. The lateral extent of proposed lakes and reservoirs is defined by the perimeter of the water body as mapped on standard 1:24,000 scale maps (comparable to the scale of a 7.5 minute U.S. Geological Survey quadrangle topographic map).

CHINOOK SALMON (*Oncorhynchus tshawytscha*)

Status: The following Chinook salmon ESUs were been listed as threatened or endangered on 28 June 2006 (70 FR 37160). Lower Columbia River Chinook salmon, Puget Sound Chinook salmon, and Willamette River Chinook salmon.

Threats: Threats to the Chinook salmon include watershed development, such as forest practices, urbanization, agricultural land use, mining, hydropower development and water manipulation and withdrawal. In addition, over-fishing, artificial propagation, and introduction of nonnative species have affected Chinook salmon. Forest practices, mining, agriculture, urbanization, hydropower, and water withdrawal have caused increased sedimentation, altered flow regimes and channel morphology, decreased water quality and quantity, loss of riparian habitat, loss of large wood and its recruitment, elevated water temperatures, decreased gravel recruitment, reduced pools and spawning and rearing areas, rerouted stream channels, degraded streambanks, and loss of estuarine rearing areas (Bishop and Morgan 1996; Myers et al. 1998). These changes have substantially degraded the spawning and rearing environment of Chinook salmon. In addition, harvest, hatchery practices, and the introduction of nonnative species have affected the expression of the varied life history strategies of Chinook salmon within these ESUs.

Range: In North America, the historical range of Chinook salmon extended from the Ventura River in California to Point Hope, Alaska. In northeastern Asia, the historical range extended from Hokkaido, Japan to the Anadyr River in Russia (Scott and Crossman 1973).

Habitat Requirements: The generalized life history of Pacific salmon involves incubation, hatching and emergence in freshwater, migration to the ocean, and subsequent initiation of maturation and return to freshwater for completion of maturation and spawning (Myers et al., 1998). Chinook salmon exhibit 2 generalized freshwater life history types, stream-type and ocean-type (Gilbert 1912). There is further life history variation within each type, which allows full utilization of freshwater, estuarine and ocean environments (Spence et al. 1996).

To complete these life history strategies successfully, Chinook salmon need access to freshwater, estuarine, coastal, and open ocean environments. In these environments they require adequate water quantity, quality, temperature, and velocity; substrate, cover and shelter, food resources, riparian vegetation, space, and safe passage conditions. The range of ocean residence for Chinook salmon is from 1 to 6 years. A small proportion of yearling males, called jacks, mature in freshwater or return after 2 to 3 months in saltwater (Myers et al. 1998; Spence et al. 1996). In general, Chinook salmon spawn in small to medium-sized rivers; however, they may also spawn in larger river systems such as the mainstem Columbia River (Spence et al. 1996).

Ocean-type Chinook salmon (Puget Sound ESU, Lower Columbia River ESU, and Willamette River fall ESU) migrate to sea normally within a few months after emergence. They reside in estuaries for longer periods as fry and fingerlings than do stream-type Chinook salmon (Reimers 1973; Kjelson et al. 1982; Healey 1991). Juvenile Chinook salmon use estuaries for rearing, physiological transition, and refugia and are the most estuarine dependent anadromous salmonids in the Pacific Northwest (Aitkin 1998). Ocean-type Chinook salmon spend most of their ocean life in coastal waters, and return to their natal river during the spring, summer, fall, late fall and winter (NMFS 1998a). Ocean-type Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991).

For ocean-type Chinook salmon, estuarine rearing environments may be more important than the freshwater environment, as these salmon can rear between 3 to 6 months in freshwater and estuarine environments (Healey 1991; Meehan and Bjornn 1991). For ocean-type Chinook salmon, estuarine environments provide staging, physiological transition, refugia from high water flows and predation, and neustonic, pelagic, and benthic prey food bases. In Washington estuaries, Chinook salmon fry feed on emergent insects and epibenthic crustaceans (gammarid amphipods, mysids, and cumaceans) in salt marsh habitat (Simenstad et al. 1982). As the Chinook salmon grow, their position and food base in estuaries changes. Larger fish move to deeper and more saline water (Healey 1982; Macdonald et al. 1987; Wissmar and Simenstad 1988) and their prey base changes to include decapod larvae, larval and juvenile fish, drift insects and euphausiids (Simenstad et al. 1982). Both of these benthic prey bases are dependent on detritus (Sibert et al. 1977; Sibert 1979). Juvenile salmonids tend to congregate in areas where estuary morphology favors detritus retention, such as weed beds, braided or meandering channels, and salt marshes (Healey 1982). Estuaries with a variety of salinity gradients, microhabitats created by large wood, boulders, channel morphology, and vegetation provide cover from predation, a good prey base, and low water velocity refugia at low tide (Aitkin 1998).

Stream-type Chinook salmon, which is characteristic of spring run Chinook salmon (Spence et al. 1996), reside as fry or parr in freshwater for a year or more before migrating to sea. They perform extensive offshore oceanic migrations and return to their natal river during the spring and early summer, several months prior to spawning (Healey 1991). Stream-type Chinook salmon tend to enter freshwater as immature or "bright" fish, migrate far upriver, and use upper watersheds for spawning in late summer and early autumn (Myers et al. 1998). Stream-type juvenile Chinook salmon, exhibit downstream dispersal and use a variety of freshwater rearing environments during their 1 to 2 years of freshwater rearing before migration to the ocean (Meehan and Bjornn 1991). Stream-type juvenile Chinook salmon fry in streams feed on drift insects (Rutter 1904) but zooplankton is a more important prey type in main river systems and estuaries (Allen and Hassler 1986). As Chinook salmon grow, they move from shallow littoral habitats into deeper river channels and their prey base changes from shallow epibenthic prey to larger pelagic species (Allen and Hassler 1986). Cool, clean water, complex habitat diversity that provides pools, riffles, off-channel habitat, and undercut banks, large woody debris or boulder structures that provide cover and shelter from predation and storm events are important habitat elements. Riparian vegetation provides shade for temperature regulation, vegetation inputs for food resources, streambank stabilization from roots and large woody debris recruitment for Chinook salmon rearing. Stream-type life history strategies may be adapted to watersheds or parts of watersheds that are more productive and less susceptible to dramatic changes in water flow, as the long rearing period requires more stable less degraded habitats (Miller and Brannon 1982; Healey 1991).

Critical habitat: Critical Habitat for these ESUs was designated on 2 September 2005 (70 FR 52630). The PCEs listed in 69 FR 74572 and considered essential to the conservation of salmon and steelhead are the following:

PCE 1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.

PCE 2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

PCE 3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

PCE 4. Estuarine areas free of obstruction with water quality, water quantity and salinity conditions supporting juvenile and adult physiological transitions between fresh-and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

PCE 5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulder and side channels.

PCE 6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

CHUM SALMON (*Oncorhynchus keta*)

Status: The Columbia River chum salmon and Hood Canal summer run chum salmon were listed as threatened on 28 June 2005 (70 FR 37160).

Threats: Threats to the chum salmon include impacts from forest practices, mining, agricultural land use, urbanization and water manipulation and withdrawal. These developments have resulted in loss and degradation of freshwater and estuarine habitat; insufficient flows, stranding, juvenile entrainment, instream temperature increases, loss of large woody debris, increased sedimentation, loss of riparian vegetation, habitat simplification, gravel removal, water pollution, stream channelization, and increased runoff (NMFS 1998b). Incidental harvest in salmon fisheries in the Strait of Juan de Fuca and coho salmon fisheries in Hood Canal is a significant threat to the Hood Canal summer chum salmon (NMFS 1998b). This threat has decreased with changes in harvest management, but may arise again with any rebound of coho salmon stocks to harvestable levels.

Range: Chum salmon have the largest range of natural geographic and spawning distribution of all the Pacific salmon species (Bakkala 1970). Historically, in North America, chum salmon occur from Monterey, California to the Arctic coast of Alaska and east to the Mackenzie River, which flows into the Beaufort Sea. Present spawning populations occur as far south as Tillamook Bay on the northern Oregon coast (Johnson et al. 1997). Historically, chum salmon in the Columbia River Basin may have spawned in the Umatilla and Walla Walla Rivers, more than 500 km from the ocean (Nehlsen et al. 1991). These fish would have had to pass Celilo Falls, which was probably only passable at high water flows (Johnson et al. 1997). Chum salmon are present in the lower Columbia River Basin, with more runs on the Washington side than the Oregon side (Salo 1991). Chum salmon runs occur in the Washougal, Lewis, Kalama, and Cowlitz watersheds in Washington.

Habitat Requirements: Chum salmon spawn in streams and rivers of various sizes, and the fry migrate to sea soon after emergence. They spend more of their life history in estuaries and marine waters than the other Pacific salmon species with the exception of ocean-type Chinook salmon. Chum salmon spawning runs can be grouped into 3 seasonal runs: summer, fall, and winter. The chum salmon of the Columbia River ESU enter freshwater to spawn from early October to mid-November, with a peak return in early November (Johnson et al. 1997). Peak spawning occurs in late November and is usually complete by early December (WDFW 1993). The chum salmon of the Hood Canal summer run ESU enter freshwater to spawn from August to mid-September (Cook-Tabor 1995). Hood Canal summer run chum salmon spawning periods vary from August 15 through early October, depending on the watershed (Cook-Tabor 1995).

Chum salmon primarily spawn in the lower reaches of rivers, extending from just above tidal influence up to 100 km of the ocean (Johnson et al. 1997). Some chum salmon may spawn in intertidal areas, with the presence of upwelling groundwater potentially being a preferred spawning location (Johnson et al. 1997). Salo (1991) reported that chum salmon prefer to spawn immediately above turbulent areas or where there was upwelling. Washington Department of Fish and Wildlife (WDFW) biologists reported that chum salmon in Washington most commonly use areas at the head of riffles (Crawford 1997). Chum salmon spawn in shallow, low gradient, low velocity streams and side channels (Salo 1991). The chum salmon shows little persistence in successfully passing falls or blockages. However, in some low gradient systems such as the Yukon River in Alaska or the Amur River in Russia, they have been documented to migrate up to 2,500 km inland (Johnson et al. 1997).

Egg hatching periods can range widely (from about 1.5 to 4.5 months), due to a large amount of variability in incubation environments (Meehan and Bjornn 1991; Johnson et al. 1997). Fry typically emerge from the gravel at night and immediately migrate downstream to estuarine waters (Salo 1991). Cues influencing the timing of downstream migration include time of adult spawning, stream temperature during egg incubation and after hatching, fry size and nutritional condition, population density, food availability, stream discharge volume and turbidity, physiological changes in the fry, tidal cycles, and day length (Salo 1991). In some populations, fry may spend a few days to several weeks in the stream and then move downstream to the ocean (Salo 1991; Johnson et al. 1997). Fry out-migration may take only a few hours or days where spawning sites are close to the mouths of rivers (Johnson et al. 1997). In Washington, Oregon, and British Columbia, migration to the estuary occurs from February through May with earlier migrations occurring to the south (Johnson et al. 1997). Chum salmon do not have the clearly defined smolt stages that occur in other salmonids; however, they are capable of adapting to seawater soon after emergence from the gravel (Johnson et al. 1997).

Juvenile chum salmon use estuaries to feed before starting their long-distance oceanic migrations. Chum and ocean-type Chinook salmon exhibit longer residence times in estuaries than do other anadromous salmonids (Healey 1982). Juvenile chum and pink salmon appear to occupy shallow sublittoral habitats before moving into neritic habitats (Johnson et al. 1997). In a summary of juvenile chum salmon diets from 16 estuaries, Simenstad et al. (1982) concluded that juvenile chum salmon less than 60 millimeters (mm) fork length fed on epibenthic food resources such as harpacticoid copepods, gammarid amphipods, and isopods, while juveniles greater than 60 mm fork length in neritic habitats fed on drift insects and calanoid copepods, larvaceans, and hyperiid amphipods. Migration within and out of estuaries appears to be related to the availability of prey (Johnson et al. 1997). As time passes and juvenile chum salmon get larger, they move into deeper habitats in the estuary or move offshore as they reach a size that allows them to feed on larger neritic plankton (Salo 1991). This movement occurs as inshore prey resources decline (Salo 1991).

Juvenile chum, sockeye, and pink salmon occur together along the coast of North America and Alaska in a band that extends out to 36 km (Hartt 1980). The chum and sockeye salmon juveniles migrate northerly, westerly and southwesterly along the coastal belt of the Gulf of Alaska, and tend to remain near shore (Salo 1991). As the chum salmon grow larger, they move offshore into the Gulf of Alaska where they remain and migrate through the gulf until they reach maturity and return towards their watershed of origin (Salo 1991). Chum salmon age at maturity appears to follow a latitudinal trend where a greater number of older fish occur in the northern latitudes of the species' range (NMFS 1998b). Mature adults return to watersheds of origin at various ages, usually at 3 to 5 years of age, with a majority maturing at 4 years of age (NMFS 1998b).

Status in the Action Area: Chum salmon use the marine nearshore and offshore areas for juvenile rearing and foraging, migration and adult foraging.

Designated Critical Habitat for Columbia River Chum and Hood Canal Summer Chum Salmon: Critical habitat was designated on 2 September 2005 (70 FR 52630) for the Columbia River chum salmon ESU and the Hood Canal summer chum.

Critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line (33 CFR 319.11). In areas where ordinary high-water line has not been defined, the lateral extent will be defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move onto the floodplain and is reached at a discharge that has a 0.5 to 1 annual exceedance probability. Critical habitat in lake areas is the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of ordinary high water, whichever is greater. In estuarine and nearshore marine areas, critical habitat includes areas contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters relative to mean lower low water.

Primary constituent elements.

Within these areas, the PCEs essential for the conservation of the Columbia River chum salmon and Hood Canal summer run chum salmon ESUs are those sites and habitat components that support 1 or more life stages, including the following:

PCE 1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

PCE 2. Freshwater rearing sites with:

(i) Water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility.

(ii) Water quality and forage supporting juvenile development.

(iii) Natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic side channels, and undercut banks.

PCE 3. Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

PCE 4. Estuarine areas free of obstruction and excessive predation with:

(i) Water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater.

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels.

(iii) Juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

PCE 5. Nearshore marine areas free of obstruction and excessive predation with:

(i) Water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

(ii) Natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

PCE 6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

Exclusion of Indian lands. Critical habitat does not include habitat areas on Indian lands. The Indian lands specifically excluded from critical habitat are those defined in the Secretarial Order, including the following:

1. Lands held in trust by the U.S. for the benefit of any Indian tribe.

2. Land held in trust by the U.S. for any Indian Tribe or individual subject to restrictions by the U.S. against alienation.

3. Fee lands, either within or outside the reservation boundaries, owned by the tribal government.

4. Fee lands within the reservation boundaries owned by individual Indians.

Land owned or controlled by the Department of Defense. Critical habitat does not include any areas subject to an approved Integrated Natural Resource Management Plan or associated with Department of Defense easements or right-of-ways. In areas within Navy security zones identified at 33 CFR 334 that are outside the areas described above, critical habitat is only designated within a narrow nearshore zone from the line of extreme high tide down to the line of mean lower low water.

STEELHEAD TROUT (*Oncorhynchus mykiss*)

Status: The Puget Sound steelhead DPS was listed as threatened on 25 September 2008 (73 FR 55451).

Threats: Threats to steelhead trout include grazing, water diversions, hydroelectric development, forestry and associated road building (Yee and Roelofs 1980; Platts 1981; Chamberlin 1982), contributing to habitat degradation (Busby et al. 1996), failure of natural stocks to replace themselves, genetic homogenization due to hatchery supplementation, and high harvest rates on steelhead smolts in rainbow trout fisheries.

Range: Steelhead trout occur from central California to the Bering Sea and Bristol Bay coastal streams of Alaska. Most streams in the Puget Sound region and many Columbia and Snake River tributaries have populations of steelhead trout (Pauley et al. 1986). Winter steelhead populations occur in the following Washington rivers: Sol Duc, Bogachiel, Hoh, Humptulips, Chehalis, Willapa, Cowlitz, Toutle, Kalama, Lewis, Washougal, Nisqually, Puyallup, Green, Snoqualmie, Skykomish, and Skagit (Pauley et al. 1986). Summer steelhead populations have been documented to occur in the following Washington rivers: Elwha, Queets, Wynochee, Cowlitz, Toutle, Kalama, Lewis, Washougal, Wind, White Salmon, Klickitat, Walla Walla, Snake, Yakima, Columbia, Wenatchee, Methow, Green, Skykomish, Stillaguamish, and Skagit (Pauley et al. 1986).

Habitat Requirements: Steelhead trout exhibits a great diversity of life history patterns, and are phylogenetically and ecologically complex with varying degrees of anadromy, differences in reproductive biology and plasticity of life history between generations (Busby et al. 1996). Different life history forms include anadromous and non-anadromous, winter or summer steelhead, inland or coastal groupings, and half-pounder strategies. Steelhead along with cutthroat trout can spawn more than once (iteroparity), whereas all other species of Oncorhynchus spawn once and then die (semelparity). North of Oregon, repeat spawning is relatively uncommon and more than 2 spawning migrations is rare. Iteroparity occurs predominantly in females (Busby et al. 1996). Anadromous forms can spend up to 7 years in freshwater and 3 years in the ocean prior to their first spawning (Busby et al. 1996).

In North America, steelhead trout is split into 2 phylogenetic groups, inland and coastal (Busby et al. 1996). These 2 groups both occur in Washington, Oregon and British Columbia (Busby et al. 1996), and are separated in the Columbia and Fraser systems in the vicinity of the crest of the Cascade Mountains (Reisenbichler et al. 1992).

Coastal steelhead occur in a diverse array of populations in Puget Sound, coastal Washington and the lower Columbia River with modest genetic differences between populations (Busby et al. 1996). Inland steelhead are represented only by populations in the Columbia and Fraser river basins, and consistent genetic differences have been found between populations in the Snake and Columbia rivers (Busby et al. 1996). Inland and coastal forms apply to both anadromous and non-anadromous forms, which means that rainbow trout east of the Cascades are genetically more similar to steelhead from east of the Cascades than they are to rainbow trout west of the Cascades (Busby et al. 1996). Researchers have documented large genetic differences between coastal and inland groups for anadromous and non-anadromous forms (Busby et al. 1996).

In Washington, coastal steelhead trout populations' age at maturity is typically 4 years: 2 years in freshwater and 2 years in the ocean. For Columbia River Basin inland populations, total age at maturity is 4 years with 2 years in freshwater, 1 year in the ocean and 1 year in freshwater as an adult prior to spawning (Busby et al. 1996). Steelhead trout with different run timing (summer or winter) in the same geographic area may be more genetically similar to each other than to fish from another area with similar run timing (Busby et al. 1996).

Steelhead have 2 basic reproductive ecotypes, based on the state of their sexual maturity at river entry and the durations of the spawning migration (Burgner et al. 1992). These reproductive ecotypes are 1) stream maturing or summer steelhead trout and 2) ocean maturing or winter steelhead (Busby et al. 1996). Summer steelhead trout enter fresh water from May to October in a sexually immature state, migrate upstream during the spring and summer, and hold in areas of protected cover such as deep pools, undercut banks, overhanging vegetation, large wood, or boulder structures until they become sexually mature. These summer steelhead do not spawn until the following spring (Pauley et al. 1986), so they hold over the fall and winter in freshwater.

Inland steelhead trout from the Columbia River basin and especially the Snake River Basin are split into 2 groups, A- and B-run steelhead trout. This split is based on a bimodal migration of adult steelhead at Bonneville Dam and differences in age at return, and adult size (Busby et al. 1996). Adult A-run steelhead trout enter freshwater from June to August, and have predominantly spent only l year in the ocean before returning to spawn (IDFG 1994). A-run steelhead trout occur throughout steelhead bearing streams in the Snake and Columbia river basins (IDFG 1994). Adult B-run steelhead trout enter freshwater from late August to October, and have predominantly spent 2 years in the ocean before returning to spawn (IDFG 1994). B-run steelhead trout are thought to reproduce only in the Clearwater, Mid-fork Salmon and South Fork Salmon Rivers in Idaho (IDFG 1994).

Winter steelhead enter their home stream in various stages of sexual maturation from November to April, and spawn within a few months of entering the river between late March and early May (Pauley et al. 1986). Winter steelhead trout are the more widespread of the 2 reproductive types. Winter steelhead are more prevalent in coastal streams and there are only a few occurrences of inland winter steelhead populations (Busby et al. 1996).

Some basins have both summer and winter steelhead present. Where they both occur, they are often separated by a seasonal hydrologic barrier such as a waterfall (Busby et al. 1996). It appears summer steelhead occur where habitat is not fully used by winter steelhead, and summer steelhead spawn further upstream than winter steelhead (Withler 1966; Roelofs 1983; Behnke 1992). Inland Columbia River Basin steelhead are almost exclusively summer steelhead; winter steelhead may have been excluded from the inland Columbia River by a seasonal barrier at Celilo Falls or the great migration distance from the ocean (Busby et al. 1996).

Some steelhead trout exhibit a “half-pounder” life history strategy. Half-pounder are immature steelhead trout that return to freshwater after only 2 to 4 months in the ocean (Busby et al. 1996). These steelhead trout overwinter in freshwater and outmigrate again the following spring. Researchers have reported occurrence of half-pounder steelhead in southern Oregon and northern California rivers (Barnhart 1986).

Non-anadromous forms of steelhead trout are called rainbow or redband trout. For example, the inland non-anadromous form is typically called the Columbia River redband trout (Busby et al. 1996). Non-anadromous and anadromous steelhead trout co-occur more often within inland populations than in coastal populations (Busby et al. 1996). Within coastal populations where anadromous and non-anadromous co-occur, the forms are usually separated by a migration barrier, either natural or human-made (Busby et al. 1996).

Where the 2 forms of steelhead trout co-occur, offspring of resident fish may migrate to sea, and offspring of anadromous steelhead may remain in streams as resident fish (Burgner et al. 1992; Shapolov and Taft 1954). Mullan et al. (1992) found evidence that due to very cold stream temperatures, juvenile steelhead had difficulty attaining size for smoltification in the Methow River, Washington and concluded that most of the juvenile fish present that do not emigrate downstream early in life do not grow enough due to the cold temperatures and are hence restricted to a resident life history, regardless of anadromous or non-anadromous parents.

After hatching and emergence, steelhead move to deeper parts of the stream, establish territories and change their prey preference from microscopic aquatic organisms to larger organisms such as isopods, amphipods and aquatic and terrestrial insects, primarily associated with the stream bottom (Wydoski and Whitney 1979). During rearing, streamside vegetation and submerged cover (logs, rocks, and aquatic vegetation) are important. Cover provides food, temperature stability, protection from predators, and densities of juvenile steelhead are highest in areas containing instream cover (Narver 1976; Reiser and Bjornn 1979; Johnson 1985). Juvenile steelhead trout remain in freshwater for 1 to 4 years before smoltification. In areas where anadromous and non-anadromous steelhead trout co-occur in sympatry, habitat partitioning occurs (Allee 1981). Smoltification may be initiated by environmental factors such as photoperiod, water temperature and water chemistry (Folmar and Dickhoff 1980; Wedemeyer et al. 1980).

Steelhead trout remain in the ocean for 2 to 3 years, occasionally for 4 years (Shapolov and Taft 1954). Distribution in the ocean is hard to track due to lack of schooling behavior, and steelhead trout do not use areas where commercial harvest of other Pacific salmon stocks occur (Pauley et al. 1986). Distribution at sea appears to associate with surface water temperature and conforms closely to the 5°C isotherm on the North and the 15°C isotherm to the south (Sutherland 1973).

Critical Habitat: On 24 February 2016, NMFS designated critical habitat for Puget Sound steelhead (78 FR 2726). It relied on the biology and life history of steelhead to determine the physical or biological habitat features essential to their conservation. These features include sites essential to support 1 or more life stages of Puget Sound steelhead (sites for spawning, rearing, migration and foraging) and in turn contained physical or biological features essential to the conservation of Puget Sound steelhead (for example, spawning gravels, water quality and quantity, side channels, forage species). Specific types of sites and the features include the following PCEs:

PCE 1. Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development.

PCE 2. Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.

PCE 3. Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

PCE 4. Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.

PCE 5. Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

PCE 6. Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

NORTH AMERCAN GREEN STURGEON (*Acipenser medirostris*)

Status: The southern DPS of green sturgeon was listed as threatened on 7 April 2006 (71 FR 17757).

Threats: Concentration of spawning, bycatch in the white sturgeon fishery, entrainment of juveniles at State and Federal pumping facilities in the Sacramento River delta, and loss of spawning habitat.

Range: The southern DPS of green sturgeon spawns in the Sacramento River (Adams et al. 2002) and occurs along the west coast of Mexico, the U.S., and Canada. They enter estuaries in Washington during summer when estuary water temperatures are more than 2°C warmer than adjacent coastal water (Moser and Lindley 2007).

Biology and Habitat Requirements: Green sturgeon are anadromous, and when not spawning, spend the majority of their lives in oceanic waters, bays, and estuaries. Early life-history stages reside in fresh water, with adults returning to freshwater to spawn. Sturgeon spawn every 2 to 5 years (Moyle et al. 1992). Adults typically migrate into freshwater beginning in late February; spawning occurs from March to July, with peak activity from April to June (Moyle et al. 1995). Juvenile green sturgeon spend 1 to 4 years in fresh and estuarine waters before dispersal to saltwater (Beamesderfer and Webb 2002). They disperse widely in the ocean after their out-migration from freshwater (Moyle et al. 1992).

Diet information for adult green sturgeon is sparse, but indicates key food sources as benthic invertebrates, including shrimp, mollusks, and amphipods, as well as small fish (Moyle et al. 1992).

Critical Habitat: On 9 October 2009, NMFS designated critical habitat for the Southern DPS of green sturgeon (74 FR 52300).

NMFS designated the following areas as critical habitat in Washington:

1. Coastal U.S. marine waters within 360 feet depth north to Cape Flattery, Washington, including the Strait of Juan de Fuca, to the U.S. border with Canada.

2. The lower Columbia River estuary.

3. Willapa Bay and Grays Harbor, Washington.

Primary constituent elements of critical habitat are areas containing the physical and biological habitat features essential for the conservation of the species and that may require special management considerations or protection. Primary constituent elements may include, but are not limited to the spawning sites, feeding sites, seasonal wetland or dryland, water quality or quantity, geological formation, vegetation type, tide, and specific soil types. Only areas that contain 1 or more PCEs are, by definition, critical habitat. The different systems occupied by green sturgeon at specific stages of their life cycle serve distinct purposes and thus may contain different PCEs. Based on the best available scientific information, NMFS identified PCEs for freshwater riverine systems (freshwater riverine systems in Washington are not designated as critical habitat), estuarine areas, and nearshore marine waters. Estuarine areas have the following PCEs:

PCE 1. Abundant prey items within estuarine habitats and substrates for juvenile, subadult, and adult life stages.

PCE 2. Within bays and estuaries adjacent to the Sacramento River, sufficient flow into the bay and estuary to allow adults to successfully orient to the incoming flow and migrate upstream to spawning grounds.

PCE 3. Water quality, including temperature, salinity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages.

PCE 4. A migratory pathway necessary for the safe and timely passage of Southern DPS fish within estuarine habitats and between.

PCE 5. A diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages.

PCE 6. A diversity of depths necessary for shelter, foraging, and migration of juvenile, subadult, and adult life stages.

PCE 7. Sediment quality necessary for normal behavior, growth, and viability of all life stages.

Nearshore marine area PCEs are the following:

PCE 1. Abundant prey items for subadults and adults, which may include benthic invertebrates and fish.

PCE 2. Coastal marine waters with adequate dissolved oxygen levels and acceptably low levels of contaminants.

PCE 3. A migratory pathway necessary for the safe and timely passage of Southern DPS fish within marine and between estuarine and marine habitats.

BOCACCIO ROCKFISH (*Sebastes paucispinis*)

Status: The Georgia Basin bocaccio rockfish was listed as endangered on 28 April, 2010 (75 FR 22276).

Threats: Threats to Bocaccio rockfish include areas of low dissolved oxygen within their range, the potential for continued losses as bycatch in recreational and commercial harvest, and the reduction of kelp habitat necessary for juvenile recruitment and low intrinsic productivity.

Range: Bocaccio are large piscivorous rockfish (of the scorpaenid family) ranging in eastern Pacific coastal waters from Stepovac Bay, Alaska, to Punta Blanca, Baja California (COSEWIC 2002; NMFS 2008). Most commonly, bocaccio occur from Oregon to California and were once common on steep walls of Puget Sound (Love et al. 2002). Genetic studies suggest that there are 2 DPSs of coastal bocaccio consisting of northern (north of the Oregon/California border) and southern (California south). However, based on the limited mobility and typical travel distance of rockfish species, it was determined that the Georgia Basin represented a third DPS for the species (NMFS 2008).

Biology and Habitat Requirements: Bocaccio are most notably identified by a large jaw that extends often past the eye. They can range in color from olive orange to burnt orange or brown on the back. Bocaccio are among the largest rockfish, reaching up to 36 inches long and living up to 55 years. Other names for bocaccio include rock salmon, salmon rockfish, Pacific red snapper, Pacific snapper, and Oregon snapper (Stanley et al. 2001).

Male bocaccio are smaller than females and mature slightly earlier, between ages 3 and 7. Females typically mature between ages 4 and 8 (Wyllie-Echeverria 1987). At maturity, males range from 16.5 to 21.6 inches (42 to 55 cm) long, while females are 18.9 to 23.6 inches (48 to 60 cm). Northern populations reach maturity at later ages (NMFS 2008). Bocaccio, as with all rockfish are livebearers. Females produce anywhere from 20,000 to 2,298,000 eggs annually. Spawning occurs in the fall between August and November; in the Georgia Basin, this occurs in October and November (Table 1). Embryonic development takes about 1 month. In Washington, females release larvae in January through April (in the Georgia Basin, this occurs in February through April), peaking in February (NMFS 2008).

Table 1 Lifestage, Water Column, and Timing of Bocaccio in the Georgia Basin

Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Copulation/Fertilization										■	▒	
Embryonic Development												■
Larval Release		■	▒	▒								
Pelagic Juveniles			▒	▒	▒	▒	▒	▒				
Settlement of Juveniles								■	■	▒	▒	▒

Notes:
Table from NMFS 2008
Gray shading = range
Black shading = peak

Larvae are 4 to 5 mm (less than 0.2 inch) long at release, are well developed, and have functional organs and the ability to swim and regulate buoyancy (NMFS 2008). Larvae readily disperse and are generally associated with surface waters and drifting kelp mats (NMFS 2009). The larvae metamorphose into pelagic juveniles after 3.5 to 5.5 months (typically 155 days) and settle to shallow, algae covered rocky areas or eelgrass and sand over several months (Love et al. 1991). They may school in these nearshore waters (MacCall and He 2002). As the juveniles age into adulthood, the fish move into deeper waters where they appear on rocky reefs and near oil platforms. Tagging data indicates that juveniles will migrate as much as 92 miles (0.9 to 148 km) within 2 years of tagging (NMFS 2008). However, once bocaccio reach adulthood, they settle and remain relatively localized as they age.

Bocaccio will make short forays outside home ranges or vertically in the water column to feed (COSEWIC 2002; NMFS 2008). Adults are most commonly found in waters between 164 and 820 feet deep, but can inhabit waters 39 to 1,568 feet deep (NMFS 2008). Although rockfish are generally associated with hard substrates, bocaccio are found on nearly all types of substrate. They are typically not associated with the bottom and tend to be more pelagic than other rockfish species (NMFS 2009).

The diet of the larval bocaccio consists of larval krill, diatoms, and dinoflagellates. Pelagic juveniles continue to be planktivores, eating fish larvae, copepods, krill, and other small prey. As adults, bocaccio are piscivorous and eat other rockfish, hake, sablefish, anchovies, lanternfish, and squid. Chinook salmon, terns, and harbor seals are predators of bocaccio (Love et al. 2002).

YELLOWEYE ROCKFISH (*Sebastes ruberrimus*)

Status: The Georgia Basin yelloweye rockfish was listed as threatened on 28 April 2010 (75 FR 22276).

Threats: Threats to yelloweye rockfish include low intrinsic productivity combined with continuing threats from bycatch in commercial and recreational harvest, loss of near shore habitat, chemical contamination, and areas of low dissolved oxygen increase the extinction risk of this species.

Biology and Habitat Requirements: Yelloweye rockfish are among the longest-lived in the scorpaenid family (rockfish), living up to 118 years (NMFS 2009). They are among the largest (up to 25 pounds) and most noticeable, with bright yellow eyes and red-orange coloring. Yelloweye rockfish have other common names of rock cod, red snapper, rasphead rockfish, red cod, and turkey-red rockfish. This species ranges from northern Baja California to the Aleutian Islands in Alaska. Most commonly, yelloweye rockfish dwell between central California and the Gulf of Alaska, but are rare in Puget Sound proper south of Admiralty Inlet (NMFS 2008; Love et al. 2002). When observed, yelloweye rockfish are recorded more frequently in north Puget Sound than in south Puget Sound (Miller and Borton 1980), likely due to the larger amount of rocky habitat in north Puget Sound.

Yelloweye rockfish appear consistently throughout the Georgia Basin. However, significantly higher observation frequencies occur in north Puget Sound and the Georgia Strait within British Columbian waters. REEF surveys indicate the further south in Puget Sound, the lower the potential for yelloweye rockfish presence or use, except around Decatur Island in the San Juan Islands where there is a spike in observations (REEF 2013). This is likely due to the fewer areas of rocky habitat in southern Puget Sound (Miller and Borton 1980). General distribution occurs in the Georgia Strait and around the Gulf Islands in British Columbia (Yamanaka et al. 2006; NMFS 2008; REEF 2013). Between 2000 and 2008, WDFW recreational catch surveys have documented a progressive decline in the number of yelloweye rockfish caught (WDFW 2009). In 2000, WDFW recorded approximately 5,800 individuals in recreational catches. By 2008, recorded catches were fewer than 1,000 fish (WDFW 2009).

As with other rockfish species, juveniles inhabit shallow waters and move deeper as they age. Juveniles are found throughout the lifestage between 49 and 1,801 feet deep (NMFS 2008). As juveniles settle, they move into high relief areas, crevices, and sponge gardens (NMFS 2009; Love et al. 1991). Adults typically reside at depths between 300 and 590 feet (NMFS 2008). The adult yelloweye rockfish tend toward rocky, high relief zones (NMFS 2009). The adults have small home ranges, generally site attached and affiliated with caves, crevices, bases of rocky pinnacles, and boulder fields (Richards 1986). Adult yelloweye rockfish rarely congregate, and more commonly appear as solitary individuals (Love et al. 2002; PFMC 2004).

Males have slightly larger mean sizes than females, with both sexes topping out at approximately 35 inches (NMFS 2008). Yelloweye rockfish attained maturity much later than some rockfish, between 15 and 20 years and as early as 7 years (NMFS 2008). Sperm is stored in males for many months (September to April) prior to fertilization. Females can produce up to 300 eggs per gram of body weight, which totals between 1.2 and 2.7 million eggs per cycle (Hart 1973). In Puget Sound/Georgia Basin, eggs are fertilized between spring and summer months (NMFS 2009). Parturition occurs in early spring through late summer. Although rockfish typically spawn once per year, there is some evidence that yelloweye rockfish in Puget Sound spawn up to twice per year (Washington et al. 1978). Larvae remain pelagic for 2 months or more and then begin to settle to deeper waters (NMFS 2008). Although the specific larval duration is unknown, it is assumed similar to that of bocaccio or canary rockfish (116 to 155 days) (NMFS 2009). Settling size is slightly less than 1 inch. Timing for various rockfish lifestages in the Georgia Basin is given in Table 2.

Table 2 Lifestage, Water Column, and Timing of Yelloweye Rockfish in the Georgia Basin

Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Copulation/Fertilization			■	■	▒	▒	▒					
Embryonic Development					■	▒	▒	▒				
Larval Release					■	■	▒	▒	▒			
Pelagic Juveniles							■	■	▒	▒		
Settlement of Juveniles								▒	▒	▒		

Notes:
Table from NMFS 2008
Gray shading = range
Black shading = peak

Yelloweye rockfish have a diverse diet and are typically opportunistic feeders (NMFS 2008). As larvae and juveniles, they typically eat larval krill, diatoms, dinoflagellates, fish larvae, copepods, and krill. Prey size increases and diversifies as yelloweye rockfish age (due to their large size) to include small yelloweye rockfish, sand lance, gadids, flatfishes, shrimp, crabs, and gastropods. Typical predators of yelloweye rockfish include salmon and orcas (Love et al. 2002; NMFS 2009).

CANARY ROCKFISH (*Sebastes pinniger*)

Status: The Georgia Basin canary rockfish was listed as threatened on 28 April 2010 (75 FR 22276).

Threats: Threats to canary rockfish include low intrinsic productivity combined with continuing threats from bycatch in commercial and recreational harvest, loss of near shore habitat, chemical contamination, and areas of low dissolved oxygen increase the extinction risk of this species.

Biology and Habitat Requirements: Canary rockfish (of the scorpaenid family) are located from the western Gulf of Alaska to northern Baja California. The species is most common in outer coastal waters between British Columbia and California (NMFS 2008). No published studies are available on the genetic structure of canary rockfish stocks and differentiation between Puget Sound and coastal individuals (NMFS 2008). However, based on similarity of genetic differences between the 2 regions in other rockfish species, NMFS determined that canary rockfish likely have 2 DPSs, separating coastal and Puget Sound/Georgia Basin populations. Canary rockfish are primarily orange with a pale gray or white background and can live up to 84 years (NMFS 2009). Other common names include rock cod and orange rockfish.

Canary rockfish were once common in Puget Sound (Holmberg et al. 1967). Historically, canary rockfish were most common in southern Puget Sound (NMFS 2009). Canary rockfish observations have been declining since 1965 and catch rate reductions are reported consistently in catch surveys today (NMFS 2008). REEF surveys indicate 1 to 2% of rockfish captured in Puget Sound proper (south of Admiralty Inlet) are canary rockfish. This percentage is slightly higher at 2 to 5% in north Puget Sound (around San Juan Islands and Georgia Strait). The majority of canary rockfish are reported in catch surveys and trawl data from the Strait of Juan de Fuca and around Vancouver Island (DFO 2008 *as cited in* NMFS 2008). Washington REEF surveys between 1996 and 2009 suggest that canary rockfish are observed most consistently in northern waters of Puget Sound, the Strait of Juan de Fuca, and the outer coast (Table 3).

Table 3 Observations and Distribution of Canary Rockfish in Inland Washington Waters during REEF Surveys between January 1996 and May 2009

Survey Area	Individual Sighting Frequency[1]	YOY Sighting Frequency[1]
Strait of Georgia	0.8	-
Gulf Islands (N. of Orcas Island)	2.3	-
Saanich Inlet (Eastern Vancouver Is.)	1.1	-
Strait of Juan de Fuca	6.3	-
W of Discovery Island – Albert Head, Victoria	6.9	-
W of Christopher Point – Possession Point	14.3	-
Hood Canal	3.4	-
Dabob Bay	8.1	-
Quatsap Pt/Misery Pt – Potlatch State Park	1.6	-
Mt Vernon/Everett	0.3	0.1
Whidbey Island	0.3	0.2
Seattle/Olympia	0.3	0.0
Vashon Island	1.9	-
West Seattle	0.5	0.3
Tacoma	0.2	-

Survey Area	Individual Sighting Frequency[1]	YOY Sighting Frequency[1]
Olympic Peninsula	6.8	0.6
Kydaka Point - Cape Flattery	10.9	1.0
Kitsap Peninsula/Sound Sound	0.5	-
Kitsap Peninsula	0.9	-
Cape Flattery – North Columbia River	18.5	-
Cape Flattery – Cape Alava	18.5	-

Notes:
Table from REEF 2013
1 Sighting frequency represents the percentage of surveys conducted that contained individuals of canary rockfish. Individual = adults and juveniles combined. YOY = young of year only

The majority of female canary rockfish are mature by age 7 to 9, while males mature by age 7 to 12 (Wyllie-Echeverria 1987; NMFS 2008). At maturity, males range from 16.0 to 18.9 inches (41 to 48 cm) long, while females are 13.7 to 17.7 inches (35 to 45 cm). Northern populations of the species reach maturity at later ages (NMFS 2008). As with all rockfish, canary rockfish are livebearers. Females produce 260,000 to 1,900,000 eggs annually, with eggs production directly related to fish length. Copulation and fertilization occur in the fall between September and December (Table 4). Embryonic development takes about 1 month. In Oregon and Washington, parturition occurs between September and March (in the Georgia Basin, this generally occurs in December and January), peaking in December and January (NMFS 2008).

Larvae and juveniles typically occupy the upper water column and surface waters. However, occasional observations of juveniles have occurred at depths to 2,750 feet (Love et al. 2002). The larval stage lasts for 1 to 4 months (typically 166 days) in the top 328 feet of the water column until reaching approximately 0.72 inch long (NMFS 2008b; NMFS 2009). Juveniles settle into tide pools, rocky reefs, kelp beds, low rock, and cobble areas (Miller and Geibel 1973; Love et al. 1991; Love et al. 2002). Juveniles exhibit diel migratory patterns by hanging in groups near the rock/sand interface at shallow depths during the day and moving to sandy areas at night (Love et al. 2002). At approximately 3 years, juveniles begin to move deeper onto rocky reefs.

Table 4 Lifestage, Water Column, and Timing of Canary Rockfish in the Georgia Basin

Lifestage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Copulation/Fertilization												
Embryonic Development												
Larval Release												
Pelagic Juveniles												
Settlement of Juveniles												

Notes:
Table from NMFS 2008
Gray shading = range
Black shading = peak

Canary rockfish adults are generally associated with hard bottom areas and along rocky shelves and pinnacles (NMFS 2008). They usually occur at or near the bottom (PFMC 2004). Adults tend to be in dense schools leading to patchy distribution (Stewart 2007). Canary rockfish adults appear to be somewhat migratory and will travel as much as 435 miles over several years (NMFS 2008). The migration is seasonal, with more distance traveled in late winter than in summer months (NMFS 2008). Relying on the Palsson et al. (2009) estimate of 40,683 rockfish in Puget Sound proper and a 0.76% frequency rate, NMFS estimates that there are about 300 individual canary rockfish in Puget Sound proper (south of Admiralty Inlet), while northern Puget Sound (north of Admiralty Inlet) has slightly higher frequencies (NMFS 2009).

Larvae feed primarily on nauplii, invertebrate eggs, and copepods (Love et al. 2002; NMFS 2008). Canary rockfish juveniles are zooplanktivorous, feeding on small crustaceans, cyprid barnacles, euphasiid eggs and larvae, and juvenile polychaetes (Gaines and Roughgarden 1987; NMFS 2008). Adults feed on euphasiids, crustaceans, and small fish such as short belly rockfish, mytophids, and stomiatids (NMFS 2008). Canary rockfish predators include sharks, salmon, lingcod, yelloweye rockfish, porpoises, and seals (NMFS 2008).

Critical Habitat for Bocaccio, Canary, and Yelloweye Rockfish: Critical Habitat for bocaccio, canary, and yelloweye rockfish was designated on 13 November 2014 (79 FR 68042). Approximately 610 square miles of nearshore habitat for canary rockfish and bocaccio, and 574.8 square miles of deepwater habitat for yelloweye rockfish, canary rockfish, and bocaccio were proposed within the geographical area of the DPSs occupied by each species. Aside from some deepwater areas proposed as critical habitat for rockfish in Hood Canal, all other proposed critical habitat overlaps with designated critical habitat for other ESA listed species. Other co-occurring ESA-listed species with designated critical habitat that, collectively, almost completely overlap with proposed rockfish critical habitat include Pacific salmon (70 FR 52630, 2 September 2005), North American green sturgeon (74 FR 52300, 9 October 2009), Southern Resident Killer Whales (71 FR 69054, 29 November 2006), and bull trout (75 FR 63898, October 18, 2010). The areas proposed for designation are all within the geographical area occupied by the species and contain physical and biological features essential to the conservation of the species and that may require special management considerations or protection. All of the areas proposed for designation have high conservation value (NMFS, 2013).

Physical or Biological Features Essential to Conservation: Based on the best available scientific information regarding natural history and habitat needs, a list of physical and biological features essential to the conservation of adult and juvenile yelloweye rockfish, canary rockfish, and bocaccio and relevant to determining whether proposed specific areas are consistent with the above regulations and the ESA section (3)(5)(A) definition of “critical habitat”. Critical habitat for larval yelloweye rockfish, canary rockfish, and bocaccio was not proposed due to a lack of basic information. The physical or biological features essential to the conservation of yelloweye rockfish, canary rockfish, and bocaccio fall into major categories reflecting key life history phases.

Physical or Biological Features Essential to the Conservation of Adult Canary Rockfish and Bocaccio, and Adult and Juvenile Yelloweye Rockfish

Benthic habitats or sites deeper than 30 meters (98ft) that possess or are adjacent to areas of complex bathymetry consisting of rock and or highly rugose habitat are essential to conservation because these features support growth, survival, reproduction, and feeding opportunities by providing the structure for rockfish to avoid predation, seek food, and persist for decades. Several attributes of these sites determine the quality of the habitat and are useful in considering the conservation value of the associated feature and whether the feature may require special management considerations or protection. These attributes are relevant in the evaluation of the effects of a proposed action in a section 7 consultation if the specific area containing the site is designated as critical habitat. These attributes include the following:

1. Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities.

2. Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.

3. The type and amount of structure and rugosity that supports feeding opportunities and predator avoidance.

Physical and Biological Features Essential to the Conservation of Juvenile Canary Rockfish and Bocaccio

Juvenile settlement habitats located in the nearshore with substrates such as sand, rock and/or cobble compositions that support kelp (families Chordaceae, Alariaceae, Lessoniacea, Costariaceae, and Laminaricea) are essential for conservation because these features enable forage opportunities and refuge from predators and enable behavioral and physiological changes needed for juveniles to occupy deeper adult habitats. Several attributes of these sites determine the quality of the area and are useful in considering the conservation value of the associated feature. These attributes include the following:

1. Quantity, quality, and availability of prey species to support individual growth, survival, reproduction, and feeding opportunities.

2. Water quality and sufficient levels of dissolved oxygen to support growth, survival, reproduction, and feeding opportunities.

PACIFIC EULACHON (Thaleichthys pacificus)

Status: The southern DPS of Pacific eulachon was listed as threatened on 18 March 2010 (75 FR 13012).

Threats: Threats to eulachon include modification of spawning substrate due to dams and water diversions, bycatch in the shrimp trawl fisheries, climate change, and loss of spawning grounds because adults cannot access to spawning ground upstream of dams.

Biology and Habitat Requirements: Eulachon (also called Columbia River smelt, candlefish, or hooligan) are a member of the osmerid family (smelts) and are endemic to the northeastern Pacific Ocean, ranging from northern California to southwest and south-central Alaska and into the southeastern Bering Sea. The southern DPS of eulachon consists of populations spawning in rivers south of the Nass River in British Columbia, Canada, to, and including, the Mad River in California. Within this range, major production areas or “core populations” for this species include the Columbia River and Frasier River.

Table 5 Eulachon Spawning and Estuarine Areas in Washington

Eulachon Spawning Areas	Spawning Regularity[1]	Estuary
Columbia River Mainstem	Regular	Columbia River
Grays River	Regular	Columbia River
Skamokawa Creek	Rare	Columbia River
Elochoman River	Irregular	Columbia River

Eulachon Spawning Areas	Spawning Regularity[1]	Estuary
Cowlitz River	Regular	Columbia River
Toutle River	Rare	Columbia River
Kalama River	Regular	Columbia River
Lewis River	Regular	Columbia River
Washougal River	Rare	Columbia River
Klickitat River	Anecdotal	Columbia River
Bear River	Occasional	Willapa Bay
Naselle River	Occasional	Willapa Bay
Nemah River	Rare	Willapa Bay
Wynoochee River	Rare	Grays Harbor
Quinault River	Occasional	Washington Coast
Queets River	Occasional	Washington Coast
Quillayute River	Rare	Washington Coast
Elwha River	Occasional	Strait of Juan de Fuca
Puyallup River	Rare	Puget Sound

Notes:
Table from Gustafson et al. 2010
1 Regular – occurring yearly or in most years
Rare, Irregular, Anecdotal, Occasional – sporadic, infrequent occurrence, does not occur every year and may not occur in most years, especially those rivers with a spawning regularity of "rare." Eulachon are described as "common" in Grays Harbor and Willapa Bay on the Washington coast, and "abundant" in the Columbia River (Gustafson et al. 2010).

The Columbia River and its tributaries support the largest eulachon run in the world (Gustafson et al. 2010). Within the Columbia River Basin, the major and most consistent spawning runs return to the mainstem of the Columbia River (from just upstream of the estuary, river mile (RM) 25, to immediately downstream of Bonneville Dam, RM 146, and the Cowlitz, Grays, Kalama and Lewis Rivers. Table 5 details all known eulachon spawning areas in Washington, based on the 2008 Eulachon Status Review (Gustafson et al. 2010).

Eulachon typically spend 3 to 5 years in saltwater before returning to fresh water to spawn from late winter through early summer. River entry and spawning begin as early as December and January in the Columbia River Basin and last through May with peak entry and spawning during February and March (see Table 6; WDFW and ODFW 2001; Gustafson et al. 2010; Shaffer et al. 2007). Entry into the spawning rivers appears to be related to water temperature and the occurrence of high tides (Ricker et al. 1954; Smith and Saalfeld 1955; Spangler 2002), although eulachon have been observed ascending well beyond tidally influenced areas (Willson et al. 2006; Lewis et al. 2002).

Spawning grounds are typically in the lower reaches of larger rivers fed by snowmelt (Hay and McCarter 2000). Spawning typically occurs at night. Spawning occurs at temperatures from 4° to 10°C in the Columbia River and tributaries (WDFW and ODFW 2001). In the Cowlitz River, spawning typically occurs at temperatures from 4° to 7°C (Smith and Saalfeld 1955). Eulachon broadcast spawn over sand, coarse gravel, or detrital substrates. Preferred spawning habitat consists of coarse, sandy substrates (WDFW and ODFW 2001). In Washington, most eulachon are found in the Columbia River basin; spawning runs also occur in some coastal rivers and tributaries to Puget Sound (Emmett et al. 1991; Willson et al. 2006).

Table 6 Range and Peak Timing of Documented Washington River-entry and/or Spawn-timing for Eulachon

Basin	Source	December	January	February	March	April	May
Columbia Basin							
Columbia River	1						
Cowlitz River	1						
Juan de Fuca							
Elwha River	2						

Notes:
Gray shading = range
Black shading = peak
Table from Gustafson et al. 2010
1 WDFW and ODFW 2001
2 Shaffer et al. 2007

Eggs are fertilized in the water column, sink, and adhere to the river bottom typically in areas of gravel and coarse sand. Approximately 7,000 to 31,000 eggs are laid, depending on the size of the female (WDFW and ODFW 2001). Eggs are spherical and 1 mm in diameter (WDFW and ODFW 2001). Eulachon eggs hatch in 20 to 40 days, with incubation time dependent on water temperature. Within days of hatching, the larvae, ranging from 4 to 8 mm long, are rapidly carried downstream and dispersed by estuarine and ocean currents. Eulachon larvae are found in the scattering layer of nearshore marine areas when they reach the sea (Morrow 1980). Juveniles rear in nearshore marine areas at moderate or shallow depths, and acquire lengths of 46 to 51 mm within 8 months (Barraclough 1964). As eulachon grow, they migrate out to deeper water and occur as deep as 625 meters (Allen and Smith 1988). Adult eulachon range in size from 14 to 30 centimeters and return to freshwater to spawn at 3 to 5 years of age, with the majority of adults returning as 3-year-olds (WDFW and ODFW 2001). Although adults can repeatedly spawn, most die shortly after spawning (WDFW and ODFW 2001).

Similar to salmon, juvenile eulachon likely imprint on the chemical signature of their natal river basins. However, juvenile eulachon spend less time in freshwater environments than do juvenile salmon. Researchers believe that this short freshwater residence time may cause returning eulachon to stray more from their natal spawning sites than salmon (Hay and McCarter 2000). This short freshwater residence time may result from the spawning grounds occurring in snowmelt-fed rivers that have a pronounced peak freshet in the spring, rapidly flushing eggs and larvae out of the spawning river reach. As such, eulachon may tend to imprint and home in on the larger local estuary rather than to individual spawning rivers (Hay and McCarter 2000).

Eulachon feed on zooplankton, primarily eating crustaceans such as copepods and euphausiids, including *Thysanoessa* spp. (Barraclough 1964; Hay and McCarter 2000), unidentified malacostraceans (Sturdevant et al. 1999), and cumaceans (Smith and Saalfeld 1955). Eulachon larvae and post-larvae eat phytoplankton, copepods, copepod eggs, mysids, barnacle larvae, worm larvae, and eulachon larvae (WDFW and ODFW 2001). Adults and juveniles commonly forage at moderate depths (15 to 182 m) in inshore waters (Hay and McCarter 2000).

Eulachon are very important to the Pacific coastal food web due to their availability during spawning runs and their high lipid content. Avian predators include harlequin ducks, pigeon guillemots, common murres, mergansers, cormorants, gulls, and eagles. Marine mammal predators include baleen whales, orcas, dolphins, pinnipeds, and beluga whales. Fish that feed on eulachon include white sturgeon, spiny dogfish, sablefish, salmon sharks, arrowtooth flounder, salmon, Dolly Varden, Pacific halibut, and Pacific cod. Eulachon and their eggs provide a significant food source for white sturgeon in the Columbia River.

Critical Habitat: Critical habitat was designated for the southern DPS of eulachon on 20 October 2011 (76 FR 65324). In freshwater areas, critical habitat includes the stream channel and a lateral extent as defined by the ordinary high-water line (33 CFR 329.11). In areas where the ordinary high-water line has not been defined, the lateral extent is defined by the bankfull elevation. Bankfull elevation is the level at which water begins to leave the channel and move onto the floodplain and is reached at a discharge that generally corresponds to a 0.5 to 1 annual exceedance probability. In estuarine areas, critical habitat includes tidally influenced areas as defined by the elevation of mean higher high water.

Physical or biological features essential for conservation. The physical or biological features essential for conservation of the southern DPS of eulachon are the following:

1. Freshwater spawning and incubation sites with water flow, quality, and temperature conditions and substrate supporting spawning and incubation.

2. Freshwater and estuarine migration corridors free of obstruction and with water flow, quality, and temperature conditions supporting larval and adult mobility, and with abundant prey items supporting larval feeding after the yolk sac is depleted.

3. Nearshore and offshore marine foraging habitat with water quality and available prey, supporting juveniles and adult survival.

Indian lands. Critical habitat does not include any Indian lands of the following federally recognized Tribes in the States of California, Oregon, and Washington:

1. Lower Elwha Tribe, Washington.
2. Quinault Tribe, Washington.
3. Yurok Tribe, California.
4. Resighini Rancheria, California.

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