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Appendix B

Species Descriptions

Appendix B - Species Descriptions

Birds:

Bald eagle *(Haliaeetus leucocephalus)*[1]

Status: In 1978, the bald eagle was federally listed throughout the lower 48 States as endangered except in Michigan, Minnesota, Wisconsin, Washington, and Oregon, where it was designated as threatened (USDI, 1978). In July, 1995, the USFWS reclassified the bald eagle to threatened throughout the lower 48 states. Bald eagle populations have increased in number and expanded their range. The improvement is a direct result of recovery efforts including habitat protection and the banning of DDT and other persistent organochlorines. The 1996 information provided by the Washington Department of Fish and Wildlife (WDFW, unpub. data) indicates that 589 nests were known to be occupied and 0.93 young/nest were produced. This is well above the recovery goal of 276 pairs for Washington, but below the recovery criteria of an average of 1.00 young/nest.

Habitat loss continues to be a long-term threat to the bald eagle in the Pacific Recovery Area of Washington, Idaho, Nevada, California, Oregon, Montana, and Wyoming. Urban and recreational development, logging, mineral exploration and extraction, and other forms of human activities are adversely affecting the suitability of breeding, wintering, and foraging areas.

In July 1999, the USFWS proposed to de-list the bald eagle.

Range*:* The bald eagle is found throughout North America. The largest breeding populations in the contiguous United States occur in the Pacific Northwest states, the Great Lakes states, Chesapeake Bay and Florida. The bald eagle winters over most of the breeding range, but is most concentrated from southern Alaska and southern Canada southward.

Habitat Requirements: In Washington, bald eagles are most common along the coasts, major rivers, lakes and reservoirs (USFWS, 1986). Bald eagles require accessible prey and trees for suitable nesting and roosting habitat (Stalmaster, 1987). Food availability, such as aggregations of waterfowl or salmon runs, is a primary factor attracting bald eagles to wintering areas and influences the distribution of nests and territories (Stalmaster, 1987; Keister et al., 1987).

Bald eagle nests in the Pacific Recovery Area are usually located in uneven-aged stands of coniferous trees with old-growth forest components that are located within I mile of large bodies of water. Factors such as relative tree height, diameter, species, form, position on the surrounding topography, distance from the water, and distance from disturbance appear to influence nest site selection. Nests are most commonly constructed in Douglas-fir or Sitka spruce trees, with average heights of 116 feet and

[1] from USFWS, 1999.

size of 50 inches dbh (Anthony et al., 1982 in Stalmaster, 1987). Bald eagles usually nest in the same territories each year and often use the same nest repeatedly. Availability of suitable trees for nesting and perching is critical for maintaining bald eagle populations. Nest sites are generally within I mile of water (USFWS, 1986). The average territory radius ranges from 1.55 miles in western Washington to 4.41 miles along the lower Columbia River (Grubb, 1976; Garrett et al.,1988). In Washington, courtship and nest building activities normally begin in January, with eaglets hatching in mid-April or early May. Eaglets usually fledge in mid-July (Anderson et al., 1986).

A number of habitat features are desirable for wintering bald eagles. During the winter months bald eagles are known to band together in large aggregations where food is most easily acquired. The quality of wintering habitat is tied to food sources and characteristics of the area that promote bald eagle foraging. Key contributing factors are available fish spawning habitat with exposed gravel bars in areas close to bald eagle perching habitat. Bald eagles select perches that provide a good view of the surrounding territory, typically the tallest perch tree available within close proximity to a feeding area (Stalmaster, 1987). Tree species commonly used as perches are black cottonwood, big leaf maple, or Sitka spruce (Stalmaster and Newman, 1979).

Wintering bald eagles may roost communally in single tree or large forest stands of uneven ages that have some old-growth forest characteristics (Anthony et al., 1982 in Stalmaster, 1987). Some bald eagles may remain at their daytime perches through the night but bald eagles often gather at large communal roosts during the evening. Communal night roosting sites are traditionally used year after year and are characterized by more favorable micro climatic conditions. Roost trees are usually the most dominant trees of the site and provide unobstructed views of the surrounding landscape (Anthony et al., 1982 in Stalmaster, 1987). They are often in ravines or draws that offer shelter from inclement weather (Hansen et al., 1980; Keister, 1987). A communal night roost can consist of two birds together in one tree, or more than 500 in a large stand of trees. Roosts can be located near a river, lake, or seashore and are normally within a few miles of day-use areas but can be located as far away from water as 17 miles or more. Prey sources may be available in the general vicinity, but close proximity to food is not as critical as the need for shelter that a roost affords (Stalmaster, 1987).

Bald eagles utilize a wide variety of prey items, although they primarily feed on fish**,** birds and mammals. Diet can vary seasonally, depending on prey availability. Given a choice of food, however, they typically select fish. Many species offish are eaten, but they tend to be species that are easily captured or available as carrion. In the Pacific Northwest, salmon form an important food supply, particularly in the winter and fall. Birds taken for food are associated with aquatic habitats. Ducks, gulls and seabirds are typically of greatest importance in coastal environments. Mammals are less preferred than birds and fish, but form an important part of the diet in some areas. Deer and elk carcasses are scavenged, and in coastal areas, eagles feed on whale, seal, sea lion and porpoise carcasses (Stalmaster, 1987).

Brown pelican *(Pelecanus occidentalis)*[2]

Status: The brown pelican was federally listed as endangered in 1970 and a recovery plan prepared in 1983 (USFWS, 1983b). Brown pelicans declined drastically in mid-20th century, as pesticides caused eggshell thinning and failure of breeding. After banning of DDT, the species made a strong recovery; it is now common and increasing. Aerial surveys along the Washington coast have documented a yearly increase of pelicans from 922 observed in 1987 to 7,61 0 observed in 1991 (Jaques, 1994).

Range: California brown pelicans are nesters utilizing relatively small, inaccessible coastal islands for colony sites. Their breeding distribution ranges from the Channel Islands of southern California southward in Mexico. Large numbers of pelicans are present along the coast of Washington, from the mouth of the Columbia River north to Cape Flattery, from June through November. The highest numbers occur in August, September and October (Jaques, 1994). Pelican concentrations are noted in Grays Harbor and the Quinault River areas (Jaques, 1994). Pelicans are not normally observed in the Straits of Juan de Fuca or in Puget Sound, but they may expand into these areas if summering populations continue to increase.

Habitat Requirements: Brown pelicans are colonial nesters and require grounds that are free from both mammalian predators and human disturbance, and an adequate and consistent food supply (Anderson, 1983). Nesting habitat varies throughout the range of the brown pelican.

Brown pelicans' diet consists almost entirely of fish, with their primary prey anchovy (Schreiber and Clapp, 1990). They also feed on Pacific sardines and Pacific mackerel (Brueggeman, 1989). Movements of pelicans in the summer and fall along the coast and into the estuaries can largely be tied to their prey migrations.

Offshore rocks, islands, river mouths with sandbars, and the many breakwaters, pilings and jetties along the US and Mexican west coasts are important to brown pelicans as roosting sites (USFWS, 1983b). Pelicans utilize a wide variety of habitats during the day, but gather at communal roosts at night which must be secure (Jaques and Anderson, 1988). These roosts must meet three essential requirements to be secure: 1) they must occur near foraging areas, 2) they must be safe from mammalian predators and human disturbance, and 3) they must provide shelter from strong winds and surf spray (Jaques and Anderson, 1988).

Marbled murrelet *(Brachyramphus marmoratus)*[3]

Status.- The Washington, Oregon, and California marbled murrelet populations were listed as threatened by USFWS in 1992. Critical habitat was designated for the species in May 1996 (USDI, 1996). Six geographic zones for marbled murrelets were identified

[2] from USFWS, 1999.
[3] from USFWS, 1999.

in the Marbled Murrelet Recovery Plan (USFWS, 1997b). Two of these zones, Puget Sound (Zone 1) and Western Washington Coast Range (Zone 2), are in Washington.

In the past, marbled murrelets in Puget Sound were considered "common" (Rathbun, 1915), "abundant (Edson, 1908), or "numerous" (Miller et al. 1935), as summarized in Speich et al. (1992). The most recent estimate 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 in 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.

As part of the recovery planning process, a demographic model was developed to help better understand marbled murrelet population dynamics (Beissinger and Nur in Appendix B, USFWS, 1997b). . The demographic model predicted that murrelet populations are likely to be declining at an estimated rate that varied from I to 14 percent per year, depending on the parameter estimates used. The authors estimated that the most likely rate of decline would be around 4 to 7 percent per pear. Predicting or estimating populations 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, 1997b) 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, occupied stands have been found 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, 1995b; Ralph et al., 1995). Booth (1991) concluded that 82 to 87 percent of the old-growth forests that existed in western Washington and Oregon prior to the 1840's 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, 1995b).

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, 1995a). Attendance at breeding sites during the non-breeding season may enhance pair bond maintenance, facilitate earlier breeding, or reinforce familiarity with Right paths to breeding sites (Naslund and O'Donnell, 1995; O'Donnell et al., 1995).

Marbled murrelets are directly affected by the loss of nesting habitat resulting from cutting of old growth forests. Fragmentation of old growth forest, resulting from this cutting also has an indirect effect on the health of marbled murrelet populations by creating more "edges" to the forest. Increased fragmentation provides more 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 percent of the nests were unsuccessful. The major cause of nest failure (57 percent) was predation (Nelson and Hamer, 1995).

Marbled murrelets forage predominantly within 1.25 mile (2 km) of shore (Strachan et al., 1995), although the species can be found 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 km of shore with a median value of less than 5 km, but with one 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 eelgrasss 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 may also be found in areas of tidal activity. Murrelets feed primarily on fish and invertebrates (Burkett, 1995).

Designated Critical Habitat for Marbled Murrelet

Critical habitat for the marbled murrelet was designated on May 24, 1996 (USFWS 1996). Critical habitat was only identified in the terrestrial environment and not in the marine environment. Designated lands are in areas identified as essential to the conservation of the species. 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 percent of the area on federal lands, primarily in Late Successional Reserves as established in the Forest Plan (USFWS, 1997 Appendix A).

The primary constituent elements (the physical and biological habitat features) for designating marbled murrelet critical habitat were identified in the document as individual trees with potential nest platforms and forest lands of at least one half site-potential tree height regardless of contiguity within 0.8 km (0.5 mile) of individual trees with potential nesting platform and that are used or potentially used by the marbled murrelet for nesting or roosting. Within the boundaries of designated critical habitat, only those areas that contain one or more primary constituent elements are, by definition, critical habitat (USFWS, 1996).

Northern spotted owl *(Strix occidentalis caurina)*[4]

Status: The northern spotted owl was listed as federally threatened in June 1990. The Northern Spotted Owl Recovery Team reported a total of about 3,602 known pairs of spotted owls in Washington, Oregon, and California, with 671 pairs in Washington (USDI, 1992b). Based on two sets of assumptions to develop estimates, Holthausen et al. (1994 in WDNR, 1997) estimated 282 or 321 pairs of spotted owls on the Olympic Peninsula, which was higher than previous estimates.

A demographic analysis of results from 5 sites distributed throughout the spotted owls' range indicated that female territorial spotted owls were declining between 6 and 16 percent per year (an average of 10 percent) at individual study sites (Anderson and Burnham, 1992 in WDNR, 1997). Burnham et al. (1994 in WDNR, 1997) estimated an annual loss of 3 to 8 percent of the resident female owls on the Olympic Peninsula using unadjusted estimates of juvenile survival. Using an adjusted estimate of juvenile survival, they estimated an annual loss of 1 percent of the resident females. Threats to existing populations of spotted owls include declining habitat, low populations, limited and highly fragmented habitat, isolation of populations, predation and competition (USDI, 1992b).

Range: The northern spotted owl is one of three subspecies (northern, California, and Mexican) and occurs from British Columbia to northern California. The northern spotted owl is associated with late successional and old-growth forest habitats. The owl also occurs in some younger forest types where the structural attributes of old-growth forests are present (WDNR 1997). The present range of the northern spotted owl is similar to the limits of its historic range (USDI, 1992a).

Habitat requirements: Detailed accounts of the taxonomy, range, and habitat requirements of northern spotted owls may be found in the 1990 Fish and Wildlife Service status review (USFWS, 1990); the 1987 and 1989 status review supplements (USFWS, 1987, 1989), and the Interagency Scientific Committee Report (Thomas et al, 1990).

Spotted owls nest, roost and feed in a wide variety of habitat types and forest stand conditions throughout their distribution, with most observations in areas having a component of old-growth and mature forests. Owls in managed forests usually occupy areas with structural diversity and a high degree of canopy closure, containing large diameter or residual old trees, in stands more dm 60 years old (USDI, 1992b).

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[4] from USFWS, 1999.

Nesting habitat is generally found in mature and old-growth stands and contains a high degree of structural complexity (WDNR, 1997a). Cavities or broken-top trees are more frequently selected in older forests and platforms (mistletoe brooms, abandoned raptor and gray squirrel nests, and debris accumulations) tend to be selected more frequently in younger forests (Foresman et al., 1984; LaHaye, 1988; Buchanan, 1991). Roosting habitat has characteristics similar to nesting habitat, i.e., high canopy closure, a multi-layered canopy, and large diameter trees (WDNR 1997a). Spotted owls roost in shady spots near streams in the summer (WDNR 1997a). Spotted' owls begin their annual breeding cycle in late winter (February or March) and dispersal of juvenile owls begins in early fall (USDI, 1992b).

Feeding habitat appears to be the most variable of the major habitat categories (Thomas et al., 1990); however it is characterized by high canopy closure and complex structure (USDI, 1992b). Spotted owls feed on a variety of small forest animals, birds, and insects. Spotted owls on the Olympic Peninsula depend primarily on flying squirrels (Carey et al., 1992).

Although habitat that allows spotted owls to disperse may be unsuitable for nesting, roosting, or foraging, it provides an important linkage among blocks of nesting habitat both locally and over the range of the northern spotted owl. This linkage is essential to the conservation of the spotted owl. Dispersal habitat, at minimum, consists of forest stands with adequate tree size and canopy closure to protect spotted owls from avian predators and to allow the owls to forage at least occasionally (USDI, 1995).

Designated Critical Habitat for Northern Spotted Owl

On January 15, 1992, approximately 6.88 million acres (2.8 million hectares) was designated as critical habitat for the northern spotted owl in Washington, Oregon, and California. These critical habitat areas included most of the Habitat Conservation Areas defined in the Interagency Scientific Committee Report (Thomas et al., 1990) and added areas around and between them. Fifty-three critical habitat units were identified in Washington.

The USFWS's primary objective in designating critical habitat was to identify existing spotted owl habitat and to highlight specific areas where management consideration should be given highest priority to manage habitat (USDI, 1992a). To assist in these determinations, the USFWS relied on the following principles identified in Thomas et al. (1990): 1) develop and maintain large contiguous blocks of habitat to support multiple reproducing pairs of owls; 2) fragmentation and edge effect to improve habitat quality; 3) minimize distance to facilitate dispersal among blocks of breeding habitat; and, 4) maintain range-wide distribution of habitat to facilitate recovery (USDI, 1992a).

The following qualitative criteria were considered when determining whether to select specific areas as critical: 1) presently suitable habitat emphasized; 2) large contiguous blocks of habitat emphasized; 3) quality of habitat; 4) dispersal distances minimized; 5) occupied habitat emphasized; 6) maintain range wide distribution; 7) need for special management or protection; and, 8) adequacy of existing regulatory mechanisms (USDI, 1992a).

Short-tailed albatross (*Phoebastria albatrus*)[5]

Status: The short-tailed albatross was originally listed as endangered outside of the conterminous U.S. in 1970. In 2000, the species listed as endangered in Washington State.

Originally numbering in the millions, the current worldwide population of breeding age birds is approximately 600 individuals and the worldwide total population is approximately 1,200 individuals. There are no breeding populations of short-tailed albatrosses in the United States, but several individuals have been regularly observed during the breeding season on Midway Atoll in the northwestern Hawaiian Islands. Current threats to the species include destruction of breeding habitat by volcanic eruption or mud or land slides caused by monsoon rains, and demographic or genetic vulnerability due to low population size and limited breeding distribution. Longline fisheries, plastics ingestion, contaminants, and airplane strikes may also be factors affecting the species' conservation (USFWS, 2000).

Range: Short-tailed albatrosses range throughout the North Pacific Ocean and north into the Bering Sea during the non-breeding season; breeding colonies are limited to two Japanese islands, Torishima and Minami-kojima (USDI, 2000).

Habitat Requirements: Available evidence from historical accounts, and from current breeding sites, indicates that short-tailed albatross nesting occurs on flat or sloped sites, with sparse or full vegetation, on isolated windswept offshore islands, with restricted human access (Aronoff, 1960; Sherburne, 1993; DeGange, 1981 in USFWS, 2000). Current nesting habitat on Torishima is steep sites on soils containing loose volcanic ash. The island is dominated by a grass, *Miscanthus sinensis var. condensatus*, but a composite, *Chrysanthemum pacificum*, and a nettle, *Boehmeria biloba*, are also present (Hasegawa, 1977 in USFWS, 2000). The grass is likely to stabilize the soil, provide protection from weather, and minimize mutual interference between nesting pairs while allowing for safe, open takeoffs and landings (Hasegawa, 1978 in USFWS, 2000). The nest is a grass or moss-lined concave scoop about 0.75 meters (m) (2 feet) in diameter (Tickell, 1975 in USFWS, 2000). The only terrestrial area within U.S. jurisdiction that is currently used by the short-tailed albatross for attempted nesting is the Midway Atoll.

Numerous records indicate that the short-tailed albatross frequents nearshore and coastal waters, which may explain why another common name for the species is the ``coastal albatross.'' However, the source of these records derives from boats that were near shore to begin with. The lack of more pelagic observations may say more about the distribution of boats than of albatrosses. Nevertheless, our short- tailed albatross at-sea sightings' database contains many observations of short-tailed albatrosses within 10 km (6 mi) of shore, and several observations of birds within 5 km (3 mi) of the shore (Terry Antrobus, Service, Anchorage, pers. comm. 2000 in USFWS, 2000). Their

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[5] From USDI, 2000.

presence may coincide with areas of high biological productivity, such as along the west coast of North America, the Bering Sea, and offshore from the Aleutians (Hasegawa and DeGange, 1982 in USFWS, 2000). The North Pacific marine environment of the short-tailed albatross is characterized by coastal regions of upwelling and high productivity and expansive, deep water beyond the continental shelf.

Western snowy plover *(Charadrius alexandrinus nivosus)*[6]

Status: The Pacific coast population of the western snowy plover was listed as threatened in 1993 (USDI, 1993b). Based on recent surveys, 28 snowy plover breeding areas occur on the Pacific coast of the United States, with 20 (71 percent) in California, six (21 percent) in Oregon, and two (7 percent) in Washington, a reduction from 87 sites in the three states (WDFW 1995b). Historically, at least five sites in Washington supported nesting snowy plovers, but presently the species is restricted to two or possible 4 sites (WDFW, 1995b; Grettenberger; pers. comm. 1999). In recent years snowy plovers have nested at Damon Point and Oyehut 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 six adults and four nests at Damon Point and Oyehut Wildlife Area and up to 13 adults and four nests at Leadbetter Point (WDFW, 1995b).

The Oregon Department of Fish and Wildlife reported an annual 7 percent decline of snowy plovers at coastal breeding areas between 1981 and 1992 (ODFW, 1994). A similar decline may be occurring in Washington (WDFW, 1995b). 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 *(Ammophila arenaria*) and predation (USDI, 1993b; WDFW, 1995b).

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 (USDI, 1993b). In Washington, nesting snowy plovers are only present at Damon Point and Oyehut 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, 1995b).

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; utilizing areas with little. or no vegetation above the high tide line (Stenzel et al., 1981; Wilson, Jacobs and Meslow, 1984; Warriner et al., 1986). Salt pans, lagoons, dredge spoils, and salt evaporators along the coast are used less extensively by nesting plovers (Warriner et al., 1986). Most adults arrive in Washington

[6] from USFWS, 1999.

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, 1995b).

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

Proposed Critical Habitat for Western Snowy Plover

The designation of critical habitat for snowy plovers along the coast of Washington, Oregon, and California was proposed in March 1995 (USDI, 1995). The proposed area includes the 28 breeding sites or areas where plovers are known to occur. The two sites identified in Washington include Leadbetter Point in Willapa Bay, and at Damon Point in Grays Harbor.

Mammals

Canada lynx (*Lynx canadensis*)[7]

Status: The Canada lynx was proposed for threatened status in the contiguous United States in 1998. Human alteration of forest landscapes is the most important factor in the decline of lynx populations. In particular, the alteration of species composition, successional stages, distribution and abundance, and connectivity of forests. Timber harvest and associated activities are the primary land uses affecting lynx habitat. Lynx were over harvested during the 1970's and 1980's. The over harvest has resulted in lynx populations which are insufficient to recolonize areas with suitable habitat. Current lynx populations in Washington are estimated between 96 and 191 individuals (WDW, 1993d).

Range: Historically and currently, lynx were present in Alaska and Canada from the Yukon and Northwest Territories south to the U.S. border and east to Nova Scotia and New Brunswick. Lynx historically were found in sixteen states in the contiguous United States. They were present in the northeast in Maine, New Hampshire, Vermont, New York, Pennsylvania, and Massachusetts; in the western Great Lakes region in Minnesota, Wisconsin, and Michigan; in the Rocky Mountains in Oregon, Idaho, and Montana on into Utah and Colorado; and in the Cascade Mountain Range of Oregon and Washington (McCord and Cardoza, 1982; Quinn and Parker, 1987).

Habitat Requirements: Canada lynx occur primarily in boreal forests throughout their range (Ruggiero et al., 1994). At the southern extent of their range, they are typically found at high elevations which have habitats similar to the boreal forests of Alaska and

[7] from USFWS, 1999.

Canada. Canada lynx are specialized predators and their distribution is linked to that of the snowshoe hare. Snowshoe hares use dense, early successional forests with woody seedlings and shrubs which provide food and cover, and escape from predators and extreme weather (Wolfe et al., 1982; Monthey, 1986; Koehler and Aubry, 1994). Lynx usually select habitats with an abundance of snowshoe hares for foraging. They use the abundant cover to stalk and lie in wait for hares (Ruggiero et al., 1994). Lynx require late-successional forests that contain cover for kittens (especially deadfalls) and for denning (Koehler and'Brittell, 1990). Breeding occurs in late March to early April with young born in late May or early June (Koehler and Aubry, 1994). Lynx populations in Alaska and Canada exhibit a cyclic oscillation in population with lynx lagging several years behind snowshoe hare population trends. This relationship does not appear to exist in the contiguous United States due to lower snowshoe hare populations resulting from patchier habitat and the presence of additional competitors and predators not present in the northern regions (Dolbeer and Clark, 1975; Wolff, 1980,1982).

Columbia white-tailed deer (Odocoileus virginianus leucurus)[8]

Status: Two populations of this subspecies exist, one in Douglas County, Oregon, (Douglas County population), and the other in Columbia and Clatsop Counties, Oregon, and Wahkiakum County, Washington (Columbia River population). The Columbia River population was listed as endangered in 1967 under the Endangered Species Preservation Act, and the Douglas County population received protection under the Act as a threatened species in 1977. The Columbia River population has increased from fewer than 400 animals in 1977 to 550 to 800 individuals in 1994-1997 (USFWS, 1997 unpublished data).

The greatest human-caused threat to the Columbia white-tailed deer is the degradation of riparian habitats. Lesser human-caused threats include automobile collisions, poaching, entanglement in barbed wire fences, and competition with livestock. Natural threats include flooding, disease, and parasites (USFWS, 1983a).

Range: Historically, this subspecies ranged from the south end of Puget Sound in Washington south to the Roseburg area in Oregon (Bailey 1936). They are now confined to a small area near the mouth of the Columbia River and in the upper Umpqua River drainage near Roseburg, Oregon. In Washington, Columbia white-tailed deer are only found in Wahkiakum County on islands in, and along the banks of, the Columbia River. Most of the habitat occupied by the deer on the Washington mainland is within the boundaries of the Julia Butler Hansen Refuge for the Columbia white-tailed deer.

Habitat Requirements: Columbia white-tailed deer are found on islands containing mature forest land, and on bottomland farms, forested swamps, and riparian areas adjacent to the Columbia River. Distribution of deer throughout this area is strongly related to the availability of woody vegetation for cover (Suring and Vohs, 1979). Suring and Vohs (1979) reported little use of those portions of pastures located more than 250

[8] from USFWS, 1999.

m (750 feet) from woodland edges. The deer prefer plant communities that provide both forage and cover; park forest is preferred. Other important plant communities include open canopy forests, sparse rush, and dense thistle (USFWS, 1983a). Peak fawning occurs the second week of June.

Their feeding preferences shifts seasonally. Studies at the Julia Butler Hansen Refuge for the Columbia white-tailed deer show herbs to be preferred foraging items spring through fall. The use of browse is most important in winter and fall (Dublin, 1980).

Gray wolf *(Canis lupus)*[9]

Status: The gray wolf was listed as endangered in 1978. In 1930, it was believed that breeding populations of wolves in Washington were extinct because of fur trading pressure in the 1800's followed by the establishment of bounties on all predators in 1871 in the Washington Territory (Young and Goldman, 1944). The last reported wolf shot in the North Cascades was in 1975 (WDW, 1975, as reported in Almack et al., 1994). Recent observations indicate that wolves exist in Washington, likely in small numbers, and mostly as individuals. However, several family units have been documented, indicating that some level of reintoduction has occurred recently (Almack and Fitkin, 1998).

Range: The probable range of gray wolves in Washington is in the Cascade Mountains and northeastern Washington (Almack and Fitkin, 1998). In northeastern Washington, the majority of the reported wolf activity is in the eastern half of the Colville National Forest and Colville Indian Reservation and also adjacent private and public lands (Hansen, 1986).

Habitat Requirements: The habitat of the gray wolf is listed as open tundra and forests (Whittaker, 1980). However, gray wolves can use a variety of habitats as long as cover and a food supply are available (Stevens and Lofts, 1988). They tend to focus on areas that are free from human disturbance and harassment, have low road densities and which support large numbers of prey species (deer, elk, goat, moose, and beaver). While they may consume some small mammals, most of their diet consists of deer (Peterson, 1986).

Wolves follow the movements of ungulate herds (deer, elk, moose) across openings and through forested areas. The major tree species in this area include white pine, lodgepole pine, Douglas fir, larch, subalpine fir, grand fir, and a number of less common species including ponderosa pine, whitebark pine, spruce, hemlock, and red cedar (Hansen, 1986). Wolves have territories ranging from 70 to 800 square miles.

Wolves general live in packs made up of 2 to 12 or more family members and individuals, lead by a dominant male and female. In other locations, denning by wolves generally occurs between April and June. Den sites are often characterized by having forested cover nearby and by being distant from human activity. The pups remain at the

[9] from USFWS, 1999.

denning site for the first 6 to 8 weeks, then they move to a rendevous site until they are large enough to accompany the adults on a hunt (Peterson, 1986). Once the pups are large enough to go hunting, the pack travels throughout its territory.

Grizzly bear *(Ursus arctos horribilis)*[10]

Status: The grizzly bear was listed as a threatened species in the conterminous United States in 1975. Livestock depredation control, habitat deterioration, commercial trapping, unregulated hunting, and protection of human life were leading cause of the decline of grizzly bears (USFWS, 1993a). Two of the six ecosystems identified in the grizzly bear recovery plan (USFWS, 1993a) include areas in Washington, the Northern Cascades and the Selkirks. Almack et al.(1994) estimated the 1991 grizzly bear population in the North Cascades recovery area at less than 50, and perhaps as low as 5 to 20. Wielgus et al. (1993) estimated a density of one bear per 27 mi^2 (71 km^2) for the U.S. portion of the Selkirks Ecosystem and one per 17 mi^2 (43 km^2) for the Canadian portion of the Selkirks Ecosystem.

Range: In Washington, the grizzly's range is limited to the Northern Cascades and the Selkirk mountains.

Habitat Requirements: Grizzly bear habitat use is determined by isolation from human disturbance, food distribution, food availability, and denning security. In general, grizzly bears move seasonally, using low-elevation riparian areas and meadows in the spring, higher elevations during the summer and fall months, and high isolated areas for winter denning.

Little is known about the grizzly bears residing in the North Cascades. It is suspected that their habits are similar to bears from other areas, but telemetry studies are needed. Information presented here is from studies in the Selkirk Mountains and other areas. Denning occurs most commonly on north-facing slopes above 6,000 feet elevation in areas where snow drifts and remains through warm spells (USFS, 1994). Grizzly bears leave their den sites after the cubs are born in February. They move quickly down to low elevation areas and feed on winter-killed ungulates and new growth. Grizzly bears generally feed on emerging grasses, forbs, and budding shrubs in the spring.

As green-up moves up-slope, the bears follow, foraging above 3,000 feet in the summer. Grizzly bears breed on their summer range between May and July. In late summer and fall, bears forage on berries such as huckleberry, serviceberry, rose, and strawberry. In September or October bears move to high elevations and denning sites. Grizzly bears may concentrate their use in mixed shrub fields, snow chutes, old bums, meadows, and cutting units.

Human disturbance, usually increased with road access into grizzly habitat, is known to affect bear use of seasonal habitat components. Habituation or avoidance may result.

[10] from USFWS, 1999.

In general, roads increase the probability of bear-human encounters and human-induced mortality (USFS, 1994).

Woodland caribou (*Rangifer tarandus caribou*)[11]

Status: The woodland caribou was federally listed as endangered in 1984. As recently as the 1950s, the Selkirk population consisted of an estimated 100 animals (Evans, 1960). However, by the early 1980s, the population had declined to 25-30 animals whose distribution centered around Stagleap Provincial Park, British Columbia (Scott and Servheen, 1985). The U.S. population was augmented in 1987, 1988, and 1990 by transplanting a total of 60 animals into northern Idaho. In 1996-1998, a total of 43 woodland caribou were transplanted from British Columbia into Washington (Audet, pers. comm., 1999) The current population estimate is approximately 45 animals (Audet, pers. comm. 1999). Factors probably limiting woodland caribou populations include habitat fragmentation and loss, poaching, disease and predation (USFWS, 1994).

Range: Prior to 1900, woodland caribou were distributed throughout much of Canada, and the northeastern, north-central, and northwestern coterminous United States. Since the 1960s, the woodland caribou population has restricted its range to the Selkirk Mountains of northeastern Washington and northern Idaho and southeastern British Columbia where they occur in two herds. In Washington, woodland caribou are found in small numbers in the Selkirk Mountains of northeastern Washington east of the Pend Oreille River in Pend Oreille County. A transplanted individual was sighted in Stevens County, but this is outside the recovery area and their typical habitat.

The recovery area for caribou in the Selkirk Mountains is comprised of approximately 5,700 km^2 in northern Idaho, northeastern Washington, and southern British Columbia. About 47 percent of the area lies in British Columbia and 53 percent lies in the United States. The United States portion includes the Salmo-Priest Wilderness and other portions of the Colville and Idaho Panhandle National Forests, Idaho Department of Lands holdings, and scattered private parcels (USFWS, 1994).

Habitat Requirements: Woodland caribou are generally found on moderate slopes above approximately 1,200 m (4,000 feet) elevation in the Selkirk Mountains in Englemann spruce/subalpine fir and western red cedar/western hemlock forest types (USFWS, 1994). Caribou use streams, bogs, basins, and other areas that are no more than 35 percent slope and are composed of mature or old-growth timber (Freddy, 1974; Simpson and Woods, 1987).

Generally the mountain ecotype of woodland caribou exhibit five distinct seasonal movements. In early winter caribou shift to lower elevation habitats (1200 and 1900 meters, 4,000-6,200 feet elevations) that are best characterized by mature to old-growth subalpine fir/Englemann and western hemlock/western red cedar forest types. Selkirk caribou have returned to the same areas of early winter habitat year after year and it is

[11] from USFWS, 1999.

considered to be the most critical habitat to the Selkirk population. Late winter habitat is characterized by deep snow and is generally above 1,828 m (6,000 ft) elevation in open canopy forests where lichen is abundant. In spring, caribou move to areas that are "greening up" that provide high quality forage. The Selkirk caribou remain at mid-elevation areas where they use open-canopied areas often adjacent to mature forest. Pregnant females move back onto snow-covered areas, often at higher elevations, to calve in early June. In summer, caribou move to more closed-canopy forest stands, western cedar/western hemlock d the Englemann spuce/sub-alpine fir zones, at an average elevation of 1700 m (5,600 ft) in the southern Sekirks. In the fall, caribou shift to lower elevations and more densely canopied forest in the southern Selkirks (USFWS, 1994). Servheen and Lyon (1989) found certain habitat characteristics to be constant for most seasonal habitats in the Selkirk Mountains: 1) a high abundance of lichens, 2) 30 percent of stands had tree crown canopy greater than 50 percent, 3) stem diameter were greater than 20 cm (8 in.), except at higher elevations.

Arboreal lichen represents almost the sole winter diet of woodland caribou. Selkirk caribou generally depend on arboreal lichens for up to 6 months of the year (USFWS, 1994). The woodland caribou's diet also consists of new herbaceous vegetation, mushrooms, shrub leaves, grasses, sedges, and soft shrubs (USFWS, 1985). Summer and early winter are critical times in which quality and availability of forage may be limiting to populations (Simpson et al., 1988).

Marine Mammals:

Blue Whale (*Balaenoptera musculus*)[12]

Status: In 1970, the blue whale was listed as an endangered species throughout its entire range.

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 somewhat 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.

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 one blue whale stock in the North Pacific (Donovan, 1991). However, there is increasing evidence suggesting that more than one stock exists within this ocean basin (Ohsumi and Wada, 1974; Mizroch et al., 1984a; Barlow, 1994b). 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;

[12] From Perry et al. 1999.

Sears et al., 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 have been reported to feed on concentrations of the pelagic red crab, *Pleuroncodes planipes* (Rice, 1978b). However, blue whales have been observed between February and April within the Gulf of California feeding on surface swarms of *Nyctiphanes simple*x, a 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, no conclusions can be made about this type of competition until further behavioral and distributional information is collected (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).

Fin Whale (*Balaenoptera physalus*)[13]
Status: In 1970, the fin whale was listed as an endangered species throughout its entire range.

Range: Fin whales inhabit a wide range of latitudes between lat. 20–75^{o}N and 20– 75^{o}S (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

[13] From Perry et al. 1999.

consumption by fin whales along the northeast U.S. continental shelf has been estimated at 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. It is assumed that fin whales 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, 1992a). For instance, in the Northern Hemisphere they consume schooling fishes, such as capelin, *Mallotus villosus;* anchovies, *Engraulis morda*x; herring, *Clupea harengus;* and sandlance, *Ammodytes* spp. (Mitchell, 1975a; Overholtz and Nicolas, 1979; Kawamura, 1982). Thus, they may be less prey selective than blue, humpback, and right whales. However, fin whales do depend to a large extent on the small euphausiids and other zooplankton species. In the Antarctic, they feed on krill, *Euphausia superb*a, which occurs in dense near-surface schools (Nemoto, 1959). In the North Pacific, *E. pacific*a, *Thysanoessa inermi*s, *T. longipe*s, and *T. spinifera* are the primary prey items. The natural mortality rate for fin whales ranges from 4 to 6% (Clark, 1982; de la Mare, 1985).

Humpback Whale (*Megaptera novaeangliae*)[14]

Status: In 1970, the humpback whale was listed as an endangered species throughout its entire range.

Range: Humpback whales inhabit all major ocean basins from the equator to sub-polar latitudes. They generally 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 one 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). Known 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, *Oncorhynchus* spp.; Arctic cod, *Boreogadus saida*; walleye pollock, *Theragra chalcogramma*; pollock, *Pollachius virens*; 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, *Clupea harengus*, capelin, *Mallotus villosus*; Atlantic mackerel, *Scomber scombrus*; and other schooling species also found in their diets (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).

[14] From Perry et al. 1999.

Humpback whales utilize a wide range of feeding techniques, at times involving more than one individual and resembling a form of cooperative participation. The two 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.

Sei Whale (*Balaenoptera borealis*)[15]
Status: In 1970, the sei whale was listed as an endangered species throughout its entire range.

Range: Sei whales are found 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., 1984c). They do not associate with coastal features, but instead they are found in deeper waters associated with the continental shelf edge (Hain et al., 1985). There is some evidence from catch data of differential migration patterns by reproductive class, whereby 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., 1984c). 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, 1992a). Estimated annual natural mortality is 7.5 percent.

Sperm Whale (*Physeter macrocephalus*)[16]
Status: In 1970, the sperm whale was listed as an endangered species throughout its entire range.

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[15] From Perry et al. 1999.
[16] From Perry et al. 1999.

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 are found in social groups in temperate and tropical waters year round. Very rarely are female/immature groups found higher than lat. 50^{o}N and lat. 50^{o}S (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. 70^{o}N in the North Atlantic and lat. 70^{o}S in the Southern Ocean (Reeves and Whitehead, 1997).

General migration patterns vary between males and females. In summer, all sperm whales can be found at 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 are found year round in temperate and tropical waters from the Equator to around lat. 45^{o}N. During summer, mature male sperm whales are thought to move north into waters off the Aleutian Islands, Gulf of Alaska, and the southern Bering Sea.

Large-scale oceanographic events, such as El Niño, also 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 the giant squid, *Architeuthis* sp. Approximately 40 species of cephalopods are consumed by sperm whales worldwide. In the North Pacific, the four most common prey items of sperm whales off central California are all cephalopod species (i.e. *Moroteuthi*s, *Gonatopsi*s, *Histioteuthi*s, and *Galiteuthi*s) (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 of the genus *Cyclopterus* (lumpsuckers) and *Sebastes* (redfishes). 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., 1992b).

Steller Sea Lion (*Eumetopias jubatus*)[17]

Status: In April, 1990, the western population (located west of 144^{o}W long.) of Steller sea lions was designated as endangered. The eastern population (located east of 144^{o}W long., which includes those sea lions found along the western U.S. coastline) was designated as threatened.

[17] From USDC, 1993

Range: The range of the Steller sea lion extends from California and associated waters to Alaska, including the Gulf of Alaska and Aleutian Islands, and then into the Bering Sea and North Pacific and into Russian waters and territory.

Habitat Requirements: Steller sea lions breed, pup, and seek rest and refuge on relatively remote islands and points of land along the Alaska coastline. Steller sea lions are opportunistic feeders, that feed primarily on schooling demersal fish, such as walleye pollock, Atka mackerel, herring, and capelin. Declines in sea lion abundance may be related to changes in the availability of sea lion prey.

In California, the reason for the decline of Steller sea lions is not known. Former rookery habitat has been abandoned (San Miguel Island), and some other rookeries (Año Nuevo Island, Farallon Islands) are at lower than historical abundance levels. The availability of suitable terrestrial habitat does not appear to be a factor in the sea lion decline in parts of California.

Designated Critical Habitat for Steller Sea Lions
Critical habitat for Steller sea lions was designated on August 27, 1993. Critical habitat includes areas surrounding rookery and major haulout areas in California, Oregon, Washington, and Alaska. In Alaska, some foraging areas within the core of the geographic range of Steller sea lions are also designated critical habitat.

Insects:

Oregon silverspot butterfly (*Speyeria zerene hippolyta*)[18]

Status: The Oregon silverspot butterfly was listed as threatened in 1980. The federal recovery plan for the Oregon silverspot butterfly calls for the restoration and reintroduction of the butterfly at historic locales such as the Long Beach Peninsula (Stine, 1982).

Range: The Oregon silverspot butterfly was historically found along the Pacific coastal areas of southern Washington and central and northern Oregon. Along the Washington coast, historic silverspot locations occurred from Long Beach north to Lake Ozette (Pyle, 1989; Hinchliff, 1996). The last sighting of an Oregon silverspot butterfly in Washington was near Long Beach in 1990 (Sayce, 1990). The butterfly's current range is most likely limited to the coast of Oregon, with possible undiscovered small populations still remnant in Washington (Hayes, 1996).

Habitat Requirements: Oregon silverspot butterflies are found in coastal salt-spray meadows and open field habitats that support the larval host plant, the early blue violet *(Viola adunca).* The violet is the sole larval food during development phases in fall, winter, spring and early summer (Hayes, 1996). Moderate grass cover found in these open habitats provides shelter for the larvae from wind, rain, and sun (Stine, 1982).

[18] from USFWS, 1999.

Plants:

Bradshaw's desert parsley (*Lomatium bradshawii*)[19]

Status: *Lomatium bradshawii* was listed as federally endangered in September 1988 (USFWS, 1993b). The population sizes have been estimated to be approximately 2,500 and over 70,000 individuals at the two Washington sites (Wentworth, 1996). The species is threatened by the destruction or modification of habitat through agricultural, residential and commercial development. Fire suppression permits the invasion of grassland vegetation by woody and invasive species, thus rendering habitat unsuitable, and precludes the expansion of *Lomatium bradshawii* populations. Activities that affect the hydrology of the area may have an impact on *the Lomdtium bradshawii* populations. Although the effects of cattle grazing, rodent seed predation, and fungal and insect infestations have not been studied in Washington, they have been documented as negatively impacting *Lomatium bradshawii* in Oregon. Rodent activity is evident at the two Washington sites (Wentworth, 1996).

Range: Most of the *Lomatium bradshawii* populations are known from habitat fragments in the Willamette Valley of western Oregon (Wentworth, 1996). The species occurs in four counties in Oregon and one county in Washington. In 1994, two *Lomatium bradshawii* populations were discovered in Clark County, Washington. Prior to the 1994 discovery *Lomatium bradshawii* the species was not known to occur in Washington (Gaddis, 1996 in Wentworth, 1996).

Habitat Requirements: *Lomatium bradshawii* occurs in remnant fragments of once widespread low elevation grasslands and prairies. The habitat type is described as wet, seasonally flooded prairies and grasslands common around creeks and small rivers (Moir and Mika,1976; Alverson, 1989). The Washington populations *Lomatium bradshawii* occur in wet meadows, one dominated by *Deschampsia cespitosa* and the other dominated by non-native grasses. The community ranges from wetter, with sedges and rushes as associated species, to drier, with more native and non-native grasses (Wentworth, 1996). This plant reproduces entirely from seed and is dependent on insects for pollination (Kaye, 1992). Flowering occurs from early April to mid May.

Golden paintbrush (C*astilleja levisecta*)[20]

Status: *Castilleia levisecta* was listed as a threatened species, without critical habitat, in June 1997. Historically, *Castilleja levisecta* was reported from over 30 sites in the Puget Trough of Washington and British Columbia, and as far south as the Willamette Valley of Oregon (Sheehan and Spraque, 1984). Through an assessment of the status of the species throughout its range in 1984, the species was found to be extirpated from more than 20 historic sites (Sheehan and Sprague, 1984; Gamon, 1995b). Many populations were found to be extirpated due to conversion of habitat to agricultural, residential, and commercial development (USDI, 1997a).

[19] from USFWS, 1999.
[20] from USFWS, 1999.

Threats to the extant populations include loss of suitable habitat, competition from native and non-native trees, woody shrubs and herbaceous vegetation, trampling and collecting by humans, and herbivory. In addition, small, fragmented populations are more vulnerable to extirpation from random, stochastic events and genetic variability is reduced (Wentworth, 1996).

Range: *Castilleia levisecta* once occurred from Oregon to Vancouver Island in British Columbia. Eleven populations of this plant now exist in open grasslands ranging from Thurston County, Washington, north through the Puget Trough to southwest British Columbia, Canada (USDI, 1997a). Nine of the populations occur in Washington - one population south of Olympia in Thurston County, five populations on Whidbey Island in Island County, one population on San Juan Island and one population each on Long Island and Lopez Island in San Juan County (USDI, 1997a). The Lopez Island site consisted of only four plants in May 1996 (J. Wentworth, Washington Natural Heritage Program, pers. comm 1996 in USDI 1997a). No plants were found at the Lopez Island site in 1998 (Thomas, pers. comm. 1998). A population of fewer than five individuals is likely not viable (Gamon, Washington Natural Heritage Program, pers. comm. 1996 in USDI, 1997a).

Habitat Requirements: The species generally occurs on open, flat grasslands, including some that are characterized by mounded topography, and on steep coastal bluffs that are grass dominated. The species has been found at elevations from sea level to 328 feet (0 to 100 m) (Gamon 1995b). The largest population in Washington occurs in a gravelly, glacial outwash prairie. Other populations occur on clayey soils derived from either glacial drift or glaciolacustrine sediment. Historical populations also have occurred on near bedrock soils and clayey alluvial soils (Gamon, 1995b). The most common associate is, depending on the site, *Festuca idahoensis or Festuca rubra*, although *Castilleja levisecta* occurs in at least one area where neither of these two species is abundant (Gamon, 1995b). Flowering begins the last week in April and continues until early June (Gamon, 1995b).

Castilleja levisecta may have historically been dependent upon fire for the maintenance of suitable habitat. Fire, as an ecosystem process, prevented the development of trees and, ultimately, forests within grassland habitat (Gamon, 1995b). Fires also maintained native grass species that allowed the establishment of *Castilleja levisecta* seedlings. The suppression of fire allowed establishment of sod-forming grasses which preclude seedling establishment.

Kincaid's lupine (*Lupinus sulphureus kincaidii*)[21]

Status: Kincaid's lupine was proposed for threatened status in 1998 and listed in January, 2000. The primary threats are from road improvement, commercial and residential development, agriculture, and herbicide use.

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[21] from USFWS, 1999.

Range: Kincaid's lupine is found only on 51 remnant native prairie sites in the Willamette Valley in Oregon and at 1 site near Boistfort, Lewis County, Washington.

Habitat Requirements: The distribution of Kincaid's lupine is strongly correlated with native upland prairie habitat. These habitats typically have xeric to mesic moisture conditions and silty clay loam to clay loam soils.

Marsh sandwort (*Arenaria paludicola*)[22]

Status: *Arenaria paludicola* was listed as endangered in 1993. The sole extant population occurs at Black Lake Canyon in San Luis Obispo County, California (USDI, 1993a). The only known true collection of *Arenaria paludicola* in Washington was collected in 1896 near Tacoma (Gamon, 1991). Surveys were conducted in Washington in 1990 on the area from which the one historical specimen *Arenaria paludicola* was located and at other potential sites along the coast of Washington. No extant sites of this plant were found as a result of the survey (Gamon, 1991).

Range: *Arenaria paludicola* historically occurred in swamps and freshwater marshes in four coastal counties of California and Washington State. The only known collection in Washington was from Pierce County in 1896 (Gamon, 1991; USDI, 1993a).

Habitat Requirements: *Arenaria paludicola* is an obligate wetland species that requires highly saturated soils to persist (Mazer and Waddell, 1995). In California, the species is found growing on ground level at elevations ranging from sea level to approximately 1,476 feet (0-450 m) (Morey, 1990). *Arenaria paludicola* is associated with *Epipactis gigantea, Sparganium sp., Carex sp., Juncus* spp. and *Rorippa gambellii* at the sites in California. No associated species are listed on the herbarium label for the Washington collection (Gamon, 1991). Flowering occurs from May to August, or even into September (Gamon, 1991).

Nelson's checker-mallow (*Sidalcea nelsoniana*)[23]

Status: *Sidalcea nelsoniana* was listed as a threatened species, without critical habitat, in February 1993 (USDI, 1993c).

Threats to the populations include: mowing, plowing, stream channel alteration, recreational activities, roadside spraying, conversion of habitat to agricultural uses, logging, water impoundment and loss of suitable habitat (USDI, 1993c). Stream channel alterations such as straightening, splash damming and rip-rapping cause alteration of instream flow and velocity (USDI, 1993c) and restrict the channels access to the flood plain, and it's ability to connect with historic secondary channel areas or create new secondary channels and slow water habitats.

[22] from USFWS, 1999.
[23] From USFWS, 1999.

Range: The range of *Sidalcea nelsoniana* extends from southern Benton County, Oregon north to Cowlitz County Washington, and from central Linn County Oregon west, to just west of the crest of the Coast Range of Oregon (USDI, 1993c). *Sidalcea nelsoniana* is known to be present in restricted areas of the Willamette Valley and the adjacent Coast Range of Oregon and at one site in the Willapa Hills/Coast Range extension into Cowlitz County, Washington (USDI, 1993c). Historically, there were at least six identified population centers in Oregon (this does not include the recently discovered population center in Washington State), (USDI 1993c). One population center has been extirpated in the Willamette Valley, four population center remain in the Willamette Valley, one population center exists in the Coast Range, and one population center in the Willapa Hills/Coast Range extension in southwest Washington (USDI, 1993c). Within this range, a total of 48 sites within six population centers are present (USDI, 1993c).

Habitat Requirements: *Sidalcea nelsoniana* has been documented to occur in ash swales with wet depressions, along streams, in wetlands with remnant prairie grasslands, along roadsides at stream crossings and in some disturbed situations such as roadside ditches and mowed hayfields (USDI, 1993c). The species generally occurs in prairie situations interspersed with oak and ash woodlands and coniferous forests in the Willamette Valley (USDI, 1993c). In the Willamette Valley, prairies were historically maintained by fire. These prairie habitats have been affected by the loss of fire in the ecosystem, conversion to agricultural land use, or invasion by introduced grasses and forbs. In the Oregon Coast Range and the Willapa Hills of Washington, *Sidalcea nelsoniana* occurs along s in meadows and other relatively open sites such as roadsides (USDI, 1993c). These areas in the Coast Range of Oregon and the Willapa Hills of Washington have been impacted by logging practices which may result in destruction of the plant, changes to groundwater hydrology, and introduction of woody species which compete with *Sidalcea nelsoniana* (USDI, 1993c). Soil types that the plant occurs on have been documented as moist to dry sites with poorly to well drained clay, clay loam and gravelly loam soils in meadow and rarely wooded habitats (CH2MHill, 1986; Glad et al., 1987). *Sidalcea nelsoniana* occurs in open areas with little or no shade and will not tolerate encroachment by woody species. Plant associations include yarrow (*Achillea*), various grasses (*Festuca, Agrostis, Elymus*) and sedges (*Carex*) (USDI, 1993c).

Snowy stickseed ***(Hackelia venusta)***[24]

Status: *Hackelia venusta* was proposed in 2000 for listing as an endangered species in Washington State.

Range: *Hackelia venusta* was historically restricted to Chelan County, Washington. Presently, it is restricted to the Wenatchee Mountains in Chelan County, Washington (Cronquist, 1959; Gentry and Carr, 1976; Washington Natural Heritage Program, 1997). Only one population is extant. It is located within Tumwater Canyon, 7 miles west of Leavenworth, Chelan County, Washington.

[24] from USFWS, 1999.

Habitat Requirements: *Hackelia venusta* grows on rocky slopes in the Ponderosa pine zone. There are few associated species that occur in its rocky thin-soiled habitat (Kennison and Taylor, 1979b). The slopes that *Hackelia venusta* inhabit are moderate to steep, ranging in elevation from 300 to 2,050 m, and are most commonly south-facing (Gentry and Carr, 1976).

Spalding's silene *(Silene spaldingii)*[25]

Status: Spalding's silene is proposed in 1999 for listing as a threatened species in Washington State.

Range: Spalding's silene is a species of the Palouse Prairie and adjacent areas in Washington, Oregon, Idaho, and Montana. In Washington, Spalding's silene is found in Asotin, Lincoln, Spokane, and Whitman counties (Washington Natural Heritage Program, 1997).

Habitat Requirements: Spalding's silene is found in undisturbed prairie on loessal hills, at low to mid-elevations. It is associated with other species including: *Festuca idahoensis, Crataegus douglasii, Symphoricarpos albus, and Agropyron spicatum.* Occasionally, Spalding's silene is found in shrub-step and open woodlands habitats. This silene flowers from June to September (WDNR, 1981).

Water howellia (*Howellia aquatilis)*[26]

Status: *Howellia aquatilis* was listed as a threatened species, without critical habitat, in June 1994 (USDI, 1994).

Threats to the populations include: loss of wetland habitat and habitat changes due to timber harvest and road building, livestock grazing, residential and agricultural development, alteration of the surface or subsurface hydrology, and competition from introduced plant species such as reed canary grass *(Phalaris arundinacea)* and purple loosestrife *(Lythrum salicaria)* (USDI, 1994).

Range: The historic range of *Howellia aquatilis* included California, Idaho, Montana, Oregon and Washington. *Howellia aquatilis* has been reported from Mendocino County, California; Clackamas, Marion and Multnomah counties, Oregon; Mason, Thurston, Clark, Spokane and Pierce counties, Washington; Kootenai and Latah counties, Idaho; and Lake and Missoula counties, Montana (Gamon, 1992; Shelly and Gamon, 1996). The range has subsequently been reduced to Idaho, Montana and Washington (USDI, 1994). *Howellia aquatilis* is currently known from the following five distinct geographic areas: Latah County, Idaho has one occurrence; Lake and Missoula Counties, Montana has one occurrence, and Spokane, Clark and Pierce Counties, Washington all have one occurrence(Shelly and Gamon, 1996). These five geographic areas may be split into 3

[25] from USFWS, 1999.
[26] from USFWS, 1999.

metapopulations, Spokane, Pierce and Lake and Missoula metapopulations (Shelly and Gamon, 1996). The occurrences in Latah County, Idaho and Clark County, Washington may be either remnants of former metapopulations, or recent colonizations (Shelly and Gamon, 1996). These occurrences contain a total of 153 individual wetland sites, although many of them aggregate into wetland complexes (Shelly and Gamon, 1996).

Habitat Requirements., *Howellia aquatilis* is an aquatic annual plant that is restricted to small vernal, freshwater wetlands which have an annual cycle of filling up with water over the fall, winter and early spring, followed by drying during the summer months (Shelly and Gamon, 1996). *Howellia aquatilis* is incapable of germinating under water, thus *Howellia aquatilis* can only complete it's life cycle in intermittent aquatic habitats (Lesica, 1992).

In Washington State, *Howellia aquatilis* has been documented to occur in three different landscape settings (Shelly and Gamon, 1996). The majority are in small ephemeral wetlands found within forested portions of the channeled scablands in eastern Washington (Shelly and Gamon, 1996). The other locations are in the Puget Trough lowlands in Thurston and Pierce Counties, and the flood plain of the Columbia River in Clark County (Shelly and Gamon, 1996). In eastern Washington, the wetlands are typically immediately surrounded by a riparian area of deciduous trees and shrubs such as aspen *(Populus tremuloides),* spring birch *(Betula occidentalis)* and red-osier dogwood *(Cornus stolonifera)* and common snowberry *(Symphoricarpos albus)* (Shelly and Gamon, 1996). Surrounding this immediate riparian area is a mosaic of exposed basalt, grasslands, and open coniferous forest, primarily ponderosa pine *(Pinus ponderosa*) (Gamon, 1992). In Pierce County, the wetlands have a significant Oregon ash *(Fraxinus latifolia)* component, as well as a well developed shrub component consisting of hardhack *(Spirea douglasii),* and are bordered by Douglas fir dominated forests (Shelly and Gamon, 1996). In Clark County, the wetland site is located in the flood plain of the Columbia River. This site is within a mosaic of wetlands and Oregon ash communities, and the surrounding area has been converted to pasture (Shelly and Gamon, 1996). Dominant species in these wetlands include sedges, horsetails *(Equisetum),* and broad-leafed emergents *(Sium, Callitriche, Potamogeton, and Ranunculus)* (Lesica, 1992).

Wenatchee Mountain Checker-Mallow (*Sidalcea oregana var. calva)*[27]
Status: *Sidalcea oregano var. calva* was federally listed as endangered in 1999 (USDI, 1999b). Critical habitat was proposed in 2001 (USDI, 2001).

Range: Although the species of *Sidalcea oregano* (Oregon checker-mallow) occurs throughout the western United States, *S oregano var. calva* is know only in the Wenatchee Mountain of central Washington. Five known populations, totally 3,300 plants, occur in the Icicle Creek and Peshastin Creek Watersheds and on the Camas Lands in Chelan County. The primary threats to this species include alterations of hydrology, rural residential development and associated activities, competition from native and alien plants, recreation, fire suppression, and activities associated with fire

[27] from USFWS, 1999.

suppression. To a lesser extent threats include livestock grazing, road construction, and timber harvesting and associated impacts including changes in surface-runoff in the small watersheds in which the plant occurs (USDI, 1997b).

Habitat Requirements: *Sidalcea oregano var. calva* is most abundant in moist meadows that have surface water or saturated upper soil profiles during spring and early summer. It may also occur in open conifer stands dominated by *Pinus ponderosa and Pseudotsuga menziesii* and on the margins of shrub and hardwood thickets. Populations are found at elevations ranging from 1,900 to 4,000 feet. Soils are typically clay-loam and silt-loams with low moisture permeability. *Sidalcea oregano var. calva* is a perennial plant with a stout taproot that branches at the rootcrown and gives rise to several stems that are 20 to 150 centimeters in length. Pink flowers begin to appear in middle June and peaks in the middle to end of July. Fruits are ripe by August (USDI, 1997b).

Proposed Critical Habitat: The area proposed for critical habitat includes all of the lands that have the primary constituent elements below 1,000 m (3,300 ft) within the Camas Creek watershed and in the small tributary within Pendleton Canyon before its confluence with Peshastin Creek, and includes: (1) The entire area encompassed by the Camas Meadow Natural Area Preserve, which is administered by the WDNR; (2) two populations located on Forest Service land; (3) the small drainage north of the Camas Land, administered by the WDNR; and (4) the population on private property located in Pendleton Canyon. Portions of the designated critical habitat are presumably unoccupied by *Sidalcea oregana* var. *calva* at present, although the entire area has not been recently surveyed. Soil maps indicate that the entire area provides suitable habitat for the species, and there may be additional, but currently unknown, populations present here (USDI, 2001).

Ute Ladies'-tresses (*Spiranthes diluvialis*)[28]

Status: *Spiranthes diluvialis* was federally listed as threatened in 1992. The main threat factors cited were loss and modification of habitat, and modification of the hydrology of existing and potential habitat. The orchids pattern of distribution as small, scattered groups, its restricted habitat, and low reproductive rate under natural conditions make it vulnerable to both natural and human caused disturbances (USFWS, 1995). These life history and demographic features make the species more vulnerable to the combined impacts of localized extirpations, diminishing potential habitat, increasing distance between populations, and decreasing population sizes (Belovsky et al., 1994; USFWS, 1995).

Range.- In the State of Washington, *Spiranthes diluvialis* is located in Okanogan and Chelan County.

Habitat Requirements.- Ute ladies'-tresses is a perennial, terrestrial orchid that is endemic to moist soils in mesic or wet meadows near springs, lakes, or perennial

[28] from USFWS, 1999.

streams (USFWS, 1995). Observations by Jennings (1990) and Coyner (1989 and 1990) indicate that the Ute ladies'-tresses requires soil moisture to be at or near the surface throughout the growing season, indicating a close affinity with the flood plain. These observations were corroborated by Martin and Wagner (1992) with monitoring research at the Dinosaur National Monument. However, Riedel (1992) reported that once established it appears to be tolerant of somewhat drier conditions, but loses vigor and may gradually die out if the groundwater table begins to consistently drop during late summer (Riedel, 1992; Arft, 1994 pers. comm. in USFWS, 1995).

Ute ladies' tresses were originally reported to occur at elevations between 4,300 and 7,000 feet in eastern Utah and Colorado (Stone, 1993). However, recent discoveries of small populations in the Snake River Basin (1996; southeastern Idaho), and in Okanogan (1997) and Chelan (2000) Counties, Washington indicate that orchids are found at lower elevations (700-4,000 feet) in the more western part of their range (USFWS, 1995). Ute ladies'-tresses are found in a variety of soil types ranging from fine silt/sand to gravels and cobbles (USFWS, 1995). They have also been found in areas that are highly organic or consist of peaty soils. Ute ladies'-tresses are not found in heavy or tight clay soils or in extremely saline or alkaline soils (pH>8.0) (USFWS, 1995).

Ute ladies' tresses occur primarily in areas where vegetation is relatively open and not overly dense or overgrown (Coyner, 1989 and 1990; Jennings, 1989 and 1990). A few populations have been found in riparian woodlands of eastern Utah and Colorado (USFWS, 1995). However, the orchid is generally intolerant of shade, preferring open, grass and forb-dominated sites (USFWS, 1995*).*

The associated plant community composition and structure is frequently a good indicator across the range of the orchid (USFWS, 1995). For example, beaked spikerush *(Eleocharis rostellata)* appears to dominate the plant community in areas occupied by the orchid (Washington State). In Idaho, Ute ladies' tresses occupies areas dominated by silverleaf *(Elaeagnus commutata) and* creeping bentgrass *(Agrostis stolonifera).* The USFWS (1995) reported that species most commonly associated with Ute ladies'-tresses throughout its range include creeping bentgrass, baltic rush *(Juncus balticus),* long-styled rush *(J longistylis),* scouring rush *(Equisetum laevigatum),* and bog orchid *(Habenaria hyperborea).* Coyote willow *(Salix exigua)* and yellow willow *(S. lutea)* are commonly present in small numbers as saplings and small shrubs (USFWS, 1995). The USFWS (1995) reported that other species commonly associated with the Ute ladies'-tresses throughout its range include paint-brush *(Castilleja* spp.), thinleaf alder saplings *(Alnus incana),* narrowleaf cottonwood saplings *(Populus angustifolia),* sweet clover *(Melilotus* spp.), *sedges (Carex spp.),* red clover *(Trifolium pratense),* and western goldenrod *(Solidago occidentalis).*

The Ute ladies'-tresses appears to be tolerant and well adapted to disturbances, especially those caused by water movement through flood plains over time (Naumann, 1992 and Riedel, 1994 pers. comm. in USFWS, 1995). Habitat alteration resulting from agricultural use (grazing, mowing, and burning) may be beneficial, neutral, or detrimental (McClaren and Sundt, 1992). USFWS (1995) reported that grazing and mowing seem to promote flowering, presumably by opening the canopy to admit more light. However, these management practices may impede fruit set by directly removing flowering stalks, enhancing conditions for herbivory by small mammals and altering habitat required by bumble bees, the primary pollinator (USFWS, 1995; Arft, 1993).

Ute Ladies' tresses flower from mid-July to mid-August. Fruits mature and dehisce from mid-August into September. Plants may remain dormant for one or more growing seasons without producing above ground shoots. Orchids generally require symbiotic associations with mycorrhizal fungi for seed germination.

Reptiles

Green sea turtle *(Chelonia mydas)*[29]

Status: Green sea turtle was listed as threatened in 1978.

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 United States or in any territory under U.S. jurisdiction. Green sea turtles have been sighted 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 known 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 have not been identified, but are most likely located along the coast of Baja California (Mexico) and southern California (United States). Foraging grounds include bays and inlets (NMFS and USFWS, 1996a). There is no data on foraging areas along the west coast of the United States (McDonald and Dutton, 1990a, b; McDonald et al., 1995). The feeding habits of juveniles and hatchlings are not known.

Leatherback sea turtle *(Dermochelys coriacea)*[30]

Status: The leatherback sea turtle was listed as endangered in 1970.

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, 1996b).

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[29] from USFWS, 1999.
[30] from USFWS, 1999.

Habitat Requirements: Little information is available on the migratory habits of this species. Sightings of leatherback turtles off the coast of Washington have occurred during the summer months (Bowlby et al., 1994). Leatherback sea turtles feed on cnidarians (jellyfish) and tunicates (NMFS and USFWS, 1996b).

Loggerhead sea turtle *(Caretta caretta)*[31]

Status: The loggerhead turtle was listed as threatened throughout its range in 1978.

Range: Most nesting grounds of the loggerhead sea turtle are found in sub-tropical and warm temperate regions. The largest nesting colonies are found along the Atlantic Coast of Florida, United States and on Masirah Island, Oman (Groombridge, 1982). There is no known nesting on the Pacific Coast of the United States, 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 found in coastal waters of the United States and Mexico. Benthic invertebrates constitute the primary diet of adult loggerheads, but it occasionally includes fish and plants.

Olive Ridley sea turtle *(Lepidochelys olivacea)*[32]

Status: The olive ridley sea turtle was listed as threatened in 1978.

Range: Olive ridley sea turtles nest primarily along the northeast coast of India (Mrosovsky, 1993) and along the west coast of Mexico and Central America. There is no recorded nesting by olive ridley sea turtles in the United States 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, 1998).

Habitat Requirements: The diet and feeding habits of the olive ridley sea turtle have not been substantially researched. 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. It is assumed that they 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 found along the central American coast.

Fish

[31] from USFWS, 1999.
[32] From USFWS, 1999.

For each species, several different evolutionarily significant units (ESUs) and distinct population segments (DPSs) are listed as threatened or endangered. The general range, habitat requirements and life histories for each species are given first, followed by a detailed description of the range and critical habitat designation for each ESU/DPS.

Bull Trout (Salvelinus confluentus)[33]

Status:

- The Columbia River DPS were listed threatened in June, 1998.
- The Puget Sound/Coastal DPS were listed threatened in November, 1999.

Bull trout are threatened by habitat degradation and fragmentation from past and ongoing land management activities such as mining, road construction and maintenance, timber harvest, hydro power, water diversions/withdrawals, agriculture, and grazing. Bull trout are also threatened by interactions with introduced non-native fishes such as brook trout *(Salvelinus fontinalis)* and lake trout *(Salvelinus namaycush).*

Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin, and presently occur in 45 percent 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 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^{o}N to 60^{o}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 also occur in the Klamath River basin of south-central Oregon. 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).

[33] From USFWS, 1999.

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 I 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 one of the three 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; Bedell 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 are found 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 15^{o}C (59^{o}F) is believed to limit bull trout distribution, which partially explains their generally 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 overwintering 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 5 to 9^{o}C (41 to 48^{o}F) in late summer to early fall (Goetz, 1989). Pratt (1992) summarized information indicating that increases in fine sediments are related to reduced egg survival and emergence. High juvenile densities were observed in Swan River, Montana, and tributaries with diverse cobble substrate and low percentage of fine sediments (Shepard et al., 1984). Juvenile bull trout in four 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 is variable 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 are known to live as long as 12 years. Repeat and alternate year spawning has been reported, 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 have been known to move upstream as far as 250 kilometers (km) (155 miles (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 generally range from 4 to 10^{o}C (39 to 51^{o}F), 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 millimeters (mm) (6 to 12 inches (in.)) total length and migratory adults commonly reach 600 mm (24 in.) 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, known to feed on various trout (*Salmo* spp.) and salmon (*Oncorhynchus* spp.), whitefish (*Prosopium* spp.), yellow perch (*Perca flavescens*). and sculpin (*Cottus* spp-) (Fraley and Shepard, 1989; Donald and Alger, 1993).

Columbia River Bull Trout DPS
The Columbia River DPS occurs throughout the entire Columbia River basin within the United States and its tributaries, excluding bull trout found in the Jarbidge River, Nevada. Although Williams et al. (1995) identified two distinct clades in the Columbia River basin (upper and lower Columbia River) based on genetic diversity patterns, a discrete geographical boundary between the two clades was not documented. The Columbia River DPS is significant because the overall range of the species would be substantially reduced if this discrete population were lost (USDI, 1998).

Puget Sound/Coastal Bull Trout DPS
The Coastal-Puget Sound bull trout DPS encompasses all Pacific Coast drainages within the coterminous United States north of the Columbia River in Washington, including those flowing into Puget Sound. This population segment is discrete because it is geographically segregated from other subpopulations by the Pacific Ocean and the crest of the Cascade Mountain Range. 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 United States, thus, occurring in a unique ecological setting. In addition, the loss of this population segment would significantly reduce the overall range of the taxon (USDI, 1999a).

Chinook Salmon (*Oncorhynchus tshawytscha*)[34]
Status:
- Snake River spring/summer chinook were listed as threatened in April, 1992.
- Snake River fall chinook were listed as threatened in April, 1992.
- Lower Columbia River chinook were listed as threatened in March, 1999.
- Upper Columbia River spring chinook were listed as endangered in March, 1999.
- Upper Willamette River chinook were listed as threatened in March, 1999
- Puget Sound chinook were listed as threatened in March, 1999.

Threats to the chinook salmon include watershed development, such as forest practices, mining, agricultural land use, urbanization, hydro power development and water manipulation and withdrawal. Over-fishing, artificial propagation and introduction of nonnative species have also impacted chinook salmon. Forest practices, mining, agricultural land use, urbanization, hydro power development and water withdrawal have resulted in increased sedimentation, changes in flow regimes and channel morphology, decrease in water quality and quantity, loss of riparian ,habitat, loss of large woody debris, and loss of large woody debris recruitment, higher water temperatures, decreased gravel recruitment, reduction in pools and spawning and rearing areas, rerouting of stream channels, degradation of streambanks and loss of estuarine rearing areas (Bishop and Morgan, 1996; Myers et al., 1998). These changes have impacted the spawning and rearing environment of chinook salmon. Harvest,

[34] From USFWS, 1999.

hatchery practices and the introduction of nonnative species have also impacted 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 two 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). In order 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 main-stem Columbia River (Spence et al., 1996).

Stream-type chinook salmon, which is characteristic of spring fish (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 utilize 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; cited in Allen and Hassler, 1986) but zooplankton are more heavily preyed on 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 the following to chinook salmon rearing: shade for temperature regulation, vegetation inputs for food resources, streambank stabilization from roots and large woody debris recruitment. 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). ESUs with stream-type life history strategies are: upper Columbia River spring ESU; and the Snake River spring/summer ESU (Myers et al., 1998).

Ocean-type chinook salmon, which is typical of fall- fish, (Spence et al., 1996), migrate to sea normally within a few months after emergence. Ocean type chinook salmon 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 and chum salmon utilize 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, 1987; Wissmar and Simenstad, 1988; cited in Aitkin, 1998), 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 in Aitkin, 1998). 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 water 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). ESUs with ocean-type life history strategies are - the Puget Sound ESU, Lower Columbia River ESU, and Snake River fall ESU (Myers et al., 1998).

<u>Snake River Spring/Summer Chinook ESU</u>
This ESU includes all natural populations of spring/summer chinook salmon in the mainstem Snake River and any of the following sub-basins: Tucannon, Grande Ronde, Imnaha and Salmon (NMFS, 1995a).

> <u>Designated Critical Habitat:</u> In December, 1993 and October, 1999 (revised), critical habitat for Snake River spring/summer chinook was designated to include river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River

spring/summer chinook salmon in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River upstream to Hells Canyon Dam. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 22,390 square miles in Idaho, Oregon and Washington. The following counties lie partially or wholly within these basins: Idaho - Adams, Blaine, Custer, Idaho, Lemhi, Lewis, Nez Perce, and Valley; Oregon - Baker, Umatilla, Union, and Wallowa; Washington - Adams, Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman.

<u>Snake River Fall Chinook ESU</u>
This ESU includes all natural populations of fall chinook salmon in the mainstem Snake River and any of the following sub-basins: Tucannon, Grand Ronde, Imnaha, Salmon and Clearwater (NMFS, 1995a).

<u>Designated Critical Habitat:</u> In December, 1993, critical habitat for the Snake River fall chinook was designated to include river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River fall chinook salmon in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches proceeding upstream to the confluence of the Columbia and Snake Rivers; the Snake River, all river reaches from the confluence of the Columbia River, upstream to Hells Canyon Dam; the Palouse River from its confluence with the Snake River upstream to Palouse Falls; the Clearwater River from its confluence with the Snake River upstream to its confluence with Lolo Creek; the North Fork Clearwater River from its confluence with the Clearwater River upstream to Dworshak Dam. Major river basins containing spawning and rearing habitat for this ESU comprise approximately 13,679 square miles in Idaho, Oregon, and Washington. The following counties lie partially or wholly within these basins: Idaho - Adams, Clearwater, Idaho, Latah, Lemhi, Lewis, and Nez Perce; Oregon - Baker, Union, and Wallowa; Washington - Adams, Asotin, Columbia, Franklin, Garfield, Walla Walla, and Whitman.

<u>Lower Columbia River Chinook ESU</u>
The ESU includes all naturally spawned chinook populations from the mouth of the Columbia River to the crest of the Cascade Range, excluding populations above Willamette Falls. Celilo Falls, which corresponds to the edge of the drier Columbia Basin Ecosystem and historically may have presented a migrational barrier to chinook salmon at certain times of the year, is the eastern boundary for this ESU. Not included in the ESU are stream-type spring chinook salmon found in the Klickitat River or the introduced Carson spring chinook salmon. Fall chinook salmon in the Wind and Little White Salmon rivers are included in this ESU, but not introduced upriver bright fall

chinook salmon populations in the Wind, White Salmon and Klickitat rivers. Populations in the ESU are considered ocean-type. Populations in this ESU tend to mature at age 3-4.

Ecologically, the Lower Columbia River ESU crosses several ecoregions: Coastal, Willamette, Cascades and east Cascades (NMFS, 1998a). Only naturally spawned chinook salmon are proposed for listing at this time (NMFS, 1998a).

Designated Critical Habitat: In February, 2000, critical habitat for lower Columbia River chinook was designated to include all river reaches accessible to listed chinook salmon in Columbia River tributaries between the Grays and White Salmon Rivers in Washington and the Willamette and Hood Rivers in Oregon, inclusive. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to The Dalles Dam. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 6,338 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, Wasco, and Washington; Washington - Clark, Cowlitz, Klickitat, Lewis, Pierce, Pacific, Skamania, Wahkiakum, and Yakima.

Upper Columbia River Spring Chinook ESU

This ESU includes stream-type chinook salmon spawning above Rock Island Dam in the Wenatchee, Entiat and Methow Rivers. All chinook salmon in the Okanogan River are considered ocean-type and are considered part of the Upper Columbia River summer and fall ESU (NMFS, 1998a). Only naturally spawned chinook salmon are proposed for listing at this time (NMFS, 1998a).

Designated Critical Habitat: In February, 2000, critical habitat for upper Columbia spring chinook was designated to include all river reaches accessible to listed chinook salmon in Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam in Washington, excluding the Okanogan River. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 7,003 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration corridors for the species): Oregon - Clatsop, Columbia, Hood River, Gilliam, Morrow, Sherman, Umatilla, and Wasco;

Washington - Benton, Chelan, Clark, Cowlitiz, Douglas, Franklin, Grant, Klickitat, Kittitas, Multnomah, Okanogan, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima.

Upper Willamette River Chinook ESU

The ESU includes all naturally spawned populations of spring-run chinook salmon in the Clackamas River and in the Willamette River, and its tributaries, above Willamette Falls, Oregon.

Designated Critical Habitat: In February, 2000, critical habitat for upper Willamette River chinook was designated to include all river reaches accessible to listed chinook salmon in the Clackamas River and the Willamette River and its tributaries above Willamette Falls. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to and including the Willamette River in Oregon. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 8,575 square miles. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Benton, Clackamas, Clatsop, Columbia, Douglas, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill; Washington - Clark, Cowlitz, Pacific, and Wahkiakum.

Puget Sound Chinook ESU

The ESU encompasses all naturally spawned spring, summer and fall chinook salmon in the Puget Sound region from the North Fork Nooksack River to the Elwha River on the Olympic Peninsula, inclusive. Chinook salmon in this area all exhibit ocean-type life history. Puget Sound stocks all tend to mature at ages 3 to 4 and exhibit similar, coastally-oriented ocean migration patterns (NMFS, 1998a). The boundaries of the Puget Sound ESU correspond generally with the boundaries of the Puget Lowland Ecoregion. The Elwha River which is in the Coastal Ecoregion, is the only system in this ESU which lies outside the Puget Sound Ecoregion. In life history and genetic attributes, the Elwha River chinook salmon appear to be transitional between population from Puget Sound and the Washington Coast ESU (NMFS, 1998a). Only naturally spawned chinook salmon are proposed for listing at this time (NMFS, 1998a).

Designated Critical Habitat: In February 2000, critical habitat for Puget Sound chinook was designated to include all marine, estuarine and river reaches accessible to listed chinook salmon in Puget Sound. Puget Sound marine areas include South Sound, Hood Canal, and North Sound to the international boundary at the outer extent of the Strait of Georgia, Haro Strait and the Strait of Juan De Fuca to a straight line extending north from the west end of Freshwater Bay, inclusive. Also included are adjacent riparian zones. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 13,761 square miles in Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Lewis, Mason, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom.

Sockeye Salmon (*Oncorhynchus nerka*)[35]

Status:

- Snake River sockeye were listed as endangered in November 1991.
- Lake Ozette sockeye were listed as threatened in March 1999

Threats to sockeye salmon populations include hydro power development, water withdrawal and diversions, water storage, harvest, predation, inadequate regulatory mechanisms (NMFS, 1991), forestry, and associated road building (Dlugokenski, 1981; Blum, 1988), agriculture, mining and urbanization have degraded simplified, and fragmented habitat (NMFS, 1998c).

Range: Sockeye salmon occur in North America from the Columbia River, Washington to the Nome River, Alaska (Gustafson et al. 1997). In Asia, sockeye salmon occur from Hokkaido, Japan to the Anadyr River (Burgner, 1991).

Habitat Requirements: Sockeye salmon exhibit greater variety of life history patterns, greater diversity in the selection of spawning habitat, and greater variation in river entry timing and duration of holding in lakes prior to spawning than chum, coho, chinook or pink salmon (Gustafson et al. 1997). The major distribution and abundance of large sockeye salmon stocks occurs in river systems that have accessible lakes in their watersheds for spawning and juvenile rearing (Burgner, 1991). Other life history forms include river-type and sea-type populations, and resident and kokanee populations. River and sea-type sockeye salmon are common in northern areas and may predominate over lake-type sockeye salmon in some river systems (Wood, 1995). River and sea-type populations have shown much less genetic differentiation than widely separated populations of lake-type Sockeye Salmon (Wood, 1995). This has been interpreted as an indication of relaxed homing adaptions in river and sea-type populations, and has been hypothesized that these populations play an important role in recolonizing habitat (Wood, 1995).

Sockeye salmon lake-type life history patterns spawn in 1) inlet or outlet streams of lakes, 2) suitable habitat between lakes, 3) in the lake along the shoreline with areas of groundwater upwelling, or on outwash fans of tributaries, or 4) along beaches or shoreline with clean gravel substrate and wind driven currents that supply egg oxygenation (Foerster, 1968; Burgner, 1991; Gustafson et al., 1997; NMFS, 1998c). After emergence in streams the fry move either upstream or downstream to rearing lakes, this migration typically occurs at night to avoid predators (Gustafson et al., 1997). After emergence in lakes, they take up residence in the lake.

[35] From USFWS, 1999.

While rearing in the lake, sockeye salmon fry may initially feed near the lake shoreline and then move into deeper waters of the limnetic zone, or the fry may enter the limnetic zone directly (Gustafson et al., 1997). While in the lakes, the juveniles are visual predators and feed on copepods, cladocerans, and insect larvae (Foerster, 1968; Burgner, 1991; Gustafson et al., 1997). Residence time in the lake is influenced by growth. Growth is influenced by interspecific and intraspecific competition, food supply, water temperature, thermal stratification, migratory movement to avoid predation, lake turbidity, and length of growing season (Gustafson et al., 1997). In Washington State and British Columbia, lake residence time is normally 1 to 2 years (Burgner, 1991).

Lake-type sockeye salmon smolt and migrate to sea in the spring, and spend 1 to 4 years in the marine environment and return to their natal lake system to spawn in the late summer or early autumn (Gustafson et al., 1997). In the ocean, sockeye salmon feed on copepods, euphasiids, amphipods crustacean larvae, fish larvae, squid and pteropods (NMFS, 1998c). Juveniles migrate northward to the Gulf of Alaska, staying relatively close to shore. Offshore movement occurs in late autumn or early winter (NMFS, 1998c).

While migrating upstream, sockeye salmon take advantage of slower water and eddies along streambanks and bottoms, and travel in schools (Burgner, 1991). Adult lake-type sockeye salmon home precisely to their natal stream or lake habitat (Hanamura, 1966; Quinn, 1985, Quinn et al., 1987). This precise homing ability is thought to be adaptive, as it ensures that juveniles will encounter a suitable nursery lake.

Sockeye salmon river-type life history patterns occur where lake rearing area is not available or inaccessible (NMFS, 1998c). River-type sockeye salmon use slow velocity areas of river as juvenile rearing areas for 1-2 years, migrate to sea, spend 1-4 years in the marine environment and return to their natal river system to spawn (Gustafson et al., 1997).

Sockeye salmon sea-type life history patterns use slow velocity areas of river for rearing, similar to river-type life histories. In contrast, sea-type sockeye salmon migrate to sea after only a few months rearing in the river environment. Studies have indicated that sea-type sockeye salmon possess heritable physiological adaptions for successful migration to the sea as underyearlings (Wood, 1995). They use tidewater sloughs and estuaries for further rearing, and then enter the marine environment and spend 1-4 years before they return to their natal river system to spawn (Gustafson et al., 1997).

Riverine spawning sockeye salmon, including both river-type and sea-type life history strategies have been reported in a number of Washington rivers. The presence of riverine spawning sockeye salmon occurring consistently over decades, has been documented in the North and South Fork Nooksack, Skagit, Sauk, North Fork Stillaguamish, Samish and Green rivers (NMFS, 1998c). Riverine spawning sockeye salmon have also been reported from the Nisqually, Skokomish, Dungeness, Calawah, Hoh, Queets and Clearwater rivers (NMFS, 1998c). Riverine spawning aggregations in

Washington State are not defined as an ESU at this time, due to insufficient evidence (Gustafson et al., 1997).

Kokanee are a self-perpetuating, non-anadromous form of sockeye that occurs in balanced sex ratio populations and whose parents and back several generations have spent their entire life cycle in freshwater (Gustafson et al., 1997). Kokanee occur in land-locked lakes, where migration to the ocean is difficult or has been cutoff, or in interior lakes where migration to the sea is possible, but not worth the energy expended (Gustafson et al., 1997). Kokanee can produce anadromous offspring, and anadromous sockeye salmon can produce kokanee offspring in lakes without ocean access (Scott, 1984; Kaeriyama et al., 1992). In two instances, (Lake Ozette Washington and Lake Cowichan, Vancouver Island), large viable kokanee populations with no documented anadromous members exist in lake basins where access to and from the ocean is relatively easy (Dlugokenski et al., 1981; Rutherford et al., 1988).

Juvenile anadromous sockeye salmon occasionally remain in their lake rearing environment and have been observed on the spawning ground with their anadromous cohorts. These sockeye salmon are referred to as "resident " sockeye salmon, to indicate that they are the progeny of anadromous parents The degree to which resident sockeye salmon produce anadromous offspring is unknown (Gustafson et al., 1997).

Kokanee and resident sockeye salmon typically spawn in the vicinity of a nursery lake, die after spawning a single time and as juveniles rear in the pelagic zone of the lake. Kokanee and resident sockeye salmon remain in fresh water ' for their entire life cycle (Gustafson et al., 1997). Kokanee and resident life history forms are smaller at maturity than anadromous primarily because of productivity differences between fresh water and oceanic rearing environments (Gustafson et al. 1997).

Genetic differentiation indicates that kokanee are polyphyletic- having arisen from sockeye salmon on multiple independent occasions. Kokanee may occur sympatrically or allopatrically in relation to sockeye salmon (Foote et al. 1989; Wood and Foote, 1990; Foote et al., 1992; Taylor et al., 1996; Wood and Foote, 1996; Winans et al., 1996). Sympatric kokanee, resident and anadromous forms of sockeye salmon may spawn at the same time and place (Foote et al., 1994), although kokanee may spawn earlier than anadromous sockeye salmon. In studied locations where anadromous sockeye salmon and kokanee remain sympatric and spawn in the same place and time, there is a high degree of size-based assortative mating (Foote and Larkin, 1988). Assortative mating by body size usually leads to assortative mating by type; hence kokanee with kokanee and sockeye salmon with sockeye salmon. Some sneak spawning by kokanee males occurs and results in the successful fertilization of sockeye salmon eggs, substantial isolating mechanisms between kokanee and sockeye salmon occur after emergence, which may reduce gene flow (Wood and Foote, 1996).

Snake River sockeye ESU

This ESU includes all natural populations of sockeye salmon in the Snake River basin below Hells Canyon Dam and Dworshak Dam on the Clearwater River including areas that were historically accessible to sockeye salmon.

Designated Critical Habitat: On December 28, 1993, critical habitat for Snake River sockey was designated to include river reaches presently or historically accessible (except reaches above impassable natural falls, and Dworshak and Hells Canyon Dams) to Snake River sockeye salmon in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) and including all Columbia River estuarine areas and river reaches upstream to the confluence of the Columbia and Snake Rivers; all Snake River reaches from the confluence of the Columbia River upstream to the confluence of the Salmon River; all Salmon River reaches from the confluence of the Snake River upstream to Alturas Lake Creek; Stanley, Redfish, Yellow Belly, Pettit, and Alturas Lakes (including their inlet and outlet creeks); Alturas Lake Creek, and that portion of Valley Creek between Stanley Lake Creek and the Salmon River. Watersheds containing spawning and rearing habitat for this ESU comprise approximately 510 square miles in Idaho. The watersheds lie partially or wholly within the following counties: Blaine and Custer.

Ozette Lake sockeye ESU
This ESU consists of sockeye salmon that return to Lake Ozette through the Ozette River and currently spawn in lakeshore upwelling areas, with a preference for locations at Allen's Bay and Olsen's Beach (Gustafson et al., 1997). Spawning also occurs in the Ozette River, or in Coal Creek, a tributary to the Ozette River. Historically, there may have been spawning in tributary streams to Lake Ozette, presently no spawning is occurring (Gustafson et al., 1997). Lake Ozette sockeye salmon are genetically distinct from all other sockeye salmon stocks in the Northwest (Gustafson et al., 1997). Kokanee are numerous in Lake Ozette, and spawn in inlet tributaries, whereas sockeye spawn primarily on lakeshore upwelling beaches (Gustafson et al., 1997). There are no physical barriers between these two environments, however sockeye salmon have not been observed to use inlet spawning grounds. Kokanee-sized *O. nerka* have been observed together with sockeye salmon on the sockeye salmon spawning beaches (Gustafson et al., 1997). Lake Ozette kokanee and Lake Ozette sockeye salmon exhibit large genetic differences, hence the biological review team excluded kokanee from the ESU. If kokanee sized *O. Nerka* observed spawning with sockeye salmon on sockeye salmon spawning beaches are identified as resident sockeye salmon, then they will be considered as part of the Lake Ozette sockeye salmon ESU (Gustafson et al., 1997). Only naturally spawned sockeye salmon are proposed for listing at this time (NMFS, 1998c).

> Designated Critical Habitat: **-** In February, 2000, critical habitat for Ozette Lake sockeye was designated to include all lake areas and river reaches (including adjacent riparian zones) accessible to listed sockeye salmon in Ozette Lake, located in Clallam County, Washington. Excluded are areas above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years) as well as tribal lands. Watersheds containing spawning and rearing habitat for this ESU comprise approximately 88 square miles in Washington. The watersheds lie partially or wholly within Clallam county.

Chum Salmon (*Oncorhynchus keta*)[36]
Status:
- In March 1999, Columbia River chum were listed as threatened.
- In March 1999, Hood Canal summer chum were listed as threatened.

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; water withdrawal conveyance, storage and flood control (resulting in insufficient flows, stranding, juvenile entrainment, degradation of spawning habitat and instream temperature increases); logging and agriculture (loss of large woody debris, sedimentation, loss of riparian vegetation, habitat simplification); mining (gravel removal, dredging, pollution); urbanization (stream channelization, increased runoff, pollution, habitat simplification) (NMFS, 1998b). Incidental harvest in salmon fisheries in the Strait of Juan de Fuca and coho salmon fisheries in Hood Canal are a significant

[36] From USFWS, 1999.

threat to the Hood Canal summer chum salmon (NMFS, 1998b). This threat has been decreased with changes in harvest management, but may arise in the future 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 are found as far south as Tillamook Bay on the northern Oregon coast (Johnson et al., 1997). In Asia, chum salmon occur from Korea to the Arctic coast of the Russian Far East and west to the Lena River which flows into the Laptev Sea (Salo, 1991). Historically, chum salmon in the Columbia River Basin may have spawned in the Umatilla and Walla Walla Rivers, more than 500 kin 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). Currently, 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 three seasonal runs; summer, fall and winter. The chum salmon of the Columbia River chum salmon 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 (WDF et al., 1993). The chum salmon of the Hood Canal summer chum salmon ESU enter freshwater to spawn from August to mid-September (Cook-Tabor, 1995). Hood Canal summer chum salmon spawning periods vary from August 15 through early October, dependent upon 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 biologists reported that chum salmon in Washington do not preferentially choose areas of upwelling groundwater for redd construction; rather they suggest that chum salmon in Washington "most commonly" use "areas at the head of riffles" (Crawford 1997; in Johnson et al., 1997). Generally, chum salmon spawn in shallower, lower gradient, lower 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 the Russian Federation, they have been documented to migrate up to 2,5 00 kin 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 outmigration 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 and pink 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). Ina summarization of the diets of juvenile chum salmon from 16 estuaries, Simenstad et al.(1982) concluded that juvenile chum salmon ≤50 to 60 min fork length fed on epibenthic food resources such as harpacticoid copepods, gammarid amphipods and isopods, while larger juveniles >50 to 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 and remain and migrate through the gulf until they reach maturity and head back 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 section 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).

Columbia River chum ESU
The biological review team concluded that, historically, at least one ESU of chum salmon in the Columbia River occurred (NMFS, 1998b). Historically, chum salmon were abundant in the lower reaches of the Columbia River and may have spawned as far upstream as the Walla Walla River (over 500 km inland). Today only remnant populations of churn salmon exist in the lower Columbia River (NMFS, 1998b). Based on genetic and ecological data available, the biological review team concluded that chum salmon in the Columbia River were different enough from other populations in nearby Washington and Oregon coastal river systems (e.g., Willapa Bay, Nehalem River, Grays Harbor, Tillamook River). Hence the Columbia River ESU extends only to the mouth of the Columbia River (NMFS, 1998b).

Designated Critical Habitat: **-** In February 2000, critical habitat for Columbia River chum was designated to include all river reaches accessible to listed chum salmon (including estuarine areas and tributaries) in the Columbia River downstream from Bonneville Dam, excluding Oregon tributaries upstream of Milton Creek at river km 144 near the town of St. Helens. Also included are adjacent riparian zones. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 4,426 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Clatsop, Columbia, Multnomah, and Washington; Washington - Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum.

Hood Canal summer chum ESU
This ESU includes summer chum salmon populations in Hood Canal in Puget Sound and in Discovery and Sequim bays on the Strait of Juan de Fuca. It may also include summer chum salmon in the Dungeness River, however the existence of that run is uncertain (NMFS, 1998b). Summer chum salmon spawn from mid-September to mid-October (WDF et al., 1993). Fall chum salmon spawn from November through December or January (WDF et al., 1993). Data on run timing from as early as 1913 indicated temporal separation between summer and fall chum salmon in Hood Canal, and recent spawning surveys show this separation still exists (NMFS, 1998b). Summer chum salmon generally spawn in the lower mainstem reaches of rivers, with redds typically dug in the mainstem or side channels, from just above tidal influence upriver approximately 16 km (NMFS, 1998b).

Designated Critical Habitat: In February 2000, critical habitat for Hood Canal summer chum was designated to include all river reaches accessible to listed chum salmon (including estuarine areas and tributaries) draining into Hood Canal as well as Olympic Peninsula rivers between and including Hood Canal and Dungeness Bay, Washington. Also included are adjacent riparian zones and estuarine/marine areas of Hood Canal, Admiralty Inlet, and the Straits of Juan De Fuca to the international boundary and as far west as a straight line extending north from Dungeness Bay. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 1,753 square miles in Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Clallam, Island, Jefferson, Kitsap, and Mason.

Steelhead Trout (*Oncorhynchus mykiss*)
Status:

- In August 1997, Upper Columbia River steelhead trout were listed as endangered.
- In August 1997, Snake River steelhead trout were listed as threatened.
- In March 1998, Lower Columbia River steelhead trout were listed as threatened.
- In March 1999, Middle Columbia River steelhead trout were listed as threatened.
- In March 1999, Upper Willamette steelhead trout were listed as threatened.

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, high harvest rates on steelhead smolts in rainbow trout fisheries.

Range: Steelhead trout are found 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 present (Pauley et al., 1986). Winter steelhead populations have been documented to occur in the following Washington rivers: Soleduck, 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: *Oncorhynchus mykiss (O. mykiss)* exhibits a great diversity of life history patterns, and are phylogenetically and ecologically complex. *O. mykiss* exhibit 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), 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 three years in the ocean prior to their first spawning (Busby et al., 1996).

In North America, *O. mykiss* is split into two phylogenetic groups, inland and coastal (Busby et al. 1996). These two 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). Large genetic difference between coastal and inland groups have been demonstrated for both anadromous and non-anadromous forms (Busby et al., 1996). In Washington coastal populations total 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, I year in the ocean and I year in freshwater as an adult prior to spawning (Busby et al., 1996). Steelhead 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 ran timing (Busby et al., 1996).

O. mykiss have two 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, or 2) ocean maturing or winter steelhead (Busby et al., 1996). Summer steelhead 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 or large woody debris 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 from the Columbia River Basin, and especially the Snake River Basin are split into two groups, A- and B-run steelhead. 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 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 occur throughout steelhead bearing streams in the Snake and Columbia river basins (IDFG, 1994). Adult B-run steelhead 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 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 are the most widespread of the two reproductive types. Coastal streams are dominated by winter steelhead, 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 exclusive 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).

Steelhead also exhibit a "half-pounder" life history strategy. Half-pounder are immature steelhead that return to freshwater after only 2 to 4 months in the ocean (Busby et al., 1996). These steelhead overwinter in freshwater and outmigrate again the following spring. Occurrence of half-pounder steelhead has been reported to occur in southern Oregon and northern California rivers (Barnhart, 1986).

Non-anadromous forms of *O.* mykiss have been 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 forms co-occur more frequently in inland populations that coastal populations (Busby et al., 1996) In coastal populations where they co-occur, the forms are usually separated by a migration barrier, either natural or man-made (Busby et al., 1996).

Where the two forms 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) in the Methow River, Washington found evidence that due to very cold stream temperatures, juvenile steelhead had difficulty attaining size for smoltification. He 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 diet changes 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 remain in freshwater for I to 4 years before smoltification. In areas where anadromous and non anadromous forms 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 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 no formation of schools, and steelhead do not use areas where commercial harvest of other Pacific salmon stocks occur (Pauley et al., 1986). Distribution at sea appears to be influenced by surface water temperature and conforms closely to the 5^{o}C isotherm on the North and the 15^{o}C isotherm on the south (Sutherland, 1973).

Upper Columbia River steelhead ESU
This ESU occupies the Columbia River Basin upstream from the Yakima River, and includes the Wenatchee, Entiat, Methow and Okanogan river basins (Busby et al., 1996). Some of the headwaters of these basins occur in British Columbia, therefore the status of steelhead in British Columbia is applicable to this ESU. Recent conversations between the B.C. Ministry of Environment and the NMFS, concluded that "steelhead never occurred in large numbers in British Columbia in the upper Columbia River Basin" (Busby et al., 1996). The NMFS therefore concluded that this ESU includes on U.S. populations of steelhead (Busby et al., 1996). All upper Columbia river steelhead are summer steelhead (Busby et al., 1996). Streams of this region drain the northern Cascade Mountains of Washington, and flow is provided by glacial runoff or snowmelt. This results in extremely cold water temperatures that can retard growth and maturation of juveniles, hence some of the oldest smolt ages, up to 7 years are reported within this ESU, and residualization of juvenile steelhead that fail to smolt also occurs (Busby et al., 1996). The relationship between anadromous and non-anadromous *O. mykiss* is unclear in the geographic area. The NMFS is listing only the anadromous life forms of *O. mykiss* in this ESU (NMFS, 1997). Only naturally spawned populations of steelhead and their progeny which are part of the biological ESU residing below long-term, naturally and man-made impassable barriers (i.e. dams) are listed (NMFS, 1997). The Wells Hatchery stock of steelhead is included as listed in this ESU because it is essential for recovery, as it probably retains the genetic resources of steelhead populations above Grand Coulee Dam that are now extinct from their native habitats (NMFS, 1997).

Designated Critical Habitat: In February, 2000, critical habitat for Upper Columbia River steelhead was designated to include all river reaches accessible to listed steelhead in Columbia River tributaries upstream of the Yakima River, Washington, and downstream of Chief Joseph Dam. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to Chief Joseph Dam in Washington. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 9,545 square miles in Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Clatsop, Columbia, Gilliam, Hood River, Morrow, Multnomah, Sherman, Umatilla, and Wasco; Washington - Benton, Chelan, Clark, Cowlitz, Douglas, Franklin, Gilliam, Grant, Kittitas, Klickitat, Okanogan, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima.

Snake River steelhead ESU

This ESU occupies the Snake River Basin of southeast Washington, northeast Oregon and Idaho. This region has high ecological complexity and supports a diversity of steelhead populations. These populations have been shown to be more genetically and meristically similar to each other than to other steelhead populations occurring outside the Snake River Basin (Busby et al., 1996). This ESU includes the highest elevations for steelhead spawning (up to 2,000 m) and the longest migration distance from ' the ocean (up to 1,500 km) (Busby et al., 1996). Snake River steelhead are summer steelhead, and are classified into two groups, A and B run. These groups are based on migration timing, ocean age and adult size (Busby et al., 1996). The relationship between anadromous and non-anadromous *O. mykiss* is unclear in the geographic area. The NMFS is listing only the anadromous life forms of *O. mykiss* in this ESU (NMFS, 1997). Only naturally spawned populations of steelhead and their progeny which are part of the biological ESU residing below long-term, naturally and man-made impassable barriers (i.e. dams) are listed (NMFS, 1997).

Designated Critical Habitat: In February 2000, critical habitat for Snake River steelhead was designated to include all river reaches accessible to listed steelhead in the Snake River and its tributaries in Idaho, Oregon, and Washington. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the confluence with the Snake River. Excluded are tribal lands and areas above specific dams identified or above longstanding, naturally impassable barriers (i.e., Napias Creek Falls and other natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 29,282 square miles in Idaho, Oregon, and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Idaho - Adams, Blaine, Boise, Clearwater, Custer, Idaho, Latah, Lemhi, Lewis, Nez Perce, and Valley; Oregon - Baker, Clatsop, Columbia, Hood River, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, and Wasco; Washington - Asotin, Benton, Clark, Columbia, Cowlitz, Franklin, Garfield, Gilliam, Klickitat, Skamania, Wahkiakum, Walla Walla, and Whitman.

Lower Columbia River steelhead ESU

This ESU occupies tributaries to the Columbia River between the Cowlitz and Wind rivers in Washington and the Willamette and Hood rivers in Oregon, inclusive (Busby et al., 1996). Excluded are steelhead in the upper Willamette River Basin above Willamette Falls, and steelhead from the Little and Big White Salmon rivers, Washington. Only naturally spawned populations of steelhead and their progeny in streams and tributaries to the Columbia River between the Cowlitz and Wind rivers, Washington, inclusive, and the Willamette and Hood rivers Oregon, inclusive, are listed at this time (NMFS, 1998d). This ESU has both winter and summer steelhead present, and non-anadromous *O. mykiss* co-occur with anadromous forms in the lower Columbia River tributaries (Busby et al., 1996). The relationship between non-anadromous and anadromous forms in this geographic area is unclear (Busby et al., 1996). A number of genetic studies have shown that steelhead in this ESU are of the coastal genetic group (Schreck et al., 1986; Reisenbichler et al,. 1992; Chapman et al., 1994) and are part of a different ancestral lineage than inland steelhead from the Columbia River Basin (Busby et al., 1996).

Designated Critical Habitat:In February 2000, critical habitat for Lower Columbia River steelhead was designated to include all river reaches accessible to listed steelhead in Columbia River tributaries between the Cowlitz and Wind Rivers in Washington and the Willamette and Hood Rivers in Oregon, inclusive. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the Hood River in Oregon. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 5,017 square miles in Oregon and Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Clackamas, Clatsop, Columbia, Hood River, Marion, Multnomah, and Washington; Washington - Clark, Cowlitz, Lewis, Pacific, Skamania, and Wahkiakum.

Middle Columbia River steelhead ESU

This ESU occupies the Columbia River Basin from above the Wind River in Washington and the Hood River in Oregon, upstream to the Yakima River in Washington, inclusive (Busby et al., 1996). Upstream of the Dalles Dam all steelhead are summer, inland steelhead (Schreck et al., 1986; Reisenbichler et al., 1992; Chapman et al., 1994). Winter steelhead occur in the Klickitat and White Salmon rivers in this ESU. Non-anadromous *O. mykiss* co-occur with anadromous forms in the ESU, and information suggests that the two forms may not be isolated except in cases where barriers are involved (Busby et al., 1996). Only naturally spawned steelhead are proposed for listing at this time (NMFS, 1998e).

Designated Critical Habitat: In February 2000, critical habitat for Middle Columbia River steelhead was designated to include all river reaches accessible to listed steelhead in Columbia River tributaries (except the Snake River) between Mosier Creek in Oregon and the Yakima River in Washington (inclusive). Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to the Yakima River in Washington. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 26,739 square miles in Oregon and

Washington. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Clatsop, Columbia, Crook**,** Gilliam**,** Grant, Harney, Hood River, Jefferson, Morrow, Multnomah, Sherman, Umatilla, Union, Wallowa, Wasco, and Wheeler; Washington - Benton, Clark, Columbia, Cowlitz, Franklin, Kittitas, Klickitat, Pacific, Skamania, Wahkiakum, Walla Walla, and Yakima.

Upper Willamette River steelhead ESU
The ESU includes all naturally spawned populations of winter-run steelhead in the Willamette River, Oregon, and its tributaries upstream from Willamette Falls to the Calapooia River, inclusive.

Designated Critical Habitat: In February 2000, critical habitat for Upper Willamette River steelhead was designated to include all river reaches accessible to listed steelhead in the Willamette River and its tributaries above Willamette Falls upstream to, and including, the Calapooia River. Also included are adjacent riparian zones, as well as river reaches and estuarine areas in the Columbia River from a straight line connecting the west end of the Clatsop jetty (south jetty, Oregon side) and the west end of the Peacock jetty (north jetty, Washington side) upstream to, and including, the Willamette River in Oregon. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 4,872 square miles in Oregon. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Oregon - Benton, Clackamas, Clatsop, Columbia, Lincoln, Linn, Marion, Multnomah, Polk, Tillamook, Washington, and Yamhill; Washington - Clark, Cowlitz, Pacific, and Wahkiakum.

Coastal cutthroat trout *(Oncorhynchus clarki clarki*)[37]
Status:

- In April 1999, Southwest Washington/Columbia River coastal cutthroat trout ESU were proposed as threatened.

Threats to the coastal cutthroat trout populations include loss of stream habitat due to logging and forest road building, and increased urbanization (Trotter, 1989).

Range*:* Coastal cutthroat trout occur along the coast of North America from Humboldt Bay, California to Prince William Sound, Alaska.. This species occurs inland to the crest of the Cascade Mountain Range in Washington and Oregon, and to the crest of the Coast Range in British Columbia and Alaska (Trotter, 1989).

Habitat Requirements: There are three basic life history forms that occur with coastal cutthroat trout, including an anadromous form, a potamodromous form that includes both stream-dwelling and lake dwelling populations, and a non-migratory form that resides in small streams and headwater tributaries (Trotter, 1989).

[37] From USFWS, 1999.

The anadromous life history form of coastal cutthroat trout spawn in low or gentle gradient areas of the mainstem or tributaries of small to moderate size streams systems (Trotter, 1989). Spawning periods extend from December through May with peak spawning periods in February in Washington, Oregon and southern British Columbia (Trotter, 1989). Emergence from the gravel can occur from March through June, with a peak occurring around mid April (Trotter, 1989). After emergence, cutthroat trout need nursery and rearing habitat with protective cover and low velocity water (Behnke, 1992). These habitats occur along stream margins, side channels, small tributaries and spring seeps. In systems where coho salmon are present, they exert social dominance in sympatric situations with cutthroat trout. Coho salmon emerge from the gravel earlier than cutthroat trout, which can result in coho salmon being larger and more aggressive. These two species compete for rearing area. Coho salmon exert their dominance and drive cutthroat trout into riffle areas. The cutthroat trout remain in the riffles until the water temperature drops, which reduces aggression in coho salmon (Trotter 1989). In addition, increasing winter flows will eventually force the cutthroat trout into areas of the stream with lower velocities and more protected environments (Glova and Mason, 1976, 1977). Where coho salmon and cutthroat trout occur together, salmon nurseries are usually found downstream of cutthroat trout nursery areas (Trotter, 1989).

Anadromous cutthroat trout begin their downstream movement to the mainstem in the winter and spring of their first year (Trotter, 1989). The fish may move back up into the tributaries to protect themselves from higher winter flows. Typically, as the fish get larger and older, they move into deeper waters with some form of cover nearby such as undercut banks, large woody debris or overhanging vegetation. These selected areas are often adjacent to fast waters that carry food for the trout to access (Behnk,e 1992).

Anadromous coastal cutthroat trout have been documented to smolt and migrate to sea from age 1 to age 6 (Giger, 1972; Lowery, 1975), with the majority smolting and migrating at age 2, 3 or 4 (Trotter, 1989). Anadromous coastal cutthroat trout can attain a maximum age of 10 years. In Washington and Oregon, seaward migration peaks in mid-May (Trotter, 1989). In bays, estuaries and along the coast anadromous coastal cutthroat trout spend 2-5 months, and return to the rivers as the winter months approach (Behnke, 1992). Anadromous coastal cutthroat trout may complete this seaward migration pattern twice before they return to the river to spawn (Trotter, 1989). While in salt water, they feed on crustaceans and fish (Behnke, 1992). While residing in the stream or river, anadromous coastal cutthroat trout prey on drifting larvae of aquatic insects, or other fish species (Behnke, 1992).

The potamodromous form of coastal cutthroat trout includes both stream and lake dwelling life history patterns. The potamodromous stream dwelling form of coastal cutthroat trout has the same migratory patterns as the anadromous form of coastal cutthroat trout, however, they do not migrate to the ocean (Moring et al., 1986), instead migrating between small tributaries, and larger rivers (Trotter, 1989). These populations are typically located above natural barriers to upstream migration, such as above falls in the Willamette and Snoqualmie rivers (Trotter, 1989). Potamodromous stream dwelling coastal cutthroat trout use spawning habitat that is similar to that used by anadromous coastal cutthroat trout in tributaries both up and downstream of mainstem river feeding areas (Trotter, 1989). Stream dwelling coastal cutthroat trout can occur with anadromous populations (Tomasson, 1978). These trout use the mainstem of rivers to feed and grow, much like anadromous coastal cutthroat trout use coastal areas of the ocean. In systems where rainbow trout or other salmonid species are present in sympatry with stream dwelling coastal cutthroat trout, there is a tendency for habitat partitioning (Moring et al., 1986). Stream-dwelling coastal cutthroat trout move into mainstem river areas as the anadromous coastal cutthroat trout move downstream and out to coastal areas (Tomasson, 1978). Researchers have suggested that resident forms of coastal cutthroat trout may contribute and/or maintain to anadromous forms (Jones, 1979). This has not been scientifically documented.

Potamodromous lake dwelling forms of coastal cutthroat trout exhibit life history patterns similar to anadromous forms, however their spawning periods occur in late winter or spring versus autumn and early winter for anadromous forms (Trotter, 1989). Spawning for lake dwelling forms of coastal cutthroat trout begins at ages 3 to 4 (Pierce, 1984), and these fish spawn every year thereafter. Lake dwelling forms exhibit both inlet and outlet spawning populations. After emergence from the gravel, lake dwelling forms of coastal cutthroat trout spend 1 to 3 years in tributaries before migrating to lakes (Trotter, 1989).

If lake dwelling coastal cutthroat trout are the only salmonid present in the lake, they make wide use of habitats, ranging from shallow littoral to open limnetic areas (Nilsson and Northcote, 1981), with attraction to areas with cover (Shepherd, 1974). They forage in all zones, consuming surface food such as terrestrial insects and floating or emerging aquatic insects and benthic prey items, with an emphasis on mid water prey such as crustacean plankton (Nilsson and Northcote, 1981).

In sympatry with rainbow trout or Dolly Varden, interactive segregation (Nilson, 1967) occurs. Cutthroat trout congregate inshore while rainbow trout and Dolly Varden congregate offshore. Feeding zones are partitioned into these inshore and offshore zones and feeding patterns change (Trotter, 1989). Where interactive segregation occurs, cutthroat trout feed on surface and benthic prey in inshore areas and abandon mid-water prey species to rainbow trout. Cutthroat trout in these sympatric habitat partitioning situations also exhibit more piscivory than their allopatric counterparts (Nilsson and Northcote, 1981).

Resident non-migratory coastal cutthroat trout populate small headwater streams and exhibit only limited instream movement (Trotter 1989). These fish are small, not reaching a length greater that 150 to 200mm, and their life span is shorter, typically living until 3 to 4 years in age (Wyatt, 1959). Resident coastal cutthroat trout mature at age 2 to 3 (June, 1981; Nicholas, 1978).

After emergence from the gravel, young fish move to channel margins, side channels and slow water areas (Moore and Gregory, 1988). At the end of the summer, they move to feeding stations in pools (Moore and Gregory, 1988). In winter, they may move downstream to more secure winter habitats. Wyatt (1959) reported that only 3 percent of the population ever moved more than 200 m from their emergence area. In the spring, when water temperatures reach 5 to 6^{o}C, mature resident non-migratory coastal cutthroat trout move back into spawning areas. Resident life history forms primarily feed at the head of pools on drift prey (Wilzbach and Hall, 1985).

Southwest Washington/Columbia River cutthroat trout ESU

This ESU includes cutthroat trout in the Columbia River and its tributaries downstream from the Klickitat River in Washington and Fifteenmile Creek in Oregon inclusive, and the Willamette River and its tributaries downstream from Willamette Falls (NMFS, 1999b). This ESU also includes cutthroat trout in Washington coastal drainages from the Columbia River to Grays Harbor, inclusive; NMFS, 1999b).