

NORTHERN SEA OTTER

TAXONOMY

Scientific name: *Enhydra lutris kenyoni*

Common name: Northern sea otter

Family: Mustelidae

Taxonomic comments:

Bodkin and Kenyon (2004) recently summarized current taxonomy as follows: Advances in multivariate analyses and molecular genetics in recent decades have helped resolve previous controversy about sub-specific taxonomy of sea otters. An exhaustive systematic review and analysis of sea otter skull morphology concludes there are three subspecies, *E. lutris lutris* from Asia to the Commander Is., *E.l. nereis* from California, and the new sub species *E.l. kenyoni*, from Alaska (Wilson et al. 1991). The subspecific taxonomy suggested by morphological analyses is largely supported by subsequent molecular genetic data. Analysis of mitochondrial DNA (mtDNA) variation among 8 geographically isolated populations identified 4 major groups (Cronin et al. 1996, Scribner et al. 1997). The haplotype frequency in the Commander Island population of *E.l. lutris* is more similar to that observed in the Aleutian-Kodiak grouping, *E.l. kenyoni*, than to the Asian subspecies, *E.l. lutris*, with which it was aligned by skull morphology. Additionally, the Prince William Sound population differs from the other Alaska populations in haplotype frequency.



DESCRIPTION

Basic description: A marine mammal (sea otter), to about 1.5 m long.

General description:

Pelage thick, dark brown, or black, with the head whitish in older individuals, tail thick (to about 35 cm), maximum tail length about 1/4 of body length; hind feet flattened and webbed, outer toe longest, with vestigial leathery foot pads; front feet relatively small and round; ear pinnae small.; to about 1.5 m in total length; adult males usually 25-40 kg, females usually 15-25 kg.

Length (m): 1.5

Weight (kg): 35

Reproduction:

Strongly polygynous. Reproduction is weakly seasonal. Births in spring and summer with peak in early summer in Alaska (late May in Prince William Sound); peak December-March (generally late winter) in California. Implantation delayed, gestation about 8-9 months in Alaska, about 4-6 months in California. Young dependent on mother for about 6-7 months in California, 76-333 days (average 170) in Prince William Sound, Alaska. In California, adult females generally give birth to 1 pup every year. In California, females sexually mature usually in 3-5 years. In Alaska, 30% of females were sexually mature at age 2, 100% by age 5; annual reproductive rates increased from 22% at age 2 to 78% at age 5 and remained relatively stable (75-88%) through age 15 (Bodkin et al.

1993). Commonly lives 10-15 years; maximum known ages are 23 years for females and 18 years for males.

Ecology:

Keystone predator; often limits prey populations; predation on herbivores determines structure of off-shore kelp communities (e.g., Estes et al. 1989).

Males defend contiguous territories from which they exclude other males (Riedman and Estes 1990).

Sea otter populations that have been translocated to vacant habitat can increase at about 17-20%/year (e.g. southeast Alaska), although the central California population never has increased at more than 5-7%/year (see Bodkin et al. 1999 for population growth rates in Alaska, Riedman and Estes 1990).

Migration:

Seasonal movements occur among some age-sex classes in certain areas (Riedman and Estes 1990). May make long distance movement up to 350 km over a relatively short period when translocated to new or vacant habitat, but breeding range in established populations range from 100 m to 1 km for males and approximately 8-16 km for sexually mature females (USFWS 2004).

Males may move up to 30-60 miles along coast; females generally stay within area 5-10 miles long. Daily movements generally encompass a few kilometers (Riedman and Estes 1990). Ralls et al. (1996) found that otters in California usually were within 1-2 km of their location on the previous day but often stayed in one place for an extended period then suddenly moved a much greater distance; the area used by individual otters during a single 24-hour period was 7-1,166 ha.

Food:

A generalist predator, known to consume more than 150 different prey species (Bodkin and Kenyon 2004). Diet varies according to location; often dominated by benthic invertebrates. Sea urchins, crabs, and a variety of molluscs are principal foods, but fish are important food items at high population densities (this is documented only for the Aleutian Islands in areas where the population was at equilibrium density). Forages usually at depths of less than 20 m. Uses rocks or other hard objects as tools to break exoskeletons of invertebrate prey. Diets and patterns of foraging behavior may be highly individualized (Riedman and Estes 1990).

Phenology:

Foraging occurs throughout the day and night, with periodic resting and grooming in between feeding bouts.

Habitat:

Occupy nearly all coastal marine habitats, from fine sediment bays and estuaries to rocky shores exposed to oceanic swells. Habitat area depends on slope of the sea floor and where depth contour intervals are widely spaced, may extend far offshore to include shallow areas. Highest densities of sea otters occur in water less than 40 m deep, although they can be found in water up to 200 m deep (Bodkin and Udevitz 1999, Bodkin and Kenyon 2004). Generally occur within 2 km of shore,

especially shallows with kelp beds and abundant shellfish. In rough weather, takes refuge among kelp, or in coves and inlets. Often comes ashore in Alaska; births may occasionally occur onshore in Alaska (USFWS 2004).

STATUS

Global rank: G4T4 (2004-04-22)

Global rank reasons:

Ranges along the margin of the Pacific Ocean from the Aleutian Islands, Alaska, to Washington; global population of 75,000 animals is stable or growing in some areas, declining in others. Stable in southcentral and southeastern Alaska; a small population is growing along the coast of Washington. Northern sea otters translocated to BC number approximately 2,500 and are listed as a Species at Risk. Population declines of up to 70% have occurred in southwest Alaska stock; currently listed as candidate species under ESA, petitioned to list as threatened in 2004. Vulnerable to oil spills, conflicts and incidental take in commercial fisheries, and potential increases in killer whale predation.

State rank: S2S3 (2004-04-22)

State rank reasons:

Statewide population estimate 70,658 as of 2000. Southwestern (Aleutian) population declined 70% between 1992-2000, and 63% between 2000-2003 at six Aleutian Islands. Southwest stock currently listed as candidate species under ESA, petitioned to list as threatened in 2004. Southcentral stock stable to slightly increasing; Southeast stock trend uncertain, although Glacier Bay population increased 185% between 2000 and 2001. Vulnerable to oil spills, conflicts and incidental take in commercial fisheries, and potential increases in killer whale predation.

DISTRIBUTION AND ABUNDANCE

Range:

Global range:

E. l. kenyoni, the northern sea otter, occurs in the Aleutian Islands, southern Alaska, British Columbia, and Washington; extirpated and later reintroduced in southeastern Alaska, British Columbia, and Washington; extirpated and unsuccessfully reintroduced in the Pribilof Islands and Oregon. *E. l. lutris*, also known as the northern sea otter, occurs in the Kuril Islands, Kamchatka Peninsula, and Commander Islands in Russia. *E. l. nereis*, known as the southern sea otter, occurs in coastal southern California.

State range:

E. l. kenyoni's Alaska range includes the Aleutian Islands, along the Alaska Peninsula, Kenai Peninsula and Prince William Sound, and southeastern Alaska. Three distinct stocks are recognized in the state: southeast, southcentral, and southwest. The southeast stock extends from Dixon Entrance to Cape Yakataga; the southcentral stock extends from Cape Yakataga to Cook Inlet including Prince William Sound, the Kenai Peninsula coast, and Kachemak Bay; and the southwest stock includes the Alaska Peninsula and Bristol Bay coasts and the Aleutian, Barren, Kodiak, and Pribilof Islands (USFWS 2002a, b, and c stock assessment). Distribution is continuous from Kachemak Bay to Cape Suckling; between Cape Suckling and Yakutat Bay 125 miles of vacant coastal habitat between southeast and southcentral Alaska stocks; nearly continuous distribution

from Attu Island in the western Aleutians to the Alaska Peninsula (>200 km between some island groups; USFWS 2002a, b, and c stock assessment).

Abundance:

Global abundance:

In the 1980s, the total population from Prince William Sound to the Kuril Islands was about 150,000 (Riedman 1990). Alaska had 100,000-150,000 in the mid- to late 1980s (Reeves et al. 1992); in 2000, the population was 70,658 (A. Doroff, per. comm.). Prince William Sound population in late 1980s was about 14,000, of which an estimated 2800 were killed as a result of the *Exxon Valdez* oil spill (Raloff 1993). From an original 402 individuals translocated in the 1960s, the population in southeastern Alaska increased to more than 3500 in five populations by 1987 (Reeves et al. 1992); 1988 estimate was 4520 (See Riedman and Estes 1990); Glacier Bay population is increasing rapidly, from 5 in 1995 to 1590 in 2001, with an increase of 187% between 2000 and 2001 (Bodkin et al. 2001).

In 1984, the population off west coast of Vancouver Island, British Columbia, was 345 (descended from 89 that were translocated from Alaska, 1969-1972) (Macaskie 1986, COSEWIC report); 1987 count was 380 (Riedman and Estes 1990). In 1995, the minimum number along the coast of British Columbia was 1522, including 135 near Goose Island (Watson et al. 1997).

Otters were transplanted from Alaska to Washington in 1969 and 1970; population increased from 36 to 94 between 1981 and 1987 (Matthews and Moseley 1990); 211 were counted in Washington in July 1989 (Jameson, in Riedman and Estes 1990, Reeves et al. 1992).

State abundance:

Current Alaska population estimate is 70,658 as of 2000 (A. Doroff, pers. comm.).

Southeast Alaska stock: adjusted total estimate 12,632; minimum population estimate 9,266 based on surveys conducted in Southeast Alaska 1994, Yakutat Bay 1995, and the Northern Gulf of Alaska (USFWS 2002a stock assessment). In 2001, 1590 sea otters were counted in Glacier Bay National Park and Preserve, an increase of 185% above the 2000 estimate (Bodkin et al. 2001).

Southcentral Alaska stock: adjusted total estimate 16,552; minimum population estimate 13,955 based on surveys conducted in the Northern Gulf of Alaska 1996, Prince William Sound 1999, and Cook Inlet/Kenai Fjords National Park in 2002 (USFWS 2002b stock assessment).

Southwest Alaska stock: adjusted total estimate 41,474; minimum population estimate 33,203 based on surveys conducted in the Aleutian Islands and N. Alaska Peninsula in 2000, S. Alaska Peninsula, Unimak Island, and the Kodiak Archipelago in 2001, and Kamishak Bay in 2002 (USFWS 2002c stock assessment). More recent surveys conducted in the Aleutian Islands suggest that populations may have declined from 8,742 in 2000 (included in above estimate) to as few as 3,261 in 2003 (Doroff et al. 2003).

Trends:**Global trend:**

Increased over the past several decades; current trends among three Alaska stocks variable; southwest stock is declining rapidly, southcentral stock is stable to slightly increasing, and status of the southeast stock is uncertain. Washington population started with 59 individuals translocated from Alaska in 1969-1970; increasing--spring 1996 survey yielded 430 individuals (USFWS 1997 draft revised stock assessment).

State trend:

State long-term trends: In the early 1700's, worldwide population estimate was between 150,000 and 300,000 animals (Kenyon 1969, Johnson 1982). By 1911, fewer than 2,000 individuals remained in 13 remnant colonies as a result of large-scale commercial exploitation (Ogden 1941, Kenyon 1969). Population regrowth began after legal protection, International Fur Seal Treaty of 1911, and sea otters have since recolonized most of their former range (Kenyon 1969, Schneider 1976a and b, USFWS 2002a stock assessment).

State short-term trend comments: Trends among three *E. l. kenyoni* stocks variable. Overall, Southeast Alaska stock is uncertain, Southcentral stock is stable to slightly increasing, and the Southwest stock is declining rapidly.

The Southeast stock population increased from 8,807 in 1998 (USFWS 1998 stock assessment) to about 12,632 in 2002 (USFWS 2002a stock assessment). Numbers in Glacier Bay are increasing rapidly, from 5 in 1995 to an estimated 1590 in 2001, with an increase of 187% between 2000 and 2001 (Bodkin et al. 2001). This increase is likely related to production within Glacier Bay and immigration from outside the Bay (Bodkin et al. 2001). Although the population trend for this stock appears to be one of growth, preliminary information from recent surveys recorded fewer animals than were previously expected; therefore, current trend is uncertain (USFWS 2002a stock assessment).

Rates of growth vary among locations for the Southcentral stock, but the overall trend is either stable or slightly increasing. The 1989 *Exxon Valdez* oil spill in Prince William Sound resulted in an estimated mortality of 750-2,650 otters. Since the spill, numbers in western Prince William Sound have increased by approximately 750 animals, but overall abundance in the sound has not increased appreciably since 1994. The current population estimate for Kenai Fjords and eastern Cook Inlet is slightly higher than 1989 estimate (2,673 vs. 2,330), suggesting slight growth (USFWS 2002b stock assessment).

Current estimates for the Southwest stock are 56-68% lower than 1976 (USFWS 2004). In 2000, the USFWS designated the northern sea otter in the Aleutian Islands (from Unimak Pass to Attu) as a candidate species under the Endangered Species Act (ESA) due to an observed 70% population decline between 1992 and 2000 and an 88% decline at islands that were at carrying capacity in 1965 (USFWS 2002c stock assessment, Doroff et al. 2004, USFWS 2004). Widespread declines were noted throughout the Aleutian Islands, with the greatest decreases occurring in the central Aleutians (USFWS 2002c stock assessment). Between 2000 and 2003, counts declined by about 63% along six islands in the central and western Aleutians (Doroff et al. 2004). Elsewhere in the range of the Southwest stock, declines of 93-94% were documented for the south Alaska Peninsula

and declines of 27-49% were documented for the north Alaska Peninsula between 1986 and 2000 and 2001 (USFWS 2002c stock assessment). In the Kodiak Archipelago, populations decreased by 40% since 1994 (USFWS 2002c stock assessment). Population trend for Kamishak Bay is unknown, while estimates from the Port Moller/Nelson Lagoon area and the Alaska Peninsula from Castle Cape to Cape Douglas suggest population increases. However, the magnitude of these increases does not offset the overall decline observed over the past 10-15 years (USFWS 2002c stock assessment).

EXISTING PROTECTION

Global protection:

Populations in Washington, Oregon, California, and Mexico (*E. l. nereis* and part of *E. l. kenyoni*) are listed by USFWS as Threatened, except in areas subject to U.S. jurisdiction south of Pt. Conception, California, where status is governed by Public Law 99-625, 100 Stat. 3500. In August 2000, The USFWS designated *E. l. kenyoni* in the Aleutian Islands (from Unimak Pass to Attu) as a candidate species under the Endangered Species Act (USFWS 2000), and petitioned to list the southwest stock as “threatened” in 2004 (USFWS 2004).

State protection:

In August 2000, USFWS designated *E. l. kenyoni* in the Aleutian Islands (from Unimak Pass to Attu) as a candidate species under the Endangered Species Act (USFWS 2000). There is a current proposal to list the Southwest Alaska distinct population segment of the northern sea otter as threatened (USFWS 2004). The majority of coastal lands within the range of the southwest population are part of the National Wildlife Refuge (NWR) system, including Alaska Maritime, Izembek, Alaska Peninsula/Becharof, and Kodiak. Within National Parks, this species occurs in coastal waters of Katmai, Aniakchak, Glacier Bay, and Wrangell-St. Elias National Park and Preserves.

CHALLENGES

Global challenges:

In various parts of the range, conflicts with commercial fisheries (gill and trammel nets, crab traps) and activities associated with oil and gas exploration, development, and transportation may be the greatest threats. Commercial fisheries are not a major threat in Alaska (USFWS 1995 stock assessment). Brody et al. (1996) determined that an oil spill of *Exxon Valdez* size, occurring at the Monterey Peninsula, California, would kill at least 50% of the total California sea otter population. Between 750 and 2,650 animals died as a result of the 1989 *Exxon Valdez* oil spill in Prince William Sound, Alaska (Garrot et al. 1993, Garshelis 1997).

State challenges:

Exploration, development, and transport of oil and gas can have adverse impacts on sea otters and nearshore coastal ecosystems. Sea otters lack the thick layer of subcutaneous fat found in other marine mammals, and instead rely on air trapped in their fur for warmth and buoyancy. This species is one of the marine mammals most likely to be detrimentally affected by contact with oil because oil contamination drastically reduces the insulative value of their pelage (USFWS 2002c stock assessment). May survive low levels of oiling (< 10%), but greater levels (> 25%) lead to death (Costa and Kooyman 1981 in USFWS 2002c stock assessment). The 1989 *Exxon Valdez* oil spill in Prince William Sound resulted in an estimated mortality of 750-2,650 otters (Garrot et al.

1993, Garshelis 1997). Within the range of the southwest stock, oil and gas development occurs in Cook Inlet; and the southcentral stock is vulnerable to tanker traffic in Prince William Sound and oil and gas development in Cook Inlet (USFWS 2002b, c stock assessment).

Contaminants from other sources are of increasing concern. Estes et al. (1997) found unexpectedly high levels of organochlorines in sea otters at Adak Island. Although the threshold of PCB toxicity to sea otters is not known, PCB concentrations found in the livers of Adak sea otters were similar to those causing reproductive failure in captive mink (Estes et al. 1997). Elevated levels of butylin residues and organochlorine compounds have been associated with sea otter mortality caused by infectious disease in California (Kannan et al. 1998, Nakata et al. 1998)

Increased predation by killer whales has been advanced as the major mechanism behind the recent declines of Aleutian sea otter population (Estes et al. 1998). Estes et al. (1998) hypothesized that killer whales may have responded to declines in their preferred prey species, harbor seals and Steller sea lions, by broadening their prey base to include sea otters. Springer et al. (2003) hypothesized that post-World War II industrial whaling in the north Pacific Ocean resulted in a substantial (95%) reduction in large whales, the main prey of killer whales. As a result, killer whales prey expanded to include smaller marine mammals, such as the sea otter.

Alaska Natives are legally allowed to take sea otters for subsistence or handicraft use. Between 1996-2000, mean annual subsistence harvest in the Southeast stock was 301 animals (USFWS 2002a stock assessment); 297 animals were taken each year for the same time period in the Southcentral stock (USFWS 2002b stock assessment); and 97 animals were removed annually from the Southwest stock (USFWS 2002c stock assessment).

Occasionally taken incidentally in commercial fisheries. Illegal killing by anglers trying to defend prey resources may occur (Simon-Jackson 1985). There is some indication of deliberate killing of sea otters by gillnet anglers in the Copper River salmon fishery (Rotterman and Simon-Jackson 1988) and harassment including possible attempts to kill otters in Orca Bay in Prince William Sound (Garshelis and Garshelis 1984).

Sea otter pups may be vulnerable to predation by bald eagles (*Haliaeetus leucocephalus*). On Amchitka Island, remains of 6-56 sea otters were found in bald eagle nests yearly from 1969-1973 (Sherrod et al. 1975).

RESEARCH AND INVENTORY NEEDS

Global research needs:

Research is needed to identify factors contributing to observed declines, particularly in Aleutian Islands. Studies monitoring population numbers, health and condition, survival and mortality rates are needed to evaluate the causes and factors that may prevent population recovery.

State research needs:

Research is needed to identify factors contributing to observed declines, particularly in Aleutian Islands. Studies monitoring population numbers, health and condition, survival and mortality rates are needed to evaluate the causes and factors that may prevent population recovery.

CONSERVATION AND MANAGEMENT NEEDS

Global conservation and management needs:

Restoration potential: Recovery potential is high if environmental conditions are favorable. In a study conducted in the mid 1980s along Kodiak Islands, Alaska, otters at the leading edge of an expanding population in an area with abundant food resources and protected water exhibited high adult survival rate, high reproductive rate, and high preweaning survival (Monson and DeGange 1995). Human harvest was the primary source of known mortality of adults.

Management and monitoring requirements: See the 1996 Endangered Species Update 13(12) for 20 articles dealing with sea otter conservation and management.

Draft revised recovery plan for California populations was available in February 2000 (contact U.S. Fish and Wildlife Service, Ventura, California).

Management programs: In central California, halibut fishermen have been required to move to deeper waters to avoid entanglement of otters in nets. A "no otter" management zone has been established south of Point Conception, including Channel Islands except San Nicolas; theoretically otters will be kept out of these waters, which can then be fished commercially (Matthews and Moseley 1990). In the late 1980s, reintroduction was initiated at San Nicolas Island, California. Home range fidelity and postrelease dispersal are probably the principal barriers to successful reintroductions (Riedman and Estes 1990).

State conservation and management needs:

Define, identify and maintain critical habitat. Update conservation plan for Southwest Stock. See Bodkin et al. (2002) for spill related conservation and management issues.

LITERATURE CITED

- Bodkin, J. L., D. Mulcahy, and C. J. Lensink. 1993. Age-specific reproduction in female sea otters (*Enhydra lutris*) from south-central Alaska: analysis of reproductive tracts. *Can. J. Zool.* 71:1811-1815.
- Bodkin, J. L., K. A. Kloecker, G. G. Esslinger, D. H. Monson, J. D. DeGroot, and J. Doherty. 2001. Sea otter studies in Glacier Bay National Park and Preserve. Annual Report 2001.
- Brody, A. J., K. Ralls, and D. B. Siniff. 1996. Potential impact of oil spills on California sea otters: implications of the *Exxon Valdez* spill in Alaska. *Marine Mammal Science* 12:38-53.
- Cronin, M. A., J. Bodkin, B. Ballachey, J. Estes, and J. C. Patton. 1996. Mitochondrial-DNA variation among subspecies and populations of sea otters (*Enhydra lutris*). *Journal of Mammalogy* 77:546-557.
- Doroff, A. M., J. A. Estes, M. T. Tinker, D. M. Burn, and T. J. Evans. 2003. Sea otter population declines in the Aleutian archipelago. *Journal of Mammalogy*. 84:55-64.
- Doroff, A. M., V. A. Gill, and J. A. Haddix. 2004. Sea otter (*Enhydra lutris kenyoni*) surveys in the west and central islands of the Aleutian archipelago 2003. Unpublished Report U.S. Fish and Wildlife Service Marine Mammals Management, MS 341.
- Estes, J. A., D. O. Duggins, and G. B. Rathbun. 1989. The ecology of extinctions in kelp forest communities. *Conservation Biology* 3:252-264.
- Estes, J.A., C.E. Bacon, W.M. Jarman, R.J. Norstrom, R.G. Anthony and A.K. Miles. 1997. Organochlorines in sea otters and bald eagles from the Aleutian archipelago. *Marine Pollution Bulletin* 34:486-490.
- Estes, J.A., M.T. Tinker, T.M. Williams and D.F. Doak. 1998. Killer whale predation on sea otters linking oceanic and nearshore ecosystems. *Science* 282:473-476
- Garrot, R.A., L.L. Eberhard, and D.M. Burn. 1993. Mortality of sea otters in Prince William Sound following the *Exxon Valdez* oil spill. *Marine Mammal Science* 9: 343-359.
- Garshelis, D.L. 1997. Sea otter mortality from carcasses collected after the *Exxon Valdez* oil spill. *Conservation Biology* 11: 905-916.
- Garshelis, D.L. and J.A. Garshelis. 1984. Movements and management of sea otters in Alaska. *J. Wildl. Manage.* 48:665-678.
- Johnson, A.M. 1982. Status of Alaska sea otter populations and developing conflicts with fisheries. *Trans. N. Am. Wildl. Nat. Resour. Conf.* 47:293-299.
- Kenyon, K. W. 1969. The sea otter in the eastern Pacific Ocean. *North Am. Fauna* 68:1-352.

- Lidicker, W. Z., Jr., and F. C. McCollum. 1997. Allozymic variation in California sea otters. *Journal of Mammalogy* 78:417-425.
- Macaskie, I. 1986. Updated Status Report on the sea otter, *Enhydra lutris*, in Canada. Committee on the Status of Endangered Wildlife in Canada. 16 pp.
- Matthews, J. R., and C. J. Moseley (eds.). 1990. The official World Wildlife Fund guide to endangered species of North America. Volume 1. Plants, Mammals. xxiii + pp 1-560 + 33 pp. appendix + 6 pp. glossary + 16 pp. index. Volume 2. Birds, Reptiles, Amphibians, Fishes, Mussels, Crustaceans, Snails, Insects, and Srachnids. xiii + pp. 561-1180. Beacham Publications, Inc., Washington, D.C.
- Ogden, A. 1941. The California sea otter trade, 1784-1848. University of California Press, Berkeley. 251 pp.
- Ralls, K., T. C. Eagle, and D. B. Siniff. 1996. Movement and spatial use patterns of California sea otters. *Canadian Journal of Zoology* 74:1841-1849.
- Raloff, J. 1993. An otter tragedy. *Science News* 143:200-202.
- Reeves, R. R., B. S. Stewart, and S. Leatherwood. 1992. The Sierra Club Handbook of Seals and Sirenians. Sierra Club Books, San Francisco, California. xvi + 359 pp.
- Riedman, M. 1990. Sea otters. Monterey Bay Aquarium, Monterey, California. 80 pp.
- Riedman, M.L., and J.A. Estes. 1990. The sea otter (*Enhydra lutris*): Behavior, ecology, and natural history. Biological Report 90(14). U.S. Fish and Wildlife Service, Washington, DC. 126 pp.
- Rotterman, L.M. and T. Simon-Jackson. 1988. Sea otter - *Enhydra lutris*. Pp. 237-271 In: Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations (J.W. Lentfer, ed.). Marine Mammal Commission, Washington, D.C.
- Schneider, K.B. 1976a. Assessment of the distribution and abundance of sea otters along the Kenai Peninsula, Kamishak Bay and the Kodiak Archipelago. Contract #03-5-022-69, research unit #240. Final report. Alaska Department of Fish and Game, Anchorage, AK.
- Schneider, K.B. 1976b. Distribution and abundance of sea otters in southwestern Bristol Bay. Contract #03-5-022-69, research unit #241. Final report. Alaska Department of Fish and Game, Anchorage, AK.
- Sherrod, S. K., J. A. Estes and C. M. White. 1975. Depredation of sea otter pups by bald eagles at Amchitka Island, Alaska. *Journal of Mammalogy* 56:701-703.
- Simon-Jackson, T. 1985. Fisherman opinions of sea otter/fisheries issues in Alaska. Unpubl. report, U.S. Fish and Wildl. Serv., Marine Mammal Management Project, Anchorage, AK.

- Springer, A. M., J. A. Estes, G. B. van Vliet, T. M. Williams, D. F. Doak, E. M. Danner, K. A. Forney, and B. Pfister. 2003. Sequential megafaunal collapse in the North Pacific Ocean: an ongoing legacy of industrial whaling? PNAS 100:12223-12228.
- U.S. Fish and Wildlife Service. 1995. Stock assessment - Sea Otter (*Enhydra lutris*), Alaska stock. Marine Mammals Management, Anchorage, AK; 5 pp.
- U.S. Fish and Wildlife Service. 1998. Draft Alaska Marine Mammal Stock Assessments 1998: Sea Otters, Polar Bear and Walrus. Marine Mammals Management, U.S. Fish and Wildlife Service, Anchorage, AK.
- U.S. Fish and Wildlife Service. 2000. Notice of designation of the northern sea otter in the Aleutian Islands as a candidate species. Federal Register 65:67343-67345.
- U.S. Fish and Wildlife Service. 2002a. Stock assessment for sea otters (*Enhydra lutris*): southcentral Alaska stock. Marine Mammal Protection Act Stock Assessment Report. 6 pp. Available at <http://alaska.fws.gov/fisheries/mmm/seaotters/reports.htm> under Stock Assessment Reports.
- U.S. Fish and Wildlife Service. 2002b. Stock assessment for sea otters (*Enhydra lutris*): southeast Alaska stock. Marine Mammal Protection Act Stock Assessment Report. 6 pp. Available at <http://alaska.fws.gov/fisheries/mmm/seaotters/reports.htm> under Stock Assessment Reports.
- U.S. Fish and Wildlife Service. 2002c. Stock assessment for sea otters (*Enhydra lutris*): southwest Alaska stock. Marine Mammal Protection Act Stock Assessment Report. 8 pp. Available at <http://alaska.fws.gov/fisheries/mmm/seaotters/reports.htm> under Stock Assessment Reports.
- U.S. Fish and Wildlife Service. 2004. Endangered and threatened wildlife and plants; listing the southwest Alaska distinct population segment of the northern sea otter (*Enhydra lutris kenyoni*) as threatened. Proposed Rules. February 11, 2004, Federal Register 69(28): 6600-6621.
- Watson, J. C., G. M. Ellis, T. G. Smith, and J.K.B. Ford. 1997. Updated status of the sea otter, *Enhydra lutris*, in Canada. Canadian Field-Naturalist 111:277-286.
- Wilson, D.E., M.A. Bogan, R.L. Brownell, Jr., A.M. Burdin, and M.K. Maminov. 1991. Geographic variation in sea otters, *Enhydra lutris*. J. Mammalogy 72:22-36.

Acknowledgements

State Conservation Status, Element Ecology & Life History Author(s): Gotthardt, T.A., C.A. Coray, and J.G. McClory

State Conservation Status, Element Ecology & Life History Edition Date: 29Mar2005

Reviewer(s): Angela Doroff, Marine Mammals Management, US Fish and Wildlife Service, Anchorage, AK.

Life history and Global level information were obtained from the on-line database, NatureServe Explorer (www.natureserve.org/explorer). In many cases, life history and Global information were updated for this species account by Alaska Natural Heritage Program zoologist, Tracey Gotthardt. All Global level modifications will be sent to NatureServe to update the on-line version.

NatureServe Conservation Status Factors Edition Date: 22Jan2004

NatureServe Conservation Status Factors Author: Hammerson, G.

Global Element Ecology and Life History Edition Date: 02May1995

Global Element Ecology and Life History Author(s): Hammerson, G.
