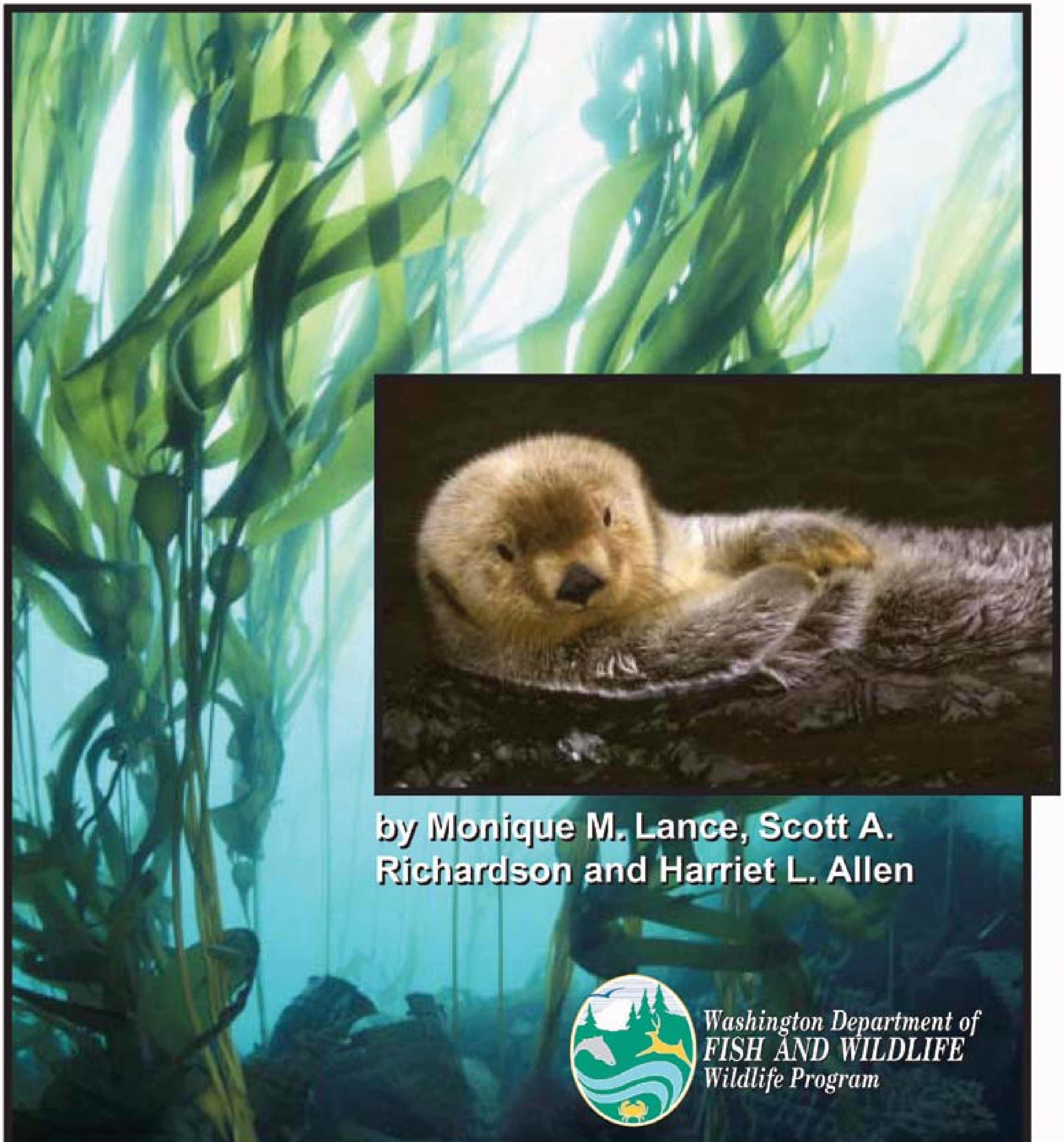
STATE OF WASHINGTON December 2004

Sea Otter Recovery Plan



by Monique M. Lance, Scott A. Richardson and Harriet L. Allen

Washington Department of
FISH AND WILDLIFE
Wildlife Program

Washington State Recovery Plan for the Sea Otter

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Recovery, as defined by the U.S. Fish and Wildlife Service, is "the process by which the decline of an endangered or threatened species is arrested or reversed, and threats to its survival are neutralized, so that its long-term survival in nature can be ensured." This definition is also applicable to the recovery of wildlife species managed by the Washington Department of Fish and Wildlife, including the sea otter.

The sea otter is classified as an endangered species in Washington (WAC 232-12-014). The Department's listing procedures (WAC 232-12-297, Appendix B) require that recovery plans be written for species listed as endangered or threatened by the Washington Fish and Wildlife Commission. The sea otter recovery plan summarizes the historic and current distribution and abundance of the sea otter in Washington, describes factors affecting the population and its habitat, sets recovery objectives and prescribes strategies to recover the species in the state.

A Sea Otter Working Group was established to provide input and help guide the development and completion of the recovery plan. The preliminary draft of the plan was written in 1999 and was peer reviewed by sea otter experts. The Draft Sea Otter Recovery Plan was released for a 90-day public review in 2000. This document is the Final Plan, which has had the public review comments addressed and has been updated with a great deal of new information developed during 2000-2004.

For additional information about sea otters or other state listed species, see the Washington Department of Fish and Wildlife website (www.wa.gov/wdfw) or contact:

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EXECUTIVE SUMMARY

Sea otters existed along the Washington coast for thousands of years before they were extirpated by an intensive harvest for their valuable pelts that began in the mid-1700s. From about 1911 to 1969, sea otters were absent from the state. In 1969 and 1970, 59 sea otters were reintroduced to the Washington coast from Amchitka Island, Alaska. The sea otter was listed as a state endangered species in 1981, due to its small population size, restricted distribution, and vulnerability.

From 1989 to the most recent survey in 2004, the population has been growing at an average annual rate of 8.2%. From 2000 to 2004, annual survey counts have ranged from 504 to 743 sea otters. The current sea otter range in Washington extends from just south of Destruction Island on the outer coast to Pillar Point in the Strait of Juan de Fuca, with concentrations in the vicinities of Destruction Island, Perkins Reef, Cape Johnson, Sand Point, Cape Alava, and Duk Point. A few individual sea otters have been seen in Puget Sound and the San Juan Islands as well as along the Oregon coast.

The current distribution of sea otters in Washington includes only a portion of the pre-exploitation range, which extended south to the Columbia River with a major concentration off of Point Grenville and northward along the Olympia Peninsula and into the Strait of Juan de Fuca. At the present time, Washington sea otters occupy almost exclusively rocky habitat along the Olympic Peninsula coast and western Strait of Juan de Fuca. It is not possible to predict whether the population will continue to grow and spread and, if so, at what rate or in which direction. If they do expand their distribution, they could disperse into historically occupied sandy habitat to the south (e.g. Grays Harbor and Willapa Bay), spread eastward along the Strait of Juan de Fuca and into Puget Sound, or move north across the Strait of Juan de Fuca to Vancouver Island where more than 2,500 sea otters exist in British Columbia. Habitat-based carrying capacity estimates for the historic sea otter range in Washington vary from 1,372 to 2,734 otters, based on four measures of habitat availability.

Sea otters feed primarily on benthic invertebrates, consuming many pounds of prey each day to meet their high metabolic needs. In Washington, they consume shellfish species including sea urchins, clams, crabs and mussels. Studies in Washington and elsewhere have shown that sea otter predation on sea urchins may indirectly enhance the growth of kelp and kelp-associated communities. Shellfish are important to commercial, recreational, and tribal fisheries in Washington and predation by sea otters in a specific area can be significant and result in localized fisheries management issues.

Oil spills are the single greatest anthropogenic threat to sea otters. Washington's sea otter population is particularly vulnerable to oil spills because it is concentrated along a relatively small geographic stretch of coastline where vessel traffic is steady. The relatively isolated nature of the current population also has implications for genetic diversity that intensify if a catastrophic event such as an oil spill were to occur. Recent studies indicate infectious diseases may be an important mortality factor in sea otters and warrant continued monitoring. Entanglement in fishing nets may cause significant losses in some parts of the sea otter range. In Washington, a small number of sea otters are taken in tribal gill net fisheries along the northern coast. These issues and others, combined with the species' popular appeal, necessitate management and recovery efforts for sea otters in Washington, as they have for sea otter populations in Alaska, California, and British Columbia.

Goals of the Washington sea otter recovery program are to implement strategies that will ensure a self-sustaining sea otter population in Washington through the foreseeable future; and to manage the Washington sea otter stock in a manner consistent with the federal Marine Mammal Protection Act, other state and federal laws, court rulings and federal treaties with Native American tribes. The recovery plan outlines strategies which, when implemented, will enhance sea otter habitat and populations to the point where the long-term survival of the species in nature can be ensured and it can be downlisted from state Threatened status.

Recovery objectives are based on achieving population levels of 60-80 percent of the estimated carrying capacity (K) for Washington. Sea otters will be considered for downlisting from State Endangered to State Threatened status when: 1) the average population level over a 3-year period equals or exceeds 1,640 sea otters (60% of K) in Washington, and 2) Washington's sea otter population is distributed such that a single catastrophic event, such as a major oil spill, would be unlikely to cause severe decline or extirpation of the population. Sea otters will be considered for downlisting from state Threatened status when the average population level over a 3-year period equals or exceeds 2,187 sea otters (80% of K), and management plans or agreements are in place by the state's co-managers that provide for the continued viability of the sea otter population in Washington. Sea otter recovery strategies include conducting research and monitoring to determine abundance, distribution and health of the population, protection of sea otters and their habitat, prevention and preparation for oil spills, exchange of information, increased public education and outreach and development of cooperative, proactive management approaches among involved entities to reduce potential future sea otter-fishery conflicts.

PART ONE: BACKGROUND

1. CURRENT STATUS

1.1 Taxonomy

The sea otter (scientific name, *Enhydra lutris*; Makah name, *ti'tcak*; Quinault name, *kakwa 'lakeh,* Quileute name *Xalidi' swa*, Chinook name, *Elakha*) is a member of the order Carnivora, the family Mustelidae, and the subfamily Lutrinae. The monotypic genus Enhydra evolved in the North Pacific about 1 to 3 million years ago and has remained confined to this range since then (Riedman and Estes 1990). The species was described by Linnaeus in 1758 from George W. Steller's 1751 account; no type specimen exists (Wilson et al. 1991).

Subspecific distinctions within *Enhydra lutris* have received considerable attention (reviews in Riedman and Estes 1990, Anderson et al. 1996), with three subspecies currently recognized based on morphometric work by Wilson et al. (1991). *Enhydra l. lutris* (Asian or northern sea otter) occurs from the Kuril Islands to the Kamchatka Peninsula and the Commander Islands; *E. l. kenyoni* (Alaskan or northern sea otter) ranges from the Aleutian Islands to Washington; and *E. l. nereis* (California or southern sea otter) is found in California (Fig. 1).

Prior to its extirpation, the original Washington population was thought to perhaps have been intermediate between *E. l. nereis* and *E. l. kenyoni*, but more closely allied with the latter (Wilson et al. 1991). Subsequent research that examined genetic material extracted from sea otter skeletal elements obtained from a Makah midden near Ozette on the northern Washington coast, indicates the historical (pre-fur trade) sea otter population had more genetic variation and was most closely related to the Alaskan subspecies (*E. l. kenyoni*) (Larson et al. 2002b). Variation in mitochondrial-DNA sequences suggests *E. l. nereis* may be the most genetically distinct population, although range-wide, sea otters apparently have experienced no major phylogenetic breaks or long-term barriers to gene flow (Cronin et al. 1996).

1.2 Stock Definitions

The Marine Mammal Protection Act (MMPA) Section 3(11) (16 U.S.C. 1361) defines a "population stock" or "stock" as a group of marine mammals of the same species or smaller taxa in a common spatial arrangement, that interbreeds when mature." The U.S. Fish and Wildlife Service (USFWS), under MMPA guidelines (Barlow et al. 1995; Wade and Angliss 1997), recognizes five sea otter stocks in U.S. waters. These include single stocks in California (California stock) and Washington (Washington stock), and three stocks in Alaska (Southeast, Southcentral, and Southwest stocks). The term "Washington sea otter stock" is used to define the sea otter population found within the marine waters of Washington state. The parent population for the reintroduced Washington stock (sea otters translocated from Amchitka Island, Alaska) is currently identified by USFWS as the Southwest Alaska stock.

An additional sea otter population is present in British Columbia waters along the west coast of Vancouver Island which originated from Alaska translocations (Amchitka Island and Prince William Sound). Ranges of sea otters in Washington and British Columbia do not overlap and there is no known genetic exchange between these populations. Marine mammal "stocks" that occur in waters under US jurisdiction are recognized under the MMPA, therefore the sea otter population that occurs in British Columbia waters is not recognized as a "stock".

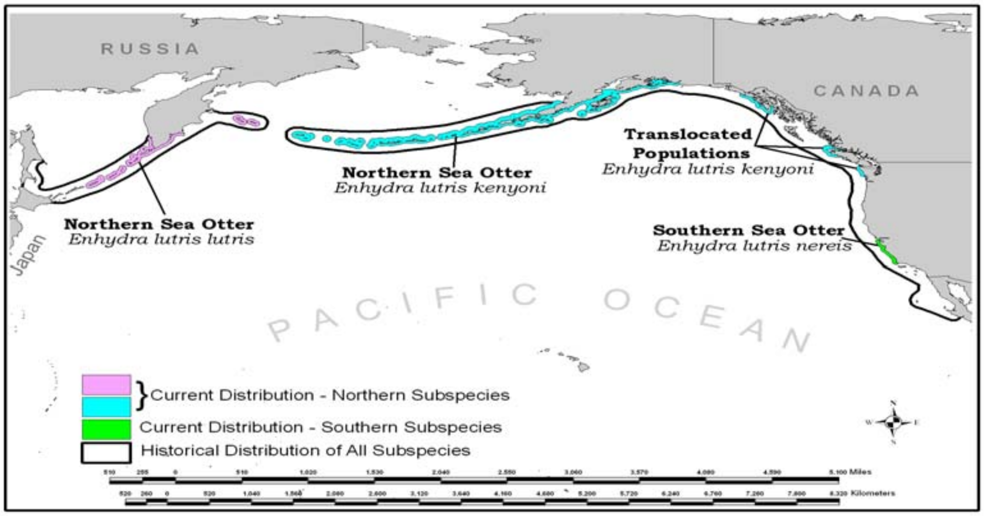

Figure 1. Historical and current range of the three subspecies of sea otter (*Enhydra lutris lutris, E. l. kenyoni,* and *E. l. nereis*). Map reproduced with permission from the USFWS Ventura, California.

1.3 Species Description

There are 12 species of otters worldwide. Sea otters are among the largest members of the Mustelidae however they are the smallest marine mammals in the North Pacific and the only species that carries out all aspects of life strictly in the marine environment (Riedman and Estes 1990). Sea otters possess several important adaptations for life in the marine environment including: hind flippers for aquatic locomotion, flattened premolars and molars for crushing hard-shelled marine invertebrates, and enlarged kidneys to process ingested sea salt (Riedman and Estes 1990). Sea otter pelage color ranges from dark brown to reddish brown, with older animals displaying paler fur around the head, neck, and shoulders (Estes 1980). Unlike seals and sea lions that have a distinct molting period, sea otters molt gradually throughout the year (Kenyon 1969). Newborn pups have light brown, or yellowish, woolly natal fur that is replaced by adult fur by 13 weeks (Payne and Jameson 1984). Sea otters have no blubber layer and thermoregulation is a function of a high metabolic rate and very thick fur. The fur consists of an outer layer of protective guard hairs and an extremely fine dense fur of approximately 100,000 hairs per square centimeter below that which entraps insulating air (Kenyon 1969). Oil from glands in the skin enhances the water repellent properties of the fur (Riedman and Estes 1990). The metabolic rate of a sea otter is 2.4 to 3.2 times higher than that of a terrestrial mammal of similar size (Costa and Kooyman 1982, 1984 *in* Doroff and Bodkin 1994). Free-ranging sea otters maintain this internal rate of heat production by consuming 23 to 33 percent of their body weight daily (Costa and Kooyman 1982). Sea otters have poor vision above water and fair or good vision below (Estes 1980). Their tactile sense (particularly in paws and whiskers) is well developed (Kenyon 1969, Estes 1980), and their senses of smell and hearing are thought to be good (Kenyon 1969, Riedman and Estes 1990).

River otters (*Lontra canadensis*), a related species, are frequently found along Washington's shorelines and observers often mistakenly identify them as sea otters when encountered in marine waters. A few physical characteristics and behavioral traits can help distinguish between the two species (Kenyon 1969, Table 1).

Table 1. Physical characteristics and behaviors used to distinguish between sea otters and river otters.

	Sea Otter	River Otter
Habitat	Typically in marine habitat	Both marine and fresh water
Swimming	Usually swims belly up, floating on the water, holding forepaws on chest, paddling with its hind flippers	Usually swims belly down, with its back nearly submerged
Land	Clumsy on land, usually seen in the water	Agile on land; often seen ashore
Eating	Always eats in water, while floating on its back	Usually eats on land
Weight	Can exceed 100 lbs	Usually less than 30 lbs
Hind feet	Flipper-like, pads visible only at tip of fifth toe, which is the longest	Not flipper-like, pads cover much of the hind feet; fifth toe is not elongated
Tail	Flattened, not broad at the base; less than 1/3 the body length	Round, thickened at the base and more than ½ the length of the body

In Washington, adult sea otter males average 37.9 kg (83.6 lbs) in weight and 139.6 cm (54.4 in) in length (Table 2, R. Jameson, unpublished data). Washington males tend to be larger than adult males in long-established populations, such as Amchitka, Alaska, and roughly equivalent in size to adult males in sparse populations (Table 2).

Adult sea otter females in Washington average 24.2 kg (53.4 lbs) in weight and 127.0 cm (49.5 in) in length (R. Jameson, unpublished data), which is similar to females from other areas. Newborn pups weigh about 2 kg (4.4 lb) and measure 50 to 60 cm (20 to 24 in) in length (Riedman and Estes 1990).

Table 2. Mean weights (kg) and lengths (cm) of adult sea otters from Alaska and Washington.

	Weight (kg)						Length (cm)					
	Male			Female			Male			Female		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Amchitka Island, Alaska[a]	28.3	7.93	79	21.1	6.49	254	143.0	4.3	79	125.2	4.73	254
Alaskan sparse populations[a]	39.5	10.12	5	25.2	13.00	4	140.8	0.5	5	129.8	6.3	4
Washington[b,c]	37.9	5.37	21	24.2	2.49	66	139.6	6.06	20	127.0	3.58	57

[a] Data from Kenyon (1969).
[b] Unpublished data from R. Jameson, USGS Biological Resources Division, Corvallis, Oregon.
[c] Sample sizes differ because during 1992 captures no anesthesia was used and animals were weighed, but not measured.

2. GEOGRAPHICAL DISTRIBUTION

2.1 North Pacific Ocean

Sea otters are found in nearshore marine waters along the coasts of California, Washington, British Columbia, Alaska, Russia (Kuril Islands, Kamchatka Peninsula and Commander Islands) and Japan. (Fig. 1).

2.2 Washington - *Historic*

Little information exists on the exact distribution of sea otters living in Washington before the population was extirpated. They are presumed to have lived along much of the North Pacific including the outer coast of Washington for several thousand years. Sea otter remains have been found at eight archaeological sites in Washington (Table 3). These include multiple sites on the outer coast near Grays Harbor, Cape Alava, and Cape Flattery, and the western portion of the Strait of Juan de Fuca near Sekiu and Neah Bay. Single specimens have been found at sites in the San Juan archipelago and entrance to Puget Sound at Indian Island.

Minimal evidence exists for sea otters from archaeological sites in the Strait of Georgia, eastern portion of the Strait of Juan de Fuca, or Puget Sound (R. L. Lyman, pers. comm.). It is important to note that while numerous archaeological sites have been excavated along the salt-water coast of Washington (Whatcom County through Puget Sound), greater Pacific Ocean coast, and mouth of the Columbia River, faunal remains recovered from many of these sites have not been identified or reported. It is somewhat tenuous to take negative evidence and assume there is no evidence of prehistoric sea otters. Sea otters may well have been in these areas, but the archaeological evidence for their presence does not exist or is weak, at best (R. L. Lyman, pers. comm.).

A single sea otter bone was recovered from an archaeological site on the banks of the Columbia River just south of St. Helens, Oregon (Saleeby 1983). The specimen likely dates to the last 1000 years. It is unclear if the specimen represents an individual that was taken from the river by prehistoric hunters, or if it represents an individual taken from the coast and transported upriver. The fact that there is only one sea otter specimen in a sample of more than 14,000 identified bones and teeth from archaeological sites in the Portland basin (Lyman and Ames 2004) suggests that if sea otters occurred prehistorically in the lower reaches of the Columbia River, they were rare.

Table 3. Archaeological sites in Washington with sea otter remains (Dr. R. L. Lyman, pers. comm.).

Site number	Site name	Located near	Age	Reference
45CA24	Ozette	Cape Alava	last 1000 years	Huelsbeck 1994
45CA22	Neah Bay	Cape Flattery	last 2000 years	Wessen 1991
45CA207	Tatoosh	Cape Flattery	last 1000 years	Friedman 1976
45CA25	Sooes	Cape Flattery	last 1000 years	Friedman 1976
45CA201	Hoko R. rockshelter	Sekiu	last 2000 years	Wigen and Stucki 1988
45GH15	Minard	Grays Harbor	last 1000 years	Roll 1974
45JE16	Indian Island	Port Townsend	last 1000 years	Blukis Onat 1976
45SJ105	Fossil Bay	Sucia Island	last 1500 years	Kidd 1971

Pitcher (1998) speculates that sea otters were present in the Strait of Georgia 500 years ago and in more ancient time (8,000 years ago) despite the lack of evidence from middens. He notes that native peoples were already pursuing fur trade with Europeans during this time, despite no specific references to sea otters in Captain George Vancouver's 1792 travel logs. Pitcher suggests that local extinction could have occurred rapidly in the enclosed calm waters and islands of the Strait of Georgia. He theorized that sea otters could have easily been extirpated during this period and concludes that the lack of evidence should not be construed to mean that they were absent from the ecosystem. Based on the assumption that similar habitats to the north and south of the Strait of Georgia undoubtedly held sea otters, and still do in Alaska, he believed it was "stretching credulity to suppose that they were absent from the ancient Strait of Georgia" (Pitcher 1998).

In 1790, Spanish explorer Manuel Quimper traded copper sheets for sea otter pelts at Neah Bay and Dungeness Bay (Wagner 1933). He also was reported to have traded at Discovery Bay for live sea otters captured north of the bay in the "interior" of the Strait of Juan de Fuca. In 1792, Captain Robert Gray sailed the *Columbia*, the first sea otter ship outfitted in America, along the coast of Washington. Pursuit of the sea otter was the primary object of the expedition. In April, somewhere along the Olympic Peninsula coast, the crew of the ship traded with local Indians, exchanging copper and iron for sea otter pelts (Scheffer 1940). Later in May, Captain Gray purchased 150 sea otter skins during an eight day stay at the mouth of the Columbia River (Scheffer 1940). In spring of the same year, Peter Puget explored the entirety of Puget Sound. Although he commented on animals encountered and traded for sea otter skins in some localities, he did not report any live sea otters during the voyage (Anderson 1939). Elmendorf (1960) stated sea otters were rare strays in Hood Canal, but presented no evidence for the claim.

Available data indicate that few sea otters occurred as far east as the San Juan Islands and Discovery Bay, and that none lived in Puget Sound (Wagner 1933, Scheffer 1940, Kenyon 1969). Gerber and VanBlaricom (1999) discussed the lack of historical evidence of sea otters in these areas and noted that this was a puzzling pattern given the large numbers of sea otters known to occur in similar coastal estuaries in Alaska and, historically, California (Kenyon 1969). Kvitek et al. (1991) suggests hunting by Native Americans and occurrence of paralytic shellfish poisoning in sea otter prey may be explanations for the absence of sea otters from Puget Sound; but to date, definitive explanations are lacking (Gerber and VanBlaricom 1999).

Lewis and Clark found and traded for sea otter pelts at the mouth of the Columbia River in the winter of 1805/1806 (Burroughs 1995). While it was reported that Lewis and Clark observed "great numbers" of sea otters at Celilo Falls (near the Dalles) on the Columbia River, Clark himself later corrected his journals and noted those animals that he believed were "sea otters" were actually harbor seals (Cutright 2003). The abundance of harbor seal remains (Lyman et al. 2002) in the collections suggests seals were not uncommon in the lower Columbia River over the last 1000 years or so. In the mid-1800's (and presumably earlier), sea otters were concentrated between the mouth of Grays Harbor and Point Grenville (Fig. 2). Scheffer (1940) included the Columbia River, as well as Willapa Bay, as part of the historic range of sea otters in Washington, but treated the intervening Long Beach peninsula as relatively unimportant (Fig. 2).

Anecdotal reports of sea otters on the Washington coast occurred beginning in 1949. Scheffer (1995) referenced a letter reporting a single-day sighting in July 1949 of several sea otters at Goodman Creek (about 13 km south of LaPush) and B. Admire (pers. comm.) reported that "the Hoh tribe was seeing a couple of sea otters around 1950" and that a friend of his told him that he "was positive he saw some sea otters" when camped out at Ozette Island in the

1950's. If these were sea otters, they either roamed to Washington from Alaska or California populations, or were a small relict population that remained undetected along the Washington coast for decades. Information on sea otter movements argues strongly against otters wandering in from Alaska or California. In 1949-50, the California sea otter population was still very small and concentrated many miles south of Monterey and the nearest Alaska population would have been in Prince William Sound.

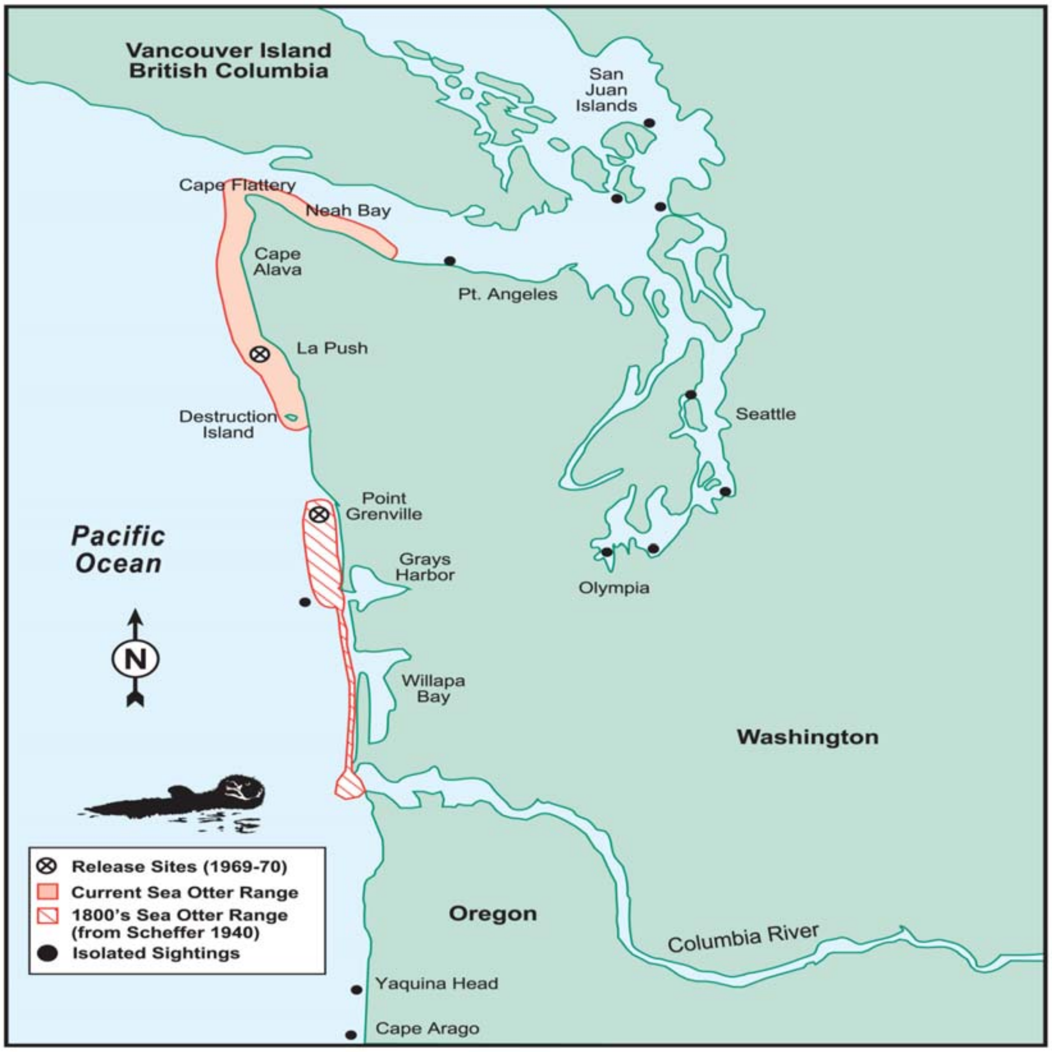

Figure 2. Current and 1800's distribution of the sea otter in Washington, 1969-70 release sites and isolated sightings in Washington and Oregon.

2.3 Washington - *Current*

Sea otters occur along the Washington coast from Destruction Island to Pillar Point and have rarely dispersed far from this "core range" since they were reintroduced in the 1970s (Fig. 2). Seasonal distribution shifts have been observed along the Olympic Peninsula coast as the Washington population has increased. During the mid-1980's, sea otters moved between Cape Johnson in the summer and Cape Alava in the winter (Bowlby et al. 1988); and in 1995, a group of more than 100 sea otters began to enter the western Strait of Juan de Fuca near Neah Bay (Jameson 1995b). Animals returned every winter between 1995-2000 (R. Jameson, pers. comm.), and in 2000, a group of about 50 sea otters came into the Strait of Juan de Fuca to just west of Pillar Point (S. Jeffries, pers. comm.). Large groups of animals were not sighted in the Strait during the winters of 2001-04 (Jameson and Jeffries 2004).

While systematic surveys have not been conducted in the inland waters of Washington, a few isolated sightings, typically of individuals, have been confirmed in recent years in the eastern Strait of Juan de Fuca, San Juan Islands, and within southern Puget Sound near Olympia (Fig. 2). Marine mammal biologists verified a single sea otter observed near Cattle Point, San Juan Island, in October 1996 (J. Zamon, letter dated 11 Nov. 1996 to G. VanBlaricom), and two sea otters were regularly reported being seen between 1996 and 1998 in Budd, Eld, Totten, Hammersley and Henderson Inlets in southern Puget Sound (J. Calambokidis, pers. comm.). On 12 December 1999, two sea otters were sighted 16 km off Grays Harbor, beyond the southern extent of the "core range" (Fig. 2, D. O'Hagan, pers. comm.). Over the past few years, one sea otter has been sighted at Yaquina Head (R. Jameson, pers. comm.) and one sea otter has been sighted at Cape Arago (J. Hodder, pers. comm.) on the central and southern Oregon coast (Fig. 2). Due to the relative distance to the north and south of the Washington and California populations, both of these sea otters are believed to be animals from the Washington translocated population (R. Jameson and S. Jeffries, pers. comm.)

Two sea otters in Puget Sound recently attracted media attention due to their unusual and newsworthy circumstances. In June 2001, a subadult male was observed in southern Puget Sound seven miles up McAllister Creek at McAllister Springs. When it became entrapped in the municipal water supply facility, it was captured, held overnight at Point Defiance Zoo and Aquarium for a health screen, tagged, and released off the Nisqually River at Luhr Beach the following day. This sea otter was resighted off the Nisqually River in late July 2001 (S. Jeffries, pers. comm.). Another sea otter, a subadult female, was observed regularly south of Seattle near Dumas Bay and Redondo Beach from March 2001 until she was captured 15 February 2002. She became habituated to humans over time and began interacting with beach walkers, dogs, and kayakers. Out of concern for the health and safety of the sea otter and the public, she was captured, held at The Seattle Aquarium, health screened, tagged, and relocated near other sea otters on the outer Washington coast. Single sea otters were seen in 2002 in Budd Inlet (February), near Viti rocks located south of Lummi Island (June), and near Port Townsend (September). In February 2004, a single sea otter was seen in Freshwater Bay west of Port Angeles.

3. NATURAL HISTORY

3.1 Ecological Importance

The sea otter's fundamental role in structuring nearshore communities was described 30 years ago when Estes and Palmisano (1974) stated that along the Pacific coast of North America, "the sea otter is an evolutionary component essential to the integrity and stability of the [nearshore marine] ecosystem." They hypothesized that sea otters reduce sea urchin populations, thereby releasing kelp beds from grazing pressure and promoting the growth of kelp-associated communities. This paradigm appears broadly applicable in southeast Alaska and the Aleutian Islands (Estes and Duggins 1995), off northwestern Vancouver Island (Watson 2000) and the outer Washington coast (Kvitek et al. 1998) and has drawn widespread acceptance. However, some researchers (notably, Foster and Schiel 1988) have questioned its broad application, suggesting previous studies were conducted in habitats chosen to support the paradigm's predicted outcome and that other factors such as disturbance are primarily responsible for kelp abundance, particularly in California.

3.2 Reproduction

Male sea otters reach sexual maturity around age five or six, but probably do not become territorial or reproductively successful for two or three subsequent years (Riedman and Estes 1990). Most female sea otters are sexually mature at age four or five (Kenyon 1969, Jameson and Johnson 1993). Breeding activity can occur at any time of year, but coitus peaks in late autumn in Washington. Sea otters are polygynous, males form pair bonds consecutively with several females. In Washington, newborn pups have been observed during almost every month, but nearly half are born in February, March, and April (Jameson 1997a, Jameson 1998a). Females normally give birth to a single pup that weighs 1.4 to 2.3 kg at birth (Riedman and Estes 1990). Twinning has been documented in sea otters (Williams et al. 1980); however, litters larger than one are rare, and when they occur, neither pup is likely to survive (Jameson and Bodkin 1986). Pups remain dependent upon their mothers for about six months (Jameson and Johnson 1993). During the first month the pups depend on mother's milk, by four months pups feed almost exclusively on prey provided by the mother, and by five months the pup is more "independent" and able to dive, capture and break open prey, and groom itself (reviewed in Riedman and Estes 1990). A complete reproductive cycle from mating to birth that includes delayed implantation, typically requires one year.

3.3 Mortality

Longevity in sea otters is estimated to be 15 to 20 years for females and 10 to 15 years for males (Riedman and Estes 1990). The two oldest female sea otters captured in Washington were both 15 years old and the oldest male was 14 years old (R. Jameson, pers. comm.). Sea otters were aged based on cementum annuli of teeth.

Most information on sea otter mortality has been collected where carcasses are frequently recovered for examination (e.g. California). Because of the remoteness of the Washington coast where sea otters occur, reports and retrievals of sea otter carcasses are rare (Bowlby et al. 1988). In 2003, a cooperative interagency effort was established to increase recovery and necropsy of sea otter carcasses in Washington. Participating agencies include USFWS, WDFW, Olympic Coast National Marine Sanctuary (OCNMS), Olympic National Park (ONP), and the Quinault, Quileute, and Makah tribes.

In California, Thomas and Cole (1996) found 10% of southern sea otters they examined to be emaciated without specific cause of mortality. Severe weather (strong winter storms, for example) and periodic climatic events such as El Niño can disrupt foraging behavior and food availability, and increase pup loss. Under these circumstances, sea otters may find it difficult to meet their high metabolic needs, leading to malnutrition or starvation. Serious tooth wear in older sea otters may also contribute to mortality (Riedman and Estes 1990).

Disease and Parasites

While previous studies reported that disease did not seem to be a significant source of mortality in sea otters (Kenyon 1969, Riedman and Estes 1990), recent studies have found infectious disease to be an important mortality factor in California sea otter populations (USFWS 2003). In the early 1990s, the USGS National Wildlife Health Center (NWHC) in

Madison, Wisconsin examined 195 sea otter carcasses collected in California and found infectious diseases (acanthocephalan peritonitis, protozoal encephalitis, bacterial and fungal infections) caused mortality in 38.5% of those examined (Thomas and Cole 1996). Heavy intestinal parasite loads are apparently a natural phenomenon in sea otters, although few links to mortality have been positively established. Mortality results from peritonitis following migration of parasites through the intestinal wall. Parasites are acquired by consumption of crabs or other invertebrates that serve as intermediate hosts (Miller et al. 2001). Spiny-headed worms (acanthocephalans) of the genus *Profilicollis* (formerly *Polymorphus*) were linked to peritonitis and affected primarily pups and juveniles (Thomas and Cole 1996).

The NWHC reported the first cases of protozoal brain infections (encephalitis) in sea otters from California caused by protozoal parasites *Toxoplasma gondii* and *Sarcocystis neurona* (Cole et al. 2000, Lindsay et al. 2000). Most affected sea otters were subadults or adults. Transmission of *T. gondii* occurs by sea otters directly ingesting oocytes suspended in water or consumption of filter feeding invertebrates that have been contaminated with cat feces via land runoff (Thomas and Cole 1996, Cole et al. 2000). Transmission of *S. neurona* is similar to *T. gondii*, but the host for *S. neurona* is the opossum. California Department of Fish and Game Marine Wildlife Veterinary Care and Research Center examined sea otter carcasses collected in 1998-2001, and found infection with the two protozoal parasites *T. gondii* and *S. neurona*. *T. gondii* and *S. neurona* caused fatal encephalitis in 16.2% of sea otters examined between 1998-2001 (Kreuder et al. 2003). Kreuder et al. (2003) found sea otters with fatal shark bites were 3.7 times more likely to have pre-existing brain infection with *T. gondii* which can cause neurological dysfunction and seizures. Protozoal parasites *T. gondii* and *S. neurona* have been found in Washington sea otters and those cases are detailed in the disease section 9.3.

Coccidioidomycosis, a systemic infection caused by inhalation of the airborne fungus, *Coccidioides immitis*, was reported in eight sea otters recovered in California during the early 1990s (Thomas and Cole 1996). Despite the high proportion of mortalities in the California sea otter population attributed to infectious diseases, other sources of mortality, such as fishery impacts, may in fact have been responsible for or contributed to a population decline which began in the mid-1990's (Estes et al. 2003a, USFWS 2003). Recent investigations into sea otter mortality in California have identified cardiac disease as a new cause of death and responsible for mortality in 13% of carcasses examined between 1998-2001 (Kreuder et al. 2003).

Predation

In general, predation is not thought to be a significant source of mortality for sea otters, but it can be important in some areas. Killer whales (*Orcinus orca*), great white sharks (*Carcharodon carcharias*), bald eagles (*Haliaeetus leucocephalus*), coyotes (*Canis latrans*), and brown bears (*Ursus arctos*) have been documented as predators of sea otters (Riedman and Estes 1990).

Interactions between sea otters and killer whales are variable. These two species have been observed coexisting peacefully in Alaska (Kenyon 1969), Washington (B. Troutman and R. Jameson, pers. comm.) and California (R. Jameson, pers. comm.). In California, Jameson observed increased alertness, but no movement, by a group of sea otters when killer whales swam within a few meters. He saw no apparent reaction by sea otters when killer whales were observed in the general vicinity of a group of sea otters in Washington (R. Jameson, pers. comm.). Bones from a minimum of five sea otters were found in the stomach of an adult male transient killer whale found dead in Prince William Sound, Alaska in April 2003 (L. Quakenbush, pers. comm.).

Predation by killer whales is one factor that is believed to have caused sea otter population declines across the Western Gulf of Alaska and

Aleutian Islands (Doroff et al. 2003, Estes et al. 1998, Hatfield et al. 1998). Significant declines in preferred prey species populations - northern fur seals (*Callorhinus ursinus*), harbor seals (*Phoca vitulina*), and Steller sea lions (*Eumetopias jubatus*) are believed to have caused killer whales to prey switch and consume sea otters (Estes et al. 1998, Hatfield et al. 1998). There has been one report of killer whales pursuing and consuming sea otters off Vancouver Island (L. Kayra, pers. comm. *in* Watson 1993), although sea otters do not appear to constitute a major prey item (Watson 1993). Killer whales have also caused sea otters in Prince William Sound to scatter and remain attentive (Beckel 1980).

Great white sharks are known to attack and inflict lethal wounds upon sea otters in California. At least 8% of 2,013 southern sea otter carcasses inspected between 1968 and 1992 showed evidence of shark wounding (Ames et al. 1997). Shark attacks were the cause of death in 13% of sea otter carcasses inspected from 1998-2001 (Kreuder et al. 2003). Great white sharks may contribute to mortality in Washington, but impacts are not known. In 1975, a great white shark tooth was found embedded in an sea otter carcass recovered at Cape Alava (Keyes 1975 *in* Bowlby et al. 1988).

Bald eagles have taken live sea otter pups in Alaska (Sherrod et al. 1975, Gelatt 1996). Gelatt (1996) estimated that bald eagles were responsible for up to 16% of sea otter pup loss during peak pupping at Amchitka Island. Pups appeared to be vulnerable to eagles when they were less than three weeks of age or weighed less than about 2.7 kg. Remains of adult sea otters found in eagle nests are thought to have been taken as carrion. Bald eagles are found within the Washington sea otter range, but no observations of eagle predation have been documented. Eagles are known to scavenge on sea otter carcasses in Washington (R. Jameson, pers. comm.).

Human-caused sources of mortality

Oil spills are the greatest anthropogenic threat to sea otter populations and can impact them in at least three major ways (Geraci and Williams 1990, Bonnell et al. 1996). First, sea otters become hypothermic when oiled because oiled sea otter fur loses its insulative property and sea otters have no blubber layer. Second, oil can be ingested while grooming, leading to gastrointestinal disorders, other ailments and death. Third, volatile components of oil inhaled by sea otters can cause lung damage.

Estimates of sea otter mortality following the *Exxon Valdez* spill in Prince William Sound ranged from 2,650 (Garrott et al. 1993) to 3,905 (DeGange et al. 1994). Computer simulations suggested that even relatively small oil spills "can cause a major and perhaps irrecoverable impact on the [southern] sea otter population" (Bonnell et al. 1996). Sea otter-impact simulations have not been prepared for potential oil spills in Washington. The use of oil spill trajectory models in assessing risk to sea otter populations has been useful in areas such as California and Alaska where the sea otter range is extensive and oceanographic processes are complex. In Washington, the limited expanse of the sea otter range, coupled with nearshore wind and current patterns, presents a situation where any spill into nearshore waters within 10 miles of the coast places the entire population at risk (B. Troutman, pers. comm.). Nearshore currents have complex tidal, seasonal and wind driven patterns that OCNMS is monitoring with nearshore moorings (E. Bowlby, pers. comm.)

Significant numbers of sea otters drowned in gill and trammel nets in California from the mid-1970's to the early 1980's (Estes 1990, Wendell et al. 1985 *in* Kvitek et al. 1989). Recent population declines in California's sea otters may be incidental to summer commercial fisheries. Estes et al. (2003a) found that sea otter mortality was elevated in the summer months and that commercial fin fish landings in the coastal live trap fishery increased through the late 1990s. Recent analyses indicated annual sea otter carcass recoveries and reported fishery landings were significantly correlated. Small numbers of sea otters (<5) have been taken in Washington's coastal salmon gill net fisheries conducted by Makah fisherman along the northern coast and Strait of Juan de Fuca (Kajimura 1990, Gearin et al. 1996, D. Sones, pers. comm.).

As the Washington sea otter population grows and expands into new areas, shooting, boat collisions and propeller lacerations could possibly become a source of mortality, but these factors are not known to be a concern at this time. The last documented gunshot mortality in Washington occurred in 1969 and was, ironically, one of the sea otters released in the 1969 translocation to Point Grenville (Kenyon 1970). An adult male sea otter in excellent body condition was recovered from just north of Kalaloch in April 2003 with a shattered skull which suggests a boat collision or some other source of blunt trauma. Capture activities associated with research and captures for display can also contribute to sea otter mortality (Riedman and Estes 1990). Sea otters are believed to be vulnerable to becoming trapped in crab pots (Newby 1975) and other fishing devices (Riedman and Estes 1990). While no entrapment has been documented in Washington to date, one sea otter was recovered from a king crab pot in Alaska (Newby 1975).

3.4 Home Range, Dispersal and Seasonal Movements

Sea otters are weakly territorial (Kenyon 1969) with fighting and aggression rare (Loughlin 1980). Only adult male sea otters establish territories. Males patrol territorial boundaries and attempt to exclude other adult males from the area through "pronounced displays of splashing and grooming" and occasional fighting (Riedman and Estes 1990, Calkins and Lent 1975). Females move freely between and among male territories. Groups of male and female sea otters generally rest separately. In populations reoccupying historic ranges, female areas tend to be found throughout the range and male areas at the periphery. However, as the population range becomes larger, males will eventually establish groups within the reestablished range (reviewed in Riedman and Estes 1990). Female areas tend to be in areas protected from weather and strong seas, while male areas tend to be in more exposed locations. During summer and fall, adult males are found within female areas and are often associated with rafts of females. Juvenile males and non-territorial males remain with male groups or wander throughout female areas. Locations of male rafts can shift dramatically between seasons (Jameson 1989).

In general, sea otter annual home ranges can occupy up to 0.8 km^2 (80 ha) and extend along 16 km of coastline (Kenyon 1969, Loughlin 1980). Typically, female sea otter home ranges are about 1.5-2 times larger than resident adult males during the breeding season; however, females have smaller annual or lifetime home ranges than males (Riedman and Estes 1990). Adult territorial males may use two distinct territories—one in a female area and another in a male area—connected by a travel corridor (Ribic 1982, Jameson 1989). Jameson (1989) monitored home range sizes and movements of 19 male sea otters over a six-year period in California. He found that territorial adult males occupied a mean home range of 0.40 km^2 (40.3 ha) during the summer-fall period (when home range size was considered equal to territory size); and mean coastline length was 1.1 km. Winter-spring mean home range size of territorial adult males that remained in female areas was 0.78 km^2 (78.0 ha), with a mean coastline length of 2.16 km (Jameson 1989).

Sea otters are capable of emigrating long distances from core populations. Wandering sea otters can settle permanently if they encounter "ideal" habitat conditions as they travel (Kenyon 1969). In some cases, small colonies can form as wanderers congregate at suitable sites. In most areas, "sea otters tend to maintain an established home range until effects of a dense population force movement" (Kenyon 1969). Males, particularly juvenile males, tend to disperse more readily than females (Riedman and Estes 1990). Males typically are the first to discover new regions with adequate food resources and groups of male sea otters travel many miles when exploring and will reside in new areas for extended periods if they find sufficient prey. After males establish a presence in a suitable area, females may arrive and become resident. When population density reaches a threshold in occupied areas, male sea otters again begin to disperse.

In Washington, radio telemetry data collected from sea otters (n = 75 individuals, 52 females, 23 males) between 1994 and 1999 indicated all tagged animals dispersed widely from their original tagging site and traveled throughout the study area defined as south of Destruction Island to the mouth of the Sekiu River (R. Jameson unpublished data *in* Laidre 2004). Seventy of these radio tagged sea otters were monitored between spring and fall for greater than six months. Thirty of the radio tagged animals (n = 17 females and 13 males) moved northward and around Cape Flattery and into the Strait of Juan de Fuca. This represents approximately 33% of all tagged females and 56% of all tagged males. Linear home range estimates were calculated between the extreme northern and southern-most telemetry locations for each sea otter (coastline distance in km along the smoothed 10 m bathymetric contour). On average, home ranges were 37 km (standard deviation [SD] 20, ranging from 5 - 84 km). Male sea otters covered larger linear coastline distances (43 km, SD 24) than females (35 km, SD 17); however, differences were not significant (R. Jameson unpublished data *in* Laidre 2004). On average, individual sea otters in Washington utilized approximately one-third of the total study area (south of Destruction Island to the mouth of the Sekiu River). Within the linear home ranges, sea otters traveled extensively (average of 91 km per year, SD 58, range 8 to 228 km) and moved long distances (on the order of 50 km) within less than two weeks (e.g. from Neah Bay or Shipwreck Point to Cape Alava and Sand Point). Adult male sea otters traveled on average 85 km per year (SD 59). Adult females traveled the farthest, on average, 104 km (SD 60, range 15-228 km). Within their home range, sub-adult animals traveled slightly less than adults, 64 km (SD 34) and 62 km (SD 55) for sub-adult females and sub-adult males, respectively (R. Jameson unpublished data *in* Laidre 2004).

Sea otters sometimes shift distribution seasonally to areas where there is food and to protected or sheltered waters to avoid exposure to storm events, prevailing winds, waves and currents (Kenyon 1969, Riedman and Estes 1990, Watson 1993). Sea otters in Washington have demonstrated these seasonal shifts. In the late 1990s, both male and female sea otters moved east into the Strait of Juan de Fuca during the winter and spring between November and April (Jameson and Jeffries 2002). Males moved almost 40 km into the Strait of Juan de Fuca, in contrast to females who moved about 11 km into the Strait of Juan de Fuca (R. Jameson unpublished data *in* Laidre 2004).

It is unknown if sea otters have immigrated from elsewhere to join the reintroduced Washington population. Interchange could occur if the population off of Vancouver Island continues to grow and expand southward, or if Washington's population continues to grow and expand northward. The deep, open water of the Strait of Juan de Fuca might function as a barrier to movement, although sea otters have overcome deep-water barriers to colonize various islands in the Aleutians (Kenyon 1969), so interchange between Washington and British Columbia is feasible.

3.5 Behavioral Characteristics

Sea otters spend most of their time either foraging, resting or grooming. Several studies show sea otter feeding activity increases during dawn and dusk. Nocturnal foraging can be significant, but individual variation is considerable and location is an important factor (reviewed in Riedman and Estes 1990). Sea otters must consume food equivalent to 20 to 25% of their own body weight each day to meet their metabolic needs (Kenyon 1969, Costa and Kooyman 1984 *in* Doroff and Bodkin 1994). Generally, they spend one-quarter to one-third of their time foraging and feeding (Riedman and Estes 1990). Specific foraging behaviors depend on time of day, time of year, environmental conditions, local prey species and prey preferences of individual sea otters (Estes et al. 1982, 1986, 2003b, Garshelis et al. 1986, Bowlby et al. 1987).

Sea otters tend to rest during the middle of the day (Riedman and Estes 1990). Sea otters are meticulous in cleaning their fur and ordinarily spend up to 20% of their daily activity budgets grooming (Riedman and Estes 1990). Soiled pelage does not entrap air efficiently, which reduces a sea otter's ability to keep warm and increases chances of hypothermia.

Sea otter activity-time budgets have long been proposed to indicate population status with respect to density dependence: populations thought to be close to equilibrium density spend more time foraging for resources due to limitations on prey availability. In contrast, populations at low densities spend less time foraging due to reduced pressure on prey availability (Estes et al. 1982, 1986, Garshelis et al. 1986, Bowlby et al. 1987, Gelatt et al. 2002). In Washington, focal observations to determine activity-time budgets of sea otters illustrated that sea otters spent relatively little time foraging (9.5-11.2%) and more time resting (62.6-66.1%) during daylight hours (Bowlby et al. 1988). More recent analyses in Washington examined diving and surfacing behavior for sea otters based on focal observations of foraging animals during daytime between 1994 and 1999 (n=13,847 dives) (R. Jameson unpublished data *in* Laidre 2004). Average dive time across all feeding bouts in Washington was 55 seconds (SD 25), ranging from 3 seconds to 300 seconds. Average surface time across feeding bouts was 45 seconds (SD 45), ranging from 1 second to 32 minutes. Although adults and sub-adult sea otters spent about the same time underwater searching for prey (mean dive time 55 seconds), capture success was significantly higher and post-dive surfacing time was significantly longer for adult animals (R. Jameson unpublished data *in* Laidre 2004).

3.6 Diet

Sea otters dive to the bottom, collect prey, and then carry it to the surface for handling and consumption. Sea otters capture their prey with their forelimbs, often storing prey in the loose flaps of skin under the forelimb. They may also carry a rock, or another hard object, on which to break shells (summarized in Riedman and Estes 1990). Sea otters typically remain under water for 60 to 90 seconds while finding and procuring a prey item. They are tactile foragers, able to feel or dig for prey where the water is turbid or the substrate is soft. Sea otters typically dive less than 30 m for food (Kenyon 1969, Riedman and Estes 1990); however, one sea otter in Alaska was recovered from a king crab pot in 100 m of water (Newby 1975).

While sea otters are a highly generalized consumer, most individuals specialize on 1-4 prey types and prey types differ widely among individuals (Estes et al. 2003b). Observations in Washington in 1986 and 1987 from four shore sites (Cape Alava, Sand Point, Cape Johnson, Duk Point) indicated sea otters preyed exclusively on invertebrates including clams, chitons, sea cucumbers, octopus, crabs and sea urchins (Bowlby et al. 1988). Diet of Washington sea otters based on studies conducted between 1994 and 1999 were collected by observing focal animals and observations continued until the focal animal was no longer visible (R. Jameson unpublished data *in* Laidre 2004, Table 4). Sea otters in Washington preyed upon at least 19 positively identified species.

Table 4. Prey items captured by sea otters on successful foraging dives along the Washington coast and in the Strait of Juan de Fuca, reported as frequency of occurrence. Data were summarized from 7,888 successful dives between 1993 and 1999 (R. Jameson unpublished data *in* Laidre 2004).

General Category	Common name	Latin name	Percentage of diet
Crustaceans	Dungeness crab	*Cancer magister*	0.3
	Rock crab	*Cancer antennarius*	1.1
	Shield-backed kelp crab	*Pugettia producta*	2.2
	Unidentified *Cancer* spp.		1.6
	Unidentified crustacean		7.9
Bivalves	Butter clam	*Saxidomus gigantea*	3.8
	Gaper clam	*Tresus nuttallii*	0.9
	Littleneck clam	*Protothaca staminea*	17.0
	Razor clam	*Siliqua patula*	<0.01
	Bent-nose clam	*Macoma nasuta*	0.1
	Rock scallop	*Hinnites giganteus*	0.1
	California mussel	*Mytilus californianus*	1.2
	Unidentified mussel		9.0
	Unidentified clam		18.0
	Unidentified barnacle		0.1
Snails	Turban snail	*Tegula* spp.	5.7
Echinoderms	Red urchin	*Strongylocentrotus franciscanus*	22.5
	Purple urchin	*Strongylocentrotus purpuratus*	3.8
	Ochre sea star	*Pisaster ochraceus*	0.6
	Sunflower star	*Pycnopodia helianthoides*	<0.1
	Red sea cucumber	*Cucumaria miniata*	<0.1
	Unidentified urchin		0.5
	Unidentified sea star		0.3
	Unidentified sea cucumber		0.3
Other	Unidentified *Octopus* spp.		0.1
	Giant Pacific chiton	*Cryptochiton stelleri*	1.6
	Unidentified chiton		<0.1
	Peanut Worm	*Phascolosoma agassizii*	0.1
	Unidentified worm		0.9
	Egg masses (from lingcod)	*Ophiodon elongatus*	0.2

Sea otter food habits in newly reoccupied areas are typically dramatically different from areas where they have long been established. In general, when sea otters reoccupy an area, they tend to exhaust one type of food before switching to another (Calkins 1972, Antonelis et al. 1981); whereas, in areas where sea otters have been established for some time, they tend to have a more diverse diet. For example, fish constitute an important part of the diet of sea otters in Alaska where populations have been established for long periods (Kenyon 1969, Riedman and Estes 1990). However, in recently occupied areas, sea otters feed primarily on sea urchins, various crustaceans and molluscs and rarely consume fish (Estes et al. 1982, Riedman and Estes 1990). There are ongoing studies of sea otter food preferences and foraging strategies in California that may provide more information in the future (G. Sanders, pers. comm.).

Striking differences were detected in the diet of Washington sea otters occupying the established range between Destruction Island and Makah Bay (inhabited for > 25 years) and recently occupied habitat north of Makah Bay and into the Strait of Juan de Fuca (inhabited for <4 years at the time of the study). In the established range, sea urchin predation (red or purple) was nearly absent, comprising no more than 1% of the sea otter diet. Sea otters instead had a diverse diet and fed heavily on bivalves (63%) (including several species of clams, scallops and mussels). This follows well with the general paradigm of diversification and stabilization of diet (including less profitable prey species) of sea otters in established areas. In contrast, in the newly occupied habitat, 60% of the sea otter's diet was comprised solely of red urchins (*S. franciscanus*) (R. Jameson unpublished data *in* Laidre 2004, Fig. 3). In general, larger size prey items were found in the diet of sea otters in this new habitat. These results support the general paradigm that as Washington sea otters have expanded their range, they have targeted preferred prey species such as large sea urchins. Evidence suggests that sea otters initially took only red urchins in new habitat and gradually diversified their diet to include bivalves in the late 1990s, likely because urchin density and large size classes were depleted (R. Jameson unpublished data *in* Laidre 2004). Distribution and abundance of urchins and other invertebrates may play an important role in prey selection by sea otters in both of these areas. Benthic surveys have shown similar patterns in prey availability (Kvitek et al. 1989, 1998, Kenner et al. 2001).

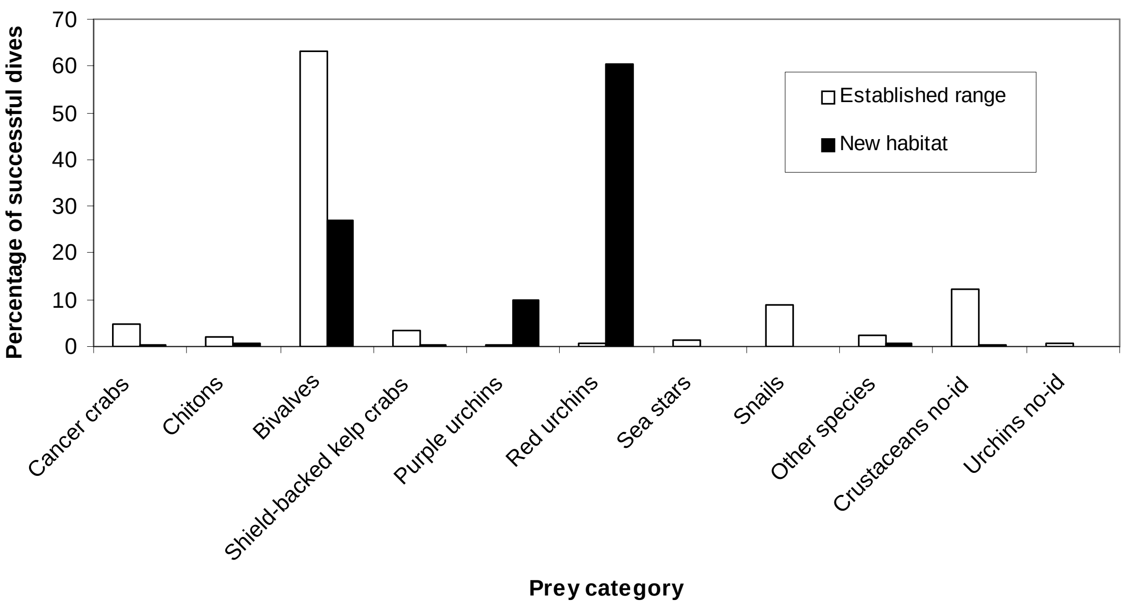

Figure 3. Distribution of prey species or prey groups taken by sea otters on successful foraging dives between 1993 and 1999 in each of two areas in Washington: established range between Makah Bay and Destruction Island (n=4,974 dives) and newly occupied habitat north of Makah Bay and into the Strait of Juan de Fuca (n=2,873 dives). Data are summarized based on frequency of occurrence (R. Jameson unpublished data *in* Laidre 2004).

4. HABITAT REQUIREMENTS

Sea otters live seaward of the high tide line almost exclusively. Sea otters occasionally haul out at low tide on offshore rocks and islands and less often on mainland beaches. This habitat-use pattern places sea otters primarily in areas defined as tidelands and bedlands. Tidelands include shores of tidal waters between mean high water and extreme low water, while bedlands are below the extreme low tide mark (Washington Administrative Code 332-30-106).

In general, they remain in nearshore waters of Washington (seldom more than 1-2 km from shore) up to 20 fathoms deep. Habitat use by sea otters along the Washington coast has recently been described using radio telemetry and resight data collected from 68 individuals (Laidre et al. 2002). Adult males foraged deeper than juvenile males (16 and 14 m, respectively), but the mean distance from shore for foraging was greater for juveniles than adults (1,382 and 1,163 m, respectively). In contrast, juvenile females foraged deeper than adult females (12 and 10 m, respectively) and also foraged at mean distance from shore greater than adults (945 and 717 m, respectively) (Laidre et al. 2002).

Throughout their range, sea otters use a variety of shallow coastal habitats. Their classic association is with rocky substrates supporting kelp beds, but they also frequent (at lower densities) soft-sediment areas where kelp is absent (Riedman and Estes 1990, DeMaster et al. 1996). Kelp canopy is an important habitat component, used for foraging and resting (Riedman and Estes 1990). In 1994-1996, sea otter numbers in California were greatest in rocky habitat types, followed by sandy and mixed habitats (Laidre et al. 2001). They may favor topographically complex substrates in preference to relatively featureless bottoms (Riedman and Estes 1990) and in some areas, they may rest in open water areas lacking the canopy-forming kelps. Sea otters in Washington historically occurred in estuarine and sandy habitats from the Columbia River to Pt. Grenville, along the rocky outer Olympic Peninsula coast, and into the Strait of Juan de Fuca (Scheffer 1940). Based on surface features and shoreline topography, Laidre et al. (2002) classified historic sea otter habitat in these areas as: 1) sandy, with exposed beaches lacking kelp and rocky substrate (Columbia River to Pt. Grenville); 2) rocky, with moderate kelp beds, reefs and rocky substrate (Destruction Island to Pillar Point); and 3) mixed, with sandy or rocky substrates and some kelp (Pillar Point to Dungeness Spit) (Fig. 4). There are also ongoing efforts to map nearshore seafloor habitat types by side-scan sonar and LIDAR (Light Detection and Ranging) surveys (E. Bowlby, pers. comm.). At present, the Washington sea otter population occupies primarily rocky habitats along the Olympic Peninsula coast from Destruction Island northward to Pillar Point in the Strait of Juan de Fuca (Figs. 2 and 4).

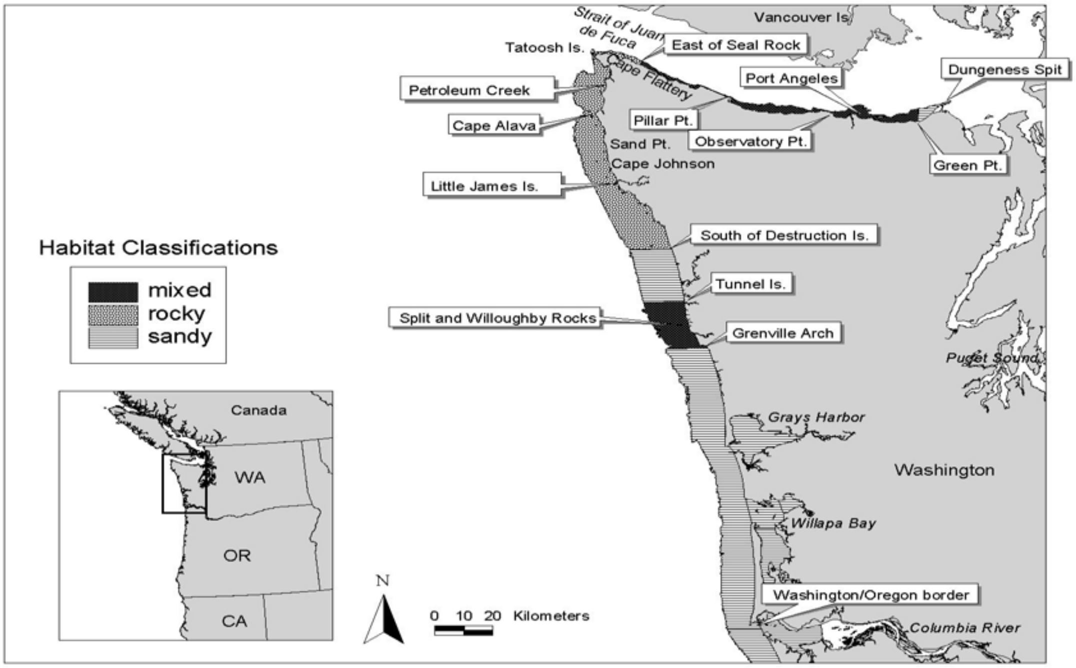

Figure 4. Map of habitat classifications (shown to the 40-m depth contour along the Washington coast from Dungeness Spit to the Columbia River and locality name mentioned in the text. Habitats are classified as rocky, sandy or mixed based on aerial surveys conducted in March 2000. (Laidre et al. 2002)

5. POPULATION STATUS

5.1 North Pacific

The size of the original North Pacific sea otter population is unknown but may have comprised 100,000 to 300,000 animals (Kenyon 1969, Johnson 1982, Marine Mammal Commission 1997). Intense, unregulated harvest of sea otters began in 1741, with discovery of sea otter populations in Alaska, the Aleutian Islands and Commander Islands by the Bering Expedition (Riedman and Estes 1990) and was continued for about 50 years by Russian, British, Spanish and American maritime fur hunters and traders before conservation measures were enacted (Estes 1980). In the late 1700's , a dozen or so fur trading vessels from New England harvested sea otters along the coast from southeast Alaska to Baja, Mexico. From 1799 to 1802, nearly 16,000 sea otter furs were sold at Canton, China. Additional sea otters were harvested by other maritime fur traders. A second period of overexploitation began in the mid-1800's and further reduced the species throughout its range. Between 1804 and 1834, an average of nearly 6,000 sea otter furs were sold annually at Canton by American vessels (Gibson 1992). As a result, the sea otter population approached extinction. By the time the sea otter received protection in 1911 under the International Fur Seal Treaty, as few as 1,000 to 2,000 animals survived, scattered in 13 small remnant groups in Russia, the Aleutian Islands, Alaska, British Columbia, California, and Mexico (Kenyon 1969, Riedman and Estes 1990). Small populations in Mexico and British Columbia declined to extinction (Kenyon 1969). After several decades of protection from commercial harvest and reintroduction to previously occupied areas, the world sea otter population was estimated to be at least 126,000 in 2000 (Gorbics et al. 2000). A dramatic decline in sea otter populations in the Aleutian archipelago (Doroff et al. 2003) has likely reduced this estimate.

Alaska

Alaska's sea otter population is composed of three stocks: Southwest, Southcentral and Southeast. The Southwest stock (Alaska Peninsula and Bristol Bay coasts, the Aleutian, Barren, Kodiak, and Pribilof Islands) of sea otters grew steadily following protection. Surveys began in the late 1950s and indicated that the Aleutian archipelago had the largest concentration of sea otters in the world (Kenyon 1969). The USFWS (2000a) minimum estimate for the entire Southwest Alaska stock is 33,203, with an adjusted estimate of 41,474. The adjusted estimate applies a correction factor for aerial surveys (Evans et al. 1997 *in* USFWS 2002a). Although several areas do not appear to be affected, large portions of this stock appear to have experienced severe population declines and the USFWS proposed listing this sea otter stock as "threatened" under the Endangered Species Act in February 2004 (USFWS 2004).

The Aleutian Island population appears to have peaked in the 1980s with the population estimated between 55,100 to 73,700 animals (Calkins and Schneider 1985). Subsequent aerial surveys in 1992 and 2000 have documented drastic population declines; the number of sea otters counted during surveys decreased by 70% to a minimum population estimate of 8,742 in 2000 (USFWS 2002a, Doroff et al. 2003). Significant declines are reported along the Alaska Peninsula and Kodiak archipelago as well. A potential cause of the decline has been attributed to increased mortality due to predation by killer whales, whose previous prey species populations (northern fur seals, harbor seals and Steller sea lions) have undergone significant declines (USFWS 2004, Doroff et al. 2003, Estes et al. 1998, Hatfield et al. 1998).

The Southcentral stock of sea otters (Cape Yakataga to Cook Inlet including Prince William Sound, Kenai Peninsula, and Kachemak Bay) has reestablished most of its former range. The *Exxon Valdez* oil spill in 1989 significantly impacted the Southcentral sea otter population; mortality estimates range from 750 (Garshelis 1997) to 3,905 (DeGange et al. 1994) animals in Prince William Sound. The stock appears to be stable, with a minimum population estimate of 13,955 and an adjusted estimate of 16,522, although sea otters in this stock remain at risk due to high tanker traffic and oil and gas developments (USFWS 2002b).

The population trend of the Southeastern Alaska stock (Dixon entrance to Cape Yakataga including southeast Alaska, Yakuktat Bay and North Gulf of Alaska) of sea otters has generally been one of growth (reviewed in USFWS 2002c). Sea otters in the Yakuktat Bay and southeast Alaska survey areas are the result of a translocation of 412 animals from Prince William Sound and Amchitka Island, which took place in the late 1960s (Jameson et al. 1982). The USFWS (2002c) minimum population estimate for the Southeastern stock was 9,266 and the adjusted estimate was 12,632 sea otters.

British Columbia

There are no estimates of sea otter abundance in British Columbia prior to extirpation. Between 1969 and 1972, 89 sea otters were successfully reintroduced to the west coast of Vancouver Island from Amchitka Island and Prince William Sound in Alaska in a series of three introductions (Bigg and MacAskie 1978). Between 1977 and 1996, the population along the west coast of Vancouver Island increased at a rate of 18.6% per year (Watson et al. 1997). An additional population of sea otters was first reported on the central British Columbia coast in 1989 and by 1995 it numbered at least 135 animals (Watson et al. 1997). The origins of this group of otters are uncertain (Watson et al. 1997). Sea otters in British Columbia are listed as Threatened under the Canadian Species At Risk Act.

Both groups of sea otters in British Columbia are expanding their ranges. The most recent (1998) population estimate was 2,000 animals on the west coast of Vancouver Island (from Cape Scott, at the northern tip of Vancouver Island, to Estevan Point, halfway up the west coast of the island) and 500 animals off the central coast of British Columbia (Watson 2000). In March 2000, a group of 131 sea otters were observed just south of Estevan Point, which is approximately 100 miles (160 km) northwest of Cape Flattery (S. Jeffries, pers. comm.). This was the first time a large group of sea otters had been reported south of Estevan Point. In April 2001 and 2002, a similarly large group of sea otters was observed on the southeast side of Flores Island, even closer to the Washington sea otter population (Nichols et al. 2003).

California

The southern sea otter population in California was hunted from a historical population estimated at about 16,000 animals to near extinction in the early 18th and 19th centuries (USFWS 2003). In 1976, the population numbered an estimated 1,789 sea otters and in 1977, the southern sea otter population was listed as threatened under the Endangered Species Act due to small population size, limited distribution, and potential impacts of a major oil spill on the population (USFWS 1977, 2003).

The USFWS released the final revised recovery plan for the southern sea otter and stated that the population is relatively stable (USFWS 2003). The USFWS Southern Sea Otter Recovery Plan recommends using a 3-year running average of the number of southern sea otters counted during spring surveys. Recent surveys have recorded higher sea otter counts with a 3-year running average for 2003 (averages of 2002, 2003, and 2004 counts) of 2,500 sea otters (Hatfield 2004). There is a concern for the welfare of the population with higher mortality rates occurring in prime age animals and loss of reproductive capability which threatens recovery efforts (G. Sanders, pers. comm.). A significant number of sea otters in California have stranded with infectious diseases (*S. neurona*, *T. gondii*, acanthocephalan peritonitis, protozoal encephalitis, bacterial and fungal infections). In addition, entanglement in fishing gear, shark attacks, shooting, cardiac disease, and starvation are mortality factors (Thomas and Cole 1996, Estes et al. 2003a, Kreuder et al. 2003, USFWS 2003).

5.2 Washington

Historic population

Little information exists on population size of sea otters in Washington before it was extirpated. Scammon (1870) described the area between the mouth of Grays Harbor and Point Grenville as “the most noted grounds” for sea otter harvest between San Francisco and the Strait of Juan de Fuca (Fig. 2) . The only written record of the sea otter’s former abundance is based on Scheffer’s (1940) interviews with long-time coastal residents. His sources spoke of sea otter “herds” that regularly numbered in the tens or hundreds. By the early 20th century, the population had become so small that few people targeted sea otters for harvest. Buck Adamire (pers. comm.), a long time trapper on the Olympic Peninsula noted that:

> “Charlie McIntyre was the last known Caucasian sea otter hunter who died around 1941-2 in Aberdeen. I believe McIntyre’s last hunt was in 1906, producing only 4 otters worth $300.00 each. Apparently McIntyre and some Quinault Indians were the best hunters producing the most pelts. “

The last sea otters shot in the state were taken from Willapa Bay about 1911 (Scheffer 1940). The species was probably extirpated from Washington shortly thereafter.

Reintroductions to Washington

Fifty-nine sea otters were translocated to the Washington coast from Amchitka Island, Alaska, in the summers of 1969 (29 sea otters) and 1970 (30 sea otters) (Fig. 2). The 59 released sea otters included 41 females and 18 males (Bowlby et al. 1988). In 1969, sea otters were released directly to the open ocean near Point Grenville. A total of 14 of those sea otters died immediately following the release, presumably due to hypothermia from fur soiling and stress of travel; another two were killed by gunshot and found sometime later (Kenyon 1970).

In 1970, the release site was changed to La Push which borders Olympic National Park, near the middle of the best sea otter habitat in Washington (Jameson 1998b). Sea otters were held in floating pens for several days prior to release at Cake Island, north of La Push (Fig. 2). Holding the sea otters enhanced survival and no immediate mortality was documented. Sea otter sightings were sporadic for several years after the translocations and no observer reported counts of more than ten sea otters through 1976 (Jameson et al. 1982, Bowlby et al. 1988). Sea otters were first observed at Cape Johnson in 1970, Destruction Island in 1971, and around Cape Alava in 1975 (Bowlby et al. 1988). Washington's present-day population descended from no more than 43 sea otters, and maybe as few as ten (Jameson et al. 1982). Reproduction was first documented in 1974 when seven independent sea otters and two pups were observed near Destruction Island (Jameson et al. 1982). Pups have been seen in all subsequent surveys.

Current population status

The first aerial survey recording sea otters since their reintroduction took place on 3 May 1974 from Grays Harbor to Cape Flattery and one sea otter was observed just offshore north of Cape Johnson (Johnson 1974). Johnson (1974) reports two sea otters near James Island during an aerial survey later in May 1974 and land based sightings of up to nine sea otters including one pup near Destruction Island in late June 1974. Another aerial survey in early July, 1974, confirmed the one sea otter at Cape Johnson and eight sea otters at Destruction Island (Johnson 1974). Systematic surveys of Washington's reintroduced sea otter population took place beginning in 1977 between 18 June and 4 July (Jameson and Kenyon 1977). During this survey, USFWS biologists covered 65 km of coastline by boat, from Destruction Island north to Bodelteh Islands and observed nineteen sea otters, including four pups (Jameson et al. 1982).

Beginning in 1981 and continuing every other year through 1987, USFWS surveyed the entire coastline from Destruction Island to Neah Bay using a combination of boat and ground counts in an attempt to survey all potential sea otter habitat on the Washington coast and determine sea otter distribution and abundance (Fig. 2, Jameson et al. 1982). Between 1977 and 1985, WDFW recorded sea otter sightings during 34 complete and partial coastal harbor seal assessment flights (S. Jeffries, unpublished data, summarized in Bowlby et al. 1988). In 1987, a sightability correction factor was applied for animals missed in the surveys and the population was estimated to have grown to 136 sea otters (Bowlby et al. 1988).

Beginning in 1989, the Biological Resources Division (BRD) of the United States Geological Survey (USGS, formerly USFWS Research Division) and WDFW biologists have conducted annual aerial and ground sea otter surveys along the Washington coast during the beginning of July (Fig. 5, Appendix A). Two aerial surveys are conducted each day and surveys are flown for three days, with sea otters counted and photographed from the air. Simultaneous counts are made from ground areas. The survey total is calculated by summing the highest daily total for the southern (Pt. Grenville to La Push/James Island) and northern (La Push/James Island to Pillar Point) segments of the range and assumes little or no movement between the two segments during the survey period. Sea otter counts made from the aerial survey component are used when ground counts are not available or when aerial counts are higher than ground counts (Jameson and Jeffries 2000). Pup counts are based on counts made from ground areas because pups are difficult to distinguish from an airplane and often go undetected (Jameson and Jeffries 2002).

From 1977 to 1989, Washington's sea otter population grew at near the maximum rate of increase for sea otter populations of 17-20% per year (Jameson 1998a, Estes 1990). From 1989 to 1996, the population increased from 208 to 430 animals at an estimated rate of increase of 11.4% (Fig. 5; Jameson 1994b, 1995b, 1996b, 1997b). In 1998, there was a drop in the count to 433 sea otters, including 389 independents and 44 pups (Jameson and Jeffries 1998). The 1999 count was 604 sea sea otters, including 554 independents and 50 pups (Jameson and Jeffries 1999). In 2000, the sea otter count dropped to 504 independents and no pups were observed during the survey (Fig. 5, Table 5). Causes of this decline are unknown, but may include shifts in distribution away from ground sites where pups are normally counted or high levels of pup mortality (Jameson and Jeffries 2000). Number of pups rose during the 2001 survey, but recent numbers have remained lower than counts in the late 1990s (Jameson and Jeffries 2001, 2002, 2003, 2004, Table 5). Sea otter surveys in 2004 counted 743 individuals with the vast majority associated with rocky habitat.

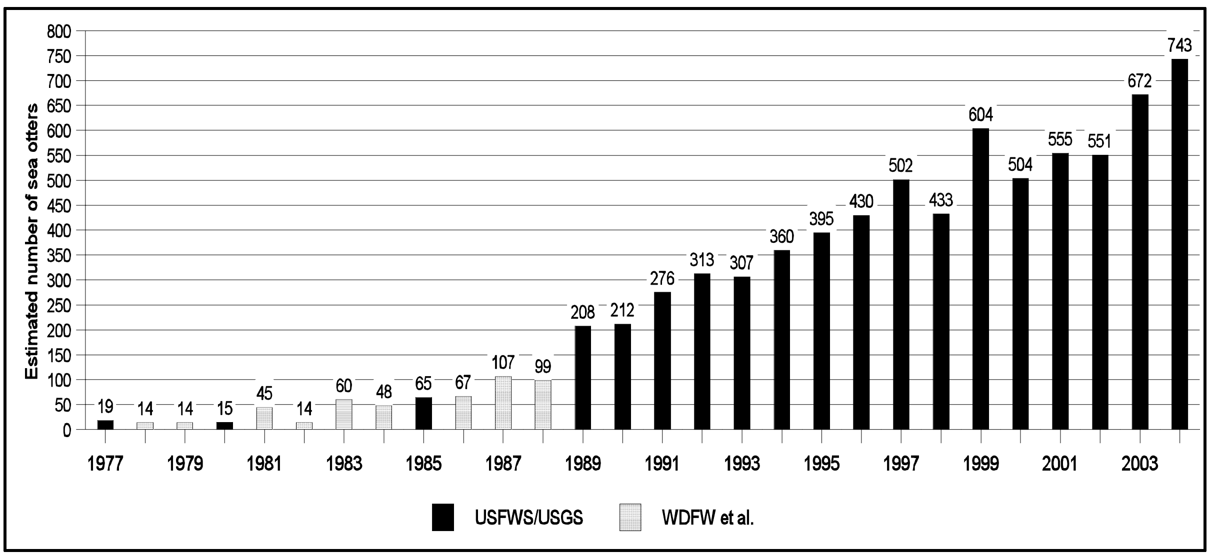

Figure 5. High counts of Washington sea otters, 1977-2004, from surveys and observations by USFWS/USGS (Jameson et al. 1986; R. Jameson, USGS Biological Resources Division, unpublished data), WDFW and others (summarized in Bowlby et al. 1988, and S. Jeffries, WDFW, unpublished data). Both independent sea otters and pups are included.

Table 5. Sea otter survey counts of independents, pups and total number of animals during aerial and ground surveys of the Washington coast (Pillar Point to Destruction Island) during July 1999-2004 (Jameson and Jeffries 1999, 2000, 2002, 2003, 2004).

Age Class	1997	1998	1999	2000	2001	2002	2003	2004
Independents	440	389	554	504	510	518	654	720
Pups [a]	62	44	50	0	45	33	18	23
Total	502	433	604	504	555	551	672	743

[a] Based on pup counts from ground monitoring sites

Trends in Abundance

Since 1989, the annual growth rate for the Washington population is 8.2% (Jameson and Jeffries 2004, Fig. 6). Using a 3-year running average of sea otter counts in Washington indicates a positive trend. A 3-year running average has been used by USFWS in the southern sea otter recovery plan (USFWS 2003) and is intended to reduce year-to-year variation and highlight overall trends. Sea otters may be approaching equilibrium densities in currently occupied rocky habitats along the Olympic Peninsula. Once all of the rocky habitat is occupied, it is unclear if Washington's sea otter population will continue to grow and expand its range south into sandy habitat found along the southern Washington coast, east into sandy and mixed habitat in the Strait of Juan de Fuca, or north to the coast of British Columbia.

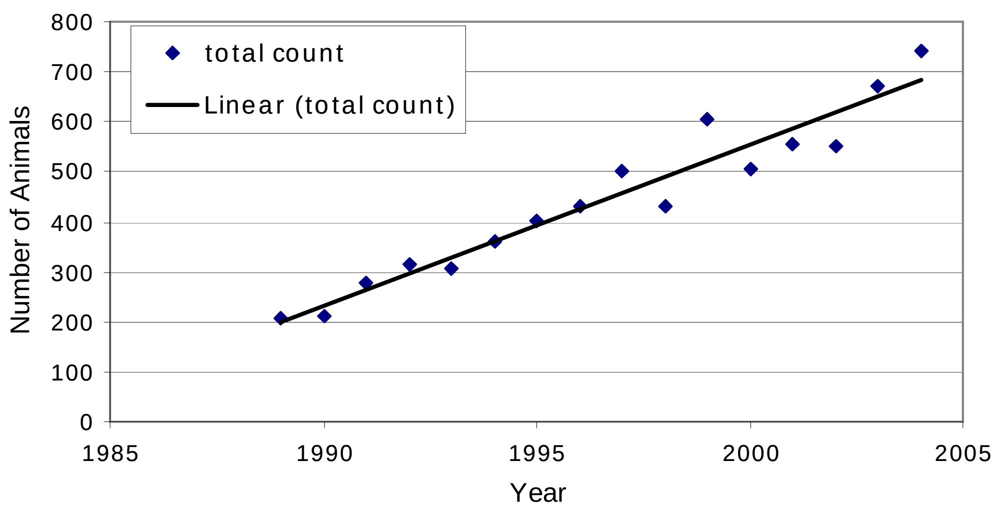

Figure 6. Growth of the Washington sea otter population showing total count (diamonds) and linear trendline, 1989-2004 (Jameson and Jeffries 2004). y = 32.303x - 64051 and r^2 = 0.9329.

Changes in Distribution Patterns

In 1977, Washington's sea otters were distributed along 60 km of the coast from Destruction Island to Cape Alava (Fig. 7, Appendix A; Jameson 1998b). In the fall of 1985, a single male sea otter was recorded at Neah Bay on six occasions (Calambokidis et al. 1987). By 1987, sea otters were distributed along 70 km of the coast from Destruction Island to Point of the Arches, primarily between Duk Point and Cape Johnson, with a small, disjunct aggregation at Destruction Island and small numbers in the Strait of Juan de Fuca near Neah Bay (Fig. 7, Bowlby et al. 1988). In 1991, a large group of sea otters moved north and established itself in Makah Bay, expanding the range to about 80 km (Jameson 1998b).

In the winter of 1995, a group of more than 100 male sea otters entered the western Strait of Juan de Fuca near Neah Bay (Jameson 1995b) and returned consistently the following four years (Jameson and Jeffries 2000). At the same time, a small group of females rounded Cape Flattery and established near Slant Rock, located approximately 8-10 km into the Strait of Juan de Fuca, an area that previously was inhabited almost entirely by male sea otters (Jameson 1998b). By 1995, the sea otter distribution ranged from Destruction Island to Neah Bay, a distance of about 110 km (Fig. 7). Since 1997, a small number of females with pups have been observed in the Strait of Juan de Fuca from Tatoosh Island to near the entrance to Neah Bay (R. Jameson pers. comm.).

Raft of male sea otters near Cape Johnson, 9 July 2002. Photograph by Steve Jeffries.

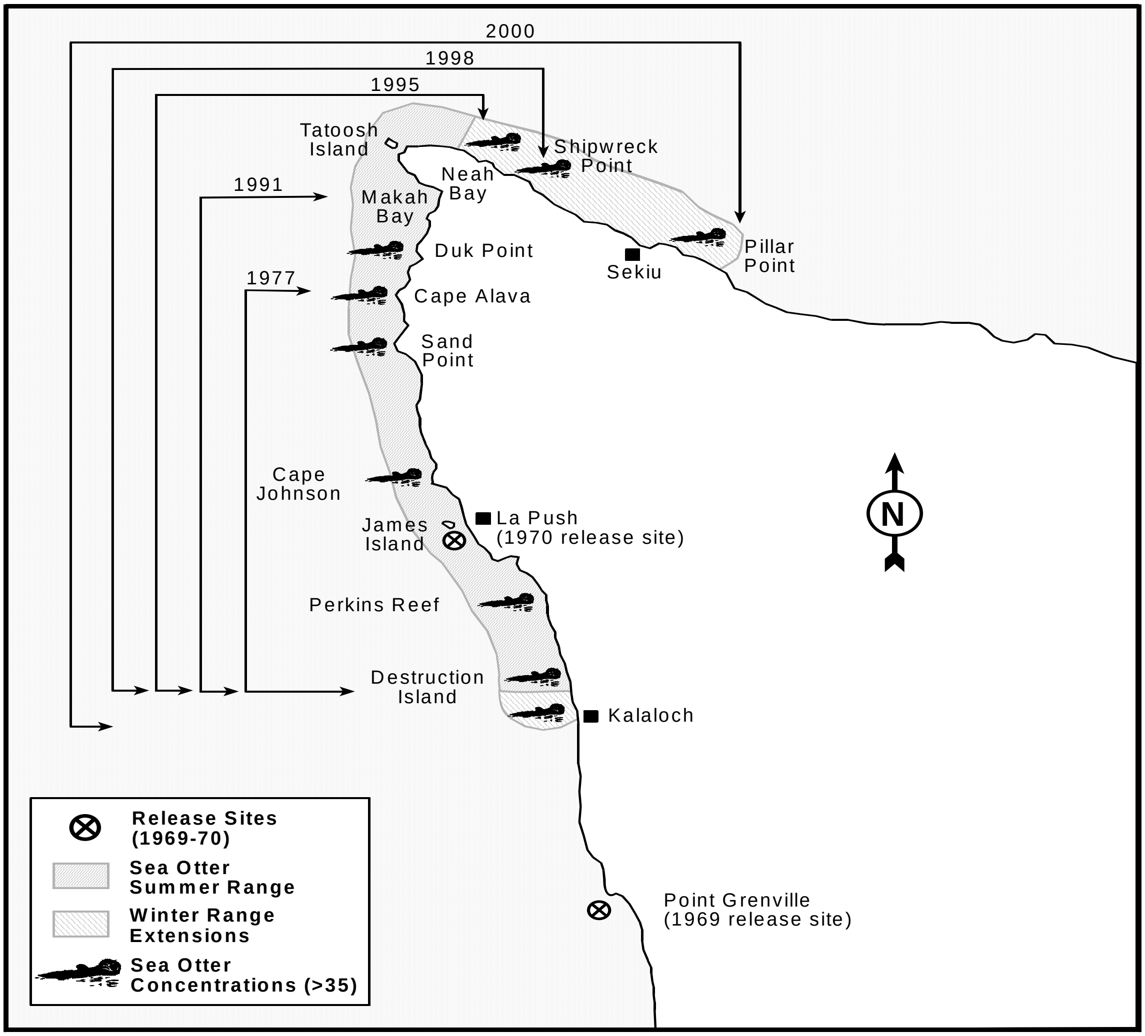

Figure 7. Changes in distribution of the Washington sea otter population from 1977-2000 and concentrations (>35) of sea otters along the coast. Since 2000, the distribution of sea otters has remained the same (Jameson 1998b; R. Jameson and S. Jeffries, pers. comm.).

In the winters of 1998 and 1999, the group of male sea otters moved 15 km further east of Neah Bay to Shipwreck Point (Fig. 7, R. Jameson, unpublished data). Winter range extensions in the Strait of Juan de Fuca were observed in 2000 with 56 sea otters seen between Slip Point and Pillar Point (S. Jeffries, pers. comm.). A slight southern range extension also occurred in 2000, with 43 sea otters seen near Kalaloch, about 10 km south of Destruction Island (Fig. 7, R. Jameson, pers. comm.). In recent years, only small numbers of sea otters have been recorded in the Strait of Juan de Fuca during the winter months. No range expansion south of Destruction Island has been noted with the exception of a few sea otters that were found stranded south of the current range (S. Jeffries, pers. comm.).

Shifts in distribution of the sea otter population occurred during 1997-2004 among the three segments of the Washington range: North (Neah Bay - Cape Alava); Central (Cape Alava - James Island); and South (James Island - Destruction Island) (Table 6, Fig. 8). In 1997 and 1998, 64-66% of the population occurred in the central portion of the range, from Cape Alava to James Island. Beginning in 1999, animals shifted to the southern segment with an almost even distribution between the central and southern segments of the range. There has been a substantial increase in the number of animals in the southern portion of the range in recent years, whereas the proportion of the population in the northern portion of the range has decreased. During 1997-2004, densities ranged from 1.0-16.1 sea otters per km of coastline with highest densities of sea otters found in any segment occurring during the most recent survey in the southern segment in 2004. The largest concentrations of sea otters in the southern segment were observed at Destruction Island (Appendix A).

In 2001-2004, sea otters with pups were seen at Diamond Rocks off the mouth of the Hoh River and approximately 4 km south of Perkins Reef. The Diamond Rock and Destruction Island areas are the southernmost groups of breeding females that have been observed in Washington (Jameson and Jeffries 2004). The largest concentration of sea otters in Washington continues to be located at Destruction Island, with 342 sea otters (46% of the population) observed in several groups around the island in 2004. A large group of males raft in the reef and kelp beds on the northeast side of the island, and an additional group of nearly 70 animals, mainly reproducing females, uses the reef and kelp beds on the west side of the island (Jameson and Jeffries 2004).

Table 6. Total number, percentage, and density (D) of sea otters (number of sea otters per km of coastline) for the north, central and south segments of the Washington coast surveyed 1997-2004 (Jameson and Jeffries 1999, 2002, 2003, 2004).

	1997		1998		1999		2000		2001		2002		2003		2004	
Segment	Total (%)	D	Total (%)	D	Total (%)	D	Total (%)	D	Total (%)	D	Total (%)	D	Total (%)	D	Total (%)	D
North[a]																
Neah Bay - Cape Alava	62 (12)	2.0	32 (7)	1.0	71 (12)	2.3	47 (9)	1.5	112 (20)	3.6	91 (17)	2.9	139 (21)	4.5	58 (8)	1.9
Central																
Cape Alava - James Is.	322 (64)	9.3	284 (66)	8.2	275 (46)	7.9	256 (51)	7.4	256 (46)	7.4	190 (35)	5.5	168 (25)	4.9	275 (37)	8.0
South																
James Is. - Destruction Is.	118 (24)	4.6	117 (27)	4.6	258 (43)	9.9	200 (40)	7.8	187 (34)	7.3	270 (49)	10. 6	365 (54)	14.3	410 (55)	16.1
Total	502		433		604		503		555		551		672		743	

[a] Smoothed line distance along 5 fathom depth contour for each segment: north (31.0 km), central (34.5 km) and south (25.5 km).

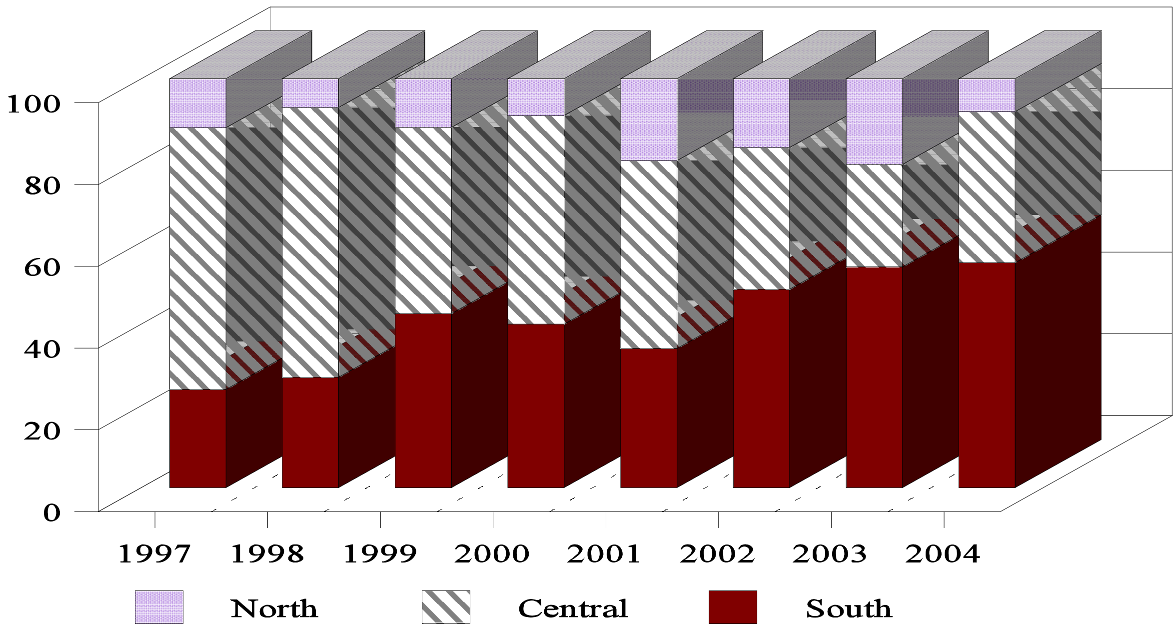

Figure 8. Percent of sea otters surveyed in north, central and south segments of Washington, 1997-2004 (Jameson and Jeffries, 1999, 2002, 2003, 2004).

Carrying Capacity

Carrying capacity (K) is defined as the maximum number of individuals in a population that can be supported by suitable habitat over an extended period of time (Gerrodette and DeMaster 1990). For all marine mammals, carrying capacity is difficult to estimate as it requires information that is typically unavailable (DeMaster et al. 1996). From a management and conservation perspective, estimating carrying capacity is essential because under the MMPA a population is no longer considered "depleted" when the lower limit of its optimum sustainable population (OSP) is reached. The lower bound of OSP is defined as the maximum net productivity level (MNPL). The MNPL has typically been expressed as a range of values from 50-70% of carrying capacity (Taylor and DeMaster 1993). The midpoint of this range (60%) was first used to determine whether dolphin stocks in the Eastern Tropical Pacific Ocean were depleted under the MMPA (42 FR 64548, Dec. 27, 1977), and has evolved into the operational definition where the lower bound of the OSP range is assumed to occur at approximately 60% of K (DeMaster et al. 1996).

One approach to calculating carrying capacity for sea otters in Washington involves extrapolating sea otter densities within their known range to the total amount of habitat available. James Dobbins Associates (1984) estimated the carrying capacity for sea otters in Washington between Destruction Island and Observatory Point (west of Port Angeles) as part of an assessment of potential release areas for translocation of southern sea otters. The estimated carrying capacity for this area was between 1,280 and 2,560 sea otters, derived from average sea otter density estimates in California (3.1 sea otters/km^2) applied to rocky substrate (414 km^2) and the total area within the 20-fathom isobath (829 km^2) in Washington. Using a more recent weighted average density estimate from California of 5.9 sea otters per square nautical miles (DeMaster et al. 1996) results in a slightly lower carrying capacity estimate of 1,251 to 2,502 sea otters (R. Jameson, pers. comm.).

Laidre et al. (2002) used a similar habitat-based approach using sea otter densities specific to three habitat types in Washington. Equilibrium sea otter densities in those habitat types were calculated and extrapolated across available sea otter habitat based on four measures of availability (coast to 20, 30, 40 m depth contour and linear estimates of coastline). An estimate of carrying capacity for sea otters was determined based on the assumption that sea otters would re-occupy their historic range in Washington, which extended from the Columbia River to Dungeness Spit (east of Port Angeles) (Scheffer 1940). Substrate type was characterized along the entire coastline during aerial surveys to classify habitat types along the coast (Laidre et al. 2002, Fig. 4). Radio telemetry data were used to determine maximum foraging distances from shore and maximum depths to estimate offshore habitat availability. Population index counts in Washington from 1996 to 1999 were used to calculate sea otter densities in currently occupied habitats, and densities from the California sea otter population were used for habitats that are not currently occupied in Washington (sandy and mixed) (Laidre et al. 2001). Sea otter density estimates in California's rocky habitat to the 40 m depth contour were more than five times higher than sea otter densities in similar habitat in Washington because a greater amount of surface area is contained within a given coastal distance in Washington relative to California (Laidre et al. 2001, 2002). Consequently, carrying capacity was calculated for the four measures of habitat availability and resulted in an estimated carrying capacity ranging from 2,550 (20 m) to 2,734 (linear) sea otters (Table 7).

Table 7. Estimated carrying capacity for sea otters in Washington from Dungeness Spit to the Columbia River, assuming habitat included sea surface area contained within the 20, 30, or 40 m depth contour or was a linear function of coastline. Coefficients of variation are in parentheses for each estimate of carrying capacity (from Laidre et al. 2002).

		Estimated Carrying Capacity			
Segment	Habitat	20 m	30 m	40 m	Linear
Dungeness Spit-E Green Pt.	sandy	22	13	6	34
E Green Pt-E of Seal Rock	mixed	82	57	28	316
E of Seal Rock-S of Destruction Island	rocky	955	1,102	822	1,019
S of Destruction Island -Tunnel Island	sandy	116	120	64	82
Tunnel Island-Grenville Arch	mixed	64	63	36	75
Grenville Arch to OR/WA border	sandy	568	447	258	309
Grays Harbor	sandy	229	119	48	208
Willapa Bay	sandy	333	174	71	431
Columbia River mouth	sandy	182	95	39	259
Total without Grays Harbor, Willapa Bay and Columbia River		1,807 (0.12)	1,802 (0.13)	1,214 (0.13)	1,836 (0.13)
Total with Grays Harbor, Willapa Bay and Columbia River		**2,550 (0.14)**	**2,191 (0.13)**	**1,372 (0.13)**	**2,734 (0.13)**

Laidre et al. (2002) concluded that the most conservative carrying capacity estimate for the Washington population was the linear model because length of coastline appeared to be a better indicator of carrying capacity in Washington. This model resulted in a carrying capacity estimate of 2,734 (2,082 - 3,452; 95% CI) when the coastal estuaries and bays were included (Laidre et al. 2002, Table 7).

It is unknown if sea otters will reoccupy their entire historic range in Washington. Significant human alterations in Grays Harbor, Willapa Bay and the Columbia River from shipping and development may have made these historic habitats unsuitable for sea otters. Additionally, it is unknown if sea otters will expand their range south into the open, exposed sandy habitats south of Point Grenville (Fig. 4). Although sea otters were distributed in these sandy habitats historically and occupy similar soft-sediment habitats elsewhere, such as Pismo Beach, California and Prince William Sound, Alaska, their use of these habitats in Washington remains unclear. With these unknowns, carrying capacity may be lower today than historically. Laidre et al. (2002) calculated a carrying capacity estimate of 1,836 for Washington if Grays Harbor, Willapa Bay and the Columbia River were not re-occupied by sea otters (Table 7).

In contrast to the habitat-based approaches for estimating carrying capacity described above, density dependent models, such as the generalized logistic, can be used to determine an equilibrium level in existing habitat, which is primarily rocky habitat in Washington. The generalized logistic model focuses strictly on population growth rate and population size within the habitat currently occupied by the Washington sea otter population. There are no terms for immigration or emigration; therefore, the estimate produced with this technique does not include the possibility of the population expanding its range into other suitable habitats (e.g. sandy, mixed). Two separate analyses of USFWS/USGS and WDFW sea otter count data (1977-2001) using a generalized logistic growth model suggest the Washington sea otter population is nearing an equilibrium level in their current range. An estimate of equilibrium within rocky habitat using a generalized logistic model resulted in a carrying capacity (K) estimate of 545 (402 - 1143 95% CI) sea otters (J. Laake, pers. comm.). Using a similar density dependent model, values of K ranged from 612 to 759 sea otters in the rocky habitat (Gerber et al. 2004). Both of these density dependent models yielded estimates that are lower than the habitat-based estimate of 1,019 sea otters in rocky habitat (Laidre et al. 2002, Table 7). Growth of the population has continued since these analyses were completed; this suggests that population equilibrium has not been reached in Washington's rocky habitat and a generalized logistic growth model may not be appropriate at this time (J. Laake, pers. comm.).

6. HABITAT STATUS

6.1 Ownership and Management

Most of the current sea otter range is within the Olympic Coast National Marine Sanctuary (OCNMS), which extends from the Copalis River mouth in Grays Harbor County to Koitlah Point on the west side of Neah Bay, Clallam County (Fig. 2). OCNMS recognizes the sea otter as a special species for the Olympic coastal ecosystem (C. Bernthal and E. Bowlby, pers. comm.).

Four Indian reservations are situated on the north coast of Washington: Makah, Quileute, Hoh and Quinault. These tribes all have off-reservation treaty rights that extend into the marine waters and cover marine mammals. Their jurisdiction overlaps with federal and state entities and they co-manage the resources. Other uplands adjacent to the sea otter range are owned by the National Park Service and managed as Olympic National Park (ONP). Rocks and islands off coastal Washington are encompassed by three national wildlife refuges: Copalis, Quillayute Needles and Flattery Rocks. The rocks and islands are co-managed by the USFWS with the effected tribes as the Washington

Maritime National Wildlife Refuge Complex (NWR).

Within the range of sea otters, most tidelands are publicly owned by ONP, as well as overlying waters being part of OCNMS. These areas are managed jointly by ONP, OCNMS and the tribes. ONP also manages intertidal areas within the NWR, with OCNMS as a co-trustee. Uplands from mean high water and above are managed by NWR. Washington Department of Parks and Recreation Commission controls some tidelands not transferred to ONP. Tribes cooperatively manage tidelands with federal and state resource managers where their respective Usual and Accustomed Area overlap with those governments' jurisdiction. Bedlands extend to three miles from the coast (also known as territorial seas) and are state-owned; submerged lands are co-managed by the Washington Department of Natural Resources (DNR) and the tribes.

Within the sea otter range, NOAA, USFWS, WDFW and tribes co-manage fish and shellfish. Management of these resources must also be in agreement with the Pacific Fishery Management Council for those species with a Council Management Plan in effect, including groundfish, salmon, and coastal pelagic species.

6.2 Affected Environment

Coastal areas are fairly pristine throughout much of the current sea otter range in Washington. Areas under federal jurisdiction should remain so with protection from the National Oceanic and Atmospheric Administration (NOAA), OCNMS, USFWS, NWR and ONP. To the south, development has been moderate to extensive; most of coastal Grays Harbor County bears residential, resort, and industrial developments. To the east, considerable development has occurred along the shores of Puget Sound and, increasingly, the Strait of Juan de Fuca. Relatively little undisturbed habitat remains around the San Juan Islands and other regions where sea otters may potentially expand to and occupy. Habitat quality of these areas for sea otters may depend in part upon types and levels of water-based human activities.

Sea otters are usually associated with kelp forests. Changes in kelp abundance and distribution in Washington have occurred over the past 150 years, but the nature of those changes is poorly known. In the mid-1800's, members of coastal tribes reported large patches of kelp several miles seaward of Point Grenville (Scheffer 1940), but Scammon (1870) was unable to find them. If these kelp beds did exist, they no longer occur. Their presence may have been important to the large number of sea otters that supported 19th century hunts near Point Grenville and their demise might be attributed to human-related effects such as dredging and increased erosion which causes sedimentation that can disrupt recruitment and growth of kelp (Devinny and Volse 1978).

Kelp harvest by humans may also have affected distribution and density, but this is not likely due to strict regulations. The maximum daily wet weight harvest or possession of seaweed for personal use from all aquatic lands and all privately owned tidelands in Washington is ten pounds per person (RCW 79.90.010). Commercial harvesting of seaweed from aquatic lands and all privately owned tidelands is prohibited (RCW 79.90.010). Only by approval of both WDFW and DNR may seaweed species of the genus *Macrocystis* be commercially harvested for use in the herring spawn-on-kelp fishery (herring eggs which have been deposited on any type of aquatic vegetation); kelp utilized may not be cut in Washington waters (RCW 79.01.805, G. Bargmann, pers. comm.). There is a large spawn-on-kelp fishery in British Columbia and most non-tribal kelp used in the Washington herring-roe fishery is imported from British Columbia. Washington does not currently support a non-tribal spawn-on-kelp fishery; however, there is an active tribal fishery authorized by DNR (G. Bargmann, pers. comm.).

Between 1989 and 1997, kelp cover (composed primarily of *Macrocystis integrifolia* and

Nereocystis leutkana) between Port Townsend and the Columbia River has been relatively stable despite high areal variation from year to year (Van Wagenen 1999, Berry et al. 2001). Recent analyses within the sea otter population range (Destruction Island to Pillar Point) have detected significant increasing trends in the areal extent of giant (*Macrocystis*) and bull kelp (*Nereocystis*) canopy (Fig. 9, R. Jameson unpublished data *in* Laidre 2004). Increasing kelp canopy follows well with the presence of sea otters, removing large quantities of marine invertebrate herbivores, reducing grazing pressure on kelp and facilitating macroalgal growth (Estes and Duggins 1995, Estes et al. 1996, Kvitek et al. 1998).

Within the sea otter population range, the proportions of giant and of bull kelp have been estimated to be nearly equivalent: approximately 47% of the canopy consisted of giant kelp (8.0 km^2, SD 1.5) and 50% of the canopy consisted of bull kelp (8.5 km^2, SD 3.7) (less than 1% was classified as mixed kelp (0.6 km^2, SD 0.45)(R. Jameson unpublished data *in* Laidre 2004). Sea otters in Washington appear to select for giant kelp more frequently than bull kelp and are found in kelp more often when resting (R. Jameson unpublished data *in* Laidre 2004). Sea otter focal areas were closely related to dense patches of kelp along coastal Washington. Large scale and rapid long-distance movements within the range between kelp canopy patches likely reflect movements of sea otters between good habitat patches.

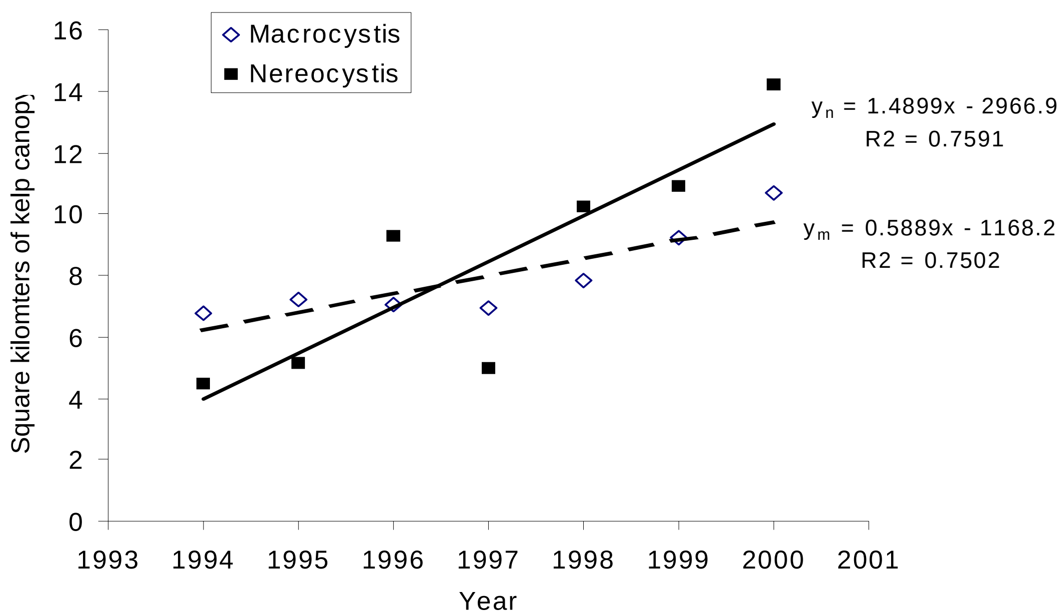

Figure 9. Trends in areal extent of kelp canopy within the sea otter range in Washington (between Destruction Island and Pillar Point). Giant kelp (*Macrocystis integrifolia*) is shown with open symbols and a dashed line. Bull kelp (*Nereocystis luetkeana*) is shown with closed symbols and a solid line. Both trends are significant ($p<0.05$). Kelp data obtained and used with permission from the WADNR Nearshore Habitat Program (from R. Jameson unpublished data *in* Laidre 2004).

Gerber and VanBlaricom (1999) looked at six models to predict impacts of sea otter expansion into the Strait of Juan de Fuca. Several of the models predicted expanded kelp communities, but at least two suggested that sea otters would not cause the type of community modification described for other locations in the North Pacific. They concluded that available data were not adequate to anticipate effects of sea otters on kelp forests in the Strait. Carter (1999) found that two years of simulated sea otter predation did not result in significantly higher densities of kelp species in areas of the San Juan Islands where her study was conducted. However, she noted that the scale and time period of the experiments may have influenced the results: sea otter predation may only affect algal communities over a longer time period, the scale of the experiment may have been too small to observe changes that would normally be associated with reoccupation of the area by sea otters, and algal recruitment may have been poor during the study. Observations suggested that kelps were not being regulated by sea urchin grazing in the San Juan Channel and that other factors such as strong currents, recruitment frequency or grazing by other herbivores may regulate kelp communities in that area.

Currently, the Washington sea otter population inhabits a relatively pristine environment on the northern outer coast and occupies almost all of the available kelp forest habitat on the outer coast. Development has been moderate to extensive to both the south in Grays Harbor, Willapa Bay and the Columbia River and to the east in Puget Sound of the current sea otter population range. There is considerable kelp forest habitat in the Strait of Juan de Fuca and San Juan Islands that is not currently occupied by sea otters; however, habitat quality of these areas for sea otters is unknown and may depend in part upon types and levels of human activities.

7. CONSERVATION STATUS

7.1 Legal Status

Washington

In 1971, the Washington Department of Game's (predecessor to Washington Department of Fish and Wildlife) authority to manage marine mammals was clarified (RCW 77.08.050). Subsequently, the Department adopted Washington Administrative Code (WAC) 232-12-660 to protect marine mammals as managed wildlife, but this Code was repealed in 1981. State laws and regulations pertaining to marine mammals, including sea otters, were superseded by the federal Marine Mammal Protection Act of 1972 (MMPA).

In October 1981, WDFW designated the sea otter as State Endangered under the Special Species Policy (policy 602). The listing was based on the sea otter's small population size, restricted distribution, and vulnerability. In 1990, the Washington Wildlife Commission reaffirmed the sea otter's State Endangered designation under WAC 232-12-014. State Endangered status is defined as "any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state" (WAC 232-12-297).

United States

Sea otters are protected under the MMPA. Under the MMPA, sea otter stocks are the responsibility of the Secretary of the Interior. The Secretary has designated the USFWS with authority to implement the MMPA as it pertains to sea otters.

Under the MMPA, sea otters are protected by a prohibition on take—"to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill." The term harassment was defined in 1994 to mean, "any act of pursuit, torment, or annoyance which, 1. (Level A Harassment) has the potential to injure a marine mammal or marine mammal stock in the wild; or 2. (Level B Harassment) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering." Provisions within the MMPA allow ceremonial and subsistence harvest of sea otters by coastal Alaskan natives (16 USC 1371, section 101(b)). Take may also be permitted under special circumstances, such as protecting human life, scientific research, public display, photography for educational or commercial purposes and incidental to commercial fisheries. Any program developed by USFWS and respective tribes for sea otters would accommodate the Federal trust responsibility, treaty rights and requirements of the MMPA.

The northern sea otter subspecies (*E. l. kenyoni*) found in Washington and Alaska has not been listed under the federal Endangered Species Act; however, the USFWS has proposed listing the Southwest Alaska distinct population segment as threatened under the ESA (USFWS 2004). The southern sea otter (*E. l. nereis*) has been listed as a threatened species under the Endangered Species Act of 1973, as amended, and consequently is also recognized as depleted under the MMPA (USFWS 1977). The USFWS final revised recovery plan for the southern sea otter was approved in February 2003 (USFWS 2003).

International

Sea otters were first afforded international protection early last century, when the species was included under the Treaty for the Preservation and Protection of Fur Seals (37 Stat. 1542, T.S. no. 564). The Treaty was signed in 1911 by Japan, Russia, the United Kingdom (for Canada), and the United States. Under the treaty, sea otters were protected in international waters—those at least 3 miles offshore (USFWS 1982). Later, the Fur Seal Act of 1966 provided protection on the high seas. NMFS has consolidated the provisions of the Fur Seal Act into regulations promulgated under the MMPA.

Sea otters in British Columbia were listed as Endangered in 1978 and down-listed to Threatened in 1996 by the Committee on the Status of Endangered Wildlife in Canada. As a proactive measure to address threats to sea otters and their habitat (e.g. oil spills), British Columbia formed a Recovery Team in June 2002 to develop a National Recovery Strategy for sea otters. The final recovery strategy was completed in June 2003 (Nichols et al. 2003).

8. MANAGEMENT ACTIVITIES

8.1 Translocations

Translocations have been used as a management tool to re-establish sea otter populations where they have been extirpated, to broaden the geographic range of established populations and to try to influence the distribution of sea otters. Between 1965 and 1972, 708 sea otters were captured in Alaska and reintroduced into unoccupied habitat in Alaska, British Columbia, Washington and Oregon. Reintroductions to Washington, British Columbia, and Alaska (except St. George Island) were successful, but the Oregon effort failed (Jameson et al. 1982). Between 1987 and 1990, 140 sea otters in California were translocated from the central coast to San Nicolas Island to expand the southern sea otter range and minimize the chance that a single catastrophic oil spill would affect the entire population. Evaluation of this translocation effort by USFWS is ongoing (USFWS 2000, 2001, 2003).

8.2 Population Surveys

Surveys of the sea otter population in Washington were conducted independently by both WDFW and USGS (Fig. 5). Since 1989, WDFW, USFWS and OCNMS researchers have conducted annual surveys of Washington's sea otter population. Winter observations have been gathered incidentally to radio-tracking flights for sea otters as well as joint British Columbia and Washington sea lion surveys. Few winter assessment surveys have been conducted.

8.3 Research

In addition to monitoring distribution and abundance, biologists from WDFW, USGS, BRD, USFWS, OCNMS and other researchers have been studying sea otter ecology in Washington. Research efforts have included examining causes of mortality, contaminant loads, activity budgets, diet, movements, and genetic diversity. Investigations have also addressed changes in benthic communities and prey availability (Kvitek et al. 1989, Kvitek et al. 1998, Kenner et al. 2001).

Between 1994 and 1998, 83 sea otters were captured and 63 of those sea otters were implanted with radio transmitters (Jameson 1994a, 1995a, 1996a, 1997a, 1998a). By tracking individual sea otters, researchers have collected data on sea otter movements, activity budgets, feeding behavior, and prey selection. These data are detailed in the Natural History section under their respective headings.

In 2001 and 2002, USFWS, WDFW, and OCNMS captured 32 sea otters (21 female and 11 male) to assess overall health, investigate contaminant loads, and track movement patterns. Basic blood chemistry parameters were generally within ranges reported from both captive animals housed in aquaria and other populations of wild sea otters that have been studied (J. Davis, pers. comm.). Blood serum was used to determine if Washington sea otters had been exposed to a number of pathogens. National Wildlife Health Center (NWHC) conducted the titer assays and found that of the 32 sea otters tested, 81% had positive titres to morbillivirus and 67% had positive titres for neospora. NWHC found 60% of sea otters had positive titres for *T. gondii* and 29% had positive titres for *S. neurona*, both protozoal parasites that cause brain infections (encephalitis) (J. Davis, pers. comm.). All bacterial flora and parasites found in the oral and fecal swabs had been found in wild sea otters. Urine samples collected opportunistically from three male sea otters were evaluated by NMFS Northwest Fisheries Science Center using receptor binding assay and High Performance Liquid Chromatography and neither indicated the presence of domoic acid (J. Davis, pers. comm.), a naturally occurring toxin produced by marine diatoms (*Pseudo-nitzschia* spp.).

Radio transmitters were implanted in 17 sea otters captured in 2001 and 15 sea otters captured in 2002 to monitor range expansion. Sea otters were relocated using aerial tracking flights along the coasts of Washington and southern Vancouver Island. No radio tagged sea otters were detected outside the existing range (S. Jeffries, pers. comm.).

8.4 Oil Spill Risk Reduction and Response

OCNMS has worked with the International Maritime Organization to designate an "Area To Be Avoided" (ATBA) by all vessels over 1,600 gross tons and those carrying cargoes of petroleum or hazardous materials. The ATBA encompasses the northern Washington coast and westernmost Strait of Juan de Fuca (Tatoosh Island to Seal Rock and Koitlah Point) and is intended to reduce impacts on shoreline areas by keeping vessels, and therefore oil spills, well offshore. The ATBA is advisory; and although compliance is not mandatory it has been generally followed (E. Bowlby, pers. comm). Since 1999, a rescue tug boat has been based at Neah Bay for vessel emergency assistance.

There are very few viable oil spill response options for the outer coast of Washington. There are no existing National Oceanographic and Atmospheric Administration (NOAA) models available to predict oil behavior and there are no sea otter use areas where deployment of an oil exclusion boom is a viable option even if modeling were able to predict which coastal areas were likely to be effected by an oil spill (B. Troutman, pers. comm.). Portions of the outer coast are provisionally approved for in-situ burning, a method to remove oil from the water's surface through controlled ignition and burning. The use of chemical dispersants is allowed in certain offshore areas along the outer coast. Waters of the outer coast greater than three nautical miles offshore are pre-approved for dispersant use. Dispersant use may be approved on a case-by-case basis for coastal waters less than three nautical miles offshore or for those waters in the Strait of Juan de Fuca west of Port Angeles. Permission to use dispersants on a case-by-case basis will depend on the season of the spill as well as other environmental factors at the time of the incident.

No gas and oil development occurs in offshore waters of Washington and none is expected in the foreseeable future. Section 2207 of the Oceans Act of 1992 indefinitely bans oil and gas exploration, development, and production within the boundary of OCNMS, prohibitions that can be lifted only by an Act of Congress (U.S. Department of Commerce 1993; CFR 922.152(1)). In addition, the outer continental shelf of Washington has been excluded from lease planning until 2012 under the current plan (1997-2002) issued by the Minerals Management Service (1996) and by Executive Order. A state-level, permanent moratorium on gas and oil exploration and production is in effect for coastal waters within three miles (4.8 km) of the Washington shoreline, under the Ocean Resources Management Act (Revised Code of Washington 43.143.010).

8.5 Fishery Interactions

Since their reintroduction in 1969 and 1970, sea otters have not appreciably affected commercial, tribal, or recreational fisheries. One instance did occur, in the late 1990's, when a group of sea otters extended their range into the Strait of Juan de Fuca during the winters and impacted a Makah tribal sea urchin fishery (S. Joner, pers. comm.). Elsewhere in their range, sea otters have contributed to loss or reduction of certain commercial and recreational shellfisheries; however, they simultaneously may have enhanced some fin fish populations that benefit from sea otters preying upon sea urchins thus restoring kelp forests (Estes and VanBlaricom 1985). This has been the case in Washington with an observed increase in kelp canopy in areas occupied by sea otters (Fig. 9, R. Jameson unpublished data *in* Laidre 2004).

While sea otters can have a significant impact on shellfisheries, cause-effect relationships between sea otter presence and fishery viability are frequently unclear. Gerber and VanBlaricom (1999) reviewed the potential for sea otter-fishery conflicts in Washington. They predicted potential future interactions with razor clam, Dungeness crab, sea urchin and abalone resources if the sea otter population expands into areas occupied by those species. If the population expands to the north or south along the Washington coast, they will encounter several important treaty and non-treaty commercial, sport and subsistence fisheries for sea urchins, razor clams, Dungeness crab, steamer clams and geoducks. If the population expands eastward into the Strait of Juan de Fuca, the potential exists for increased interactions with sea urchin fisheries (Gerber and VanBlaricom 1999).

A number of methods have been considered for influencing the distribution and movements of sea otters (Packard 1982). They include capture and relocation, natural and artificial barriers, acoustic repellents, negative conditioning, selective killing, demographic manipulation, habitat improvement and mariculture enclosures. As an example, USFWS in California as part of the translocation program was legally bound to enforce zonal management to limit sea otter impacts on existing commercially valuable fisheries and other resources (Benz 1996). Under this approach, certain coastal habitat blocks surrounding the translocation site (San Nicolas Island) were designated “sea otter zones” and others “sea otter free” zones. In “sea otter free” zones, sea otters were removed non-lethally by USFWS. None of these methods are being considered in Washington.

Washington’s coastal native tribes depend upon marine resources including shellfish and fin fish for subsistence and commercial harvest. A sea otter population growing in size and distribution will directly compete with these coastal tribes for shellfish resources and could compromise their ability to maintain harvest levels (Gerber and VanBlaricom 1999). The Rafeedie decision of 1994 reserves the rights of twenty native tribes to harvest up to half of all shellfish from the usual and accustomed places, except from those that are "staked" or "cultivated" by citizens (Shellfish subproceedings of United States vs. State of Washington 873 F. Suppl. 1422, 1994). This court decision has instigated a cooperative co-management between the State of Washington and treaty tribes including sharing of harvest data and management plans.

As the WDFW is considering future sea otter recovery actions, it is advisable to present a fairly thorough review of fisheries currently or potentially affected by sea otter presence. The following sections should not be read as announcements of imminent threat to various fisheries, but as informational notes for an uncertain future where sea otters and shellfish resources overlap that warrant monitoring.

Photograph by Jeff Foott.

Sea urchin

In Washington, sea urchins (primarily red sea urchins, *Strongylocentrotus franciscanus*) are found on rocky bottoms in the Strait of Juan de Fuca, around the San Juan Islands, and on the outer Olympic Peninsula coast. Washington supports commercial, tribal, and recreational fisheries for sea urchins. During a period of peak landings for the sea urchin fishery, between 1988 and 1992, commercial statewide sea urchin harvest averaged 6.3 million pounds per year with an average ex-vessel (price paid to fishers) value of $3 million annually (Hoines 1996). Since this time, management of the sea urchin fishery has undergone significant changes: the resource is now co-managed with treaty tribes, a rotational harvest management strategy has been replaced with statewide openings, a regional fishery quota system has been implemented, and regional harvest quota reductions have been made as a conservative safeguard in the absence of adequate quantitative resource stock assessments (M. Ulrich, pers. comm.). For the period between 2000 and 2003, statewide average seasonal sea urchin harvest (tribal and non-tribal commercial combined) has been 662,000 pounds per year, with a seasonal ex-vessel value of $563,000 (M. Ulrich, pers. comm.). Harvest districts in the San Juan Islands and Strait of Juan de Fuca currently provide most of the catch. Current levels of red sea urchin commercial harvest in Washington may not be sustainable, regardless of sea otter presence (Carter 1999).

A fishery for sea urchins developed in the Neah Bay area during the 1980's. Total harvest increased from 20,000 pounds in 1982/83 to 1.6 million pounds during the first three months of the 1987/88 season (Kvitek et al. 1989). Sea otters were not found in areas supporting significant sea urchin fisheries until 1995. Their movement during the winter months into Neah Bay and further eastward between 1995-2000, began to impact sea urchin-harvest areas. Sea urchin surveys completed in summer 1997 revealed that few sea urchins remained in the vicinity of Neah Bay (A. Bradbury, pers. comm.). Following this survey, the Neah Bay management district was closed to the commercial harvest of sea urchins by Tribal/State harvest agreement and has remained closed since (M. Ulrich, pers. comm.).

The decline in sea urchin abundance in the Neah Bay area may be attributed to a combination of intensive human harvest and sea otter predation. Sea urchin abundance is lower where sea otter populations have become established in comparison to where sea otters are absent (Jameson et al. 1986, Kvitek et al. 1989, Watson 1993, Estes and Duggins 1995, Kvitek et al. 1998). Intense predation by sea otters, in combination with a low recruitment rate of urchins, is likely to preclude a sustainable commercial or recreational sea urchin harvest (Estes and VanBlaricom 1985, Gerber and VanBlaricom 1999, Carter and VanBlaricom 2002).

Dungeness crab

In Washington, Dungeness crabs (*Cancer magister*) are found on sandy bottoms along the outer coast, within the Strait of Juan de Fuca, and in north Puget Sound. Crabs are most productive and broadly distributed from La Push southward. On the outer coast, crabbing occurs from nearshore (waters less than 10 fathoms in depth) to well offshore. Dungeness crab is the only crab species of commercial importance in Washington. Approximately 190-200 crab fisherman use an estimated 80-90,000 crab pots during a typical nine-month coastal crab season. The number of pots used in the coastal fishery has dropped since the mid-1990s after a pot limitation program was implemented in 1999. Coastal crab fishermen landed an average of 12.5 million pounds of Dungeness crab annually between 1990 and 2001, representing an average ex-vessel value of $19.1 million per year. Two coastal treaty tribes have a much smaller fleet. The combined harvest of the Quinault and Quileute tribes is typically 1 million pounds, but combined tribal landings for the 2002-2003 season will exceed 2 million pounds for the first time in history (H. Reed, pers. comm.).

Most of Washington's Dungeness crab harvest occurs in waters deeper than those typically used by sea otters, with more than half the harvest occurring more than three miles offshore (LaRiviere and Barry 1997). However, hundreds of crab pots are placed in nearshore waters less than 10 fathoms sdeep (LaRiviere, pers. comm.). At this depth, they are accessible to sea otters and could pose an entrapment hazard. Sea otters impacted the Dungeness crab fishery in east Prince William Sound, Alaska, when they moved into the area in the early 1980's. Within a year after large numbers of sea otters entered the area, the commercial crab fishery was closed due to low crab abundance (Garshelis et al. 1986).

If sea otters expand their range southward toward the shallow, enclosed waters of Grays Harbor and Willapa Bay, they would be within major crab nurseries that could be highly vulnerable to predation. Gerber and VanBlaricom (1999) noted this relationship in their evaluation of the potential interaction of sea otters and Dungeness crabs in Washington. They concluded that the effect of sea otters on Dungeness crabs would be the most severe in areas where fisheries focus on shallow habitats, such as the Dungeness Spit region in the eastern Strait of Juan de Fuca. They also predicted significant reductions in crab harvests if sea otters eventually expand southward and occupy the estuaries of Grays Harbor and Willapa Bay.

Razor clam

In Washington, most razor clams (*Siliqua patula*) are found in the sandy beaches between the Columbia River and Moclips, but they also occur along the Olympic Peninsula coast as far as Makah Bay. Five major razor clam “management beaches” are monitored: Long Beach, Twin Harbors, Copalis, and Mocrocks are monitored by WDFW. Kalaloch in ONP, is monitored jointly by the ONP and WDFW. Among these, Long Beach and Copalis are favored by recreational diggers; razor clams taken from these two beaches in the 2001-02 season (October-May) represented the highest harvest level since 1984 (D. Ayres, pers. comm.). For all beaches, a total of 307,000 digger trips harvested a total of 4.3 million razor clams. Effort and success in the razor clam sport fishery have varied widely since 1949, with the most recent peak of over 13 million clams being taken during nearly one million digger trips in 1979 (Ayres and Simons 1997). A typical low tide opener during the 2001-02 season brought several thousand clammers to the beaches, with more than 20,000 recreational diggers present on some days (D. Ayres, pers. comm.).

In 1993, the Quinault Indian Nation began to exercise their treaty rights to harvest shellfish by holding an off reservation commercial razor clam harvest at Mocrocks Beach. During the 2001-02 season, the Quinault Indian Nation harvesters took a total of 1.1 million clams from the Copalis, Mocrocks and Kalaloch Beaches in a combination of commercial, ceremonial and subsistence fisheries (D. Ayres, pers. comm.). The non-treaty commercial razor clam harvest is limited to sand spits in Willapa Bay. The average annual harvest for recent seasons (1996-2001) was 36,000 pounds, with 28 licensed clammers (a record low) taking 2,849 pounds in 1997 (Ayres and Simons 1997). During the 2002 season, 105 license holders landed 120,000 pounds of razor clams with an ex-vessel value of $118,400 (D. Ayres, pers. comm.).

If Washington’s sea otters expand their range southward, they could consume razor clams that now support a highly popular recreational fishery, as well as tribal and non-tribal commercial fisheries. Gerber and VanBlaricom (1999) predicted that Washington’s razor clam recreational fishery would be vulnerable to sea otter predation if sea otters occupy the preferred habitats of razor clams along the southern outer coast of Washington. Sea otter and razor clam ranges overlap from Makah Bay to near Kalaloch. When sea otters lived south of Point Grenville during the mid- to late-19th century, “the flesh of razor clams was often found in stomachs of the sea otter, and the sea otters were believed to be most abundant where the clams were plentiful” (Scheffer 1940).

Abalone

In Washington, pinto abalone (*Haliotis kamtschatkana*) are found in high energy, rocky reef habitats and are generally associated with kelp forests. Their range in Washington includes the northern outer coast, Strait of Juan de Fuca and San Juan Islands (West 1997, WDFW unpublished data, D. Rothaus, pers. comm.). Sea otter and pinto abalone ranges currently only overlap on the northern outer coast and the western end of the Strait of Juan de Fuca between Cape Flattery and Waadah Island.

Pinto abalone have experienced population reductions in the absence of sea otters in Washington. There has never been a commercial fishery in Washington for abalone and recreational fisheries for abalone closed in August 1994. Pinto abalone were listed by WDFW in 1996 as a "State Candidate Species" (WDFW Policy 6001) and by NOAA Fisheries in 2004 as a "Species of Concern". Illegal harvest has occurred in the San Juan Islands and Strait of Juan de Fuca and may be an ongoing problem (WDFW Enforcement, pers. comm.). WDFW surveys of ten pinto abalone index stations in the San Juan Islands have shown a dramatic decrease of 61% in abalone abundance from 1992 through 2003 (WDFW unpublished data, D. Rothaus, pers. comm.). Abalone are sedentary invertebrates and use broadcast spawning which requires spawning adults to be within one to two meters of one another for successful fertilization (Babcock and Keesing 1999, Pennington 1985). If populations have fallen below critical densities, recruitment failure could be the biggest challenge facing Washington abalone stocks.

Sea otters and abalone have coexisted for millions of years, however there is evidence that sea otters can contribute to reductions in abalone populations. Research conducted in marine protected areas off California on red abalone (*Haliotis rufescens*) concluded that sea otter predation affects the density, size and distribution of abalone and thus abalone fisheries cannot be sustainable in regions if they also contain sea otters (Fanshawe et al. 2003). Sea otters in Morro Bay, central California, were implicated as a major contributing factor in the reduction of red abalone densities from 0.1010 abalone/m^2 to 0.0072 abalone/m^2 between 1965 and 1993 (sea otters arrived in 1967). Estimated population reduction was from 253,350 to 18,050 abalones (Wendell 1994). The commercial abalone fishery ended in the 1960's and the sport fishery now is limited. Abalone life history characteristics make them vulnerable to rapid over-harvest, thus sea otter predation may not be entirely responsible for the fishery's decline in California (Estes and VanBlaricom 1985). If the sea otter population extends into the Strait of Juan de Fuca and eastward as it did in the late 1990s, it is likely that abalone densities will be reduced (Gerber and VanBlaricom 1999, D. Rothaus, pers. comm.).

Sea cucumber

In Washington, sea cucumbers (*Parastichopus californicus*) are found on sand, mud, or rock bottoms along the outer coast, in the Strait of Juan de Fuca and Puget Sound. Harvest of sea cucumbers was a relatively minor fishery in Washington through 1987, with annual harvests typically below 400,000 pounds (Hoines 1996). In 1988, harvest for the export market increased dramatically. The fishery peaked between 1988 and 1992 when harvests averaged 3 million pounds annually and were valued (ex-vessel) on average at $2.5 million per year (Hoines 1996). Since that time, management of the commercial sea cucumber fishery has undergone significant changes: the resource is now co-managed with treaty tribes, a rotational harvest management strategy has been replaced with statewide openings, a regional fishery quota system has been implemented and regional harvest quota reductions have been made as a conservative safeguard lacking adequate quantitative resource stock assessments (M. Ulrich, pers. comm.). For the period between 2000 and 2003, statewide average seasonal sea cucumber harvest (commercial tribal and non-tribal combined) has been 600,000 pounds per year, with a seasonal average ex-vessel value of $784,000 (M. Ulrich, pers. comm.).

In the mid-1980's, sea cucumbers were noted as a minor part of the sea otter diet at Cape Alava and Cape Johnson (Bowlby et al. 1988), but still coexisted in significant numbers with sea otters (Kvitek et al. 1989). Sea cucumbers are generally considered poor quality prey for sea otters. Tribal and non-tribal commercial fisheries exist for sea cucumbers in Puget Sound and the Strait of Georgia east of the present sea otter range. Minor tribal and non-tribal harvests occur in the western Strait of Juan de Fuca where a group of sea otters wintered during 1995-2000 (S. Joner and A. Bradbury, pers. comm.). Along northwestern Vancouver Island, sea cucumbers declined in abundance as sea otters reoccupied habitat and were absent where sea otters had become established (Watson 1993). In Gerber and VanBlaricom's (1999) evaluation of sea otter-fishery interactions, they were not able to predict the effects of sea otters on sea cucumber fisheries due to a lack of data on the importance of sea cucumbers in sea otter diet and a lack of information on the life history and harvest sustainability of sea cucumbers in Washington.

Geoduck

In Washington, geoducks (*Panopea abrupta*) are found in the Strait of Juan de Fuca and Puget Sound in sand and mud substrates (Goodwin and Pease 1991). The geoduck is the most valuable clam fishery on the west coast of the United States. Geoduck harvest in Washington averaged over 3 million pounds annually between 1988 and 1992, with an ex-vessel value of $3.4 million per year (Hoines 1996). For the period between 2000 and 2002, statewide average seasonal geoduck harvest (commercial tribal and non-Indian combined) has been 3,972,000 pounds per year, with a seasonal average ex-vessel value of $17,841,000 (M. Ulrich, pers. comm.). The majority of the harvest occurs in Puget Sound and Hood Canal (Sizemore and Ulrich 2002).

At present, the sea otter range does not include areas where geoducks are commercially exploited, although small commercial beds exist in the western Strait. Sea otters are able to prey upon geoducks (R. G. Kvitek, pers. comm. *in* Riedman and Estes 1990), but their foraging efficiency is poor because adult geoducks bury up to 1 m deep (Kvitek and Oliver 1989). For this reason, Carter and VanBlaricom (1998) believed that geoducks along the Strait of Juan de Fuca would not be significantly impacted by potential sea otter expansion. Observations of excavation pits, discarded shells and surface observations indicate geoducks are prey for sea otters in British Columbia. Recent studies suggest the impact of sea otters on geoducks is not high; however, additional research is need to further evaluate predation affects (Watson and Smith 1996).

Other clams

Several clam species of recreational, tribal, or commercial importance are found in Washington, primarily in protected bays. Hardshell clams include Manila, littleneck, butter, cockle and horse, with only the first two being broadly sought by commercial clammers. Hardshell clam harvest in Washington averaged over 5 million pounds annually between 1988 and 1992, with an ex-vessel value above $7.1 million (Hoines 1996). Mussels represented 288,000 pounds valued at $330,000 annually.

Where sea otters preyed on butter clams off Kodiak Island, Alaska, the clam population was reduced both in abundance and mean size (Kvitek et al. 1992). Sea otters have affected the Pismo clam fishery in California to such an extent that Wendell et al. (1986) pronounced, "Once sea otters are established on clam-bearing beaches, any future stocks of clams will be fully utilized by sea otters, preventing the return of a fishery." Although sea otters are found in areas supporting clams, they are not known to significantly affect harvests in Washington. The role shellfish aquaculture may play in fishery interactions with sea otters in the future is unknown.

Fin fish

Fin fish are rarely an important component of sea otter diets, probably because they are more mobile than the sedentary invertebrates usually eaten by sea otters. Thus, it is unlikely that sea otters will affect fin fish populations or conflict with important fisheries. On the other hand, it is possible that sea otters will benefit fin fish populations in cases where the sea otters cause indirect enhancement of kelp forests. Kelp adds structural complexity to the nearshore environment, providing shelter and nursery habitat for fin fish. Areas with kelp support more fish and greater species diversity than similar areas without kelp (Simenstad et al. 1978, Bodkin 1988, Laur et al. 1988). Rockfish especially favor kelp forests (Bodkin 1988, Laur et al. 1988). When kelp breaks free and becomes a drifting algal mass, it becomes habitat for pelagic species, expanding the sea otters' potential sphere of influence. Fish found in drifting algal masses off coastal Washington include rockfish, sablefish, salmonids, sand lance, and lingcod (R. Buckley, pers. comm.).

9. FACTORS AFFECTING CONTINUED EXISTENCE

9.1 Oil Spills

Sources

Within the Washington sea otter range, no natural seeps are known from the outer continental shelf off Washington (Strickland and Chasan 1989). High vessel traffic along the outer coast of Washington and into its major ports in the Columbia River, Grays Harbor and Puget Sound increases the potential risk of spills due to collisions, sinking and groundings, as well as unlawful discharges of oily bilge waste. Transit by vessels through the Strait of Juan de Fuca has the greatest potential to impact the current sea otter population distributed along the northern Washington coast. In 2003, there were 1,699 transits for cargo and passenger vessels 300 gross tons or larger bound for Washington ports in Puget Sound via the Strait of Juan de Fuca and 2,303 transits for cargo and passenger vessels 300 gross tons or larger bound for Canadian ports via the Strait of Juan de Fuca. The number of transits for tank ships (transporting crude oil, refined petroleum products, or chemicals) bound for Washington ports in Puget Sound via the Strait of Juan de Fuca was 567 and the number of transits for tank ships bound for Canadian ports via the Strait of Juan de Fuca was 55 (Washington State Department of Ecology 2004).

Four oil spills have occurred in Washington since 1972 that illustrate the susceptibility of sea otter habitat to oiling. In January 1972, the unmanned troopship *General M.C. Meigs* broke loose from its tow and grounded at Portage Head, releasing 2,200 gallons of Navy Special fuel oil; in December 1985, the tanker *ARCO Anchorage* ran aground in Port Angeles harbor, releasing about 239,000 gallons of crude oil; in December 1988, the barge *Nestucca* collided with its tug off Grays Harbor, releasing 239,000 gallons of No. 6 fuel oil; and in July 1991, the fishing vessel *Tenyo Maru* was struck by a freighter and sank 25 miles northwest of Cape Flattery, while carrying 354,000 gallons of intermediate fuel oil and 97,800 gallons of diesel fuel. The *Meigs, Nestucca*, and *Tenyo Maru* spills affected areas within the current sea otter range. The *Anchorage* spill occurred within potential sea otter habitat in the Strait of Juan de Fuca.

Vulnerability to Oil

Sea otter susceptibility to oil has been recognized for many years, but the Exxon Valdez spill in Prince William Sound in 1989 brought the risk into sharp focus. Public attention was directed toward sea otters, which figured prominently in media coverage of the event. Batten (1990) explained the intense interest:

> As a playful, photogenic, innocent bystander, the sea otter epitomized the role of victim ... cute and frolicsome sea otters suddenly in distress, oiled, frightened, and dying, in a losing battle with the oil.

Protecting sea otters from spilled oil can be difficult or impossible. Even under the best circumstances, protection strategies such as booming, skimming, in-situ burning and dispersants are likely to have limited success in the open-ocean environment. Pre-emptive capture and removal of unoiled sea otters in the path of oil is neither practical nor advisable due to environmental conditions along the Washington coast that would pose significant potential risks to handlers and sea otters during pre-emptive capture attempts.

Effects of oil on sea otters

The effects of oil on sea otters may be acute (immediate) or chronic (long-term). The most pronounced acute effect is the fouling of a sea otter's insulative pelage. Because sea otters rely on clean and well-groomed fur to remain warm, even partial contamination (as little as 30% of the total body surface) can lead to death from hypothermia (Kooyman and Costa 1979 *in* Riedman and Estes 1990). When sea otters attempt to clean their pelage, they ingest hydrocarbons that can be acutely toxic. Sea otters also can inhale volatile components of freshly spilled oil, injuring their lungs and other organs (Ralls and Siniff 1990).

Recent and accumulating evidence indicates residual oil from the 1989 *Exxon Valdez* oil spill as a factor constraining recovery of sea otters in western Prince William Sound, Alaska. The abundance of sea otters in the most heavily oiled areas of Prince William Sound is estimated to be about half the pre-spill number, with no increase observed through 2002 (B. Ballachey, pers. comm.). Sea otters in the oiled areas exhibited elevated mortality rates relative to pre-spill through at least 1998 (Monson et al. 2000, Bodkin et al. 2002). Measurements of cytochrome P4501A, a biomarker of hydrocarbons, indicate sea otters continue to be exposed to hydrocarbons persisting in the environment, possibly through disturbance of oiled sediments while foraging. Alternatively, they may be ingesting hydrocarbons directly in contaminated prey (Bodkin et al. 2002). Concentrations of aliphatic and aromatic hydrocarbons in kidney, liver, and muscle tissues are two to eight times greater in sea otters found dead with heavy external oiling than in sea otters unaffected by spills (Mulcahy and Ballachey 1994). Biomarker assays indicated exposure to residual oil is declining over time, however; chronic effects of the *Exxon Valdez* oil spill have persisted well over a decade after the initial event (Bodkin et al. 2002).

Fortunately, the 1988 and 1991 oil spills in Washington resulted in little impact to the Washington sea otter population, although thousands of sea birds died in each (Jameson 1998a). While no oiled sea otters were found off the Washington coast following the 1988 *Nestucca* spill (Bowlby and Jeffries 1989), at least one sea otter was reported killed as a result at Checleset Bay, Vancouver Island, British Columbia, 440 km north of the spill site (British Columbia Ministry of Environment, Lands and Parks 1993). Following the *Tenyo Maru* spill, a sea otter found dead at Rialto Beach in the Olympic National Park was determined to have died of complications caused by oiling (N. Thomas, National Wildlife Health Research Center, Madison, Wisconsin, necropsy report).

Despite low mortality in Washington to date, the entire coastal population is highly vulnerable to future spills. The potential for high mortality was illustrated by the *Exxon Valdez* spill in Prince William Sound, Alaska. Within six months following that spill, biologists documented roughly 1,000 sea otter deaths. Mortality estimates varied, ranging from 2,650 (Garrott et al. 1993) to 3,905 (DeGange et al. 1994). Additional impacts to Washington's sea otter population could occur if critical areas of kelp habitat were injured or destroyed as a result of oiling (Antrim et al. 1995, B. Troutman and E. Bowlby, pers. comm.).

Rescue and Rehabilitation

Following the *Exxon Valdez* oil spill in Prince William Sound, extraordinary efforts were made to rescue and rehabilitate oiled sea otters (Bayha and Kormendy 1990). Those efforts may have had minimal value to the sea otter population in Prince William Sound at that time (Monnett et al. 1990, Estes 1991). Knowledge gained about spill progression patterns and the effectiveness of various response strategies was substantial, and is important in guiding policies and protocols for future spill events (G. VanBlaricom, pers. comm.). When an oil spill occurs and threatens or affects sea otters in Washington, every effort will be made to protect, rescue, and rehabilitate. The Northwest Area Contingency Plan contains very detailed procedures for spill management in Washington, a spill rescue protocol has been developed with USFWS (USFWS 1994), and protocols have been developed for standardized care of oiled sea otters (Williams and Davis 1995, White 1998).

9.2 Contaminants

Persistent environmental contaminants, including polychlorinated biphenyls (PCBs), chlorinated hydrocarbons (DDT and derivatives), organotins and heavy metals, have been found to bioaccumulate in aquatic food chains and reach elevated concentrations in high trophic level consumers (Ross et al. 1996, Kannan et al. 2000). The Marine Mammal Commission (1999) concluded that the potential effects of contaminants may include mortality, disruption of endocrine cycles and developmental processes causing reproductive failure or birth defects, suppression of immune system function and metabolic disorders resulting in cancer or genetic abnormalities.

Research using laboratory animals has demonstrated that the immunotoxicological effects of contaminating chemicals on the immune system is characterized by thymus atrophy and reduced T-cell function (Ross 2002). Tissue residue threshold values for seals, otter, and mink have been established by feeding fish of varying concentrations of organochlorines to test animals (Kannan et al. 2000). Response to varying dietary doses of pollutants included altered vitamin A levels, reduced thyroid hormone concentrations, and immunosuppression (Kannan et al. 2000). Vitamin A is a collective name for a group of fat-soluble molecules essential to growth, development, reproduction and immunocompetence.

Sea otter contaminant studies conducted in California between 1968-1980 generally found residue levels of heavy metals, PCBs and organochlorine pesticides (e.g. DDT) in sea otter tissues to be present, but below levels known to cause mortality or pathological conditions (Riedman and Estes 1990). The effects of environmental contaminants on sea otters has not been studied in detail; however, PCB concentrations in several sea otter liver samples were elevated to levels known to cause reproductive failure in the confamilial species, mink (*Mustela vison*) (Risebrough 1984 *in* Riedman and Estes 1990). Subsequent research examined PCB and DDT levels in California and Alaska (southeast and Aleutian Islands) sea otter populations and found PCB levels in Aleutian sea otters were surprisingly high despite their remote location and DDT levels in California sea otters were high and most likely a reflection of agricultural practices and pesticide runoff (Jarman et al. 1996, Bacon et al. 1999).

Washington sea otters are currently distributed in what many believe to be a relatively pristine environment with sources of contamination thought to be minimal. Recent analyses have found that industrial and agricultural compounds are making their way into Washington sea otter tissues, likely via trophic transfer (J. Davis, pers. comm.). This indicates that the outer coast ecosystem is not sheltered from contamination despite its remote location.

High PCB levels have been reported for harbor seals in southern Puget Sound (Ross et al. 1998) and killer whales which frequent the coastal waters of British Columbia and the outer coast of Washington (Calambokidis et al. 1999, Ross et al. 2000). Sea otters are top-level predators and reside only along the outer coast of Washington, therefore their contaminant burdens should reflect contaminant levels found on the outer coast of Washington. Contaminant analyses using blood and liver tissues collected from approximately 32 sea otters during captures in 2001 and 2002 are currently being analyzed for residue levels of congener specific PCBs, organochlorines, metals, and organotins by Geochemical and Environmental Research Groups at Texas A & M University and Laboratory and Environmental Testing, Inc. Preliminary analyses of 2001 samples indicate liver samples had detectable levels of total petroleum hydrocarbons (PAHs, butyltins, metals such as cadmium, mercury, and copper) and organochlorines (PCBs, chlordane, and DDT metabolites). Whole blood samples had detectable concentrations of PCBs and butyltins (J. Davis, pers. comm.). Additional testing and analyses are underway and a final report by USFWS on these data is expected in 2005.

9.3 Disease

During 2000, 2002, and 2003 sea otter carcasses were collected and necropsied to determine cause of death. In 2001, two mortalities were reported on the northern Washington coast in May, but no sea otter carcasses were recovered. Necropsy and disease screening revealed acanthocephalan peritonitis, protozoal encephalitis, and leptospirosis infections in Washington sea otters. These diseases had been recorded in California sea otter populations, but had not been previously documented in the Washington sea otter population.

In 2000, between June and August, 21 sea otter carcasses were found along the Washington coast and one was found very decomposed near Sand Lake on the northern Oregon coast (270 km south of Destruction Island). The advanced state of decomposition of the sea otter found in Oregon indicates it likely drifted a significant distance before becoming beach cast (Jameson and Jeffries 2000). The relative age and sex of the 22 sea otter carcasses were: four females (3 adult, 1 unknown age), four males (3 adult, 1 subadult), one pup unknown sex, and 13 unknown. Six of those carcasses in the first stages of decomposition were recovered and shipped over night to National Wildlife Health Center (NWHC) for necropsy. Protozoal encephalitis (dual infection with *S. neurona* and *T. gondii*) was the cause of death for one adult male and cause of death was not determined for five individuals (1 female undetermined age, 2 adult females, 1 subadult male, 1 adult male) (Lindsay et al. 2001). Protozoal brain infections (encephalitis) are caused by the protozoal parasite *T. gondii* or *S. neurona*. Transmission of these protozoal parasites occurs by sea otters directly ingesting oocytes suspended in water or consumption of filter feeding invertebrates that have been contaminated with cat (*T. gondii*) or opossum (*S. neurona*) feces via land run off (Thomas and Cole 1996, Cole et al. 2000). This was the first case of protozoal encephalitis reported in sea otters in Washington. A small percentage (8%) of harbor seals in southern Puget Sound screened for *T. gondii* had titres indicating exposure to this disease (Lambourn et al. 2001).

In 2002, between February and October, 27 sea otter carcasses were found along the Washington coast (13 north of La Push and 14 south of La Push). Of those carcasses, seven were females, 11 were males and nine were unknown sex. WDFW necropsied one adult female who was pregnant with twins and died from birth complications. NWHC necropsied eight carcasses (all recovered south of La Push). Cause of death was not determined for one adult male that was decomposed, protozoal encephalitis (*S. neurona*) was the cause of death for one adult male and leptospirosis was determined or suspected to be the cause of death for six sea otters examined (5 adult males, 1 adult female). These were the first documented cases of leptospirosis reported in sea otters in Washington. Leptospirosis is a bacterial infection seen in pinnipeds, which affects the liver, kidney, and reproductive system. Of harbor seals screened from 1986-2000 (n = 1,064) in the Columbia River, Willapa Bay and Grays Harbor, southern Puget Sound and British Columbia, 21% had suspect titres indicating exposure to leptospirosis (Lambourn et al. 2001).

In 2003, between April and November, 15 sea otter carcasses were found along the Washington coast (eight north of La Push, 6 south of La Push, and one unknown). Of those carcasses, three were females (two adults, one unknown age) and ten were males (six adult, one subadult, two immature, and one unknown age). Sex was not determined for two sea otters (one immature and one adult). Four of 15 carcasses were sent to NWHC for necropsy. Of those necropsied, one adult male died of severe trauma to the head, one adult male died of pneumonia, and the cause of death has not been determined for the other two sea otters (one adult male and one adult female). No diseases were found in the four animals necropsied.

In 2004, between February and October, thirteen sea otters carcasses were found along the Washington coast (seven animals north or at La Push, six south of La Push). One additional live sea otter was reported in the surf at Kalaloch in September, but the high tide took the animal off the beach before responders arrived. Of those carcasses, five were females (three adults, one subadult, one unknown age) and two were males (one subadult and one unknown age). Sex was not determined for six sea otters (two adults, four unknown age). NWHC conducted necropsies on three fresh carcasses and found that two animals, one adult female and one subadult male both had severe protozoal encephalitis (*S. neurona*). *S. neurona* was the cause of death for five harbor seals collected during May and June on the southern Washington (D. Lambourn, pers. comm.). The third sea otter necropsied in 2004, an adult female, died of Canine Distemper (CDV). CDV has recently been detected in a river otter in British Columbia (Mos et al. 2003). This is the first reported case of CDV in sea otters. Clinical symptoms of animals infected with CDV and Phocine Distemper (PDV), both morbilliviruses, include depression, fever, cutaneous lesions, gastrointestinal dysfunction, nervous disorders, and respiratory distress (Visser et al. 1991; Visser et al. 1993). Viral diseases such as CDV that infect populations that have not been previously exposed can result in large-scale mortalities (Osterhaus et al. 1990). An adult female sea otter was necropsied by WDFW and serology results were positive for dual infection with *S. neurona* and *T. gondii*. Histopathology results are pending (D. Lambourn, pers. comm.).

Sea otters are not known to have morbillivirus-associated mortalities in Washington, but of the 32 sea otters captured in 2000 and 2001, 81% tested positive for exposure to morbilliviruses (J. Davis, pers. comm.). The subadult female sea otter that was observed regularly near Dumas Bay and Redondo Beach (south of Seattle) from March 2001 until she was captured 15 February 2002, also tested positive for exposure to morbilliviruses (J. Davis, pers. comm.). High mortalities in both pinnipeds and cetaceans have been caused by morbilliviruses (Kennedy-Stoskopf 2001). For example, in 1988 an estimated 20,000 harbor seals and several hundred grey seals (*Halichoerus grypus*) died in Western Europe and the causative agent for this disease was in the genus Morbillivirus, similar to CDV and subsequently named Phocine Distemper (PDV) (Osterhaus and Vedder 1988, Mahy et al. 1988).

A herpes-like virus caused oral lesions in Alaskan sea otters, but the virus was considered of "minimal health significance" (Harris et al. 1990). Evidence of Phocine herpesvirus-1 exposure was found in 91.9% of free-ranging harbor seals tested between 1994-2002 in Oregon and Washington (Goldstein et al. 2003). Herpes-like lesions have been observed in sea otters captured in Washington (R. Jameson, pers. comm.).

Between August and late November of 2004 and continuing to date, an unusually large number of California (*Zalophus californianus*) and Steller sea lions (*Eumatopias jubatus*) have been reported moribund or dead in Washington and Oregon coastal waters. These sea lions exhibited behaviors indicative of infection with leptospirosis (e.g. immobility, drinking fresh water). Complete necropsies or kidney samples were taken from a subsample of animals and preliminary results of urine or kidney indicate at least 11 animals were positive for *Leptospira interrogans*, serovar *pomona* using polymerase chain reaction (D. Lambourn, pers. comm.). Washington sea otters tested positive for leptospirosis in 2002, but were not found during the 2004 outbreak in sea lions.

9.4 Marine Biotoxins

Two naturally occurring marine toxins are present along the west coast and in Washington waters that are capable of moving through the food chain and having significant effects on marine mammals. Paralytic Shellfish Poisoning (PSP) is produced by the dinoflagellate *Alexandrium catenella*. Crabs and bivalve shellfish (clams, oysters, mussels, and scallops) are filter feeders and have the potential to accumulate PSP toxins as they take in the *Alexandium* cells. PSP poisoning could have been the cause of some sea otter mortality at Kodiak Island, Alaska during the summer of 1987, although DeGange and Vacca (1989) and Kvitek and Bretz (2004) suggest sea otters are able to detect paralytic shellfish toxins and choose low-toxicity prey when available. In Washington, elevated levels of PSP have been documented along the outer coast and inside both Grays Harbor and Willapa Bay (D.

Ayres, pers. comm.). In 1992, the razor clam fishery along the outer coast closed due to levels of PSP in the gut tissue of 3,480 mg/100 g which is more than forty times the 80 mg/100 g action level (D. Ayres, pers. comm.). Elevated PSP toxin levels have not been found in sea otter carcasses examined from Washington.

Domoic acid is a naturally occurring toxin produced by marine diatoms (*Pseudo-nitzschia* spp.) that was first detected on the west coast of the United States in 1991 (Wekell et al. 1994). Filter-feeding shellfish (razor clams and crabs, for example) and fish can accumulate domoic acid without suffering ill effects; however, severe neurological symptoms and death are reported for humans that have ingested high concentrations of domoic acid (Perl et al. 1990, Teitelbaum et al. 1990). During May-October 1998, 70 California sea lions that had preyed upon significant amounts of anchovies and sardiness stranded and suffered from severe seizures attributed to domoic acid toxicity (Gulland 2000). There is no cure for domoic acid poisoning. Urine samples collected opportunistically from three male sea otters during captures in 2000 and 2001 were evaluated by NMFS Northwest Fisheries Science Center using receptor binding assay and High Performance Liquid Chromatography and neither test indicated the presence of domoic acid (J. Davis, pers. comm.).

The Northwest Fisheries Science Center of the NOAA is actively investigating how and why blooms of *Pseudo-nitzschia*, the organism capable of producing domoic acid, occur sporadically along the West Coast of North America and specifically the role of the Juan de Fuca eddy. A major algal bloom occurred off the coast of Washington in 2002, and domoic acid levels in razor clams peaked at 185 ppm at Copalis and Mocrocks, which is well above the 20 ppm threshold safe for human consumption. Shellfish tissues purify slowly and tests over six months later have shown domoic acid levels remained elevated with highest concentrations at 90 ppm at Kalaloch (D. Ayres, pers. comm.).

Domoic acid levels in razor clams are actively monitored by WDFW shellfish biologists. Impacts on sea otters if they expanded their range south and foraged on razor clams during these biotoxin outbreaks are unknown. People who eat affected shellfish may suffer from Amnesic Shellfish Poisoning. The effects of marine biotoxins on sea otters only recently have been studied, but early results suggest sea otters are able to detect and avoid lethal doses of at least one biotoxin (saxitoxin; Kvitek et al. 1991, Kvitek and Bretz 2004). A number of sea otter carcasses were found in 2002 within the range of beaches containing shellfish with high levels of domoic acid. Necropsies performed by NWHC found no evidence to support speculation that some of the sea otter mortalities in Washington may be attributed at least in part to individuals having consumed high concentrations of domoic acid in their prey.

9.5 Entanglement and Entrapment

Drowning of sea otters can occur when they are incidentally entangled in gill or trammel nets (Riedman and Estes 1990). Set-nets have entangled sea otters in Alaska (DeGange and Vacca 1989) and California (Wendell et al. 1985 *in* Kvitek et al. 1989). Net entanglement is believed to have killed an average of 80 sea otters per year in California between the mid 1970's and the early 1980's (Wendell et al. 1985 *in* Riedman and Estes 1990). Restrictions on the use of gill and trammel nets have been enacted in California at least in part to protect the sea otter population (USFWS 1996, 2003).

Under Section 118 of the MMPA, incidental mortality of marine mammals is regulated and take of marine mammals has to be either authorized or exempted. In Washington, non-treaty gill nets are prohibited throughout the current sea otter range on the outer coast of Washington, but tribal gill nets are used along the northern coast and into the Strait of Juan de Fuca. The Quinault, Queets, Hoh and Quileute tribes all use gill nets at river mouths near sea otter habitat.

Small numbers of sea otters have been documented being taken in the salmon gill net fisheries conducted by Makah tribal fishermen along the northern Washington coast and into the Strait of Juan de Fuca. This fishery is identified as the northern Washington marine set net fishery by NMFS and WDFW. Incidental takes of sea otters in this fishery are considered rare, but do occur. The Makah northern Washington marine set net fishery has typically operated in the Pacific Ocean and Strait of Juan de Fuca from 1 May to 15 September and targets Chinook salmon (*Oncorhynchus tshawytscha*) as well as green and white sturgeon (*Acipenser* spp.). This fishery operates in WDFW Marine Statistical Catch Areas 3, 4, 4A, 4B and 5.

Makah and NMFS biologists have monitored this fishery since 1988. From observer data collected in the northern Washington marine set gill net fishery from 1988 through 2001, few sea otters have been taken annually in Makah set net fisheries, with a total of 11 taken during this period (Table 8, D. Sones and NMFS/NMML, pers. comm.). Observer coverage for this fishery ranged from 5.5-100%. Ten of the sea otters were taken in Area 4, which is near the Point of Arches in the Spike Rock fishing grounds, approximately five miles south of Makah Bay, and one was taken to the south in Area 3, near Cape Alava (Fig. 2, D. Sones and NMFS/NMML, pers. comm.). No sea otters were reported observed or taken in the Strait of Juan de Fuca Marine Areas 4B or 5. From 1995-1997, experiments using acoustic alarms (pingers) were conducted in the fishery to test for reductions in harbor porpoise entanglement. During the three-year study, seven sea otters were taken incidentally in nets with no pingers and only one was taken in nets with pingers (Gearin et al. 1996) suggesting pingers may reduce sea otter mortalities in gill nets.

Table 8. Summary of sea otter incidental mortality in Makah tribal set gill net fisheries from 1988 to 2001 in Marine Areas 3, 4, and 4A in Washington. (Source: David Sones, Makah Tribe/Makah Tribal Fisheries and NMFS/NMML observer programs).

Year	Observer coverage (%)	Mortality by year
1988-1992	5.5-75.0	0, 1, 0, 0, 0
1993	no fishing effort	no fishing effort
1994-1997	29.7-100	2, 2, 5, 1
1998-1999	no fishing effort	no fishing effort
2000	100	0
2001	no fishing effort	no fishing effort

NMFS continues to work with tribal fishery managers to monitor incidental take of all marine mammals in their fisheries. Gerber and VanBlaricom (1999) noted that the potential for incidental take of sea otters in tribal set nets will likely increase as their number and range increases. In recent years, due to declining northwest salmon runs and subsequent restrictions in fishing seasons and quotas, tribal fishing effort along the northern Washington coast has declined (e.g. no fishing effort occurred in Marine Areas 4 and 5 in 1993, 1998-99, or 2001; Table 8). Treaty fisheries also use set and drift gillnets along the Strait of Juan de Fuca in the summer and fall, but sea otter numbers in the area are low and few entanglements would be expected.

Sea otters can drown in trap or pot gear used for crabs or cod. Seventeen sea otters are known to have been taken in various traps and pots used in Alaska and California (Newby 1975, B. Hatfield, pers. comm.). No sea otter deaths have been attributed to pot gear in Washington. Crab pots may be the most likely to capture sea otters, as many are used near shore. Evidence from California and Alaska suggests that the potential for incidental take of sea otters in crab traps will increase if the population expands its range south of Destruction Island into prime Dungeness crab fishing habitat. Black cod and shrimp pots are not likely to capture sea otters because they are generally used in deeper waters beyond typical dive depths (< 30 m) of sea otters.

9.6 Harvest

Sea otters were extirpated in Washington due to intensive commercial harvest for their valuable pelts. When sea otters from Alaska were reintroduced to the state's fauna in 1969 and 1970, the Washington Department of Game stressed its disinterest in once again exposing sea otters to harvest:

> The purpose of reintroducing the sea otter to its former Washington habitat is not to attempt to create a fur industry of economic importance, but to establish once again an unusual and interesting mammal that rightfully deserves a place in Washington's wildlife heritage.....The State Game Department does not contemplate any future trapping... (WDG 1969)

Native Americans of the Pacific Northwest have adjudicated tribal rights to various fish and wildlife resources in Washington State. The Quinault, Queets, Quileute, and Makah at Taholah, Queets, LaPush, Ozette and Neah Bay were known to have taken sea otters historically (Scheffer 1940, 1999). The Makah, S'Klallam, and Quinault tribes are known to have hunted sea otters in the past (Wagner 1933, Scheffer 1940). Outside of Alaska, there is no current directed harvest of sea otters by Native Americans. The Makah, in Article 4 of the Treaty of Neah Bay, reserved "the right of taking fish and of whaling or sealing." Other tribes reserved "hunting" rights in their treaties. The MMPA does not abrogate treaty rights. Any program developed by USFWS and respective tribes for sea otters would accommodate the Federal trust responsibility, treaty rights and requirements of the MMPA.

9.7 Habitat Loss

Since their reintroduction into Washington, sea otters have tended to congregate in areas with kelp cover. This association is characteristic of sea otters elsewhere. Kelp distribution has been relatively stable in Washington (Van Wagenen 1999), but threats to kelp canopy cover exist. Increased watershed sediment loads have negatively impacted nearshore kelp beds (Devinny and Volse 1978, Dayton et al. 1992, Shaffer and Parks 1994). El Niño events appear to affect *Macrocystis* negatively (Van Wagenen 1999), but research on this topic is lacking. Long-term effects of oil pollution on kelps has not been studied in detail, however short-term deleterious impacts have been documented (Antrim et al. 1995).

9.8 Genetic Diversity

The extirpation and reduction of sea otter populations as a result of commercial hunting in the 18th and 19th centuries created a population bottleneck and loss of genetic diversity for all sea otter populations. Reduced genetic variation, which is generally presumed to impart deleterious effects, can potentially result in inbreeding depression which could lead to reduced fecundity, higher juvenile mortality, and slower overall growth rates (Ralls et al. 1983). In addition, low genetic diversity reduces the ability of a population to combat unexpected biological and environmental events such as disease or El Niño events.

When considering the case of southern sea otters, Ralls et al. (1983) concluded the population theoretically retained a large proportion of its genetic diversity, despite having numbered as few as 50 individuals in 1914. Tests on mitochondrial-DNA sequences (Cronin et al. 1996) and electrophoretic variation (Lidicker 1997) support their conclusion. Subsequent analyses using restriction fragment length polymorphism of mitochondrial DNA (Bodkin et al. 1999) and microsatellites and mitrochondrial DNA (Larson et al. 2002a) show all existing populations (both remnant and translocated) exhibit low levels of genetic variation. This low observed genetic variation is also found in other species that have experienced population bottlenecks, such as northern elephant seals, which were reduced by hunting to a population of 10-30 seals (Hoelzel 1997).

Genetic diversity is a concern in Washington's present-day sea otter population. The population is descended from no more than 43 animals that were known to have survived the translocations in 1969 and 1970, however; the founder population may have been much smaller. In the early 1970's, no more than ten sea otters were reported seen (Bowlby et al. 1988) and the first systematic survey in 1977 found 19 individuals (Jameson et al. 1986). Tests on the mitochondrial DNA of Washington's translocated sea otters indicate a haplotype diversity loss of 16% relative to the source population at Amchitka Island (Bodkin et al. 1999).

A recent study examined the genetic variability in translocated populations in comparison to existing populations (including source) and found no evidence of reduced genetic variability despite the fact that translocated populations experienced two bottlenecks rather than just one (Larson et al. 2002a). Subsequent research that examined genetic material extracted from ancient sea otter skeletal elements obtained from a Makah midden near Ozette, located on the northern Washington coast, indicates the historical (pre-fur trade) sea otter population had significantly more genetic variation than existing populations of sea otters found in Alaska, Washington, and California (Larson et al. 2002b).

The closest sea otter population to Washington is located along the coast of Vancouver Island (just south of Estevan Point) approximately 160 kilometers to the north across the Strait of Juan de Fuca (Watson 2000, Nichols et al. 2003). Data suggest that sea otters are capable of traveling distances greater than 300 kilometers and tens of kilometers is not unusual (Garshelis and Garshelis 1984, USFWS 2003), which means gene flow between these two populations is possible. In some areas, discontinuities in habitat have effectively impeded gene flow (e.g. among island groups of the Aleutian archipelago; Scribner et al. 1997). Should Washington sea otters remain isolated from other populations and become impacted by any catastrophic decline in abundance, the population could experience further erosion of genetic diversity. It is hard to assess how the effects of low genetic variation could impact overall fitness of a population. Interchange with British Columbia sea otters is possible, which could lead to a more panmictic and genetically diverse population (Bodkin et al. 1999, Larson et al. 2002a).

10. CONCLUSIONS

Sea otters existed off the coast of Washington for thousands of years before they were extirpated by an intensive harvest for their valuable pelts during the 18th and 19th centuries. From about 1911 to 1969, sea otters were absent from the state, but in 1969 and 1970, 59 sea otters were reintroduced to the coast from Amchitka Island, Alaska. After a decade of uncertain status, the Washington sea otter population began to grow steadily. Since 1989, the population has grown at an average annual rate of 8.2%. The most recent survey in 2004 counted 743 sea otters in Washington and survey data show a positive trend.

The present sea otter range extends from just south of Destruction Island to Pillar Point, with concentrations in the vicinities of Duk Point, Cape Alava, Sand Point, Cape Johnson, Perkins Reef, and Destruction Island (Fig. 2), with almost half (46%) of the sea otter population located at Destruction Island. The existing distribution is restricted from the pre-exploitation range, which extended along the Olympic Peninsula south to the Columbia River (Fig. 2). Recent radio telemetry studies have increased understanding of sea otter movements within the current range.

Sea otters are predators of benthic invertebrates, consuming many pounds of prey each day to meet their high metabolic needs. Sea otters consume primarily shellfish species including sea urchins and a variety of clams and mussels that are important to commercial, recreational, and tribal fisheries. The growth and restoration of the sea otter population in Washington raises tribal and non-tribal fishery management issues.

Sea otters are highly vulnerable to oil spills. The limited geographic distribution of Washington sea otters and overlap of frequent vessel traffic transiting the Strait of Juan de Fuca effectively magnifies oil spill risk to the Washington population. Diseases have recently been detected in California and Washington sea otters. Continued monitoring of disease and mortality is necessary to increase understanding of impacts to the Washington sea otter population. Results from contaminant analyses will help shape future priorities. Management and recovery of sea otters in Washington is dependent on careful consideration of all of these issues as well as proactive communication, conservation efforts, and research among all involved federal, state and tribal resource management agencies and interest groups.

PART TWO: RECOVERY

1. RECOVERY GOALS

The goals of the sea otter recovery program are to implement strategies which will restore the sea otter population in Washington to a self-sustaining level and geographic distribution that will result in a high probability that sea otters will reside in Washington through the foreseeable future (>100 years); and to manage Washington's sea otter population in a manner consistent with the Marine Mammal Protection Act, state and federal laws, court rulings, and tribal treaty rights. The Recovery Plan outlines strategies that will enhance sea otter habitat and populations to the point where the sea otters will be considered for downlisting from state endangered or threatened status in Washington.

2. RECOVERY OBJECTIVES

Sea otters will be considered for downlisting from State Endangered to State Threatened status when:

1. The average population level over a 3-year period equals or exceeds 1,640 sea otters in Washington, and

2. Washington's sea otter population is distributed in areas outside the current range such that a single catastrophic event, such as a major oil spill, would be unlikely to cause severe decline or extirpation of the population.

Sea otters will be considered for downlisting from State Threatened to State Sensitive or Monitor when:

1. The average population level over a 3-year period equals or exceeds 2,187 sea otters, and

2. Management plans or agreements are in place by the state's sea otter co-managers that provide for the continued viability of the sea otter in Washington.

2.1 Rationale

Recovery Goals

WDFW bears a responsibility to preserve, protect, and perpetuate Washington's wildlife (RCW 77.12.010). However, state laws and regulations pertaining to the Washington sea otter stock are superseded by the U.S. MMPA (Section 109, 16 USC 1379). Accordingly, management of Washington's sea otter population is consistent with MMPA regulations and guidelines.

Objective 1 - *Population*

The recovery objectives to "downlist" Washington's sea otter population from Endangered to Threatened and from Threatened to Sensitive or Monitor status were based on habitat based carrying capacity estimates (Laidre et al. 2002). The MMPA defines the Optimum Sustainable Population (OSP) level for marine mammals as "the number of animals that will result in the maximum productivity of the population, keeping in mind the carrying capacity [K] of the habitat and health of the ecosystem" (16 USC 1362, Section 3, paragraph 9). In practice "the lower end of the OSP range (Maximum Net Productivity Level or MNPL) is assumed to occur at approximately 60% of... K" and this estimate has evolved into the operational definition for MNPL (DeMaster et al. 1996). A population below MNPL may be considered "depleted" under the MMPA.

The estimated linear carrying capacity for Washington is 2,734 if all habitat types (rocky, mixed, sandy) are occupied from the Columbia River to Dungeness Spit in the Strait of Juan de Fuca (Laidre et al. 2002). It is uncertain whether this population estimate is attainable in Washington, particularly in areas such as Grays Harbor, Willapa Bay and the Columbia River where significant alterations to habitat have occurred. Likelihood of movement by sea otters into these previously occupied estuaries was carefully considered and deemed possible; therefore, the most conservative carrying capacity estimate (2,734 sea otters) was chosen to establish recovery goals. WDFW will use a 3-year running average of the sea otter population in Washington to downlist from Endangered to Threatened and from Threatened to Sensitive status. The use of a 3-year running average of the population estimate is intended to reduce year-to-year variation and highlight overall population trends.

To reclassify the Washington population from Endangered to Threatened status, the population recovery objective is 1,640 sea otters or 60% of the estimated linear carrying capacity of 2,734 sea otters for the outer Olympia Peninsula coast and Strait of Juan de Fuca to Dungeness Spit and to the Columbia River, including Grays Harbor, Willapa Bay and the Columbia River estuaries (Laidre et al. 2002). Combined with the distribution objective, the Washington sea otter population will not be "seriously threatened with extinction throughout all or a significant portion of its range within the state" (WAC 232-12-297) when this population and distribution objective is achieved and it will be at the high end of its OSP range.

To reclassify the Washington sea otter population from Threatened status to Sensitive or Monitor status, the population recovery objective increases from 60 to 80% (2,187 sea otters) of the estimated linear carrying capacity of the outer Olympic Peninsula coast to the Columbia River (including Grays Harbor, Willapa Bay and the Columbia River estuaries) and the Strait of Juan de Fuca to Dungeness Spit (Laidre et al. 2002). In the future, if the Washington sea otter population does not expand its range to occupy coastal bays and estuaries, recovery objectives will be re-evaluated based on linear carrying capacity estimates excluding Grays Harbor, Willapa Bay and the Columbia River estuaries (Table 7, Laidre et al. 2002)

Objective 2 - *Distribution*

The current distribution of sea otters in Washington is restricted between Destruction Island and Neah Bay and leaves the population vulnerable to decline from catastrophic events. A broader distribution (e.g. along the southern outer coast and/or east into the Strait of Juan de Fuca) is needed to remove the threat to the population. If sea otters remain restricted primarily to the northern outer coast, the entire population could be affected by a single oil spill or other catastrophic event. In order to prevent a severe decline (or extirpation), the population should be geographically distributed so that a sustainable reproductive nucleus of sea otters would remain isolated and unaffected by such an event. To reclassify the Washington population from Endangered to Threatened status, distribution such that a single catastrophic event would be unlikely to cause the population to decline severely or be extirpated.

If interchange occurs between the Washington population and the British Columbia population, these recovery objectives may need to be reassessed. If sea otters from Washington and British Columbia begin to interbreed, it may reduce the risk of a catastrophic event causing extirpation because of an increase in geographic distribution as well as increase genetic diversity and overall fitness of the population.

Objective 3 - *Management Plan*

Cooperation through co-management is essential to the conservation of the Washington sea otter population. Agreements among state (WDFW, DNR), federal (USFWS, ONP, OCNMS), and tribal entities (Quinault, Queets, Hoh, Quileute, Makah, Jamestown S'Klallam, Port Gamble S'Klallam, and Lower Elwah Klallam) will provide a degree of certainty assuring co-managers will work together to maintain a self-sustaining population of sea otters in Washington which is necessary once they are downlisted from Threatened status.

3. RECOVERY STRATEGIES AND TASKS

Conservation and management of the Washington sea otter population is a cooperative effort with state, federal and tribal entities. The following overarching recovery strategies and specific tasks are detailed in this section and priority and agency or entity responsibility for implementation of each task is detailed in Table 9.

1. Monitor the sea otter population.

1.1 Conduct annual surveys of sea otter abundance and distribution.

In order to monitor population trends, shifts in distribution,, and range expansion, the potential sea otter range from the Columbia River to Dungeness Spit in the Strait of Juan de Fuca should be surveyed annually from the air. Shore-based surveys are probably the most accurate method for estimating sea otter abundance, but their usefulness is limited due to inadequate access to suitable viewing sites throughout the entire sea otter range in Washington. To complement ground-based observations, surveys should be completed from fixed-wing aircraft or helicopter. The search area should extend from the shoreline to at least the 20-fathom (36-m; 120-ft) isobath. The aircraft should travel at approximately 100 knots at an altitude of 500 to 700 ft. Two surveys per day should be completed over a period of three days (thus, six surveys of entire range, if conditions are favorable), with sea otters counted and photographed from the air. Simultaneous counts should be made from ground areas. The total survey count is calculated by summing the highest daily total for survey segments. This assumes there is little or no movement between segments during the survey period. Survey segments should be modified as sea otter distribution changes to ensure the entire population continues to be surveyed annually. Development of a correction factor to account for missed animals during annual surveys should be investigated.

Sea otter counts made from the aerial survey component should be used when ground counts are not available and when aerial counts are higher than ground counts. Pup counts should be based on counts made from ground areas because pups are difficult to distinguish from an airplane and often go undetected. These will provide an index of production in the population.

Observers should make periodic explorations beyond the survey area described above, in order to readily detect distribution shifts. The survey effort should be modified as needed to account for range changes to ensure all sea otters are surveyed. Collaboration with researchers in British Columbia conducting sea otter surveys is considered essential.

1.2 Conduct seasonal surveys of sea otter abundance and distribution.

To refine our understanding of seasonal distribution patterns, systematic surveys should be completed more frequently than once per year. Methods should be similar to those used during annual surveys, but may need to be modified to account for changing survey conditions throughout the year. Monthly surveys should be considered.

1.3 Establish a stranding network to recover sea otter carcasses and stranded animals in Washington to monitor the health of this population.

Establish a carcass recovery effort (stranding network) to determine levels and causes of mortality in Washington sea otters. Effort should be made to respond to beach-cast carcasses in a timely manner. Coordinate agency and volunteer efforts to notify responders, collect data and sea otter carcasses (if appropriate) including involvement of the Northwest Marine Mammal Stranding Network. When carcasses are in good condition they should be sent immediately for complete necropsy to the National Wildlife Health Center, or another appropriate laboratory. Establish and implement standardized protocols and procedures for data collection and handling of carcasses and/or live animals and conduct training of agency personnel on protocols and procedures. Ensure standardized data forms are used (Appendix B). A toll free number (1-877-326-8837; 187SEAOTTER) has been established to report sea otter strandings in Washington. Coolers and collection kit materials have been distributed to cooperating agencies (ONP and OCNMS) on the Olympic Peninsula to collect and ship sea otter carcasses. If stranded live animals are recovered, work with The Seattle Aquarium and Point Defiance Zoo and Aquarium to provide short-term holding or care facilities for sick or injured animals on a case by case basis.

2. Protect the sea otter population.

2.1 Develop an oil spill response plan for sea otters in Washington.

Procedures for standardized care of soiled sea otters have been developed by an oil spill task force (White 1998). The care standards address capture and transport protocols, rehabilitation protocols, housing requirements, record-keeping techniques, health and safety recommendations and training requirements for staff supervisors and animal care volunteers. Additional information on sea otter rescue following oil spills is presented by Bayha and Kormendy (1990), USFWS (1994), and Williams and Davis (1995).

Currently, there are two documents to guide initial response efforts for oiled sea otters in Washington: Washington Sea Otter Rescue Protocols (USFWS 1994), which sets forth standards and guidelines for capture and transport of oiled sea otters in Washington; and Alaska’s Sea Otter Response Plan (USFWS 1997), which provides guidance on capture, handling, transport and treatment of oiled sea otters.

USFWS and WDFW are building on these documents to create a comprehensive oil spill response plan specific to sea otters in Washington (C. Schexnider, pers. comm.). There are two primary additions necessary to make the plan specific for Washington. The first is to create more specific protocols, as needed, for initial response activities. Draft protocols developed thus far include procedures for notifying natural resource trustees participating in an oiled sea otter response, conducting beach and aerial reconnaissance to assess oil threat/impacts to sea otters, and contacting trained personnel to capture oiled sea otters.

The second aspect is to develop procedures for triage, stabilization, treatment, and release of captured sea otters. USFWS and WDFW have determined that the preferred option for rehabilitation of oiled Washington sea otters is to stabilize them in Washington. After being stabilized, sea otters would be transported to an appropriate facility capable of handling and rehabilitating oiled sea otters (e.g. California Department of Fish and Game (CDFG) Office of Spill Prevention and Response facility in Santa Cruz). Options also need to be developed if a facility outside the state were not available to care for oiled sea otters.

At this point in time we are not considering preemptive capture due to the inclement environment where the sea otter population is currently distributed and the lack of available personnel for preemptive captures.

2.2 Address incidental mortality of sea otters in fisheries.

Sea otters can die when entangled in nets or caught in traps, but little information is available on the extent of incidental take in Washington. Co-managers should document sea otter interactions and deaths in fishing gear to determine types of equipment involved, frequency of interactions, and vulnerable sexes or age classes of the sea otter population. Strategies should then be developed to minimize mortality.

There is an ongoing cooperative NMFS and Makah Fisheries Management observer program monitoring the Northern Washington Marine set net fishery, which operates in current sea otter range along the outer Olympia Peninsula coast and into the Strait of Juan Fuca (Catch Areas 3, 4, 4A, 4B and 5). This program is designed to assess interactions and mortality of various marine mammals, primarily harbor porpoise. Currently, no agreement is in place to monitor sea otter interactions. Incidental take is regulated under section 118 of the MMPA. NMFS, Makah Tribal Fisheries, and USFWS should coordinate efforts to address sea otter interactions if necessary.

2.3 Ensure protection of Washington sea otters.

WDFW and USFWS should lead an active education and enforcement program that ensures adequate protection of Washington sea otters. In the future, Washington tribes may develop and implement sea otter harvest and management plans under treaty rights in cooperation with USFWS. Any program developed by USFWS and respective tribes for sea otters would accommodate the Federal trust responsibility, treaty rights and requirements of the MMPA. WDFW should work with tribes and other co-managers (USFWS, OCNMS) to ensure that any proposed harvest or hazing of sea otters would not hinder recovery efforts.

3. Protect habitats used by sea otters.

3.1 Prevent oil spills that could affect areas frequented by sea otters.

The OCNMS has identified an Area To Be Avoided by vessels transporting petroleum or other hazardous materials using the northern coast. Compliance is not mandatory, but should be encouraged. The use of the Area to Be Avoided by OCNMS (Galasso 2000) should be continued and additional areas should be considered for delineation.

3.2 Respond to oil spills to minimize their effects on sea otter habitats.

Whenever feasible, shorelines and waters used by sea otters should be protected from pollution by spilled oil. Portions of the Washington coast are provisionally approved for in-situ burning, a method to remove oil from the water's surface through controlled ignition and burning. Chemical dispersants are also pre-approved for use in offshore areas greater than three nautical miles from the shorelines of the outer coast. Oil skimming vessels, while having limited ability to collect significant quantities of oil in offshore environments, may still be useful in reducing certain shoreline impacts.

4. Establish information management and retrieval systems.

4.1 Centralize data collected during Washington sea otter assessment surveys.

WDFW should maintain a centralized data base of Washington sea otter survey data and results to ensure accurate and consistent information is shared with sea otter co-managers and the general public. WDFW maintains a centralized statewide database (Wildlife Resource Data System) and will retain copies of data collected during annual sea otter surveys.

4.2 Maintain a centralized mortality database.

USFWS will maintain a centralized database on sea otter mortalities in Washington, including data from carcass recovery forms and necropsy reports. USFWS should provide notification and information to cooperating agencies on collection of carcasses and necropsy reports during each year.

5. Develop public information and education programs.

5.1 Implement a proactive public information dissemination program for use during oil spills. Ensure that information on sea otters in Washington and on rescue and rehabilitation protocols are readily available to be shared with the public and media in the event of an oil spill. Human activity in response to oil spills is intense and an uncoordinated information system can exacerbate confusion. Pooled media coverage, employing a partnership between agency public information specialists and a sea otter biologist, will ensure consistent presentation of spill details as they relate to sea otter effects and rehabilitation efforts.

5.2 Enhance public awareness of sea otter status and threats.

Encourage media attention to the sea otter population in Washington. Stockpile videography and still photography to provide to the media as needed. Issue news releases after annual surveys. Place sea otter information on agency web sites. Make presentations to schools, interest groups, and scientific gatherings. Publish survey and research results promptly in scientific journals, proceedings, and technical literature. Work with conservation organizations (e.g. Friends of the Sea Otter, Defenders of Wildlife and the Humane Society of the United States) to assist with outreach and education on the recovery needs, status and threats to sea otters in Washington.

5.3 Initiate information and education programs to reduce human interactions with sea otters.

Sea otters displaying little fear of humans have appeared in Puget Sound and have interacted with humans. WDFW and USFWS should develop and post educational signs in areas of the Olympic Coast, Puget Sound, and San Juan Islands that describe MMPA restrictions regarding marine mammals and the negative consequences of people interacting with sea otters.

5.4 Identify appropriate safeguards for regulating sea otter ecotour activities.

Washington sea otters on the outer coast generally have received only sporadic exposure to human activity. Because they have not habituated to human presence, they may be particularly susceptible to disturbance from any ecotour activities that may develop. Shorebased sea otter viewing should be encouraged.

Restrictions and guidelines on air and boat proximity to marine mammals should be widely publicized and linked to other public outreach campaigns to reduce human impacts on sensitive coastal wildlife (Tenyo Maru Oil Spill Natural Resource Trustees 2000). Existing guidelines developed for other marine mammals include: OCNMS prohibitions on flights below 2000 feet, within one mile of coastline or refuge island; NMFS Marine Mammal and Whale Watch Guidelines for not flying below 1,000 feet and avoiding boat approaches closer than 100 yards of marine mammals; and USFWS Refuge guidelines of a 200-yard buffer to refuge islands. Effectiveness of these guidelines for sea otters is uncertain. Guidelines for aerial and vessel viewing of sea otters should be developed, in cooperation with co-managers and ecotour operators, that prevent harassment of sea otters. Guidelines for watching marine wildlife have been developed by NMFS, WDFW's Watchable Wildlife Program, and others.

5.5 Establish protocols to address "nuisance" animals.

Establish procedures for responding to "nuisance" sea otters. Develop agreements and coordinate among state and federal agencies and zoo and aquarium facilities, such as The Seattle Aquarium or Point Defiance Zoo and Aquarium, to hold animals after capture in order to complete health and disease screening before release. Establish protocols to determine when a sea otter becomes a "nuisance" sea otter and requires removal and relocation. Work with the public to discourage interactions with animals that might lead to a sea otter being determined a "nuisance". Coordinate among agencies and facilities to address media needs/responses in the event that an animal becomes a "nuisance" and requires relocation. Cases of "nuisance" animals will be handled individually with consultation as necessary between WDFW and USFWS under authority of Section 109H of the MMPA.

A cooperative process among state managers (federal, state and tribal) has been developed for multi-jurisdictional sea otter incident response and is currently in draft form. The mission statement of this agreement is to preserve and protect Washington's sea otter population, provide for human health and safety, clarify authorities, and delineate jurisdictional questions while providing guidance for timely and effective response to problematic sea otter incidents. This document is in the process of being finalized.

6. Undertake research that will facilitate and enhance recovery efforts.

Research is essential to future management of sea otters in Washington and will be used to revise future recovery goals, if needed. The following tasks are expected to have the greatest potential to specifically address immediate issues relating to near-term recovery and management of Washington's sea otters. Broad participation and cooperation will be required. No cost estimates are available for most of these projects.

6.1 Determine long-term growth and expansion of the population in Washington.

There is currently no research on Washington sea otters being conducted to determine natural history parameters related to long-term growth and expansion. Future research should focus on marking a representative sample of Washington's sea otter population including juveniles, which would be expected to disperse more widely into unoccupied areas. Animals will have to be instrumented with radio transmitters and/or marked with tags and monitored frequently to identify individuals dispersing into new areas. Investigate movements, habitat use, and food habits of sea otters at Destruction Island to determine and monitor potential southward expansion of the population.

6.2 Determine if interchange is occurring between Washington and British Columbia sea otter populations.

Maintaining genetic diversity is important for the overall fitness of the Washington sea otter population. Expansion of the Washington sea otter population north and genetic interchange with the British Columbia sea otter population is possible. Capture and mark animals at the north end of the current sea otter range in Washington to monitor for movement to British Columbia. Work with British Columbia researchers to monitor animals in British Columbia to determine if interchange is occurring. Determination of whether sea otters are moving between British Columbia to Washington will depend upon research efforts in British Columbia.

6.3 Determine abundance, distribution and quality of food resources available to sea otters in current and potential habitats.

Conduct studies to determine type and abundance of prey resources available to sea otters in the three available habitats (rocky, sandy, mixed) within the historic sea otter range in the state. Prey availability will affect sea otter population growth and range expansion. Information on prey distribution and abundance in the available habitats will help refine carrying capacity estimates in the future.

6.4 Inventory kelp distribution.

Washington Department of Natural Resources (DNR) is responsible for managing the state's kelp resources and OCNMS has identified kelp as an integral component of the nearshore ecosystem. WDFW should encourage DNR and OCNMS to continue a kelp inventory in order to monitor long-term trends in macroalgae distribution in Washington waters. DNR has generously made data available, those data have been reviewed, and collaboration will continue to determine its usefulness in sea otter management efforts.

6.5 Estimate sea otter survival rates in Washington

Data on juvenile and adult survival is needed to determine sea otter life history parameters specific to Washington such as survival rates from birth to weaning, from weaning to age 1 or 2, and during adulthood. Life history parameters are largely unknown for Washington sea otters and will be useful for predicting population trends.

Data that have been collected from Washington sea otters should be examined to assist in determining survival rates and age at first reproduction. Data from tagged animals will be useful.

7. Coordinate and cooperate with public agencies, landowners and nongovernmental organizations, and secure funding sources for recovery efforts.

7.1 Cooperate with entities involved with sea otter research and monitoring.

WDFW should be involved, to the greatest extent possible, with monitoring, management, and research related to Washington's sea otter population. WDFW's recovery plan process has brought participants together to consider long-term management of Washington's sea otter population. These parties should continue to meet to implement and modify recovery strategies, focus research and coordinate monitoring efforts.

7.2 Secure funding to support recovery efforts.

Cooperative projects and grants should be pursued to provide ongoing funding for recovery tasks. Creative avenues for expanding the funding base should be explored. In the event of an oil spill that affects sea otters or their habitat, funding for sea otter recovery efforts should be sought as part of a negotiated spill settlement and restoration plan.

8. Prepare for direct management or intervention.

8.1 Develop a strategy to reduce sea otter-fishery conflicts.

Sea otters can be expected to impact important commercial, tribal, or recreational fisheries as they expand their range in Washington. The WDFW and co-managers must be prepared to address resource conflicts between sea otters and humans if sea otters enter sensitive shellfish areas. Sea otter and fishery co-managers should undertake cooperative, proactive planning for handling sea otter-resource conflicts prior to further sea otter range expansion and fishery impacts and develop and evaluate alternative management strategies. Development of management strategies in Washington should benefit from and build on the experiences of managers in other areas who have been addressing these issues. A review of sea otter management experiences in California and Alaska, with an assessment of short- and long-term effectiveness, relative permanence of effects, and cost-efficiency is encouraged. Public sentiment toward management approaches should also be included. Any program developed by USFWS and respective tribes for sea otters would accommodate the Federal trust responsibility, treaty rights and requirements of the MMPA.

IMPLEMENTATION RESPONSIBILITIES AND COST ESTIMATES

The strategies and tasks on the following pages identifies priorities, co-managers, WDFW involvement, and estimates of annual expenditures (if available). The following conventions are used:

Priority 1	Actions necessary to prevent the extirpation of the species from Washington and to monitor the population.
Priority 2	Actions to prevent a significant decline in species population or habitat quality, or some other significant negative impact short of extirpation.
Priority 3	All other actions necessary to meet recovery objectives.

Management Agency and Entity Acronyms:

DFO	Department of Fisheries and Oceans - Canada
DNR	Washington Department of Natural Resources
NMFS	NOAA National Marine Fisheries Service
OCNMS	NOAA Olympic Coast National Marine Sanctuary
ONP	Olympic National Park
TC	Tribal Councils
USCG	United States Coast Guard
USFWS	USDI Fish and Wildlife Service

WDFW Program Acronyms and Abbreviations:

CONT	Contracts
DATA	Wildlife Resource Data System
ENF	Enforcement
ES	Endangered Species
IE	Information and Education
MED	Media
MMI	Marine Mammal Investigations
RA/MR	Resource Assessment, Marine Resources
SPILL	Spill Response
WD	Wildlife Diversity
WW	Watchable Wildlife

Implementation of Recovery Strategies is contingent upon availability of sufficient funds to undertake Recovery Tasks.

Table 9. Implementation and cost estimates for Washington State Recovery Plan for the Sea Otter.

Priority	Recovery Task	Responsible Agency/Entity	WDFW Involvement	Estimated Annual Cost
1	1.1 Conduct annual surveys of sea otter abundance and distribution	WDFW, USFWS, OCNMS, ONP, DFO	MMI	$10-12,000
1	1.2 Conduct seasonal surveys of sea otter abundance and distribution.	WDFW, USFWS, OCNMS, ONP	MMI	$10-12,000
1	2.1 Develop an oil spill response plan for sea otters in Washington	USFWS, WDFW, OCNMS, ONP	SPILL, MMI	TBD
1	3.2 Respond to oil spills to minimize their effects on sea otter habitats.	USFWS, USCG, WDFW, OCNMS, ONP, DOE	SPILL, MMI	TBD
1	7.2 Secure funding to support recovery efforts.	WDFW, USFWS, OCNMS, ONP, TC	MMI, WD, SPILL, CONT	TBD
2	2.2 Address incidental mortality of sea otters in fisheries.	USFWS, NMFS, WDFW, OCNMS TC	MMI, RA/MR	TBD
2	1.3 Establish a stranding network to recover sea otter carcasses and stranded animals in Washington to monitor the health of this population.	USFWS, WDFW, OCNMS, ONP	MMI	$6-8,000
2	5.5 Establish protocols to address "nuisance" animals	USFWS, NMFS, WDFW, OCNMS TC, ONP	MMI	TBD
2	3.1 Prevent oil spills that could affect areas frequented by sea otters.	OCNMS, USFWS, WDFW, USCG, ONP	MMI, SPILL	TBD
2	2.3 Ensure protection of Washington sea otters.	USFWS, WDFW, OCNMS, NMFS, ONP, TC	ENF, IE, ES, MMI	TBD
2	6.1 Determine long term growth and expansion of the population in Washington	WDFW, USFWS, OCNMS, NMFS, ONP	MMI	$100-120,000
2	6.2 Determine if interchange is occuring between Washington and British Columbia sea otter populations.	WDFW, USFWS, DFO, OCNMS, ONP	MMI	$100-120,000
2	6.3 Determine abundance, distribution, and quality of food resources available to sea otters in current and potential habitats.	OCNMS, WDFW, USFWS, NMFS, ONP	MMI	TBD
2	6.4 Inventory kelp distribution.	DNR, OCNMS, WDFW	MMI	TBD

Priority	Recovery Task	Responsible Agency/Entity	WDFW Involvement	Estimated Annual Cost
2	7.1 Cooperate with entities involved with sea otter research and monitoring.	WDFW, USFWS, OCNMS, ONP, DFO, TC	MMI, WD	TBD
2	8.1 Develop a strategy to reduce sea otter-fishery conflicts.	WDFW, USFWS, TRIBES, OCNMS, NMFS	ES, MMI, RA/MR, ENF	TBD
3	4.1 Centralize data collected during Washington sea otter assessment surveys	WDFW, USFWS, OCNMS, ONP	MMI, DATA	$3-4,000
3	4.2 Maintain a centralized mortality database	USFWS, WDFW, OCNMS, ONP	MMI	$3-5,000
3	5.1 Implement a proactive information dissemination program for use during oil spills.	USFWS, WDFW, OCNMS, ONP	SPILL, MMI, MEDIA	$5,000
3	5.2 Enhance public awareness of sea otter status and threats.	USFWS, WDFW, OCNMS, ONP, TC	SPILL, MMI, MEDIA	TBD
3	5.4 Identify appropriate safeguards for regulating sea otter ecotour activities.	USFWS, OCNMS, WDFW, NMFS, USFWS, ONP, TC	MMI, WW, ENF	TBD
3	5.3 Initiate information and education programs to reduce human interactions with sea otters.	WDFW, OCNMS, USFWS, ONP, TC	MMI, MEDIA, WD	TBD
3	6.5 Estimate sea otter survival rates in Washington	WDFW, USFWS, OCNMS, DFO	MMI	TBD

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Appendix A. 1977-2004 summer sea otter surveys for three segments of the Washington coast, and 1995-2000 winter locations (x) of a group of sea otters in the Strait of Juan de Fuca (Jameson et al. 1986; R. Jameson and S. Jeffries, unpub data; pers. comm.).

	77	78	81	83	85	87	89	90	91	92	93	94	95	96	97	98	99	00	01	02	03	04
NORTH																						
Waddah Island															5							
Tatoosh Island												1			4		5	2				
Fuca Pillar																	1					
Makah Bay/Waatch Pt.								1	65	60	80	48	60	40	18	11	5	5	5	48	2	2
Portage Head/Anderson Pt														1							8	14
Pt of Arches/ Father & Son									1				3	2	9	7	16	5	52		1	28
Duk Point						12	53	71	2			65	110	3	26	14	43	35	55	43	128	14
Ozette River						2					1	1	3	1			1					
Subtotal						14	53	72	68	60	81	115	176	47	62	32	71	47	112	91	139	58
CENTRAL																						
W Bodelteh																	1	2				
Ozette/Cape Alava	8	1	21	19	11	13	33	20	56	38	34	19	58	129	120	143	116[a]	48	63	56	23	77
S.Ozette Island				15				12				1	1	2	47			2	2			11
White Rock						2									7		1		11	6	1	3
Submarine Rock											15	1	1									
Sand Point			1	2	33	22	34	36	34	21	26	34	8	112	48	33	36	15	51	17	22	21
North Point						3						5				1						
Yellow B Area						5	47	28	46	45	4	78	55	60	4	15	18	34	28	25	25	27
Off Yellow B						3										35						3
Kayostla Beach						1				36							3		1		1	
Cedar Creek						1			14	17	48	11	6	20	11	15	11	42	33	30	21	36
Jagged Island					9						10	29	12	5	8	1	1	16		7		18
Carroll Island													1					1				
Sandy Island		5									1	1		1		6	4		1	1	10	5
Bluff Point										21							56			1		
Cape Johnson	1		11	9	4	25	8		18	30	41	13	2	7	63	35	15	95	59	45	64	71
S. Cape Johnson						2			12		5				14		13		7	2	1	3
James Island								10					2					1				
Subtotal	9	6	12	26	46	77	122	106	180	208	184	173	146	207	322	141	275	256	256	190	168	275
SOUTH																						
Quillayute Needles																1				1		
Giants Graveyard	4					1	5	3	3	1	13	1	8	7	5		2	8	10	1	1	2
Toleak/Strawberry									1	11	2	3		1	2			1	5			
Goodman Creek																			1	6	2	8
Hoh R/Perkins R						1			1			1	13	13	31	13	85	61	30	57	88	9
Diamond Rock																			25	24	4	49
Destruction Is.	6	6	3	7	8	6	28	30	23	33	27	48	52	26	80	103	171	129	116	181	270	342
Willoughby Rk.																		1				
Subtotal	10	6	3	7	8	8	33	33	28	45	42	53	73	47	118	117	258	200	187	270	365	410
TOTAL	19	12	36	52	65	99[b]	208	212	276	313	307	360	395	430	502	433	604	503	555	551	672	
Neah Bay													X	X	X	X	X					
Shipwreck Point																X	X					
W of Pillar Point																		X				

[a] Minor addition error found in 1999 Cape Alava count data therefore the total was adjusted down by one from previous reports (R. Jameson, pers. comm.)
[b] Total for 1987 adjusted upward from the total presented previously because of an error in addition in the original data set (R. Jameson, pers. comm.).

Appendix B. Responses to written public comments received on the 2000 Draft Washington State Recovery Plan for the Sea Otter.

Section	Comments and Response
Exec Summary	The statement that sea otters "may eventually be harvested by Indian tribes" should be deleted; there is no basis for the statement. *This statement has been deleted.*
Taxonomy	You suggest that the original Washington population may have been intermediate between *E. l. nereis* and *E. l. kenyoni*, but more closely allied with the latter (Wilson et al. 1991)." My examination of prehistoric remains of sea otters dating to the last 1,000 years or so (Lyman 1988) from Oregon, suggests sea otters there were, at least in terms of tooth dimensions, intermediate between Alaskan and California sea otters. On late Pleistocene (ice age) sea otter remains, see Mitchell (1966) and Kilmer (1972). *Information was added to the plan on results of research that examined genetic material extracted from sea otter skeletal elements obtained from a Makah midden near Ozette on the northern Washington coast. The analyses of the genetic material indicated that the historical (pre-fur trade) Washington sea otter population was most closely related to the Alaskan subspecies (E.l. kenyoni) (Larson et al. 2002b).*
Stock Definition	We do not agree that the MMPA limits its definition to U.S. waters. To the contrary, one of the primary purposes of the MMPA is to promote the international conservation of marine mammal species, and there is no reason that its definition of population stock would not apply to animals located in Canada. *We agree that the MMPA is intended to promote international conservation of marine mammal species and that the sea otter population in British Columbia is a separate population, however only marine mammal "stocks" that occur in waters under US jurisdiction are recognized under the MMPA. The sea otter population that occurs in British Columbia waters is not recognized as a "stock" under the MMPA.*
Distribution	Based on numerous historical books I've read which contain no mention of sea otters in the straits, I doubt sea otters were numerous within the inner strait areas, although plenty of kelp beds are present. Based on an 1832 account of the Makah tribe having quantity of sea otter and the Klallam tribe beaver; the sea otter being far more valuable than beaver tells me if any quantity of sea otter were available, the Klallams would have concentrated on sea otters. *Little information exists on the exact distribution of sea otters in Washington before the population was extirpated. The plan discusses the uncertainties about early distribution. There is mention of trading for sea otter pelts at Neah Bay and Dungeness Bay in 1790 (Wagner 1933) and of live sea otters captured north of Discovery Bay in the "interior" of the Strait of Juan de Fuca.* The archeological record of sea otter remains from Sucia Island and cited by Kenyon (1969) is reported in the archaeological literature by Kidd (1971). *This has been added to the recovery plan.*

Section	Comments and Response
	You need to incorporate data on sea otter mortalities in summer 2000. *These data have been added to the recovery plan.* Lyman examined the reports for numerous archaeological sites in the Strait of Georgia, as well as the eastern portion of the Strait of Juan de Fuca and Puget Sound. There is *minimal* prehistoric evidence for sea otters in any of these areas; all sites known that have produced remains of sea otters are plotted on the enclosed figure and listed in a table, along with pertinent references. Some references are more up-to-date than those in the draft (e.g. Huelsbeck 1983, Wigen 1982). *This information has been added to the plan.* Numerous archaeological sites have been excavated along the salt-water coast of Washington, from Whatcom County through Puget Sound, along the Pacific Ocean coast, and around the mouth of the Columbia River. Unfortunately, recovered faunal remains from many of these sites have not been identified or reported, so it is somewhat tenuous to take the negative evidence - areas where there is no evidence of prehistoric sea otters - at face value. Sea otters may well have been in such areas as the Strait of Georgia and Puget Sound, but the evidence for their presence there does not exist or is weak, at best. *This information has been added to the plan and the uncertainty noted.* The account of sea otters off Goodman Creek might not be river otters, which also use saltwater areas. I say this because the Hoh Tribe was seeing a couple of sea otters around 1950. A deceased friend of mine who certainly knew what river otters were, told me that during the 1950's he and a friend were camped out on Ozette Island and he was positive he saw some sea otters. *If the report at Goodman Creek was actually sea otters, they would probably have had to have been either a small relict group that went undetected for decades, or a group that roamed to Washington from either California or Alaska. It is unlikely they would have roamed from as far away as California or Alaska. We are not aware of otters being seen in the 1950's. We have no way to know whether this report was accurate or not. The anecdotal notes about sea otters in the 1950's have been added to the plan.* There are references in the Journals of Lewis & Clark that refer to sea otters in the Columbia River. On Oct 23, 1805, Lewis reported “Great numbers” of sea otters at Celilo Falls (near The Dalles); again on Nov 1, 1805, Clark reported “Great numbers of Sea Otters in the river below the falls” at what is now Cascade Locks. Based on relevant pages from Burroughs (1995) on sea and river otters, I don’t think these naturalists and explorers would have mistaken river otters for sea otters.

Appendix B. continued. Responses to written public comments received on the 2000 Draft Washington State Recovery Plan for the Sea Otter.

Section	Comments and Response
	While it was reported that Lewis and Clark observed "Great numbers" of sea otters at Celilo Falls (near the Dalles) on the Columbia River, Clark himself later corrected his journals and noted those animals that he believed were "sea otters" were actually harbor seals (Cutright 2003).
	Charlie McIntyre was the last known Caucasian sea otter hunter who died around 1941-2 in Aberdeen. I believe McIntyre's last hunt was in 1906 producing only 4 otters worth $300.00 each. Apparently McIntyre and some Quinault Indians were the best hunters producing the most pelts.
	These anecdotal reports have been added.
Natural History	The role of disease as a source of sea otter mortality should be revised in the plan. Over the last few years, 40% of southern sea otter mortality was attributed to disease.
	Additional information on the role of disease in sea otter mortality has been added to the recovery plan and current references (Thomas and Cole 1996, Lindsay et al. 2000, Cole et al. 2000, USFWS 2003, Kreuder et al. 2003) have been added.
Population	Discussions of carrying capacity do not account for the possibility of a much broader range in WA; you must be careful not to adopt too limited a definition of historic K.
	Carrying capacity estimates for Washington were developed by Laidre et al. (2002) and have been incorporated into the recovery plan. These estimates address the historic range of sea otters within Washington.
	The range-wide population estimate of 126,000 sea otters is likely to be high based on recent information about severe declines in Alaska.
	This information has been added.
Habitat	Tidelands (extending to mean lower low water) within Olympic National Park are under the jurisdiction of the National Park Service.
	This has been corrected.
Conservation	The spring 2000 sea otter survey results in California need to be interpreted cautiously - the results are not sufficient to show that the declining trend has reversed. Two key sea otter experts, Jim Estes and Brian Hatfield, instrumental in carrying out the southern sea otter census, have indicated that we would need to observe 3-4 years of high spring counts before being confident that the downward trend observed in 4 of 5 last years in the southern sea otter, has been reversed.
	The California sea otter population status has been updated based on data presented in USFWS 2003 and Hatfield 2004.

Section	Comments and Response

In the discussion of the Marine Mammal Protection Act (MMPA), you should include a brief discussion regarding allowing marine mammals to achieve optimum sustainable population levels.

A discussion of optimum sustainable population levels under the MMPA has been added to the plan in the carrying capacity section and under the rationale for recovery objectives.

Management Activities
Fishery Interactions

The sentence: "Intense predation by otters, in combination with a low recruitment rate of urchins, is likely to preclude a sustainable commercial or recreational sea urchin harvest..." should also include "intensive human harvesting."

This has been added to the recovery plan

A field study is currently being conducted in conjunction with the U.S. Army Corps of Engineers, the National Marine Fisheries Service, the Makah Indian Tribe, and Taylor Shellfish Farms in Neah Bay, Washington, evaluating the possibility of developing an aquaculture for purple-hinged rock scallops. You may want to consider including a section on potential rock scallop aquaculture as an additional type of commercial fishery.

Shellfish aquaculture and its potential role in sea otter fishery related issues is speculative at this point; however, the following sentence was added to the "Bivalve" section under Fishery Interactions **-** *"The role shellfish aquaculture may play in fishery interactions with sea otters in the future is unknown." Acquisition of aquaculture permits in Neah Bay has not been confirmed. Multiple attempts were made to contact Taylor Shellfish Farms, but no confirmation of the research described above was made.*

Factors Affecting Continued Existence

The oil spill section might benefit by referring to the report by French (April 2000), "Review of Draft Southern Sea Otter Recovery Plan (Revised) Sections on Oil Spill Risks and Impacts". Much of the modeling Dr. French used is an attempt to update and critique the reports by Ford and Bonnell (1995), "Potential Impacts of Oil spills on the Southern Sea Otter Population" and Brody (1992), "Using Information About the Impact of the Exxon Valdez Oil Spill on Sea Otters in South-Central Alaska to Assess the Risk of Oil Spills to the Threatened Southern Sea Otter Population". Both of these reports were contained in the 1996 draft of the southern sea otter recovery plan.

The limited distribution of sea otters in Washington, coupled with well-defined nearshore current patterns, presents a situation where any spill into nearshore waters within 10 miles of the coast could potentially affect the entire range currently occupied by sea otters. There are no NOAA models available to predict oil behavior for the outer coast of Washington. It is noted in the recovery plan that oil spill models from other areas do not apply to Washington because of the relative simplicity of the system. The use of oil spill trajectory

Section	Comments and Response
	models in assessing risk to sea otter populations has been useful in areas such as California and Alaska where the sea otter range is extensive and the oceanographic processes are complex. As also noted in the plan, there are very few viable response options for the outer coast. There are no sea otter use areas where deployment of oil exclusion boom is a viable option even if modeling were able to predict which coastal areas were likely to be effected by an oil spill.
	The contaminants section should be updated and incorporate a more detailed explanation of the potential for exposure, body burdens and potential effects of environmental contaminants on sea otters. Some additional references include: Williams et al. 1995 and Lefebvre et al 1999, Kannan et al. 1989, Ross et al. 2000, Tanabe et al. 1994, Bacon et al. 1999, Kannan et al. 1998. Discuss thresholds & effects on other marine mammals (Ross et al. 1995, 1996, 2000) re: potential relevance to sea otters inhabiting the same waters.
	The contaminants section of the plan has been updated and expanded.
	The Entanglement and entrapment section should be updated to note the 120-day emergency order on 13 September 2000 by California Department of Fish and Game Director, which "prohibits the use of gill or trammel nets in ocean waters which are 60 fathoms (360 ft) or less in depth in an area extending from Point Reyes, Marin County, to Yankee Point in Monterey county. Also closed is an area of water 60 fathoms or less in depth from Point Arguello to Point Sal in Santa Barbara County.
	The entanglement and entrapment section of the plan has been updated to include some information and provide references to California state laws effecting gill, trammel, and live trap fisheries.
	There should be a discussion on any kelp harvesting activities in Washington which might have an impact on areas sea otters inhabit, as well as sea otter behavior.
	This has been added to the recovery plan.
	The statement that "Direct and indirect effects of human activities on sea otters have not been well studied" is subjective and doesn't reflect attempts to investigate the impacts of human recreational impacts on sea otters in Monterey Bay (Curland 1997). There is a lack of data to support or refute that sea otters "appear to have habituated to human activities". There are preliminary steps being undertake to conduct a follow-up study to assess human impacts to sea otters in Elkhorn Slough, California.
	While there have been few studies on direct and indirect effects of human activities on sea otters and future studies are being planned, our Recovery Strategies and Tasks, Section 5.4, identify appropriate safeguards for sea otter ecotour activities.

Appendix B. continued. Responses to written public comments received on the 2000 Draft Washington State Recovery Plan for the Sea Otter.

Section	Comments and Response
	The plan should address the possibility of boat-based eco-tourism directed at sea otters here. *Identifying appropriate safeguards for sea otter ecotour activities has been addressed in the Recovery Strategies and Tasks, Section 5.4.* It has not been legally determined that the provisions for hunting in any of the tribe's treaties apply to harvest of sea otters; we request that the plan reflect this. *It is correct that there has been no legal determination regarding tribal harvest of sea otters in the lower 48 states and this statement has been added to the plan. Outside of Alaska, there is no directed harvest of sea otters by Native Americans. Any program developed by USFWS and respective tribes for sea otters would accommodate the Federal trust responsibility, treaty rights and requirements of the MMPA.* Almost the entire distribution of sea otters in Washington is currently adjacent to tribally-owned or customary or traditional hunting grounds - this should be mentioned in the section re: the potential impact of future tribal activities on sea otters. *This has been added to the recovery plan in the ownership and management section.* We disagree with the statement that the MMPA does not abrogate treaty rights; the issue is, at best, an unsettled legal question. The statement should be deleted. *The MMPA does not do away with treaty rights. Treaty rights to hunt and fish are guaranteed to Native Americans. The Makah tribe, in Article 4 of the Treaty of Neah Bay, reserved "the right of taking fish and of whaling or sealing." Other tribes reserved "hunting" rights in their treaties. Any program developed by USFWS and respective tribes for sea otters would accommodate the Federal trust responsibility, treaty rights and requirements of the MMPA.*
Rec. Objectives	The draft plan does not set an appropriate limit for downlisting of the species. *The recovery objectives have been revised.* The term "viability" is not consistent with the Marine Mammal Protection Act; the plan should use Optimal Sustainable Population (OSP) and Potential Biological Removal (PBR), especially regarding harvest. PBR needs to be calculated in a way that considers indirect anthropogenic pressures that may need to be accounted for as otters move into more heavily populated and polluted areas. With regard to having management plans in place...that provide for continued viability, agreements should instead reflect ongoing movement towards the desired population recovery objectives and the MMPA.

Appendix B. continued. Responses to written public comments received on the 2000 Draft Washington State Recovery Plan for the Sea Otter.

Section	Comments and Response
	A discussion of optimum sustainable population levels under the MMPA has been added to the plan in the carrying capacity section and under the rationale for recovery objectives. The issue of PBR is important relative to human caused mortality and will be addressed in the development of a managment plan for sea otters in Washington. The objective for "management plans in place that provide for continued viability" addresses management after the recovery objectives have been met.
	The recovery plan should contain an indication of what would and would not be an acceptable distribution - perhaps it could be based on the best available sea otter habitat data and predicted oil spill scenarios. If distribution between Destruction Island and Tatoosh Island is too restrictive, what range would not be?
	An appropriate distribution such that a catastrophic event would not effect the entire population might be additional animals along the southern outer coast, and/or east into the Strait of Juan de Fuca.
	Because females are less likely to disperse than males, the distribution goal should be expressed in terms of female distribution (males could be distributed widely, but will not protect the population if all females are concentrated in one area.).
	We agree that in order to prevent a severe decline (or extirpation), the population should be geographically distributed so that a sustainable reproductive nucleus of sea otters would remain isolated and unaffected by a catastrophic event. If we acheive our population and distribution recovery objectives we will assume that the population is composed of both males and reproductive females. This could be documented in the annual surveys of females with pups.
Recovery Strategies	The recovery plan should give consideration to reintroducing sea otters into the Columbia River, at least in those places where their presence has been historically documented.
	Large scale changes in Columbia River habitat have occurred since otters inhabited this area as well as considerable risks associated with current high levels of shipping traffic. At this point sea otter co-managers are not considering active reintroduction of sea otters to additional areas in Washington.
	Most of the tidelands and associated uplands within the current range of the sea otter fall within the jurisdiction of Olympic National Park and the park should be included in several of the recovery strategies and tasks: l. 1.1, 3.2, 4.1, 6.1, 6.3, 8.1.
	The Park has been added to these recovery strategies and tasks.
	Tracking of future population dispersal and migration (Strait of Juan de Fuca, southern Washington coast) should remain a top priority in sea otter management.
	This is included in the research priorities.

Section	Comments and Response
	The plan should discuss problems with self-reporting incidental take of marine animals. The plan should specify that co-managers participate with WDFW and USFWS to explore safe, humane and noninvasive methods to minimize incidental take of otters. *This has been addressed in the recovery plan.* The recovery plan should reference the extensive data from California on sea otter mortality caused by fishing gear. *The entanglement and entrapment section has been updated to include sea otter mortality caused by fishing gear in California and provides references that contain details.* The plan needs to address oil spill prevention and recovery. It is essential that concrete procedures are in place for spill management. With respect to the OCNMS Area to be Avoided, vessels are encouraged, but not obligated to follow this guideline. Such compliance should be made mandatory. *The ATBA remains advisory, but has generally been followed. OCNMS continues to assess the effectiveness of this regulation and investigate additional areas. A rescue tug boat has been placed at Neah Bay since 1999 for vessel emergency assistance. If an oil spill occurs, portions of the outer coast are provisionally approved for in-situ burning and chemical dispersants are allowed in certain offshore areas. These approaches to spill recovery are approved on a case by case basis. We agree with the need for "concrete procedures" for spill management. The Northwest Area Contingency Plan contains very detailed procedures for spill management in Washington and can be downloaded from:* http://www.rrt10nwac.com/nwacp_document.htm. *This information has been added to the plan.* The draft errs in suggesting non-local rehabilitation of oiled otters. Local treatment will not only foster quick reintroduction into their environment, but will also involve local community response teams in their recuperation, as it has in California. *A spill rescue protocol is being developed for Washington including procedures for capture, transport, standardized care, treatment, and release of oiled sea otters. USFWS and WDFW have determined that the preferred option for rehabilitation of oiled sea otters is to stabilize them in Washington using local and regional expertise and then transport them to a wildlife care center (e.g. CDFG Office of Spill Prevention and Response). A facility that is designed specifically for treatment of oiled sea otters and where expertise is present is critical to successful rehabilitation. There may be opportunities for local community involvement in the early stages of sea otter rescue. In order to provide oiled sea otters with the best possible care, state of the art facilities and drawing on sea otter specialists in California is the intent of WDFW. Treatment and rehabilitation of sea otters at a non-local site would not delay reintroduction. Reintroduction of sea otters will be driven primarily by the timeline of oil spill clean up. Rehabilitated sea otters would need to be held until healthy and recovered and the risk of becoming re-oiled was removed.*

Appendix B. continued. Responses to written public comments received on the 2000 Draft Washington State Recovery Plan for the Sea Otter.

Section	Comments and Response
	There is concern regarding the current lack of in-state preparedness for rescue and rehabilitation of otters in case of a significant oil spill. *USFWS and WDFW are creating a comprehensive oil spill response plan specific to Washington sea otters.* The WDFW Watchable Wildlife Program should initiate shore-based observation sites for the public to view sea otters. *A significant portion of the current range of sea otters in Washington is contained within the boundaries of the Olympic National Park with observation areas available near Kalaloch and Cape Alava. Olympic National Park naturalists also routinely provide information on ecology of sea otters within the Park. WDFW's Watchable Wildlife program works cooperatively with various NGOs to provide interpretive information on a number of wildlife species in Washington including sea otters and will continue to do so in the future.* The plan should include mention of the assistance from non-governmental organizations, such as Friends of the Sea Otter and Humane Society of the U.S., in accomplishing the goal of "enhancing public awareness of sea otter status and threats." *This has been added to the recovery plan.* The WDFW plan should discuss the need to cooperate with USFWS to assist and support federal actions for management of sea otters such as: stock assessments under the Marine Mammal Protection Act, possible listing of the Washington population under the ESA; preparation of federal recovery plans; and addressing threats to the species through appropriate conservation measures. *WDFW works cooperatively with USFWS in preparation of stock assessment reports, status reviews and additional federal documents for Washington sea otters and is actively involved with USFWS with research, management and conservation activities.* The state's plan should acknowledge the depleted status of this species under the MMPA and discuss the steps that WDFW will take to assist in achieving a depleted finding under federal law. *The Washington sea otter population is not currently designated as depleted under the MMPA by USFWS. A depeleted designation is the responsibility of USFWS.* The Friends of the Sea Otter would strongly oppose any management of sea otters that is akin to zonal management or containment. *The problems and experiences with zonal management in other areas, such as California, are discussed in the plan. Zonal management is not being considered by WDFW.*

Section	Comments and Response
	We generally concur with the recommendation to "do-nothing" to allow otters to recover to viable levels"; but request replacing the term "viable" with OSP and WDFW specific management goals.
	This has been addressed in the recovery plan.
	The reference to "California Public Law 99-625" should be "Public Law 99-625".
	This detail has been removed from the recovery plan. References are provided.
	The draft plan discusses the possibility of future tribal harvests. These discussions appear to presume that there is a legal basis for such take to occur under federal or state law. It is critical for the draft plan to clarify that no such harvest or take is currently authorized. Section 9.2 must be deleted. There is no basis to suggest that the tribe "may develop and implement sea otter management plans."
	Regarding tribal harvest: If treaties are determined to legally allow harvest of sea otters, WDFW needs to establish cooperative agreements with the tribes to establish specific harvest quotas guided by MMPA, OSP and WDFW Recovery Goals. Goals also need to direct WDFW efforts to monitor and minimize incidental take of otters in tribal fisheries.
	WDFW should include stakeholder groups in any discussion of proposed harvest or hazing of sea otters by tribes.
	There has been no legal determination regarding tribal harvest of sea otters in the lower 48 states and this statement has been added to the plan. Any program developed by USFWS and respective tribes for sea otters would accommodate the Federal trust responsibility, treaty rights and requirements of the MMPA. USFWS is the managing agency; however, WDFW and all entities (including stakeholder groups) would be involved if a tribe decides to develop a sea otter management plan.
General	We support the actions by the WDFW to develop a recovery plan for this species. By taking the initiative in this manner, WDFW has pursued an important step in the recovery of the sea otter. We appreciate that WDFW is actively managing (with co-managers) this stock towards its recovery.
	Thank you for your support.
	The recovery plan is terrible. The goal to return a native species to the state has been accomplished. It appears to me a sea otter population of 500 between Pillar Point and Destruction Island would be best, with the tribes hunting the surplus when available. This would also save a lot of potential future conflict. Allowing the sea otters to expand will deprive most clams, crabs, etc. from state recreation harvest.

Appendix B. continued. Responses to written public comments received on the 2000 Draft Washington State Recovery Plan for the Sea Otter.

Section	Comments and Response
	Sea otters lived along much of the outer coast for several thousand years before being extirpated although historic population numbers are unknown. It is unknown if sea otters will reoccupy their entire historic range due to significant alterations in habitat and development by humans. Due to their current restricted distribution and associated risk and also their limited genetic diversity, WDFW believes an average population level over a 3-year period exceeding 1,640 sea otters as well as an increase in distribution are necessary for a change of status from Endangered to Threatened. Fishery resource management has been addressed in the plan and WDFW has identified this as a goal to work with co-managers to cooperatively address resource conflicts before they arise and develop action plans to allow sea otters to recover and mitigate conflict.

Appendix C. Washington/Oregon sea otter mortality data sheet

WASHINGTON/OREGON SEA OTTER MORTALITY DATA SHEET *Vsersion*: May 1, *2003* Modified from CDFG & USGS California dead sea otter fact sheets.	**Return completed sheets to: Deanna Lynch** 510 Desmond Dr. Suite 102 Lacey, WA 98503 Telephone: 360-753-9545 FAX: 360-534-9331	**Report dead sea otters to:** 1-87-SEAOTTER 1-877-326-8837

REFERENCE INFORMATION

MORTALITY DATABASE NUMBER: **WASOM:**____________________

USGS RESEARCH DATABASE NUMBER: **WASO:** ____________________

ADDITIONAL REFERENCE NUMBERS: **NWHC:** ____________________

Other: ____________________

DATE FOUND: ________| ________ | ________ (**month** **day** **year**)   **DATE EXAMINED:**________ | ________ | ________ (**month** **day** **year**)

FOUND BY: ______________________________________**PHONE** ____________________

PERSON REPORTING:__________________________________ **PHONE** ____________________

RECOVERY AREA: ____________________

RECOVERY LOCATION: Geographic: ____

Global:____________________| ____________________ (**latitude** **longitude**)

CARCASS CONDITION & MORPHOMETRICS

CONDITION: ________ **1 = Alive 2 = Fresh Dead 3 = Moderate Decomposition 4 = Advanced Decomposition 5 = Mummified/Fragment U = Undetermined (see key on reverse for code descriptions)**

AGE: ________ **1 = Pup 2 = Immature 3 = Subadult 4 = Adult 5 = Aged Adult 6 = Juvenile U = Undetermined**

SEX: ______________**(male / female / undetermined)**

TOTAL LENGTH: __________**cm** __________**in** **WEIGHT:** __________**kg** __________**lb**

NOSE SCAR: **Size:** ______ (**diameter of scar or wound) Freshness:** ______ (**white = healed, pink =healing, red/bleeding = Fresh)**

TEETH: ________ **1 = Excellent 2 = Good 3 = Fair 4 = Poor 5 = All Milk Teeth 6 = Some Milk Teeth U = Undetermined**

PELAGE COLOR: (grizzling) ________ **1 = None To Slight 2 = To Eyes 3 = To back of head (Lamboidal Crest) 4 = To Chest 5 = To Tail 6 = Natal U = Undetermined (color refers to lightness of fur on head, neck, and belly)**

OBVIOUS TRAUMA: __________________________ **(No / Yes / Undetermined, see reverse)**

CARCASS DISPOSITION: ____________________________**(left on beach, skull taken, recovered)**
(If recovered, include name of person recovering and where, when, and time carcass was sent)

MARKING INFORMATION

TAGGED OR TAG EVIDENCE: ________ **(yes / no)**

Right: ______________ | ______________ | ______________ (**color** **position** **number**)   **Transmitter frequency**__________________

Left: ______________ | ______________ | ______________ (**color** **position** **number**)   **PIT TAG: Working:** ______________**(yes / no / undetermined)**

PIT Number: ____________________

KNOWN AGE: ________ **Tag Date:** _______ | _______ | _______ **Age At Tagging:** ___________ | _______________

Yes/No **Day** **Month** **Year** **estimate** **cementum**

Wt At Tagging: ____________**kg** _________ **lb**

DESCRIPTION OF TRAUMA AND/OR FIELD REMARKS (continue on separate sheet if necessary): __________________

____

____

CONDITION CODES MODIFIED FROM: J.R. Geraci and V. J. Lounsbury. 1993. ***Marine Mammals Ashore: A Field Guide For Strandings.*** Texas A&M Sea Grant Publication. 305pp.

CODE 1: Live Animals--*Uses*: morphometrics; limited life history, external gross pathology, parasitology and microbiology; biopsies; blood studies, including DNA analysis and clinical chemistry.

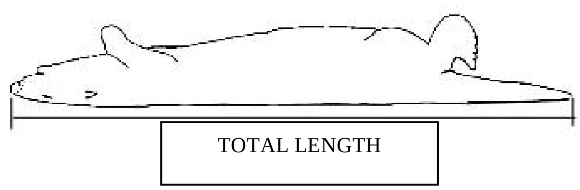
CODE 2: Carcass in Good Condition (Fresh/Edible)-- ***Characteristics***: normal appearance, usually with little scavenger damage; fresh smell; minimal drying and wrinkling of skin, eyes and mucous membranes; eyes clear; carcass not bloated, muscles firm, dark red, well-defined; blood cells intact, able to settle in a sample tube; serum unhemolyzed; viscera intact and well-defined; gut contains little or no gas; brain firm with no discoloration, surface features distinct, easily removed intact. ***Uses***: morphometrics; DNA analysis; life history; parasitology; gross and histopathology; toxicology; microbiology; limited blood studies.

CODE 3: Fair (Decomposed, but organs basically intact)-- ***Characteristics***: carcass intact, bloating evident and skin cracked and sloughing; possible scavenger damage; characteristic mild odor; mucous membranes dry, eyes sunken or missing, muscles soft and poorly defined; blood hemolyzed, uniformly dark red; viscera soft, friable, mottled, but still intact; gut dilated by gas; brain soft, surface features distinct, dark reddish cast, fragile but can usually be moved intact. ***Uses***: morphometrics; DNA analysis; limited life history; parasitology; gross pathology; marginal for toxicology (useful for metals, marginal for organochlorines, poor for biotoxins); histopathology of skin, muscle, lung, and possibly firm lesions.

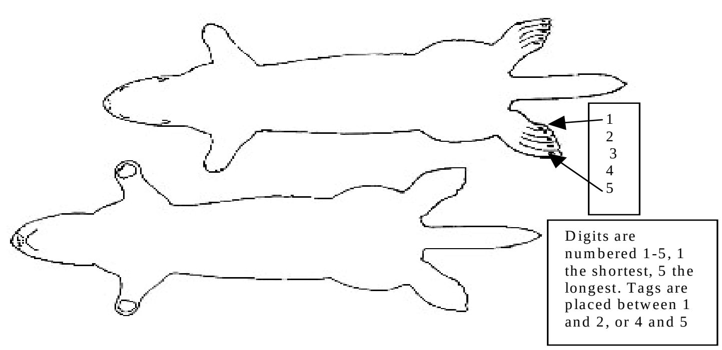
CODE 4: Poor (Advanced decomposition)-- ***Characteristics***: carcass may be intact, but collapsed; skin sloughing, often severe scavenger damage; strong odor; muscles nearly liquefied and easily torn, falling easily off bones; blood thin and black; viscera often identifiable but friable, easily torn, and difficult to dissect; gut gas-filled; brain soft, dark red, containing gas pockets, pudding-like consistency. ***Uses***: morphometrics; limited life history (teeth, baleen, bone, claws, some stomach contents, possibly reproductive condition); limited DNA analysis, parasitology, and gross pathology.

CODE 5: Mummified or Skeletal Remains-- ***Characteristics***: skin may be draped over skeletal remains; any remaining tissues are desiccated ***Uses***: morphometrics; limited life history (teeth, baleen, claws, bone) and DNA analysis..

TOTAL LENGTH: With the carcass in the supine position total length is measured from the tip of the nose to the tip of the tail. If length is measured in any other manner please note how measured on the form.



WOUNDS OR TRAUMA: On the illustrations below draw any trauma areas or wounds noted during field examination.



Appendix D. Washington Administrative Code 232-12-297, Section 11 addresses Recovery Plans.

WAC 232-12-297 Endangered, threatened, and sensitive wildlife species classification.

PURPOSE

1.1 The purpose of this rule is to identify and classify native wildlife species that have need of protection and/or management to ensure their survival as free-ranging populations in Washington and to define the process by which listing, management, recovery, and delisting of a species can be achieved. These rules are established to ensure that consistent procedures and criteria are followed when classifying wildlife as endangered, or the protected wildlife subcategories threatened or sensitive.

DEFINITIONS

For purposes of this rule, the following definitions apply:

2.1 "Classify" and all derivatives means to list or delist wildlife species to or from endangered, or to or from the protected wildlife subcategories threatened or sensitive.

2.2 "List" and all derivatives means to change the classification status of a wildlife species to endangered, threatened, or sensitive.

2.3 "Delist" and its derivatives means to change the classification of endangered, threatened, or sensitive species to a classification other than endangered, threatened, or sensitive.

2.4 "Endangered" means any wildlife species native to the state of Washington that is seriously threatened with extinction throughout all or a significant portion of its range within the state.

2.5 "Threatened" means any wildlife species native to the state of Washington that is likely to become an endangered species within the forseeable future throughout a significant portion of its range within the state without cooperative management or removal of threats.

2.6 "Sensitive" means any wildlife species native to the state of Washington that is vulnerable or declining and is likely to become endangered or threatened in a significant portion of its range within the state without cooperative management or removal of threats.

2.7 "Species" means any group of animals classified as a species or subspecies as commonly accepted by the scientific community.

2.8 "Native" means any wildlife species naturally occurring in Washington for purposes of breeding, resting, or foraging, excluding introduced species not found historically in this state.

2.9 "Significant portion of its range" means that portion of a species' range likely to be essential to the long term survival of the population in Washington.

LISTING CRITERIA

3.1 The commission shall list a wildlife species as endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available, except as noted in section 3.4.

3.2 If a species is listed as endangered or threatened under the federal Endangered Species Act, the agency will recommend to the commission that it be listed as endangered or threatened as specified in section 9.1. If listed, the agency will proceed with development of a recovery plan pursuant to section 11.1.

3.3 Species may be listed as endangered, threatened, or sensitive only when populations are in danger of failing, declining, or are vulnerable, due to factors including but not restricted to limited numbers, disease, predation, exploitation, or habitat loss or change, pursuant to section 7.1.

3.4 Where a species of the class Insecta, based on substantial evidence, is determined to present an unreasonable risk to public health, the commission may make the determination that the species need not be listed as endangered, threatened, or sensitive.

DELISTING CRITERIA

4.1 The commission shall delist a wildlife species from endangered, threatened, or sensitive solely on the basis of the biological status of the species being considered, based on the preponderance of scientific data available.

4.2 A species may be delisted from endangered, threatened, or sensitive only when populations are no longer in danger of failing, declining, are no longer vulnerable, pursuant to section 3.3, or meet recovery plan goals, and when it no longer meets the definitions in sections 2.4, 2.5, or 2.6.

INITIATION OF LISTING PROCESS

5.1 Any one of the following events may initiate the listing process.

5.1.1 The agency determines that a species population may be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

5.1.2 A petition is received at the agency from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the classification process.

5.1.3 An emergency, as defined by the Administrative Procedure Act, chapter 34.05 RCW. The listing of any species previously classified under emergency rule shall be governed by the provisions of this section.

5.1.4 The commission requests the agency review a species of concern.

5.2 Upon initiation of the listing process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the classification process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

INITIATION OF DELISTING PROCESS

6.1 Any one of the following events may initiate the delisting process:

6.1.1 The agency determines that a species population may no longer be in danger of failing, declining, or vulnerable, pursuant to section 3.3.

6.1.2 The agency receives a petition from an interested person. The petition should be addressed to the director. It should set forth specific evidence and scientific data which shows that the species may no longer be failing, declining, or vulnerable, pursuant to section 3.3. Within 60 days, the agency shall either deny the petition, stating the reasons, or initiate the delisting process.

6.1.3 The commission requests the agency review a species of concern.

6.2 Upon initiation of the delisting process the agency shall publish a public notice in the Washington Register, and notify those parties who have expressed their interest to the department, announcing the initiation of the delisting process and calling for scientific information relevant to the species status report under consideration pursuant to section 7.1.

SPECIES STATUS REVIEW AND AGENCY RECOMMENDATIONS

7.1 Except in an emergency under 5.1.3 above, prior to making a classification recommendation to the commission, the agency shall prepare a preliminary species status report. The report will include a review of information relevant to the species' status in Washington and address factors affecting its status, including those given under section 3.3. The status report shall be reviewed by the public and scientific community. The status report will include, but not be limited to an analysis of:

7.1.1 Historic, current, and future species population trends.

7.1.2 Natural history, including ecological relationships (e.g., food habits, home range, habitat selection patterns).

7.1.3 Historic and current habitat trends.

7.1.4 Population demographics (e.g., survival and mortality rates, reproductive success) and their relationship to long term sustainability.

7.1.5 Historic and current species management activities.

7.2 Except in an emergency under 5.1.3 above, the agency shall prepare recommendations for species classification, based upon scientific data contained in the status report. Documents shall be prepared to determine the environmental consequences of adopting the recommendations pursuant to requirements of the State Environmental Policy Act (SEPA).

7.3 For the purpose of delisting, the status report will include a review of recovery plan goals.

PUBLIC REVIEW

8.1 Except in an emergency under 5.1.3 above, prior to making a recommendation to the commission, the agency shall provide an opportunity for interested parties to submit new scientific data relevant to the status report, classification recommendation, and any SEPA findings.

8.1.1 The agency shall allow at least 90 days for public comment.

8.1.2 The agency will hold at least one Eastern Washington and one Western Washington public meeting during the public review period.

FINAL RECOMMENDATIONS AND COMMISSION ACTION

9.1 After the close of the public comment period, the agency shall complete a final status report and classification recommendation. SEPA documents will be prepared, as necessary, for the final agency recommendation for classification. The classification recommendation will be presented to the commission for action. The final species status report, agency classification recommendation, and SEPA documents will be made available to the public at least 30 days prior to the commission meeting.

9.2 Notice of the proposed commission action will be published at least 30 days prior to the commission meeting.

PERIODIC SPECIES STATUS REVIEW

10.1 The agency shall conduct a review of each endangered, threatened, or sensitive wildlife species at least every five years after the date of its listing. This review shall include an update of the species status report to determine whether the status of the species warrants its current listing status or deserves reclassification.

10.1.1 The agency shall notify any parties who have expressed their interest to the department of the periodic status review. This notice shall occur at least one year prior to end of the five year period required by section 10.1.

10.2 The status of all delisted species shall be reviewed at least once, five years following the date of delisting.

10.3 The department shall evaluate the necessity of changing the classification of the species being reviewed. The agency shall report its findings to the commission at a commission meeting. The agency shall notify the public of its findings at least 30 days prior to presenting the findings to the commission.

10.3.1 If the agency determines that new information suggests that classification of a species should be changed from its present state, the agency shall initiate classification procedures provided for in these rules starting with section 5.1.

10.3.2 If the agency determines that conditions have not changed significantly and that the classification of the species should remain unchanged, the agency shall recommend to the commission that the species being reviewed shall retain its present classification status.

10.4 Nothing in these rules shall be construed to automatically delist a species without formal commission action.

RECOVERY AND MANAGEMENT OF LISTED SPECIES

11.1 The agency shall write a recovery plan for species listed as endangered or threatened. The agency will write a management plan for species listed as sensitive. Recovery and management plans shall address the listing criteria described in sections 3.1 and 3.3, and shall include, but are not limited to:

11.1.1 Target population objectives.

11.1.2 Criteria for reclassification.

11.1.3 An implementation plan for reaching population objectives which will promote cooperative management and be sensitive to landowner needs and property rights. The plan will specify resources

11.1.4 Public education needs.

11.1.5 A species monitoring plan, which requires periodic review to allow the incorporation of new information into the status report.

11.2 Preparation of recovery and management plans will be initiated by the agency within one year after the date of listing.

11.2.1 Recovery and management plans for species listed prior to 1990 or during the five years following the adoption of these rules shall be completed within five years after the date of listing or adoption of these rules, whichever comes later. Development of recovery plans for endangered species will receive higher priority than threatened or sensitive species.

11.2.2 Recovery and management plans for species listed after five years following the adoption of these rules shall be completed within three years after the date of listing.

11.2.3 The agency will publish a notice in the Washington Register and notify any parties who have expressed interest to the department interested parties of the initiation of recovery plan development.

11.2.4 If the deadlines defined in sections 11.2.1 and 11.2.2 are not met the department shall notify the public and report the reasons for missing the deadline and the strategy for completing the plan at a commission meeting. The intent of this section is to recognize current department personnel resources are limiting and that development of recovery plans for some of the species may require significant involvement by interests outside of the department, and therefore take longer to complete.

11.3 The agency shall provide an opportunity for interested public to comment on the recovery plan and any SEPA documents.

CLASSIFICATION PROCEDURES REVIEW

12.1 The agency and an ad hoc public group with members representing a broad spectrum of interests, shall meet as needed to accomplish the following:

12.1.1 Monitor the progress of the development of recovery and management plans and status reviews, highlight problems, and make recommendations to the department and other interested parties to improve the effectiveness of these processes.

12.1.2 Review these classification procedures six years after the adoption of these rules and report its findings to the commission.

AUTHORITY

13.1 The commission has the authority to classify wildlife as endangered under RCW 77.12.020. Species classified as endangered are listed under WAC 232-12-014, as amended.

13.2 Threatened and sensitive species shall be classified as subcategories of protected wildlife. The commission has the authority to classify wildlife as protected under RCW 77.12.020. Species classified as protected are listed under WAC 232-12-011, as amended. [Statutory Authority: RCW 77.12.020. 90-11-066 (Order 442), § 232-12-297, filed 5/15/90, effective 6/15/90.]