Revised: April 2014

NORTHERN SEA OTTER (*Enhydra lutris kenyoni*):

Southwest 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-meter (approximately 12.2 feet) depth contour because the animals require frequent access to benthic foraging habitat in subtidal and intertidal zones (Reidman and Estes 1990). Sea otters are not migratory and generally do not disperse over long distances, although movements of tens of kilometers (tens of miles) are common (Garshelis and Garshelis 1984). Annual home range sizes of adult sea otters are relatively small, with male territories ranging from 4 to 11 square kilometers (km^2) (approximately 10.5 to 28.5 square miles [mi^2]) and adult female home ranges from a few to 24 km^2 (approximately 62 mi^2) (Garshelis and Garshelis 1984; Ralls *et al*. 1988; Jameson 1989). Due to their benthic foraging, sea otter distribution is largely limited by their ability to dive to the sea floor (Bodkin *et al.* 2004).

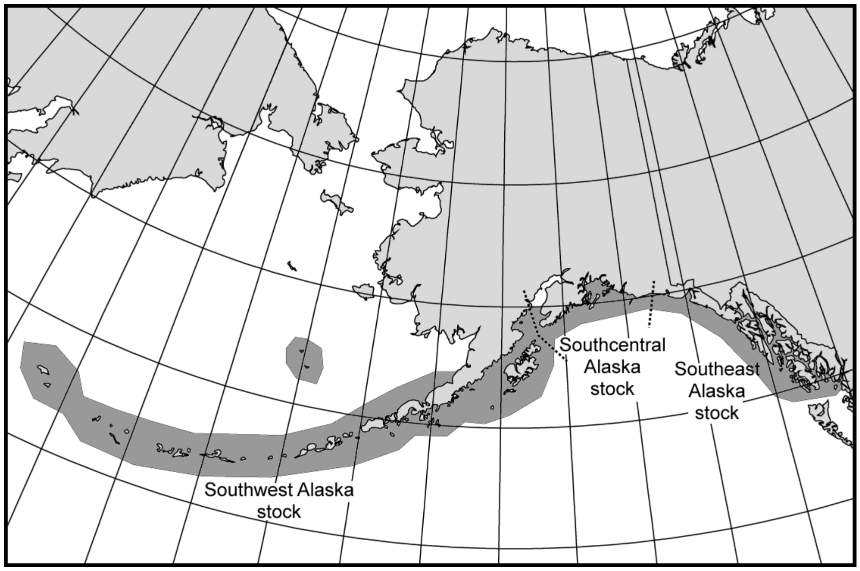

Figure 1. Approximate distribution and stock boundaries of northern sea otters in Alaska waters (shaded area).

The spatial scale at which sea otter populations are managed remains an important, although largely unexplored issue (Bodkin and Ballachey 2010) deserving further study. Bodkin and Ballachey (2010) used models of sea otter mortality to show that range-wide reductions and extirpations during the commercial fur trade of the 18th and 19th centuries occurred not simply because of excessive harvest, but because the harvest was not allocated proportional to the abundance and distribution of sea otters. This process of serial depletion was facilitated by the relatively sedentary nature of sea otters. To reduce the risk of overexploitation, sea otters must be managed on a spatial scale compatible with their well-known behavioral and reproductive biology (Bodkin and Monson 2002), incorporating traits such as home range and movements. These proposed scales for management are much smaller than the currently recognized stocks.

Gorbics and Bodkin (2001) applied the phylogeographic approach of Dizon *et al.* (1992) and used the best available data at the time to identify three sea otter stocks in Alaska: Southeast, Southcentral, and Southwest. The ranges of these stocks are defined as follows: (1) Southeast

Alaska stock extends from Dixon Entrance to Cape Yakataga; (2) Southcentral Alaska stock extends from Cape Yakataga to Cook Inlet including Prince William Sound, the Kenai Peninsula coast, and Kachemak Bay; and (3) Southwest Alaska stock includes the Alaska Peninsula and Bristol Bay coasts, and the Aleutian, Barren, Kodiak, and Pribilof Islands (Figure 1). This stock assessment report is focused on the Southwest stock of sea otters in Alaska.

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 peoples of the North Pacific hunted sea otters. Although it appears that harvests may have 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 thirteen remnant colonies (Kenyon 1969). Population recovery began following legal protection. As part of efforts to re-establish sea otters in portions of their historical range, otters from Amchitka Island and Prince William Sound were translocated to other areas in the

1960s and 1970s, including to southeast Alaska (Jameson *et al.* 1982). Sea otters have since recolonized much of their historical range in Alaska.

The most recent abundance estimates for survey areas within the Southwest Alaska stock are presented in Table 1. The estimate for the Katmai area has been added since the previous stock assessment report. Aerial surveys along the shorelines of the Aleutian Islands in April 2000 resulted in a count of 2,442 sea otters in the nearshore waters (Doroff *et al.* 2003). Comparison of aerial and skiff survey counts at six islands in 2000 was used to calculate a correction factor of 3.58 for this aerial survey, which resulted in an adjusted population estimate of 8,742 sea otters (CV= 0.22; Doroff *et al.* 2003).

In May 2000, a survey of offshore areas along the north Alaska Peninsula from Unimak Island to Cape Seniavin produced an abundance estimate of 4,728 sea otters (CV= 0.33; Burn and Doroff 2005). A similar survey of offshore areas along the south Alaska Peninsula from False Pass to Pavlov Bay conducted in summer 2001 resulted in a population estimate of 1,005 sea otters (CV= 0.81; Burn and Doroff 2005). Although a correction factor to account for sightability was not calculated during this survey, Evans *et al.* (1997) used a similar twin-engine aircraft flying at the same altitude and air speed to calculate a correction factor of 2.38 (CV = 0.09). Using this correction factor produced adjusted estimates of 11,253 (CV = 0.34) and 2,392 (CV = 0.82) for the north and south Alaska Peninsula offshore areas, respectively.

Table 1. Population estimates for the Southwest Alaska stock of northern sea otters. The previous stock assessment report (SAR) total is from 2008.

Survey Area	**Year**	**Unadjusted Estimate**	**Adjusted Estimate**	**CV**	**N_{min}**	**Reference**
Aleutian Islands	2000	2,442	8,742	0.22	7,309	Doroff *et al*. (2003)
North Alaska Peninsula	2000	4,728	11,253	0.34	8,535	Burn and Doroff (2005)
South Alaska Peninsula - Offshore	2001	1,005	2,392	0.82	1,311	Burn and Doroff (2005)
South Alaska Peninsula - Shoreline	2001	2,651	6,309	0.09	5,865	Burn and Doroff (2005)
South Alaska Peninsula - Islands	2001	402	957	0.09	889	Burn and Doroff (2005)
Unimak Island	2001	42	100	0.09	93	USFWS unpublished data
Kodiak Archipelago	2004		11,005	0.19	9,361	USFWS unpublished data
Katmai	2008		7,095	0.13	6,362	Coletti *et al*. (2009)
Kamishak Bay	2002		6,918	0.32	5,340	Bodkin *et al*. (2003)
Current Total			**54,771**		**45,064**	
Previous SAR Total			47,676		38,703	

In 2001, aerial surveys along the shoreline of the south Alaska Peninsula from Seal Cape to Cape Douglas recorded 2,651 sea otters (Burn and Doroff 2005). Additional aerial surveys of the south Alaska Peninsula island groups (Sanak, Caton, and Deer Islands, and the Shumagin and Pavlov Island groups) and a survey of Unimak Island, recorded 402 otters for the south Alaska Peninsula island groups and 42 animals for Unimak Island. Applying the same correction factor of 2.38 from Evans *et al.* (1997) produced adjusted estimates of 6,309 (CV = 0.09), 957 (CV = 0.09) and 100 (CV = 0.09) for the south Alaska Peninsula shoreline, south Alaska Peninsula islands, and Unimak Island, respectively.

An aerial survey of the Kodiak Archipelago conducted in 2004 resulted in an estimate of 11,005 sea otters (CV = 0.19; USFWS unpublished data). The methods used in this survey follow those of Bodkin and Udevitz (1999), which include the calculation of a survey-specific correction factor for animals undetected by observers. An aerial survey of Katmai National Park in 2009, also using the Bodkin-Udevitz method, resulted in an estimate of 7,095 sea otters (CV = 0.13; Coletti *et al.* 2009). Finally, an aerial survey of Kamishak Bay and western Cook Inlet conducted in June 2002 resulted in an estimate of 6,918 sea otters (CV = 0.32; Bodkin *et al.* 2003). This survey also used the methods of Bodkin and Udevitz (1999).

Combining the adjusted estimates for these areas, as summarized in Table 1, results in a total estimate of 54,771 sea otters for the Southwest Alaska stock. This estimated population size for the Southwest Alaska stock is slightly higher than in the 2008 stock assessment report due to the addition of an estimate for Katmai, which was surveyed in 2009 for the first time.

Minimum Population Estimate

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the Potential Biological Removal Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842 \times [\ln(1+[CV(N)]^2)]^{½})$. The N_{MIN} for each survey area is presented in Table 1. The estimated N_{MIN} for the entire Southwest Alaska stock is 45,064 sea otters.

Current Population Trend

In spring 2000, the U.S. Fish and Wildlife Service (Service) repeated an aerial survey that had previously been conducted in 1992 and observed widespread declines throughout the Aleutian Islands, with the greatest decreases occurring in the central Aleutians. The uncorrected count for the area was 2,442 animals, indicating that sea otter populations had declined 70% since 1992 (Doroff *et al.* 2003). Burn *et al.* (2003) estimated that the sea otter population in the Aleutians in 2000 may have been reduced to less than 10% of the carrying capacity for the area. With the exception of the Kodiak Archipelago, which was surveyed in 2004, there have been no new large-scale abundance surveys for sea otters in southwest Alaska since the stock assessment report of August 2002.

On-going efforts to monitor trends in abundance include repeated skiff surveys at selected islands (index sites) in the Aleutian Islands. A Bayesian state-space trend analysis (Clark and Bjornstad 2004) developed using all available data compiled from skiff surveys around five islands in the western Aleutian Islands from 1993 to 2003 indicated that the population trends during this time period were strongly negative, with an average rate of decline of approximately 20% per year (USFWS 2013b, USGS unpublished data). Population trends changed during the period 2003 to 2011, with an average growth rate of approximately 0. Some variation in trends was evident but the trends were consistent among islands. These results suggest that population trends have stabilized in the western Aleutian Islands over the last 5 to 8 years, although there is still no evidence of recovery (USFWS 2013a, USFWS 2013b, USGS unpublished data).

Unlike in the Aleutian Islands and along the western Alaska Peninsula, sea otters in other areas within the range of the Southwest stock do not appear to have undergone a population decline over the past 20 years. Sea otter numbers in the Kodiak Archipelago, the Alaska Peninsula coast from Castle Cape to Cape Douglas, and Kamishak Bay in lower western Cook Inlet are stable and may be increasing (Coletti *et al.* 2009, Estes *et al*. 2010, USFWS 2013a, USGS unpublished data).

The estimated population size for the Southwest Alaska stock is slightly higher than in the previous stock assessment report due to the addition of Katmai, which was surveyed in 2009 for the first time. However, the overall sea otter population size in southwest Alaska has declined by more than 50% since the mid-1980s, and there is no evidence of recovery. Although current numbers are well below historical levels, the overall population trend for the Southwest Alaska stock is believed to have stabilized.

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. Although maximum productivity rates (R_{MAX}) have not been measured throughout much of the sea otter's range in Alaska, in the absence of more detailed information, the rate of 20% calculated by Estes (1990) is considered the best available estimate of R_{MAX}. There is insufficient information available to estimate the current net productivity rate for this population stock.

POTENTIAL BIOLOGICAL REMOVAL

Under the Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as *the maximum number of animals, not including natural mortalities, that may* *be removed from a marine mammal stock while allowing that stock to reach or maintain its optimal sustainable population.* The potential biological removal is the product of the minimum population estimate (N_{MIN}), one-half the maximum theoretical net productivity rate, and a recovery factor (F_R): PBR = N_{MIN} x 0.5 R_{MAX} x F_R. In August 2005, sea otters in southwest Alaska were listed as a threatened distinct population segment (DPS) under the Endangered Species Act of 1973, as amended (70 FR 46366; August 9, 2005) (ESA). Although Wade and Angliss (1997) provide a default recovery factor of 0.5 as a guideline for threatened species, a lower value may be considered appropriate in the case of a declining population. Therefore, for the Southwest Alaska stock, which has experienced a decline, we are taking a more conservative approach and have set the recovery factor at the default value for an endangered species (0.1). The calculated PBR for this stock is 450 sea otters per year (45,064 x 0.5 (0.2) x 0.1).

ANNUAL HUMAN CAUSED MORTALITY

Fisheries Information

A complete list of fisheries and marine mammal interactions is published annually by the National Oceanic and Atmospheric Administration (NOAA) Fisheries, the most recent of which was published on August 29, 2013 (78 FR 53336). Numerous fisheries exist within the range of the Southwest Alaska stock of northern sea otters, with the only one identified as interacting with this stock being the Kodiak salmon set gillnet fishery, with an estimated 188 vessels and/or persons participating. Additional salmon set gillnet fisheries occur in Bristol Bay (982 participants) and the Alaska Peninsula/Aleutian Islands (114 participants). Although no interactions with salmon drift gillnets have been identified for this stock, interactions have been observed in Prince William Sound with the Southcentral Alaska stock. Salmon drift gillnet fisheries occur in Bristol Bay (1,863 vessels) and the Alaska Peninsula/Aleutian Islands (162 vessels). Although both salmon set and drift gillnet fisheries occur in Cook Inlet, most of the fishing effort for these gillnet fisheries occurs north of the range of sea otters from the Southwest Alaska stock. Available information suggests that fisheries using other types of gear, including trawl, longline, and purse seine, appear to be less likely to have interactions with northern sea otters due to either the areas where such fisheries operate, or the specific gear used, or both.

Although commercial fisheries in Alaska have observer programs that monitor and report injury and mortality of marine mammals incidental to their operations, a reliable estimate of the levels of commercial fisheries incidental mortality and serious injury relative to the Southwest sea otter stock cannot be made because observer coverage is not sufficient and data are not collected consistently over time. Observer data were summarized from 1989 to 2010 (Perez 2003, Perez 2006, Perez 2007, NOAA unpublished data) for Bering Sea, Aleutian Islands, and Gulf of Alaska trawl, longline, and pot groundfish fisheries. During this period, no sea otters were taken in any trawl or longline fisheries. In 1992, a total of eight sea otters were observed caught in the Pacific cod pot fishery in the Aleutian Islands. Observer records indicate that those takes occurred in nearshore waters that had been closed to fishing. This explains why no additional take of sea otters was observed in legal pot fisheries, which took place in other areas, through 2010 (Perez 2006, Perez 2007, NOAA unpublished data). Sea otters are known to interact with pot fisheries in California, and it is possible that observer effort for pot fisheries in Alaska has been too low to detect sea otter bycatch (Hatfield *et al.* 2011).

The NOAA Fisheries conducted a marine mammal observer program for the Kodiak salmon set gillnet fishery during the 2002 and 2005 fishing seasons. This fishery has a seasonal component, occurring only during the summer months. In 2002, four entanglement events were observed in this fishery (Manly *et al.* 2003). Two of these events required intervention to untangle the otter from the net, and the other two were able to escape by themselves. In none of these instances was there any sign of external injuries. The sea otter by-catch in this fishery was estimated at 62 otters during the 2002 fishing season. Although no serious injuries or mortalities were observed in this small sample size of observed entanglements, it is reasonable to assume that some of these otters may have suffered injury as a result of entanglement in set gillnet fisheries. In fact, there was one self-report of an otter killed during the 2002 fishing season. Results from the 2005 Kodiak salmon set gillnet fishery indicate entanglement of one otter that subsequently released itself from the net, although it was not clear if this was a sea otter or river otter (Manly 2007). Assuming that this animal was a sea otter, the total by-catch in this fishery would be estimated at 28 animals during the 2005 season. Based on these results, it would appear that although entanglement of sea otters does occur in this fishery, the rate of mortality or serious injury is low.

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 NOAA Fisheries. In 1997, fisher self-reports indicated one sea otter caught in the Bering Sea and Aleutian Island groundfish trawl fishery; however, it is unclear if the animal was alive when caught. Credle *et al.* (1994) considered fisher self-reports to be a minimum estimate of incidental take as these data are most likely negatively biased. Observer coverage for fisheries within the range of the Southwest stock of sea otters has been absent in some fisheries and low in others, particularly with respect to the set and drift gillnet fisheries that are recognized as interacting with this stock, and current estimates of sea otter bycatch are not available. Self-reporting is not sufficiently reliable to replace observer effort. Additionally, assessment of injury and mortality in sea otters that interact with fisheries is difficult. Information is, therefore, insufficient to determine whether or not the total fishery mortality and serious injury for the Southwest Alaska stock of the northern sea otter is insignificant and is approaching a zero mortality and serious injury rate.

Oil Spills

Activities associated with 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. Estimates of mortality for the Prince William Sound area vary from 750 otters (range 600 to 1,000; Garshelis 1997) to 2,650 otters (range 500 to 5,000; Garrott *et al.* 1993). Statewide, 3,905 sea otters (range 1,904 to 11,257) were estimated to have died in Alaska as a result of the spill (DeGange *et al.* 1994). At present, although abundance of sea otters in some oiled areas of Prince William Sound remains below pre-spill estimates, evidence from ongoing studies suggests that sea otters numbers in this area are increasing, a trend interpreted as strong evidence of a trajectory toward recovery of spill-affected sea otter populations in western Prince William Sound (Bodkin *et al.* 2002, Stephensen *et al.* 2001, Bodkin *et al.* 2011).

Within the range of the Southwest Alaska sea otter stock, oil and gas development and production occurs only in Cook Inlet. As of 2011, 16 offshore oil platforms operated in Cook Inlet, and two more are slated to begin operations in 2012. A Federal lease sale in lower Cook Inlet is planned for the fall of 2013. Although the amount of oil transported in southwest Alaska is relatively small, the *Exxon Valdez* oil spill demonstrated that spilled oil can travel long distances and take large numbers of sea otters far from the point of initial release. The grounding in 2004 of the freighter *Selendang Ayu* on Unalaska Island, within the range of this stock, released 1,219,800 liters (approximately 321,000 gallons) of non-crude oil and caused at least two sea otter mortalities (USFWS unpublished data). While the catastrophic release of oil has the potential to take large numbers of sea otters, there is no evidence that other effects (such as disturbance) associated with routine oil and gas development and transport have had a direct impact on the Southwest Alaska sea otter stock.

Information on oil spills compiled by the Alaska Department of Environmental Conservation from 2006 to 2010 indicates that there were no reported spills of crude oil in southwest Alaska during that time period. In addition to spills that may occur in association with the development, production, and transport of crude oil, each year numerous spills of non-crude oil products in the marine environment occur from ships and shore facilities throughout southwest Alaska. During that same time period, an average of 64 non-crude oil spills occurred each year, ranging in size from less than 4 to 551,000 liters (approximately1 to 145,000 gallons).

The majority of these spills were small, with a mean size of about 3,500 liters (approximately 921 gallons) and a median size of 15 liters (approximately 2 gallons). There is no indication that these small-scale spills have an impact on the Southwest Alaska stock of northern sea otters.

Subsistence/Native Harvest Information

The MMPA exempts Alaska Natives from the prohibition on take of marine mammals, provided such taking is not wasteful and is done for subsistence use or for creating and selling authentic handicrafts or clothing. In addition, section 10(e) of the ESA allows for take of listed species for primarily subsistence purposes under certain circumstances. According to the Service's Law Enforcement records, there were no prosecutions from 2006 to 2010 for unlawful take, possession, transport, or sale of sea otters or sea otter hides taken within the range of the Southwest Alaska stock. Data for subsistence harvest of sea otters in southwest Alaska are collected by a mandatory Marking, Tagging and Reporting Program administered by the Service since 1988. Figure 2 provides a summary of harvest information for the Southwest stock from 1989 through 2010. The mean reported annual subsistence take during the past five complete calendar years (2006-2010) was 76 animals. Reported age composition during this period was 84% adults, 12% subadults, 1% pups, and 3% unknown. Sex composition during the past five years was 77% males, 19% females, and 4% unknown. The majority of this harvest (83%) comes from the Kodiak Archipelago; areas within the stock that show signs of continued population declines have little to no record of subsistence harvest.

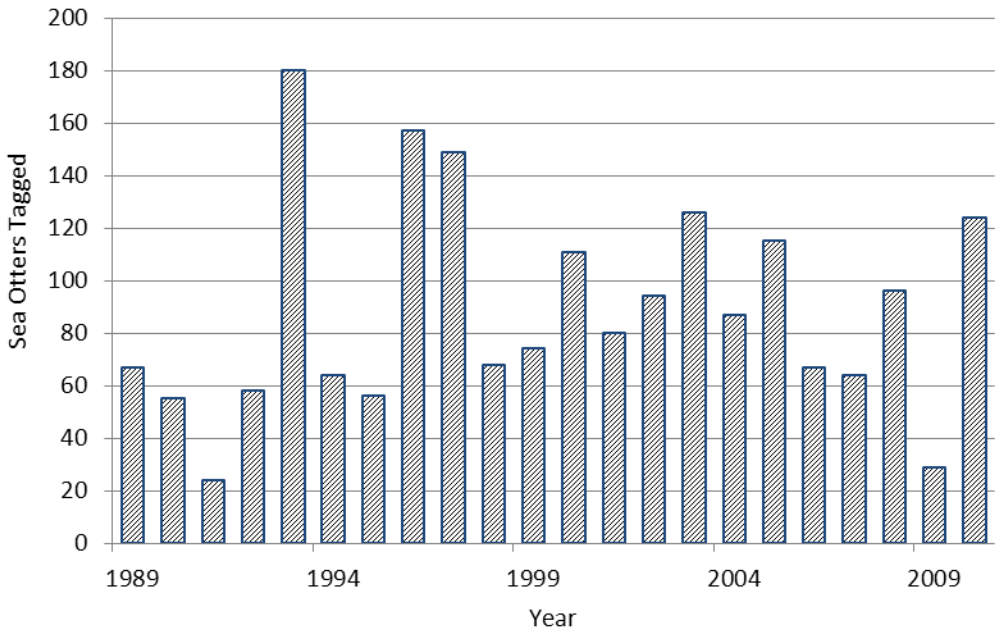

Figure 2. Reported subsistence harvest of northern sea otters from the Southwest Alaska stock, 1989-2010.

Research and Public Display

During 2006 to 2010, one orphaned sea otter pup from the Southwest Alaska stock was captured, rehabilitated, and placed for public display. During this period, a total of 65 otters were live-captured from this stock and released for research purposes. The captures occurred in the vicinities of Kukak Bay (Katmai National Park and Preserve coast), Unga Island (Shumagin Island group), and Dolgoi Island (Pavlov Island group). There were no reported injuries and/or mortalities related to these activities.

Other Factors

Each year, several thousand commercial vessels of varying sizes traverse the North Pacific Great Circle Route between North America and Asia, carrying a variety of cargoes. Vessels generally pass through the Aleutian Islands twice, through Unimak Pass to the east and near Buldir Island to the west. A risk assessment for the area concluded that while a majority of the vessel traffic along the Great Circle Route passes through the region without making any port calls, accidents involving these vessels have the potential to significantly and adversely impact coastal and marine ecosystems, economies, and human activities in the region (Aleutian Islands Risk Assessment Project Management Team 2011). Previous vessel accidents in the Aleutian Islands have resulted in loss of cargo, oil spills, and loss of life. The remoteness, limited infrastructure, and severe weather of the region often limit the potential to mitigate or respond to incidents. Overall, both the total number of accidents and the total risk of a bunker oil spill in the region are predicted to increase (Aleutian Islands Risk Assessment Project Management Team 2011).

Since 2002 the Service has undertaken a health and disease study of northern sea otters from all three Alaskan stocks. On average, the Service conducts about 100 necropsies a year on sea otter carcasses to determine cause of death, disease incidence and status of general health parameters. Boat strike is a recurring cause of death across all three stocks. However, it has been determined in most of these cases that although trauma was the ultimate cause of death, there was a contributing factor, such as disease or biotoxin exposure, which incapacitated the animal and made it more vulnerable to boat strike.

In August 2006, the Working Group on Marine Mammal Unusual Mortality Events reviewed information provided by the Service, and declared that a dramatic increase in sea otter strandings since 2002 constituted an Unusual Mortality Event (UME) in accordance with section 404 of the MMPA. The disease that typifies this UME is caused by a *Streptococcus infantarius* infection and has been observed over a broad geographic range in Alaska, including a few cases from southwest Alaska; however, the majority of cases have come from Kachemak Bay in the Southcentral Alaska stock. It is not clear if the observed stranding pattern is representative of overall sea otter mortality, or an artifact of having a well-developed stranding network in the Kachemak Bay area. The Service will continue to work with NOAA Fisheries and the Alaska Sea Life Center to develop the infrastructure for a State-wide marine mammal stranding network in Alaska.

STATUS OF STOCK

On August 9, 2005, the Southwest Alaska DPS of the northern sea otter was listed as "threatened" under the ESA, and it is, therefore, classified as a strategic stock under the MMPA.

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