A POPULATION MONITORING PLAN FOR SEA OTTERS IN ALASKA

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Introduction

The Marine Mammal Protection Act (MMPA) of 1972 delegated management responsibility for marine mammals in U.S. waters to the Secretaries of Interior and Commerce. Under the authority of the Secretary of Interior, the U.S. Fish and Wildlife Service (Service) has responsibility for sea otters, polar bears, walrus, and manatees; under the Secretary of Commerce, NOAA-Fisheries (Fisheries) has responsibility for all cetaceans (whales, dolphins, and porpoises) and pinnipeds other than walrus(seals and sea lions).

The primary objective of the MMPA is to maintain the health and stability of the marine ecosystem, with the goal of maintaining marine mammals at optimum sustainable population (OSP) levels. The MMPA defines OSP as "the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem." In order to implement the MMPA, it is therefore essential to monitor the abundance, status, and trends of marine mammal populations.

The functional management unit under the MMPA is the species or population stock, which is defined as "a group of marine mammals of the same species or smaller taxa in a common spatial arrangement, that interbreed when mature." The Service recognizes three stocks of sea otters in Alaska: southeast, southcentral, and southwest (Figure 1). Under section 117 of the MMPA, the Service periodically updates stock assessment reports for marine mammal stocks in U.S. waters; the Alaska sea otter reports were last revised in August 2002 (Appendix E).

In addition to management under the authority of the MMPA, sea otters in southwest Alaska have been proposed for listing as a threatened population under the Endangered Species Act (ESA). In the event the listing action is finalized, this population will require consistent monitoring to evaluate its status to determine when it should be removed from the list, or up-listed to endangered status.

On February 8-9, 2005, the Service and the Alaska SeaLife Center (ASLC) co-hosted a workshop to develop a population monitoring plan for Alaskan sea otters (Appendix D). After a thorough review of previous sea otter survey objectives, methods, and results, the group produced a comprehensive strategy for future sea otter surveys in Alaska.

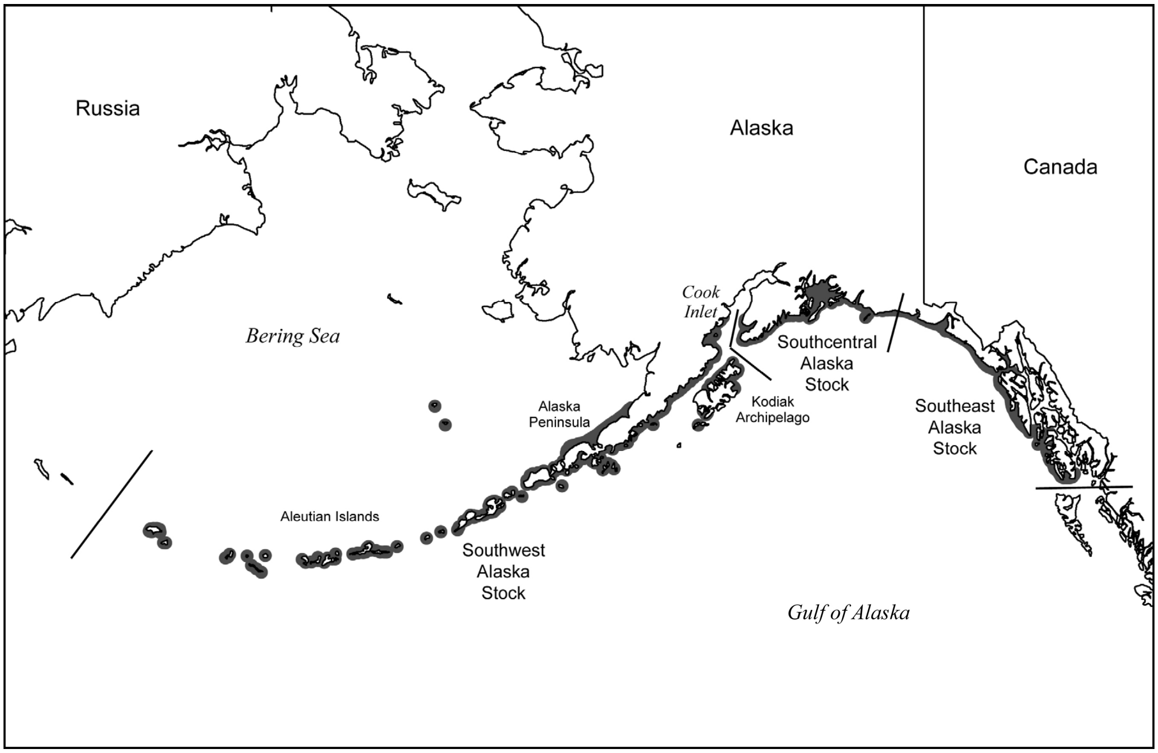

Figure 1. Sea otter stocks in Alaska.

Survey Considerations

General - wildlife population surveys are typically conducted to determine animal abundance at a specific point in time. A series of comparable surveys can also be used to determine population trends (increasing, stable, or decreasing) over time. For the purposes of stock assessment as mandated by the MMPA, we are primarily interested in sea otter abundance in Alaska. From a management perspective however, population trends are of equal or even greater importance. The ESA defines an endangered species as one that is likely to become extinct throughout all or a significant portion of its range in the foreseeable future. Similarly, a threatened species is one that is likely to become endangered throughout all or a significant portion of its range in the foreseeable future. In both cases, an unbiased assessment of population trends is often a consideration in both listing and de-listing decisions.

Any estimate of abundance will be subject to two kinds of uncertainty—bias and imprecision. Bias is defined as the difference between the metric of abundance (a count, for example) and the actual population size. Precision is defined as the degree to which a metric of abundance is repeatable. For trend analysis, precision is typically of greater concern and importance than bias. Alternatively, in the context of stock assessment, accuracy (or lack of bias) may be of greater concern than precision.

Both stock assessments and trend monitoring can be done in one of two general ways; through comprehensive counts of entire populations or stock units, or through sampling. Comprehensive counts have the intuitive appeal of knowing that the data are maximally representative (in a geographical sense) of the population or stock unit. That is, this approach eliminates any possibility (at least in theory) of misrepresenting population abundance or change due to a lack of independence between the spatial structure of the sampling units and smaller-scale spatial heterogeneity in population density or change. However, the obvious disadvantage of comprehensive counts is the high costs in terms of time and money, as well as bias for otters not detected by observers. Representative samples, if properly selected, can provide assessments that are of similar or even improved (because of the potential for increased replication over time) quality, often at much reduced costs. If a sampling approach is to be used in either stock assessments or trend monitoring, then it is important that the sample units are representative of the population. While this can never be guaranteed, it is often feasible to establish a monitoring program based on sample units in which one has a high degree of confidence that the measured trends will be representative of population trends.

No population is ever perfectly static (often the desired goal of management). The more important question for trend analyses is whether stocks are increasing or decreasing to a degree that is both statistically detectable and biologically meaningful. Computer-based algorithms for power analysis have been developed to help the Service make these determinations (Appendix C).

Specific concerns in Alaska - the principal issue of present concern for sea otters in Alaska is the recent and apparently continuing population declines of the southwest Alaska stock (Doroff et al. 2003, Estes et al. 2005, Burn and Doroff 2005). An effective monitoring program for this region must be able to answer two important questions: 1) will the rate of decline change; and 2) will the area of decline change? The first of these questions can be answered by continued monitoring of the area within the present region of the decline. The second question can be answered by careful monitoring of areas near the geographic peripheries of the current decline. Since the western-most point of the decline is Attu Island, a range reduction in the decline would first be seen at Attu and a range expansion in the decline would first be seen in the Commander Islands. The eastern-most extent of the decline is less clear, in large measure because surveys have not been done as frequently in this region. However, it now appears that the Kodiak archipelago may lie beyond the eastern-most extent of the decline, and it also seems quite clear that the Shumagin Islands are within the area of the decline. Thus, a range reduction at the eastern end of the decline might first be seen in the Shumagins and a range expansion in the decline would first be seen in the Kodiak archipelago. This logic emphasizes the importance of these 4 sites for trend analysis in southwest Alaska.

A secondary issue in parts of Alaska concerns the potential influences of human removals of sea otters, including both subsistence and illegal harvests, as well as fisheries-related mortality. For example, with the exception of Glacier Bay, population growth and range expansion in southeast Alaska has not occurred over the past 15 years, and potential sea otter habitat remains unoccupied throughout much of the region. The reasons for this lack of growth are not clear, but the role of human removals warrants further investigation, as these may be the only factors influencing sea otter populations that can be effectively managed.

The monitoring plan for sea otters in Alaska will require decisions on 3 fundamental issues: 1) survey methods; 2) survey frequencies; and 3) survey regions. While survey methods and frequencies will be dictated largely by logistical and economic considerations, there are an almost infinite number of possible geographic divisions. If these geographic divisions are made either too small or too large, or if their borders are established so as to be discordant with real biological patterns of population change, data from the monitoring program will may be difficult to interpret.

Gulf Ecosystem Monitoring (GEM) Program – as part of the *Exxon Valdez* Oil Spill (EVOS) restoration, the EVOS Trustee Council established the GEM program to conduct long-term monitoring of the Gulf of Alaska ecosystem. As sea otters were a marine mammal species that suffered serious injury from the spill, they are of particular interest to researchers looking to understand the long-term effects on nearshore marine environment. Surveys of sea otter abundance currently planned under the GEM program will be integrated into this plan for monitoring the population statewide.

Survey Methods

Skiff surveys – some of the earliest surveys of sea otter abundance were conducted from small boats or skiffs. Due to the relatively slow survey speeds (~10 knots), skiff surveys are not well-suited for covering large areas. This method, described in Estes et al. (1990) and Doroff et al. (2003), consists of surveying the nearshore marine environment from a distance of approximately 100m from shore, or from the offshore margin of the kelp forest (if kelp is present). Although the slower survey speed limits the amount of area that can be surveyed, this method typically results in fewer otters missed by observers than aerial survey. In one study to determine the proportion of otters not recorded by skiff-based observers, Udevitz et al. (1995) estimated that up to 30% may be missed during skiff survey operations.

In recent years, skiff surveys have been used primarily to document sea otter distribution and abundance at select locations in Alaska. Results are typically reported as counts over a given length of shoreline surveyed.

Aerial surveys – the first state-wide surveys of sea otters were conducted from aerial platforms in the late 1950s and early 1960s (Kenyon 1969). At survey speeds that typically range from 70-100 knots, aerial surveys are the only practical means of surveying sea otters over their entire range in Alaska.

Similar to skiff surveys, aerial surveys have been used to record otters in the nearshore marine environment adjacent to shore, and results are reported as counts over a given length of shoreline. In most areas of Alaska however, shoreline surveys do not cover the full extent of sea otter habitat, which is predominantly defined by water depth. Instead, strip transects have been used to sample a portion of sea otter habitat, and the observed density is extrapolated over the entire study area to estimate abundance. This approach was first used along the north side of the Alaska Peninsula, where a broad, shallow shelf extends into Bristol Bay (Schneider 1976). In the early 1970s, it was not uncommon to see large rafts of sea otters several miles from shore, yet still in waters less than 100m in depth.

In the 1990s, Bodkin and Udevitz (1999) developed an aerial survey technique that produces accurate population estimates that are adjusted for animals missed by observers on transects. This method uses strip transects to sample 2 survey strata: 1) high-density habitat, defined as all waters less than 40m in depth or within 400m from shore; and 2) low-density habitat, defined as all waters less than 100m in depth or within 2km from shore. The high-density survey strata also include bays and fiords less than 6km across. A series of 400m-wide parallel strip transects are oriented roughly perpendicular to the shore, and surveyed at various levels of effort, typically ranging from 10-20% of the transects in the high-density stratum, and 2-5% of the transects in the low-density stratum. A sample of the sea otter sightings recorded on transect are circled using "intensive search units," or "ISUs" to estimate the proportion of otters missed by the observer. We will refer to this method throughout the remainder of the plan as the "ISU survey method." The survey platform for the ISU survey method is a small single-engine aircraft on floats, typically a Super Cub or Scout. While this method has been successfully used throughout much of Alaska, there are some remote areas where logistical and safety considerations require a twin-engine aircraft.

Shore-based surveys – although this is the primary survey method for southern sea otters in California, shore-based surveys have been rarely used in Alaska. Due to the extremely limited area in Alaska that can be surveyed from shore, this method may only be practical as an index of population trends on a local scale.

Survey Frequency

While repetition of abundance surveys or indices of abundance over time provides information on population trends, economic considerations may make it impossible to conduct range-wide abundance surveys frequently enough to identify problems (such as population declines) in a timely manner. The primary mandate for abundance surveys is the MMPA requirement for periodic stock assessments for all marine mammals in U.S. waters. Survey data that are more than 8 years out-of-date are considered to be unsuitable for the purposes of stock assessment; therefore abundance surveys should be conducted no less frequently than every 8 years.

To effectively monitor trends, it may be more cost-effective to survey selected sites within a population stock on a more frequent basis. More frequent surveys will provide more precise assessments of the direction and magnitude of population trends. However, precision (as defined by the standard error of or confidence interval around the estimate) does not improve linearly with sample size (n), but rather as the square root of n. As the limiting factor for sea otter surveys will be the availability of operating funds, survey frequency will ultimately be dictated by economic considerations. Once a survey interval has been established, the precision of the survey methods can then be used to determine the sensitivity to detect real population trends with a given level of statistical confidence. Existing survey data may be suitable for estimating the sensitivity of a given trend survey plan schedule. Sensitivity to detect real population trends can be re-evaluated as new data are collected.

Survey Regions

The population stock is the fundamental management unit under the MMPA, and serves as the primary division for sea otter survey areas in Alaska. Within each of the 3 stocks, further subdivisions are based on logistical and safety considerations. In some cases, it may be important to maintain existing survey regions for consistency reasons.

It is important to note that the geographic scale for surveys based on regions within population stocks may not be appropriate for assessing the impact of certain activities that affect sea otters in Alaska. For example, disease epidemics and/or oil spills may occur across stock or region boundaries. Conversely, human activities such as subsistence harvest or fisheries mortality may occur on a smaller geographic scale than survey regions, which may confound our ability to determine their impacts on the sea otter population.

MONITORING PLAN FOR THE SOUTHWEST ALASKA STOCK

Aleutian Region

Location – the Aleutian region ranges from Attu Island in the west to Unimak Pass in the east (Figure 2).

Trend surveys – several long-term trend sites exist in the western and central Aleutians, including Adak, Amchitka, Attu, Kagalaska, Little Kiska, and the Semichi islands. These sites have been surveyed by skiff using the methods described in Estes (1990) and Doroff et al. (2003). The data history at most of these sites spans from the early 1990s to the present; surveys occurred at irregular intervals. Additional skiff survey sites will be added to existing sites to obtain adequate representation throughout the Aleutian chain west of Amukta Pass.

In the eastern Aleutians, it is logistically feasible to use aerial surveys to monitor sea otter population trends. The Service will establish trend sites in the Islands of Four Mountains and Krenitzen Islands, as both island groups can be easily reached from the airport at Dutch Harbor, Alaska.

A correction factor for otters missed by observers will not be calculated for skiff survey trend sites; the correction factor used for aerial surveys of abundance (described below) can be used to correct those data for otters missed by observers. Both skiff and aerial surveys will be conducted at 2-year intervals. Skiff surveys in the Near Island and Rat Island groups will be conducted in alternate years. Adak Island will be surveyed annually, at least for the next several years.

Abundance surveys – the Service conducted complete shoreline aerial surveys of the Aleutians in 1992 and 2000 (Doroff et al. 2003). These surveys were expensive, and it is unlikely that future funding levels will allow for an abundance survey with complete coverage. The Service will examine the possibility of estimating the size of sea otter population by sampling shoreline habitat instead of complete coverage. Existing data from 1992 and 2000 will be re-sampled to determine the optimum survey effort needed to obtain a population estimate with adequate precision.

A correction factor for otters missed by observers will be calculated based on comparison of aerial and skiff survey counts at trend survey sites conducted during the same year, as detailed in Doroff et al. (2003). This correction factor scales the aerial counts to a minimum estimate of total abundance, as it is recognized that skiff surveys are also biased low due to otters missed by observers.

Abundance surveys in the Aleutian region will be conducted at 5-year intervals.

Action items – conduct power analysis to determine sensitivity of surveys to detect trends. Determine optimum survey effort for abundance surveys. Estimate costs for both trend and abundance surveys.

North Alaska Peninsula Region
Location – the North Alaska Peninsula region ranges from Cape Sarichef on Unimak Island, to Port Heiden.

Trend surveys – there are no existing trend sites within this region. Due to uncertainty about habitat use and animal movements, new trend sites will not be established within this region.

Abundance surveys – previous aerial surveys of sea otter abundance in this area followed the methods of Brueggeman et al. (1988) and Burn and Doroff (2005). The previous survey design recognized a single offshore survey stratum extending from shore to the approximate 70m depth contour. Due to the extensive distance from shore that was surveyed, a twin-engine fixed-wing aircraft has been the survey platform of choice. The Service will redesign this survey by creating 2 survey strata, similar to those used in the ISU survey method. Survey effort will be allocated differentially between the nearshore high-density and offshore low-density strata. For safety considerations, a twin-engine aircraft will continue to be the survey platform used. These data will be used both for stock assessment and trend analysis. The trend analyses will be based on resurveys of the areas sampled by Brueggeman et al. (1988). Stock assessments will be based on the results of the complete survey.

A correction factor for otters missed will be calculated based on a comparison of surveys using the ISU survey method and the twin-engine survey aircraft. The location and methods for calculation of this correction factor for the twin-engine survey aircraft have yet to be determined.

Abundance surveys in the North Alaska Peninsula region will be conducted at 5-year intervals.

Action items – create survey strata and develop series of strip transects. Determine optimum sampling effort within survey strata. Develop study plan for calculation of correction factor. Estimate costs for abundance survey.

South Alaska Peninsula Region
Location – The south Alaska Peninsula region ranges from Cape Sarichef on Unimak Island to the western boundary of Katmai National Park, and includes all offshore islands.

Trend surveys – shoreline aerial surveys have been conducted at 23 islands at various intervals. All these sites can be reached from the airport at Cold Bay, Alaska. A subsample of these islands will be surveyed to monitor population trends in this area.

A correction factor for otters missed by observers will not be necessary for these trend survey sites; rather, we will assume that detection among surveys is equal over time. Aerial trend surveys will be conducted at 2-year intervals.

Abundance surveys – similar to the north Alaska Peninsula region, previous aerial surveys of sea otter abundance in this area followed the methods of Brueggeman et al. (1988) and Burn and Doroff (2005). The geographic extent of the offshore survey stratum was determined by the location of proposed offshore oil and gas lease sales, rather than by any biologically meaningful criteria. The area from Kupreanof Point to Cape Douglas has been surveyed as a shoreline aerial survey. The Service will redesign the survey for this region by creating 2 survey strata similar to those used in the ISU survey method. Due to logistical and safety concerns, it is not yet clear if this region can be surveyed using the ISU survey method, however. If it proves unfeasible to use that method in this region, the area will be surveyed using a twin-engine aircraft.

If the survey can be conducted using the ISU survey method, the calculation of a survey-specific correction factor will be included. In the event that this survey will be conducted using a twin-engine aircraft, a correction factor for otters missed will be calculated based on a comparison of surveys using the ISU survey method and the twin-engine survey aircraft.

Abundance surveys in the South Alaska Peninsula region will be conducted at 5-year intervals.

Action items – conduct power analysis to determine sensitivity of trend surveys. Create survey strata and develop series of strip transects. Determine feasibility of using the ISU survey method for this survey. Estimate costs for both trend and abundance surveys.

Kodiak Region
Location – the Kodiak region encompasses the entire Kodiak archipelago, including Afognak, Shuyak, and the Trinity and Barren Islands.

Trend surveys – there are no existing trend sites for the Kodiak region. As this region is scheduled to be partially surveyed annually, and completely surveyed every 3 years as part of the GEM program, establishing new trend sites is not necessary. We note that some areas within this region may be surveyed using shoreline skiff survey methods as part of the TASSC Small Boat Survey program, as well as the Kodiak National Wildlife Refuge annual winter sea duck surveys.

Abundance surveys – previous surveys of the Kodiak region have been conducted using the ISU survey method in 1994, 2001, and 2004 (Doroff et al. in prep.). This method includes the calculation of a survey-specific correction factor. A complete survey of the region using the ISU method is scheduled for every 3 years as part of the GEM program.

As sea otters have yet to completely re-colonize available habitat within this region, a thorough search of available distribution data will be used to determine the geographic extent of the population prior to conducting the survey.

Action items – conduct power analysis to determine sensitivity of surveys to detect trends.

Lower Western Cook Inlet Region
Location – the lower western Cook Inlet region ranges from the western boundary of Katmai National Park to the northern boundary of Lake Clark National Park.

Trend surveys – there are no existing trend sites for the lower western Cook Inlet region. As this region is scheduled to be partially surveyed annually, and completely surveyed every 3 years as part of the GEM program, establishing new trend sites is not necessary.

Abundance surveys – a single survey of the Kamishak Bay portion of this region was conducted using the ISU survey method in 2002 (Bodkin et al. 2003), which includes the calculation of a survey-specific correction factor. A complete survey of the region is scheduled for every 3 years as part of the GEM program.

Action items – conduct power analysis to determine sensitivity of surveys to detect trends.

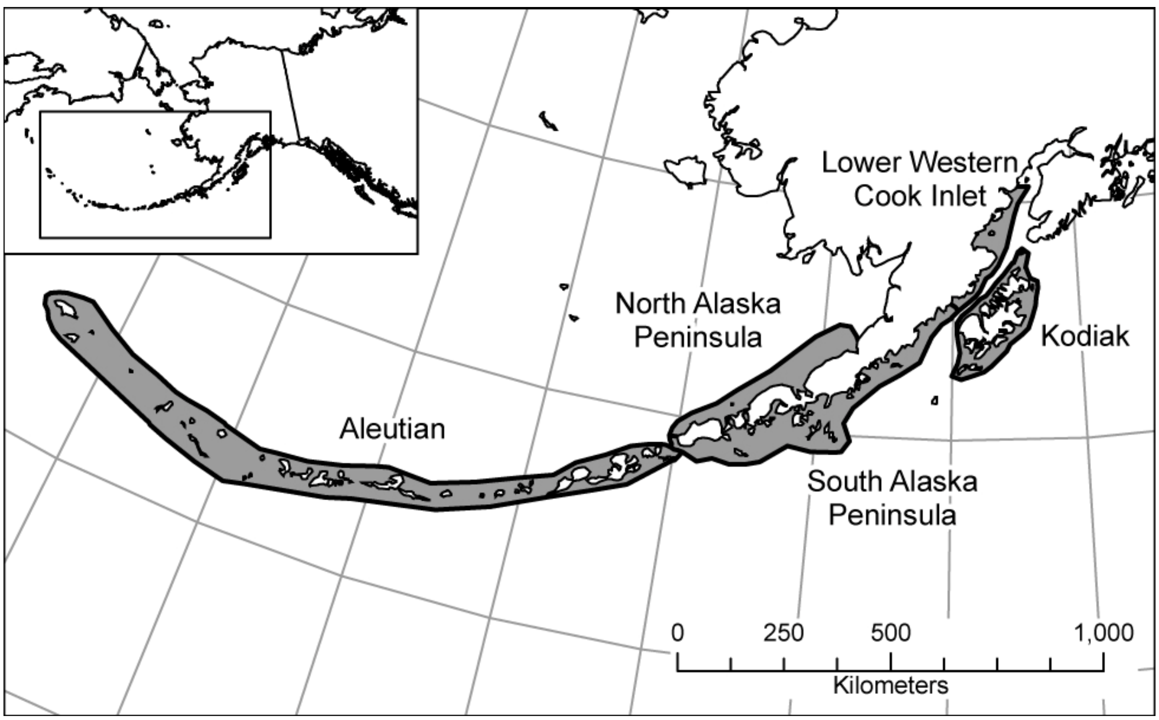

Figure 2. Survey regions for the southwest Alaska stock of sea otters.

Sea otter survey regions, methods, frequencies, and costs for the southwest Alaska stock are summarized in Appendix A.

MONITORING PLAN FOR THE SOUTHCENTRAL ALASKA STOCK

Cook Inlet-Kenai Fjords Region

Location – the Cook Inlet-Kenai Fjords region ranges from Anchor Point on the eastern shore of Cook Inlet, to Port Bainbridge at the southwest corner of Prince William Sound (Figure 3).

Trend surveys – there are no existing trend sites for the lower western Cook Inlet region. As this region is scheduled to be partially surveyed annually, and completely surveyed every 3 years as part of the GEM program, establishment of new trend sites is not necessary. We note that some areas within this region may be surveyed using shoreline skiff survey methods as part of the TASSC Small Boat Survey program.

Abundance surveys – a single survey of this region was conducted using the ISU survey method in 2002 (Bodkin et al. 2003). This method includes the calculation of a survey-specific correction factor. A complete survey of the region is scheduled for every 3 years as part of the GEM program.

Action items – conduct power analysis to determine sensitivity of surveys to detect trends.

Prince William Sound Region

Location – this region ranges from Port Bainbridge to Strawberry Channel at the mouth of Orca Inlet, excluding the seaward portions of Montague and Hinchinbrook Islands.

Trend surveys – the sea otter population trend in Prince William Sound has been monitored by aerial surveys using the ISU survey method that have been conducted since 1993 as part of the Exxon Valdez Oil Spill Restoration Program (Bodkin et al. 2002). As this region is scheduled to be partially surveyed annually, and completely surveyed every 3 years as part of the GEM program, establishment of additional trend sites is not necessary.

Abundance surveys – this region will be surveyed using the ISU survey method. This method includes the calculation of a survey-specific correction factor. A complete survey of the region is scheduled for every 3 years as part of the GEM program.

Action items – conduct power analysis to determine sensitivity of surveys to detect trends.

Outer Coast Region

Location – this region includes the outer coasts of Montague and Hinchinbrook Islands, ranging from Cape Cleare on Montague Island to Point Bentinck on Hinchinbrook Island. It also includes coastal waters ranging from Strawberry Channel to the eastern boundary of the southcentral Alaska stock, located at Cape Yakataga.

Trend surveys – there are no existing trend sites within this region. Due to uncertainty about habitat use and animal movements, new trend sites will not be established within this region.

Abundance surveys – the Service will design a survey for this region by creating 2 survey strata similar to those used in the ISU survey method. Due to logistical and safety concerns, it is not yet clear if all (or a portion) of this region can be surveyed using the ISU survey method. If it proves unfeasible to use that method in this region, the area will be surveyed using a twin-engine aircraft.

If the survey can be conducted using the ISU survey method, calculation of a survey-specific correction factor will be included. In the event that this survey will be conducted using a twin-engine aircraft, a correction factor for otters missed will be calculated based on a comparison of surveys using the ISU survey method and the twin-engine survey aircraft.

Abundance surveys of the outer coast region will be conducted at 3-year intervals.

Action items – create 2 survey strata and develop series of strip transects. Determine feasibility of using the ISU survey method for this survey. Estimate costs for both trend and abundance surveys.

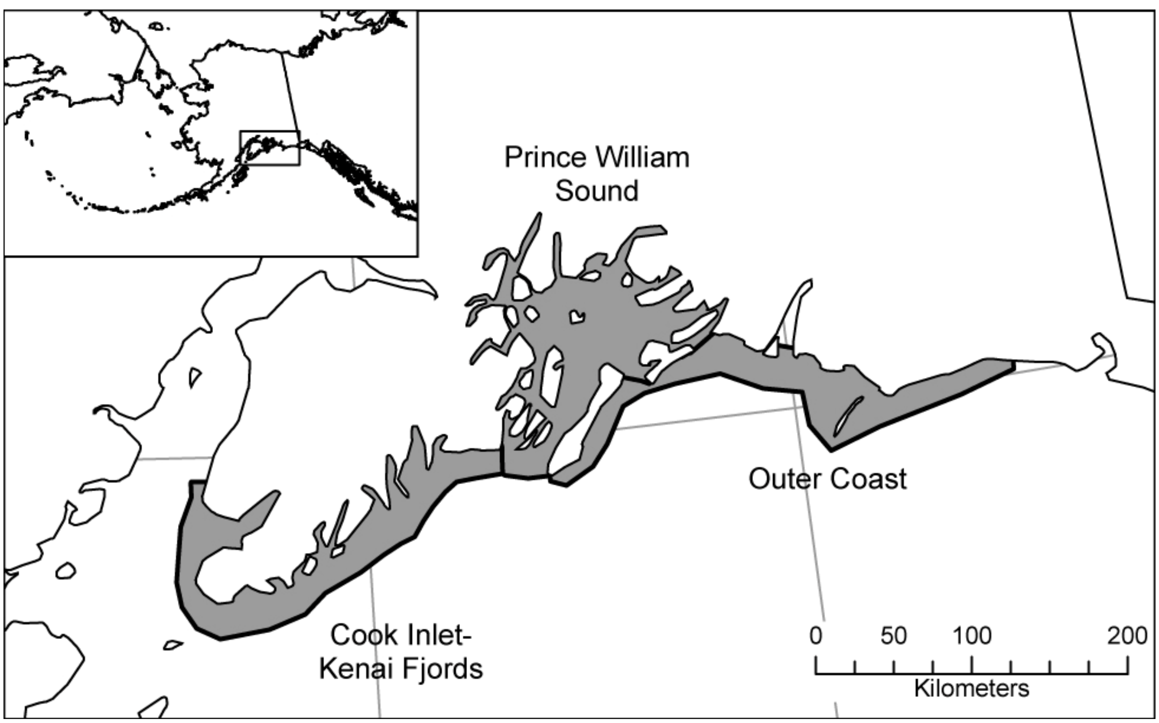

Figure 3. Survey regions for the southcentral Alaska stock of sea otters.

Sea otter survey regions, methods, frequencies, and costs for the southcentral Alaska stock are summarized in Appendix A.

MONITORING PLAN FOR THE SOUTHEAST ALASKA STOCK

Yakutat Bay Region

Location – the Yakutat Bay region consists of the waters of Yakutat Bay, Russell Fiord, and Nunatak Fiord (Figure 4).

Trend surveys – there are no existing trend sites for the Yakutat Bay region. We note that some areas within this region may be surveyed using shoreline skiff survey methods as part of the TASSC Small Boat Survey program.

Abundance surveys – a single survey of the Yakutat Bay portion of this region was conducted using the ISU survey method in 1995 (Doroff and Gorbics 1998). Future surveys of this region will continue to use this survey method, which includes the calculation of a survey-specific correction factor.

Abundance surveys of the Yakutat Bay region will be conducted at 5-year intervals.

Action items – none.

Gulf of Alaska Region

Location – the Gulf of Alaska Region consists of nearshore waters from Cape Yakataga in the east, to Bassoule Bay in the west (exclusive of Yakutat Bay).

Trend surveys – there are no existing trend sites for the Gulf of Alaska region. As the area contains few sea otters, we do not anticipate establishing new trend sites in the future.

Abundance surveys – a shoreline survey of this area was conducted in 1996 using a twin-engine aircraft (Doroff and Gorbics 1998). Future surveys of this region will use either a single engine aircraft on floats or twin-engine aircraft to conduct a complete shoreline survey at 5-year intervals, during the same year as surveys of the Yakutat Bay region are conducted. A correction factor for this survey will be developed by calibration with the ISU survey method.

Action items – estimate cost of abundance survey.

Glacier Bay Region

Location – the Glacier Bay region includes the waters of Glacier Bay.

Trend surveys – the sea otter population trend in Glacier Bay has been monitored by aerial surveys using the ISU survey method that have been conducted annually since 1999 as part of a joint USGS/National Park Service project (Bodkin et al. 2003). Establishment of new trend sites is therefore not necessary.

Abundance surveys – this region has been surveyed using the ISU method annually until 2004. Future surveys are planned, but not yet funded.

Action items – none.

Northern Southeast Alaska Region
Location – the northern southeast Alaska region ranges from the waters of Boussole Bay, Cross Sound and Icy Strait in the north, southward to Chatham Strait and Frederick Sound.

Trend surveys – there are no existing trend sites for the northern southeast Alaska region. We note that some areas within this region may be surveyed using shoreline skiff survey methods as part of the TASSC Small Boat Survey program.

Abundance surveys – in the late 1980s Pitcher (1989) surveyed by skiff the nearshore waters around the sites where sea otters were translocated to southeast Alaska between1965 and 1969. In 1994, Agler et al. (1995) conducted a seabird and marine mammal survey of this area using skiffs to sample transects in both nearshore and offshore waters. A single survey of the northern southeast Alaska region was conducted using the ISU survey method in 2002 (U.S. Geological Survey unpublished data). Within the region, the survey covered waters of Boussole Bay, Cross Sound, Icy Strait, Peril Strait, and the outer coast of Baranof Island. Future surveys of this region will continue to use the ISU survey method, which includes the calculation of a survey-specific correction factor. As sea otters have yet to re-colonize all available habitat within this region, a thorough search of available distribution data will be used to determine the geographic extent of the population prior to conducting the survey. This will include interviews with local residents and other people familiar with the region.

The northern southeast Alaska region will be surveyed at 5-year intervals.

Action items – re-sample historical survey data to determine optimum survey effort. Estimate costs for abundance surveys.

Southern Southeast Alaska Region
Location – the southern southeast Alaska region ranges from the waters of Chatham Strait and Frederick Sound in the north, to Dixon Entrance in the south.

Trend surveys – there are no existing trend sites for the southern southeast Alaska region. We note that some areas within this region may be surveyed using shoreline skiff survey methods as part of the TASSC Small Boat Survey program.

Abundance surveys – this area was also surveyed by both Pitcher (1989) and Agler et al. (1995) as described above. A single survey of the southern southeast Alaska region was conducted ISU survey method in 2003 (U.S. Geological Survey unpublished data). Within the region, the survey covered waters surrounding Kuiu Island, and all waters west of Prince of Wales Island. Future surveys of this region will continue to use the ISU survey method, which includes the calculation of a survey-specific correction factor.

Similar to the northern southeast Alaska region, sea otters have yet to re-colonize all the available habitat in this region. Prior to conducting the survey, a thorough search of available distribution data will be used to determine the geographic extent of the survey area. This will include interviews with local residents and other people familiar with the region.

The southern southeast Alaska region will be surveyed at 5-year intervals.

Action items – re-sample historical survey data to determine optimum survey effort. Estimate costs for abundance surveys.

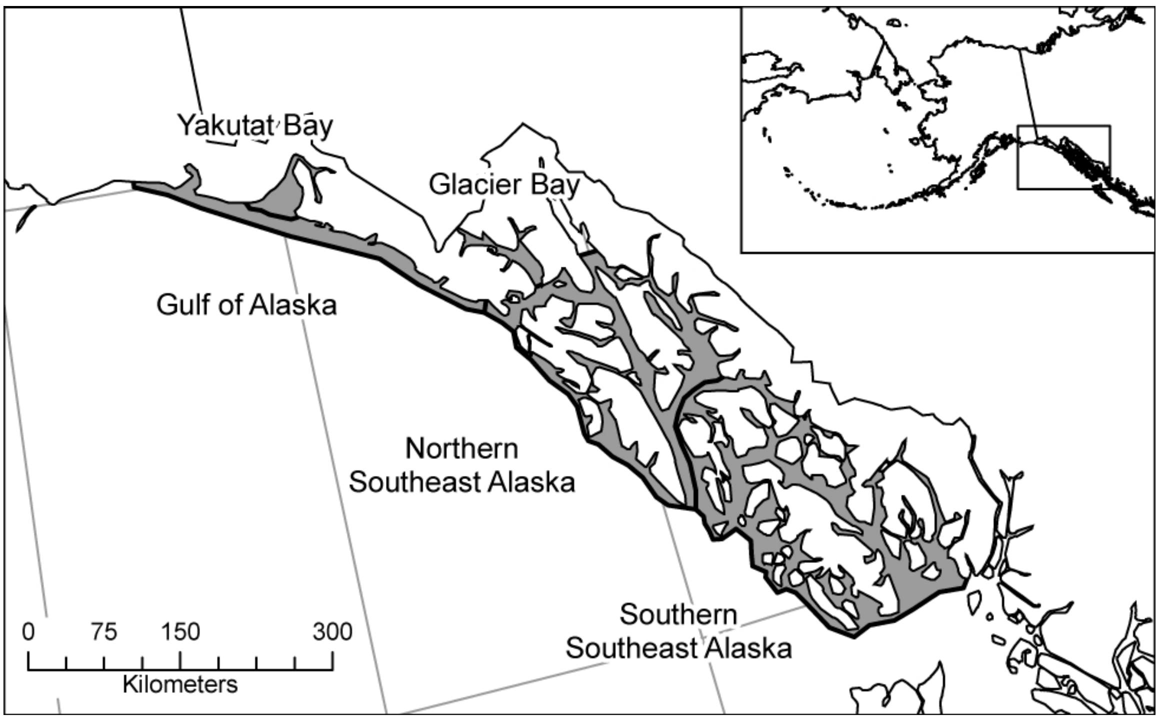

Figure 4. Survey regions for the southeast Alaska stock of sea otters.

Sea otter survey regions, methods, frequencies, and costs for the southeast Alaska stock are summarized in Appendix A. A preliminary 5-year sea otter population monitoring survey schedule is presented in Appendix B.

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Appendix A. Alaska Sea Otter Population Monitoring Plan Matrices

SOUTHWEST ALASKA STOCK

Region	Survey Type	Survey Method	Correction Factor	Period	Cost[a]
Aleutian	Trend	Skiff survey at existing trend sites in western and central Aleutians. Additional skiff sites west of Amukta pass. Shoreline aerial surveys in eastern Aleutians.	None	2 years	$50K[b]
	Abundance	Twin-engine shoreline aerial survey of a random sample from each island group. Observed density within each island group extrapolated to estimate abundance.	Skiff surveys at whole islands.	5 years	$100K[b]
North Alaska Peninsula	Trend	Not applicable			
	Abundance	Twin-engine offshore aerial survey of high and low density strata.	Calibration with ISU method	5 years	$50K[b]
South Alaska Peninsula	Trend	Shoreline aerial survey of Pavlof and Shumagin islands, Sutwick Island. Katmai region of NPS study.	None	2 years	$40K[b]
	Abundance	ISU survey method or twin-engine aircraft.	Included, or Calibration with ISU method	5 years	$75K[b]
Kodiak	Trend	ISU survey method (GEM Program)	Included	1 year	$20K
	Abundance	ISU survey method (GEM Program)	Included	3 years	$20K
Lower Western Cook Inlet	Trend	ISU survey method (GEM Program)	Included	1 year	$20K
	Abundance	ISU survey method (GEM Program)	Included	3 years	$20K

SOUTHCENTRAL ALASKA STOCK

Region	Survey Type	Survey Method	Correction Factor	Period	Cost[a]
Cook Inlet-Kenai Fjords	Trend	ISU survey method (GEM Program)	Included	1 year	$20K
	Abundance	ISU survey method (GEM Program)	Included	3 years	$20K
Prince William Sound	Trend	ISU survey method (GEM Program)	Included	1 year	$20K
	Abundance	ISU survey method (GEM Program)	Included	3 years	$20K
Outer Coast	Trend	Not applicable			
	Abundance	ISU survey method or twin-engine aircraft	Included	3 years	$20K

SOUTHEAST ALASKA STOCK

Region	Survey Type	Survey Method	Correction Factor	Period	Cost[a]
Yakutat Bay	Trend	Not applicable			
	Abundance	ISU survey method w/ replication	Included	5 years	$12K
Gulf of Alaska	Trend	Not applicable			
	Abundance	Single- or twin-engine shoreline survey	Calibration with ISU method	5 years	$5K
Glacier Bay	Trend	Not applicable			
	Abundance	ISU survey method	Included	1 year	$10K
Northern Southeast	Trend	Not applicable			
	Abundance	ISU Survey method	Included	5 years	$40K
Southern Southeast	Trend	Not applicable			
	Abundance	ISU Survey method	Included	5 years	$40K

[a] Costs are for operational expenses, not including salary for observers or reporting.
[b] Preliminary estimate.

Appendix B. Preliminary survey schedule for Fiscal Years 2006-2010. Italics indicate surveys in Gulf Ecosystem Program (GEM) plan.

Survey Type	Stock	FY2006	FY2007	FY2008	FY2009	FY2010
Trend (skiff)	SW	Near islands, Adak, Seguam	Rat islands, Delarof islands, Adak	Near islands, Adak, Seguam	Rat islands, Delarof islands, Adak	Near islands, Adak, Seguam
Trend (aerial)	SW	Shumagins	*Lower Western Cook Inlet*	*Kodiak*, Eastern Aleutians, Shumagins	*Kodiak, Lower Western Cook Inlet*	Eastern Aleutians, Shumagins, *Lower Western Cook Inlet,*
	SC		*Cook Inlet – Kenai Fjords, Prince William Sound*	*Cook Inlet – Kenai Fiords*	*Prince William Sound*	*Cook Inlet – Kenai Fjords, Prince William Sound*
Abundance	SW	Aleutian	North Alaska Peninsula, *Kodiak*	South Alaska Peninsula, *Lower Western Cook Inlet*		*Kodiak*
	SC			*Prince William Sound*	*Cook Inlet – Kenai Fjords*	
	SE				Northern southeast	Southern southeast
Annual Costs[a]		$190K	$180K	$265K	$140K	$210K

[a] Costs are for operational expenses, not including salary for observers.

Appendix C. Narrative documentation for operating the power analysis software package. To be prepared.

Appendix D. Workshop Agenda and Attendees

1) Introductions

2) Background
   a) Objectives
   b) Stock Structure
      i) Southeast Alaska
      ii) Southcentral Alaska
      iii) Southwest Alaska
   c) Management Needs
      i) Marine Mammal Protection Act
         (1) Stock Assessments
         (2) Depleted Status
      ii) Endangered Species Act
         (1) Recovery Planning
         (2) Up-listing or De-listing

3) Review of Past Surveys
   a) Objectives
   b) Survey Platforms
      i) Skiff Surveys
      ii) Aerial Surveys
      iii) Shore-based Surveys
   c) Survey Areas
   d) Survey Methods
      i) Counts
      ii) Estimates
      iii) Correction Factors

4) Plan for Future Surveys
   a) Objectives
   b) Power Analysis Software
   c) Geographic Areas
   d) Survey Methods
   e) Survey Frequency

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Appendix E. Sea Otter Stock Assessment Reports

Revised: 08/20/2002

SEA OTTER (*Enhydra lutris*): 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 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.

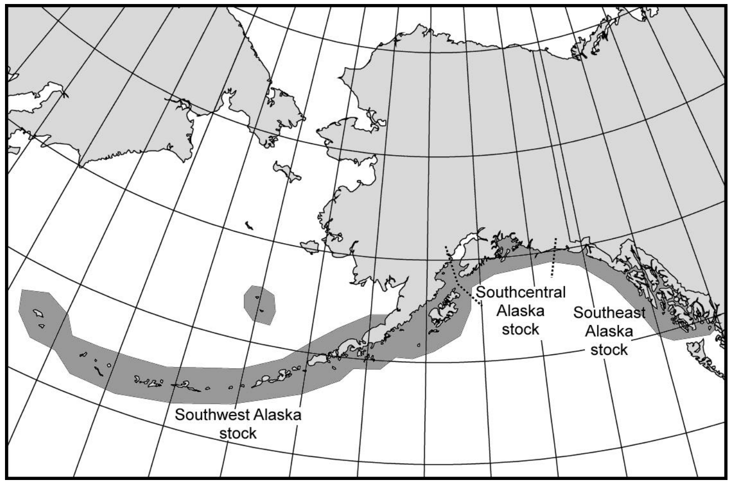

Figure 1. Approximate distribution of sea otters in Alaska waters (shaded area).

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) Southeast 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 thirteen 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 Southwest Alaska stock are presented in Table 1.

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

Survey Area	Year	Unadjusted Estimate	Adjusted Estimate	CV	N_{min}	Reference
Aleutian Islands	2000	2,442	8,742	0.215	7,309	Doroff *et al.* (in press)
North Alaska Peninsula	2000	4,728	11,253	0.337	8,535	USFWS Unpublished data
South Alaska Peninsula - Offshore	2001	1,005	2,392	0.816	1,311	USFWS Unpublished data
South Alaska Peninsula - Shoreline	2001	2,190	5,212	0.087	4,845	USFWS Unpublished data
South Alaska Peninsula - Islands	2001	405	964	0.087	896	FWS Unpublished data
Unimak Island	2001	42	100	0.087	93	FWS Unpublished data
Kodiak Archipelago	2001		5,893	0.228	4,875	USFWS Unpublished data
Kamishak Bay	2002		6,918	0.315	5,340	USGS Unpublished data
Total			41,474		33,203	

Surveys of the Aleutian Islands in summer 2000 included the Near, Rat, Andreanof, Delarof, Four Mountain and Fox Island groups, and resulted in a population estimate of 8,742 (CV= 0.215) sea otters (Doroff *et al.*, in press). In the Aleutian Islands, aerial surveys consisted of shoreline counts that used a correction factor to account for sightability.

A survey of offshore area of the North Alaska Peninsula from Unimak Island to Cape Seniavin flown in summer 2000 produced an abundance estimate of 4,728 (CV= 0.326) sea otters (USFWS unpublished data). A similar survey of offshore areas of the south Alaska Peninsula from False Pass to Pavlov Bay conducted in summer 2001 resulted in a population estimate of 1,005 (CV= 0.811) 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 adjusted estimates of 11,253 (CV = 0.337) and 2,392 (CV = 0.816) for the north and south Alaska Peninsula offshore areas, respectively.

In 2001, aerial surveys along the shoreline of the South Alaska Peninsula from Seal Cape to Cape Douglas recorded 2,190 sea otters (USFWS unpublished data). 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 405 otters for the South Alaska Peninsula island groups and 42 animals for Unimak Island. Applying the same correction factor of 2.38 (CV = 0.087) for sea otter aerial surveys using a twin-engin aircraft produces adjusted estimates of 5,212 (CV = 0.087), 964 (CV = 0.087) and 100 (CV = 0.087) for the south Alaska Peninsula shoreline, south Alaska Peninsula islands, and Unimak Island, respectively.

An aerial survey of the Kodiak Archipelago conducted in 2001 provided a population estimate of 5,893 (CV = 0.228) sea otters (USFWS unpublished data). The population estimate was calculated by applying a ratio estimate of density to the entire study area, and a correction factor was applied to account for group size bias and undetected diving animals.

Finally, an aerial survey of Kamishak Bay conducted in June 2002 produced a population estimate of 6,918(CV = 0.315) sea otters. This population estimate was also calculated by applying a ratio estimate of density to the entire study area, and a correction factor was applied to account for group size bias and undetected diving animals.

Combining the adjusted estimates for these study areas areas results in a total estimate of 41,474 sea otters for the southwest 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): $N_{MIN} = N/\exp(0.842 \times [\ln(1+[CV(N)]^2)]^{1/2})$. The N_{MIN} for each survey area is presented in Table 1; the estimated N_{MIN} for the southwest Alaska stock is 33,203.

Current Population Trend

The first systematic aerial surveys of sea otters in southwest Alaska were conducted from 1957 to 1965. These surveys indicated that sea otter populations were growing and that animals were recolonizing much of their former range. Additionally, surveys showed that the greatest concentration of sea otters in the world was located in the Aleutian Islands (Kenyon 1969). By the 1980s, sea otters were present in all the island groups in the Aleutians (Estes 1990), and the total population in the Aleutian Islands was estimated as 55,100 to 73,700 individuals (Calkins and Schneider 1985). In 1992, nearly three decades after the original aerial surveys, USFWS conducted another systematic aerial survey of the Aleutian Islands. The total uncorrected count for the entire area was 8,042 sea otters. Survey results showed that sea otter abundance had declined since 1965 by more than 50% in several island groups in the central Aleutians (Evans *et al.* 1997). Boat-based surveys conducted during the 1990s independently documented severe declines in sea otter abundance within portions of the central Aleutians (Estes *et al.* 1998). In spring 2000, USFWS repeated the 1992 aerial survey and observed widespread declines throughout the Aleutian Islands, with the greatest decreases occurring in the central Aleutians. The total uncorrected count for the area in 2000 was 2,442 animals, indicating that sea otter populations had declined 70% between 1992 and 2000. In August 2000, USFWS designated the northern sea otter in the Aleutian Islands (from Unimak Pass to Attu) as a candidate species under the Endangered Species Act.

As part of a continued effort to determine the full range of the sea otter decline in Western Alaska, USFWS conducted aerial surveys along the Alaska Peninsula and the Kodiak Archipelago in 2000 and 2001. Surveys of the Alaska Peninsula repeated methods used in a 1986 aerial survey by Brueggeman *et al.* (1988). When current results were compared with those from the previous study, declines of 93-94% were documented for the South Alaska Peninsula and declines of 27-49% were documented for the North Alaska Peninsula (USFWS unpublished data). In the Kodiak Archipelago, data from 2001 aerial surveys indicates that sea otter populations have decreased as much as 40% since 1994 (USFWS unpublished data).

A recent aerial survey of Kamishak Bay indicates nearly 7,000 sea otters inhabit this area. Kamishak Bay was previously surveyed as part of a boat-based survey of lower Cook Inlet (Agler *et al.* 1995). An estimate for just Kamishak Bay is not available, therefore the population trend for that area is unknown. Although large portions of the southwest Alaska stock appears to have undergone dramatic population declines, several areas do not appear to have been affected. Estimates from the Port Moller/Nelson Lagoon area and the Alaska Peninsula from Castle Cape to Cape

Douglas show evidence of population increases. The magnitude of these increases however, does not offset the declines observed in the last 10-15 years.

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. However, in areas where resources are limiting or where populations are approaching equilibrium density, slower rates of growth are expected (Estes 1990, Bodkin *et al.* 1995). Maximum productivity rates have not been measured through much of the sea otter's range in Alaska. In the absence of more detailed information regarding maximum productivity rates throughout the state, the rate of 20% calculated by Estes (1990) is considered a reliable estimate of R_{MAX}.

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} x 0.5 R_{MAX} x F_R. Since 1992, sea otter counts in the Aleutians have declined by an average of 70%. In August 2000 sea otters in the Aleutian Islands were designated as a Candidate Species under the Endangered Species Act. Candidate species designation was expanded to encompass the entire southwest Alaska stock of sea otters in June 2002. Given the geographic extent and overall magnitude of the decline, along with the uncertainty regarding the cause, we have set the recovery factor (F_R) for this stock at 0.25. Thus, for the Southwest stock of sea otters, PBR = 830 animals (33,203 x 0.5 (0.2) x 0.25).

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. In 1992, fisheries observers reported eight sea otters taken incidentally by the Aleutian Island Black Cod Pot Fishery. During that year, 33.8% of the Bering Sea area groundfish fisheries were observed, resulting in a total estimate of 24 ± 3 sea otter mortalities for the Bering Sea groundfish fisheries in 1992. No other sea otter kills were reported by observer programs operating in the region of the Southwest stock from 1993 through 2000 (Perez et al, 1999). The NMFS is currently conducting a marine mammal observer program for the Kodiak salmon set net fishery that will operate during the 2002 and 2003 fishing seasons.

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. In 1997, fisher self-reports indicated one sea otter kill in the Bering Sea and Aleutian Island groundfish trawl. Self-report records were incomplete for 1994, not available for 1995 and reported no kills or injuries in 1996. From 1998 through 2000, there were no further records of incidental take of sea otters by commercial fisheries in this region. Thus, during the period between 1996 and 2000, fisher self-reports resulted in an annual mean of 0.2 sea otter mortalities from interactions with commercial fishing gear. 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.

Based on the available data, sea otter abundance in the Southwest stock is not likely to be significantly affected by commercial fishery interactions at present. The total fishery mortality and serious injury (0.2) is less than 10% of the calculated PBR (830) and, therefore, can be considered insignificant and approaching a zero mortality and serious injury rate (Wade and Angliss 1997). 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 1989 oil spill (Bodkin *et al.*, in press, Stephensen *et al.* 2001). Other areas outside of Prince William Sound that were affected by the spill have not been intensively studied for long-term impacts.

Within the range of the Southwest Alaska sea otter stock, oil and gas development occurs only in Cook Inlet. Although the amount of oil transport in southwest Alaska is 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. Annual mortality due to oil and gas development activities has not been estimated for the Southwest sea otter stock. While the catastrophic release of oil has the potential to take large numbers of sea otters, there is no evidence that routine oil and gas development and transport have a direct impact on the Southwest 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 Southwest Alaska were collected by a mandatory Marking, Tagging and Reporting Program implemented by USFWS since 1988. Fig. 2 provides a summary of harvest information for the Southwest stock from 1989 through 2000. The mean annual subsistence take during the past five years (1996-2000) was 97 animals. Age composition during this period was 87% adults, 10.5% subadults, and 2.5% pups. Sex composition during the past five years was 62% males, 20% females and 18% unknown sex.

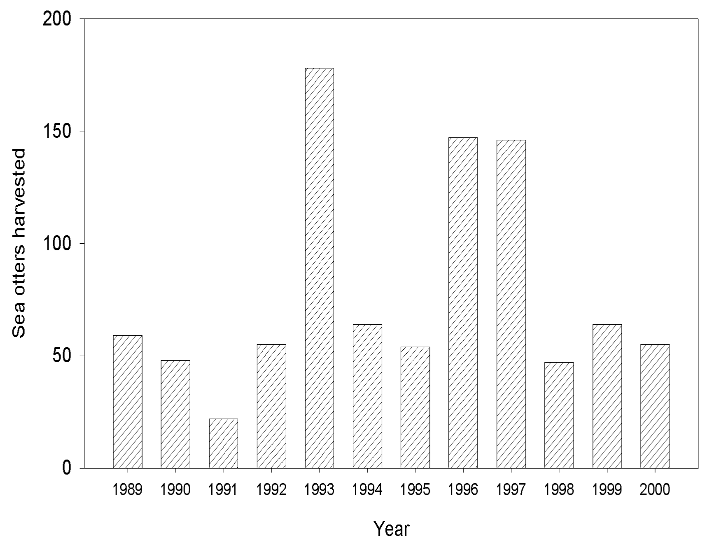

Figure 2. Estimated subsistence harvest of sea otters from the southwest Alaska stock, 1989-2000.

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, 11 sea otters have been removed from the southwest Alaska stock for public display. A limited amount of live capture for scientific research has been conducted in the Aleutian Islands. There have been no observed effects on sea otter populations in the Southwest Alaska stock from these activities.

STATUS OF STOCK

Sea otters in southwest Alaska are not presently listed as "depleted" under the MMPA. However, based on the best available scientific information that indicates sea otter numbers across southwest Alaska are declining, USFWS designated the southwest Alaska Distinct Population Segment of the northern sea otter as a candidate species under the Endangered Species Act in June 2002. As a result, the southwest Alaska stock is classified as strategic.

In the Aleutians and the Alaska Peninsula, subsistence hunting of sea otters occurs at low levels and does not appear to be a major factor in the decline. Additionally, current levels of incidental take of sea otters by commercial fisheries in southwest Alaska can be considered insignificant and approaching a zero mortality rate. Thus, these populations are declining for unknown reasons that are not explained by the level of direct human-caused mortality.

Habitat Concerns

Potential threats to sea otter populations include natural fluctuations, such as disease or predation, and indirect effects of human activities. Population studies in the Aleutian Islands indicate that observed declines are the result of increased adult mortality. A current theory proposes that predation by transient killer whales may be a leading cause of the population decline (Estes *et al.* 1998). Studies show that disease, starvation and contaminants are not presently implicated in the Aleutians; however, further evaluation of these factors is warranted along with additional investigation of the predation hypothesis to better elucidate the cause of the decline.

Sea otters play an important role in maintaining the coastal ecosystems they inhabit. In near-shore kelp beds, sea otters function as keystone species, strongly influencing ecosystem functions. In the Aleutian archipelago, sea urchins are a dominant herbivore and an important food source for sea otters (Estes *et al.* 1978). If sea otters disappear from these areas, sea urchin populations will be released from the control of sea otter predation, and may soon overgraze the attachments of bull kelp. Detached kelp is swept away, exposing remaining fish, crustaceans and bivalves. A secondary consequence of the decline in sea otter populations in southwestern Alaska is that kelp forests in many areas may also be in decline (Estes *et al.* 1998).

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

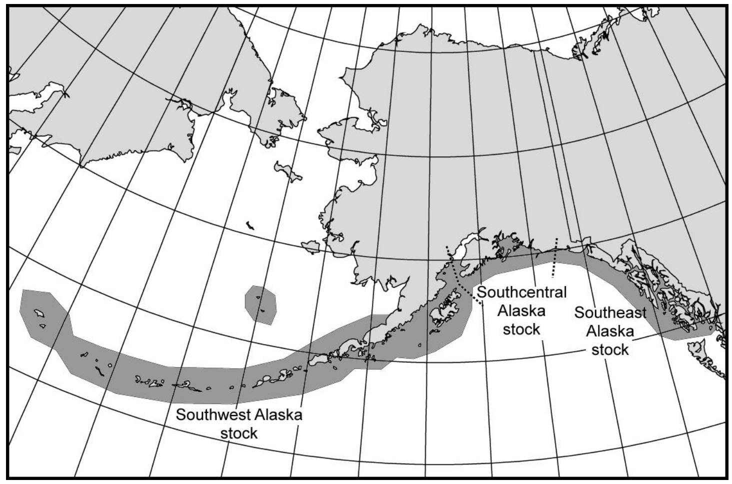

Figure 1. Approximate distribution of sea otters in Alaska waters (shaded area).

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.

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) southeast 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 thirteen 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 southcentral Alaska stock are presented in Table 1.

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

Survey Area	Year	Unadjusted Estimate	Adjusted Estimate	CV	N_{min}	Reference
North Gulf of Alaska	1996	271	645	0.087	600	Doroff and Gorbics (1998)
Prince William Sound	1999		13,234	0.198	11,220	USGS Unpublished data
Cook Inlet/Kenai Fiords	2002		2,673	0.271	2,136	USGS Unpublished data
Total			16,552		13,955	

In 1999, a survey of Prince William Sound resulted in an abundance estimate of 13,234 (CV = 0.198) animals (USGS unpublished data). This survey followed methodology described in Bodkin and Udevitz (1999) and included a survey-specific correction factor to account for undetected animals.

The survey of lower Cook Inlet and the Kenai Fiords area conducted in June and August 2002 also followed the methodology of Bodkin and Udevitz (1999) with an abundance estimate of 2,673 (CV = 0.271) (USGS unpublished data).

Finally, two aerial surveys of the northern Gulf of Alaska coastline flown in 1995 and 1996 provided a minimum uncorrected count of 271 sea otters between Cape Hinchinbrook and Cape Yakataga (Doroff and Gorbics 1998). 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 645 (CV = 0.087). Combining the adjusted estimates for these three areas results in a total estimate of 16,552 sea otters for the southcentral 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): $N_{MIN} = N/\exp(0.842 \times [\ln(1+[CV(N)]^2)]^{½})$. The N_{MIN} for each survey area is presented in Table 1; the estimated N_{MIN} for the southcentral Alaska stock is 13,955 sea otters.

Current Population Trend

Although rates of population growth may vary among locations, the trend for this stock of sea otters is generally one of growth (Irons *et al.* 1988, Bodkin and Udevitz 1999). Since 1911, when sea otters were protected from commercial hunting, remnant populations in southcentral Alaska have recolonized much of their former range. Persisting populations in Alaska have generally exhibited trends of growth, with declines occurring only when populations exceed available resources (Estes 1990, Bodkin *et al.* 1995). The 1989 *Exxon Valdez* oil spill resulted in an estimated sea otter mortality in Prince William Sound ranging from 750 (range 600-1,000) (Garshelis 1997) to 2,650 (range 500 - 5,000) otters (Garrot *et al.* 1993). Since the spill, sea otters in western Prince William Sound have increased by approximately 750 animals (Bodkin *et al.*, in press). However, overall sea otter abundance in Prince William Sound has not increased appreciably since 1994. The current population estimate for Kenai Fiords and eastern Cook Inlet is slightly higher than the previous estimate from 1989 (2,673 vs. 2,330), which suggests slight growth in this area. The overall trend for this stock appears to be either stable or slightly increasing.

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. However, in areas where resources are limiting or where populations are approaching equilibrium density, slower rates of growth are expected (Estes, 1990, Bodkin *et al.* 1995). Maximum productivity rates have not been measured through much of the sea otter's range in Alaska. In the absence of more detailed information for maximum productivity rates throughout southcentral Alaska, the rate of 20% calculated by Estes (1990) is considered a reliable estimate of R_{MAX}.

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} x 0.5 R_{MAX} x 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 southcentral stock of sea otters, PBR = 1,396 animals (13,955 x 0.5 (0.2) x1.0)

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. Fisheries observers monitored the Cook Inlet set gillnet and drift gillnet fisheries from 1999-2000. The observer coverage during both years was approximately 2-5%. No mortalities or injuries of sea otters were reported by fisheries observers for the Cook Inlet set gillnet and drift gillnet fisheries for this period. On several occasions, sea otters were observed within 10 meters of the gillnet gear, but did not become entangled. No other fisheries operating in the region of the southcentral stock were monitored by observer programs from 1992 through 2000. From 1990 to 1991, fisheries observers in the southcentral Alaska region reported no mortalities or injuries of sea otters. Prior to the implementation of the NMFS observer program, studies were conducted on sea otter interactions with the drift net fisheries in western Prince William Sound from 1988 to1990 and no mortalities were observed (Wynne 1990, 1991).

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. In 1990, fisher self-report records show 1 kill and 4 injuries due to gear interaction and 3 injuries due to deterrence in the Prince William Sound drift gillnet fishery. Self-reports were not available for 1994 and 1995. Between 1996 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 for the 5-year period from 1996-2000 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.

Based on the available data, sea otter abundance in the southcentral Alaska stock is not likely to be significantly affected by commercial fishery interaction at present. The total fishery mortality and serious injury is less than 10% of the calculated PBR (1,951) and, therefore, can be considered insignificant and approaching a zero mortality and serious injury rate (Wade and Angliss 1997). 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) otters (Garrot *et al.* 1993). 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.*1994b). 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 1989 oil spill (Bodkin *et al.*, in press, Stephensen *et al.* 2001).

In addition to tanker traffic in Prince William Sound, oil and gas development occurs in Cook Inlet. While the catastrophic release of oil has the potential to take large numbers of sea otters, there is no evidence that routine oil and gas development and transport have a direct impact on the southcentral 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 southcentral Alaska were collected by a mandatory Marking, Tagging and Reporting Program implemented by USFWS since 1988. Fig. 2 provides a summary of harvest information for the southcentral stock from 1989-2000. The mean annual subsistence take during the past five years (1996-2000) was 297 animals. Age composition during this period was 93% adults,6% subadults, and 1% pups. Sex composition during the past five years was 81% males, 17% females and 2% of unknown sex.

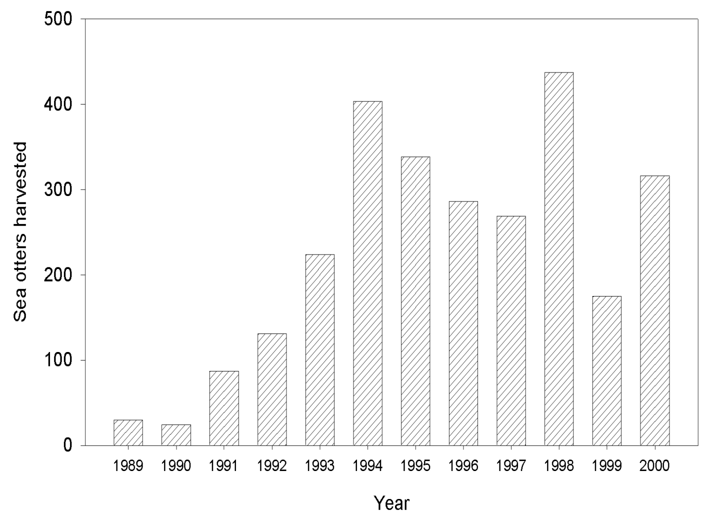

Figure 2. Estimated subsistence harvest of sea otters from the southcentral Alaska stock, 1989-2000.

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

During the past five years there have been no live captures of sea otters for public display from the southcentral Alaska stock. Since 1996, 253 sea otters have been captured and released for scientific research in Prince William Sound. There have been no observed effects on sea otter populations in the southcentral Alaska stock from these activities.

STATUS OF STOCK

Sea otters in the southcentral 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 serious 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 (297) does not exceed the PBR (1,396). As a result, the southcentral 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 size is unknown.

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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.

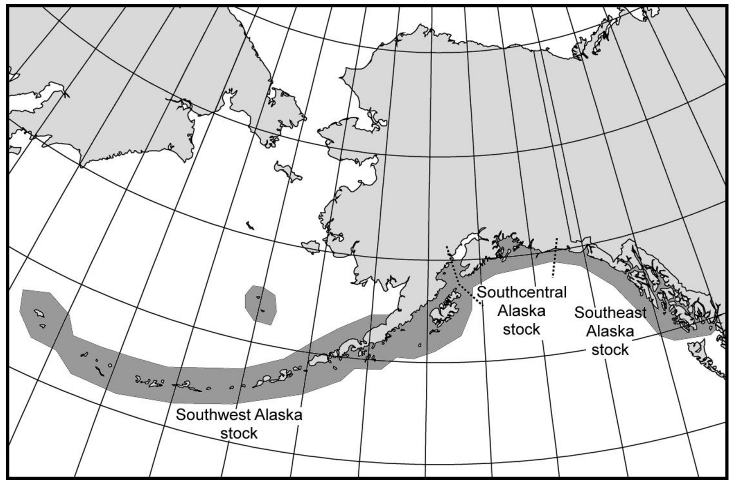

Figure 1. Approximate distribution of sea otters in Alaska waters (shaded area).

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): $N_{MIN} = N/\exp(0.842 *[\ln(1+[CV(N)]^2)]^{½})$. 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 a mandatory 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.

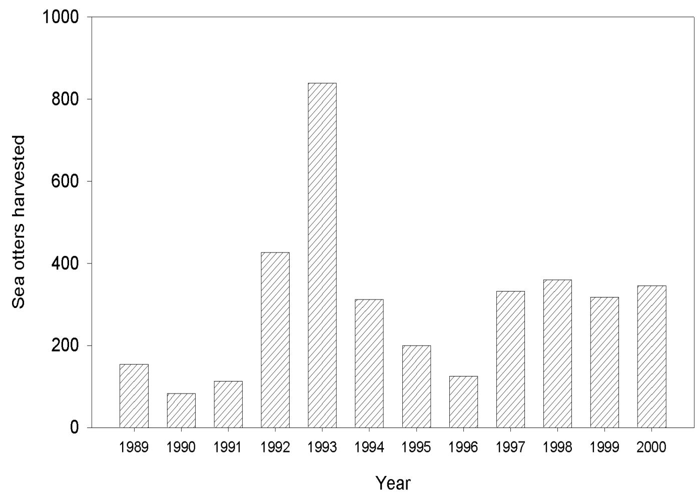

Figure 2. Estimated subsistence harvest of sea otters from the southeast Alaska stock, 1989-2000.

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.

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