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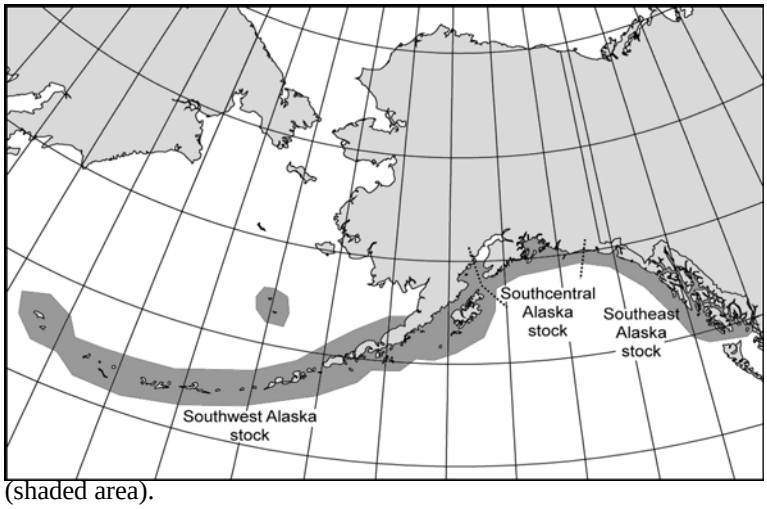
SEA OTTER (*Enhydra lutris*): Southeast Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Sea otters occur in nearshore coastal waters of the U.S. along the North Pacific Rim from the Aleutian Islands to California. The species is most commonly observed within the 40 m depth contour since animals require frequent access to foraging habitat in subtidal and intertidal zones (Reidman and Estes 1990). Sea otters in Alaska are not migratory and generally do not disperse over long distances, although movements of tens of kilometers are normal (Garshelis and Garshelis 1984). Individuals are capable of long distance movements of >100 km (Garshelis *et al.* 1984), however movements of sea otters are likely limited by geographic barriers, high energy requirements of animals, and social behavior.



(shaded area).

Applying the phylogeographic approach of Dizon *et al.* (1992), Gorbics and Bodkin (2001) identified three sea otter stocks in Alaska: southeast, southcentral,and southwest. The ranges of these stocks are defined as follows: (1) south stock extends from Dixon Entrance to Cape Yakataga; (2) southcentral stock extends from Cape Yakataga to Cook Inlet including Prince William Sound, the Kenai peninsula coast, and Kachemak Bay; and (3) southwest stock which includes Alaska Peninsula and Bristol Bay coasts, the Aleutian, Barren, Kodiak, and Pribilof Islands (Fig. 1). The phylogeographic approach of stock identification, which considers four types of data, is presented in greater detail below.

1) Distributional data: geographic distribution is continuous from Kachemak Bay to Cape Suckling, at which point 125 miles of vacant coastal habitat between Cape Suckling and Yakutat Bay separates the southeast and southcentral Alaska stocks (Doroff and Gorbics 1998). Sea otters in Yakutat Bay and southeast Alaska are the result of a translocation of 412 animals from Prince William Sound and Amchitka in the late 1960s (Pitcher 1989; Reidman and Estes 1990). Prior to translocation, sea otters had been absent from these habitats since the beginning of the 20th century. Distribution is nearly continuous from Attu Island in the western Aleutians to the Alaska Peninsula, although distances of >200 km between island groups in the Aleutians may effectively limit exchange of individuals. Sea otters do not occur in upper Cook Inlet, and population densities are currently low between the Kenai peninsula and the Alaska Peninsula, which suggests discontinuity in distribution at the stock boundary. Physical features that may limit movements of otters between the Kenai and Alaska peninsulas include approximately 100 km of open water across Cook Inlet with a maximum water depth of 100 m, and 70 km of open water between the Kenai Peninsula and the Kodiak Archipelago with a maximum water depth of 200 m. However, the open water between Kenai and Kodiak is interrupted mid-way by the Barren Islands (Gorbics and Bodkin 2001).

Contaminant levels may also indicate geographic isolation of stocks. In general, tissues from sea otters in Alaska contain relatively low levels of contaminants; however, higher levels of heavy metals and trace elements were found in animals from southcentral Alaska, with the general trend among groups being southcentral>southwest>southeast (Comerci *et al.*, in prep.). Patterns of contamination are consistent with distribution of pollutants from anthropogenic sources in populated areas. High levels of PCBs in some otters from the Aleutian Islands (southwest Alaska) likely reflect local "point sources," such as military installations (Estes *et al.* 1997; Bacon *et al.* 1999).

2) Population response data: variation in growth rates and reproductive characteristics among populations likely reflect local differences in habitat and resource availability rather than intrinsic differences between geographically distinct units (Gorbics and Bodkin 2001) .

3) Phenotypic data: significant differences in sea otter skull sizes exist between southwest and southcentral Alaska (Gorbics and Bodkin, 2001).

4) Genotypic data: the three stocks exhibit substantial differences in both mitochondrial and nuclear DNA (Cronin *et al.* 1996; Bodkin *et al.* 1992, 1999, Larson *et al.* in prep.). Significant differences in frequencies of mtDNA haplotypes and genetic differences among geographic areas show sufficient variation to indicate restricted gene flow (Gorbics and Bodkin 2001). A recent analyses of mitochondrial and nuclear DNA by Cronin *et al.* (2002) corroborates the stock structure proposed by Gorbics and Bodkin (2001).

POPULATION SIZE

Historically, sea otters occurred across the North Pacific Rim, ranging from Hokkaido Japan through the Kuril Islands, the Kamchatka Peninsula, the Commander Islands, the Aleutian islands, peninsular and south coastal Alaska and south to Baja, California, Mexico (Kenyon 1969). In the early 1700s, the worldwide population was estimated to be between 150,000 (Kenyon 1969) and 300,000 individuals (Johnson 1982). Prior to large-scale commercial exploitation, indigenous people of the North Pacific hunted sea otters. Although it appears that harvests periodically led to local reductions of sea otters (Simenstad *et al.* 1978), the species remained abundant throughout its range until the mid-1700s. Following the arrival in Alaska of Russian explorers in 1741, extensive commercial harvest of sea otters over the next 150 years resulted in the near extirpation of the species. When sea otters were afforded protection by the International Fur Seal Treaty in 1911, probably fewer than 2,000 animals remained in 13 remnant colonies (Kenyon, 1969). Population regrowth began following legal protection, and sea otters have since recolonized much of their historic range in Alaska.

The most recent population estimates for the southeast Alaska stock are presented in Table 1.

Table 1. Population estimates for the southeast Alaska stock of sea otters.

Survey Area	Year	Unadjusted Estimate	Adjusted Estimate	CV	N_{MIN}	Reference
Southeast Alaska	1994	8,180	11,697	0.398	8,467	Agler *et al.* (1995)
Yakutat Bay	1995		404	0.339	306	Doroff and Gorbics (1998)
North Gulf of Alaska	1996	223	531	0.087	493	Doroff and Gorbics (1998)
Total			12,632		9,266	

The survey of the southeast Archipelago conducted in 1994 ranged from Cape Spencer south to the Dixon Entrance. A ratio estimator was used to estimate a population size of 8,180 (CV = 0.392) sea otters. Applying a correction factor of 1.43 (CV = 0.071) for this type of boat survey (Udevitz *et al.* 1995) for sea otters not detected by observers produces an adjusted estimate of 11,697 (CV = 0.398).

An aerial survey of Yakutat Bay conducted in 1995 resulted in an adjusted population estimate of 404 (CV = 0.339) sea otters. The Yakutat Bay survey followed methodology described in Bodkin and Udevitz (1999) and included a survey-specific correction factor to account for undetected animals. A distribution survey of the Gulf Coast from Cape Yakataga to Cape Spencer excluding Yakutat Bay provided a minimum uncorrected count of 223 animals. Applying a correction factor of 2.38 (CV = 0.087) for sea otter aerial surveys using a twin-engine aircraft (Evans *et al.* 1997) produces an adjusted estimate of 531 (CV = 0.87). Combining the adjusted estimates for these three areas results in a total estimate of 12,632 sea otters for the southeast Alaska stock.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842 * [\ln(1+[CV(N)]^2)]^{1/2})$. The N_{MIN} for each survey area is presented in Table 1; the estimated N_{MIN} for the southeast Alaska stock is 9,266 sea otters.

Current Population Trend

Although rates of population growth may vary among locations, the trend for this stock of sea otters has been one of growth (Pitcher 1989, Agler 1995). Sea otters inhabiting Yakutat Bay and southeast Alaska are the result of a translocation of 412 animals from Prince William Sound and Amchitka Island in the late 1960s. High rates of population growth reported for the southeast stock of sea otters are characteristic of translocated sea otter populations in Alaska (Bodkin *et al.* 1999). Regular aerial surveys of the Cross Sound/Icy Straight area and Glacier Bay have been conducted since 1994 (USGS unpublished data). Sea otter counts from these surveys suggest an average annual population growth rate of 12%, and indicate that animals in this portion of southeast are continuing to expand their range into Icy Strait and Glacier Bay, however this growth rate may not be representative of the entire stock. Preliminary information from recent aerial surveys recorded fewer sea otters than were previously expected. Therefore, the current population trend for the southeast Alaska stock is uncertain.

MAXIMUM NET PRODUCTIVITY RATE

Estes (1990) estimated a population growth rate of 17 to 20% per year for four northern sea otter populations expanding into unoccupied habitat. Pitcher (1989) estimated that annual rates of increase for the southeast Alaska sea otter stock ranged from 15.7 to 23.3% between 1966 (the time of re-establishment of the southeast stock) and 1988. However, the multiple surveys on which these growth rates were based were all attempts at total counts using varying techniques. Furthermore, no attempt was made to account for availability and sightability biases or for weather conditions. Consequently, the rate of 20% calculated by Estes (1990) was used to estimate R_{MAX} for this stock.

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5\ R_{MAX} \times F_R$. The recovery factor ($F_R$) for this stock is 1.0 (Wade and Anglis 1997) as population levels have increased or remained stable with a known human take. Thus for the southeast stock of sea otters, PBR = 927 animals (9,266 x 0.5(0.2) x 1.0).

ANNUAL HUMAN CAUSED MORTALITY

Fisheries Information

Each year, fishery observers monitor a percentage of commercial fisheries in Alaska and report injury and mortality of marine mammals incidental to these operations. Although no fisheries operating in the region of the southeast Alaska sea otter stock have been included in the NMFS observer programs to date, there are plans to conduct an observer program in southeast Alaska in 2004.

An additional source of information on the number of sea otters killed or injured incidental to commercial fishery operations in Alaska are fisher self-reports required of vessel-owners by NMFS. From 1990 to 1993, self-reported fisheries data reflected no sea otter kills or injuries in the southeast Alaska region. Self-reports were incomplete for 1994 and not available for 1995 or 1996. Between 1997 and 2000, there were no records of incidental take of sea otters by commercial fisheries in this region; thus, the estimated mean annual mortality reported is zero. Credle *et al.* (1994) considered this to be a minimum estimate as fisher self-reports and logbook records (self-reports required during 1990-1994) are most likely negatively biased.

Data available from other areas of the state suggest that rates of lethal interactions between sea otters and commercial fisheries are insignificant. Thus it is probably reasonable to assume that the southeast stock of sea otters is not likely to be significantly affected by fisheries at the present. The total fishery mortality and serious injury is less than 10% of the calculated PBR and, therefore, can be considered insignificant and approaching a zero mortality and serious injury rate. A complete list of fisheries and marine mammal interactions is published annually by NMFS [67 FR 2410].

Oil and Gas Development

Exploration, development, and transport of oil and gas resources can adversely impact sea otters and nearshore

coastal ecosystems in Alaska. Sea otters rely on air trapped in their fur for warmth and buoyancy. Contamination with oil drastically reduces the insulative value of the pelage, and consequently, sea otters are among the marine mammals most likely to be detrimentally affected by contact with oil. It is believed that sea otters can survive low levels of oil contamination (< 10% of body surface), but that greater levels (>25%) will lead to death (Costa and Kooyman 1981, Siniff *et al.* 1982). Vulnerability of sea otters to oiling was demonstrated by the 1989 *Exxon Valdez* oil spill in Prince William Sound. Total estimates of mortality for the Prince William Sound area vary from 750 (range 600-1,000) (Garshelis 1997) to 2,650 (range 500 - 5,000) (Garrot *et al.* 1993) otters. Statewide, it is estimated that 3,905 sea otters (range 1,904 - 11,257) died in Alaska as a result of the spill (DeGange *et al.* 1994). At present, abundance of sea otters in some oiled areas of Prince William Sound remains below pre-spill estimates, and evidence from ongoing studies suggests that sea otters and the nearshore ecosystem have not yet fully recovered from the spill (Bodkin *et al.*, in press, Stephensen *et al.* 2001).

There is currently no oil and gas development in southeast Alaska. In addition, tankers carrying oil south from the Trans-Alaska Pipeline typically travel offshore and therefore pose a minimal risk to sea otters in southeast Alaska. As a result, no mortalities due to oil and gas development have been documented within the range of the southeast Alaska sea otter stock.

Subsistence/Native Harvest Information

The Marine Mammal Protection Act of 1972 exempted Native Alaskans from the prohibition on hunting marine mammals. Alaska Natives are legally permitted to take sea otters for subsistence use or for creating and selling authentic handicrafts or clothing. Data for subsistence harvest of sea otters in southeast Alaska were collected by the Marking, Tagging and Reporting Program implemented by USFWS since 1988. Fig. 2 provides a summary of harvest information for the southeast stock from 1989-2000. The mean annual subsistence take during the past five years (1996-2000) was 301 animals. Reported age composition across during this period was 80% adults, 17% subadults, and 3% pups. Sex composition during the past five years was 65% males, 25% females and 10% of unknown sex.

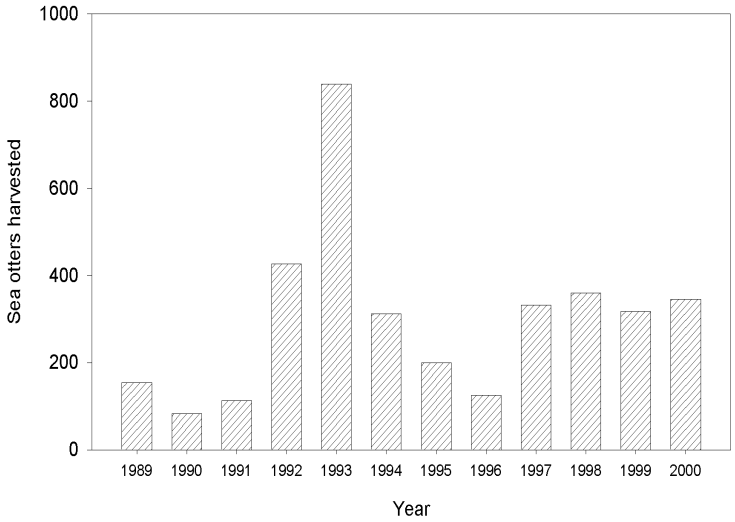


Figure 2. Estimated subsistence harvest of sea otters from the southeast Alaska stock, 1989-2000.

Since 1997, the USFWS and the Alaska Sea Otter and Steller Sea Lion Commission (TASSC) have signed cooperative agreements authorized under Section 119 of the MMPA for the conservation and co-management of sea otters in Alaska. Each of the six TASSC regions has a regional management plan that includes harvest guidelines. Several villages have also developed local management plans that address sea otter harvests.

Research and Public Display

In the past five years, no sea otters have been removed from the southeast Alaska stock for public display. Since 1996, a total of 64 sea otters have been captured and released for scientific research in Glacier Bay National Park. There have been no observed effects on sea otter populations in the southeast Alaska stock from these activities.

STATUS OF STOCK

Sea otters in the southeast Alaska stock are not listed as “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. Based on currently available data, the estimated minimum mortality and injury incidental to commercial fisheries (0) is less than 10% of the calculated PBR and, therefore, can

be considered insignificant and approaching a zero mortality and serious injury rate. The estimated annual level of total human-caused mortality and serious injury over the 5-year period from 1996 through 2000 (301) does not exceed the PBR (927). As a result, the southeast Alaska sea otter stock is classified as non-strategic. This classification is consistent with the recommendations of the Alaska Regional Scientific Review Group (DeMaster 1995). The status of this stock relative to its Optimum Sustainable Population levels is unknown.

CITATIONS

Agler, B. A., S. J. Kendall, P. E. Seiser, and J. R. Lindell. 1995. Estimates of marine bird and sea otter abundance in southeast Alaska during summer 1994. Migratory Bird Management, U.S. Fish and Wildlife Service, Anchorage, Alaska. 90pp.

Bacon, C. E., W. M. Jarman, J. A. Estes, M. Simon, and R. J. Norstrom. 1999. Comparison of organochlorine contaminants among sea otter (*Enhydra lutris*) populations in California and Alaska. Environmental Toxicology and Chemistry 18(3):452-458.

Bodkin, J. L., B. E. Ballachey, and M. A. Cronin. 1992. Mitochondrial DNA analysis in the conservation and management of sea otters. Research Information Bulletin, U.S. Department of the Interior 37:1-3.

Bodkin, J. L., R. J. Jameson, and J. A. Estes. 1995. Sea otters in the North Pacific Ocean. Pages 353-356 in LaRoe III, E. T., G. S. Farris, C. E. Pucket, and P. D. Doran, eds. Our Living Resources 1994: a report to the nation on the distribution, abundance and health of U.S. plants, animals and ecosystems. U.S. Department of the Interior, National Biological Service, Washington D.C.

Bodkin, J. L., B. E. Ballachey, M. A. Cronin, and K. T. Scribner. 1999. Population demographics and genetic diversity in remnant and translocated populations of sea otters (*Enhydra lutris*). Conservation Biology 13(6):1378-1385.

Bodkin, J. L., and M. S. Udevitz. 1999. An aerial survey method to estimate sea otter abundance. Pages 13-26 in G.W. Garner *et al.*, editors. Marine Mammal Survey and Assessment Methods. Balekema, Rotterdam, Netherlands.

Bodkin, J. L., B. E. Ballachey, T. A. Dean, A. K. Fukuyama, S. C. Jewett, L. M. McDonald, D. H. Monson, C. E. O'Clair, and G. R. VanBlaricom. In press. Sea otter population status and the process of recovery from the *Exxon Valdez* spill. Marine Ecology Progress Series.

Comerci, L. R., C. S. Gorbis, A. Matz, and K. A. Trust (in prep.). Tissue concentrations of elemental and organochlorine compounds in sea otters in Alaska. U.S. Fish and Wildlife Service Technical Report, Anchorage, Alaska.

Costa, D. P., and G. L. Kooyman. 1981. Effects of oil contamination in the sea otter *Enhydra lutris.* Outer Continental Shelf Environmental Assessment Program. NOAA Final Report. La Jolla, California.

Credle, V. A., D. P. DeMaster, M. M. Merlein, M. B. Hanson, W. A. Karp, and S. M. Fitzgerald (eds.). 1994. NMFS observer programs: minutes and recommendations from a workshop held in Galveston, Texas, November 10-11, 1993. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-OPR-94-1. 96 pp.

Cronin, M. A., J. L. Bodkin, B. E. Ballachey, J. A. Estes, and J. C. Patton. 1996. Mitochondrial-DNA variation among subspecies and populations of sea otters. Journal of Mammology 77(2):546-557.

Cronin, M. A., W. J. Spearman, W. Buchholz, S. Miller, L. Comerci, and L. Jack. 2002. Microsatellite DNA and mitochondrial DNA variation in Alaskan sea otters. Alaska Fisheries Technical Report.

DeGange, A. R., A. M. Doroff, and D. H. Monson. 1994. Experimental recovery of sea otter carcasses at Kodiak Island, Alaska, following the Exxon Valdez oil spill. Marine Mammal Science 10:492-496.

DeMaster, D. P. 1995. Minutes from the 4-5 and 11 January 1995 meeting of the Alaska Scientific Review Group, Anchorage, Alaska. 27 pp. + appendices (available upon request- D.P. DeMaster, National Marine Mammals Laboratory, 7600 Sand point Way, NE, Seattle, WA 98115).

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conservation Biology 6(1):24-36.

Doroff, A. M., and C. S. Gorbics. 1998. Sea Otter Surveys of Yakutat Bay and Adjacent Gulf of Alaska Coastal Areas - Cape Hinchinbrook to Cape Spencer 1995-1996. Minerals Management Service, OCS Study MMS 97-0026. 31 pp.

Estes, J. A. 1990. Growth and equilibrium in sea otter populations. Journal of Animal Ecology 59:385-401.

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(6):486-490.

Evans, T.J., D.M. Burn, and A.R. DeGange. 1997. Distribution and relative abundance of sea otters in the Aleutian Archipelago. U.S. Fish & Wildlife Service, Marine Mammals Management Technical Report, MMM 97-5. 29 pp.

Garrott, 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., and J. A. Garshelis. 1984. Movements and management of sea otters in Alaska. Journal of Wildlife Management 48(3):665-678.

Garshelis, D. L., A. M. Johnson, and J. A. Garshelis. 1984. Social organization of sea otters in Prince William Sound, Alaska. Canadian Journal of Zoology 62:2648-2658.

Garshelis, D. L. 1997. Sea otter mortality estimated from carcasses collected after the *Exxon Valdez* oil spill. Conservation Biology 11(4): 905-916.

Gorbics, C. S., and J. L. Bodkin. 2001. Stock structure of sea otters (*Enhydra lutris kenyoni*) in Alaska. Marine Mammal Science 17(3): 632-647.

Johnson, A. M. 1982. Status of Alaska sea otter populations and developing conflicts with fisheries. Pages 293-299 in: Transactions of the 47th North American Wildlife and Natural Resources Conference, Washington D.C.

Kenyon, K. W. 1969. The sea otter in the eastern Pacific Ocean. North American Fauna 68. U.S. Department of the Interior, Washington D.C.

Larson, S., R. Jameson, J. L. Bodkin, M. Staedler, and P. Bentzen (submitted to J. Mammalogy). Microsatellite and MtDNA sequence variation within and among remnant and translocated sea otter, *Enhydra lutris*, populations.

Pitcher, K. W. 1989. Studies of southeastern Alaska sea otter populations: distribution, abundance, structure, range expansion and potential conflicts with shellfisheries. Anchorage, Alaska. Alaska Department of Fish and Game, Cooperative Agreement 14-16-0009-954 with U.S. Fish and Wildlife Service. 24 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.

Simenstad, C. A., J. A. Estes, and K. W. Kenyon. 1978. Aleuts, sea otters, and alternate stable-state communities. Science 200:403-411. 127 pp.

Siniff, D. B., T. D. Williams, A. M. Johnson, and D. L. Garshelis. 1982. Experiments on the response of sea otters *Enhydra lutris* to oil contamination. Biological Conservation 23: 261-272.

Stephensen, S. W., D. B. Irons, S. J. Kendall, B. K. Lance, and L. L. MacDonald. 2001. Marine bird and sea otter population abundance of Prince William Sound, Alaska: trends following the T/V *Exxon Valdez* oil spill, 1989-2000. Restoration Project 00159 Annual Report. USFWS Migratory Bird Management, Anchorage, Alaska. 114 pp.

Udevitz, M.S., J.L. Bodkin, and D.P. Costa. 1995. Detection of sea otters in boat-based surveys of Prince William Sound, Alaska. Marine Mammal Science, 11(1): 9-71.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Department of Commerce, NOAA Technical Memo. NMFS-OPR-12. 93 pp.