

Chapter 3. Affected Environment

The EIS study area encompasses ESA-listed salmonid habitat in the Columbia River Basin and tern nesting habitat in the States of Washington, Oregon, California, Idaho, and Nevada. This study area falls within the breeding range of the Pacific Coast regional population of terns and the management jurisdiction of the three cooperating agencies (U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, NOAA Fisheries).

During the planning process, the affected environment for this DEIS was more specifically identified as those tern nesting areas within Washington, Oregon, and California that are most likely to be affected by proposed management alternatives under consideration in this DEIS. The affected environment (Figure 3.1) extends from the Columbia River estuary, the area of primary management concern, into those sites proposed for Caspian tern management for displaced terns from East Sand Island (as described in Chapter 2, Table 2.1). Although we anticipate that the boundaries of the affected environment extends to all areas potentially affected by proposed management alternatives, Caspian terns may pioneer into locations not discussed in this DEIS on their own volition. Thus, since this species takes advantage of ephemeral habitat and forage conditions over a wide geographical range, we cannot predict with complete certainty where colonies would establish themselves in the future.

The following description of the affected environment, organized by State, summarizes only those aspects of the environment that could potentially be affected by direct management actions

at proposed alternate sites (Table 2.1) identified for proposed management alternatives. Scientific names of the plants and wildlife discussed in this chapter are listed in Appendix H. Specific anticipated effects of the proposed management alternatives will be described in Chapter 4, Environmental Consequences.

3.1 Physical Environment

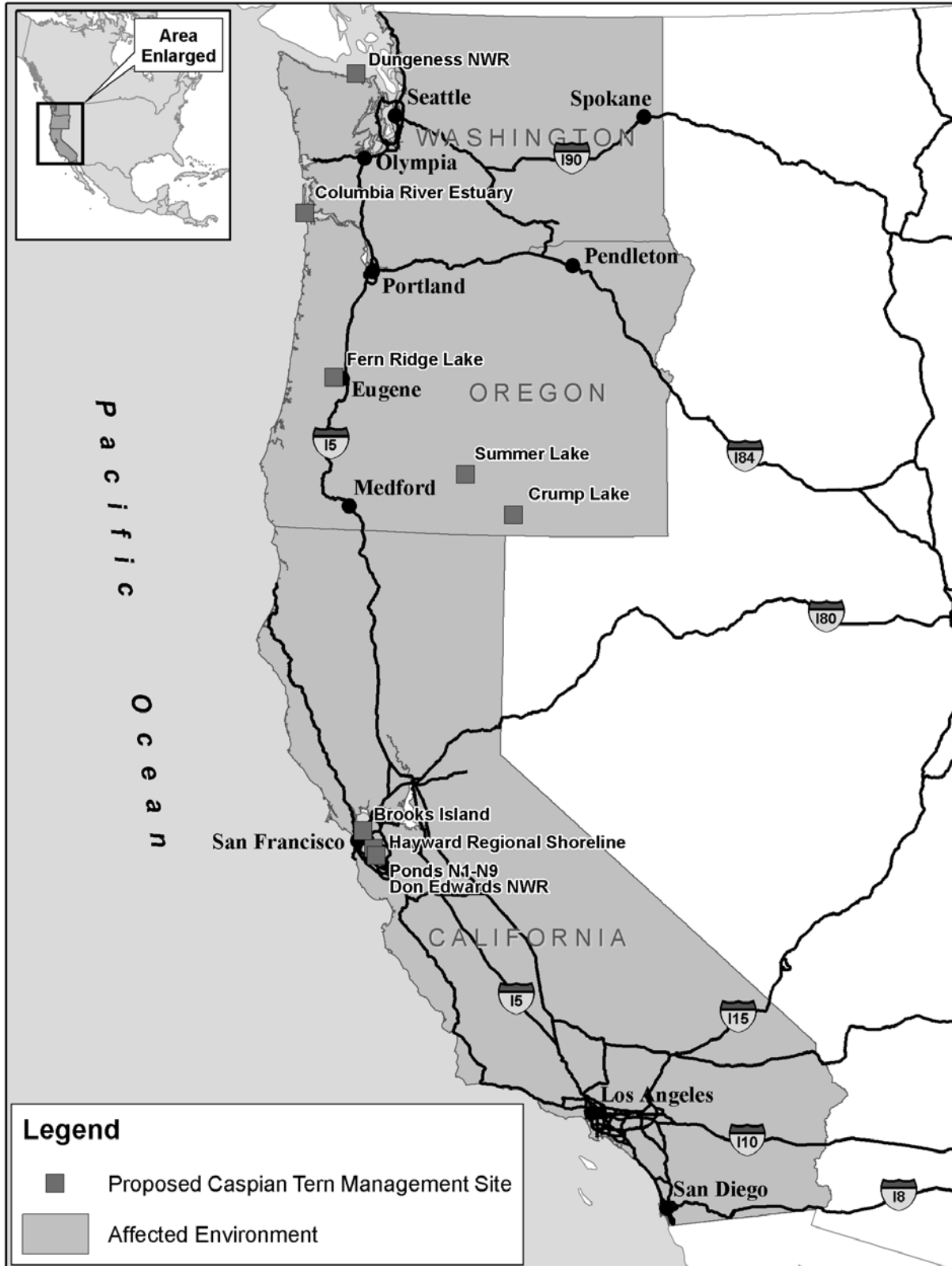
Nesting habitat for Caspian terns in the Pacific Coast region includes both coastal and interior sites. Colonies are located in estuarine or marine habitats or freshwater lakes, rivers, marshes, sloughs, reservoirs, irrigation canals, and (low salinity) saline lakes (Cuthbert and Wires 1999). Many sites are ephemeral and their suitability for nesting varies with water levels, vegetation density, and prey availability as affected by droughts, floods, erosion (Shuford and Craig 2002), ocean conditions, or other factors.

WASHINGTON. Interior nesting sites consist of rock or silt islands in natural lakes or human-created reservoirs, the majority of which are relatively flat with little to no vegetation. Coastal nesting sites have varied considerably through the years, occurring both in Puget Sound and the coastal bays (e.g., Willapa Bay and Grays Harbor). Nesting habitat has primarily been sandy, flat islands with little to no vegetation but also includes sites on the mainland that are sandy or bare, but typically near the shoreline (e.g., Dungeness Spit, Everett Naval Base). The only documented coastal tern

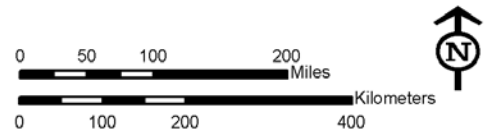


Caspian terns nesting among driftwood on Dungeness Spit, Dungeness NWR, Washington

FIGURE 3.1 Map of Affected Environment



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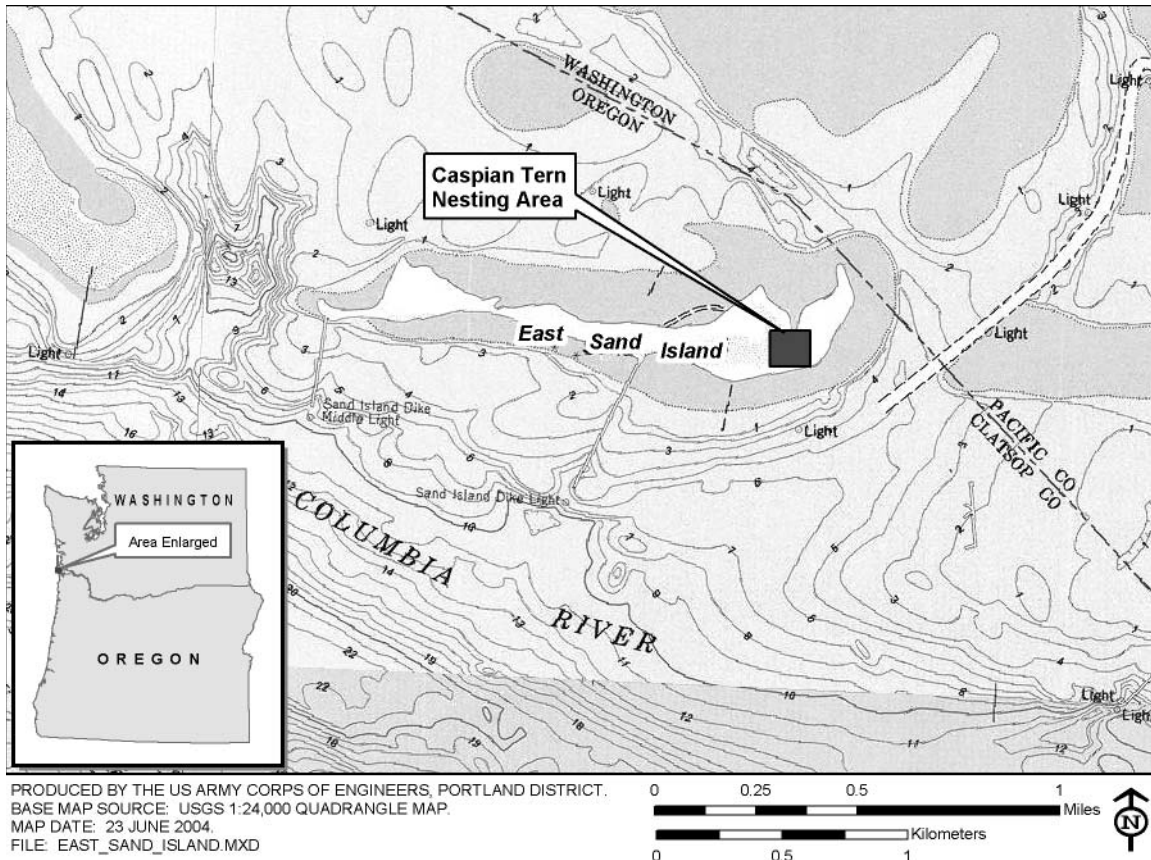
colony in 2003 nests at Dungeness NWR, located on Dungeness Spit near Sequim in Clallam County, Washington, on the southern side of the Strait of Juan de Fuca. The 6-mile long Dungeness Spit is characterized on its north (Strait) side by sand and cobble beaches. The bay side is more sandy, resembling the character of the shoreline on the Strait side, but driftwood and a variety of grass are also present (U.S. Fish and Wildlife Service 1996).

OREGON. The only coastal tern nesting activity in Oregon has been restricted to islands (natural and/or artificial) in the Columbia River. The colony on East Sand Island (Figure 3.2), located in the Columbia River estuary, is the primary management focus of this DEIS. The Columbia River estuary is 4 to 5 miles wide, and, for the purposes of this DEIS, extends upriver to around river mile (RM) 46 (Figure 2.1, although tidal influence extends up to Bonneville Dam, RM 146). The main navigation channel is dredged annually by the Corps to maintain the presently authorized 40-foot-deep, 600-foot-wide navigation project. Miller Sands Spit and Rice and Pillar Rock islands are active disposal sites for operations and maintenance dredging actions. Active disposal areas/islands typically have little vegetation on the upland portion of the site. The high tide lines at these islands contain lush vegetation

communities because of accumulated organic material (debris) and availability of water. East Sand Island is located near the mouth of the Columbia River and is a naturally occurring island. Stone fill was placed on the western end of East Sand Island in 1950 and persists to date. Dredged material was placed in a diked containment area on the eastern end of the island in 1983. Caspian terns initiated nesting on the dredged material disposal site in 1984. Alders and willows form the dominant vegetative cover beginning at the western boundary of the disposal site and extending eastward to the area managed for Caspian tern nesting habitat (bare ground). A wet, hummocky, driftwood strewn flat occurs northeast of the tern nesting habitat with a sandy spit extending towards the water at this location. The southern shore is beaten by ocean swells, waves and tidal currents, and is rocky from the western end to approximately the mid-point of the island, thereafter, the shoreline is a sandy beach.

Two of three proposed sites in Oregon (Summer and Crump lakes) are located in natural lakes, with terns primarily nesting on silt islands with little vegetation. Exposure of islands, and thus availability of nesting habitat, varies considerably from year to year based on lake water levels. The Summer Lake Wildlife Area, managed by the Oregon Department

FIGURE 3.2 Caspian Tern Nesting Habitat on East Sand Island



of Fish and Wildlife (ODFW), is located at the north end of Summer Lake and was established in 1944 (St. Louis 1993). The lake and marsh are primarily fed by the Ana River that arises from a series of springs located 5 miles to the north in the Ana Reservoir. The majority of the area is a very shallow, primarily man-made alkaline and freshwater marsh. Crump Lake is located in the southern end of the Warner Basin. Crump Island is a barren, flat island in the central part of the lake, north of the peninsula that nearly bisects the lake. In the 1990s, ODFW attempted to restore the island; the island was not rebuilt to an elevation above highest water levels in the lake, thus, is regularly underwater during high water levels (C. Foster pers. comm.).

Although terns do not currently nest in Fern Ridge Lake, the site represents potential nesting habitat. Fern Ridge Lake is a reservoir located on the Long Tom River approximately 6 miles west of Eugene, Oregon in the southern Willamette Valley. The primary purpose of the lake is for flood control. More than 5,000 acres are licensed to ODFW for wildlife management. Currently, there is no suitable habitat for nesting terns in the lake, but habitat can be easily created adjacent to a sub-impoundment project constructed by the Corps (U.S. Army Corps of Engineers 1988).

CALIFORNIA. Tern nesting sites in California have been numerous in both interior and coastal areas. Interior sites consist of natural and artificial wetlands, lakes, or reservoirs and coastal sites can be found in almost all the coastal bays and estuaries in the State. Sites of management concern in this DEIS are located in San Francisco Bay. San Francisco Bay and estuary contain a variety of habitats, ranging from deep bays, channels, and tidal marshes to artificial salt ponds. The Sacramento and San Joaquin rivers enter the bay in the northeastern portion, forming a delta. These rivers drain California's Central Valley, including parts of the Sierra Nevada and Cascade mountains, forming the largest estuary on the west coast of North America. The freshwater runoff in the delta flows seaward, mixing with ocean water through Suisun Bay, San Pablo Bay, and lastly, San Francisco Bay. Caspian tern nesting in the bay has usually been associated with artificial salt ponds. Commercial salt production has been discontinued in many of the salt ponds throughout the bay. Inactive salt ponds have been transferred to Federal, State, or local governments and are managed primarily as wildlife habitat. Some have been or will be restored to tidal influence. Ponds N1-N9 are active salt ponds included within the Don Edwards San Francisco Bay NWR. Although active salt harvest is occurring, internal levees are free from disturbance and have provided habitat for nesting terns in the past. Also of management concern in San Francisco Bay is Brooks Island, a 373-acre island, located in the

east-central part of the bay just off the Richmond Inner Harbor near Point Potrero. It is managed as a natural preserve by East Bay Regional Parks District and contains salt marshes, tidal flats, sandy shoreline and an upland portion that rises 163 feet. Caspian terns and gulls nest on the flat sandy shoreline that is mostly vegetated with a non-native ice plant and a Mediterranean aster.

3.2 Biological Environment

3.2.1 Caspian Terns

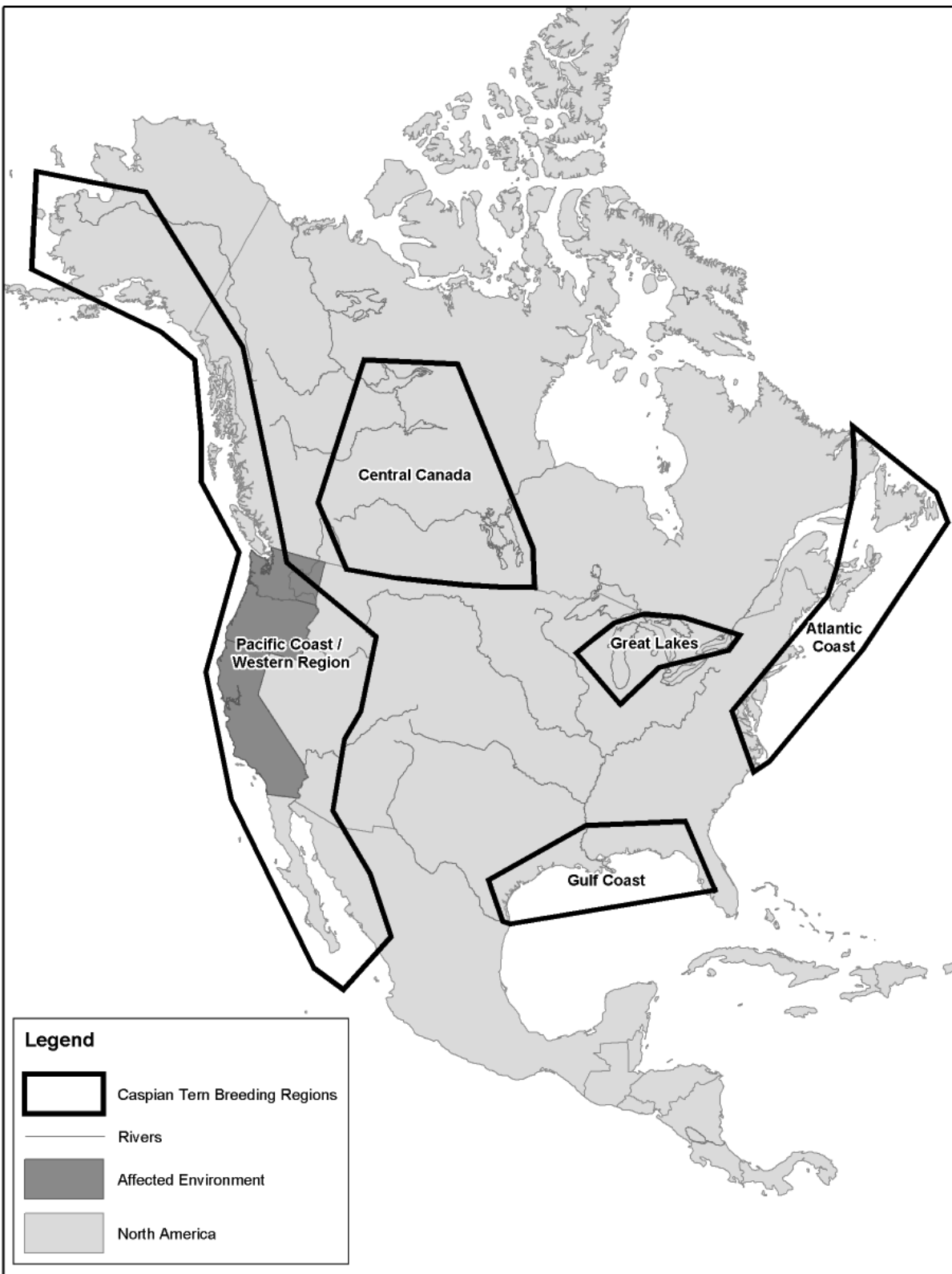
The 2002 Settlement Agreement required the Service to prepare a technical report summarizing the distribution, abundance, and conservation needs of Caspian terns in North America. Much of the information presented below is derived from this report, entitled: *Status Assessment and Conservation Recommendations for the Caspian Tern (Sterna caspia) in North America* (Shuford and Craig 2002).

SPECIES RANGE. Caspian terns breed at widely scattered sites across North America. Wires and Cuthbert (2000) described five disjunct breeding regions in North America (Figure 3.3). Caspian terns breeding in the Columbia River estuary are in the Pacific Coast region. This region includes coastal Alaska, southwestern British Columbia, Washington, Oregon, California, Baja California, and Sinaloa, Mexico; and interior Washington, Oregon, California, southern Idaho, Montana, Wyoming, western Nevada, and northern Utah. See Appendix F (Table F.1) for a complete list of current and historic tern nesting sites within the Pacific Coast region.

PACIFIC COAST REGION OVERVIEW. Since the beginning of the 20th Century, the Pacific Coast regional population has shifted from nesting in numerous small colonies associated with freshwater marshes in interior California and southern Oregon, to primarily larger colonies along the coast extending into the State of Washington (Gill and Mewaldt 1983). Caspian terns adapt to spatial and temporal variability of breeding habitat and prey, leading to highly variable colony locations and sizes within the region.

In recent years, terns were documented to have nested on about 60 sites scattered throughout the Pacific Coast region, including Alaska (Table F.2). This habitat base serves as a network of sites, which individually may vary in suitability from one year to the next but collectively provide a suite of locations for terns on a regional scale. Colonies in the interior are characteristically small in size (few to hundreds of birds, Table F.2) and are subject to substantial shifts in location, quantity, and quality corresponding to cycles of flood and drought. Interior sites may

FIGURE 3.3 Caspian Tern Breeding Regions in North America



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also be subject to intensive management such as the control of reservoir and irrigation water. Larger colonies (e.g., many hundreds to thousands of terns) have been documented primarily along the Pacific Coast.

Coastal nesting habitat can be managed or natural and is typically subject to erosion and vegetation changes over time. Although ocean conditions may affect prey availability, coastal prey resources are typically more diverse, abundant, and stable in comparison to prey resources at interior sites which are highly variable from year to year. For a detailed review of current, historic, and potential tern nesting habitat throughout the Pacific Region see: *A Review of Caspian Tern Nesting Habitat: A Feasibility Assessment of Management Opportunities in the U.S. Fish and Wildlife Service Pacific Region* (Seto et al. 2003).

REGIONAL POPULATION TRENDS. The tern breeding population in the Pacific Coast region is the largest within the United States (see Table 3.1 for a breakdown of regional populations). This regional population has increased exponentially since the early 1960s (Figure 3.4, Gill and Mewaldt 1983, Shuford and Craig 2002). Although actual numbers were not reported for the early 1960s, Gill and Mewaldt (1983) described a regional population estimate of approximately 6,000 pairs in the late 1970s and early 1980s (a 74 percent increase from the 1960s numbers). Thus, the regional population in the 1960s would have been around 3,500 pairs. Shuford and Craig (2002) reported that this increase may have represented a rebound to, or below, the levels before the great loss of wetland habitat at interior portions of the region. A second increase occurred in the late 1990s with an estimated 14,500 breeding pairs reported in the region.

The overall regional population increase (Figure 3.4), beginning in the early 1980s, mainly represents the large increase observed in the Columbia River estuary (see section below) from 1984 to 2002. Numerous anthropogenic and natural factors are thought to have contributed to this increase in tern numbers but the interactions among them are not well understood. The initial colonization and growth of the Rice Island tern colony appears to have occurred because of the immigration of terns from large colonies in Washington (e.g., Grays Harbor and Willapa Bay). A number of factors such as habitat loss, decreased prey availability, erosion of islands, vegetation of nesting sites, and increased predators (gulls, eagles) may have contributed to the shift of nesting terns from coastal Washington to the Columbia River estuary. The continued growth and success of this colony at Rice Island, and now East Sand Island, are attributed to the stability of the human-created and/or maintained nesting habitat, reliable food supply, vulnerability of some hatchery smolts to tern predation, and the apparent immigration of terns that have lost nesting habitat or were hazed from other colonies (e.g., Everett Naval Base, Shuford and Craig 2002). Highly productive ocean conditions which supported an abundance of marine prey species most likely also contributed to the high tern reproductive success observed on East Sand Island from 1999 to 2003. In 2003, the East Sand Island colony comprised 71 percent of the regional population (approximately 11,756 nesting pairs, Table F.2) which has declined slightly since the 1996-1998 estimate.

COLONY SIZES AND GROWTH RATES. Colony size varies widely among locations and years, but typically ranges from tens to hundreds of pairs (Shuford and Craig 2002). Terns rarely breed in colonies greater than 1,000 nesting pairs (Cuthbert and Wires 1999, Wires and Cuthbert 2000). Development of

TABLE 3.1 Estimates of the Caspian tern breeding population in the United States, by region, from 1976 to 1982 and 1997 to 1998, including current Pacific Coast regional population estimate.

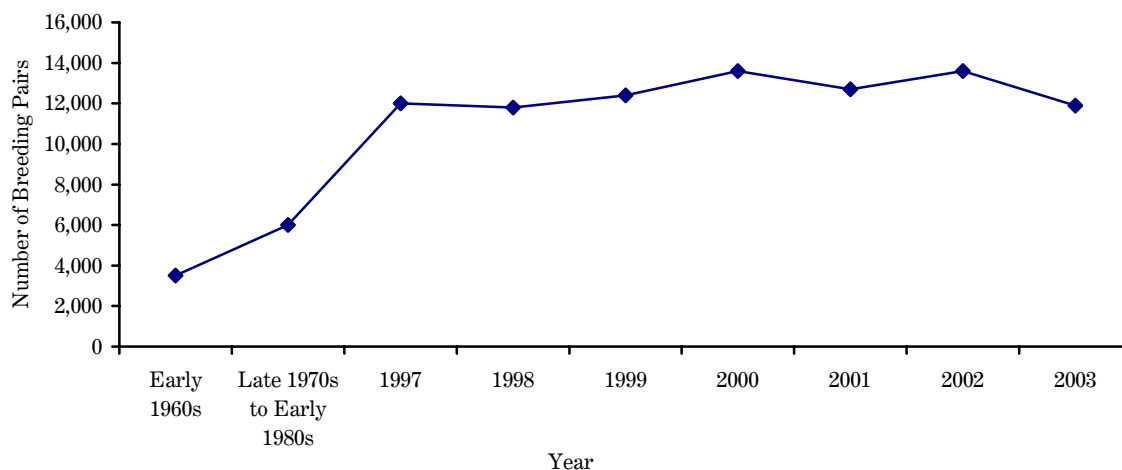
	1976-1982 ^a		1997-1998 ^b		2003 ^c
	Estimated Pairs	% U.S. Population	Estimated Pairs	% U.S. Population	Estimated Pairs
Pacific Coast	6,218	66.4	14,534	69.4	11,756
Great Lakes	1,682	18.0	3,979	19.0	-
Gulf Coast	1,456	15.5	2,303	11.0	-
Atlantic Coast	10	0.12	122	0.6	-
TOTAL	9,366	100.00	20,938	100.00	-

^a Spendelow and Patton 1988. Numbers of adults divided by two to estimate nesting pairs. Some of the original data were raw counts of adults, thus, these numbers are likely underestimated given some adults are usually away from the colony at any given time.

^b Shuford and Craig 2002.

^c U.S. Fish and Wildlife Service, unpublished data.

FIGURE 3.4 Pacific Region Caspian Tern Population Trend



References:

Early 1960s – Spendlow and Patton 1988. Estimated population was calculated based on a 74% decrease from the estimated population reported during the late 1970s – early 1980s.

Late 1970s to Early 1980s – Spendlow and Patton 1988.

1997 to 2001 - Shuford and Craig 2002. Data for 1997 and 1998 consists of data for individual sites in the region for each year and differs slightly from that reported in Wires and Cuthbert 2000 for the two years combined.

2002 to 2003 - U.S. Fish and Wildlife Service, unpublished data.

dredge material islands and salmonid production (hatchery reared and barged salmonids) have provided an abundance of stable and predictable nesting and foraging resources for breeding terns in the Columbia River estuary. These unique characteristics enabled the unprecedented growth rate and size of the tern colony in the estuary. These characteristics are not representative of tern habitat elsewhere in the Pacific Coast region and North America.

In contrast to the colony in the Columbia River estuary (average size of 7,248), the average sizes of other individual tern colonies in the Pacific Coast region since 1997 ranges from 8 to 681 nesting pairs (Table F.2), often fluctuating from year to year (Shuford and Craig 2002, D. Shuford and U.S. Fish and Wildlife Service unpublished data). In California, colonies fluctuated in growth rates and size but the overall breeding population remained stable for over 30 years (Shuford and Craig 2002). The trends observed in California are characteristic of the region overall, excluding the Columbia River estuary. Colony sizes from East Sand Island in the estuary, north along the Washington coastline averaged about 1,000 pairs between 1957 to 1991. In 1987, the colony at Grays Harbor, Washington peaked at 3,590 pairs, representing the second largest colony historically in the Pacific Coast region. By 1989 terns abandoned this site and Grays Harbor has since been used only intermittently as a foraging area (no nesting activity) by a small number of terns (e.g., 50 to 100 adults, Seto et al., Columbia Bird Research 2003).

HABITAT REQUIREMENTS. Caspian terns nest in single-species colonies or in multi-species assemblages with other ground nesting waterbirds (gulls, skimmers, other terns, and cormorants). Caspian terns breed in a variety of habitats ranging from coastal estuarine, salt marsh, and islands. Terns typically nest in open, barren to sparsely vegetated areas, but also among or adjacent to driftwood, partly buried logs, rocks, or tall annual weeds (Shuford and Craig 2002). Nest substrates vary from sand, gravel, spongy marshy soil, or dead or decaying vegetation to hard soil, shell banks, limestone, or bedrock (Shuford and Craig 2002). Nests range from simple depressions in a bare substrate to nests lined with debris, such as shells, crayfish chelipeds, dried grasses and weed stems, wood, or pebbles (Shuford and Craig 2002).

DIET. Breeding Caspian terns eat almost exclusively fish, catching a diverse array of species with shallow plunge dives, usually completely submerging themselves underwater (Shuford and Craig 2002, Cuthbert and Wires 1999). The sizes of fish caught and diet composition are largely determined by geography and annual and seasonal prey availability, but most fish are between 5 to 25 cm and occur near the surface of the water (Shuford and Craig 2002). In the Columbia River estuary, diet studies of the Caspian tern colonies on Rice and East Sand islands documented that terns nesting on Rice Island (1999 to 2000) had an average of 83 (77 to 90) percent juvenile salmonids in their diet (Roby et al. 2002), while on East Sand Island (1999 to 2003), terns had an average of 36 (24 to 47) percent juvenile salmonids in their diet (Collis et al. 2002a,

2002b, 2003a, 2003b). From 1999 to 2003, the tern diet on East Sand Island, closer to the mouth of the Columbia River than Rice Island, was primarily non-salmonids, including northern anchovy, herring, shiner perch, sand lance, sculpins, smelt, and flatfish (Roby et al. 2002, Collis et al. 2002b and 2003a). As ocean conditions improved, and therefore, productivity, the percentage of juvenile salmonids in the diet of terns in the estuary has continued to decline.

In all other areas that have been studied, except Commencement Bay, salmonids were found to be uncommon diet items. For example, in Grays Harbor, coastal Washington, chum and coho salmon were found in the tern diet in low numbers (14 to 21 percent), while primary prey taken were shiner perch and northern anchovy (Penland 1976). This is in contrast to that observed in Commencement Bay (Puget Sound), Washington. In 2000, terns here were observed to have an average of 52 percent salmonids in their diet (Thompson et al. 2002). A possibility for these observed differences in diet composition could be that Grays Harbor contains a larger diversity and/or abundance of marine prey species than Commencement Bay in Puget Sound. In addition, Commencement Bay is located at the mouth of the Puyallup River, with outmigrating salmonids coinciding with the tern breeding season. In San Francisco Bay, a diet study conducted in 2003 found that the Caspian tern diet varied among the various nesting locations found in the bay, but primary prey species included anchovy, surf perch, silversides, herring, sunfish, gobies, and toadfish (Roby et al. 2003a). Salmonids (not including trout from reservoirs) were found in the diets of four out of five nesting colonies, ranging from 0.1 (Agua Vista Park and Baumberg Pond) to 8.7 (Knight Island) percent of prey items (Roby et al. 2003a). Some tern colonies do not have salmonids available as prey items. In interior Oregon (Summer and Crump lakes), a study conducted in 2003 found tui chubs to be the primary prey of nesting Caspian terns (Roby et al. 2003a). In San Diego, food habits of terns were studied in 1995, 1997, and 1998. These studies consistently found terns to feed primarily on sardines, anchovies, and topsmelt (Horn et al. 1996, Horn and Dahdul 1998 and 1999).

MIGRATION. Caspian terns migrate singly or in groups that can be as large as thousands (Shuford and Craig 2002). Most terns congregate for migration at traditional foraging locations along marine coasts and major rivers or freshwater lakes about a month after young have fledged (Shuford and Craig 2002). Timing of migration varies with region; fall movement typically occurs between mid-July and mid-September along the Pacific Coast (Shuford and Craig 2002).



Adult Caspian tern with chick. Photo credit: Dan Roby

COLONY DESCRIPTIONS. Two documents describe and summarize Caspian tern colony information: (1) *Status Assessment and Conservation Recommendations for the Caspian Tern in North America* (Shuford and Craig 2002), and (2) *A Review of Caspian Tern Nesting Habitat: A Feasibility Assessment of Management Opportunities in the U.S. Fish and Wildlife Service Pacific Region* (Seto et al. 2003). Full descriptions of Caspian tern colonies found in the Pacific Coast region can be found in these documents. The following section summarizes tern nesting activity within the affected environment. See Table F.2 for a summary of all current nesting sites within the Pacific Coast region and estimated nesting tern numbers for 1997 to 2003.

WASHINGTON. The distribution and abundance of Caspian terns in the State has fluctuated dramatically since they were first reported along the coast of Westport in 1929 (Shuford and Craig 2002). Breeding activity was first recorded in the 1950s with small coastal colonies in Grays Harbor. The Washington breeding population peaked in 1982 with nesting colonies in Grays Harbor, Willapa Bay (coast), and the Potholes Reservoir (eastern Washington). By 1995, several tern nesting islands were lost in Grays Harbor and Willapa Bay from erosion, typical at naturally occurring ephemeral habitats. The one remaining tern nesting island in Grays Harbor, Sand Island, is now vegetated. Some terns moved to nest in Puget Sound (Padilla Bay, Everett Naval Base, and Commencement Bay), but urban development, active hazing, and habitat loss ultimately precluded nesting terns from using those sites. In 2003, nesting Caspian terns were only documented on the Washington coast at Dungeness NWR, and at the Potholes Reservoir, Banks Lake, and Crescent Island in the interior and all of these were small colonies consisting of less than 1,000 nesting pairs.

The newly colonized Dungeness NWR colony constitutes the only current coastal nesting site in Washington. Caspian terns have been observed in small numbers in Dungeness Bay since the late 1990s but nesting activity was never documented until 2003 (P. Sanguinetti pers. comm.). About 200 adult terns were observed in late July with at least 50 young chicks (P. Sanguinetti pers. comm.). A complete count of nesting terns was not possible due to visual obstructions (driftwood) and colony sensitivity. The peak count of adults (300) was converted to an estimate of breeding pairs (186) by multiplying the number of adults by a 0.62 correction factor based on the average ratio of nests to adults at sites on the California coast (Shuford and Craig 2002). The area used by terns is sandy and open, with pieces of driftwood and very little vegetation. Although the terns nested on less than 0.25 acre in 2003, more nesting habitat is available in the immediate area. Adults and chicks were observed through the end of September (P. Sanguinetti pers. comm.). Although specific prey species have not been identified, terns were observed feeding in Dungeness Bay and the Strait of Juan de Fuca (P. Sanguinetti pers. comm.).

OREGON. Local summer residents and migrants occur along Oregon's coast, major rivers, and inland water bodies (Shuford and Craig 2002). In 1940, less than 1,000 pairs nested throughout Oregon. Historically, breeding terns were restricted to shallow lakes and reservoirs of the Klamath Basin and Great Basin (Shuford and Craig 2002). In recent years, tern numbers in Oregon averaged around 9,000 pairs. Currently, what has been considered the world's largest colony is found near the mouth of the Columbia River on East Sand Island, and small colonies still occur in interior Oregon. Recent trends in Oregon reflect the population trend observed in the Pacific Coast regional population (see section 3.2.1, Shuford and Craig 2002).

Although terns were observed near East Sand Island in 1975 (Tabor 1976), nesting activity in the Columbia River estuary was first documented in 1984 (1,164 nesting pairs, Shuford and Craig 2002). Terns used habitat created by deposition of dredged material on the eastern tip of East Sand Island. By 1985, vegetation covered the East Sand Island nesting site and by 1986, most of the colony shifted to Rice Island, a large sandy dredge disposal island 21 km farther upriver. From 1987 to 1998, no terns attempted to breed on East Sand Island. The tern colony on Rice Island increased rapidly from the initial estimate of 1,000 pairs in 1986 to about 6,200 pairs in 1991 (Shuford and Craig 2002). Growth of this colony slowed after 1991, but it again increased substantially in size in 1995 and 1996, coincident with loss of a colony at the U.S. Naval Base at Everett, Washington (Shuford and Craig 2002). The number of terns peaked on Rice Island at 8,700 pairs in

1998. In 1999, a pilot study to attract the breeding colony of terns on Rice Island to East Sand Island resulted in approximately 547 pairs nesting at the eastern end of East Sand Island (Roby et al. 2002) while approximately 8,300 pairs remained on Rice Island. This relocation effort included the removal of vegetation to create bare sand nesting habitat and social attraction techniques (i.e., decoys and audio playback systems) on East Sand Island. Terns that nested on East Sand Island were presumably from the nearby Rice Island colony (Roby et al. 2002). In 2000, colony relocation efforts continued, resulting in only about 590 nesting terns on Rice Island and approximately 8,500 on East Sand Island (Roby et al. 2002). Thereafter, all Caspian terns in the Columbia River estuary have nested on East Sand Island and terns attempting to nest elsewhere in the estuary have been hazed. In 2002 and 2003, 9,933 and 8,352 nesting pairs, respectively nested on East Sand Island (Collis et al. 2003a and 2003b).

Caspian terns were described as "usually breeding" at Summer Lake in 1940 (Shuford and Craig 2002) but in recent years observations of terns have been less than 50 pairs. At Crump Lake, tern numbers are slightly higher. In 2000, approximately 150 pairs were observed in Crump Lake (Shuford and Craig 2002). Since then, water levels have been high and the island used for nesting has been underwater and unavailable to terns. In 2003, 49 active tern nests were monitored on an artificial platform constructed by a research group in Crump Lake (Roby et al. 2003a). Currently, Caspian terns are a casual visitor at Fern Ridge Lake during spring migration and in late summer during the post-breeding season dispersal and/or migration. Fern Ridge Lake does not contain a suitable nesting site for this species at present.

CALIFORNIA. There is very little historical information on tern nesting activity in California. Prior to 1945, only six breeding sites were known for the State, five in the interior and one in San Francisco Bay (Shuford and Craig 2002). In the late 1970s, approximately 2,586 pairs nested at 10 sites (78 percent on coastal sites and 22 percent on interior sites). By 1997, a colony at the Salton Sea increased, bringing the State population to 4,350 pairs; but by 2000, the California breeding population declined to about 2,583 pairs at 12 sites. Other than for the very brief period when peak numbers were reached at the Salton Sea in the mid-1990s, the Statewide breeding population appears to have been relatively stable in the last 30 years despite shifts in the number and location of breeding sites (Shuford and Craig 2002).

In San Francisco Bay, Caspian terns initially nested in salt ponds but later expanded or relocated to new sites, typically in response to disturbance from routine maintenance of salt pond levees or predation. A study which monitored nesting tern colonies in

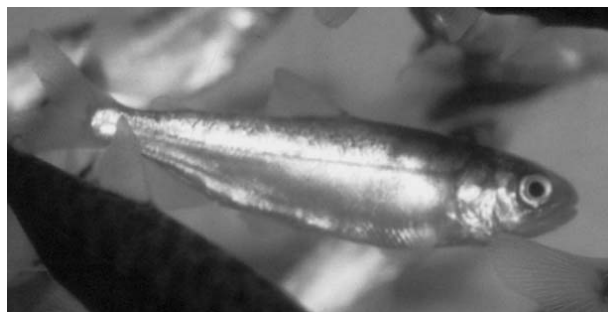
San Francisco Bay between the years of 1982 to 2003 found that the numbers of nesting terns in the bay have remained relatively stable during the past 20 years, but considerable annual movement among colony sites was observed (Strong et al. 2003). During this same period, tern numbers in the entire bay ranged from approximately 1,000 to 2,600 pairs (Strong et al. 2003), with approximately 1,190 pairs nesting in 2003 (Roby et al. 2003a).

3.2.2 Fish

A variety of fish are found within the affected environment. These vary greatly based on their location (coastal vs. interior waterbodies). Generally, coastal areas contain a larger diversity of fish including marine and anadromous fish (e.g., salmon). Abundance of these fish is heavily dependent upon ocean conditions. In contrast, interior sites contain fish such as trout, tui chub, bass, crappie, or suckers. Abundance and availability of these fish are heavily dependent upon drought conditions and water levels. The section below describes an overview of fish that could be affected by proposed management alternatives of this DEIS.

SALMONIDS. Salmonids discussed in this DEIS refer to anadromous species only. Salmon and steelhead are similar in their ecological requirements. They spend most of their lives in the ocean where they grow to relatively large size, and then return to freshwater to spawn. Steelhead are the anadromous form of rainbow trout (a salmonid native to western North America and the Pacific Coast of Asia) and do not necessarily migrate to sea at a specific age or die after spawning. Even though repeat spawning is common, post-spawning survival rates are quite low (10 to 20 percent, California Department of Fish and Game 2001).

Salmon and steelhead exhibit two principle life history types. The first is stream-type, in which fish rear in fresh water, usually remaining in the stream where they hatched for a year or more before beginning their downstream migration to the ocean. Stream-type salmonids include some of the Chinook, sockeye, and coho salmon and steelhead. The second is ocean-type, in which fish migrate downstream to and through the estuary as sub-yearlings (less than one year old), generally leaving the spawning area where they hatched within days to months following their emergence from the gravel. Ocean-type salmonids include Chinook and chum salmon. Ocean-type subyearlings arrive in estuaries at a small size (generally 3 to 7 cm) and can remain in the estuary for weeks to months until they reach the transitional size necessary to migrate to the ocean (U.S. Army Corps of Engineers 2001, California Department of Fish and Game 2001).



Salmon smolt. Photo credit: Bonneville Power Administration

WASHINGTON. Dungeness NWR and Harbor are important nursery habitats for salmonids. Large numbers of ESA-listed (see section 3.2.3) and unlisted juvenile salmonids transit and are presumed to rear along the shore in this vicinity. Non-listed salmonids include Puget Sound pink salmon, coho, Puget Sound sockeye, Puget Sound steelhead, cutthroat, and possibly Fraser River (Canadian) sockeye. The nearshore Strait (shorelines stretching from Neah Bay to Admiralty Inlet including Port Angeles, Dungeness, Sequim, and Discovery bays, Kilsut, and Port Townsend Harbors) provide a critical feeding, refuge, and migration corridor for many species, including three federally ESA-listed salmonids (see section 3.2.3), as well as sockeye, pink, and chum salmon. Washington coastal waters also include designated Essential Fish Habitat (EFH) for salmonids.

OREGON. All Columbia River Basin salmonids pass through the Columbia River estuary during their migration out to the sea and back upstream to their natal spawning grounds. The Columbia River estuary is also an important nursery area for some stocks of salmon, in particular, chum and fall Chinook (Fresh et al. 2003). Many of the salmonids found in the river are ESA-listed species (see section 3.2.3). The Columbia River estuary also includes designated EFH for salmonids.

Salmonids do not occur within Summer and Crump lakes. At Fern Ridge Lake, salmonids do not occur within the lake proper, however, they do occur in the Willamette and McKenzie rivers which are greater than six miles from Fern Ridge Lake, within foraging range of Caspian terns (if terns were to nest at Fern Ridge Lake). These include spring and fall Chinook and winter and summer steelhead.

CALIFORNIA. California coastal waters also include designated EFHs for salmonids. Native salmonids found in San Francisco Bay include Chinook salmon and steelhead, both of which are listed under the ESA (see section 3.2.3 for description). Coho salmon were historically found in the estuary but are now believed to be extirpated (Brown et al. 1994).

OTHER FISH. A variety of marine and freshwater fish that are not part of the salmonid family also occur within the affected environment. Abundance and diversity varies greatly among locations.

WASHINGTON. Several species of cod and sole rear in the shallow nearshore marine and estuarine habitats of Dungeness Bay. Surf smelt, sand lance, herring, anchovies, and a variety of rockfish are also found in the area. Juvenile surf smelt reside in nearshore waters and may use estuaries for feeding and rearing (Emmett et al. 1991, Lemberg et al. 1997). Surf smelt are a widespread and important member of the nearshore fish community throughout Puget Sound. Although surf smelt movements within Puget Sound are unstudied, a number of genetically distinct stocks are thought to occur. Because no stock assessment studies have been done, the status of Puget Sound surf smelt populations is currently unknown (Lemberg et al. 1997). EFH has been designated for certain groundfish and coastal pelagic species in Washington coastal waters.

OREGON. Other fish that occur in the Columbia River estuary include some anadromous species such as green and white sturgeon, Columbia River smelt, stickleback, shiner perch, and shad. Marine species such as anchovies, Pacific herring, sardines, surf smelt, surf perch, rockfish, and flounder are also present. EFH has been designated for certain groundfish (Pacific Fishery Management Council. 1998a and 1998b) and coastal pelagic species in Oregon coastal waters. At Summer, Crump, and Fern Ridge lakes, primary fish species include tui chub, rainbow trout, carp, bass, crappie, bullhead catfish, and suckers.

CALIFORNIA. Northern anchovy and Pacific herring are the most abundant fish species in San Francisco Bay. Other fish found in the bay include smelt, flounder, sole, sturgeon, Sacramento splittail, and shad. In addition, the introduced striped bass range throughout San Francisco, San Pablo, and Suisun bays (Herbold et al. 1992).

3.2.3 Federally Endangered and Threatened Fish

Federally endangered and threatened (ESA-listed) fish that occur in the affected environment are either anadromous or non-anadromous. The discussion of anadromous fish species involves species within Evolutionary Significant Units (ESU) or Distinct Population Segments (DPS). An ESU includes “any distinct population segment of any species of vertebrate fish or wildlife that interbreeds when mature” (Waples 1991). This population segment must be reproductively isolated from other nonspecific population units. It also must represent an important component in the evolutionary legacy of the species. All ESU designations used by NOAA Fisheries, including steelhead trout, are associated with salmonids. Although steelhead trout are

commonly called trout, they are closely related to other salmon scientifically grouped with them in the *Oncorhynchus* genus. The definition of DPS used by the Service is essentially the same as that for an ESU but is a designation for non-salmonid anadromous fish. The Service and NOAA Fisheries issued a joint policy describing DPSs in *Policy Regarding the Recognition of Distinct Vertebrate Population Segments Under the Endangered Species Act* (61 CFR 4722).

A description of the species and available historical and most recently published abundance information for ESA-listed salmonids, as well as life history and biological requirements, are summarized in *Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California* (Myers et al. 1998), *Status Review of Coho Salmon from Washington, Idaho, Oregon, and California* (Weitcamp et al. 1995), *Status Review of Chum Salmon from Washington, Oregon, and California* (Johnson et al. 1997) and *Status Review Update for Chum Salmon for Hood Canal Summer-Run and Columbia River ESUs* (Grant et al. 1999), and *Status Review of West Coast Steelhead from Washington, Idaho, Oregon, and California* (Busby et al. 1996). Table 3.2 lists all threatened and endangered anadromous fish and associated ESUs or DPSs protected under the ESA that occur in the affected environment. Figure 3.5 illustrates known occurrence times for the various salmonids in comparison to the Caspian tern nesting season.

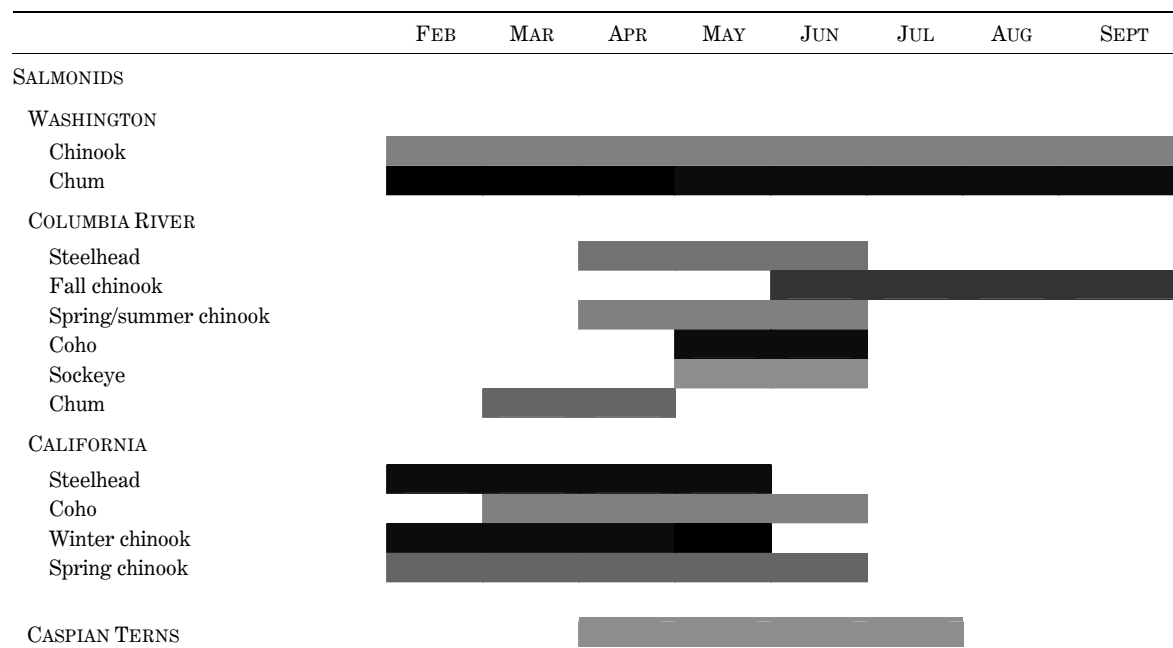
WASHINGTON. ESA-Listed Puget Sound Chinook salmon, Hood Canal summer-run chum salmon, and bull trout occur in Dungeness Bay. The Puget Sound Chinook ESU includes all naturally spawned populations of Chinook salmon from rivers and streams flowing into Puget Sound including the Straits of Juan De Fuca to the Elwha River. Chinook salmon from the following hatchery stocks are considered part of the ESA-listed ESU: Kendall Creek (spring run); North Fork Stillaguamish River (summer run); White River (spring run); Dungeness River (spring run); and Elwha River (fall run, NOAA Fisheries 2003c). The bay’s location at the southeastern end of the Strait of Juan de Fuca indicates that Chinook juveniles that emigrate annually from Puget Sound travel along the nearshore of Dungeness Spit (M. Longenbaugh pers. comm.).

Ocean-type Chinook salmon predominately occur in coastal regions, including Puget Sound, and use estuaries and coastal areas more extensively for juvenile rearing (Levy and Northcote 1982, Pearce et al. 1982). Juvenile Chinook may be present in nearshore areas from May through mid-September (NOAA Fisheries 2004, Marlowe et al. 2001) and may reside up to 189 days in estuarine habitats (Wallace and Collins 1997, Levy and Northcote

TABLE 3.2 Federally Listed ESUs/DPSs that Occur in the Affected Environment.

Evolutionarily Significant Unit (ESU) or Distinct Population Segments (DPS)	Status	Life History Type
CHINOOK		
Puget Sound	Threatened	Stream/Ocean
Snake River spring/summer	Threatened	Stream
Snake River fall	Threatened	Ocean
Lower Columbia River	Threatened	Ocean
Upper Columbia River spring	Endangered	Stream
Upper Willamette River	Threatened	Ocean
California Coastal	Threatened	Ocean
Sacramento winter-run	Endangered	Stream
Central Valley spring-run	Threatened	Stream
COHO		
Lower Columbia River/Southwest Washington	Candidate	Stream
Central California Coast	Threatened	Stream
Southern Oregon/Northern California Coasts	Threatened	Stream
CHUM		
Hood Canal summer-run	Threatened	Ocean
Columbia River	Threatened	Ocean
SOCKEYE		
Snake River	Endangered	Stream
STEELHEAD TROUT		
Snake River	Threatened	Stream
Lower Columbia River	Threatened	Stream
Middle Columbia River	Threatened	Stream
Upper Columbia River	Endangered	Stream
Upper Willamette River	Threatened	Stream
Central Valley	Threatened	Stream
Central California Coast	Threatened	Stream
Northern California	Threatened	Stream
BULL TROUT		
Puget Sound	Threatened	Trout
Columbia River	Threatened	Trout

FIGURE 3.5 Arrival Times of Juvenile Salmonids and Nesting Period of Caspian Terns in the Affected Environment



1982). Overall, the abundance of Chinook salmon in the Puget Sound ESU has declined substantially, and both long and short term abundance trends are predominantly downward (Myers et al. 1998).

Increasing harvest, coupled with generally increasing trends in spawning escapement, provides evidence that chum salmon, while still ESA-listed, have been increasing in recent years within the Hood Canal ESU (Johnson et al. 1997). Juvenile chum salmon depend on estuarine and nearshore habitats for rearing, and usually have longer residence times (from days to three months) in estuaries than other anadromous salmonids besides Chinook (Pearce et al. 1982, Johnson et al. 1997).

Bull trout are char native to the Pacific Northwest and western Canada. Bull trout within the Coastal/Puget Sound DPS were listed as threatened under the ESA in 1999. Bull trout generally spawn from August through November in small tributaries and headwater streams. Anadromous bull trout juveniles typically spend 2 to 3 years rearing in tributary streams before migrating to sea.

OREGON. Seven salmon and steelhead runs have population segments that are ESA-listed and spend a portion of their lives in the lower Columbia River (Figure 3.5). The species include 12 ESUs identified by NOAA Fisheries (Table 3.2).

The first outbound migrants of the lower Columbia River fall Chinook and chum (ocean-type) may arrive in the lower Columbia River as early as late February (Herrmann 1970, Craddock et al. 1976, Healey 1980, Congleton et al. 1981, Healey 1982, Dawley et al. 1986, and Levings et al. 1986). The majority of these fish are present from March through June. Outbound Snake River fall Chinook begin their migration much farther upstream. They arrive in the lower Columbia River approximately a month later. As Chinook fry migrate to the estuary, they may remain in the low salinity or even freshwater areas for some time until they have grown somewhat larger (Kjelson et al. 1982, Levings 1982, Levy and Northcote 1982, MacDonald et al. 1986, Shreffler et al. 1992, and Hayman et al. 1996). However, some Chinook fry appear to move immediately to the outer edges and higher salinity portions of the estuary (Stober et al. 1971, Kask and Parker 1972, Sibert 1975, Healey 1980, Johnson et al. 1992, and Beamer et al. 2000).

Stream-type or yearling steelhead and Chinook migrate to the ocean in their second year of life or later as relatively large smolts [generally 10 to 30 cm (4 to 12 inches)] and move through the lower Columbia River and estuary within days to weeks (U.S. Army Corps of Engineers 2001).

The bull trout information in this paragraph is excerpted from the Service's 2002 Biological Opinion

on the Columbia River Channel Improvements Project (U.S. Fish and Wildlife Service 2002a). Bull trout are relatively dispersed throughout the tributaries of the Columbia River Basin, including its headwaters in Montana and Canada. The Columbia River DPS includes bull trout residing in portions of Oregon, Washington, Idaho, and Montana. Bull trout are estimated to have occupied about 60 percent of the Columbia River Basin and currently occur in 45 percent of the estimated historical range (Quigley and Arbelbide 1997). The Columbia River DPS comprises 141 bull trout sub-populations in four geographic areas of the Columbia River Basin. The current distribution of bull trout in the lower Columbia River Basin is less than the historical range (Buchanan et al. 1997).

Incidental catches of bull trout in the Bonneville Pool (Wachtel 2000) indicate that bull trout are using the mainstem reach of the lower Columbia River. Bull trout have been reported from the lower reaches of the Kalama and Lewis rivers (J. Byrne pers. comm.) and Sandy River (PGE *in litt.*). One bull trout was reportedly caught and released in the Columbia River downstream from Bonneville Dam between the dam and Reed Island in 1994. Another was harvested from the area below Bonneville Dam in 1998 (Wachtel 2000). Three other bull trout have been reported as having been caught in Bonneville Pool during 1998 by anglers participating in the northern pikeminnow Sport-Reward fishery (Wachtel 2000). There have been two reports of bull trout caught by anglers in the White Salmon River downstream from Condit Dam in recent years.

The endangered Oregon chub was formerly distributed throughout the lower elevation backwaters of the Willamette River drainage. Decline of the Oregon chub is attributed to loss of its backwater habitats. Habitat at the remaining population sites typically consists of low- or zero-velocity water flow conditions, depositional substrates, and abundant aquatic or overhanging riparian vegetation. Currently, known populations are restricted to an 18.6 mile stretch of the Middle Fork Willamette River in the vicinity of Dexter and Lookout Point Reservoirs in Lane County (58 FR 53800).

Threatened Warner suckers are endemic to the Warner Valley (Crump Lake). Warner suckers are bottom dwellers and comprise less than five percent of the total fish population in the Warner Valley (C. Allen pers. comm.). There are no ESA-listed fish species in Fern Ridge Lake. However, ESA-listed salmonids occur in the Willamette and McKenzie rivers, approximately 6 miles east of the lake. These include Upper Willamette River Chinook, and Upper Willamette winter steelhead ESUs.

CALIFORNIA. ESA-listed salmonid ESUs that occur in the San Francisco Bay estuary include the

Sacramento River winter-run Chinook; Central Valley spring, fall, and late-fall run Chinook; Central Valley steelhead; Central California Coast steelhead; and Central California Coast coho.

Adult Sacramento River winter-run Chinook salmon leave the ocean and migrate through the Sacramento-San Joaquin delta to the upper Sacramento River from December through June. Most juveniles distribute themselves to rear in the Sacramento River through the fall and winter months. Some Sacramento River winter-run Chinook salmon juveniles move downstream to rear in the lower Sacramento River and delta during the late fall and winter and may begin migrating downstream from December through March (Moyle et al. 1989, Vogel and Marine 1991).

Most yearling Central Valley spring-run Chinook salmon move downstream in the first high flows of the winter from November through January (U.S. Fish and Wildlife Service 1995, California Department of Fish and Game 1998), while some remain throughout the summer and exit the following fall as yearlings. At present, all Central Valley steelhead are considered winter-run steelhead (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940s (Interagency Ecological Program Steelhead Project Work Team 1999). Juveniles live in freshwater from one to four years (usually two years in California, Barnhart 1986), then smolt, and migrate to the sea from February through April. However, some steelhead smolts may outmigrate during the fall and early winter months.

Central California Coast steelhead have been virtually extirpated in most tributaries to San Francisco and San Pablo bays (McEwan and Jackson 1996). Fair to good runs of steelhead occur in coastal Marin County tributaries. Based on a 1994 to 1997 survey of 30 San Francisco Bay watersheds, NOAA Fisheries believes that there is a relatively broad distribution of steelhead in smaller streams throughout the watershed (Busby et al. 1996).

Central Valley fall and late fall-run Chinook is a candidate species. This ESU includes all naturally spawned populations of fall-run Chinook in the Sacramento and San Joaquin River basins and their tributaries. Fall-run Chinook juveniles emigrate during their first winter (January to March).

The delta smelt, which is endemic to the upper Sacramento-San Joaquin estuary, is federally ESA-listed as threatened. Delta smelt inhabit open surface waters where they school. The green sturgeon is a candidate species and is comprised of two DPSs (68 FR 4433). The green sturgeon

is anadromous but is the most marine oriented sturgeon species (Adams et al. 2002). Green sturgeon adults and juveniles occur throughout the upper Sacramento River.

3.2.4 Other Birds

Bird species other than Caspian terns that could potentially be affected by proposed management alternatives of this DEIS are described below, except for those species listed under the ESA. Descriptions of ESA-listed bird species are located in section 3.2.6 with other ESA-listed wildlife.

WASHINGTON. A variety of shorebirds and waterbirds use Dungeness Bay throughout the year. The bay is one of Washington's major wintering and spring staging areas for the brant (U.S. Fish and Wildlife Service 1996). A pair of black oystercatchers nest on the site at Dungeness NWR used by Caspian terns in 2003. Numerous glaucous-winged gulls and double-crested cormorants also use this area.

OREGON. Two species of cormorants nest on East Sand Island. East Sand Island supports the largest known colony of double-crested cormorants on the Pacific Coast (Roby pers. comm.). These cormorants nest on the western end of the island, separated from the tern nesting site by dense upland shrub habitat. The nesting colony has increased nearly 100-fold since it was first recorded in 1989 (Anderson 2002). In 2003, about 10,600 pairs of cormorants nested on East Sand island (Roby pers. comm.). Brandt's cormorants nest on a pile dike offshore of East Sand Island. A large gull colony is also located on East Sand Island both at the eastern end near the Caspian tern colony and at the western end near the cormorant colony site. Nesting gulls consist mostly of glaucous-winged/western gull hybrids but several hundred pairs of ring-billed gulls also nest on the island. The endangered California brown pelican roosts on East Sand Island (see section 3.2.6 for more details on pelican use of the island). Bald eagles also have a substantial breeding and wintering/transient population in the Columbia River estuary (see section 3.2.6 for more details). Mallards and western Canada geese are probably the most abundant breeding waterfowl on the island. Songbirds also use the vegetated habitat on the upland portion of the island.

Several species of colonial waterbirds and shorebirds use Summer and Crump lakes. These include American avocet, black-necked stilt, willet, common snipe, California gull, ring-billed gull, double-crested cormorant, Forster's tern, and American white pelican. Some of these species may compete for nesting habitat with Caspian terns. Gulls are common in Fern Ridge Lake but no nesting occurs since habitat is currently unavailable.

CALIFORNIA. Double-crested cormorant, California gull, and Forster's tern are commonly found in

San Francisco Bay. These bird species use habitat similar to terns and may nest adjacent to or near tern colonies. The numbers of Forster's terns in the bay have declined significantly between 1984 and 2003 (Strong et al. 2003). Much of this decline is attributed to fluctuating water levels, encroachment by gulls, predation, human disturbance, and contaminants.

3.2.5 Mammals

WASHINGTON. Coyote, skunk, river otter, red fox, weasel, and raccoon all occur on Dungeness NWR in low numbers (P. Sanguinetti pers. comm.). All of these species could be potential predators of Caspian terns. Up to 600 harbor seals have been observed on Dungeness NWR (U.S. Fish and Wildlife Service 1996). Dungeness Spit is a traditional haul-out and pupping site. In recent years, pupping activity here occurred near the tern nesting site used in 2003.

OREGON. Nutria, vole, mice, and rat are residents on East Sand Island. Occasionally, visitors such as deer can be found on the island. None of these species are predators of terns. Mammals found in the Summer Lake Wildlife Area include coyote, skunk, mink, raccoon, and feral cat (St. Louis 1993). Coyote and raccoons are in the area around Crump Lake but do not have access to the tern nesting island. Beaver, nutria, raccoon, and muskrat are common species at Fern Ridge Lake. River otter and mink are likely present and could be potential predator species. More terrestrial species such as red fox, coyote, and black-tailed deer are also present at Fern Ridge Lake.

CALIFORNIA. Mammals commonly found in San Francisco Bay include river and sea otters, coyote, and the non-native red fox. The red fox has been implicated in the population declines of the endangered California clapper rail, Caspian tern, and other colonial nesting species, such as the great blue heron and great egrets (Goals Project 2000). The Service began a Predator Management Program in 1991 which focused on removing red fox and other targeted predators on refuge lands (Goals Project 2000).

3.2.6 Federally Endangered and Threatened Wildlife

A complete list of federally endangered and threatened (ESA-listed) wildlife that occur in the affected environment is located in Appendix H. The description below focuses only on those species that may be affected by proposed management actions presented in this DEIS.

WASHINGTON. The threatened western snowy plover is found at Dungeness NWR with peak numbers of four to six birds observed in 1995 (U.S. Fish and Wildlife Service 1996). The current breeding status of western snowy plovers at Dungeness NWR

remains uncertain. The threatened bald eagle also occurs here, with as many as 24 birds seen feeding or roosting on the Refuge at one time. Marbled murrelets also occur in the Dungeness Bay area.

OREGON. The endangered California brown pelican typically occurs from late spring to mid-fall along the Oregon Coast. Concentrations of this species form at the mouth of the Columbia River at the South Jetty and at East Sand Island-Baker Bay. This species forages in nearshore waters of the Pacific Ocean and estuarine waters of the Columbia River. Up to 10,800 birds were observed roosting on East Sand Island in 2002, primarily, on the western end of the island (Fischer 2004). In 2003, a peak of 6,700 pelicans was observed on East Sand Island (Fischer 2004). In recent years, nest building behavior by a few pelicans has been observed, however, egg-laying has never been documented. The Columbia River estuary supports a healthy bald eagle population with approximately 46 nesting territories. In Summer Lake, bald eagles occur in large numbers, especially in the spring when 50 to 100 birds may be found using the lake. An active nesting territory is found two miles west of the area (St. Louis 1993). One bald eagle territory is located on Fern Ridge Lake (Issacs and Anthony 2003). Resident, transient, and wintering bald eagles occur at Fern Ridge Lake.

CALIFORNIA. Western snowy plovers are present in San Francisco Bay. Salt ponds, their levees, and pond edges, which may mimic historic salt pan habitat, provide almost all known western snowy plover nesting habitat in the bay. The endangered California least tern also nests in the bay. California least terns were first recorded in the San Francisco Bay Area in 1927, in Alameda, where the current largest northern California colony breeds (Goals Project 2000). The proposed Alameda NWR is the only known nesting location in San Francisco Bay. The Bay Area colony is considered a critical population, vital to the Statewide species recovery effort (Goals Project 2000). California least terns also occur in coastal sites in southern California (e.g., Bolsa Chica Ecological Reserve and South San Diego NWR).

3.3 Socioeconomic Environment

3.3.1 Commercial and Recreational Fisheries

Because fish are exposed to harvest from commercial and recreational fisheries across large geographic regions of the West Coast, Pacific salmon and steelhead management is governed by numerous regional organizations. The Pacific Salmon Commission (PSC) implements the Pacific Salmon Treaty between Canada and the U.S. to achieve optimum production and divide the harvests so that

each country reaps the benefits of its investment in salmon management. The Pacific Fishery Management Council (PFMC), established by the U.S. Magnuson Act, regulates commercial fisheries off the coasts of California, Oregon, and Washington, including groundfish, shellfish, and salmon.

Coastal ocean fisheries in Washington and Oregon became important in the late 1950s as more restrictions were imposed on freshwater and coastal estuary fisheries. Ocean harvest of salmonids peaked in the 1970s and 1980s. In recent years, commercial and recreational ocean harvest of salmonids have generally been reduced as a result of international treaties, fisheries conservation acts, regional conservation goals, and State and Tribal management agreements.

WASHINGTON. Commercial fisheries that occur in Dungeness Bay include Dungeness crab, clams (including geoduck), octopus, coho and steelhead trout. In addition, many marine species for which EFH is designated are likely to spend part of their life history in the vicinity of Dungeness Bay. Recreational fishing and crabbing are also intensive uses in Dungeness Bay. In 1997, the Washington State Department of Health reported increasing levels of fecal coliform bacteria in Dungeness Bay. Since then, bacteria levels have continued to increase. As a result of this, 300 acres near the mouth of the Dungeness River has been closed to shellfish harvest. There are increasing concerns that marine sources, including wildlife, are contributing to this decrease in water quality.

At least 18 Pacific herring stocks, defined by spawning grounds, occur inside Puget Sound (Lemberg et al. 1997). Currently, there are two commercial herring fisheries in Washington; the principal one is in south-central Puget Sound and has an annual average catch (1992 to 1996) of 510 tons (Lemberg et al. 1997). Currently, Puget Sound herring are fished at a conservative level (Puget Sound Water Quality Action Team 2002). Although Puget Sound herring stocks have declined over the past 20 years, NOAA Fisheries decided they did not warrant listing under the ESA in 2001. It is probable that Pacific herring of all ages pass through nearshore habitats, including Dungeness Bay, especially as juveniles rearing in the summer months and as adults migrating to holding areas near natal spawning grounds.

OREGON. Before 1975, lower Columbia River recreational fisheries focused primarily on salmonid and steelhead harvest. Season closures to protect declining salmonids transitioned much of the recreational fisheries to sturgeon. Salmonid fishing efforts have rebounded with recent improvements in fish returns and selective fishery opportunities. Recreational fisheries for salmonids, white sturgeon,

and steelhead can be quite extensive in the Columbia River estuary depending on stock populations and associated regulations. Recreational crabbing is also pursued extensively in the lower estuary. The lower Columbia River mainstem below Bonneville Dam is separated into two main areas for recreational harvest management: Buoy 10 (ocean/in-river boundary) to the Astoria-Megler Bridge, and the Astoria-Megler Bridge to Bonneville Dam. Columbia River tributary recreational fisheries occur throughout the lower Columbia. Depending on the time of year, different salmonids are targeted, including spring Chinook, summer steelhead, fall Chinook, coho, and winter steelhead.

Columbia River commercial fisheries became important in the 1860s. Since the early 1940s, Columbia River commercial catches of salmon and steelhead have steadily declined, reflecting changes in fisheries in response to declines in salmonid abundance. Lower Columbia River non-Indian commercial fisheries occur below Bonneville Dam in the mainstem or in select off-channel fishing areas. The Columbia River above Bonneville Dam to McNary Dam (Zone 6) was open to non-Indian commercial fishing until 1956. Commercial fishing for salmonids (gillnet and tanglenet) occurs in the estuary and lower Columbia River although it is heavily restricted in time and space. Groundfisheries and trolling occur offshore. Commercial crabbing occurs to a limited extent in the estuary with the primary focus occurring offshore.

Washington and Oregon establish season dates and gear restrictions for mainstem commercial fisheries according to the Columbia River Compact (organization charged by congressional and statutory authority to adopt seasons and rules for Columbia River commercial fisheries). Columbia River fisheries are also regulated according to the Columbia River Fish Management Plan adopted by the U.S. District Court order in 1988 and agreed to by the parties of US v. Oregon: the United States; the States of Oregon, Washington, and Idaho; and the four treaty Indian Tribes (the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes and Bands of the Yakama Nation, and the Nez Perce Tribe). Finally, because of the ESA status of many Columbia River salmonids, harvest managers must consult annually with NOAA Fisheries to ensure fishers are regulated to meet no-jeopardy standards established for ESA-listed salmonids.

There are no commercial fisheries at Crump and Summer lakes. Recreational fishing occurs primarily along the upper four miles of the Ana River but no fishing occurs within the Summer Lake Wildlife Area. Largemouth bass, white and black crappie, and brown bullhead primarily make

up the recreational fisheries at Crump Lake. The fisheries are highly dependent upon water levels and crappie fishing is the primary fishery (C. Edwards pers. comm.). No commercial fishery occurs at Fern Ridge Lake. Recreational fishing for introduced warmwater species is a common recreational pursuit at Fern Ridge Lake and on the Long Tom River. The Willamette and Mackenzie rivers, approximately 6 miles east of Fern Ridge Lake, support recreational fisheries for salmon, steelhead, and trout, plus some warmwater fish species.

CALIFORNIA. In San Francisco Bay, special status fisheries of the San Francisco Bay estuary include anadromous and resident species, crab, and shrimp. All portions of the bay/delta support commercially and/or recreationally important fisheries. Important sportfish that forage and/or rear young in intertidal mudflat and rocky shore habitats include native species such as Chinook salmon, white sturgeon, diamond turbot, and a variety of sharks in addition to the introduced striped bass. Pacific herring support a large fishery in the estuary as bait and human food, but more importantly as the roe and roe-on-kelp fishery for export to Japan. The roe fishery is closely regulated by CDFG (California Department of Fish and Game 2001). Depressed herring populations were observed in San Francisco resulting from the 1977/1978 El Nino event (California Department of Fish and Game 2001). Anchovies support a commercial bait fishery. As juveniles in the near shore areas, anchovies are vulnerable to a variety of predators, including birds and some recreationally and commercially important species of fish. Total anchovy harvests and exploitation rates since 1983 have been below the theoretical levels for maximum sustained yield, and stock biomass estimates are unavailable for recent years. Based on abundance index data, the stock is thought to be stable at a modest biomass level (California Department of Fish and Game 2001). Introduced species that have commercial and recreational value in the estuary include American shad and striped bass. American shad supported a large commercial fishery soon after its introduction. Commercial fishing was later banned in 1957 due to declining populations. Today a sport fishery exists in the estuary. Despite a ban on commercial fishing of the striped bass, its population continues to decline.

The white sturgeon is also an important fishery resource. White sturgeon are particularly vulnerable to the effects of over-harvesting because they mature slowly. Commercial fishing of sturgeon dates back to the mid-1800s, but declined by the early 1900s. In 1954, the Fish and Game Commission abolished the commercial fishery and established a sport fishery that continues today. Populations have continued to decline in recent years. The major factor affecting sturgeon populations is believed to be decreased river outflow into the bay (CDFG

2001). Adult English sole and starry flounder support a small commercial ocean fishery. While English sole shows no signs of decline, the starry flounder has declined specifically in San Pablo and Suisun bays. The starry flounder appears to be more sensitive to hydrologic and environmental changes (SFEP 1992a). Dungeness crab has provided a valuable commercial fishery for San Francisco for over a century.

3.4 Tribal Fisheries

WASHINGTON. Jamestown S'Klallam, Lower Elwah Klallam, and Port Gamble Klallam have Tribal treaty rights for fisheries associated with the Point No Point Treaty. Dungeness Bay is the main fishing area for the Jamestown S'Klallam Tribe. The Tribe operates a commercial fishery for coho (of hatchery origin), primarily from September through October (S. Chitwood pers. comm.). The Jamestown S'Klallam Tribe also operates a small commercial net fishery for steelhead (December to February), commercial oyster operation (in the bay), commercial and recreational crab fishery (in the bay), and a commercial geoduck harvest (outside the bay, S. Chitwood pers. comm.).

OREGON. Tribal (treaty) fisheries on the Columbia River occur upstream of Bonneville Dam. Treaty Indian harvest includes commercial, ceremonial, and subsistence (C&S) fisheries. The four Columbia River treaty Indian Tribes include the Bands of the Yakama Nation, Confederated Tribes of the Warm Springs Reservation of Oregon, Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce Tribe. Treaty Indian commercial catches became a larger portion of the total Columbia River commercial catches following the 1968 Federal court ruling regarding equitable Indian and non-Indian harvest sharing. Since 1968, commercial fishing in the area between Bonneville and McNary dams (Zone 6) has been the exclusive province of the Treaty Indian Tribes. No Tribal fisheries occur at Summer, Crump, and Fern Ridge Lakes.

CALIFORNIA. No Tribal fisheries occur in San Francisco Bay.

3.5 Cultural Resources

WASHINGTON. The New Dungeness Lighthouse on Dungeness NWR is located approximately 0.5 mile from the tern colony. The lighthouse was established in 1857 and was placed on the National Register of Historic Places in 1993. The concrete foundations and rubble remains of a small WWII naval station is on Graveyard Spit about three-quarters of a mile southwest of the colony.

The S'Klallam Indian Tribe inhabited the Dungeness area when the first European settlers arrived. Their use of Dungeness and Graveyard spits probably included temporary camping and food gathering. The Tribe lived on Dungeness Spit from 1872 to 1873 after being asked to move off land which had been homesteaded in the Dungeness community. Dungeness and Graveyard spits are known S'Klallam burial grounds. In 1980, a burial canoe was collected from Graveyard Spit by the Service.

OREGON. The Columbia River has a rich history of cultural resources associated with Native Americans and European exploration and settlement. Shipwrecks are particularly abundant in the area. East Sand Island was formerly a part of a mid-estuary shoal that migrated north and west to its present location apparently due to various navigation improvements. Cultural resources on the island are primarily associated with the early commercial fishing industry and military blockade of the mouth of the Columbia River during the World Wars.

Cultural resources associated with Native Americans are abundant in southeastern Oregon. Artifacts are especially prevalent around waterbodies such as Summer and Crump lakes. Human occupation at these locations goes back at least 11,500 years. Sites found in both areas range from large village sites located on the shores of each lake to small camp sites in the adjacent uplands or on playas. Depending upon water levels, sites may be inundated on both lakes, may appear as islands within the lakes or may be located high above the present shoreline. Native Americans with interests in Summer and Crump lakes include the Fort Bidwell Tribe, the Burns Paiute Tribe, Paiutes from the Confederated Tribes of Warm Springs, and the Yahuskin Band of the Klamath-Modoc Tribe.

Fern Ridge Lake has high value as an archaeological and historical resource. Native Americans used the area heavily. The Indian bands that ceded this area are documented under a treaty by the Confederated Bands of the Willamette Valley, January 22, 1855. Their descendants are included in the modern Confederated Tribes of Grand Ronde. A travel route for early settlers passed through the now inundated portions of Fern Ridge Lake, including the historic Applegate Trail (U.S. Army Corps of Engineers 1988). Native Americans were also a substantial presence in the Long Tom River channel, Coyote Creek, and areas adjacent to Orchard Point Park, which represent major archaeological areas. A Cultural Resources Management Plan has been prepared for known cultural resource sites at Fern Ridge Lake.

CALIFORNIA. There are no cultural resources located in the areas proposed for management actions in San Francisco Bays with the exception of Brooks Island. Brooks Island was home to local natives for two or three thousand years. The Ohlone Indians originally settled the island. Their shell mounds and burial sites, up to 2,500 years old, are an archaeological treasure being preserved and protected on Brooks Island.