Revised: July 2023

NORTHERN SEA OTTER (*Enhydra lutris kenyoni*): Southcentral Alaska Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Sea otters (*Enhydra lutris*) occur in nearshore coastal waters of the North Pacific Rim from the northern end of Japan to California. The northern sea otter sub-species (*E. lutris kenyoni*) extends from Alaska's Aleutian Islands through British Columbia (Canada) and Washington. Sea otters primarily inhabit nearshore habitats within the 40 meters (m) (~ 130 feet [ft]) depth contour where they forage for benthic invertebrates in shallow subtidal and intertidal zones (Riedman and Estes 1990), though they can forage and will occur at depths over 100 m (~ 328 ft) (Bodkin et al. 2004). Sea otters are not migratory and generally do not disperse over long distances, although movements of tens of kilometers (km) (tens of miles [mi]) 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) (~ 1.5 to 4.2 square miles [mi^2]) and adult female home ranges from a few to 24 km^2 (~ 9.3 mi^2) (Garshelis and Garshelis 1984, Ralls et al. 1988, Jameson 1989). Sea otter distribution and density can vary at small spatial scales seasonally and across years as sea otters seek refuge from storms (Stewart et al. 2015) and populations recover across their historic range (Larson et al. 2014).

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, eastern Cook Inlet and Kachemak Bay; and (3) Southwest Alaska stock includes Western Cook Inlet, 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 Southcentral stock of sea otters in Alaska (hereafter "Southcentral stock"). The U.S. Fish and Wildlife Service (Service) recognizes that the inclusion of genetic variation among sea otter populations is important to define stock delineations. Recent genetic analyses support existing stock structure designations that genetic differentiation among northern sea otters is clinal across their range (Larson et al. 2021, Flannery et al. 2021). The Service also acknowledges 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 proportionally to the abundance and distribution of sea otters (Bodkin and Ballachey 2010). 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, incorporating traits such as home range and movements (Bodkin and Monson 2002).

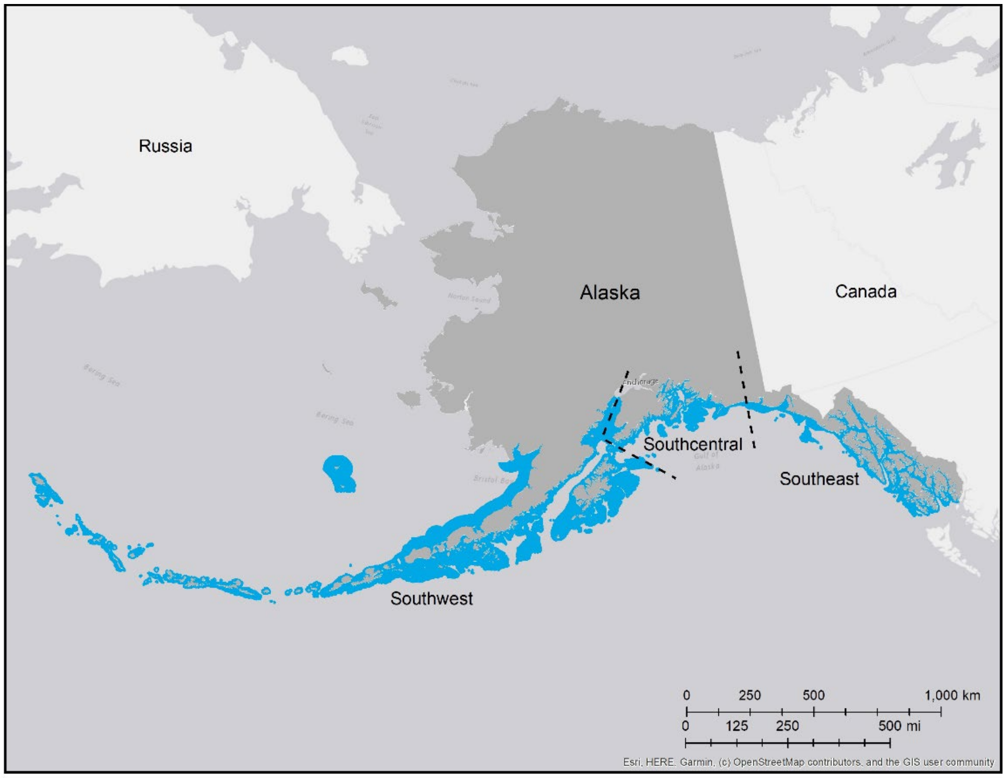

Figure 1. Northern sea otter distribution in Alaska (blue) delineated as ocean waters within the 100 m (328 ft) depth contour, within the median ice extent for the month of March from 2001–2020 and restricted to the 24 nautical mile Contiguous Zone maritime boundary. The boundaries among the three stocks are indicated with a dashed line.

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, Alaska Peninsula and southern coasts of Alaska, and south through British Columbia, Canada, into Washington, Oregon, California and Baja California, Mexico (Kenyon 1969). However, commercial exploitation of sea otters extirpated them from much of their range, with probably fewer than 2,000 animals remaining in an estimated thirteen remnant colonies (Kenyon 1969) when they were afforded protection by the International Fur Seal Treaty in 1911. Population recovery began following legal protection. As part of efforts to re-establish sea otters in portions of their historical range to offset costs of nuclear testing in Alaska and reinvigorate fur harvest, otters from Amchitka Island and Prince William Sound were translocated to other areas in the 1960s and 1970s, including to southeast Alaska, Washington, and Oregon (Jameson et al. 1982). Through both natural population growth and human-assisted translocations, sea otters have since repatriated much of their historical range in Alaska.

The most recent stock-wide abundance estimate for the Southcentral stock is 21,617 ± 2,190 (Std. Err.; CV = 0.101) (Esslinger et al. 2021; Table 1). This estimate is a compilation of surveys conducted from 2014–2019 across the Southcentral stock region and depicts an increase from the 2014 Southcentral Stock Assessment Report (SAR), which reported a total of 18,297 sea otters, also summed across surveys and years.

Since publication of the 2014 Southcentral SAR, multiple surveys have been completed across Southcentral Alaska, yielding more recent abundance estimates for Eastern Cook Inlet, Kachemak Bay, Kenai Fjords National Park, and Prince William Sound. Aerial surveys were conducted between 2014 and 2019 using the methods described in Bodkin and Udevitz (1999) which included a survey-specific correction factor to account for undetected and unavailable animals due to diving behavior. Surveys were conducted across Prince William Sound in two surveys efforts, first in 2014 (northern and eastern regions) and more recently in the Exxon Valdez Oil Spill (ca. 1989) affected region of Western Prince William Sound in June 2017, resulting in a Sound-wide estimate of 10,845 sea otters (CV=0.17; Esslinger et al. 2021). In June 2019, an aerial survey in Kenai Fjords National Park resulted in an estimate of 3,015 sea otters (CV=0.47; Esslinger et al. 2021). Eastern Cook Inlet and Kachemak Bay were surveyed in May 2017 as part of a replicated survey across all lower Cook Inlet (Garlich-Miller et al. 2018), yielding estimates of 3,164 sea otters (CV=0 .22; Esslinger et al. 2021), and 5,988 sea otters (CV=0.13; Esslinger et al. 2021), respectively. An aerial survey of the remote northern Gulf of Alaska coastline between Cape Hinchinbrook and Cape Yakataga has not been flown since 2000 due to logistical constraints and is therefore excluded from calculations in this SAR. While sea otters do occur along the outer coast from Cape Cleare to Cape Yakataga, the habitat predominately consists of long stretches of sandy beaches exposed to high wave action, with sea otter densities and overall abundance expected to be low (Esslinger et al. 2021).

Table 1. Population estimates for the Southcentral stock of northern sea otters as reported in Esslinger et al. (2021).

Region	Year	Pop. Est.	CV	N_{MIN}
Eastern Cook Inlet	2017	9,152	0.11	
Outer Kenai Peninsula	2019	1,620	0.34	
Prince William Sound	2014/2017	10,845	0.17	
Southcentral Stock wide		**21,617**	**0.10**	**19,854**

MINIMUM POPULATION ESTIMATE

The Marine Mammal Protection Act (MMPA) defines a minimum population estimate (N_{MIN}) as “an estimate of the number of animals in a stock that: (A) is based on the best available scientific information on abundance, incorporating the precision and variability associated with such information; and (B) provides reasonable assurance that the stock size is equal to or greater than the estimate.” (MMPA § 3(27)).

The minimum population estimate (N_{MIN}) for this stock is calculated using Equation 1 from the Potential Biological Removal Guidelines (Wade and Angliss 1997; NMFS 2016): $N_{MIN} = N/\exp(0.842 \times [\ln(1+[CV(N)]^2)]^{1/2})$. Using the abundance estimate for all the Southcentral Stock from Esslinger et al. (2021) as the best available, contemporary stock-wide estimate, N_{MIN} for the Southcentral stock is calculated to 19,854 sea otters and a CV of 0.10.

CURRENT POPULATION TREND

The trend for the Southcentral stock has generally been one of growth and stability in post Exxon Valdez oil spill years (Esler et al. 2018, Coletti et al. 2016, Esslinger et al. 2021). All surveys analyzed for trends in abundance used standardized methods described in Bodkin and Udevitz (1999), including use of a survey-specific correction factor to account for undetected and unavailable animals. While the overall trend shows that the Southcentral stock has been increasing or stable, the pattern varies regionally, with stability exhibited by the outer Kenai Peninsula coast population and apparent growth driven primarily by sea otters residing along the inside of the lower Kenai Peninsula, specifically around eastern Cook Inlet and Kachemak Bay (Figure 3).

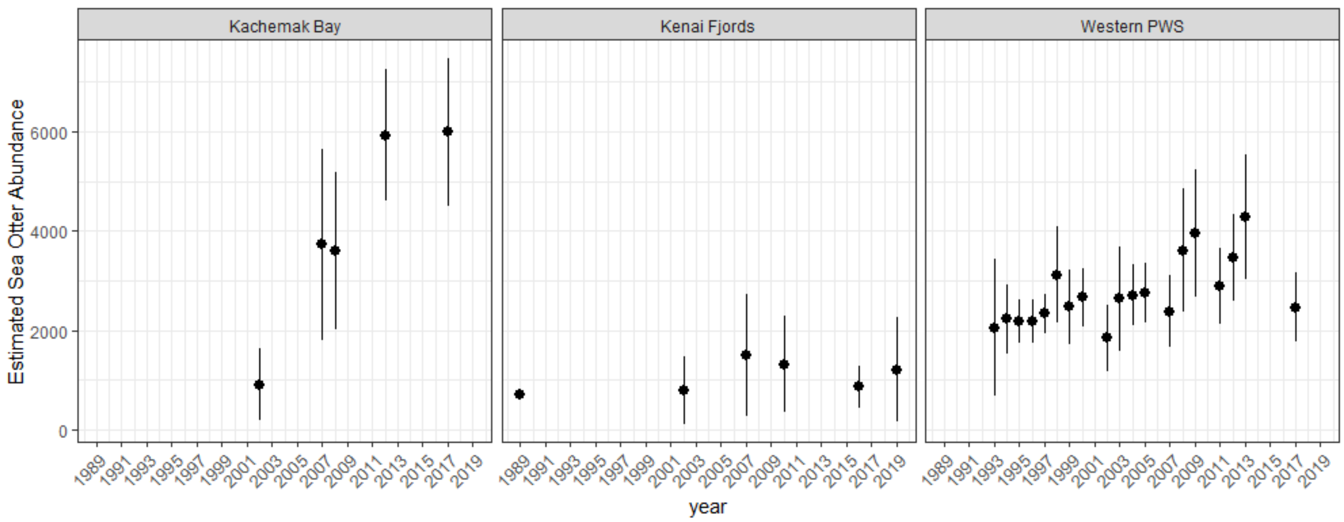

Figure 3. Sub-regional sea otter abundance estimates over time, with 95 percent confidence intervals, from aerial surveys conducted from 1989 to 2019. KBAY = at Kachemak Bay, Western Prince William Sound, and Kenai Fjord National Park.Data sourced from USFWS, USGS, and the Gulf Watch Alaska long-term monitoring program (Esslinger 2017, Garlich-Miller et al. 2018, Esslinger al. 2021a, 2021b, 2022).

Since 2002, the Kachemak Bay sea otter population increased exponentially until the 2012 survey, which indicated similar abundance as the 2017 survey (5,926 sea otters, CV= .11) (Figure 3). This suggests sea otters in Kachemak Bay may have reached a dynamic equilibrium density or carrying capacity within the ecosystem (Garlich-Miller et al. 2018) as determined in adjacent populations on the Katmai coast (Coletti et al. 2016). Immigration from other areas (Cook Inlet and outer Kenai Peninsula) may have contributed to the initial observed increase in sea otter numbers in Kachemak Bay. It is possible that the system has now reversed, and reproductive rates within Kachemak Bay remain elevated and approximately equal to mortality plus net emigration rates to areas outside of the Bay, driving observed increases in the eastern Cook Inlet region (Garlich-Miller et al. 2018).

Results from aerial surveys in Kenai Fjords National Park reflect an overall stable but low-density population (Figure 3), where most sea otters are highly concentrated around glacial moraine and protected lagoon habitats (Esslinger et al. 2021). Sea otter abundance estimates in western Prince William Sound reflect a population recovering from the 1989 *Exxon Valdez* oil spill until 2014, after which point natural variability around a dynamic equilibrium density has been presumed (Esler et al. 2018) (Figure 2). Sea otters in western Prince William Sound have experienced a lag in population recovery due to lingering oil that persisted in the environment, sequestered within intertidal sediments where sea otters forage on benthic invertebrates. Chronic exposure to residual oil increased mortality rates and altered normal mortality patterns observed in this area, with higher proportions of prime-age sea otters dying in the spill year and the 20 years following the spill (Monson et al. 2011). Population growth was observed in the years shortly following the spill, with the greatest increase in abundance observed post-2007 (Figure 3). Based on abundance estimates from most recent surveys in the past decade, the best assessment is that the Prince William Sound sea otter population is stable at this time. The Northern and Eastern regions of Prince William Sound have not been surveyed since 2014 and it is presumed that their populations are stable; however, contemporary survey data is required to adequately assess the entire Prince William Sound region.

Current abundance and distribution of sea otters in the northern Gulf of Alaska region is unknown because this area has not been surveyed since 2000. Sea otters do occur along the outer coast from Cape Cleare to Cape Yakataga. However, given that the habitat in the region predominately consists of long stretches of sandy beaches exposed to high wave action, sea otter densities and overall abundance are expected to be low (Esslinger et al. 2021).

MAXIMUM NET PRODUCTIVITY RATE

Eisaguirre et al. (2021) provides the most recent estimate of R_{MAX} for northern sea otter at 0.29 (90 percent Bayesian Credible Interval: 0.28–0.31) based on an assessment of sea otter population dynamics in southeast Alaska. Given that R_{MAX} is the maximum intrinsic rate of growth achievable by northern sea otters, the value of 0.29 is also applied to calculations used for this Stock Assessment Report. Previously, R_{MAX} values ranging 0.20–0.24 were reported by Estes (1990) were generally accepted to be realistic for northern sea otter (Tinker et al. 2019). Estes (1990) assumed age of first reproduction of 3–4 years and female reproductive rates of 0.43–0.45 per year. However, more recent evidence suggests sea otters are physiologically capable of reproducing, and many do reproduce, at 2 years (von Biela et al. 2009), and female reproductive rates are probably as high as 0.54 (Riedman et al. 1994). Therefore, an R_{MAX} value of 0.29 was used for the Southcentral stock.

POTENTIAL BIOLOGICAL REMOVAL

Under the MMPA, the potential biological removal (PBR) is defined as "the maximum number of animals, not including natural mortalities, that maybe removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population." (MMPA § 3(20)). Potential biological removal is the product of the 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.

The F_R value for this stock has been adjusted to account for biases and uncertainties associated with human caused mortality rates and current and future population trends. There have been no reported rates of incidental mortality and serious injuries associated with commercial fisheries in the U.S. However, this is based on self-reporting and observer programs on vessels that may not overlap with sea otter habitat, and therefore it is difficult to state the full effect of fisheries on the Southcentral stock. Reported subsistence harvest rates have declined slightly since 2018, but it is unknown how much underreporting occurs. There is also additional uncertainty to the rate of human-caused mortality associated with oil spills, local boating activity, and increased development in the mariculture industry. Although population levels have been stable or increasing, there is also an unknown degree of error due to the disparate nature of when these population surveys were conducted.

A F_R value of 0.75 has been adopted for this stock to account for uncertainty and buffer against an underestimate of mortality by approximately 25 percent. Using an $F_R < 1.0$ accounts for the known biases and uncertainties associated with the human-caused mortality rates and the biases associated with inferring trends from population surveys conducted over multiple years. Thus, the calculated PBR value for the Southcentral stock is 2,159 (19,854× 0.5(0.29) × 0.75).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Our best estimate of the average rate of annual human-caused mortality and serious injury for the Southcentral stock for the period 2017 through 2021 is 389 sea otters/year, which is below the calculated PBR of 2,159. Self-reported fisheries interactions averaged < 1 sea otter interaction per year. Data for subsistence harvest of sea otters in the Southcentral stock are collected by a mandatory Marking, Tagging, and Reporting Program (MTRP) administered by the Service since 1988. Total annual subsistence harvest removals averaged 388 sea otters/year over this same 5-year period, which represents < 1 percent of N_{MIN} of the average annual harvest rate but is likely an underestimate. The MTRP indicates they have received anecdotal reports of illegal and unreported harvest around Southcentral Alaska, but the extent to which this occurs in this stock is unknown. Rates of serious injury and strike and loss are also unknowns not quantified.

Additional factors likely to result in human-caused mortality or serious injury for this stock include oil and gas development and spills, boat strikes, and anthropogenic disturbance-related mortalities associated with fisheries or mariculture farms. Thus, the estimated annual human-caused mortality rate should be considered negatively biased to an unknown degree.

Fisheries Information

A complete list of fisheries and marine mammal interactions is published annually by the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service, the most recent of which was published on April 19, 2022 (NOAA Fisheries 2022; 87 FR 23122). Numerous fisheries exist within the range of the Southcentral Alaska stock of northern sea otters. Three have been documented to incidentally kill or injure sea otters in the Southcentral stock: the Prince William Sound salmon drift gillnet fishery with 537 vessels and/or persons participating, the Prince William Sound salmon set gillnet fishery with 29 vessels and/or persons participating, and the Cook Inlet salmon set gillnet fishery with 736 vessels and/or persons participating. Additional salmon drift gillnet fisheries occur in Cook Inlet (569 vessels participating), but no interactions between sea otters and this fishery have been documented at this time.

While much of the salmon set gillnet effort in Cook Inlet occurs north of the range of sea otters, interactions between sea otters and fisheries are reported from the Kachemak Bay region. In July 2009, five sea otters with slashed throats were found dead on a Seldovia beach. They were believed to have been killed after being captured in a set gillnet. In July 2011, a female and pup were successfully released from a set gillnet in the Homer area. Interactions with set gillnet gear also have been observed in the Kodiak and Prince William Sound areas within the ranges of the Southwest and Southcentral stocks. 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 the areas where such fisheries operate, 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 Southcentral stock cannot be made because observer coverage is not sufficient and data were not collected consistently over time. No incidents of sea otter mortality or serious injury have been reported in trawl, longline, or pot groundfish fisheries in Southcentral Alaska in the last two decades (NOAA unpublished data). Sea otters are known to interact with pot fisheries in California, however, 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).

An additional source of information on the number of sea otters killed or injured incidental to commercial fishery operations in Alaska is found in fisher self-reports required of vessel owners by NOAA Fisheries. No new reports of sea otter mortalities or serious injuries have been reported in the preceding 5 years, 2017-2021. Credle et al. (1994) considered fisher self-reports to be a minimum estimate of mortality and serious injury as these data are most likely negatively biased.

In summary, in the last 5-year period there have not been any records of mortality and serious injury of sea otters by commercial fisheries within the range of the Southcentral stock. However, there has been one report on a stranded sea otter in Kachemak Bay in 2018 whose mortality was attributed to a fishery interaction that resulted in drowning (USFWS unpublished data). Therefore, the estimated mean annual mortality and serious injury reported for the 5-year period is one. Observer coverage for fisheries within the range of the Southcentral stock 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. Additionally, assessment of serious injury and mortality in sea otters that interact with fisheries is difficult and self-reporting does not appear to yield many details. Information is, therefore, insufficient to determine whether or not the total fishery mortality and serious injury for the Southcentral stock 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 ecosystems in Alaska. Sea otters rely on air trapped in their fur for warmth. Contamination with oil drastically reduces the insulative value of the pelage, and consequently, sea otters are among the marine mammals most vulnerable to the direct effects of contact with oil. It is believed that sea otters can survive low levels of oil contamination (<10 percent of body surface), but that greater levels (>25 percent) will lead to death (Costa and Kooyman 1981, Siniff et al. 1982).

Within the range of the Southcentral stock, oil and gas development and production is primarily based on offshore platforms and shoreside pump stations within Cook Inlet. The Bureau of Ocean Energy and Management (BOEM) manages oil and gas lease sales in Cook Inlet. The eastern portion of Cook Inlet includes the Southcentral stock and the western portion includes the Southwest stock. There are currently 14 active leases in Cook Inlet spanning 76,615 acres (BOEM 2022). Seven of these leases overlap Eastern Cook Inlet and the Southcentral stock (BOEM 2022). No oil and gas incidents associated with the Cook Inlet oil and gas activities are known to have led to sea otter mortalities or serious injuries. Tankering of North Slope crude oil also occurs regularly through the waters of Prince William Sound, and there have been no major oil spills since the *Exxon Valdez*. However, according to the U.S. Coast Guard Response Center, mild oil spills do still occur within sea otter habitat of the Southcentral stock.

While the catastrophic release of oil has the potential to affect large numbers of sea otters, there is currently no evidence that other effects (such as disturbance) associated with routine oil and gas development and transport have had a population-level impact on the Southcentral stock. The Service has not received incident reports of oil-related mortalities or serious injuries in sea otters within the last 5-year time period.

Alaska Native Subsistence 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. It is possible that some harvested sea otters are never reported, and the Service does not currently have a method in place to estimate the amount of unreported harvest that occurs. However, sea otter hides are required to have MTRP tags before they can be commercially tanned, which is thought to help ensure proper reporting. We rely on MTRP as an indication of harvest levels in the Southcentral stock.

The mean reported annual subsistence harvest during the past five complete calendar years (2017 to 2021) was 388 animals (Figure 4). Subsistence harvest reporting should be considered a minimum estimate, as it does not account for underreporting of harvest or correct for struck and lost animals (i.e., attempted to be harvested, but not recovered and tagged). Those factors are known to exist, but since they are not currently monitored in any substantive way, the subsistence harvest data is not corrected to account for them.

Age and sex composition of harvest can influence sea otter population demographics but is not a concern at the current harvest level (Bodkin and Ballachey 2010). Reported age composition of harvested sea otters during this period was 88 percent adults, 9 percent subadults, 2 percent pups, and 1 percent unknown age. Sex composition of harvested sea otters during the past 5 years was 64 percent males, 31 percent females, and 5 percent of unknown sex.

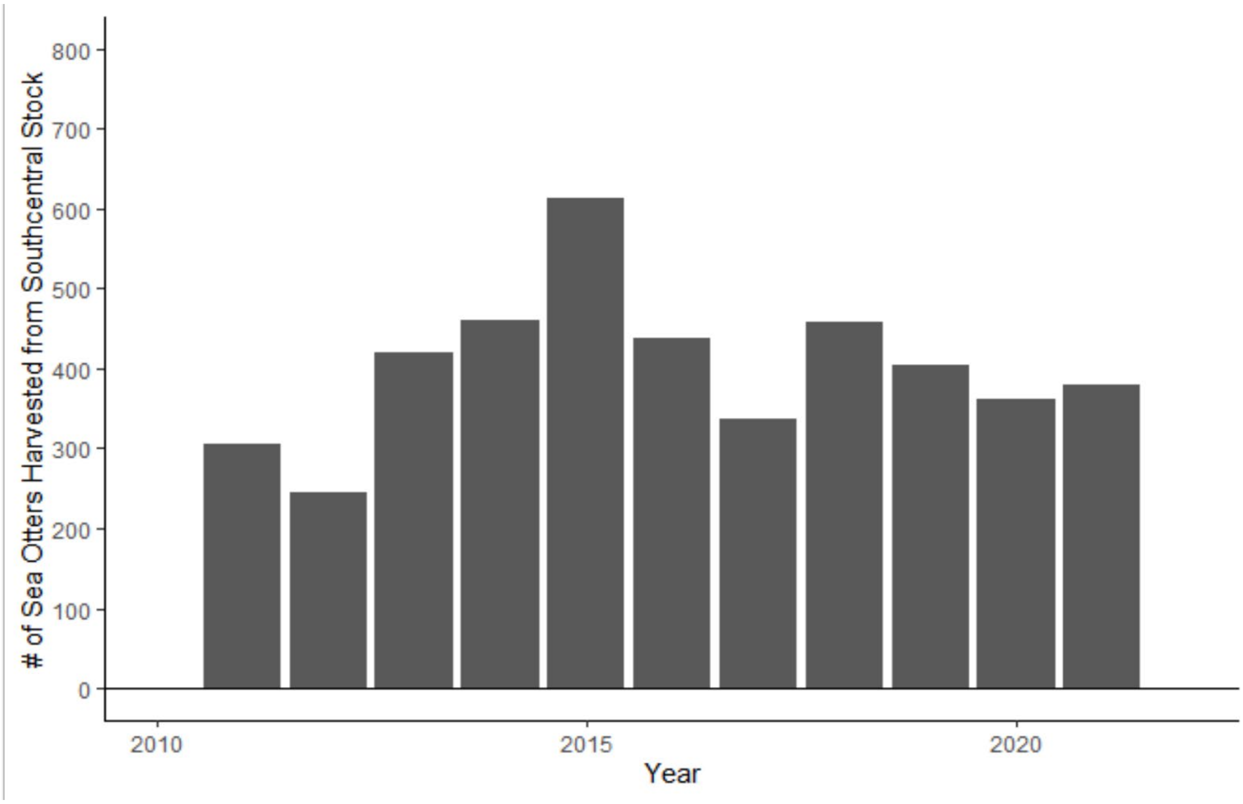

Figure 4. Reported annual subsistence harvest of northern sea otters from the Southcentral stock, 2011 to 2021.

Illegal Take

The extent to which sea otters are illegally killed as a result of conflict with fisheries-related activities is unknown. The Service's Law Enforcement office maintains records of the number of prosecutions for unlawful take, possession, transport, or sale of sea otters or sea otter hides. From 2017–2021, there were no specific prosecutions in Southcentral Alaska. The Service does not currently have a method for quantifying illegal take of northern sea otters.

Research and Public Display

Between 2017 and 2021, 16 dependent sea otter pups from the Southcentral stock stranded and were brought into captivity at the Alaska Sealife Center via the Marine Mammal Stranding Response Network. Fifteen of the pups were successfully rehabilitated; 13 were placed for public display, and two were released back into the wild, while one perished in care despite rehabilitation efforts. In summer 2019, 20 adult female sea otters were captured and released for scientific research by the Service in Kachemak Bay; there were no reported serious injuries and/or mortalities related to those activities.

Boat Strike

The Service maintains a baseline stranding program to determine cause of death, disease incidence, and status of general health parameters. The majority of reported strandings are called in from Southcentral Alaska in the Kachemak Bay region, providing a perspective on mortality in that area, and boat strikes were the most encountered human-inflicted injury (Burek-Huntington et al. 2021). Carcasses are occasionally necropsied for cause of death when possible. Despite the spatial imbalance of stranding reporting, boat strike is a recurring cause of death across all three stocks (Burek-Huntington et al. 2021). Necropsies of boat-struck sea otters have revealed that although trauma was the ultimate cause of death, there was a contributing factor such as disease or biotoxin exposure which likely incapacitated the animal, making it more vulnerable to boat strike (Burek-Huntington et al. 2021, Lefebvre et al. 2016). Due to the limitations of the stranding program, the total serious injury/mortality related to boat strikes is unknown for Southcentral Alaska.

Mariculture

Mariculture is defined as the farming of aquatic plants, such as kelps and other macro-algae, fish, and shellfish in salt water (Monson and Degange 1988). Aquatic farms specializing in cultivating macro-algae and various shellfish species have been increasing in Alaska since 1988 when the Aquatic Farm Act (Alaska Statutes 16.40.100-199) was passed by the Alaska Legislature (Alaska Mariculture Task Force 2018). It is currently unknown how mariculture activities affect the Southcentral stock and how these effects will change under various scenarios of industry growth. The Service has developed a Mariculture Working Group to better understand mariculture activities and to take a proactive role in helping reduce any potential negative sea otter-farm interactions. A recent review of self-reporting to the State of Alaska revealed conflicts between sea otters and mariculture operations in Kachemak Bay and described measures taken by operators (e.g., maintaining a human physical presence to discourage and mitigate sea otter impacts), which may have disturbed some Southcentral sea otters (Rehberg and Goodglick 2023). Future monitoring of reporting and outreach to mariculture operators about legal and sustainable pathways to resolving sea otter conflicts, in collaboration with State agencies tasked with oversight will be essential to reducing conflict with sea otters.

Other Mortality Sources

Predation

Sea otter predation occurs in all three stocks from killer whales, wolves, bears, and eagles on pups. Where sea otters have recolonized and frequently haul out, they become susceptible to terrestrial predators such as bears and wolves (Monson 2021, Roffler et al. 2021); however, terrestrial predators are unlikely to have stock-wide population impacts (Monson 2021). Eagle predation primarily occurs on pups less than 1 month old and experienced sea otters will alter behavior to minimize eagle predation risk to pups (Esslinger et al. 2014). While the population-level impacts from predators are generally hard to discern, predation from killer whales was a driver of population dynamics for the Southwest stock (Tinker et al. 2021). There have been recent observations of killer whales predating sea otters around the Cook Inlet region; however, the rate of predation is unknown and does not appear to be impacting the population at this time.

Biotoxins

Biotoxins are compounds produced by algae (dinoflagellates and diatoms) that can reach high levels under certain conditions known as harmful algal blooms (HAB). HABs occur most often in warm water conditions, but biotoxins can occur in the environment at high levels at any time, particularly in bivalve mollusks. Biotoxins associated with HABs that cause significant illness and mortality in marine mammal species, including neurotoxins domoic acid and saxitoxin, are an emerging concern in Alaska as sea surface temperatures increase (Burek et al. 2008).

While sea otters are at risk for exposure and uptake of biotoxins as detected in Kachemak Bay (Bowen et al. 2022) and around the State of Alaska (Lefebvre et al. 2016), it is unknown how the concentrations reported in sea otters to date relate to concentrations known to cause clinical signs of toxicity or mortality in other animals. Therefore, the population-level health effects to sea otters are not well understood and while the population shows an increasing trend, it is unknown how the frequency and severity of HABs influence sea otter demographics.

Pathogens

Pathogens (bacteria, fungi, viruses, parasites) can exert population-level effects through increased rates of mortality and reducing fertility or fecundity. Individual health and susceptibility to disease is a complex interaction of several factors such as immune status, body condition, and environmental conditions (Burek et al. 2008). Climate change is also increasing the prevalence of existing pathogens and introducing new pathogens to arctic and sub-arctic animal populations (Harvell et al. 1999, Dudley et al. 2015). However, due to the lack of information on sea otter health statewide in Alaska and the uncertainty in how a changing climate will influence distribution of pathogens and sea otter vulnerability to them, it is difficult to predict the impact pathogens will have at the stock level in the future.

STATUS OF STOCK

The Southcentral stock is not designated as depleted under the MMPA, nor is it listed as threatened or endangered under the U.S. Endangered Species Act. Currently the stock is classified as non-strategic, per the MMPA. There is insufficient information to determine if incidental mortality and serious injury related to commercial fisheries is zero or approaching zero, as the information that exists is based on self-reporting. However, the best available information indicates that fishery-related mortality and serious injury is likely low. Current sea otter harvest levels are within a sustainable range. The reported annual human-caused removals average 389 sea otters/year. The total known human-caused removals are below the calculated PBR level of 2,159 sea otters/year. Therefore, the Southcentral stock remains classified as non-strategic under the MMPA.

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