3.8 Marine Mammals

The purpose of this chapter is to describe the baseline condition of marine mammals as they relate to the federally managed groundfish fishery in Alaska. This baseline condition includes a description of the pertinent natural history for each species and an assessment of the various natural and anthropogenic factors that have shaped the status of each species in Alaskan waters. These accounts summarize the human and natural effects on each species, to the extent that they are known, and thus provide the historical and scientific basis for analyzing the potential effects of the alternative FMPs in Chapter 4.

The geographical and temporal scope of material presented in this chapter is not consistent between different species because of the wide variability in their distributions and the incompleteness of historical information. For some species, like many of the baleen whales, commercial whaling that took place many years ago and often in distant waters have greatly influenced their present status in Alaska. For other species, like the "ice seals" (spotted, bearded, ribbon, and ringed), there are few historical records of impacts and basic biological parameters such as population abundance are still not known. The intent is to provide as much relevant information as possible for each species. In order to minimize redundancy in the individual species accounts, general information on the types of effects that may impact marine mammal populations are described below. Information pertinent to only one species will be presented in the individual species accounts.

Marine mammals occur in diverse habitats, including deep oceanic waters, the continental slope, and the continental shelf (Lowry *et al.* 1982). In the areas fished by the federally managed groundfish fleets, twenty-six species of marine mammals are present from the orders Pinnipedia (seals, sea lion, and walrus), Carnivora (sea otter and polar bear), and Cetacea (whales, dolphins, and porpoises) (Lowry and Frost 1985). Most species are resident throughout the year, while others seasonally migrate into and out of Alaskan waters.

Marine Mammal Protection Act

The MMPA of 1972 (16 USC 1361 *et seq.*), as amended through 1996, establishes a federal responsibility to conserve marine mammals. Management responsibility for cetaceans and pinnipeds other than walrus is vested with the NOAA Fisheries Protected Resources Division. The USFWS is responsible for management of walrus and sea otters. The MMPA's primary management objective is to maintain the health and stability of the marine ecosystem, with a goal of obtaining an optimum sustainable population of marine mammals within the carrying capacity of the habitat. The MMPA is intended to work in concert with the provisions of the ESA. If a fishery affects a marine mammal population, then the potential impacts of the fishery must be analyzed in the appropriate environmental assessment document, and NPFMC or NOAA Fisheries may be requested to consider regulations to mitigate adverse impacts.

Assessment of Population-Level Effects

In order to fulfill their oversight responsibilities under the MMPA, NOAA Fisheries and USFWS have developed appropriate survey methodologies to census the various species of marine mammals. The results of these surveys, and other factors that affect the status of each species, are published in an annual "Marine Mammal Stock Assessment" report that is available on the internet at:
http://www.nmfs.noaa.gov/prot_res/PR2/Stock_Assessment_Program/sars.html.

Some species are much more difficult to census accurately than others so there is a great deal of variation in the uncertainty of various population estimates. In addition, the huge expanses over which many species traverse and the remoteness of their habitats make surveys logistically difficult and expensive. For budgetary and logistical reasons, surveys of most species are not carried out every year and survey effort is prioritized for species of management concern. As a result, population estimates for some species may be outdated and trend information may not exist. While it is the intent of this chapter to assess the past effects of various events on the various populations of marine mammals, including fishery management actions, those efforts may be limited in quantitative detail by the availability of population trend information.

Some species are divided into separate stocks for management purposes based on genetic, morphological, behavioral, or home range information. Even though some individual animals may cross over from one stock to another, the following species accounts concentrate on the stocks that regularly spend at least part of the year in the project area.

Past and Present Effects on Marine Mammals

Direct Mortality from Intentional Take

Commercial harvests of marine mammals have occurred at various times and places, sometimes with devastating impacts on the populations of particular species. In some cases, such as the northern right whale, the species have not recovered to pre-exploitation population-levels even though commercial whaling was halted decades ago.

Marine mammals have been hunted by Alaska Natives for thousands of years and continue to be an important source of food, clothing, and material for a variety of uses. They also have an overriding cultural significance that goes far beyond their value as subsistence resources. Data on the harvest of marine mammals in subsistence hunts is collected by several entities, including the ADF&G and various Alaska Native organizations. In some cases, Alaska Native groups have entered into cooperative management agreements with NMFS, USFWS, and ADF&G to regulate subsistence takes.

Direct Mortality from Incidental Take in Fisheries

Some types of fisheries are much more likely to catch marine mammals incidentally than others. High seas driftnet fishing killed thousands of mammals before it was prohibited in 1991. Longline and pot fisheries very rarely catch marine mammals directly. NMFS requires all commercial fisheries in the U.S. EEZ to report the incidental take and injury of marine mammals that occur during their operations (50 CFR 229.6). In addition to self-reported records, which NMFS considers to be negatively biased and under representing actual take levels, certified observers are required in some fisheries to provide independent monitoring of incidental take as well as other fishery data. Marine mammal incidental take data from the North Pacific Groundfish Observer Program is included in each of the following species accounts.

Section 118 of the MMPA (50 CFR 229.2) requires all commercial fisheries to be placed into one of three categories, based on the frequency of incidental take (serious injuries and mortalities) relative to the value of potential biological removal (PBR) for each stock of marine mammal. PBR is defined as the maximum number of animals, not including natural mortalities, that may be removed from a stock while allowing that stock to reach or maintain its optimum sustainable population. In order to categorize each fishery, NMFS first looks at the level of incidental take from all fisheries that interact with a given marine mammal stock. If the combined take of all fisheries is less than or equal to 10 percent of PBR, each fishery in that combined total is assigned to Category III, the minimal impact category. If the combined take is greater than 10 percent of PBR, NMFS then looks at the individual fisheries to assign them to a category. Category I designates fisheries with frequent incidental take, defined as those with takes greater than or equal to 50 percent of PBR for a particular stock; Category II designates fisheries with occasional serious injuries and mortalities, defined as those with takes between one percent and 50 percent of PBR; Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities, defined as those with takes less than or equal to one percent of PBR. Owners of vessels or gear engaging in Category I or II fisheries are required to register with NMFS to obtain a marine mammal authorization in order to lawfully take a marine mammal incidentally in their fishing operation (50 CFR 229.4). In Alaska, this registration process has been integrated into other state and federal permitting programs to reduce fees and paperwork. Owners of vessels or gear engaging in Category III fisheries are not required to register with NMFS for this purpose. Every year, NMFS reviews and revises its list of Category I, II, and III fisheries based on new information and publishes the list in the FR.

Under provisions of the MMPA, NMFS is required to establish take reduction teams with the purpose of developing take reduction plans to assist in the recovery or to prevent the depletion of strategic stocks that interact with Category I and II fisheries. A "strategic" stock is one which: 1) is listed as endangered or threatened under the ESA, 2) is declining and likely to be listed as threatened under the ESA, 3) is listed as depleted under the MMPA, or 4) has direct human-caused mortality which exceeds the stock's PBR.

The immediate goal of a take reduction plan is to reduce, within six months of its implementation, the incidental serious injury or mortality of marine mammals from commercial fishing to levels less than PBR. The long-term goal is to reduce, within five years of its implementation, the incidental serious injury and mortality of marine mammals from commercial fishing operations to insignificant levels approaching a zero serious injury and mortality rate, taking into account the economics of the fishery, the availability of existing technology, and existing state or regional FMPs. Take reduction teams are to consist of a balance of representatives from the fishing industry, fishery management councils, state and federal resource management agencies, the scientific community, and conservation organizations. Fishers participating in Category I or II fisheries must comply with any applicable take reduction plan and may be required to carry an observer onboard during fishing operations.

In 2002, all of the MSA groundfish fisheries (trawl, longline, and pot gear in the BSAI and GOA) were listed as Category III fisheries (67 FR 2410). In addition, a number of state-managed salmon drift and set gillnet fisheries are listed in Category II, including those in Bristol Bay, Aleutian Islands, Alaska Peninsula, Kodiak, Cook Inlet, PWS, and southeast Alaska. NMFS has recently proposed reclassifying the Cook Inlet drift and set gillnet fisheries from Category II to Category III (68 FR 1414).

Indirect Effects through Entanglement

The following effects are classified as indirect because the impacts are removed in time and/or space from the initial action although in the analysis, these effects are considered together with the direct effect of incidental take. In some cases, individual marine mammals may be killed outright by the effect. In other cases, individuals are affected in ways that may decrease their chances of surviving natural phenomenon or reproducing successfully. These sub-lethal impacts may reduce their overall "fitness" as individuals and may have population-level implications if enough individuals are impacted.

Although some fisheries have no recorded incidental take of marine mammals, all of them probably contribute to the effects of entanglement in lost fishing gear. Evidence of entanglement comes from observations of animals trailing ropes, buoys, or nets or bearing scars from such gear. Sometimes stranded marine mammals also have evidence of entanglement but it may not be possible to ascertain whether the entanglement caused the injury or whether the corpse picked up gear as it floated around after death. Sometimes an animal is observed to become entangled in specific fishing gear, in which case an incidental take or minor injury may be recorded for that particular fishery, but many times the contributions of individual fisheries to the overall effects of entanglement are difficult to document and quantify.

The Marine Plastic Pollution Research and Control Act of 1987 (33 USC §§ 1901 *et seq.*), implements the provisions relating to garbage and plastics of MARPOL. These regulations apply to all vessels, regardless of flag, on the navigable waters of the U.S. and in the EEZ of the U.S. It applies to U.S. flag vessels wherever they are located. The discharge of plastics into the water is prohibited, including synthetic ropes, fishing nets, plastic bags, and biodegradable plastics.

Indirect Effects through Changes in Prey Availability

The availability of prey to marine mammals depends on a large number of factors and differs among species and seasons. Among these factors are oceanographic processes such as upwellings, thermal stratification, ice edges, fronts, gyres, and tidal currents that concentrate prey at particular times and places. Prey availability also depends on the abundance of competing predators and the ecology of prey species, including their natural rates of reproduction, seasonal migration, and movements within the water column. The relative contributions of factors that influence prey availability for particular species and areas are rarely known. Most critical is the lack of information on how events outside an animal's foraging range or in a different season may influence the availability of prey to animals in a particular place and time.

Marine mammal species differ greatly from one another in their prey requirements and feeding behaviors, leading to substantial differences in their responses to changes in the environment. For some species, such as the baleen whales, diets consist largely of planktonic crustaceans or small squid and have no overlap of prey with species that are targeted or taken as bycatch in the groundfish fisheries. For other species, notably Steller sea lions, there is a high degree of overlap between their preferred size and species of prey and the groundfish catch. Many other species are in between, perhaps feeding on the same species but smaller sizes of fish than what is typically taken in the fisheries. Although they may take a wide variety of prey species during the year, many species may depend on only one or a few prey species in a given area and season. In addition, the prey requirements and foraging capabilities of nursing females and subadult animals may be much more restricted than for non-breeding adults, with implications for reproductive success and survival.

The question of whether different types of commercial fisheries have had an effect on the availability of prey to marine mammals has been addressed by examining the degree of direct competition (harvest) of prey and by looking for potential indirect or cascading effects of the fisheries on the food web of the mammals. For marine mammals whose diets overlap to some extent with the target or bycatch species of the fisheries, fishery removals could potentially decrease the density of prey fields or cause changes in the distribution of prey such that the foraging success of the marine mammals is affected. If alternate prey is not available or is of poorer nutritional quality than the preferred species, or if the animal must spend more time and energy searching for prey, reproductive success and/or survival can be compromised. In the case of marine mammals that do not feed on fish or feed on different species than are taken in the fisheries, the removal of a large number of target fish from the ecosystem may alter the predator/prey dynamics and thus the abundance of another species that is eaten by marine mammals. The mechanisms and causal pathways for many potential food web effects are poorly documented because they are very difficult to study scientifically at sea (Loughlin *et al.* 1999).

Although reductions in the availability of forage fish to marine mammals have been attributed to both climatic cycles and commercial fisheries, a NRC study on the Bering Sea ecosystem (NRC 1996) concluded that both factors probably are significant. Regime shifts are major changes in atmospheric conditions and ocean climate that take place on multi-decade time scales and trigger community-level reorganizations of the marine biota (Anderson and Piatt 1999). Two cycles of warm and cold regimes have been documented in the GOA in the past 100 years, with the latest shift being from a cold regime to a warm regime in 1977. The consequences of this shift on fish and crustacean populations have been documented, including major improvements in groundfish recruitment and the collapse of some high-value forage species such as shrimp, capelin, and Pacific sand lance (Anderson and Piatt 1999). Directed fisheries on forage fish can deepen and prolong their natural low population cycles (Duffy 1983, Steele 1991), with potential effects on marine mammal foraging success. There is some evidence that another regime shift may have begun in 1998 with colder water temperatures and increases in certain forage populations (NPFMC 2002c), but the implications for marine mammals are still unclear. Climate change may also affect the dynamics of the ice pack, with serious consequences for the marine mammals associated with the ice pack, such as bowhead whales, the ice seals, and walrus.

<u>Direct Effects through Disturbance by Fishing Vessels</u>

The effects of disturbance caused by vessel traffic, fishing operations, engine noise, and sonar pulses on marine mammals are largely unknown. With regard to vessel traffic, many baleen and toothed whales appear tolerant, at least as suggested by their reactions at the surface. Observed behavior ranges from attraction to the vessel to course modification or maintenance of distance from the vessel. Dall's porpoise, Pacific white-sided dolphins, and even beaked whales have been observed adjacent to vessels for extended periods of time. Conversely, harbor porpoise tend to avoid vessels. However, a small number of fatal collisions with various vessels have been recorded in California and Alaska in the past decade and others likely go unreported or undetected (Angliss *et al.* 2001).

Reactions to some fishing gear, such as pelagic trawls, are poorly documented, although the rarity of incidental takes suggests either partitioning of foraging and fishing areas or avoidance. Given their distribution throughout the fishing grounds, at least some individuals may be expected to occasionally avoid contact with vessels or fishing gear, which would constitute a reaction to a disturbance. Assuming these instances occur, the effects are likely temporary. Sonar devices are used routinely during fishing activity as well as during vessel transit. The sounds produced by these devices may be audible to marine mammals and may thus constitute disturbance sources. Wintering humpback whales have been observed reacting to sonar pulses by moving away (Maybaum 1990, 1993), although few other cases of reaction have been documented.

Indirect Effects through Contamination by Oil Spills

For species such as the pinnipeds and sea otters that spend a substantial amount of time on the surface of the water or hauled out on shore, oil spills pose a significant environmental hazzard, even in small amounts. The toxicological effects of ingested oil, ranging from potential organ damage to weakening of the immune system, are poorly known for most species, especially in regard to chronic low doses. Sea otters are particularly susceptible to oil spills because they depend on their thick fur to protect them from cold water, rather than layers of fat, and oil destroys the insulative properties of their fur. Thousands of sea otters died over a large expanse of the GOA as a result of the EVOS in 1989 (Garshelis 1997, Garrot *et al.* 1993, DeGange *et al.* 1994). There is very little data on the mortality of marine mammals from the much smaller volumes of oil that are more typical of marine vessel spills, resulting from fuel transfer accidents and bilge operations.

3.8.1 Steller Sea Lion (*Eumetopias jubatus*)

Life History and Distribution

The Steller sea lion, also found in the literature as Steller's sea lion and northern sea lion, is a member of the order Pinnipedia and is in the same family (Otariidae) as northern fur seals. Sea lions are strongly dimorphic, meaning that mature males and females look very different. Females weigh up to 600 pounds (270 kg) and reach 7 ft (2.1 m) in length while males can reach 2000 pounds (900 kg) and reach 10.5 ft (3.2 m) in length (Burt and Grossenheider 1976). Steller sea lions have a highly polygynous mating system, with males defending territories to restrict access to females.

Pupping and breeding occur in rookeries on relatively remote islands, rocks, and reefs. Females generally return to the rookeries where they were born to mate and give birth (Alaska Sea Grant 1993, Calkins and Pitcher 1982, Loughlin *et al.* 1984). Males establish territories in May in anticipation of the females' arrival in late May through June (Pitcher and Calkins 1981). Viable births begin in late May and continue through early July; the sex ratio at birth is slightly in favor of males. Steller sea lions give birth to a single pup each year; twinning is rare. Females breed again about two weeks after giving birth. Copulation may occur in the water, but mostly occurs on land (Pitcher *et al.* 1998, Gentry 1970, Gisiner 1985). The mother nurses the pup during the day. She stays with her pup for the first week, then goes to sea on feeding trips. Pups generally are weaned before the next breeding season, but it is not unusual for a female to nurse her offspring for a year or more. Females reach sexual maturity between three and eight years of age and may breed into their early twenties. Females can have a pup every year but may skip years as they get older, or when nutritionally stressed. Males also reach sexual maturity at about the same ages but do not have the physical size or skill to obtain and keep a breeding territory until they are nine years of age or older. Males may return to the same territory for up to seven years, but most return for no more than three years (Gisiner 1985). During the breeding season, males may not eat for 1 to 2 months. The rigors of fighting to obtain and hold a territory and the physiological stress of the mating season reduces their life expectancy. Males rarely live beyond their mid-teens, while females may live as long as 30 years.

Although most often found within the continental shelf region, sea lions may be found in pelagic waters as well (Bonnell *et al.* 1983, Fiscus *et al.* 1976, Kajimura and Loughlin 1988, Kenyon and Rice 1961, Merrick and Loughlin 1997). Observations of Steller sea lions at sea suggest that large groups usually consist of females of all ages and subadult males; adult males sometimes occur in those groups but are usually found individually. On land, all ages and both sexes haul out in aggregations during the non-breeding season. Steller sea lions are not known to migrate, but they do disperse widely at times of the year other than the breeding season. For example, sea lion pups marked near Kodiak, Alaska, have been sighted in British Columbia, Canada (about 1,700 km distant) (Raum-Suryan *et al.* 2002). Generally, animals up to about 4 years of age tend to disperse farther than adults. As they approach breeding age, they have a propensity to stay in the general vicinity of the breeding islands, and, as a general rule, return to their island of birth to breed as adults.

Steller sea lions range along the NPO rim from northern Japan to California (Loughlin *et al.* 1984), with centers of abundance and distribution in the GOA and Aleutian Islands, respectively (Figure 3.8-1). The northernmost rookery in the Bering Sea is on Walrus Island near the Pribilof Islands and in the GOA on Seal Rocks just outside of PWS (Kenyon and Rice 1961).

Population assessment for Steller sea lions has been achieved primarily by aerial surveys and on-land pup counts. Historically, this included surveys of limited geographical scope in various portions of the species' range, in many cases conducted using different techniques, and occasionally during different times of year. Consequently, population trends for Steller sea lions from the 1970s and earlier, and over a large geographical area, must be reconstructed from a patchwork of regional surveys conducted over many years. Prior to 1997, only one population of Steller sea lions was recognized in Alaskan waters. Based largely on differences in genetics, morphology, and population trends, this single population was split into two distinct population segments (DPSs) (Bickham *et al.* 1996, Loughlin 1997, 62 FR 30772). The term DPS is used in reference to the status under ESA (16 USC 1532). NOAA Fisheries, under the MMPA, uses the term "stock" when referring to a population or population segment, however for this discussion the term population is used when referring to Steller sea lions. The western DPS (western population) of Steller sea lions occurs from 144°W (approximately at Cape Suckling, just east of PWS) westward to Russia and Japan, including the Bering Sea. The eastern DPS (eastern population) of Steller sea lions occurs from southeast Alaska southward to California. Recent evidence suggests that the western population consists of two distinct sub-populations: the central population, from 144°W through the Aleutian Islands and the Commander Islands (Russia); and the Asian population, which includes all animals that breed on the Kamchatka Peninsula, Kuril Islands, and the Sea of Okhotsk (J. Bickham, Texas A&M University, report to the Steller sea lion recovery team).

<u>Western Distinct Population Segment of Steller Sea Lions</u>

Aerial surveys conducted from 1953 through 1960 resulted in combined counts of 170,000 to 180,000 Steller sea lions in what we now define as the western population in Alaska (Mathisen 1959, Kenyon and Rice 1961). Surveys during 1974 through 1980 suggested an equivocal increase to about 185,000, based on maximal counts at sites over the same area, as summarized by Loughlin *et al.* (1984). It was concurrent with the advent of more systematic aerial surveys that population declines were first observed. Declines of at least 50 percent were documented from 1957 to 1977 in the eastern Aleutian Islands, the center of what now is the western population (Braham *et al.*1980). Merrick *et al.* (1987) estimated a population decline of about 50 percent from the late 1950s to 1985 over a much larger geographical area, the central GOA through the central Aleutian Islands, based on a patchwork of regional counts and surveys (Figure 3.8-2). The population in the GOA and Aleutian Islands declined by an additional 50 percent from 1985 to 1989, resulting in an overall decline of about 70 percent from 1960 to 1989 (Loughlin *et al.* 1992).

The decline of the western population has been apparent in all regions, although not at the same rate. The decline was first observed in the eastern Aleutian Islands (Braham *et al.* 1980). During subsequent years the decline was noted in adjacent regions in the Aleutian Islands and GOA (Merrick *et al.* 1987). In the eastern Aleutian Islands, the rate of decline decreased and by 1989 or 1990 the population there appeared to stabilize, but at very low levels. Since 1975 throughout the entire range of the western population there has been a steady rate of decline of at least 6 percent a year, with an additional drop of about 8.7 percent per year during the late 1980s when the population from the Kenai Peninsula to Kiska Island in the central Aleutian Islands declined at about 15.6 percent per year (York *et al.* 1996). Other regions have demonstrated short periods of stability within a general declining trend. With the exception of the differentiation between the eastern and western populations, however, these regional boundaries are not based on ecological or other biological parameters, and differences in regional trends should be interpreted with caution.

Much of the population trend analyses during recent years has focused on trend sites as designated by the Steller Sea Lion Recovery Team (NMFS 1992, NMFS 1995b). Trend sites are those rookeries and haul-out sites surveyed consistently from the mid 1980s to the present, thus allowing analysis of population trends on a decadal scale. Trend sites include about 75 percent of animals observed in recent surveys (Strick *et al.* 1997, Sease *et al.* 1999, Sease and Loughlin 1999, Sease *et al.* 2001, Sease and Gudmundson 2002). During the 1990s, the average annual rate of decline was consistently around 5 percent (Strick *et al.* 1997, Sease *et al.* 1999, Sease and Loughlin 1999, Sease *et al.* 2001) (Figure 3.8-3). Recent surveys at 84 trend sites have shown the first region-wide increase in the last two decades. Between 2000 and 2002, non-pup abundance increased by 5.5 percent (Sease 2002, Sease and Gudmundson 2002). A similar trend was documented within the Kenai-to-Kiska subareas , an index count area of 70 sites between the Kenai Peninsula and Kiska Island, near the western end of the Aleutian Island which showed an increase of 4.8 percent from 2000 to 2002. However, the long-term trend was still a decline of 3.1 percent per year from 1991 to 2002 and an overall decrease of 26 percent from 1991 to 2002 (Loughlin and York 2000, Sease 2002, Sease and Gudmundson 2002).

Although numbers of non-pups increased in five of the six western population sub-regions from 2000 to 2002, these changes involve only a few hundred animals. The western Aleutian Islands region continued to decline by 24 percent from 2000 to 2002 following a 44 percent decline from 1998 to 2000. The overall decline in the western Aleutian Islands was 75 percent from 1991 to 2002 (Sease and Gudmundson 2002).

In most years, pups within the western population in Alaska have been counted only at selected rookeries and on an alternating schedule to minimize potential cumulative effects of disturbance. Range-wide survey efforts included pup counts at virtually all western population rookeries in Alaska in 1998, and all except the Near Islands in the western Aleutian Islands in 1994 (Strick *et al.* 1997, Sease and Loughlin 1999). The composite pup count for 2001 and 2002 for the western population, which includes counts from 24 rookeries in 2002 and seven in 2001, showed continuing decline in pup production. The area with the longest series of region-wide pup counts is the Kenai-to Kiska index area. In this area, 2002 numbers were down 7.8 percent from 1998, 24 percent from 1994, and 42.4 percent from 1990 to 1991. Pup counts increased in only one region (5.5 percent in the western GOA) from 1998 to 2002, but declined in the five other regions. The western Aleutian Islands experienced the largest decline in pup abundance (39 percent) from 1998 to 2002 (Sease and Gudmundson 2002).

The most recent comprehensive census of the U.S. portion of the western population of Steller sea lions was conducted in 1998 and 1999. Combining pup counts (9,373) and non-pup counts (26,658) with an estimate for unsurveyed sites (757) resulted in a minimum abundance estimate of 38,788 sea lions for the U.S. portion of the western population in 1998 (Angliss and Lodge 2002). The June 2002 survey of all surveyed sites for the western population resulted in a total count of 26,602 non-pup sea lions. Combining pup counts from 2001 (3,927) and 2002 (5,650) and non-pup counts from 2002 resulted in a minimum abundance of 36,179 sea lions for the western population in 2002 (Sease and Gundmundson 2002). These estimates are considered minimums because they do not account for animals that may have been at sea during the counts.

For the Russian and Japanese portion of the western population of Steller sea lions, recent and historic counts in the Russian Federation indicate that the present number of animals is about one-third of historic levels (NMFS 1992). In some instances, the decrease in numbers has been accompanied by complete disappearance of rookeries (Perlov 1991). Numbers of adults and juvenile sea lions at major rookeries and haulouts in the Kuril Islands declined 74 percent, from 14,076 in 1969 to 3,615 in 1989 (Merrick *et al.* 1990). Most of the decline occurred between 1969 and 1974. The numbers since 1974 appear to have remained relatively stable. Pup numbers have declined 60 percent, from 3,673 in 1963 to 1,476 in 1989. Based on 1989 counts, Burkanov *et al.* (1991) estimated that the total number of sea lions, including those on haulouts, rookeries and those observed swimming in the water near the site at the time of the survey, along the Kamchatka Peninsula and Commander Island was between 3,500 and 3,800. Estimates for this region between 1982 and1985 were 1.6 to 3.5 times larger. This decline is similar to what has occurred in the U.S. portion of the western population in the Bering Sea, and is thought likely to continue (Perlov 1991). There are about 2,000 sea lions on a few small islands in the Sea of Okhotsh, where numbers are reduced from previous levels, but stable (Perlov 1991).

Eastern Distinct Population Segment of Steller Sea Lions

The earliest abundance estimate for what is now known as the eastern population of Steller sea lions is derived from surveys conducted in southeast Alaska in 1996 (10,907 non-pups and 3,714 pups for a total of 14,621 sea lions), British Columbia in 1994 (8,091 non-pups and 1,186 pups for a total of 9,277 sea lions), and the combined coasts of Washington, Oregon, and California in 1996 (5,464 non-pups and 1,091 pups for a total of 6,555 sea lions). The total of these 1994 to 1996 counts was 30,453 sea lions in the eastern population, which is considered a minimum estimate because there was no correction for animals that may have been at sea during the surveys (Angliss *et al.* 2001). In the southeast Alaska part of the range alone, surveys conducted in 1998 and 2000 yielded a minimum estimate of 12,417 non-pups and 4,257 pups for a total of 16,674 sea lions.

Loughlin *et al.* (1992) described southeast Alaska as the only region of Alaska in which the Steller sea lion population appeared to be stable in 1989. Based on a series of counts at index, or "trend", sites, the numbers of non-pup sea lions (adults and juveniles combined) in southeast Alaska increased by an average of 3.5 percent to 4.0 percent per year from 1985 to 1989 for an overall increase of about 16 percent. Calkins *et al.* (1999) estimated that the Steller sea lion population in southeast Alaska increased by an average of 5.9 percent per year from 1979 to 1997, based on pup counts at the three rookeries in the region. The increase was lower than the average over the longer time period. From 1989 to 1997, pup numbers increased by only 1.7 percent and counts of non-pups at 12 index sites were stable (average change of +0.5 percent per year). The Steller Sea Lion Recovery Team employed a different set of index sites for monitoring population status (NMFS 1992, NMFS 1995b). Counts of non-pup sea lions at these three rookeries and ten haulout trend sites showed an overall increase of 29.3 percent from 1990 to 2000, or an average annual increase of 1.9 percent (Sease *et al.* 2001). Pup counts in 2002 suggest that numbers of pups in southeast Alaska increased by about 11 percent from 1998 to 2002, consistent with the average rate of about 3 percent per year over the last decade (Sease and Gudmundson 2002). Despite differences in individual index sites or model type (e.g., based on counts of pups versus non-pups), the conclusion is that numbers of Steller sea lions in southeast Alaska are stable or increasing.

Steller sea lions in southeast Alaska are not an isolated population, as demonstrated by genetic data and by the movement of branded and tagged animals from southeast Alaska to British Columbia and Washington (Raum-Suryan *et al.* 2002). The number of non-pup sea lions in British Columbia is similar to southeast Alaska, and increased by about 2.5 percent per year during the last decade (Figure 3.8-4). Pup numbers in British Columbia have increased by about 1.5 percent per year during the same time (personal communication from P. Olesiuk, Pacific Biological Laboratory, Nanaimo, British Columbia). Counts of Steller sea lions in Oregon and northern California have been stable during recent decades at about a third as many animals as in either British Columbia or southeast Alaska. Counts of non-pups and pups in central and southern California have been low and decreasing at about 4.5 percent to 5.0 percent per year since 1982 or as much as 10 percent per year since 1990 (NMFS 1995b, Calkins *et al.* 1999, Ferrero *et al.* 2000, Angliss *et al.* 2001). Despite the observed declines in southern and central California, the eastern population as a whole is stable or increasing.

Trophic Interactions

In the BSAI and GOA, the Steller sea lion diet consists of a variety of schooling fishes (e.g., pollock, Atka mackerel, Pacific cod, flatfish, sculpin, capelin, Pacific sand lance, rockfish, Pacific herring, and salmon), as well as cephalopods, such as octopus and squid (Calkins and Goodwin 1988, Lowry *et al.* 1982, Merrick and Calkins 1995, Perez 1990). An analysis of 1990 to 1998 trends in prey consumption across the western population showed pollock and Atka mackerel as the two dominant prey species, followed by Pacific salmon and Pacific cod (Sinclair and Zeppelin 2002). Other primary prey species consistently occurring in Steller sea lion scats at frequencies > 5 percent include arrowtooth flounder, Pacific herring, Pacific sand lance, Irish lord, squid, and octopus (Sinclair and Zeppelin 2002). Steller sea lion prey varies in adult body size. Pollock and Atka mackerel, for instance, range in body length from approximately 10 to 70 cm. (Zeppelin *et al.* in press). The most recent diet study of the western population (Sinclair and Zeppelin 2002) indicates that prey remains in scat are primarily from late stage juvenile to adult size fish. Seasonal and regional patterns in prey consumption by western population Steller sea lions indicate that they target prey which are densely schooled in spawning aggregations nearshore, over or near the continental shelf, or along oceanographic boundaries (Sinclair and Zeppelin 2002).

Merrick *et al.* (1997) documented Steller sea lion consumption from scat samples throughout their range and identified seven prey categories in the GOA: 66.5 percent are gadids (pollock, Pacific cod, Pacific hake, and unidentified gadids), 20.3 percent are Pacific salmon, 6.1 percent are small schooling fish, 3.9 percent are flatfish, 2.9 percent are squid or octopus, and 0.3 percent are Atka mackerel. Merrick and Calkins (1996) determined 70 percent of the stomachs collected from animals in the GOA during the 1970s and 1980s also contained gadids.

Recent analyses of fecal samples collected on Steller sea lion haulouts and rookeries suggest that Atka mackerel is particularly important for Steller sea lions in the central and western Aleutian Islands. Over 70 percent of the animals' summer diet in this area is Atka mackerel. Pollock represents over 60 percent of the diet in the central GOA, 29 percent in the western GOA and eastern Aleutian Islands, and over 35 percent in parts of the central Aleutian Islands (Merrick and Calkins 1995). Small pollock (less than 20 cm) appear to be more commonly eaten by juvenile sea lions than older animals (Merrick and Calkins 1995). Pollock are also a major prey species in southeast Alaska where the population has showed an increase over the last ten years (Winship and Trites 2002).

The most recent analysis of Steller sea lion diet compares trends in prey species consumption among seasons and areas with different rates of sea lion decline (Sinclair and Zeppelin 2002, Winship and Trites 2002). Regions of diet similarity closely correspond to the Steller sea lion metapopulations defined by York *et al.* (1996), suggesting that diet differences and population trends of Steller sea lions are linked. Overall, where population trends are most positive, diet diversity is highest but more supporting data is needed to draw firm conclusions. Recent data from more intensive sampling at rookeries and haulouts suggest sea lions have a much more diverse diet than previously thought (Wynne, unpublished). Regional diet patterns generally reflect regional foraging strategies learned at or near the natal rookery site, with sea lions concentrating on seasonally dense prey patches characteristic of that area (Sinclair and Zeppelin 2002).

Steller sea lion foraging distribution is inferred from at-sea sightings or observations of presumed foraging behavior (Fiscus and Baines 1966, Kajimura and Loughlin 1988, NMML unpublished data[a] from the Platform of Opportunity Program [POP]), records of incidental take in fisheries (Perez and Loughlin 1991), and satellite telemetry studies (Merrick *et al.* 1994, Merrick and Loughlin 1997). Three foraging areas were designated as critical habitat for Steller sea lions based on observations and incidental takes in the vicinity of Seguam Pass, the southeastern Bering Sea, and Shelikof Strait (Loughlin and Nelson 1986, Perez and Loughlin 1991).

The value of a given area for foraging sea lions depends not only on the nutritive quality of the prey available but also on the energetic effort required to obtain that prey. Foraging efficiency, as a function of net energy gain, thus depends in part on how far sea lions must travel, how deep they must dive, and how much time they must spend to catch prey. These parameters have been and continue to be studied with satellite telemetry techniques. The NMFS Alaska Ecosystem program and the ADF&G Steller sea lion research program collaborated to produce a "white paper" on the use of satellite telemetry to study Steller sea lion movements and foraging behavior (ADF&G and NMFS 2001). The limitations of this data and its use in establishing protective measures for sea lions is described in the Steller sea lion protection measures FEIS and the associated BiOp (NMFS 2001b and NMFS 2001c). NOAA Fisheries has completed a supplement to the 2001 BiOp which presents recent telemetry data, how that scientific information was interpreted with relation to foraging needs of Steller sea lions, and its relevance to the efficacy of sea lion protection measures (NMFS 2003). These telemetry studies suggest that foraging distributions vary by individual, size, age, season, site, and reproductive status (Merrick and Loughlin 1997, ADF&G and NMFS 2001, Loughlin *et al.* 2003).

Compared to other pinnipeds, Steller sea lions tend to make relatively shallow dives, with few dives recorded to depths greater than 250 m. Foraging patterns of adult females differ during summer months when females are with pups versus winter periods when considerable individual variation has been observed. Trip duration (the period between haulouts) for females with young pups in summer is approximately 18 to 20 hours. Dives are typically shallow (mean = 21 m), of short duration (mean = 1.4 min), and frequent (mean = 13/h). Trip length averages 17 km, and sea lions dive approximately 4.7 hours per day. In winter, females with young of the year (5 to 10 months of age) have trips averaging almost one day in duration while females with yearlings (17 to 22 months of age) had trips averaging 2.3 days (Loughlin *et al.* 2003). During winter, mean trip length is about 130 km, and dives total about 5.3 hours per day (Merrick and Loughlin 1997). In winter, yearling sea lions' foraging trips average 30 km in distance and 15 hours in duration, with less effort devoted to diving than adult females during their trips (mean of 1.9 hours per day). Estimated home ranges are 320 km^2 for adult females in summer, about 47,600 km^2 (with large variation) for adult females in winter, and 9,200 km^2 for yearlings in winter (Merrick and Loughlin 1997).

Recent telemetry studies have examined the movement patterns of immature sea lions (6 - 22 months of age) whose survival rate is considered an important component in the Steller sea lion decline (Loughlin *et al.* 2003). Young-of-the-year sea lions (6 to 12 months of age) had dives that were more brief in duration and more shallow than yearlings (13 to 22 months of age). The length of trips taken by sea lions less than 10 months of age was much shorter than trips taken by older juveniles (means = 7.0 km and 24.6 km respectively). The length of foraging trips, dive characteristics, and depth of dives, began to increase substantially after 9 months of age, corresponding with the presumed age of weaning (Loughlin *et al.* 2003). This study also compared the diving characteristics of sea lions from Washington with those from Alaska and found that the Washington animals spent more time diving and dove deeper than Alaska sea lions. These differences were attributed to localized differences in where their prey are concentrated (Loughlin *et al.* 2003). The recent telemetry data suggests that the areas of highest use are within 0 to 10 nm of rookeries and haulouts. However, both older juveniles and adult females may utilize the 10 to 20 nm zone of critical habitat to a greater extent in the winter. NOAA Fisheries concluded that the 0 to 10 nm zone was of "high" concern from potential overlap with fisheries, the 10 to 20 nm zone was "low to moderate", and beyond 20 nm was of "low" concern (NMFS 2003).

A brief review of predation on Steller sea lions by killer whales was presented in the 2000 BSAI and GOA FMP groundfish BiOp (NMFS 2000a).

Based on stomach contents of six stranded killer whales and feeding habit studies in PWS and British Columbia, sea lions were estimated to comprise 5 to 20 percent of transient killer whale diet in these areas (Matkin *et al.* 2001). In a study dedicated to tracking killer whales in PWS between 1984 and 1996, of the 31 documented marine mammal kills by transient killer whales, none were Steller sea lions (Saulitas *et al.* 2000). In the northern GOA, only 9 of the 49 known or suspected transient killer whales in the area have been observed to prey on or harass sea lions (Matkin *et al.* 2003). This may indicate that there is some predatory specialization among transient killer whales, with only a portion of transient killer whales attempting to capture sea lions (Matkin *et al.* 2003). Based on surveys of researchers, fishermen, tour boat operators and others, killer whale predation on sea lions may occur more frequently in the Aleutian Islands compared to other parts of Alaska (Barrett-Lennard *et al.* 1995).

The decline of the western population of Steller sea lions has prompted researchers to explore whether killer whale predation has played a major or minor role in the decline. Estimates vary in how many transient killer whales regularly hunt in the BSAI/GOA and how many sea lions they might eat. According to NOAA Fisheries latest marine mammal stock assessment (Angliss and Lodge 2002), preliminary photographic and genetic data indicate that there are approximately 86 transient killer whales in the range of the western population of Steller sea lions (PWS, GOA, and western Alaska). Matkin et al. (2001) give a conservative estimate of 125 to 175 transients in the same area, although they acknowledge that there has been little photographic research conducted in the western Aleutians. These authors calculate a range of predation rates on sea lions and conclude that killer whale predation was insufficient to cause the historical decline of sea lions but may be an important factor in limiting their recovery (Matkin *et al.* 2001, Matkin *et al.* 2003).

In contrast, a recent paper estimates that there are many more killer whales than previously believed, including at least 272 transients in the Aleutian archipelago alone, and that killer whale predation could be more than ten times the level necessary to cause the historic Steller sea lion population decline (Springer *et al.* 2003). According to this top-down hypothesis, killer whales may have been forced to eat more pinnipeds and sea otters after their preferred prey, great whales, were decimated by post-World War II industrial whaling. Although additional research is needed to corroborate their population estimates and dietary assumptions, these authors conclude that killer whale predation may be responsible for the population declines not only of Steller sea lions, but of harbor seals, northern fur seals, and sea otters in the Aleutians (Springer *et al.* 2003).

One complication for all top-down hypotheses that seek to explain the decline of the western population of Steller sea lions is the need to compare and reconcile the proposed mechanisms with the increasing population trend of the eastern population of Steller sea lions. If increased killer whale predation (or any other top-down mechanism) has contributed to a massive collapse of the western population, what is the mechanism that prevented the same thing from happening with the smaller eastern population of Steller sea lions? There are many transient killer whales in the range of the eastern population of Steller sea lions (219 transients, Angliss and Lodge 2002) and they appear to make up a much higher percentage of all killer whales (35 percent) than in western Alaska waters (7 to 12 percent) (Matkin *et al.* 2001, Springer *et al.* 2003). It is currently not known whether western Alaska transient killer whales are taking a much higher percentage of sea lions in their diet than whales in the eastern portion of their range. Unfortunately, data on transient killer whale diet is very limited and difficult to obtain. Therefore, comparisons among different geographic locations are problematic. Additional research on population size and feeding behavior is needed to determine the contribution of killer whale predation to the decline and recovery of Steller sea lion populations.

Attacks by great white sharks have been documented on sea lions at the southern end of their range in California (Ainley *et al.* 1985). Though Alaska waters are north of the normal range of white sharks, sleeper sharks (*Somniosus pacificus*) range throughout the GOA and Bering Sea, and small marine mammals have been documented in sleeper shark stomach contents (Yang and Page 1999). However, no remains of Steller sea lions were found in 13 sleeper shark stomachs collected in the GOA between June and August 1996 in areas near active sea lion rookeries and haulout sites (Yang and Page 1999). In a recent study of sleeper sharks, a total of 198 sleeper shark stomach contents were analyzed from sharks taken near rookeries, and preliminary analysis found no direct evidence of sea lion parts (Hulbert *et al.* 2002).

Management Overview

Steller sea lions are under the management jurisdiction of NOAA Fisheries, Protected Resource Division, as established by the MMPA of 1972. In November 1990, NOAA Fisheries listed Steller sea lions as "threatened" range-wide under the U.S. ESA (55 FR 49204). In 1997, two populations were formally recognized (Bickham *et al.* 1996, Loughlin 1997). The western population, which occurs from 144°W (approximately at Cape Suckling) westward to Russia and Japan, was listed as "endangered" in June 1997 (62 FR 24345). The eastern population, which occurs from southeast Alaska southward to California, remains classified as threatened. Aquatic critical habitat for the western population of the Steller sea lion was designated in 1993 (50 CFR 226.202) and consists of the areas within 20 nm (37 km) of designated rookeries and haulouts and key foraging areas in the Bogoslof District, Seguam Pass, and Shelikof Strait. Designated aquatic critical habitat for the eastern population of the Steller sea lion consists of the areas within 3,000 ft (0.9 km) of designated rookeries and haulouts. Terrestrial critical habitat for both populations consists of areas landward within 3,000 ft (0.9 km) of designated rookeries and haulouts.

Critical habitat designation does not automatically preclude particular activities, such as commercial fishing, but it defines areas that are important to the continued survival and recovery of ESA-listed species. The ESA (Section 7) requires the responsible agency, in this case NOAA Fisheries PRD, to assess whether proposed activities in the range of ESA-listed species would jeopardize the continued existence or recovery of the species or adversely modify its critical habitat. These assessments are made for all federally funded or managed activities that might impact the listed species and the resulting document is called a BiOp. NOAA Fisheries has issued many BiOps regarding the BSAI and GOA groundfish fisheries since 1991. The history of these plans and a summary of their respective findings is detailed in Appendix B and Appendix F-4 of this document.

Under the direction of NPFMC, NOAA Fisheries Office of Sustainable Fisheries has implemented many management measures to protect Steller sea lions and their foraging habitat. These measures are described in Appendix F-4 of this document. The following are examples of the types of management measures that have been taken but are not meant to be comprehensive.

In 1990, coincident with the ESA listing, NOAA Fisheries: 1) prohibited entry within 3 nm of listed Steller sea lion rookeries west of 150°W; 2) prohibited shooting at or near Steller sea lions; and 3) reduced the allowable level of take incidental to commercial fisheries in Alaskan waters (50 CFR 227.12) (Fritz *et al.* 1995). The 1991 to 1995 period saw broad implementation of fishery area and time closures to protect Steller sea lions. Measures taken in this time period to protect Steller sea lions were the first pervasive restrictions on the operations of the fishing fleet. Trawling was prohibited in the BSAI within 10 nm of 37 Steller sea lion rookeries year-round and within 20 nm of five rookeries during the pollock A season (January 20 to April 15). Similar closures were instituted in the GOA. To reduce competition for prey, the pollock TAC was spread over three areas, and limits were placed on the amount of excess pollock that could be taken in a quarter. These groundfish fishery management measures were designed to spread the harvests out over time and space to avoid potential localized depletion of prey for sea lions, and to greatly reduce the amount of harvest from areas designated as critical habitat for Steller sea lions. Additional rookeries and haulout areas were closed to certain types of fishing and the entire Bogoslof and Aleutian Islands management areas were closed to pollock fishing. In 1998, the Atka mackerel fishery in the Aleutian Islands was modified to restrict removals from inside critical habitat, seasonal apportionments were established, and the Aleutian

Islands were closed to pollock trawling. In June 1999, the NPFMC developed a set of measures to protect Steller sea lions and avoid jeopardy and adverse modification under the ESA and implemented these measures. The measures were subsequently challenged in court and were revised. The final set of measures was accepted by the courts and implemented for the following season.

Groundfish fisheries for pollock, Pacific cod and Atka mackerel in the BSAI and GOA presently operate under a suite of restrictions on where, when, and how fish can be taken. Many of these restrictions were imposed to protect Steller sea lions. The most recent BiOp was issued in October 2001 (NMFS 2001c), with a supplement to the BiOp published in June 2003 (NMFS 2003). In conjunction with that BiOp, a series of Steller sea lion protection measures were developed by NPFMC to protect the Steller sea lion from effects of the groundfish fisheries. These protection measures were analyzed in a separate EIS (NMFS 2001b). The NPFMC adopted a preferred alternative and the Steller sea lion protective measures were implemented by emergency rule in January, 2002 (67 FR 956).

Steller sea lions prey on a variety of species and sizes of fish, some of which, such as members of the families of Osmeridae (smelt), Myctophidae (lanternfish) and Clupeidae (Pacific herring), are considered “forage fish” and are not targeted by the groundfish fisheries. Forage fish are thought to be important for certain individuals (i.e., juvenile sea lions) at particular times and places. As part of their efforts to protect the food supplies of sea lions and the ecosystem needs of other species, NPFMC adopted Amendment 36 to the BSAI FMP and Amendment 39 to the GOA FMP in April 1997 to prevent the development of commercial fisheries for forage fish. NOAA Fisheries published the final rule implementing the regulations on March 17, 1998 (63 FR 13009).

Under the 1994 reauthorization of the MMPA, direct human-related mortality is monitored using a formula for the PBR to calculate the maximum number of individuals that can theoretically be taken without adversely affecting the population. Values for PBR have been calculated for both populations of Steller sea lions in Alaska based on the latest minimum population estimates. For the western population, PBR is 208 Steller sea lions per year. For the eastern population, PBR is 1,396 Steller sea lions per year (Angliss and Lodge 2002). These calculations take into account the different status of the populations under the ESA. Any population that is listed under the ESA is automatically considered to be a depleted and strategic stock under the MMPA.

Past and Present Effects and Management Actions

<u>Direct Mortality: Harvest and Other Intentional Take</u>

Little information is available on the fluctuations of Steller sea lion population prior to the 1960s, but it is suspected that decreases in population numbers were likely due to human exploitation (NRC 1996). Commercial harvest of sea lions for hides and meat occurred prior to 1900 and likely depleted some local populations. Over a nine year period, 1963 to 1972, more than 45,000 Steller sea lion pups were taken for commercial purposes (Merrick *et al.* 1987). It is likely that historic commercial harvests also have had residual effects on the present day population-levels of Steller sea lions in certain areas. However, a drastic decline in Steller sea lion numbers has still occurred in some North Pacific regions since commercial hunting was prohibited in 1972 by the MMPA.

The Steller sea lion has been harvested for subsistence purposes throughout history by the indigenous people of the Bering Sea, Aleutian Islands, and GOA regions. Current harvest is primarily in communities within the range of the western population. The eastern population is subject to an average of only two Steller sea lions taken per year from southeast Alaska (1992 through 1997) (Angliss and Lodge 2002). Of those sea lions taken from the western population, most are harvested in the Pribilof Islands. Subsistence take of Steller sea lions during the 1993 to 1995 period was estimated to average 412 animals annually (Angliss and Lodge 2002). Estimates of the total number of Steller sea lions taken (harvested plus struck and lost) declined over the six year period from 1992 to 1998 from 549 to 171 per year (Angliss and Lodge 2002), with an overall mean annual take of 329 sea lions for the entire period. In 2001, subsistence harvest of Steller sea lions was estimated to be 198 individuals (Wolfe *et al.* 2002). This is very close to the calculated value of PBR of 208 for this population (Angliss and Lodge 2002).

Based on a published life table and the current rate of decline, Loughlin and York (2000) estimate the total number of mortalities of non-pup Steller sea lions in 2000 was about 6,425 animals; of those, 4,710 (73 percent) were mortalities that would have occurred if the population were stable, and 1,715 (27 percent) were additional mortalities that fueled the decline. Loughlin and York (2000) classified 438 anthropogenic mortalities and 779 anthropogenic plus some predation mortalities as “mortality above replacement”; this accounted for 25 percent and 45 percent of the estimated total level of “mortality above replacement.” The remaining mortality (75 percent and 55 percent, respectively) was not attributed to a specific cause and may be the result of nutritional stress.

Direct Mortality from Incidental Take in External Fisheries

It was not until after the 1950s that large numbers of Steller sea lions were taken in the commercial fisheries in the Alaska region (Alverson 1992). The take of Steller sea lions was substantial after this time with over 20,000 animals believed to have been incidentally killed in the foreign and JV groundfish fisheries from 1966 to 1988, although data from this period is not complete (Perez and Loughlin 1991). Based on telemetry data indicating that sea lions from the western population rarely leave the waters of the U.S. EEZ and on the minimal amount of international net fisheries in nearby waters, NOAA Fisheries has concluded that the current amount of sea lion incidental take from international fisheries is likely to be insignificant (Angliss and Lodge 2002).

Steller sea lions are incidentally taken by commercial fisheries other than groundfish fisheries, including some state-managed nearshore salmon gillnet fisheries and halibut longline fisheries. Based on observer data from 1990 to 1991, an estimated 14.5 sea lions were incidentally taken each year in the PWS drift gillnet fisheries (Wynne *et al.* 1992). Very few state-managed fisheries have been monitored with independent observers but fisherman are required to report incidental takes of all marine mammals. Based on incomplete records of self-reported salmon and longline fisheries, the minimum estimated average take is 5.4 sea lions per year. This is considered to be a minimum estimate because self-reported take data is considered unreliable and negatively biased (Wynne *et al.* 1992).

Direct Mortality from Incidental Take in Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the BSAI and GOA groundfish trawl, longline, and pot fisheries during 1990-2000. Steller sea lions were observed to be taken in the BSAI and GOA trawl fisheries and in the GOA longline fisheries. No incidental takes were observed in the pot fisheries or in the BSAI longline fishery (Angliss and Lodge 2002). In the BSAI groundfish trawl fisheries, incidental take has declined from about 20 per year in the early 1990s to an average of 7.8 sea lions per year from 1996-2000. Sea lion takes occur less often in the GOA, with an average of 0.6 animals taken per year in the trawl fishery and 1.2 per year in the longline fishery (1996-2000) (Angliss and Lodge 2002). The combined incidental take from BSAI and GOA groundfish fisheries is thus 9.4 sea lions per year based on observer data from 1996-2000.

Direct Mortality from Illegal Shooting

Intentional shooting of Steller sea lions, other than in subsistence hunts, became illegal after the species was listed as threatened under the ESA in 1990. It is thought that shooting used to be a significant source of mortality prior to that time. It is possible that intentional shooting could have contributed to the steep decline in the late 1980s but this is largely speculative. NOAA Fisheries Alaska Enforcement Division has successfully prosecuted two cases of illegal shooting involving four sea lions from the eastern population (Angliss *et al.* 2001). It is not known whether, and to what extent, illegal shooting continues in either population.

Indirect Effects through Changes in Prey Availability

Key prey species of Steller sea lions include species that are targeted or taken as bycatch by the BSAI and GOA groundfish fisheries and parallel fisheries in state waters. This was also true for past foreign and JV groundfish fisheries, and there is partial overlap with other state-managed fisheries. NOAA Fisheries issued a number of BiOps since 1991 that analyzed the key issue of whether the groundfish fisheries were contributing to the decline of sea lion populations or causing adverse impacts to their critical habitat. The NMFS 2001 EIS and BiOp (NMFS 2001b and 2001c) explores this subject indepth.

Although the factors and mechanisms for the decline of the western population of Steller sea lions have been, and continue to be, the subject of intensive research, it is generally thought that the decline is due to a combination of nutritional stress from climate-induced or fisheries-related declines in prey abundance or availability (bottom-up hypotheses), or resulting from human-related mortality and predation (top-down hypotheses) (NRC 1996, NMFS 2001b and 2001c, NRC 2001). The causes of the decline of the western population of Steller sea lion are not clearly understood, and experts agree that these causes have probably changed over time (DeMaster *et al.* 2001, Loughlin and York 2000). Reasons for the steep decline in the 1980s are thought to be related to different factors than those resulting in the more gradual declines during the 1990s (NRC 2001). The marked change in the rate and spatial extent of the decline over the past decade suggests that factors that contributed most strongly to the more rapid declines prior to the 1990s may not be the most significant factors operating today (Bowen *et al.* 2001). In addition to the direct taking of animals through commercial and subsistence harvests and interactions with fisheries, evidence from the 1970s and 1980s supports that sea lions were nutritionally stressed which, resulted in reductions in recruitment and reproductive rates in the first phase of the decline (DeMaster *et. al.* 2001). Hypotheses to explain the second phase or continued decline of the western population of Steller sea lions include potential nutritional stress due to competition with fisheries for prey and/or changes in the ocean environment due to climate change and an increase in the natural predation of Steller sea lions by sharks and killer whales. However, direct evidence for the nutritional stress hypothesis in the second phase of the decline is lacking (DeMaster *et al.* 2001).

It is believed that some of these factors such as nutritional stress may have acted most strongly against juveniles between the time they are weaned and when they are grown to adult size and foraging capability. Adult females may also be negatively affected by these factors because of the physiological stress and limited geographic mobility when caring for pups. Hence, mitigation efforts have focused on protecting the integrity of food supplies near rookeries and haulouts. It is important to realize that the key issue for the survival and reproductive success of sea lions is not the total amount of fish that are present, but how available they are to foraging sea lions. Major changes in the abundance and distribution of preferred prey species may lead to animals not being able to catch enough to eat and/or to spending more time foraging, thus exposing them to increased predation pressure from killer whales and sharks. Since NOAA Fisheries cannot control climate and oceanic changes, such as ENSO, or the behavior of killer whales, their management efforts are focused on human-caused adverse effects to Steller sea lions including fisheries that focus on important sea lion prey. The allocation of TAC among different seasons, areas, and gear types is the main thrust of these management efforts. Minimizing the competitive overlap between the fisheries and Steller sea lions is the primary focus of sea lion protective measures.

<u>Indirect Effects through Contamination by Oil Spills</u>

Other human-controlled factors such as oil spills have had effects on Steller sea lions in past years. A number of Steller sea lion haulouts and rookery sites were affected by the EVOS in PWS in 1989, but insufficient data exists to determine the overall impact of the spill on the population.

Comparative Baseline

Steller sea lions were split into two separate populations in 1997 based on several factors, including major differences in their population trends. The western population was estimated to be approximately 185,000 Steller sea lions in the late 1970s but has declined precipitously to an estimated 34,595 animals in 2002 (Angliss and Lodge 2002). Surveys in 2002 indicated the first region-wide increase in population in over 20 years but it remains to be seen whether this positive trend will continue. The western population was listed as endangered under the ESA in 1997 so it is automatically considered a depleted and strategic stock under the MMPA. According to current estimates, incidental take from the BSAI and GOA groundfish fisheries and other fisheries (29) and subsistence harvest (198) exceeds the PBR (208) for this population (Angliss and Lodge 2002). The eastern population, in contrast, has been stable or increasing in most parts of its range. Current estimates place the eastern population abundance at a minimum of 30,453 sea lions (Angliss and Lodge 2002) but could be as high as 45,000, a historic high for this population (Pitcher *et al.* 2003). The eastern population is listed as threatened under the ESA. Subsistence and incidental take in this population is relatively small.

A great deal of effort has been expended on trying to understand the reasons that the western population declined at the same time that the eastern population grew. The effects of natural factors, such as climate and oceanographic fluctuations, as well as human-influenced factors, including commercial fishing, have been studied on their own and are increasingly studied as part of complex models. While research continues, fishery management efforts have focused on trying to minimize the spatial and temporal competition between the fisheries and sea lions, which have a very substantial overlap of preferred prey with species taken in the groundfish fisheries as both target species and non-target species taken as bycatch. The past/present effects on Steller sea lions are summarized in Table 3.8-1.

Status for Cumulative Effects Analysis

Because the eastern and western populations of Steller sea lions are listed as threatened and endangered, respectively, under the ESA, have very different population trends, and are subject to very different intensities of interaction with the groundfish fisheries, each population will be considered separately in the analysis of Alternative FMPs in Chapter 4.

3.8.2 Northern Fur Seal (*Callorhinus ursinus*)

Life History and Distribution

The northern fur seal ranges throughout the North Pacific Ocean from southern California north to the Bering Sea and west to the Okhotsk Sea and Honshu Island, Japan. The species is strongly sexually dimorphic, meaning that mature males and females look very different. Females weigh about 135 pounds (61 kg) and reach 4.5 ft (1.4 m) in length while males average about 600 pounds (270 kg) and reach 6 ft (1.8 m) in length (Burt and Grossenheider 1976). Northern fur seals have a highly polygynous mating system, breeding in dense colonies on islands located near highly productive marine areas (Gentry 1998). Breeding is restricted to only a few sites: the Pribilof Islands (where 74 percent of the population breeds), Commander Islands (Russia), Bogoslof Island, and San Miguel Island (California) (Gentry 1998, Angliss *et al.* 2001).

The northern fur seal breeding cycle is highly stable, with adult males arriving on land during May and June to establish territories at traditional breeding areas (Bigg 1986). Females and juvenile males arrive on the breeding islands in late June through August with arrival times occurring progressively earlier as seals increase in age. Northern fur seals exhibit strong site fidelity and philopatry (Baker *et al.* 1995, Gentry 1998). The tendency to return to land at the natal area increases with age for both juvenile male and female northern fur seals (Baker *et al.* 1995). Female northern fur seals give birth to a single pup within 1 to 2 days after arrival on land and mate within 4 to 7 days after parturition (Bartholomew and Hoel 1953). Northern fur seal females undergo a period of delayed implantation characteristic of all pinnipeds (Boyd 1993); the embryo does not implant in the uterus and begin to develop until late November (York and Scheffer 1997). Approximately 7 to 8 days after giving birth, lactating females begin a series of foraging trips to sea alternating with 1 to 2 days on land to nurse their pups (Gentry *et al.* 1986). Pups are weaned in October and November, at about 125 days of age, and go to sea soon afterward (Gentry and Kooyman 1986).

Most females, pups, and juveniles leave the Bering Sea by late November and are pelagic in the North Pacific Ocean during the late fall and winter, migrating south as far as Southern California in the eastern North Pacific and Japan in the western North Pacific, until they begin returning to the rookeries in March (Bartholomew and Hoel 1953). In 1989 through 1990, radio-tagged pups departed St. Paul Island in mid-November and entered the North Pacific Ocean through the Aleutian Islands from Samalga Pass to Unimak Pass an average of 10 to 11 days later (Ragen *et al.* 1995). Of four fur seal pups tracked by satellite during 1996, two pups left the Bering Sea after 10 and 13 days, while two other pups traveled northwest of St. Paul Island and remained in the Bering Sea for 50 and 68 days until late January (D. DeMaster, AFSC, personal communication.). Adult males appear to migrate only as far south as the GOA and Kuril Islands (Kajimura and Fowler 1984, Loughlin *et al.* 1999).

Two separate stocks of northern fur seals are recognized within U.S. waters: an eastern Pacific stock, which includes all the animals in the BSAI and GOA, and a San Miguel Island (California) stock. Population estimates for the eastern Pacific stock are calculated by estimating the number of pups at rookeries and then multiplying by an expansion factor (4.5) that approximates a life table analysis (Angliss and Lodge 2002). Since 1990, pup counts have been made every other year on St. Paul and St. George Islands, but less frequently on Sea Lion Rock (a small reef just off St. Paul Island) and Bogoslof Island. Based on pup counts made during 2000, the most recent estimate of the number of fur seals in the eastern Pacific stock is 941,756 (Angliss and Lodge 2002).

Population Trends

Until the mid-1970s, northern fur seal population trends could be explained largely by commercial harvest patterns in the NPO. Large population declines coincided with large harvests of female and juvenile fur seals. The fur seal population has shown a resiliency to sustained harvests of adult males when females and juveniles were not harvested. The history of pelagic sealing (1875 - 1909), its impact on the fur seal population, and a subsequent treaty banning pelagic sealing is found in Gentry (1998). At the peak of pelagic sealing (1891 to 1900), more than 42,000 fur seals (mostly lactating females) were taken annually in the Bering Sea (Scheffer *et al.* 1984). Because the takes were greatly reducing the fur seal stock, Great Britain (for Canada), Japan, Russia, and the United States ratified the Treaty for the Preservation and Protection of Fur Seals and Sea Otters in 1911. With the signing the treaty, commercial pelagic harvests ended.

The population grew rapidly after the cessation of pelagic sealing until the mid 1940s. There was no commercial harvest from 1912 to 1917. From 1918 to about 1941, the Pribilof Island fur seal stock grew at eight percent per year under a land based harvest of males that ranged from 15,862 in 1923 to 95,016 in 1941 (NMML unpublished data[b]). The Alaska population of fur seals peaked at a high of approximately 2 million during the 1950s. In 1957, the signatories of the 1911 Treaty ratified a new agreement. During those negotiations, calculations presented by the U.S. suggested that maximum sustained productivity would occur at lower female population-levels than those of the early 1950s. Consistent with that analysis, from 1956 to 1968, a total of about 300,000 female fur seals were killed on the Pribilof Islands (York and Hartley 1981). Concurrently, 30,000 to 96,000 juvenile males were harvested each year and a pelagic collection of about 16,000 females was taken for research purposes by the United States and Canada. This harvest of females and juveniles caused a large population decline into the late 1960s.

With the cessation of female and juvenile harvests, the population increased only briefly into the mid-70s. The population then began a steady decline of 6 to 8 percent per year into the 1980s; the cause for this decline has not been determined. By 1983 the population was estimated to be 877,000 seals (Angliss *et al.* 2001). Annual pup production on St. Paul Island remained relatively stable between 1981 through 1998, indicating that the population had not changed very much. Since 1998, population estimates from pup surveys indicate that the population is declining at a rate of more than five percent per year. The cause for this decline is unknown.

Trophic Interactions

Studies on northern fur seal diets began with the work of Lucas (1899). The most extensive research was based on the pelagic sampling of over 18,000 fur seals between 1958 and 1974 (Perez and Bigg 1986). Of the fur seal stomachs collected, 7,373 contained food and an additional 3,326 had trace remains. Based on the frequency of occurrence, the diet consisted of 67 percent fish (34 percent pollock, 16 percent capelin, 6 percent Pacific herring, 4 percent deep-sea smelt and lantern fish, 2 percent salmon, 2 percent Atka mackerel, and no more than one percent eulachon, Pacific cod, rockfish, sablefish, sculpin, Pacific sand lance, flatfish, and other fish) and 33 percent squid (Perez 1990). These data showed marked seasonal and geographic variation in the species consumed. In the EBS, pollock, squid, and capelin accounted for about 70 percent of the energy intake. In contrast, sand lance, capelin, and herring were the most important prey in the GOA. However, no fur seal stomach samples have been collected following the decline in abundance of forage fish in the GOA after the regime shift in the mid 1970s.

One study of gastrointestinal contents of 73 northern fur seals collected from the Bering Sea in the early 1980s indicated that a positive correlation exists between pollock year-class strength and the frequency of pollock in fur seal diets (Sinclair *et al.* 1994). The same report concluded that northern fur seals are size-selective midwater feeders during the summer and fall in the eastern Bering Sea. Since 1987, studies of northern fur seal diets have been based on fecal samples (scat). A comparative study of fur seal diets based on the current method of scat analysis versus stomach content analysis from the 1980s collections demonstrated that the different methods yield very similar results (Sinclair *et al.* 1996). Based on diet studies conducted since the early pelagic collections (Sinclair *et al.* 1994, Sinclair *et al.* 1996, Antonelis *et al.* 1997), some prey items, such as capelin, have disappeared entirely from fur seal diets in the eastern Bering Sea and squid consumption has been markedly reduced. At the same time, pollock consumption has tripled and the age category of pollock eaten has decreased.

Recent studies have used bio-chemical methods to study the diet of northern fur seals. Kurle and Worthy (2000) used carbon and nitrogen isotope analysis of fur seal skin and whole prey to investigate the feeding ecology of female and juvenile male northern fur seals during the spring migration and of lactating female fur seals during the breeding season. Their results suggest that lactating females eat prey at trophic levels equivalent to 2 to 4 year-old walleye pollock and small Pacific herring during the fall. Nitrogen isotope ratios used to determine the trophic level of prey did not indicate a diet of juvenile pollock. During the northward spring migration, nitrogen isotope ratios indicated that the diet of both pregnant females and juvenile males consisted of prey at the same trophic level as capelin, herring, or adult pollock. Carbon isotope ratios suggested that migrating adult females fed in coastal areas while juvenile males and females were feeding further offshore. Using fatty acid signature analysis of fur seal milk to study the foraging patterns of lactating females on the Pribilof Islands, Goebel (2002) determined that prey of shallow-diving seals foraging off the continental shelf differs from shallow divers on-shelf, and that prey of deep diving females differs from both types of shallow divers. Milk of deep diving seals had fatty acid signatures most similar to fatty acid signatures of walleye pollock. The results of this study indicate that different dive patterns and foraging locations of lactating females likely result from exploitation of different prey resources. In waters over the continental shelf, adult walleye pollock are generally found near the bottom while juvenile pollock are usually concentrated in the surface layer above the thermocline (Bailey 1989) suggesting that the diet of deep diving fur seals in these areas includes adult pollock.

Management Overview

Northern fur seals are managed by NOAA Fisheries and by co-management agreements with Alaska Native Organizations under Section 119 of the MMPA. Northern fur seals were listed as depleted under the MMPA in 1988 because population-levels had declined to less than 50 percent of those observed in the late 1950s (NMFS 1993a). The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives.

Past and Present Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Commercial harvest of fur seals were a major source of human-induced mortality for over 200 years and the abundance of fur seals fluctuated greatly in the past, largely due to this commercial harvest (NMFS 1993a). Commercial harvest of fur seals peaked in 1961 with over 126,000 animals, but was halted in 1985. Commercial harvests of females from 1956 through 1968 likely contributed to the decline of the population from the 1950s to the 1970s, and may have had lingering effects after it's cessation (York and Hartley 1981). The population increased slightly in the early 1970s, though, and declines since then are difficult to explain. At present, the PBR for this population is 17,138 animals per year (Angliss and Lodge 2002).

Alaska Natives are allowed to harvest fur seals for subsistence purposes, with a take range determined by annual household surveys. From 1986 to 1996, the average annual subsistence take was 1,605 from St. Paul and St. George. From 1995 to 2000 this average take dropped to 1,340 seals per year, which represents about 8 percent of PBR. Only juvenile males are taken in the subsistence hunt, which minimizes the impact of the hunt on population growth. Subsistence take in other areas besides the Pribilofs is known to occur, but is thought to be minimal (Angliss and Lodge 2002).

Intentional killing of fur seals by commercial fishermen, sport fishermen, and others likely occurs but the magnitude of this mortality is not known. Intentional take is illegal under the MMPA except for subsistence uses of Alaska Natives.

Direct Mortality from Incidental Take in External Fisheries

Incidental take of fur seals from the foreign and joint venture groundfish fisheries averaged 22 animals per year from 1978 to 1988 (Perez and Loughlin 1991). The high seas driftnet fisheries killed thousands of fur seals every year, including an estimated 5,200 fur seals in 1991, the last year before these fisheries were outlawed by United Nations Resolution (46/215) (Hill and DeMaster 1999). Illegal driftnet fishing apparently continues at low levels, but no quantitative information is available on incidental take.

Based on self-reported mortalities, state-managed salmon fisheries took an average of 15 fur seals per year from 1990 to 1998. Most of these mortalities came from the Bristol Bay salmon drift gillnet fishery. Self-reported data are considered negatively biased, so these results are taken as minimum estimates (Angliss *et al.* 2001).

Another mechanism for incidental take of fur seals is through entanglement with fishing gear, packing bands, and other debris lost or ejected from fishing vessels, shipping vessels, and shoreside sources. Some gear may continue to circulate in the environment for many years. The contribution of particular fisheries to this problem is not known. The numbers of animals entangled at sea that never make it back to land are not known, but this issue has been cited as making a significant contribution to the decline of the population in the 1970s and early 1980s (Fowler 1987). Surveys of fur seals on St. Paul indicated that the proportion of animals with debris wrapped around part of their bodies decreased from 0.4 percent in 1976 to 1985 to 0.2 percent in 1988 to 1992 and 1995 to 1997 (Angliss *et al.* 2001). Some efforts have been made by NOAA Fisheries and Pribilof Island villagers to capture and remove debris from fur seals, with over 100 seals treated each year from 1995 through 1997.

<u>Direct Mortality from Incidental Take by MSA Groundfish Fisheries</u>

The incidental take of northern fur seals is uncommon in the groundfish fisheries. The last recoreded mortality in any Alaskan groundfish fishery occurred in 1996, when the take rate was one animal per 1,862,573 mt of groundfish harvested. Observer Program data from 1990 to 1998 indicate that fur seals were taken incidentally only in the BSAI groundfish trawl fishery, despite observer placement in pot, longline, and trawl fisheries in both the BSAI and GOA. Estimated average take in trawls is less than one seal per year (Angliss *et al.* 2001). This level of take contributes little to the northern fur seal PBR and is inconsequential to population trends. The contribution of the MSA groundfish fisheries to gear and debris that causes entanglement of fur seals is unknown.

<u>Indirect Effects through Changes in Prey Availability</u>

Ecological interactions between northern fur seals and the groundfish fisheries are caused by spatial and temporal overlap between fur seal foraging areas and groundfish fisheries and from competition for target and bycatch species taken by the fisheries. The diet of northern fur seals includes a wide range of fish species, with less apparent dependance on Pacific cod and Atka mackerel compared to Steller sea lions. However, both adult and juvenile pollock occur in the diet of northern fur seals and consumption rates vary according to the abundance of different age classes of pollock in the foraging environment (Swartzman and Haar 1983; Sinclair *et al.*, 1996). Evaluation of the indirect effects of fisheries on northern fur seals focuses less on removals of Pacific cod and Atka mackerel and more broadly on removals of pollock and small schooling fishes.

Fishing effort displaced by Steller sea lion protection measures may be concentrated in areas important to fur seals. The proportion of the total June through October pollock catch in fur seal foraging habitat (defined as the combined home ranges of females from the Pribilofs) increased from an average of 40 percent between 1995 and 1998 to 69 percent from 1999 to 2000 (NMFS 2001b). There is a particular concern for the potential impact of this increased fishing pressure on lactating females from St. George Island where catch rates were consistently higher than in areas used by females from St. Paul Island.

Comparative Baseline

Northern fur seals are numerous in the BSAI and GOA, with an estimated population of over 940,000 animals. However, they are listed as a “depleted” stock under the MMPA because of major population declines from 1950s to the late 1960s and again from the mid 1970s through the early1980s. Subsistence hunts make up the great majority of anthropogenic mortality, but these levels are well below PBR. Incidental take in the groundfish fisheries hovers around zero, but there is still concern about potential competitive interactions on prey availability, especially as fishing effort is diverted from Steller sea lion habitat to areas around the fur seal rookeries on the Pribilof Islands. Pup counts in 2000 were significantly less than in 1990. The past/present effects on northern fur seals are summarized in Table 3.8-2.

Status for Cumulative Effects Analysis

Because of their "depleted" status under the MMPA and potential for competitive overlap for prey with the groundfish fisheries, northern fur seals will be considered as a separate species in the analysis of Alternative FMPs in Chapter 4.

3.8.3 Pacific Walrus (*Odobenus rosmarus*)

Life History and Distribution

The Pacific walrus occurs primarily in the shelf waters of the Bering and Chukchi Seas (Allen 1880, Smirnov 1929). Most of the population congregates during the summer at the southern edge of the Chukchi Sea pack ice between Long Strait, Wrangell Island, and Point Barrow (Fay *et al.* 1984). The remainder of the population, primarily adult males, stays in the Bering Sea during summer (Brooks 1954, Burns 1965, Fay 1955, Fay 1982, Fay *et al.* 1984). Females and subadult males migrate toward Bering Strait in the autumn when the pack ice begins to re-form (Fay and Stoker 1982a). Walruses use terrestrial haulout sites when suitable haulout sites on ice are unavailable. The major haulout sites are located along the northern, eastern, and southern coasts of the Chukchi Peninsula, on islands in the Bering Strait, on the Punuk Islands, on Round Island in Bristol Bay (Lentfer 1988), and at Cape Seniavan on the north side of the Alaska Peninsula.

The population of Pacific walrus has never been known very precisely and has fluctuated substantially over the past 150 years, presumably as a result of changes in human exploitation. Prior to commercial hunting in the late 1700s, the population was estimated at 200,000 to 250,000 but decreased to an estimated 50,000 to 100,000 in the 1950s (USFWS 2002a). After U.S. and Soviet protection measures reduced hunting pressure, the population increased dramatically. A series of cooperative aerial surveys between the U.S. and the Soviet Union (and later, Russia) from 1975 to 1985 yielded population estimates of about 221,000 to 246,000 (USFWS 2002a). The survey methodology had technical problems so the results should be considered rough estimates. The most recent cooperative aerial survey was made in 1990 and yielded an estimate of just over 200,000 animals. However, this survey did not include an area that had been used by walrus in previous years and should be considered conservative. These cooperative surveys were discontinued after 1990 because of financial limitations and because of continuing technical difficulties in survey methodology (USFWS 2002a). The current size and trend of the Pacific walrus population are unknown but efforts have been made in recent years to improve survey methodology.

Trophic Interactions

Walrus feed almost exclusively on benthic invertebrates (bivalve mollusks) which they locate with their vibrissae and dislodge prey with jets of water and suction and sucking the meat out of the shells (Fay 1982, Fay and Stoker 1982a and 1982b). Feeding occurs in depths of 10 to 50 m, with a maximum depth of about 80 m (Fay and Stoker 1982a, Vibe 1950). Walrus diets in the EBS are more than 97 percent invertebrates and less than one percent fish. Some walruses, primarily males, occasionally feed on seals (Lowry and Frost 1981).

Management Overview

In contrast to the other pinnipeds, management of the Pacific walrus is the responsibility of the USFWS. The species is protected under the MMPA but it is not considered a "depleted" or "strategic" stock. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. In 1997, the USFWS entered into a cooperative agreement with the Eskimo Walrus Commission to facilitate the participation of subsistence hunters in the conservation and management of walrus in Alaska. This agreement has strengthened harvest monitoring programs and promoted locally-based subsistence harvest guidelines (USFWS 2002a). Based on the 1990 population estimate of 200,000 animals, but recent current populations size is not known, therefore, a PBR can't be calculated. (USFWS 2002a). The accuracy of this value for present use is not known. Round Island, south of Togiak in Bristol Bay, is an important haulout site and is part of the Walrus Islands State Game Sanctuary. FRs prohibit entry of fishing vessels inside 12 miles of this sanctuary (672.22[a][4]).

Past and Present Effects and Management Actions

<u>Direct Mortality: Harvest and Other Intentional Take</u>

Walrus are an important subsistence species for certain coastal communities in western Alaska and Russia, being used for meat, hides, and ivory. The combined Russian-Alaskan subsistence harvest of walrus has ranged from 3,200 to 16,100 animals per year with an average of about 7,000 per year for the past forty years (USFWS 2002a). These numbers include a correction factor to account for the number of walrus shot but lost during the hunt. An analysis of hunting success concluded that approximately 42 percent of animals struck by bullets were lost and that very few of them survived their injuries (Fay *et al.* 1994). Recent subsistence harvests have been smaller than the historic average, perhaps for a variety of reasons. The estimated harvest during 1996 to 2000, adjusted for animals shot but lost, was about 5,798 walrus per year (USFWS 2002a).

<u>Direct Mortality from Incidental Take in External Fisheries and Research</u>

There are no data on incidental take from Russian fisheries but it is to be believed to be very low. Between 1996 and 2000, 15 mortalities were associated with research activities, including 5 orphaned walrus calves. This data leads to an estimated loss of four walrus per year from research (USFWS 2002a).

<u>Direct Mortality from Incidental Take by MSA Groundfish Fisheries</u>

Walrus have been reported to be taken incidentally in the Bering Sea groundfish trawl fisheries. NOAA Fisheries observer data collected from 1992 to 1996 indicate that approximately 17 animals were caught each year (USFWS 2002a). Between 1996 and 2000, 63 walrus were caught (USFWS 2002a). However, the great majority of animals caught in trawls were already decomposed, indicating that many of the mortalities were unrelated to fisheries interactions. These carcasses came from animals that were either lost during subsistence hunts or from natural mortality. It is estimated that the amount of incidental take directly related to the fishery is about two walrus per year (USFWS 2002a).

Comparative Baseline

There is no reliable estimate of the current population of walrus in Alaska waters and there is little to indicate the current trend. Walrus eat benthic clams so their prey do not overlap with species caught in the groundfish fisheries. Incidental take in the groundfish fisheries is a rare occurrence. The species is an important subsistence resource for Alaska Natives. The past/present effects on walrus are summarized in Table 3.8-3.

Status for Cumulative Effects Analysis

Because there is little indication of a positive or negative trend in the walrus population and they infrequently interact with the groundfish fisheries, Pacific walrus will be considered in the "other pinniped" group in the analysis of Alternative FMPs in Chapter 4.

3.8.4 Harbor Seal (*Phoca vitulina*)

Life History and Distribution

The harbor seal is a widespread species in both the north Atlantic and Pacific Oceans and is found in Alaska along the coast from British Columbia north to Kuskokwim Bay and west throughout the Aleutian Islands. Adults weigh about 180 pounds (82 kg) with males somewhat larger than females. Sexual maturity occurs between 3 and 7 years. Maximum ages estimated from annual rings in their teeth are 26 years for a male and 32 years for a female. In Alaska, single pups are born between May and mid-July. The young pups are able to swim almost immediately after birth. They normally remain with their mothers about one month, after which they are weaned and separate from their mother. Births of harbor seal pups are not restricted to a few major rookeries (as is the case for many species of pinnipeds) but occur at many hauling sites (ADF&G 1994b).

Satellite radio-collar and tagging studies indicate that harbor seals do not appear to make long annual migrations but undertake considerable local movements. Most harbor seals are associated closely with coastal waters although there have been occasional observations of seals up to 50 miles (81 km) from shore. Harbor seals haul out of the water periodically to rest, give birth, and nurse their pups. Reefs, sand and gravel beaches, sand and mud bars, and glacial and sea ice are commonly used for hauling sites. Harbor seals are sometimes found in rivers and lakes, usually on a seasonal basis (present in summer, absent in winter) (ADF&G 1994b).

State and federal biologists have been collecting harbor seal count data sporadically since the 1940s. However, until the past decade most of these counts have been incidental to other ongoing studies. With the reauthorization of the MMPA in 1988, an increased effort began on federal and state levels to establish reliable population estimates for Alaska pinnipeds. In 1991, the National Marine Mammal Laboratory (NMML) initiated a survey project to generate a minimum population estimate for Alaska harbor seals. The surveys represent the first state-wide attempt targeting harbor seals throughout their Alaskan range. Aerial census procedures have been developed and are being updated annually using state-of-the-art imaging, mapping, and computer technologies. NMML biologists have also developed new capture techniques for tagging studies in order to generate correction factors to improve the accuracy of Alaska harbor seal abundance estimates. For budgetary and logistical reasons, the state is divided into five survey regions, only one of which is surveyed each year on a rotating basis. Hence, population estimates for the entire state are produced once every five years (AFSC 1999).

NMML aerial surveys are conducted in cooperation with ADF&G surveys and are scheduled to coincide with the Alaska harbor seal's annual molt in August, the longest time the animals spend hauled out on land or ice. During the second or third week in August, a tidal cycle is selected when the tides are low during daylight hours and the cycle of near-minus tides lasts from 8 to 10 days. Surveys are flown within 2 hours on either side of low tide when the greatest number of seals is expected to be hauled out (AFSC 1999).

For the past 30 years, three separate harbor seals stocks have been recognized in Alaska waters: (1) the Bering Sea stock, including all waters north of Unimak Pass; (2) the GOA stock, occurring from Cape Suckling to Unimak Pass, including animals throughout the Aleutian Islands; and (3) the southeast Alaska stock, occurring from the Alaska/British Columbia border to Cape Suckling (Hill and DeMaster 1999). Note that this stock division is different than that used in the fisheries. Population sizes and mortality rates in fisheries have been calculated separately. However, new genetic research indicates that there may be as many as 14 genetically isolated stocks of harbor seals in Alaska. NOAA Fisheries is presently working with the Alaska Native Harbor Seal Commission and ADF&G to redefine harbor seal stocks (Angliss *et al.* 2001, 67 FR 54792).

Bering Sea

The Bering Sea stock was surveyed during the autumn molt of 1995 throughout northern Bristol Bay and along the north side of the Alaska Peninsula (Withrow and Loughlin 1996). The estimated abundance, corrected for animals in the water, is 13,312 (Hill and DeMaster 1999).

Land-based counts at Nanvak Bay (in northern Bristol Bay) are used as an index to estimate local population trends (Pitcher 1990). Trends were estimated and adjusted for covariates (date, time of day, tide, weather variables, and count quality). In 1975, the first year standardized counts were conducted , maximum counts during pupping and molting were 375 and 2942 respectively. In the early 1990s, maximum counts during pupping were 2-3 times less than in 1975 but counts during molting were 6 times less than 1975. By 2000, the maximum count during pupping (477) was greater than in 1975 while the maximum count during molting (575) was still 5 times lower than in 1975 (Jemison *et al.* 2001). Annual surveys were conducted from 1990 through 2000 (excluding 1999). Results from this period indicate that total seal numbers increased 9.2 percent per year during the pupping period and 2.1 percent per year during the molting period (ADF&G 2001b).

At Otter Island (in the Pribilof Islands), pupping period surveys were made for all seals and for pups in 1974, 1978, and 1995. Maximum counts of all seals declined progressively from 1175 seals in 1974, to 707 seals in 1978, and to only 202 seals in 1995. This represents an 83 percent decline from 1974 to 1995. Maximum counts of pups went from 228 pups in 1974, to 114 pups in 1978, and to only 28 pups in 1995. This represents an overall decline in pups of 88 percent. This decline may have been exacerbated by the increasing presence of Northern fur seals that began to haul out on Otter Island in the early 1980s and reached numbers greater than 1000 by 1995 (Jemison *et al.* 2001).

A new ADF&G trend survey route was established in 1998 along the north side of the Alaska Peninsula from Port Moller northeast to Kvichak Bay. This new "Bristol Bay" trend route was flown again in 1999, with subsequent annual surveys planned to estimate population trend in this southeast region of the Bering Sea. A preliminary comparison between NOAA Fisheries counts in 1995 and ADF&G's counts in 1999 indicates that harbor seal numbers were stable for the Bristol Bay trend route area during 1995 through 1999. However, this crude comparison does not take into account all the differences between the NOAA Fisheries and ADF&G survey logistics that are known to substantially influence the number of seals hauled out (ADF&G 2001b).

GOA/Aleutian Islands

The GOA/Aleutian Islands stock was assessed by photographic aerial surveys in sections during the autumn molt in 1994 and 1996. Using a correction factor to account for harbor seals in the water (i.e., not accounted for in aerial photographs, the estimate was 29,175 (Hill and DeMaster 1999).

Tugidak Island (40 kilometers southwest of Kodiak Island) offers one of the most important data sets for population trend analysis because it has one of the largest concentrations of harbor seals in Alaska, it can be surveyed from land, and it has been surveyed since 1976 (by ADF&G). At Tugidak, seal counts decreased by 90 percent from 1976 to 1992 (NMFS and ADF&G 2000). This major population decline appears to have turned around in the early 1990s. From 1994 to 1999, the trend estimate turned positive with an increase of 4.9 percent during the molting period. The trend estimate for the 30 haulout sites that comprise the ADF&G's survey route on the east side of Kodiak Island for 1993 to 1999 was a positive 5.6 percent per year, representing the first documented increase in harbor seal numbers over a relatively broad area in the GOA. Despite increasing trends, the population remains greatly reduced from the 1970s (ADF&G 2001b).

<u>Prince William Sound</u>

The ADF&G began systematic surveys in 1984. For the period between 1984 and 1997, the population estimate decreased by 63 percent in this area (NMFS and ADF&G 2000).

<u>Southeast Alaska</u>

The most recent comprehensive aerial surveys of the southeast Alaska stock were conducted during the autumn molt in 1997 and 1998. Using a correction factor to account for harbor seals in the water (i.e., not accounted for in aerial photographs), the combined population estimate for southeast Alaska is 77,917 (Hill and DeMaster 1999).

In contrast to population trends in the GOA and Bering Sea, harbor seal populations in southeast Alaska did not undergo large declines in the 1970s and 1980s, but have generally increased over this period. Population trends have not been consistent in all areas, ranging from slight declines in the Glacier Bay area to 7 percent increases in southern southeast Alaska and similar increases along the coast to California (Jemison *et al.* 2001). In the Sitka area, the number of harbor seals increased in the 1984 to 1999 period by 1.1 percent per year. In the Ketchikan area, the number of harbor seals increased 7.4 percent per year during 1983 to 1998, followed by a slightly lower rate of growth (5.6 percent per year) during the more recent 1994 to 1998 period (ADF&G 2001b).

Trophic Interactions

Harbor seals generally feed in waters less than 80 m in depth, although they are able to dive to depths exceeding 600 feet (183 m) and can remain submerged for over 20 minutes (Stewart 1984). They have a relatively diverse diet that appears to vary by seasonal and local availability. Scat and stomach analyses indicate that harbor seal diets include sand lance, smelt, sculpins, herring, capelin, shrimp, mysids, octopus, pollock, and flatfishes (Lowry *et al.* 1982). Based on an average of data for the Aleutian Islands and EBS, harbor seal diet composition is approximately 75 percent fish (12 percent pollock, 9 percent Atka mackerel, 9 percent sculpin, 8 percent greenling, 8 percent Pacific cod, 5 percent capelin, 5 percent Pacific herring, 4 percent eulachon, 4 percent Pacific sand lance, 3 percent flatfish, 3 percent saffron cod, 2 percent other fish, and no more than one percent Arctic cod, eelpouts, rockfishes, and Pacific salmon) and 25 percent invertebrates (Perez 1990). Daily consumption rates of 6 to 8 percent of total body weight have been estimated for captive harbor seals. For a 180 pound seal, this would translate into a daily consumption of 11 to 14 pounds of food. Food consumption by captive subadult harbor and spotted seals, as reported by Ashwell-Erickson and Elsner (1981), was about 4 percent of body weight in March through August, and about 8 percent of body weight in the winter.

Prey quality may also be an important factor in harbor seal diets. Studies on captive animals have shown that certain blood parameters change when harbor seals consume different prey. The significance of these findings on wild populations of seals is unknown but is under investigation (NPFMC 2001).

Harbor seals are known to be prey of killer whales, Steller sea lions, and sharks. The impact of these predators on harbor seal populations is unknown but may be significant, especially when seal numbers are low (Frost 1997). There is some concern that the decrease in Steller sea lion populations, a favorite prey of killer whales, has led the whales to prey more heavily on harbor seals than when sea lions are less abundant.

Management Overview

Most marine mammals, including harbor seals, fall under the jurisdiction of the NOAA Fisheries and are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. In 1994, an amendment to the MMPA included provisions for the development of cooperative agreements between the USFWS, NOAA Fisheries, and Alaska Native organizations to conserve marine mammals, and provide for co-management with Alaska Natives. NOAA Fisheries has entered into an agreement with the Alaska Native Harbor Seal Commission (ANHSC) for co-management of the seals. In addition, the ADF&G has management authority in state waters (less than 3 nm from shore) which includes much of the seal's habitat.

The ANHSC is a consortium of Native communities organized in 1995 to strengthen the role of Alaska Natives in resource policy and management decisions concerning harbor seals. ANHSC collaborates with federal and state agencies in scientific studies and educates the public on traditional Native uses of marine mammals (ANHSC 2002).

Past and Present Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Fifty years ago, the harbor seal was so abundant in Alaska (and perceived to be in conflict with commercial salmon fisheries) that the state issued a bounty for the animal (ADF&G 1994b). State-sponsored bounties and predator control programs, as well as commercial harvest of harbor seals, occurred on a regular basis throughout the animal's range until the passage of the MMPA. Both adult seals and pups were harvested for pelts (Pitcher and Calkins 1979). An estimated 3,000 seals, mostly pups, were harvested annually for their pelts along the Alaska Peninsula between 1963 and 1972, accounting for 50 percent of the pup production (Pitcher 1986).

Harvest of harbor seals for subsistence purposes is likely the highest cause of anthropogenic mortality for this species since the cessation of commercial harvests in the early 1970s. Between 1992 and 1998, the state-wide harvest of harbor seals from all stocks ranged between 2,546 and 2,854 animals, the majority of which were taken in southeast Alaska (Wolfe and Mishler 1993, 1994, 1995, 1996, 1997, and 1998; Wolfe and Hutchinson-Scarbrough 1999). Aside from their value as a food source, harbor seals play an important role in the culture of many Native Alaskan communities (ANHSC 2002). The Bering sea stock of harbor seals is approximately 13,000 animals, and the calculated PBR is 379 animals. The annual subsistence harvest from this stock from 1994 to 1996 was approximately 161 animals, 42 percent of PBR for this species (Wolfe and Mishler 1995, 1996, and 1997). In 1998, 178 harbor seals from this stock were taken in the subsistence harvest (Wolfe and Hutchinson-Scarbrough 1999). For the GOA stock, the calculated PBR is 868 animals (Hill and DeMaster 1999). The average annual subsistence harvest from the GOA between 1992 and 1996 was 791 animals, representing 91 percent of the PBR for this stock (Wolfe and Mishler 1995, 1996, and 1997). The latest available harvest data from 1998 (792) is comparable to the average subsistence harvest of harbor seals from previous years (Wolfe and Hutchinson-Scarbrough 1999). For the southeast stock, the calculated PBR is 2,114 animals (Hill and DeMaster 1999). The average annual subsistence harvest from southeast between 1992 and 1996 was 1,749 animals, representing 83 percent of the PBR for this stock.

Direct Mortality from Incidental Take in External Fisheries

Foreign and JV groundfish fisheries in the 1960s and 1970s have likely contributed to some level of direct harbor seal mortality from entanglement in gear, but there is no data on the actual effects. Based on the near-shore distribution of harbor seals, minimal direct interaction seems likely between the early foreign fisheries and harbor seals, and mortality from those fisheries is believed to have been very low.

Harbor seal mortality in the state-managed salmon drift and set net fisheries has been estimated to average about 31 animals per year over a 6-year period in the 1990s for the Bristol Bay area, one of the most heavily fished areas (Hill and DeMaster 1999). In the GOA, a minimum estimate of incidental take is 36 seals per year. In southeast, the minimum estimate is 35 seals per year, mostly from the Yakutat area. However, these fisheries self-report harbor seal mortality and actual take of animals in these fisheries is likely to be under reported (Angliss *et al.* 2001).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

Observer Program data from 1990 to 1996 yield minimum estimates of harbor seals taken incidentally in groundfish gear. In the Bering Sea, 4 harbors seals are estimated to be killed each year in all groundfish gear combined. In the GOA, less than one harbor seal per year is estimated to be killed in trawls. In southeast Alaska, 4 harbors seals are estimated to be killed each year on longlines (Angliss *et al.* 2001).

Indirect Effects through Changes in Prey Availability

Harbor seals have a varied diet and may compete directly with various fisheries for their natural prey. Climate and oceanographic fluctuations also impact prey populations. The relative contributions of fisheries and natural influences on prey availability is unknown. As a precautionary measure in the face of this uncertainty, NPFMC established a forage fish category and allocated a zero harvest quota to that category specifically to benefit marine mammals (FMP Amendments BSAI 36 and GOA 39).

Indirect Effects through Contamination by Oil Spills

The EVOS adversely affected harbor seals in the PWS area. An estimated 300 seals died in the immediate months following the spill from direct contact with oil in the water and on beaches. Toxicological effects were documented for a couple years after the spill but dissipated as seals molted oiled fur and oil was washed from the beaches. The accident apparently exacerbated the existing local seal population declines, at least in the short-term (Frost *et al.* 1999).

Comparative Baseline

Harbor seal populations suffered a major decline in the Bering Sea and GOA during the 1970s and 1980s. In situations similar to Steller sea lions, the southeast Alaska stock appeared to be stable or increasing during this same period. The causes of this massive decline in one part of their range while an adjacent population prospers are still a matter of debate and intensive scientific research. Populations of harbor seals in the groundfish FMP areas seem to have turned the corner in the late 1980s and early 1990s and now appear to be stable or increasing, albeit at much lower levels than their historic numbers. Subsistence take is the largest source of direct anthropogenic mortality. Groundfish takes of this predominately nearshore species are minimal. There is some overlap of prey species with targeted groundfish but harbor seals have many alternative prey and forage species mostly inshore of MSA groundfish operations. The past/present effects on harbor seals are summarized in Table 3.8-4.

Status for Cumulative Effects Analysis

Because harbor seals have undergone major population declines in the GOA, interact with the groundfish fisheries on an infrequent but regular basis, and have some direct competition for prey, they will be considered as a separate species in the analysis of Alternative FMPs in Chapter 4.

3.8.5 Spotted Seal (*Phoca largha*)

Life History and Distribution

Spotted seals are distributed along the continental shelf of the Beaufort, Chukchi, Bering, and Okhotsk Seas south to the northern Yellow Sea and western Sea of Japan (Shaughnessy and Fay 1977). They are also known to occur around the Pribilof Islands, Bristol Bay, and the eastern Aleutian Islands. Of eight known breeding areas, three occur in the Bering Sea. Only the Alaska stock is recognized in U.S. waters.

Pups are born in the pack ice during March and April and the seals move to coastal habitats after the ice retreats (Fay 1974, Shaughnessy and Fay 1977, Braham *et al.* 1984). From August to October, spotted seals inhabit coastal and estuarine habitats in the northen Bering and Chukchi Sea (Braham *et al.* 1984, Lowry *et al.* 2000). Availability of food nearby and freedom from disturbance seem to be important criteria for selection of coastal haulout sites (Lowry 1982). Satellite tagging studies indicate that spotted seals summering along the Chukchi Sea coast migrate south in October and pass through the Bering Strait in November (Lowry *et al.* 1998), moving south into the Bering Sea with the ice edge through December (Lowry *et al.* 2000). Preferred habitat for spotted seals in Alaska from January to April is the "front zone" of pack ice (the transition zone between the southern fringe of ice and the heavier southward-drifting pack ice, generally on rectangular floes 10 to 20 m in diameter with brash ice or open water in between (Burns *et al.* 1981a, Lowry *et al.* 2000).

Early estimates of the world population of spotted seals were in the range of 334,000 to 450,000 animals (Burns 1973). The population of the Bering Sea, including Russian waters, was estimated to be 200,000 to 250,000, based on the distribution of "family" groups (mother and pup, with attending male) on ice during the mating season (Burns 1973). However, comprehensive systematic surveys were not conducted to obtain these estimates. Reliable estimates of current population abundance and past trends are not available (Angliss and Lodge 2002).

Trophic Interactions

Adult spotted seals eat fish, crustaceans, and cephalopods. Their diet varies with region, season, and age. Spotted seals along the Sakhalin Island coast in Russia consume pink salmon, kundzha *(Salvelinus leucomaenis)*, redfin (*Leuciscus brandti*), *Myoxocephalus* sp., pleuronectids, and crab (Makhnyr and Perlov 1988). In the Bering Sea, they eat pollock, capelin, Arctic cod, and crustaceans. In winter, pollock, capelin, sand lance, Arctic cod, and shrimp are common in spotted seal diets (Sobolevskii 1996). During March through June, principal prey vary by region: pollock and eelpout in the central Bering Sea; capelin, small pollock, and herring in the southeast Bering Sea; Arctic cod, capelin, and saffron cod in the northern Bering Sea; and herring and smelt in both the southeastern Chukchi Sea and southwestern Seward Peninsula (Bukhtiyarov *et al.* 1984, Sobolevskii 1996). In summer, young seals eat mostly small crustaceans and euphausiids (Sobolevskii 1996). In the Bering Sea, the estimated diet composition of spotted seals is 96 percent fish and 4 percent invertebrates (Lowry *et al.* 1982, Bukhityarov *et al.* 1984). Spotted seal are preyed on by a number of larger predators such as killer whales, sharks, polar bears, brown bears, and to some extent Steller sea lions and walrus (Burns 1973).

Management Overview

Spotted seals are jointly managed by the ADF&G and the NOAA Fisheries PRD, and they are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. Because there is no evidence that subsistence hunting is adversely affecting this stock, and because of the minimal interactions between spotted seals and any U.S. fishery, the Alaska stock of spotted seals is not classified as a "depleted" or "strategic" stock under the MMPA (Angliss and Lodge 2002). Because there are no reliable estimates of population abundance, no value for PBR has been calculated for this stock.

Past and Present Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Spotted seals are an important species for Alaskan subsistence hunters, primarily in the Bering Strait and Yukon-Kuskokwim regions, with estimated annual harvests ranging from 850-3,600 seals (averaging about 2,400 annually) taken during 1966 to 1976 (Lowry 1984). Recent estimates of subsistence take from ADF&G surveys indicate that an average of 5,265 spotted seals is taken every year by Alaska Natives, which is a substantial increase from previous estimates (Angliss and Lodge 2002, Wolfe *et al.* 2002) .

Direct Mortality from Incidental Take in External Fisheries

One source of information on the number of spotted seals killed or injured incidental to external fishing operations is the logbook reports maintained by vessel operators in the Bristol Bay salmon drift gillnet and set gillnet fisheries during 1990 to 1993 (Angliss and Lodge 2002). These reports indicate an annual mean of 1.5 mortalities from interactions with commercial fishing gear, but these estimates are considered minimum, because logbook records are likely negatively biased (Credle *et al.* 1994).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the 1990 to 1999 BSAI groundfish trawl, longline, and pot fisheries. Observed incidental takes in the Bering Sea trawl fishery (three seals killed in 1996) form the basis for an estimated annual mortality of one incidental take per year over the 1995 to 1999 period (Angliss and Lodge 2002). Some of these observations may be harbor seals rather than spotted seals, due to the difficulty in distinguishing between the two species. However, the proximity of the observations to the sea ice indicate that at least two of these observations were probably spotted seals.

Comparative Baseline

There is no reliable estimate of the spotted seal population in Alaska waters, but they appear to be common and are believed to be stable. Spotted seals eat a variety of fish and have a partial overlap of prey with species caught in the groundfish fisheries. Incidental take in the groundfish fisheries has been documented but appears to be a rare occurrence. The species is an important subsistence resource for Alaska Natives. The past/present effects on spotted seal are summarized in Table 3.8-5.

Status for Cumulative Effects Analysis

Because their population appears to be stable and they infrequently interact with the groundfish fisheries, ringed seals will be considered in the "other pinniped" group in the analysis of Alternative FMPs in Chapter 4.

3.8.6 Bearded Seal (*Erignathus barbatus*)

Life History and Distribution

Bearded seals are circumpolar in their distribution, extending from the Arctic Ocean south to Hokkaido in the western Pacific. Only the Alaskan bearded seal stock is recognized in U.S. waters. In Alaskan waters, bearded seals occur on the continental shelves of the Bering, Chukchi, and Beaufort Seas (Burns 1981a, Johnson *et al.* 1966, Ognev 1935). The majority of bearded seals move south with the advancing sea ice in winter. Pups are born in the pack ice from March through mid-May. In summer, many of the seals that winter in the Bering Sea move north through Bering Strait during April through June, and are distributed along the ice edge in the Chukchi Sea during the summer. Some seals, particularly juveniles, may spend the summer in open-water areas of the Bering and Chukchi seas (Burns 1967 and 1981a).

Early estimates of the Bering-Chukchi Sea population range from 250,000 to 300,000 (Popov 1976, Burns 1981a, Burns *et al.* 1981). Aerial surveys in 1999 and 2000 yielded conflicting results, so additional surveys will be required to obtain reliable estimates of abundance. Reliable data on population trends are likewise unavailable although there is no indication that the population is declining.

Trophic Interactions

Bearded seals are primarily benthic feeders, and their distribution appears to be strongly linked to areas of shallow water and high prey biomass. They appear to be limited to feeding depths of less than 200 m but prefer depths of 25 to 50 m (Kosygin 1966, Burns 1981a, Stirling *et al.* 1982, Kingsley *et al.* 1985). Crabs, shrimp and mollusks make up most of the diet, although a wide variety of invertebrates and fish is also included. In the Bering Sea, the estimated diet composition of bearded seals is 23 percent fish and 77 percent invertebrates (Lowry *et al.* 1979, 1980a, 1981a, 1981b, Smith 1981, Burns and Frost 1983). Fish species most common in the diet are sculpins, Arctic cod , and saffron cod, although pollock are also eaten in the EBS (Lowry *et al.* 1996).

Management Overview

Bearded seals are jointly managed by the ADF&G and the NOAA Fisheries PRD, and they are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. Due to a lack of information suggesting subsistence hunting is adversely affecting this stock, and because of the minimal interactions between bearded seals and any U.S. fishery, the Alaska stock of bearded seals is not classified as a strategic stock under the MMPA (Angliss *et al.* 2001). Since reliable population estimates are not available, no value for PBR has been calculated.

Past and Present Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Bearded seals are an important species for Alaskan subsistence hunters, with estimated annual harvests of 1,784 seals from 1966 to 1977 (Burns 1981a). Between August 1985 and June 1986, 791 bearded seals were harvested by hunters from five villages in the Bering Strait region (Kelly 1988a). The ADF&G estimates the average number of bearded seals currently taken by Alaska Natives for subsistence at approximately 6,788 seals per year (Angliss and Lodge 2002, Wolfe *et al.* 2002) . This number is substantially higher than previous estimates of harvest based on a limited sample of villages.

Direct Mortality from Incidental Take in External Fisheries

Logbook reports maintained by vessel operators in the Bristol Bay salmon drift gillnet fishery from 1990 to 1993 indicated that 14 mortalities and 31 injuries occurred to bearded seals in the Bristol Bay salmon drift gillnet fishery. However, these reports are suspect because it is unlikely that bearded seals would have been in the Bristol Bay vicinity during the summer salmon fishing season (Angliss *et al.* 2001).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990 to 1999. The only fishery with observed incidental takes was the Bering Sea trawl fishery (three in 1991, four in 1994, one in 1998, and two in 1999). These records form the basis for an estimated mean annual mortality of 0.6 bearded seals per year from the groundfish trawl fishery. The estimated minimum mortality rate incidental to commercial fisheries is 0.6 bearded seals per year, based on observer data (Angliss *et al.* 2001).

Comparative Baseline

There is no reliable estimate of the bearded seal population in Alaska waters, but they appear to be abundant and are believed to be stable. Bearded seals eat a variety of fish and invertebrates and have a partial overlap of prey with species caught in the groundfish fisheries. Incidental take in the groundfish fisheries has been documented but appears to be a rare occurrence. The species is an important subsistence resource for Alaska Natives. The past/present effect on bearded seal are summarized in Table 3.8-6.

Status for Cumulative Effects Analysis

Because their population appears to be stable and they infrequently interact with the groundfish fisheries, bearded seals will be considered in the "other pinniped" group in the analysis of Alternative FMPs in Chapter 4.

3.8.7 Ringed Seal (*Phoca hispida*)

Life History and Distribution

Ringed seals are found throughout the arctic in areas of seasonal sea ice as well as in areas covered by the permanent polar ice cap (McLaren 1958, Smith 1987, Kelly 1988b, Ramsay and Farley 1997, Reeves 1998). In the North Pacific Ocean, they are found in the Bering Sea and range as far south as the seas of Okhotsk and Japan. Most ringed seals overwinter, breed, give birth, and nurse their young within the shorefast sea ice, although some breeding seals (and pups) have been observed in pack ice (Smith and Stirling 1975, Finley *et al.* 1983). Only the Alaskan ringed seal stock, in the Chukchi, Bering, and Beaufort seas, is recognized in U.S. waters.

In the Chukchi and Beaufort seas, ringed seals haul out in highest densities in shorefast ice during the May-June molting season, immediately following the March-April pupping season (Johnson *et al.* 1966, Burns and Harbo 1972, Frost *et al.* 1988, 1997, 1998, and 1999). Little is known about the distribution of ringed seals during the "open water" season, from July to October, but ringed seals have been seen both hauled out on pack ice and foraging in open water some distance away from the nearest sea ice (Smith 1987). Whether ringed seals foraging in open water commute from ice edge haulout sites or forage in open water all summer long without hauling out is currently unknown. Ringed seals migrate north and south with the retreat and advance of the sea ice edge, but some seals in areas of seasonal shorefast sea ice may be sedentary (Burns 1970, Smith 1987, Heide-Jørgensen *et al.* 1992, Kapel *et al.* 1998, Teilmann *et al.* 1999). In addition to ice-associated migrations, ringed seals, particularly young seals, can also travel long distances east or west (greater than 2000 km) (Smith 1987, Kapel *et al.* 1998).

Crude estimates of ringed seal abundance in Alaskan waters range from 1 million to 3.6 million, based on aerial surveys conducted in 1985, 1986, and 1987 (Frost 1985, Frost *et al.* 1988). A reliable estimate for the current abundance of ringed seals in Alaska is not available (Angliss *et al.* 2001). Reliable data on population trends is also unavailable, although there is no evidence of declining population-levels (Angliss *et al.* 2001).

Trophic Interactions

Ringed seals prey primarily on fish (saffron cod, smelt, herring, and Arctic cod) during the fall and winter (November-April) and consume crustaceans (shrimps, amphipods, and euphausiids) and some fish (saffron cod) during the spring and summer (McLaren 1958, Fedoseev 1965, Johnson *et al.* 1966, Lowry *et al.* 1980b). In the Bering Sea, the estimated diet composition of ringed seals is 85 percent fish and 15 percent invertebrates (Kenyon 1962, Lowry *et al.* 1978, 1980b, and 1982, Lowry and Frost 1981).

Management Overview

Ringed seals are jointly managed by the ADF&G and the NOAA Fisheries PRD, and they are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. Due to a lack of information suggesting subsistence hunting is adversely affecting this stock, and because of the minimal interactions between ringed seals and any U.S. fishery, the Alaska stock of ringed seals is not classified as a strategic stock under the MMPA (Angliss *et al.* 2001). Since reliable population estimates are not available, no value for PBR has been calculated.

Past and Present Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Ringed seals are an important species for Alaska Native subsistence hunters. The annual subsistence harvest in Alaska dropped from 7,000 to 15,000 during the period of 1962 to 1972 to an estimated 2,000 to 3,000 in 1979 (Frost 1985). Based on data from two villages on St. Lawrence Island, the annual take in Alaska during the mid-1980s likely exceeded 3,000 seals (Kelly 1988b). The ADF&G estimates that the average harvest of ringed seals by Alaska Natives, as of 2000, is 9,567 animals per year (Angliss and Lodge 2002, Wolfe 2001).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990 to 1999. Incidental take was only observed in the Bering Sea trawl fishery with two seals in 1992. No mortalities have been observed since then, so the estimated mean annual mortality due to trawl fisheries in the Bering Sea is zero seals per year (Angliss *et al.* 2001).

Comparative Baseline

There is no reliable estimate of the ringed seal population in Alaska waters, but they appear to be abundant and are believed to be stable. Ringed seals eat a variety of fish and invertebrates and have a partial overlap of prey with species caught in the groundfish fisheries. Incidental take in the groundfish fisheries has been documented but appears to be a rare occurrence. The species is an important subsistence resource for Alaska Natives. The past/present effects on ringed seal are summarized in Table 3.8-7.

Status for Cumulative Effects Analysis

Because their population appears to be stable and they infrequently interact with the groundfish fisheries, ringed seals will be considered in the "other pinniped" group in the analysis of Alternative FMPs in Chapter 4.

3.8.8 Ribbon Seal (*Phoca fasciata*)

Life History and Distribution

Ribbon seals inhabit the North Pacific Ocean and adjacent fringes of the Arctic Ocean, most commonly in the Okhotsk and Bering seas (Burns 1981b). During the breeding season, ribbon seals are found only in the pack ice of the Okhotsk and Bering seas (Kelly 1988c). Only the Alaskan stock is recognized in U.S. waters.

In Alaska waters, ribbon seals are found in the open sea, on the pack ice, and only rarely on shorefast ice (Kelly 1988c). Ribbon seals in Alaska range northward from Bristol Bay in the Bering Sea into the Chukchi and western Beaufort seas (Burns 1970, Burns 1981b, Braham *et al.* 1984, Moore and Barrowclough 1984). They inhabit the northern part of the Bering Sea ice front from late March to early May and move north with the receding ice edge in May to mid-July (Shustov 1965a, Tikhomirov 1966, Burns *et al.* 1981). Ribbon seals are thought to be associated with the Anadyr massif, a remnant of the pack ice that extends from the Gulf of Anadyr toward St. Matthew Island (Burns *et al.* 1981). Little is known of the distribution of ribbon seals after the ice recedes from the Bering Sea. They are presumed to be solitary and pelagic in summer and fall but their distribution is unknown (Burns 1981b, Kelly 1988c). Single ribbon seals have been observed during the summer (June-August) within 84 miles of the Pribilof Islands (Burns 1981b), near Cordova (Burns 1981b), and south of the Aleutian Islands (Stewart and Everett 1983).

The worldwide population of ribbon seals was estimated at 240,000 in the mid-1970s, with an estimate of 90,000 to 100,000 in the Bering Sea (Burns 1981b). Reliable data on stock structure, trends in population abundance, and current population estimates for the Alaska stock of ribbon seals are unavailable, although there is no evidence that population-levels are declining (Angliss *et al.* 2001).

Trophic Interactions

Ribbon seals eat crustaceans, cephalopods, and fish (Arsen'ev 1941, Shustov 1965b, Frost and Lowry 1980). Two ribbon seals collected in winter (February) had been feeding entirely on cod and pollock (Burns 1981b). Fish consumed in the Bering Sea in spring (March to June), when most animals have been collected, include pollock, Arctic cod, saffron cod, capelin, eelpout, sculpins, and flatfish. There appear to be regional differences in that small pollock and eelpout were most commonly eaten in the south-central and EBS, while Arctic cod were eaten only by seals taken in the northern Bering Sea (Frost and Lowry 1980, Lowry *et al.* 1996). Few data are available on seasonal variations in the diet, as the distribution of ribbon seals during the open water season (July to November) is poorly known. Knowledge of ribbon seal feeding habits is also limited by small sample sizes, as most of the seals sampled in spring (March to June) were not actively feeding.

Management Overview

Management of ribbon seals is the responsibility of the NOAA Fisheries PRD, and they are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. Ribbon seals are an important target species for some Alaska Native subsistence hunters. Reliable estimates of the minimum population, PBR, and human-caused mortality and serious injury are currently not available. However, due to a lack of information suggesting that subsistence hunting is adversely affecting this stock, and because of the minimal interactions between ribbon seals and any U.S. fishery, the Alaska stock of ribbon seals is not classified as a strategic stock under the MMPA (Angliss *et al.* 2001).

Past and Present Effects and Management Actions

<u>Direct Mortality: Harvest and Other Intentional Take</u>

Ribbon seals are an important species for Alaska Native subsistence hunters, primarily from villages in the vicinity of the Bering Strait and to a lesser extent at villages along the Chukchi Sea coast (Kelly 1988c). The annual subsistence harvest was estimated to be less than 100 seals annually from 1968 to 1980 (Burns 1981b). In the mid-1980s, the Alaska Eskimo Walrus Commission estimated the subsistence take to be less than 100 seals annually (Kelly 1988c). A reliable estimate of the annual number of ribbon seals currently taken by Alaska Natives for subsistence is unavailable.

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the BSAI groundfish trawl, longline, and pot fisheries during 1990 through 1999. The Bering Sea trawl fishery was the only fishery to have observed incidental take of ribbon seals with one taken in 1990, one in 1991, and one in 1997. No ribbon seal mortalities were recorded in logbook reports from all Alaska fisheries. The estimated minimum mortality rate incidental to commercial fisheries is one ribbon seal per year, based exclusively on observer data (Angliss *et al.* 2001).

Comparative Baseline

The population of ribbon seals in Alaska waters has not been reliably estimated, but is thought to be stable. Incidental take in the groundfish fisheries has been documented but appears to be a very rare occurrence. Diets of ribbon seals are not well known, but do include fish targeted by the groundfish fisheries. The past/present effect on ribbon seals are summarized in Table 3.8-8.

Status for Cumulative Effects Analysis

Because their population trend is unknown and they infrequently interact with the groundfish fisheries, ribbon seals will be considered in the "other pinniped" group in the analysis of Alternative FMPs in Chapter 4.

3.8.9 Northern Elephant Seal (*Mirounga angustirostris)*

Life History and Distribution

Northern elephant seals range throughout the northeast Pacific Ocean from central Baja California, Mexico, to the GOA and eastern Aleutian Islands, with occasional sightings in the southern Bering Sea. Breeding occurs on islands from central Baja California north through central Oregon. Pupping and mating occurs on isolated islands and mainland rookeries during January and February. Following the breeding season, adults go to sea and forage until they return to rookery islands to molt in April (females) and July (males). Following the molt (which requires 4 to 6 weeks to complete), adults again return to foraging areas, where they feed until returning for the following breeding season.

Elephant seals complete two long distance migrations each year, with males traveling an average of 13,020 miles (21,000 km) and females 11,160 miles (18,000 km) (Stewart and DeLong 1995, LeBoeuf *et al.* 2000). Adult males and females occupy different foraging areas. Females forage in an area generally bounded by 38°N to 45°N, off the North American continental shelf, westward to the central Pacific Ocean. Adult males are distributed farther north than females, primarily occupying pelagic waters from Oregon northward to British Columbia, through the GOA, and westward to the eastern Aleutian Islands.

In Alaska, males that traveled to the Aleutian Islands showed a preference for Amutka Pass and Amchitka Pass (LeBoeuf *et al.* 2000) and deep water south of the eastern Aleutian Islands (Stewart and DeLong 1994).

The existing population of northern elephant seals is descended from perhaps 100 animals that survived in Mexico after the species was nearly exterminated by commercial hunting in the 19th century (Carretta *et al.* 2002). The population has expanded rapidly since hunting was halted. An estimated population of 127,000 northern elephant seals existed in U.S. and Mexican waters in 1991, of which 95,000 were in U.S. waters (Stewart *et al.* 1994). Approximately 101,000 animals were estimated to make up the U.S. population in 2001 (Carretta *et al.* 2002).

Trophic Interactions

All of the published food habits data on northern elephant seal are from California: adult males and females under anesthesia were lavaged on San Miguel Island (Stewart and DeLong 1993, Antonelis *et al.* 1987), and stomach contents were collected from dead animals along the southern California Bight northward through central California (Hacker 1986, Condit and LeBoeuf 1984). Cephalopods occurred in all animals containing food with 15 squid species occurred in 10 percent or more of the stomachs. Pacific hake occurred in 39 percent of the samples and was the only teleost fish that occurred in greater than 10 percent of the samples (Antonelis *et al.* 1994). The food habits of elephant seals while in Alaskan waters are unknown. Diving patterns of males feeding in Alaska imply that they are pursuing benthic prey (LeBoeuf *et al.* 2000). The adults that are feeding in very deep water off the continental shelf are probably primarily taking squid, as they do in California. The degree to which the smaller fraction of the northern elephant seal population frequenting areas on the continental shelf feed on demersal teleost fishes is unknown.

Males foraged in areas close to or over the continental shelf break during intense feeding (LeBoeuf *et al.* 2000) while females tended to forage in deeper waters off the continental shelf (Stewart and DeLong 1994, LeBoeuf *et al.* 2000). In these waters, elephant seals dive to average depths of 1312 ft (400 m), apparently feeding on organisms associated with the deep scattering layer. Some adult and subadult males occupy more coastal habitats where dive records suggest feeding on or near the bottom. While the proportion of the population using coastal habitats is unknown, most adult males and females appear to feed in the water column over very deep water.

Management Overview

Management of the northern elephant seal is the responsibility of the NOAA Fisheries PRD, and they are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. Northern elephant seals are not an important target species for Alaska Native subsistence hunters. Because their annual human-caused mortality is much less than the calculated PBR for this stock (2,513), they are not considered a "strategic" stock under the MMPA (Carretta *et al.* 2002).

Past and Present Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

As mentioned above, commercial harvest of elephant seals nearly exterminated the species at the end of the 1800s.

Direct Mortality from Incidental Take in External Fisheries

An average of 86 elephant seals are taken each year in various gillnet fisheries from California to Washington (Carretta *et al.* 2002). Data from other external fisheries are not available, but the amount of incidental take of elephant seals is thought to be minimal.

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the 1990 to 1999 BSAI and GOA groundfish trawl, longline, and pot fisheries. Observed incidental kills included one in the Bering Sea trawl fishery in 1990, two in the GOA trawl fishery in 1990, and three in the GOA longline fishery in 1990. One juvenile elephant seal, originally misidentified as a bearded seal, was taken in the Bering Sea trawl fishery in 1991 (Angliss *et al.* 2001).

Comparative Baseline

The population of northern elephant seals in U.S. waters continues to expand and is presently over 100,000 animals. Male elephant seals spend part of their year in Alaska waters, but there is little information on their Alaska diet. Incidental take in the groundfish fisheries has been documented, but appears to be a very rare occurrence. The past/present effect on northern elephant seal are summarized in Table 3.8-9.

Status for Cumulative Effects Analysis

Because their population appears to be increasing and they infrequently interact with the groundfish fisheries, northern elephant seals will be considered in the "other pinniped" group in the analysis of Alternative FMPs in Chapter 4.

3.8.10 Sea Otter (*Enhydra lutris)*

Life History and Distribution

Adult male sea otters weigh 70 to 100 pounds (32-45 kg) while females average 40 to 60 pounds (18-27 kg). Unlike seals, which rely on a heavy layer of blubber for protection against cold water, sea otters depend on air trapped in their fur for maintaining body temperature. Sea otters mate at all times of the year, and young may be born in any season, but most pups in Alaska are born in late spring. Females can produce one pup a year, but in areas where food is limited, they may produce pups every other year. Sea otters seldom travel far unless an area has become overpopulated and food is scarce. They are gregarious, sometimes resting in pods of 10 to more than 1,000 animals. Many sea otters live for 15 to 20 years (Schneider 1994).

Sea otters inhabit shallow coastal waters of the North Pacific Ocean and the southern Bering Sea (Estes 1980, Estes and Van Blaricom 1985, Estes and Palmisano 1974). Habitat is generally shallow (less than 34 m) nearshore marine waters with sandy or rocky bottoms supporting substantial populations of benthic invertebrates. In some areas, large numbers of sea otters occur offshore. For example, in the Copper River Delta and inside PWS, sea otters are often present more than 8 km from shore (Garshelis and Garshelis 1984). Large aggregations have also been observed more than 30 km north of Unimak Island in the Bering Sea (Kenyon 1969).

Historically, sea otters occurred all across the North Pacific Rim and were estimated to number between 150,000 and 300,000 in the early 1700s. Following the arrival of Russian explorers in 1741, commercial harvest of otters for fur nearly resulted in their extinction. When sea otters were finally afforded protection under the International Fur Seal Treaty in 1911, there were probably fewer than 2,000 animals remaining in thirteen remnant colonies (Kenyon 1969).

Three genetically and geographically distinctive stocks of sea otters are recognized in Alaska: the southwest Alaska stock, which extends from the Bering Sea, Aleutian Islands, and Alaska Peninsula to the western shore of Cook Inlet; the southcentral Alaska stock, which extends from Cook Inlet east to Cape Yakataga, including Kachemak Bay, the Kenai Peninsula coast, and PWS; and the southeast Alaska stock, which extends from Cape Yakataga to the southern boundary of Alaska (Gorbics and Bodkin 2001).

Southwest Alaska

The first systematic aerial surveys for sea otters in southwest Alaska were conducted from 1957 to 1965. Those surveys indicated that the otter population was growing and that they were recolonizing former habitat. However, the population appears to have started a major decline in the 1980s. In the 1980s, the population of sea otters in the Aleutian Islands was estimated between 55,100 and 73,700 animals (uncorrected for sightability of otters). In 1992, USFWS conducted another systematic count of the Aleutians and the (uncorrected) population estimate was only 8,042 otters. This survey was repeated in 2000 and yielded an (uncorrected) estimate of 2,442 otters. This represents a 70 percent decline from 1992 and about a 95 percent decline from the 1980s (Doroff *et al.* 2003). Other sectors of the southwest stock have also declined over the same period. Comparing similar counts from aerial surveys in 1986 and 2000, USFWS estimates that sea otter populations declined 93 to 94 percent along the south shore of the Alaska Peninsula, and 27 to 49 percent along the north shore. Aerial surveys in the Kodiak Archipelago indicate a 40 percent decline in the population between 1994 and 2001 (USFWS 2002b, Doroff *et al.* submitted, Burn and Doroff submitted).

The most recent estimates of sea otters in southwest Alaska are based on aerial and boat-based surveys in 2000 and 2001 and have been corrected for sightability of otters under different conditions (and hence are different than the uncorrected estimates above). The combined estimate is 23,967 sea otters in the southwest Alaska stock, including the Aleutians (8,742), Alaska Peninsula (north side 5,756, south side 3576), and the Kodiak archipelago (5,893) (USFWS 2002b).

Southcentral Alaska

The most recent estimates of sea otter abundance in southcentral Alaska are based on a variety of aerial and small-boat surveys from 1989 to 1999. Combining corrected counts from various surveys with one small uncorrected count, the estimated abundance of sea otters in southcentral is 21,749. Although rates of population growth vary among locations, the trend for the southcentral stock is generally one of growth (USFWS 2002c).

Southeast Alaska

After being essentially extirpated by the fur trade, sea otters in the southeast Alaska stock result from a translocation of 412 animals from PWS and Amchitka Island in the late 1960s. The population has increased rapidly since that time. The most recent estimates of the sea otter population in southeast are based on small-boat and aerial surveys in 1994 and 1995. Combining corrected and uncorrected counts yields an estimated abundance of 8,807 sea otters. Although rates of population growth vary among locations, the trend for the southeast stock is one of growth (USFWS 2002d).

Trophic Interactions

Sea otters eat a wide variety of slow-moving benthic invertebrates, including sea urchins, clams, mussels, crabs, snails, octopus, squid, and epibenthic fishes (Kenyon 1969, Estes and Van Blaricom 1985, Reidman 1987). The sea otter's diet consists of an estimated 82 percent invertebrates and 18 percent fish (Kenyon 1969, Kenyon 1981, Lowry *et al.* 1982). The fish component includes lumpsuckers, sculpin, rock greenling, Atka mackerel, rockfish, sablefish, Pacific cod, and pollock. Captive animals require a daily food intake equal to one-quarter of their body weight. Of the total estimated annual fish consumption, commercial groundfish comprise 8 percent, which is considered a trace amount of the standing biomass of commercial groundfish consumed annually (by all predators) in the EBS (Perez and McAlister 1993).

Bald eagles prey on newborn pups, and killer whales prey on adults. In past years, predation rates were considered insignificant in regard to population growth (Schneider 1994). However, as noted above, sea otter populations in some areas have decreased dramatically in the past decade. Estes *et al.* (1998) suggested that increased predation by killer whales is the likely cause of these declines. Further, the authors speculate that the increased predation may have resulted from declines in the populations of other killer whale prey, namely Steller sea lions and harbor seals. If this hypothesis is correct, then any impact the groundfish fisheries may have on Steller sea lion recovery could also be considered a factor in the sea otter declines, in so far as they may have contributed to a shift in predator-prey relationships. Having said that, very little data currently exist to test the validity of this hypothesis. Surveys of Native Alaskan hunters in the False Pass area of the Aleutians failed to provide any support for killer whale predation on sea otters. The Alaska Sea Otter and Steller Sea Lion Commission continues to research this hypothesis (Jack 2000).

Sea otters also play an important ecosystem role in maintaining nearshore kelp bed habitats. In the Aleutian archipelago, sea urchins are a dominant herbivore and an important food source of sea otters (Estes *et al.* 1978). As has been demonstrated by historic sea otter declines, when sea otters disappear from an area, sea urchin populations are released from the control of sea otter predation and 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 southwest Alaska is that kelp forests in many areas may also be in decline (Estes *et al.* 1998, USFWS 2002b).

Management Overview

The early Russian settling of Alaska was largely a result of the sea otter industry which greatly reduced the numbers of sea otters. Sea otters continued to be heavily exploited after Alaska was sold to the U.S. and became alarmingly scarce. Finally in 1911, when so few animals were left that it was no longer profitable to hunt them, sea otters were given full protection under the International Fur Seal Treaty. In 1960, the State of Alaska assumed management authority for sea otters. The management program conducted by the state included the successful reintroduction of sea otters to unoccupied habitat in southeast Alaska, British Columbia, and Washington. The MMPA transferred management authority to the USFWS in 1972 (Schneider 1994).

The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. The USFWS has cooperative agreements with the Alaska Sea Otter and Steller Sea Lion Commission, a consortium of 51 Alaska Native community groups. The Marking, Tagging, and Reporting Program is a USFWS program used throughout coastal Alaska to monitor the harvest of sea otters by Alaska Natives (Jack 2000).

Because of concerns about the severity and unknown cause(s) of the population decline in the southwest Alaska stock, the USFWS published a notice in the FR on November 9, 2000 designating the southwest Alaska stock of sea otters as a candidate species for protection under the ESA. In February 2004, the USFWS proposed listing the southwest Alaska DPS, which corresponds to the range of the southwest stock of sea otters under the MMPA, as threatened under the ESA due to their precipitous decline in numbers (69 FR 6600-6630 [11February 2004]). Critical habitat for these otters has not been designated under the proposed rule. The southwest Alaska stock of sea otters is not presently listed as depleted under the MMPA (USFWS 2002b).

The PBR for the southwest stock is calculated to be 830 animals. PBR for the southcentral stock is calculated to be 1,951 animals, and for southeast, PBR is calculated to be 871 animals (USFWS 2002b, 2002c, and 2002d).

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Commercial exploitation for pelts had a huge impact on sea otters dating from the mid-1700s to the late 1800s, causing them to become nearly extinct (Bancroft 1959, Lensink 1962). Protective measures instituted in 1911 have allowed remnant groups to increase and reoccupy much of the historic sea otter range in Alaska (Kenyon 1969, Estes 1980). Residual effects from this early harvest likely persist in several areas.

Alaska Natives have hunted sea otters for pelts and meat throughout history. Data on the subsistence harvest of sea otters has been collected by USFWS since 1988. For the southwest stock, the numbers of sea otters taken has varied from 25 to 175 animals each year with an average of 97 animals taken between 1996 and 2000, representing 9 percent of PBR (USFWS 2002b). For the southcentral stock, subsistence take has ranged between 25 and 425 animals per year with an average of 297 otters between 1996 and 2000, representing 15 percent of PBR (USFWS 2002c). For the southeast stock, subsistence take has ranged between 90 and 825 animals per year with an average of 301 otters between 1996 and 2000, representing 35 percent of PBR (USFWS 2002d).

Direct Mortality from Oil Pollution

Exploration, development, and transportation of oil and gas can adversely impact sea otters if these processes contaminate nearshore waters. Estimates of sea otters killed during the EVOS ranged from 750 to 2,650 in PWS (Garshelis 1997, Garrot *et al.* 1993) and additional thousands were killed elsewhere in the GOA because of the spill (DeGange *et al.* 1994). The EVOS demonstrated that spilled oil can travel long distances and kill large numbers of sea otters far from the point of initial release. There is no evidence that routine oil and gas development and transport have a direct impact on otter populations. At present, estimates of sea otter numbers in some areas of PWS are still below pre-spill estimates, indicating a possibly lingering effect from the catastrophe (USFWS 2002d).

Direct Mortality from Incidental Take in External Fisheries

Sea otter interactions with fishing gear of any type are infrequent. In the southcentral area, only a small fraction (2 to 5 percent) of the commercial salmon fisheries is covered by any observer program. No fishery-related sea otter injuries or mortalities have been observed in this area in the past decade and only one kill has been self-reported (USFWS 2002c). No fisheries operating in southeast Alaska are subject to the NOAA Fisheries observer program. Although the records are incomplete, there have been no self-reported injuries or fatalities related to commercial fishing in southeast in the past decade (USFWS 2002d). Laist (1997) reported that sea otter entanglement in marine debris is rare.

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

In 1992, fisheries observers reported eight sea otters taken incidentally by the Aleutian Island sablefish pot fishery. During that year, only a third of the fisheries were observed, yielding an estimate of 24 otters killed in pot gear in the sablefish fishery. No other sea otter takes were reported from observed fisheries in the range of the southwest stock from 1993 through 2000. In 1997, the BSAI groundfish trawl fishery reported one sea otter taken (USFWS 2002b).

Comparative Baseline

Sea otters have played an important role in the history and culture of Alaska. Their numbers have fluctuated greatly over time because of both major declines from relentless hunting pressure and tremendous growth from intentional reintroduction efforts. Current population trends parallel the situation for Steller sea lions and harbor seals in that sea otter numbers have declined dramatically from the Alaska Peninsula to the Bering Sea, but have remained stable or increased in southcentral and southeast Alaska. Unlike the historic population fluctuations, there is little agreement in the scientific community regarding the cause(s) of the present dynamic. There is only a small amount of overlap between their prey and the groundfish harvest. The species is an important subsistence resource for Alaska Natives, but take from the declining southwest stock is relatively low. The past/present effects on sea otters are summarized in Table 3.8-10.

Status for Cumulative Effects Analysis

Because their population in southwest Alaska is being considered for listing under the ESA and they interact with the groundfish fisheries on a regular basis, sea otters will be considered as a separate species in the analysis of Alternative FMPs in Chapter 4.

3.8.11 Blue Whale (*Balaenoptera musculus*)

Distribution and Abundance

The IWC recognizes only one stock of blue whales in the North Pacific (Donovan 1991, Best 1993), but some evidence suggests that there may be as many as five separate stocks, two of which are relevant to this analysis: the central stock near the Aleutian Islands, and the eastern GOA stock (Rice 1992, Calambokidis *et al.* 1995, Gilpatrick *et al.* 1996, Barlow 1995, Calambokidis and Steiger 1995, NMFS 1998c, Stafford *et al.* 1999). Analysis of whaling records from 1929 to 1965 indicates that there is a western stock off Kamchatka and the Kuril Islands that is separate from the central Aleutian Islands stock (Forney and Brownell 1996). Sightings of blue whales in Alaskan waters have been infrequent (Forney and Brownell 1996). Sightings reported in the Platform of Opportunity database (from 1960 to 1995) occurred primarily during the summer months. However, acoustic data collected from 1995 to 1999 from hydrophone arrays showed blue whales calling in Alaskan waters during all seasons, with the majority of calls in the GOA occurring in the fall and winter (Watkins *et al.* 2000a and 2000b). Surprisingly, blue whales did not appear to migrate and were numerous over deepwater regions in the North Pacific (Watkins *et al.* 2000a and 2000b). Blue whale range does not extend north of the Aleutian Islands, except rarely in the far southeastern corner of the Bering Sea (Rice 1998).

Estimates of abundance in the North Pacific Ocean have ranged from 1,400 to 1,900 individuals (Nishiwaki 1966, Omura and Ohsumi 1974, Rice 1978a, Tillman 1975), although these estimates are now considered outdated (Perry *et al.* 1999a). More blue whales are thought to be distributed on the east side of the North Pacific than on the west side (Omura 1955, Tomilin 1967). There are no reliable population estimates for blue whales in the south EBS or the GOA A minimum abundance estimate of 3,300 has been proposed for the North Pacific as a whole, including about 2,000 whales that breed in California waters (Wade and Gerrodette 1993, Forney *et al.* 2000). However, recent surveys conducted in previous commercial hunting areas in Alaska and Russia failed to find any blue whales (Forney and Brownell 1996).

Trophic Interactions

Blue whales are found both in coastal waters of the continental shelf and far offshore in pelagic environments. Blue whale distribution is likely governed largely by food requirements, as reported in two fine-scale studies of blue whale ecology offshore of southern California (Fiedler *et al.* 1998, Croll *et al.* 1998). Blue whales are almost exclusively euphausiid eaters, concentrating on *Thysanoessa inermis, T. longipes*, and *T. spinifera* in the Bering Sea (Tomilin 1957, Nemoto 1957, Klumov 1963, Nemoto and Kawamura 1977, Kawamura 1980). Blue whales occasionally consume copepods, pelagic gastropods, pelagic schooling squid, and fish such as sardines, capelin, and sand lance (Mizue 1951, Sleptsov 1955, Klumov 1963). A blue whale of average size, 23.5 to 24.5 m long and weighing 54 to 64 mt, eats about 1.8 to 2.3 mt of food per day (Klumov 1963). Estimates of total prey consumption are not available for this species.

Management Overview

Management of blue whales is the responsibility of the NOAA Fisheries PRD. Blue whales are listed as endangered under the ESA, and a recovery plan was finalized in 1998 (NMFS 1998c). The long-term goal of this plan is to promote the recovery of the blue whale to the extent that it is removed from ESA-listing. One of the primary means of achieving this goal is to minimize or eliminate human-caused mortality. Critical habitat has not been designated for the species. Its endangered status also means that the species is automatically classified as a depleted and strategic stock under the MMPA. The IWC instituted a ban on harvest of blue whales in 1966.

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

At least 9,500 blue whales were taken by commercial whalers from 1910 to 1965 in the North Pacific (Carretta *et al.* 2001). Blue whales were hunted by the Japanese along the south side of the Aleutian chain from 1952 to 1965 (Forney and Brownell 1996). Catches averaged 80 whales per year until 1961, after which annual catches included 67, 404, 119, and 121 whales (Forney and Brownell 1996). The IWC banned the hunt of blue whales in 1966, although it is likely that Soviet whaling continued and that Soviet catch reports under-represented the true harvest (Yablokov 1994).

Direct Mortality from Incidental Take in External Fisheries

The potential for human-caused mortality (from ship strikes and interactions with fisheries) exists, but few incidents have been reported and none have occurred in Alaskan waters (Forney *et al.* 2000).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

No blue whales have been reported taken in the groundfish fisheries since the Observer Program was initiated in 1989.

Comparative Baseline

Blue whales are an endangered species, but the number of whales that actually live in waters affected by the BSAI and GOA groundfish fisheries is unknown. Their diet does not overlap with species taken by the fisheries, and they do not appear to interact with the fleet on a regular basis (Table 3.8-11).

Status for Cumulative Effects Analysis

Because of their endangered status under the ESA and their documented presence in the action area, blue whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, since they interact so infrequently with the groundfish fisheries, blue whales will be considered in the baleen whales species group.

3.8.12 Fin Whale (*Balaenoptera physalus*)

Distribution and Abundance

Fin whales are divided into three stocks for management purposes, including stocks in California and Hawaii. The northeast Pacific stock of fin whales ranges throughout the BSAI and GOA area (Angliss *et al.* 2001). Recent vessel surveys have documented large concentrations of fin whales in the central Bering Sea in July. Acoustic detections of fin whale calls indicate that fin whales also aggregate near the Aleutian Islands in summer (Moore *et al.* 1998). Some whale calls continue to be detected in northern latitudes throughout the winter with no noticeable migratory movement south (Watkins *et al.* 2000a and 2002b).

Pre-whaling estimates for the northeast Pacific stock of fin whales range from 42,000 to 45,000 whales, and post-whaling estimates range from 14,620 to 18,630 whales. However, these estimates are not considered reliable, and current abundance or population trends of fin whales are not available (Angliss *et al.* 2001). One recent survey yielded a regional estimate of abundance of 4,951 fin whales (95 percent confidence interval = 2,833-8,653) for the central Bering Sea shelf in the summer of 1999 (Angliss *et al.* 2001; Moore *et al.* 2000).

Trophic Interactions

Prey includes planktonic crustaceans (euphausiids and copepods), squid, fish (herring, cod, mackerel, pollock, and capelin), and cephalopods (Gambell 1985a). The total estimated annual food consumption by the EBS population is 57,500 mt, of which 9,200 mt (16 percent) is fish (Perez and McAlister 1993).

Management Overview

Fin whales fall under the jurisdiction of the NOAA Fisheries PRD. Fin whales are listed as endangered under the ESA and are therefore considered a depleted and strategic stock under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. A draft joint Recovery Plan has been develop in 1998 which covers both the fin and sei whales (NMFS 1998d). The long-term goal of this plan is to promote the recovery of these species to the extent that they are removed from ESA-listing. One of the primary means of achieving this goal is to minimize or eliminate human-caused mortality.

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

As noted above, commercial whaling about 100 years ago had a major impact on fin whale populations, including the northeast Pacific stock. Commercial whaling continued into modern times with 1,000 to 1,500 fin whales taken annually from the mid-1950s to the mid 1960s. Thereafter, catches declined sharply and ended altogether in 1976 when commercial whaling was outlawed (Angliss *et al.* 2001). There are no reports of subsistence takes of fin whales from either Alaska or Russia. Since population estimates are unreliable, no value for PBR has been calculated.

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

Prior to 1999, no fin whale mortalities were recorded by observers in the BSAI and GOA groundfish trawl, longline, and pot fisheries (Hill and DeMaster 1999). However, in 1999, one fin whale was killed incidental to the BSAI trawl fishery, resulting in an extrapolated take of three whales from this fishery in 1999 (Angliss *et al.* 2001). From this one recorded take, the average incidental take of fin whales is estimated to be 0.6 whales per year between 1995 and 1999. There are no records of fin whale entanglement in fishing gear.

Comparative Baseline

Fin whales are an endangered species due to commercial whaling prior to 1976. There are no reliable population estimates or trend information for the northeast Pacific stock. They are not hunted for subsistence purposes. Diets of fin whales overlap to a small extent with species taken by the groundfish fisheries, but they do not appear to interact with the fleet on a regular basis (Table 3.8-12).

Status for Cumulative Effects Analysis

Because of their "endangered" status under the ESA and their residence in the action area, fin whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, since they interact so infrequently with the groundfish fisheries, fin whales will be considered in the baleen whales species group.

3.8.13 Sei Whale (*Balaenoptera borealis*)

Distribution and Abundance

Sei whales are found in all oceans, but remain in more temperate waters than other baleen whales. They migrate long distances from low latitude winter areas to higher latitude summer grounds, but infrequently venture into cold, polar waters (Gambell 1976 and 1985b, Rice 1998). In the North Pacific Ocean, the summer range extends from southern California to the GOA and across the North Pacific south of the Aleutian Islands, extending into the Bering Sea only in the deep southwestern Aleutian Basin (Gambell 1985b, Rice 1998). There is evidence, from catch data, of differential migration by reproductive class, with pregnant females leading the migration into and out of the feeding grounds (Masaki 1976). There is also evidence of segregation by age, with a higher proportion of older and larger sei whales in the higher latitudes (Gambell 1985b). Sei whales are usually seen alone or in small groups, and the species does not appear to have a well-defined social structure (Tomilin 1957).

The IWC recognizes only one stock of sei whales in the North Pacific for management purposes, although there is evidence that more than one stock exists (Horwood 1987, Masaki 1977, Donovan 1991). Based on data from commercial whaling operations, the North Pacific population of sei whales was estimated to be from 42,000 to 62,000 animals before commercial whaling began in the 1800s. In 1974, after whaling was prohibited, the population was estimated to be between 7,260 and 12,620 (Tillman 1977, Carretta *et al.* 2001). Current abundance or trends are not known for stocks in the North Pacific.

Trophic Interactions

In the northern North Pacific, sei whales feed primarily on copepods (*Calanus cristatus, C. plumchrus*, and *C. pacificus*), euphausiids *(Thysanoessa inermis* and *T. longipes)*, small schooling fish such as saury and squid (Kawamura 1973, Nemoto 1959, Nemoto and Kawamura 1977). Sei whales use both engulfing and skimming feeding strategies, depending on the type of prey (Nemoto 1959 and 1970, Perry *et al.* 1999b).

Management Overview

Sei whales fall under the jurisdiction of the NOAA Fisheries PRD. Sei whales are listed as endangered under the ESA and a joint recovery plan for fin and sei whales was drafted in 1998 (NMFS 1998c). The long-term goal of this plan is to promote the recovery of these species to the extent that they are removed from ESA-listing. Critical habitat has not been designated for the species. Because of its endangered status, the eastern North Pacific stock is automatically considered a depleted and strategic stock under the MMPA. For MMPA stock assessments, sei whales in the eastern North Pacific (east of 180°W) are considered a separate stock; however, there are no abundance estimates for sei whales along the west coast of the U.S. or in the eastern North Pacific (Barlow *et al.* 1997).

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Between 1946 and 1987, an estimated 61,500 sei whales were harvested throughout the North Pacific (Carretta *et al.* 2001). However, there is some evidence that Soviet whalers may have over-reported catches of about 3,500 sei whales, presumably to hide illegal catches of other protected species (Doroshenko 2000). Commercial whaling was prohibited in U.S. waters in 1972 by the MMPA, and sei whales were given full protection from hunting by the IWC in 1976.

Direct Mortality from Incidental Take in External Fisheries

Human-caused mortalities (i.e., incidental to commercial fishing operations or from ship strikes) have not been reported in the North Pacific (Perry *et al.* 1999b).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the 1990 to 1997 BSAI and GOA groundfish trawl, longline, and pot fisheries, but no mortalities or serious injuries of sei whales were observed (Hill and DeMaster 1999).

Comparative Baseline

Sei whales are listed as an endangered species under the ESA due to commercial whaling in the mid-1900s. Population trends and current status are unknown. Diets of sei whales do not overlap with species taken by the groundfish fisheries, and they do not appear to interact with the fleet on a regular basis. No incidental take from commercial fisheries has been reported (Table 3.8-13).

Status for Cumulative Effects Analysis

Because of their endangered species status and their presence in the action area in summer, sei whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, since they interact so infrequently with the groundfish fisheries, sei whales will be considered in the baleen whales species group.

3.8.14 Minke Whale (*Balaenoptera acutorostrata*)

Distribution and Abundance

Minke whales are distributed worldwide. In the eastern North Pacific, minkes are relatively common in the Bering and Chukchi seas and in the inshore waters of the GOA, but are not considered abundant elsewhere (Stewart and Leatherwood 1985, Mizroch 1992). Minke whales in Alaska are managed as a separate stock from those in California, Oregon, and Washington. However, few data are available on the migratory behavior and apparent home ranges of eastern North Pacific minke whales (Dorsey *et al.* 1990). No estimates have been made for the number of minke whales in the North Pacific. (Angliss *et al.* 2001). In the central Bering Sea, 936 minke whales (95 percent confidence interval 473 to 1852) were observed in 1999 (Moore *et al.* 2000).

No estimates have been made for the number of minke whales in the entire North Pacific. In the central Bering Sea, an estimated 936 minke whale (95 percent confidence interval 473 to 1,852, coefficient of variation = 0.35) were observed during the summer of 1999 (Moore *et al.* 2000). However, this covers only a small portion of the Alaska stocks range. Seabird surveys around the Pribilof Islands indicated an increase in local abundance of minke whales between 1975 to 1978 and 1987 to 1989 (Baretta and Hunt 1994). No data exist on trends in abundance in Alaskan waters (Angliss *et al.* 2001).

Trophic Interactions

Prey preferences of eastern North Pacific minke whales are unknown. Data from western North Pacific minke whales indicate that, depending on season and region, pelagic schooling fishes (herring, pollock, mackerel, anchovy, and saury in particular) make up over 90 percent of the total prey by weight (Kasamatsu and Hata 1985, Tamura *et al.* 1998).

Management Overview

Minke whales fall under the jurisdiction of the NOAA Fisheries PRD and are protected under the MMPA. They are not listed as a depleted or strategic stock and are not listed under the ESA.

Past and Present Human Effects and Management Actions

<u>Direct Mortality: Harvest and Other Intentional Take</u>

Minke whales were not targeted by commercial whalers in the eastern North Pacific. Subsistence takes of minkes by Alaska Natives have been documented but occur only rarely. The last recorded subsistence take was two whales in 1989 (Angliss *et al.* 2001).

Direct Mortality from Incidental Take in External Fisheries

Minke whales have been taken in small numbers incidental to coastal set gillnet and offshore drift gillnet fisheries, but quantitative information is unreliable because these fisheries rely on self-reported interactions rather than independent observers (Angliss *et al.* 2001).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take during the 1990 to 1999 BSAI and GOA groundfish trawl, longline, and pot fisheries. No mortalities were observed during that time. One minke whale mortality was observed at Shelikof Strait in 1989 in a JV groundfish trawl fishery, the predecessor to the current Alaska groundfish trawl fishery (Hill and DeMaster 1999). In September 2000, one minke whale mortality occurred in the Bering Sea groundfish trawl fishery (NMFS 2000b).

Comparative Baseline

Minke whales in the eastern North Pacific are not listed under the ESA and have never been targeted by commercial whaling. Population trends and current status are unknown, although the species is relatively common in the action area based on the frequency of sightings. Diets of minke whales apparently overlap partially with species taken by the groundfish fisheries, but minkes do not appear to interact with the fleet on a regular basis. One minke whale mortality occurred in the Bering Sea groundfish trawl fishery in September 2000 (NMFS 2000b) (Table 3.8-14).

Status for Cumulative Effects Analysis

Because of their presence in the action area and partial overlap in diet with the groundfish fisheries, minke whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, since they interact so infrequently with the groundfish fisheries, minke whales will be considered in the baleen whales species group.

3.8.15 Humpback Whale (*Megaptera novaeangliae*)

Distribution and Abundance

Humpback whales are common in Alaska waters. Their historic summer range in the North Pacific Ocean encompasses coastal and inland waters around the Pacific Rim from California north to the GOA and the Bering Sea and west along the Aleutian Islands to the Kamchatka Peninsula (Johnson and Wolman 1984, Nemoto 1957, Tomilin 1967, Perry *et al.* 1999a). Through a variety of information sources (surveys, photo-identifications, genetics), it has become evident that at least three relatively separate populations exist in the U.S. EEZ. Each population migrates between its respective summer/fall feeding areas and its winter/spring calving and mating areas (Calambokidis *et al.* 1997, Baker *et al.* 1998). These apparent populations are considered as separate stocks for management purposes: the western North Pacific stock, central North Pacific stock, and the Washington-Mexico stock. The western and central North Pacific stocks are seasonally distributed in Alaskan waters. The western North Pacific stock winters in Japanese waters and probably migrates to the BSAI to feed in the summer (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991). The central North Pacific stock winters in Hawaiian waters and summers in northern British Columbia, southeast Alaska, PWS, and west to at least Kodiak Island (Baker *et al.* 1986, Baker *et al.* 1990, Perry *et al.* 1990, Calambokidis *et al.* 1997).

The North Pacific population of humpbacks has been estimated at 15,000 animals before commercial whaling began in the late 1800s. By the time whaling was prohibited in 1966, there may have been only 1000 animals left (Rice 1978b). Baker and Herman (1987) estimated that the central North Pacific stock contained about 1,400 animals between 1980 and 1983. That estimate is questionable, however, due to the opportunistic nature of the survey methodology and the small sample size. A more recent abundance estimate was based on data collected by nine independent research groups that conducted photo-identification studies in the three wintering areas (Mexico, Hawaii, and Japan). Using photographs from 1991 to 1993, abundance estimates for the western North Pacific stock and the central North Pacific stock were calculated to be 394 (coefficient of variation = 0.084) and 4,005 (coefficient of variation = 0.095), respectively (Angliss *et al.* 2001; Calambokidis *et al.* 2001). There is no trend information for the western North Pacific stock. The central North Pacific stock appears to be increasing, although the rate of increase is unknown due to the uncertainty of the earlier estimate (Baker and Herman 1987, Hill and DeMaster 1999).

Trophic Interactions

Humpback whales exhibit site fidelity to feeding areas, and return year after year to the same feeding location (Baker *et al.* 1987, Clapham *et al.*1993). There is very little interchange between feeding areas (Baker *et al.* 1986, Calambokidis *et al.* 1996, 2000, 2001, Waite *et al.* 1999, Urban *et al.* 2000). Prey in the North Pacific and Bering Sea include small schooling fishes, euphausiids, and other large zooplankton (Nemoto 1959, Bryant *et al.* 1981, Dolphin and McSweeney 1983). Euphausiid prey include *Thysanoessa inermis. T. longipes, T. spinifera* and to a lesser extent *T. raschii* (Kawamura 1980, Tomilin 1957). Fish preference include Atka mackerel, pollock, herring, anchovy, eulachon, capelin, saffron cod, sand lance, Arctic cod, rockfish, and salmon species (Nemoto 1959, Tomilin 1957, Kawamura 1980). Atka mackerel ranging in size from 5.9 to 11.7 inches (15 to 30 cm) were considered the preferred prey of humpback whales in the Aleutian Islands west of Attu Island and south of Amchitka Island (Nemoto 1959). Distribution of whales in the inland waters of southeast Alaska appears to be determined primarily by distribution of their main prey: herring and euphausiids. Humpbacks use a variety of feeding behaviors to catch food including exhalation of columns of bubbles that concentrate prey, herding of prey, and lunge feeding. Humpbacks return year after year to the same feeding location with very little interchange between feeding areas (Baker *et al.* 1986, Calambokidis *et al.* 1996, Waite *et al.* 1999, Urban *et al.* 2000).

Management Overview

Humpback whales fall under the jurisdiction of the NOAA Fisheries PRD. They are listed as endangered under the ESA and are automatically considered a depleted and strategic stock under the MMPA. An ESA recovery plan has been written (NMFS 1991b). The primary goal of this plan is to assist humpback whale populations to grow and occupy areas where they were historically found. Critical habitat has not been designated for this species.

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Intensive commercial whaling took more than 28,000 humpbacks from the North Pacific during the 1900s (Rice 1978b). This is likely an underestimate because of under-reporting of Soviet catches (Yablokov 1994).

At the present time, the calculated PBR for the western North Pacific stock of humpbacks is less than one animal per year while PBR for the central North Pacific stock is 7.4 animals per year (Angliss *et al.* 2001).

Direct Mortality from Incidental Take in External Fisheries

Brownell *et al.* (2000) found records of six humpbacks taken as bycatch by Japanese and Korean fisheries between 1995 and 1999. In addition, two strandings were reported during this period that are assumed to be the result of fishery entanglement. Samples of whale meat sold in Japanese and Korean markets also indicate that humpbacks are being sold. Although there are questions regarding the nature of these mortalities, the data indicate a minimum incidental take of 1.1 to 2.4 humpbacks per year from the western North Pacific stock (Angliss *et al.* 2001).

A small proportion of various Hawaiian fisheries has also been monitored by independent observers. One humpback was observed entangled in longline gear in 1991 and is presumed to have died. Another humpback was taken in Hawaiian longline gear in 1993. In southeast Alaska, purse seine and drift gillnet salmon fisheries have reported incidental takes of humpbacks in 1989, 1994, and 1996. In addition, over 25 humpbacks were found stranded or swimming with entangled fishing gear in Hawaii and Alaska between 1994 and 1999. Some of the whales were freed, apparently uninjured, but others are considered to have died. All fishery-related takes in Alaska and Hawaii, excluding the federal groundfish fisheries, are estimated to average 3.1 whales per year. These mortality rates from both Hawaii and Alaska are considered to be minimums based on the small number of observers and the unreliability of self-reported data (Angliss *et al.* 2001).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the 1990 to 1999 BSAI and GOA groundfish trawl, longline, and pot fisheries. One humpback whale mortality was observed in the BSAI trawl fishery in 1998 and one in 1999, resulting in an extrapolated average mortality of 0.4 humpbacks per year during this period. It is not known whether these incidental takes derived from the western or central stocks so the takes are counted against the PBRs for both stocks (Angliss *et al.* 2001).

Direct Mortality from Ship Strikes

Ship strikes and interactions with vessels unrelated to fishing have also accounted for humpback mortality. In the central North Pacific stock, four ship strikes were recorded between 1995 and 1999 for an average of 0.8 humpback mortalities per year (Angliss *et al.* 2001).

Indirect Effects from Disturbance

Coincident to fishing activity, as well as vessel transit, is the routine use of various sonar devices. The sounds produced by these devices may be audible to baleen whales and suggest disturbance sources. Wintering humpback whales have been observed reacting to sonar pulses by moving away (Maybaum 1990, 1993), although few other reactions have been documented. There is concern that noise generated by vessels as well as for research (such as the U.S. Navy's Low Frequency Active sonar program and NOAA's Acoustic Thermometry of Ocean Climate program) may be impacting humpback whales throughout their range. Research on this issue is underway (Angliss *et al.* 2001).

Humpbacks are also subject to a growing whale-watching industry in both Hawaii and Alaska. Regulations concerning minimum approach distances and operation guidelines for whale-watching vessels have been established, but there is still concern that the whales may abandon preferred habitats to avoid persistent whale-watching activity (Angliss *et al.* 2001). This issue is attracting attention in certain popular visitor areas such as Glacier Bay National Park in Alaska.

Comparative Baseline

Humpback whales are listed as an endangered species under the ESA due to commercial whaling in the 1900s. Recent population estimates for the western and central North Pacific stocks are 394 and 4,005 respectively. Trends for the western stock are unknown. The central stock is thought to be increasing but at an unknown rate. Diets of humpback whales do not generally overlap with species taken by the groundfish fisheries. There have been numerous cases of incidental take related to commercial fisheries in the past ten years, including two observed mortalities from BSAI groundfish trawls since 1998 (Table 3.8-15).

Status for Cumulative Effects Analysis

Because of their endangered species status and their presence in the action area in summer, humpback whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, although they interact frequently with commercial fisheries, and the effects among management alternatives would be difficult to discern from other baleen whales, humpback whales will be considered in the baleen whales species group.

3.8.16 Gray Whale (*Eschrichtius robustus*)

Distribution and Abundance

Gray whales (*Eschrichtius robustus*) occur across the coastal and shallow water areas of both the eastern and western reaches of the North Pacific Ocean, as well as the Bering, Chukchi, and Beaufort seas. Two stocks are recognized: the western Pacific or Korean stock, which is considered rare and endangered, and the eastern North Pacific stock, which was removed from the list of endangered wildlife in 1994 (Rugh *et al.* 1999). Only the eastern North Pacific stock is found in the BSAI and GOA groundfish management areas.

The eastern North Pacific Ocean population winters in the warm coastal waters of Baja California and the southern Gulf of California. From late February to May, the whales begin a northward migration, following the coast closely. They enter the Bering Sea, primarily through Unimak Pass, mostly in April and May, and continue moving along the coast of Bristol Bay. After passing Nunivak Island, they head toward St. Lawrence Island, arriving there in May or June. The whales disperse to spend the summer feeding in shallow waters (usually less than 200 ft deep) of the northern and western Bering Sea and the Chukchi Sea. Gray whales begin their southward migration in mid-October, passing through Unimak Pass between late October and early January. They arrive in Baja California mainly in December and January (Frost 1994).

Gray whales were nearly exterminated by commercial whaling in the 1800s and 1900s, and may have numbered only in the hundreds by the time whaling was prohibited in 1946 (Angliss *et al.* 2001). Since then, they have recovered to pre-exploitation abundance. The eastern North Pacific stock abundance has been estimated by conducting shore-based counts of whales migrating past the coast of California. For the 1997 to 1998 census period this estimate was 26,635 whales (coefficient of variation = 10 percent) (Hobbs and Rugh 1999). This estimate was significantly greater than the estimate from 1992 to 1993 (17,674). Some of the difference could be attributed to survey or migration pattern variations rather than real changes in population (Angliss *et al.* 2001). A recent estimate of the population trend calculated an annual rate of increase of 2.4 percent between 1967 and 1998 (Breiwick 1999). However, there are indications that this increase may have leveled off and is perhaps declining as this population reaches the carrying capacity of its environment, estimated to be between 20,000 to 28,000 animals.

On average, there have been about 38 reports of stranded gray whales per year from 1995 to 1998 (Norman *et al.* 2000). However, there were unusually high mortality rates of greater than 270 in 1999 (LeBoeuf *et al.* 2000; Norman *et al.* 2000) and greater than 300 in 2000 (NMML unpublished data[c]). Based on a 5 percent annual natural mortality level for gray whales (Wade and DeMaster 1996), estimated average mortality rates would likely be 800 to 1200 animals for a population of 22,000 to 26,000 (Norman *et al.* 2000). Because stranding reports reflect only a small portion of total mortality, the high rates observed in 1999 and 2000 probably indicate large die-offs in these two years. Reports of emaciated whales (LeBoeuf *et al.* 2000, Perryman and Lynn 2002) and low calf production (Perryman *et al.* 2002) are suggestive of a deterioration in available resources, such as benthic amphipods in primary feeding areas of the Bering and Chukchi seas. This may be associated with the high abundance of gray whales, which may be approaching their carrying capacity (Moore *et al.* 2001). But in 2000 and 2001, relatively few strandings were found, even though the search effort has increased in recent years. Migration counts during 2001 and 2002 resulted in a preliminary abundance estimate of about 17,500 whales. While this number is less than a few years before, scientists expect populations at carrying capacity to fluctuate as environmental conditions change, and the population experiences good years and bad years (NMFS 2002e).

Trophic Interactions

Gray whales are the only baleen whales that are mainly bottom feeders. They feed by sucking up sediment from the sea floor and filtering out food items with their baleen. Gray whales eat primarily benthic amphipods in the Bering and Chukchi seas, while other feeding locations may provide more opportunistic feeding (Nerini 1984). Several studies have found *Ampelisca macrocephala, Lembos arcticus, Anonyx nugax, Pontoporeia femorata, Eusirus* spp., and *Atylus* spp. to be the most dominant species in stomach contents (Zimushko and Lenskaya 1970, Rice and Wolman 1971, Tomilin 1957, Nerini 1984, Lowry *et al.* 1982). The ratio of each species varied between areas but one of the amphipod species usually accounted for 80 to 90 percent of the food intake for each meal. Other stomach contents included small percentages of sponges, ascidians, hydrozoans, anthozoans, polychaetes, priapulids, sipunculids, isopods, decapod crustaceans, gastropods, bivalves, holothuroidians, echinoderms, cumaceans, fish larvae, sand, mud, algae, wood fragments, silt, pebbles, and kelp, probably ingested incidental to bottom feeding (Zimushko and Lenskaya 1970, Rice and Wolman 1971, Tomilin 1957, Nerini 1984, Lowry *et al.* 1982). There were no significant differences found in prey species between immature and adult whales or between males and females. The total estimated food consumption by the population in the EBS is 271,500 mt, which included only a trace amount of fish (Perez and McAlister 1993). Concentrations of 12,000 to 20,000 amphipods per square yard have been found in the southern Chukchi Sea and northern Bering Sea where the whales feed. The estimated daily consumption of an adult gray whale is about 2,600 pounds. In the approximately five months spent in Alaska waters, one whale eats about 396,000 pounds of amphipod crustaceans (Frost 1994). Previous studies have reported estimates of annual food consumption in the Bering Sea region as 850,000 mt (Zimushko and Lenskaya 1970), 2,700,000 mt to 3,240,000 mt (Frost and Lowry 1981), and 571,000 mt to 1,674,000 mt (Nerini 1984). In general, gray whales feed little during their annual migration (Rice and Wolman 1971).

Management Overview

Gray whales fall under the jurisdiction of the NOAA Fisheries PRD, and are protected under the MMPA. Gray whales were originally listed as endangered under the ESA, but were delisted in 1994 (Rugh *et al.* 1999). The IWC sets an annual quota for subsistence take by aboriginal peoples but no other intentional take is permitted.

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

In the 1800s and early 1900s gray whales were heavily hunted. First on their calving grounds and later, with the advent of modern technology, in other areas. It is estimated that by the 1930s only a few hundred to a few thousand remained. In 1948 the International Convention for the Regulation of Whaling banned all hunting of gray whales except by aboriginal people (Frost 1994).

Subsistence hunters from Alaska and Russia have traditionally harvested whales from this stock. In Alaska, Native hunters took only two gray whales in the past decade, both in 1995 (Angliss *et al.* 2001). Russian subsistence hunters took an average of 76 gray whales per year between 1994 and 1998. The 1968 to 1993 average take for Russian and Alaska Natives combined was 159 whales per year (Angliss *et al.* 2001). In 1997, the IWC approved a 5-year quota of 620 gray whales (140 per year maximum) for these Native hunters. The calculated PBR for the eastern North Pacific stock is 575 whales per year (Angliss *et al.* 2001).

Direct Mortality from Incidental Take in External Fisheries

In state-managed and tribal gillnet fisheries along their migration corridor, small numbers of gray whales become entangled in the nets and are either lost or injured as a result. The total number of gray whale incidental takings averages about 6 per year, including about 4 per year that are found entangled in fishing gear that cannot be attributed to a specific fishery. These numbers are considered minimal estimates since these types of fisheries are not monitored by observers in most areas, including Canada and Alaska (Angliss *et al.* 2001).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take on the 1990 to 1998 BSAI and GOA groundfish trawl, longline, and pot fisheries. No gray whale mortalities were observed (Hill and DeMaster 1999).

Indirect Effects through Changes in Prey Availability

Bottom trawls on the EBS shelf operate during the summer when most of the eastern stock of gray whales uses that area as a feeding ground. The impact of bottom trawling activity on the availably of benthic prey, the primary food source for gray whales, is unclear. However, population-level impacts do not appear to have occurred in light of increasing gray whale populations concurrent to decades of bottom trawling on the EBS shelf (Rugh *et al.* 1999).

Comparative Baseline

Gray whales were once an endangered species under the ESA due to whaling but their population has been increasing, and they were delisted in 1994. They are rarely taken for subsistence by Alaska Natives, but are still hunted by Natives in Russian waters. Diets of gray whales do not overlap with species taken by the groundfish fisheries, and they do not appear to interact with the fleet on a regular basis (Table 3.8-16).

Status for Cumulative Effects Analysis

Because of their protected status under the MMPA and their residence in the project area in summer, gray whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, since they interact so infrequently with the groundfish fisheries, gray whales will be considered in the "baleen whales" species group.

3.8.17 Northern Right Whale *(Eubalaena japonica)*

Distribution and Abundance

Right whales historically summered in Alaska waters, mostly between 50° and 60°N from April to September, with a peak in sightings in coastal waters in June and July (Maury 1852, Townsend 1935, Omura 1958, Klumov 1962, Omura *et al.* 1969). Important historical concentration areas in Alaska appear to have been located in the GOA, especially south of Kodiak Island (Rice and Wolman 1982), and in the eastern Aleutian Islands and southern Bering Sea shelf waters (Braham and Rice 1984, Scarff 1986). Migration and winter distribution patterns are unknown, but a few sightings have been made as far south as 27°N in the eastern North Pacific and near Hawaii. Data from the NMMLs POP (1997) include right whale sightings in Alaskan waters (from 1979 to 1997) during all seasons except winter. Vessel and aerial surveys conducted during July from 1997 to 2000 reported lone animals or small groups of right whales in western Bristol Bay (Perryman *et al.* 1999, Moore *et al.* 2000, LeDuc *et al.* 2000, Angliss *et al.* 2001).

The IWC currently recognizes two species of northern right whales: *Eubalaena glacialis* in the North Atlantic and *E. japonica* in the North Pacific (IWC 2000), based upon the findings of recent genetic analyses (Rosenbaum *et al.* 2000). Stock structure in the North Pacific is unknown, and there are insufficient data about where calving and breeding take place to confirm or deny the existence of more than one stock in the North Pacific (Perry *et al.* 1999a). The pre-exploitation population estimate for this stock was approximately 11,000 animals (NMFS 1991a). Only a few individuals are believed to have survived the period of commercial whaling (Rice 1974). There have been only 14 individuals photographed in 1998 to 2000 aerial surveys, and two of these were repeats. This mark-recapture ratio is consistent with a very small population (Angliss *et al.* 2001). A reliable estimate of current abundance for the North Pacific right whale stock is not available (but is expected to be very small), nor is there any estimate of population trend (Ferrero *et al.* 2000, Angliss *et al.* 2001).

Trophic Interactions

Right whales in the North Pacific are known to prey on a variety of zooplankton species including *Calanus marshallae, Euphausia pacifica, Metridia* spp., and copepods of the genus *Neocalanus* (Omura 1986). Zooplankton sampled near right whales seen in the EBS in July 1997 included *Calanus marshallae*, *Pseudocalanus newmani*, and *Acartia longiremis* (Tynan 1999).

Management Overview

Northern right whales fall under the jurisdiction of the NOAA Fisheries PRD. They are listed as endangered under the ESA and are automatically considered a depleted and strategic stock under the MMPA. The 1991 ESA Recovery Plan for northern right whales (NMFS 1991a) is currently undergoing revision to include recent findings. Critical habitat has not been designated for this species. However, in November of 2000, NOAA Fisheries received a petition from the Center for Biological Diversity to designate critical habitat for this species. The petitioners asserted that the southeast Bering Sea shelf from 55 to 60° N should be considered critical habitat. On June 1, 2001, NOAA Fisheries found the petition to have merit (66 FR 29773) and is considering whether the petition is warranted under the ESA (Angliss and Lodge 2002). In February 2002, NOAA Fisheries determined that the petition was not warranted, but agreed to reevaluate the petition after a review of 2002 right whale surveys and research. Currently, NMML and NOAA Fisheries Alaska Region are reviewing the data and will schedule a meeting with NOAA Fisheries Northeast Region to discuss appropriate criteria for critical habitat designation for the right whales in the Pacific and Atlantic Oceans. NOAA Fisheries reevaluation of the 2000 petition will commence soon afterwards.

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Right whales are large, slow-swimming, tend to congregate in coastal areas, and have a thick layer of blubber which enables them to float when killed. These attributes made them a preferred species for whaling, and their population was decimated by the late 1800s. Between 1835 and 1909, over 15,000 right whales were estimated to be taken by U.S. registered whaling vessels; most of these whales were taken before 1875 (Angliss *et al.* 2001). Since 1931, the northern right whale has been protected from commercial whaling internationally, first under the League of Nations Convention and since 1949 by the IWC. However, reports from Russia indicate that Soviet whalers continued to harvest northern right whales illegally until 1971 (Zemsky *et al.* 1995, Tormosov *et al.* 1998).

Direct Mortality from Incidental Take in External Fisheries

Two right whale deaths reportedly occurred in the Russian gillnet fishery, one in 1983 and one in 1989 (NMFS 1991a, Kornev 1994). No incidental takes of right whales have been reported in other North Pacific fisheries (Ferrero *et al.* 2000, Angliss *et al.* 2001). Ship strikes and entanglement in fishing gear are important sources of mortality in the Atlantic stock of northern right whales, but their rarity in the Pacific has made it impossible to assess the susceptibility of the North Pacific stock to vessel strikes (Angliss *et al.* 2001).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the 1990 to 1997 BSAI and GOA groundfish trawl, longline, and pot fisheries, but no mortalities or injuries of right whales were observed (Hill and DeMaster 1999). Any mortality incidental to commercial fisheries would be considered significant (Angliss *et al.* 2001).

Comparative Baseline

Northern right whales are listed as an endangered species under the ESA due to commercial whaling in the 1800s and early 1900s. A recovery plan was finalized in 1991 (NMFS 1991a). The goal of this plan is to assist in the recovery of this species to the point where it is appropriate to remove it from ESA listing. One of the objectives of this plan is to reduce or eliminate injury or mortality caused by fishing and fishing gear. Population trends and current status are unknown although the population is believed to be very small based on the infrequency of sightings. Diets of right whales do not overlap with species taken by the groundfish fisheries, and they do not appear to interact with the fleet on a regular basis. No incidental take from the groundfish fisheries has been reported (Table 3.8-17).

Status for Cumulative Effects Analysis

Because of their endangered species status and their presence in the action area in summer, northern right whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, since they interact so infrequently with the groundfish fisheries, right whales will be considered in the baleen whales species group.

3.8.18 Bowhead Whale (*Balaena mysticetus*)

Distribution and Abundance

The IWC recognizes five stocks of bowhead whales. The western Arctic stock is the only stock found in U.S. waters and is widely distributed in the central and western Bering Sea in winter (November-April). Bowhead whales are generally associated with the marginal ice front and found near the polynyas of Saint Matthew and Saint Lawrence Islands and the Gulf of Anadyr (Moore and Reeves 1993). From April through June, these whales migrate north and east, following leads in the sea ice in the eastern Chukchi Sea until they pass Point Barrow, and reach the southeastern Beaufort Sea where most spend June to September (Shelden and Rugh 1995). By late October and November they arrive in the Bering Sea (Kibal'chich *et al.* 1986, Bessonov *et al.* 1990), where they remain until the following spring migration. Historically, there were many records of bowhead whales in the Bering and Chukchi seas in summer (Townsend 1935), but the area appeared to be abandoned after commercial whaling decimated the population (Bogoslovskay *et al.* 1982, Bockstoce 1986). Some recent sightings in these waters in summer are thought to be whales from the expanding western Arctic stock (Rugh *et al.* 2000).

The western Arctic stock originally numbered about 18,000 whales and was reduced to about 3,000 after commercial whaling ended in the early 1900s (Woodby and Botkin 1993, Breiwick *et al.* 1984). Since 1978, counts of bowheads have been conducted from the sea ice north of Point Barrow during spring migration and have been corrected for whales missed for various reasons. Recent improvements in acoustical sampling have improved the detection and reliability of estimates (Angliss *et al.* 2001). From 1978 to 1993, the western Arctic stock increased from approximately 5,000 to 8,000 whales, a rate of 3.1 percent (Raftery *et al.* 1995). In 1993, the population was estimated to be 8,200 animals (IWC 1997). The most recent estimate derived from spring 2001 census was about 9,860 bowheads (IWC 2003).

Trophic Interactions

Prey species identified from bowhead whale stomach contents have included crustacean zooplankton, particularly euphausiids and copepods, ranging in length from 3 to 30 mm, and epibenthic organisms, mostly mysids and gammarid amphipods. Benthic species were relatively rare in bowhead stomach contents (Lowry 1993). Studies of stable isotope ratios in bowhead baleen suggest that the Bering and Chukchi seas are the preferred feeding habitats, rather than the Beaufort Sea (Lee and Schell 1999).

Management Overview

Bowhead whales fall under the jurisdiction of the NOAA Fisheries PRD. Bowheads are listed as endangered under the ESA and are listed as a depleted and strategic stock under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. In 1994, an amendment to the MMPA included provisions for the development of cooperative agreements between the USFWS, NOAA Fisheries, and Alaska Native organizations to conserve and co-manage marine mammals taken in subsistence hunts, including bowheads. The Alaska Eskimo Whaling Commission, representing ten whaling villages in northwestern Alaska, has signed a co-management agreement with NOAA Fisheries. Quotas for the bowhead hunts are established annually by the IWC.

Past and Present Human Effects and Management Actions

<u>Direct Mortality: Harvest and Other Intentional Take</u>

Bowheads have been a favored whale for hunting for at least 2,000 years because they produce large quantities of oil, baleen, meat, and muktuk (skin with blubber). They are also slow, non-aggressive, and float when they are killed. Bowheads are the most important subsistence animal, both culturally and nutritionally, for most northwestern Alaska Inupiaq and Yupik people. Alaska Eskimo whalers use handheld weapons and skin boats propelled by paddles to pursue bowheads during the spring hunt and motor-driven boats during the fall (Carroll 1994). The IWC has authorized Alaska Natives to strike up to 67 bowheads per year since

1978 but actual strikes have been less than the quota. The calculated PBR for this stock is 77 animals per year (Angliss *et al.* 2001).

As noted above, commercial whaling had a devastating impact on bowhead whale populations, including the western Arctic stock. Between 1848 and 1919, over 20,000 bowheads were estimated to have been harvested from pelagic and shore-based whaling operations in the Bering Sea (Woodby and Botkin 1993). The demand for baleen products, however, decreased dramatically in the early 1900s, largely due to changes in fashion. Fur trading and freighting voyages took the place of whaling ventures. In 1908, the baleen market collapsed, and by 1921, the last bowhead whale was taken at sea (Bockstoce and Burns 1993).

Direct Mortality from Incidental Take in External Fisheries

There are no Observer Program records of bowhead whale mortality incidental to commercial fisheries in Alaska (Hill and DeMaster 1999). However, there have been several cases of entanglements recorded (Philo *et al.*1992). These included three harvested bowheads that had scars attributed to rope entanglements, one bowhead found dead entangled in ropes similar to those used with fishing gear in the Bering Sea, and one bowhead with ropes on it that were attributed to rigging from a commercial offshore fishing pot, most likely a crab pot. There have been two other recent reports of bowheads with gear attached or marks that likely were from crab gear (J.C. George, North Slope Borough, personal communication). Aerial photographs in at least two cases have shown ropes trailing from the mouths of bowheads (NMFS unpublished data).

Indirect Effects through Oil Development

Increasing oil and gas development in the Arctic leads to increasing risk of various forms of pollution and noise from higher levels of boat traffic as well as exploration and drilling operations. There is evidence that bowheads are sensitive to noise from offshore development activities and that they will actively avoid seismic operations during their fall migration (Richardson *et al.* 1995, Davies 1997). In a recent ESA Section 7 consultation regarding the impact of the proposed Liberty oil development project in the Beaufort Sea, NOAA Fisheries acknowledged these impacts, but noted that the bowhead whale population was increasing and concluded that the development was not likely to jeopardize the continued existence of the bowhead whale (NMFS 2002f).

Comparative Baseline

Bowhead whales are an endangered species due to commercial whaling in the 1800s and early 1900s, but their population has been increasing in the project area since commercial whaling was stopped. They are an important subsistence resource for northern Alaska Natives. Diets of bowheads do not overlap with species taken by the groundfish fisheries, and they do not appear to interact with the fleet on a regular basis (Table 3.8-18).

Status for Cumulative Effects Analysis

Because of their “endangered” status under the ESA and their residence in the project area, bowhead whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, since they interact so infrequently with the groundfish fisheries, bowhead whales will be considered in the baleen whales species group.

3.8.19 Sperm Whale (*Physeter macrocephalus*)

Distribution and Abundance

The sperm whale is one of the most widely distributed of any marine mammal species with their northernmost boundary at approximately 62°N in the Bering Sea (Leatherwood *et al.* 1982, Omura 1955). They are a pelagic species, known to dive deeper than 1,000 m and remain submerged for an hour or more. Females and young sperm whales usually remain in tropical and temperate waters year-round while males are thought to move north in the summer to feed in the BSAI and GOA area (Rice 1989).

For management purposes, the IWC has divided sperm whales in the North Pacific into eastern and western stocks. However, this division is not based on genetic or morphological differences, and the movement patterns of sperm whales are poorly known (Angliss *et al.* 2001). For stock assessment purposes, NOAA Fisheries has divided the North Pacific population into three management stocks (Angliss *et al.* 2001), only one (the Alaska stock) of which is considered relevant to this review. Sperm whales inhabit deeper pelagic waters as well as the broad continental shelf of the eastern Bering Sea, and nearshore environs in the eastern Aleutian Islands, GOA, and southeast Alaska (Rice 1989). Current and historic estimates of abundance, and therefore population trends, are considered unreliable. The abundance of sperm whales in the North Pacific, including whales from the separate California/Oregon/Washington stock, was reported to be 1,260,000 prior to whaling in the early 1900s, which was reduced to 930,000 whales by the late 1970s (Rice 1989). The number of sperm whales occurring within Alaskan waters is unknown.

Trophic Interactions

Sperm whales feed primarily on mesopelagic squid, but also consume octopi, other invertebrates, and fish (Tomilin 1967, Berzin 1971). Fish consumption becomes more evident near the continental shelf break and along the Aleutian Islands (Okutani and Nemoto 1964). Diet of sperm whales in the Bering Sea is comprised of 70-90 percent squids and 10-30 percent fish (Kawakami 1980). Fish eaten in the North Pacific included salmon, lantern fishes, lancetfish, Pacific cod, pollock, saffron cod, rockfishes, sablefish, Atka mackerel, sculpins, lumpsuckers, lamprey, skates, and rattails (Tomilin 1967, Kawakami 1980, Rice 1986a). Food consumption rates were calculated to be 3 percent of their total body weight per day in smaller sperm whales (mostly females and juvenile males) that weighed less than 13.6 mt (Lockyer 1981). Larger males weighing more may eat 3.5 percent of their total body weight per day. This number also increases sharply for pregnant and lactating females. Sperm whales consuming 2 to 4 percent of their total body weight per day equals0.9 to 2.7 mt for a 13 to 14 m animal (Kawakami 1980). The total estimated annual food consumption by the EBS population is 952,800 mt, of which 171,500 mt is fish (Perez and McAlister 1993). This estimate assumes: 1) about 15,000 adult male sperm whales summer in the EBS and Aleutian Islands region, 2) an average body mass of 26 mt, and 3) a diet of 82 percent cephalopods (mostly squid) and 18 percent fish (Perez 1990).

Management Overview

Sperm whales fall under the jurisdiction of the NOAA Fisheries PRD, and are protected under the ESA and the MMPA. Sperm whales are listed as endangered under the ESA and are listed as depleted and strategic under the MMPA. Although abundance estimates for this stock are not available, the species is considered unlikely to be in danger of extinction in the foreseeable future (Angliss *et al.* 2001). There are no critical habitats designated for this species.

Following reauthorization of the MMPA, with its emphasis on direct takes of marine mammals, NOAA Fisheries determined the approximate number of lethal takes each fishery imposed on ESA-listed species and issued exemption certificates for those with minimal impacts. The issuance of the certificates was a federal action subject to Section 7 consultation under the ESA. NOAA Fisheries issued a BiOp concerning the issuance of MMPA exemptions for all commercial fisheries (including the MSA groundfish fisheries) and concluded that the BSAI and GOA groundfish fisheries were not likely to jeopardize the continued existence and recovery of any listed species under the purview of NOAA Fisheries (NMFS 1979). The BiOp contained nine conservation recommendations, including monitoring of interactions.

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Approximately 258,000 sperm whales in the North Pacific were harvested by commercial whalers between 1947 and 1987 (Perry *et al.* 1999a). However, this number may be negatively biased by as much as 60 percent due to under-reporting by Soviet whalers (Brownell *et al.* 1998). In particular, the Bering Sea population of sperm whales (consisting mostly of males) was severely depleted (Perry *et al.* 1999a). Catches in the North Pacific continued to climb until 1968, when 16,357 sperm whales were harvested, after which catches declined, in part through limits imposed by the IWC (Rice 1989). Sperm whales have been protected from commercial harvest by the IWC since 1985, although the Japanese continued to harvest sperm whales in the western North Pacific until 1988 after filing a formal objection with the IWC (Rice 1989, Reeves and Whitehead 1997). Sperm whales have never been reported to be taken by subsistence hunters (Rice 1989).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take of marine mammals in the 1990 to 1999 BSAI and GOA groundfish trawl, longline, and pot fisheries. Sperm whale interactions with longline fisheries operating in the GOA are known to occur and may be increasing in frequency. In 1996, NOAA Fisheries received reports from observers on commercial fishing vessels that sperm whales were preying on sablefish caught on commercial longline gear in the GOA. Three entanglements have been reported in the GOA longline fishery; one in 1997, 1999, and 2000. In two cases (1997 and 2000), the whales were released without serious injury; although the whale entangled in 1999 was alive when released, the extent of injuries to the whale is not known (Angliss *et al.* 2001, NMFS 2000b). Several observer reports have noted efforts by fishermen to deter sperm whales from their lines, including yelling at the whales and throwing seal bombs in the water. A pilot project using fishery observers in 1997 and 1998 was initiated to determine the extent of the interactions between sperm whales and the commercial longline fishery in Alaska (Hill *et al.* 1999).

Indirect Effects through Changes in Prey Availability

Sperm whale diets overlap with commercial fisheries harvests more than any other species of toothed whales, but the degree of overlap is at least partly because of direct interactions with longline gear. In addition to consuming primarily medium- to large-sized squids, sperm whales also consume some fish and have been observed feeding off longline gear targeting sablefish and halibut in the GOA. The interactions with commercial longline gear do not appear to have an adverse impact on sperm whales. Much to the contrary, the whales appear to have become more attracted to these vessels in recent years (Angliss *et al.* 2001).

Comparative Baseline

Sperm whales are divided into several stocks in U.S. waters, including the North Pacific stock that regularly inhabits Alaskan waters, but population estimates are considered unreliable. Sperm whales are listed as endangered under the ESA. No incidental take of sperm whales has been observed or reported in commercial fisheries, including the MSA groundfish fisheries, although there have been reports of fishermen trying to deter sperm whales from their longline catches in the GOA. NOAA Fisheries has issued a BiOp that concludes the groundfish fisheries do not jeopardize the recovery or survival of endangered sperm whales (Table 3.8-19).

Status for Cumulative Effects Analysis

Because of their endangered status under the ESA, sperm whales will be considered in the analysis of Alternative FMPs in Chapter 4. However, since they interact so infrequently with the groundfish fisheries, sperm whales will be considered in the toothed whale species group in the analysis of Alternative FMPs in Chapter 4.

3.8.20 Beaked Whales

– Baird’s beaked whale (*Berardius bairdii*)
– Cuvier’s beaked whale (*Ziphius cavirostris*)
– Stejneger’s beaked whale (*Mesoplodon stejnegeri*), also known as the Bering Sea beaked whale

Distribution and History

Baird’s beaked whales inhabit the North Pacific Ocean and adjacent seas, particularly in areas with submarine escarpments and seamounts (Kasuya and Ohsumi 1984, Ohsumi 1983). In the eastern North Pacific Ocean, the species range extends north into the Bering Sea at least as far as Saint Matthew Island and the Pribilof Islands, where stranded individuals have been found (Hanna 1920, Rice 1986b). An apparent break in distribution occurs in the eastern GOA, but there are sighting records from the mid-gulf to the Aleutian Islands and in the southern Bering Sea (Kasuya and Ohsumi 1984). According to Tomilin (1957), Baird’s beaked whales arrive in the Okhotsk and Bering seas in April and May and are especially numerous in summer months. Baird’s beaked whales are migratory, arriving in continental slope waters during summer and fall months when surface water temperatures are the highest (Dohl *et al.* 1983, Kasuya 1986). Baird’s beaked whales are the most commonly observed beaked whales in their range, perhaps because they are relatively large and gregarious, traveling in schools composed of a few to several dozen animals (Balcomb 1989).

Cuvier's beaked whales are distributed in all oceans and most seas and range as far north as the Aleutian Islands (Moore 1963, Rice 1986b). No seasonal changes in distribution are apparent from stranding records, and morphological evidence is consistent with a single panmitic population from Baja California to Alaska (Barlow *et al.* 1997, Mitchell 1968).

Stejneger's beaked whales are rarely observed at sea, and distribution has been inferred from stranded animals (Loughlin and Perez 1985, Mead 1989). They are endemic to the cold temperate waters of the North Pacific Ocean, ranging from the coast of California north through the GOA and Aleutian Islands and into the Bering Sea as far as the Pribilof Islands and Commander Islands (Loughlin and Perez 1985). Stejneger's beaked whales are believed to inhabit deeper waters of the continental slope (Moore 1963, Morris *et al.* 1983) and frequent the Aleutian Basin and Aleutian Trench rather than the shallow waters of the northern or eastern Bering Sea (Mead 1989). This species is not known to enter the Arctic Ocean and is the only species of *Mesoplodon* in Alaskan waters (Loughlin and Perez 1985). Loughlin *et al.* (1982) reported that Stejneger's beaked whales sighted in the central Aleutian Islands were in groups of 5 to 15 individuals.

Due to the rarity of beaked whale sightings at sea, there are no reliable estimates for the number of Baird's, Cuvier's, or Stejneger's beaked whales in Alaska waters (Hill and DeMaster 1999). The abundance of Baird's beaked whales off the Pacific coast of Japan is about 5,000 animals (Kasuya *et al.* 1997, Miyashita 1986, Miyashita and Kato 1993), but it is unclear whether these animals mix with whales in Alaska waters.

Trophic Interactions

Prey species of Baird's beaked whales include benthic and epibenthic creatures such as squid, skate, grenadier, rockfish, and octopus (Pike 1953, Tomilin 1957), as well as pelagic species such as Atka mackerel, sardines, and Pacific saury (Nishiwaki and Oguro 1971). Judging by the benthic habits of their prey species, these whales routinely dive to depths of 1,000 m. Typical dives are 25 to 35 minutes in duration and dives of 45 minutes are not unusual (Balcomb 1989).

Squid are considered to be the primary prey of Cuvier's beaked whales, although few stomach samples have been analyzed. Fiscus (1997) reviewed the prey species identified in the stomach contents of animals found stranded on Amchitka Island and Kodiak Island (Foster and Hare 1990) and concluded that, in Alaskan waters, Cuvier's beaked whales feed mainly on cephalopod species that inhabit mesopelagic and deeper depths in the open ocean. However, he also noted that some of these squid species (mostly gonatids) have been taken in surface gillnets (Fiscus 1997, Fiscus and Mercer 1982, Kubodera *et al.* 1983).

The primary food of Stejneger's beaked whale is probably squid (Moore 1963, Tomilin 1957). Mead (1989) found trace quantities of squid beaks, but no fish in the stomachs of two stranded animals. Stomach samples collected from eleven animals stranded on Adak Island, Alaska, contained primarily cephalophods of the families Gonatidae and Cranchiidae (Walker and Hanson 1999).

Management Overview

All three species of beaked whales fall under the jurisdiction of the NOAA Fisheries PRD, and are protected under the MMPA. The Alaska stocks of Baird's, Cuvier's, and Stejneger's beaked whales are not listed as threatened or endangered under the ESA, nor are they considered depleted or strategic under the MMPA. Since there are no reliable estimates of population size, no values for PBR have been calculated (Hill and DeMaster 1999).

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

There are no known subsistence hunts for any beaked whales in Alaska. Japanese whalers reportedly took an average of 54 Baird's beaked whales per year from 1992 to 1997, but it is not known whether these whales came from the Alaska stock (Angliss and Lodge 2002).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries observers monitored incidental take in the 1990 to 1997 BSAI and GOA groundfish trawl, longline, and pot fisheries, and no mortalities or serious injuries of Baird's, Cuvier's, or Stejneger's beaked whales were observed (Hill and DeMaster 1999). No other interactions between commercial fisheries and beaked whales have been recorded in Alaska.

Comparative Baseline

Three species of beaked whales are present in the project area but their ecology and population dynamics are very poorly known. There appears to be essentially no direct impacts of the groundfish fishery on these species. The past/present effect on beaked whales are summarized in Table 3.8-20.

Status for Cumulative Effects Analysis

Because they do not appear to interact directly with the groundfish fisheries, the three species of beaked whales will be considered as part of the toothed whales species group in the analysis of Alternative FMPs in Chapter 4.

3.8.21 Pacific White-Sided Dolphin (*Lagenorhychus obliquidens*)

Life History and Distribution

Pacific white-sided dolphins are found throughout the temperate North Pacific Ocean north to the GOA and west to Amchitka in the Aleutian Islands, but are rarely encountered in the southern Bering Sea. They are mostly pelagic but also occur occasionally on the continental shelf (Dahlheim and Towell 1994, Ferrero and Walker 1996, Hobbs and Jones 1993). These gregarious dolphins are found in groups of 5 to 100 individuals but can also occur in large schools of up to 1000 during migration (Evans 1977).

Of two stocks recognized in the North Pacific Ocean, the North Pacific stock is present in the BSAI and GOA management areas (Angliss *et al.* 2001). The most complete population abundance estimate for Pacific white-sided dolphins was calculated from line transect analyses applied to the 1987 to 1990 central North Pacific marine mammal sightings survey data (Buckland *et al.* 1993). That abundance estimate, 931,000 animals, more closely reflects a rangewide estimate rather than one that can be applied to either of the two management stocks off the west coast of North America. However, the portion of the Buckland *et al.* (1993) estimate derived from sightings north of 45°N in the GOA (26,880) can be used as the population estimate for this area. At present, there are no reliable data to estimate population trends for this species (Angliss *et al.* 2001).

Trophic Interactions

Prey of the Pacific white-sided dolphin include a variety of small schooling fish, such as sauries and lanternfish, and also squid, which they feed on at night (Walker and Jones 1993).

Management Overview

Pacific white-sided dolphins fall under the jurisdiction of the NOAA Fisheries PRD, and are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. The calculated PBR for this species is 294 animals per year (Angliss *et al.* 2001). They are not listed as depleted or strategic under the MMPA.

Past and Present Effects and Management Measures

Direct Mortality from Incidental Take in External Fisheries

Between 1978 and 1991, thousands of Pacific white-sided dolphins were killed annually in the high seas driftnet fisheries (Angliss *et al.* 2001). However, these fisheries have been outlawed by international agreement since 1992. Self-reported records from state-managed salmon gillnet fisheries indicate a take of approximately two dolphins per year. However, data on these interactions are incomplete and most likely underestimate actual take (Angliss *et al.* 2001). Records of toothed whale entanglement in derelict fishing gear are almost entirely absent (Laist 1997).

Direct Mortality from Incidental Take in Groundfish Fisheries

Incidental take in the BSAI and GOA groundfish trawl, longline, and pot fisheries was recorded by NOAA Fisheries-certified observers from 1990 to 1998. One dolphin was taken in that time period in the BSAI trawl fishery and one in the BSAI longline fishery (Angliss *et al.* 2001). No dolphins were reported from any other fishery.

Comparative Baseline

The Pacific white-sided dolphin is a fairly common seasonal resident of the BSAI and GOA. There is very little overlap between their prey and species taken in the groundfish fisheries. Incidental take in the groundfish fisheries or other current fisheries is rare. The past/present effects on Pacific white-sided dolphin are summarized in Table 3.8-21.

Status of Cumulative Effects Analysis

Based on the lack of interaction between the groundfish fisheries and the Pacific white-sided dolphin, the low level of effect in other fisheries, and its lack of status under the MMPA or ESA, this species will be discussed only as part of the toothed whales species group in the analysis of FMP alternatives in Chapter 4.

3.8.22 Killer Whale (*Orcinus orca*)

Distribution and Abundance

Killer whales occur in stable social groups called pods. Three types of pods have been identified based on differences in behavior, ecology, and morphology (Bigg *et al.* 1987, Heyning and Dahlheim 1988). Resident pods are seen throughout much of the year in certain areas and concentrate on eating fish. Transient pods appear to move over broad areas and concentrate on marine mammal prey. A third type of killer whale, termed the offshore type, has been observed in southeast Alaska but is found in more southern waters (Angliss *et al.* 2001). Whales from the different pod types are genetically distinct and do not appear to interact with each other.

Killer whales have been observed in all oceans and seas of the world (Leatherwood *et al.* 1982) and are present throughout the BSAI and GOA area (Braham and Dahlheim 1982). They occur primarily in coastal waters, although they have been sighted well offshore (Heyning and Dahlheim 1988). Five stocks of killer whales have been recognized in U.S. Pacific waters, two of which are regularly found in Alaska. The eastern North Pacific northern resident stock (hereinafter referred to as the resident stock) occurs from British Columbia north and west through all Alaskan marine waters. The eastern North Pacific transient stock (hereinafter referred to as the transient stock) occurs from Washington north and west through all Alaskan marine waters (Angliss *et al.* 2001).

During the 1980s, photoidentification techniques were used for the first time in southeast Alaska and in PWS to determine the number of individuals and pods of killer whales occurring in those two areas. Following the EVOS, these studies were expanded and carried out on a more systematic basis. As a result of this research, 216 resident whales have been identified in British Columbia as of 1998; 99 have been identified in southeast Alaska as of 1999; and 362 resident whales have been identified in PWS and Kenai Fjords as of 1998. An additional 68 whales that have ties to other resident pods reside in waters west of Seward and are considered part of the resident stock (745 total known residents). Some whales that have only been studied through photographs have been provisionally determined to be residents, including 241 whales observed in waters west of Seward, so the total resident stock size in Alaska should be considered a minimum value. At present there are no reliable data on resident whale population trends (Angliss and Lodge 2002).

The number of transient killer whales in Alaska waters includes 219 that traverse British Columbia and southeast Alaska, 11 in PWS, and 21 in the eastern GOA (251 total known transients). An additional 14 whales in southeast Alaska and 53 whales in waters west of Seward have been provisionally identified as transients (based on morphological characteristics visible in photographs), so the total transient stock size in Alaska should be considered a minimum value. At present there are no reliable data on transient whale population trends (Dahlheim 2001, Angliss and Lodge 2002).

Trophic Interactions

Resident killer whales appear to feed primarily on a wide variety of fish such as salmon, herring, halibut, and cod. Transient killer whales are opportunistic feeders and have been observed to prey on virtually any large marine animal available (Jefferson *et al.* 1991). Killer whales also have been observed to prey on river otters, squid, and several species of birds. Killer whales may briefly leave the water to grab seals and sea lions from the shore. Animals within a pod often feed cooperatively. When preying on large animals such as gray or humpback whales, the killer whales may attack as a pack, tearing away at the prey animal from several angles. When preying on schooling fish, smaller killer whales may swim close to the beach to drive the fish from shallow waters out to the rest of the pod. Large groups of killer whales are often involved in hunting schools of fish. Smaller groups (two to eight animals) are more often used when preying on marine mammals such as seals or porpoises (Baird 2000).

Killer whales frequently take fish directly from commercial fishing gear as it is retrieved. Interactions with commercial longline fisheries are well-documented throughout the BSAI. Depredation rates of bottomfish by killer whales on longline catches, based on four different methods of calculation, suggested that whales took 14 to 60 percent of the sablefish, 39 to 69 percent of the Greenland turbot, and 6 to 42 percent of the arrowtooth flounder caught in commercial gear (Yano and Dahlheim 1995). Depredation rates can be so high in some areas that fishermen have abandoned particular fisheries even when they are still open.

Management Overview

Killer whales fall under the jurisdiction of the NOAA Fisheries PRD, and are protected under the MMPA. The resident stocks are not considered depleted or strategic, however, in 2003, NOAA Fisheries proposed to designate the AT1 group of killer whales as a depleted stock of marine mammals pursuant to the MMPA and is based on biological evidence that indicates that the group is a depleted population stock as defined by the MMPA (68 FR 206 [60899-60903] 2003). The MMPA established a moratorium on the taking of all marine mammals in the U.S. Killer whales are not taken for subsistence use by Alaska Natives. Because population estimates for killer whales are considered minimums and do not include provisionally classified whales, the calculated values for PBR are considered to be conservative estimates. For the resident stock (including 216 whales resident in British Columbia), the PBR is 7.2 whales per year, and for the smaller transient stock, the PBR is 2.8 whales per year (Angliss *et al.* 2001).

Past and Present Human Effects and Management Actions

<u>Direct Mortality: Harvest and Other Intentional Take</u>

Killer whales have not been targeted by commercial whalers or subsistence hunters.

Direct Mortality from Incidental Take in External Fisheries

Canadian fisheries that are most likely to interact with killer whales are not generally covered by independent observers. In 1994, the salmon gillnet fishery reported one killer whale hitting salmon gillnet gear but not becoming entangled. No killer whale mortalities have been reported in Canadian or state-managed fisheries (Angliss *et al.* 2001). Records of toothed whale entanglement in derelict fishing gear are almost entirely absent (Laist 1997).

Direct Mortality from Incidental Take by MSA Groundfish Fisheries

NOAA Fisheries-certified observers monitored incidental take in the 1990 to 1999 BSAI and GOA groundfish trawl, longline, and pot fisheries. Incidental mortality of killer whales occurred in the BSAI groundfish trawl (including four observed takes and one during an unobserved trawl) and longline fisheries (including one observed take and two during unobserved hauls). For the most recent 5-year period, 1995 to 1999, the mean annual estimated mortality is 0.6 killer whales in the BSAI trawl and 0.8 whales in the BSAI longline fisheries. No killer whale mortality was observed in the pot fisheries. The combined mortality from the observed groundfish fisheries was therefore 1.4 whales per year (Angliss *et al.* 2001). While whales interacting with fisheries are most likely from resident pods (since they eat fish), no genetic testing has been done on whales incidentally taken in the groundfish fisheries to ascertain whether they were from resident or transient stocks. Because of this uncertainty, NOAA Fisheries counts the mortality from fisheries against the PBR for each of the stocks in its annual MMPA stock assessments (Angliss *et al.* 2001).

Direct Mortality from Vessel Strikes

In addition to mortalities caused by entanglement, killer whales are also susceptible to injury or mortality through vessel strikes. Several observers have reported large groups of killer whales following trawl vessels in the BSAI, sometimes for days at a time, in order to consume fish-processing wastes (Angliss *et al.* 2001). One killer whale was reported to be killed when it struck the propeller of a BSAI groundfish trawl vessel in 1998 (Angliss and Lodge 2002).

Direct Mortality from Illegal Shooting

Killer whales interact with longline fisheries in the BSAI and GOA where predation on catch, especially sablefish and Greenland turbot, occurs periodically as gear is being retrieved (Dahlheim *et al.* 1996). During the 1992 killer whale surveys in the BSAI and western GOA, 9 of 182 individual whales (4.9 percent) had evidence of bullet wounds, presumably from irate fishermen. Under provisions of the MMPA, it is illegal to shoot or injure killer whales. The relationship between wounding due to shooting and survival is unknown (Angliss *et al.* 2001). In PWS, the pod responsible for most of the fishery interactions experienced a 59 percent decline in its members (from 37 to 15) between 1986 and 1991. These whales are believed to have died but the cause of death, whether from gunshot wounds, the EVOS, or some other factor, is unknown (Dahlheim and Matkin 1994).

Indirect Effects through Changes in Prey Availability

Many factors may affect the abundance and distribution of the various fish species consumed by resident killer whales, including directed fisheries on those species and oceanographic fluctuations. Given the ability of whales to eat a variety of fish species and to hunt over large areas of water, it seems unlikely that resident whales find food limited. However, the large decline in the western stock of Steller sea lions over the past 20 years has led to concerns that transient killer whales may be experiencing a relative shortage of this preferred prey and have been switching to less preferred prey such as harbor seals, northern fur seals, and sea otters. The decline of all these species at the same time has led to concern about possible cascading effects of commercial fishing on predator-prey relationships. However, recent surveys of transient killer whales in PWS, outer Kenai Peninsula and Kodiak indicates the number of killer whales feeding off Steller sea lions is likely quite low (possibly <30). Additional data is needed to determine the actual contribution to the decline or recovery of Steller sea lions (Matkin *et al.* 2003).

Comparative Baseline

Killer whales are divided into two stocks that regularly inhabit Alaskan waters, the eastern North Pacific northern Resident stock (745 known residents) and the eastern North Pacific northern transient stock (251 known transients). Population estimates are made by identifying individual whales through photographic analysis but a substantial numbers of provisional identifications are not included in the estimates, so they should be considered minimums. Resident whales feed on various fish species and are likely the type that interacts directly with the fisheries through depredation of longline catches, incidental take in trawl and longline gear, and other effects. Transient whales concentrate on marine mammal prey and are being investigated for their potential role in the decline of Steller sea lion populations as well as other marine mammal species. The past/present effects on killer whales are summarized in Table 3.8-22.

Status for Cumulative Effects Analysis

Because of their frequent interaction with the groundfish fisheries and their possible role in the decline of several marine mammal species, killer whales will be considered as a separate species in the analysis of Alternative FMPs in Chapter 4.

3.8.23 Beluga Whale (*Delphinapterus leucas*)

Distribution and Abundance

Belugas are distributed throughout seasonally ice-covered arctic and subarctic waters of the northern hemisphere and are closely associated with open leads and polynyas in ice-covered regions (Gurevich 1980, Hazard 1988). Five stocks are recognized in Alaskan waters: Beaufort Sea, eastern Chukchi Sea, EBS, Bristol Bay, and Cook Inlet. The first four stocks winter in the drifting ice of the Bering Sea and segregate into four discrete stocks in the spring, with concentrations in Bristol Bay, Norton Sound, Kotzebue Sound, and Kasegaluk Lagoon (Hazard 1988, O'Corry-Crowe *et al.* 1997, O'Corry-Crowe and Lowry 1997). The Cook Inlet population occurs in the inlet and Shelikof Strait region, although wanderers have been seen east to Yakutat Bay and to Kodiak Island (Angliss and Lodge 2002).

Belugas can move long distances. Some migrate over 1,500 miles from the Bering Sea to the Mackenzie River estuary in Canada. In Bristol Bay, they sometimes swim over 100 miles per day. It is not unusual for belugas to ascend large rivers such as the Yukon, and they seem to be unaffected by salinity changes. Belugas are very vocal animals, producing a variety of grunts, clicks, chirps, and whistles which are used for navigating, finding prey, and communicating. Because of this, they have sometimes been called "sea canaries" (Lowry 1994).

Since belugas are closely associated with ice flows, aerial survey counts of whales must account for the number of animals under the ice or otherwise undetectable during surveys by multiplying actual counts by a correction factor. For belugas, this correction factor typically ranges between 2.5 and 3.27 (Frost and Lowry 1995). The most recent aerial survey of the Beaufort Sea stock was conducted in July 1992 and yielded a corrected estimate of almost 40,000 whales. This stock is considered to be stable or increasing (Hill and DeMaster 1999). Aerial surveys of the Chukchi stock in 1989 to 1991 yielded a corrected estimate of 3,710 whales. Based on comparisons of this data with more recent but less comprehensive surveys, this stock appears to be stable (Hill and DeMaster 1999). Aerial surveys of the eastern Bering stock were conducted yearly between 1992 to 1995 and yielded a corrected estimate of about 8,000 whales. Aerial surveys of Norton Sound were also conducted in 2000. Preliminary analysis of this data yielded a corrected estimate of 18,142 belugas in the eastern Bering stock (Angliss and Lodge 2002). This major difference in population estimates may be more of an artifact of differences in survey routes and conditions between years rather than an actual population change, but it does indicate that the population is at least stable or increasing (Angliss and Lodge 2002). Based on a series of aerial surveys, the corrected abundance estimate for the Bristol Bay stock was 1,555 in 1994, 2,133 in 1999, and 1,642 in 2000. These estimates are at or above the high end of estimates made in the 1950s and in 1983, suggesting that the Bristol Bay stock is at least stable and may be increasing (Angliss and Lodge 2002).

The Cook Inlet population has declined significantly from historic levels. A comprehensive aerial survey conducted in 1979 yielded a corrected estimated population of 1,293 whales (Hill and DeMaster 2000). This stock has been surveyed annually since 1994 and has shown a 50 percent decline from 1994 to 1999. The corrected estimate for this stock was 375 whales in 1999 and 435 whales in 2000 (Angliss and Lodge 2002). Offshore sightings of belugas in upper Cook Inlet have declined since 1994 and sightings in lower Cook Inlet have been dramatically reduced (Angliss and Lodge 2002).

Trophic Interactions

Alaskan belugas feed primarily on a variety of schooling and anadromous fishes that are sequentially abundant in coastal zones (e.g., herring, capelin, smelt, eulachon, cod, and salmon) during the spring and summer. Octopus, squid, shrimps, crabs, and clams are eaten occasionally. Fall and winter diets are not known (Frost and Lowry 1981, Lowry *et al.* 1985). Most feeding is done over the continental shelf and in nearshore estuaries and river mouths. In the shallow waters of Alaska, most feeding dives are probably to depths of 6 to 30 m and last two to five minutes. In captivity, beluga whale food consumption rates were found to vary with age, sex, and season. On average, the larger the animal the smaller the relative food intake; therefore, belugas at 200 kg consumed about 4.5 percent of their body weight per day while belugas at 1,400 kg needed only 1.2 percent (Kastelein *et al.* 1994).

Natural predators of belugas include polar bears and killer whales. They are also a traditionally significant part of Alaska Native subsistence hunts in some coastal communities.

Management Overview

Beluga whales fall under the jurisdiction of the NOAA Fisheries PRD, and are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. In 1994, an amendment to the MMPA included provisions for the development of cooperative agreements between USFWS, NOAA Fisheries, and Alaska Native organizations to conserve and co-manage marine mammals. NOAA Fisheries has signed agreements with the Alaska Beluga Whale Committee for co-management of the four western Alaska beluga stocks and with the Cook Inlet Marine Mammal Commission (CIMMC) for co-management of that population.

The Cook Inlet population has declined significantly from historic levels and has become the subject of intensive co-management actions. NOAA Fisheries decided that listing the population under the ESA was not warranted (64 FR 38778) but did designate the population as depleted and strategic under the MMPA in May 2000 (65 FR 34590). Subsistence hunting was determined to be the immediate cause of the decline, and this activity has been essentially halted until the stock improves (Mahoney and Shelden 2000). None of the other stocks are listed as depleted under the MMPA.

Past and Present Human Effects and Management Actions

Direct Mortality: Harvest and Other Intentional Take

Belugas are harvested by Alaska Natives living in coastal villages from Cook Inlet to Barter Island. Belugas are principally used for human consumption, either as meat or muktuk, which consists of skin and the outer layer of blubber. The oil is used for cooking and for fuel. Belugas are hunted in spring as they travel northward through channels of water through the ice, as well as during the summer and autumn open-water period.

Data on subsistence harvest of beluga whales are provided by the Alaska Beluga Whale Commission. The annual subsistence harvest of beluga whales from the Beaufort Sea stock (1996 to 2000) includes an average of 68 whales per year by Alaska Natives and 109 whales per year by Canadian Natives (Angliss and Lodge 2002). The total average take is thus 177 belugas per year, well below the calculated PBR of 649 animals in this stock (Angliss and Lodge 2002). The annual subsistence harvest of beluga whales from the Chukchi stock (1996 to 2000) averages 60 animals per year. The calculated PBR for this stock is 74 animals per year (Angliss and Lodge 2002). The annual subsistence harvest of beluga whales from the EBS stock (1996 to 2000) averages 164 animals per year. The calculated PBR for this stock is 298 animals per year (Angliss and Lodge 2002). The annual subsistence harvest of beluga whales from the Bristol Bay stock (1996 to 2000) averages 15 animals per year. The calculated PBR for this stock is 32 animals per year (Angliss and Lodge 2002).

As noted above, the decline of the Cook Inlet beluga population is thought to have been the result of subsistence harvests by Alaska Natives. Between 1993 and 1998, the numbers of belugas that were reported to be taken ranged from 21 to 123 animals per year, not including an apparently large number of whales that were struck and lost. Beginning in 1999, subsistence harvest of belugas in this area was prohibited under the MSA, unless a co-management agreement between hunting communities and CIMMC was established. Since 1999, such agreements have been made for the strike of beluga whales by hunters from the Native Village of Tyonek and for Cook Inlet community hunters. In 2001, Native Village of Tyonek hunters harvested one beluga. Cook Inlet community hunters took one in 2002. Future agreements under MMPA allow for one strike for Native Village of Tyonek in 2003 and 2004, and one strike for Cook Inlet community hunters in 2004. The co-management agreements are for strikes only, regardless of whether or not the animal is retrieved (NMFS and CIMMC 2002). The PBR for this stock is calculated to be 2.2 animals per year (Angliss and Lodge 2002).

<u>Direct Mortality from Incidental Take in External Fisheries</u>

Commercial salmon gillnet fisheries in the Bristol Bay area are not subject to any observer program, but are required to self-report interactions with marine mammals. Between 1990 to 2000 there were two reports of beluga mortality in fishing gear. Self-reports are likely to under estimate interactions. In 1983, ADF&G documented 12 beluga whale mortalities in Bristol Bay related to drift and set gillnet fishing (Hobbs *et al.* 2000). State-managed personal use and subsistence salmon fisheries also occur in coastal waters used by belugas, but there are no reporting requirements for these fisheries. However, one beluga was reported to be taken from the eastern Bering stock in 1996, and seven were reported taken in Bristol Bay in 2000. The extent of these non-commercial fishery interactions is unclear given the lack of reporting requirements. It is likely that belugas taken in subsistence nets were themselves used for subsistence purposes by Alaska Natives and may have been counted in subsistence harvest data (Hobbs *et al.* 2000).

In 1999 and 2000, observers were placed on Cook Inlet commercial salmon set and drift gillnet vessels because of the potential for incidental take of belugas. No belugas were observed to be taken in these fisheries in either year or self-reported in the fisheries between 1990 to 2000 (Angliss and Lodge 2002).

<u>Direct Mortality from Incidental Take by MSA Groundfish Fisheries</u>

NOAA Fisheries-certified observers monitored incidental take in the 1990 to 1998 BSAI groundfish trawl, longline, and pot fisheries. No mortality or serious injuries to belugas were observed incidental to these fisheries (Hill and DeMaster 1999). Three different commercial fisheries that could have interacted with beluga whales in Bristol Bay and the EBS were monitored by fishery observers for incidental take during 1990 to 1999: BSAI groundfish trawl, longline, and pot fisheries. Observers did not report any mortality or serious injury of beluga whales incidental to these groundfish fisheries (Angliss *et al.* 2001). A review of all cetacean surveys conducted in the GOA from 1936 to 1999 discovered only 31 sightings of belugas among 23,000 sightings of other cetaceans, indicating that very few belugas occur in the GOA outside of Cook Inlet (Laidre *et al.* 2000) and are therefore unlikely to interact with the GOA groundfish fishery.

<u>Direct Mortality from Strandings</u>

In 1996, 60 belugas were stranded in Turnagain Arm (Cook Inlet), causing at least four deaths. In 1999, another 60 belugas were stranded in Turnagain Arm with five whales subsequently found dead. There was no indication that the strandings were related to any human activity (Moore *et al.* 2000, Angliss and Lodge 2002).

Comparative Baseline

Beluga whales are divided into five stocks including four stocks that winter in the Bering Sea and one that resides year round in Cook Inlet. Population estimates are made by aerial surveys corrected for sightability of the whales. The four Bering Sea stocks appear to be stable or increasing. The Cook Inlet stock declined substantially in the last ten years because of excessive subsistence harvests and was recently listed as depleted under the MMPA. The stock is now under a co-management agreement that greatly controls subsistence harvest. Belugas feed on a variety of fish species, but prefer to forage near coastal waters or near the pack ice. No belugas have been reported to be taken in the groundfish fisheries, but they are infrequently taken in state-managed salmon fisheries. The past/present effects on beluga whales are summarized in Table 3.8-23.

Status for Cumulative Effects Analysis

Because of their infrequent interaction with the groundfish fisheries, beluga whales will be considered as part of the toothed whales species group in the analysis of Alternative FMPs in Chapter 4.

3.8.24 Harbor Porpoise (*Phocoena phocoena*)

Life History and Distribution

Harbor porpoises are found all along the coasts of the BSAI and GOA area and their range extends both north and south of these waters. They occur primarily in coastal waters, but are also found where the shelf extends offshore (Gaskin 1984, Dahlheim *et al.* 2000).

Differences found in genetic samples from California, Washington, British Columbia, and Alaska (Rosel *et al.* 1995) and studies of contaminant levels from California to Washington (Calambokidis and Barlow 1991) show that harbor porpoises do not move or interbreed over great distances. Because regional populations are believed to exist, it was considered prudent to establish three management units within Alaska: southeast Alaska, GOA, and BSAI stocks. Based on aerial surveys corrected for undetected animals and unsurveyed habitat, the most recent estimates of harbor porpoise numbers in these 3 stocks include 10,508 porpoises in southeast Alaska (1997 survey), 21,451 in the GOA (1998 survey), and 10,946 in just the Bristol Bay portion of the BSAI stock (1991 survey). No surveys have been conducted in the Aleutians or in the Bering sea north of Bristol Bay. The GOA survey in 1998 was considerably different than the previous surveys in 1991 to 1993, both in overall area covered and in the specific areas sampled. Largely due to this change in sampling, the corrected estimate from the earlier surveys (8,271) was much less than the 1998 survey (21,451). The 1998 survey is thought to be much more representative of the GOA stock size because it included more of the inshore habitat commonly used by harbor porpoise. No reliable information on abundance trends exists for any of these stocks (Angliss *et al.* 2001).

Trophic Interactions

No prey studies have been conducted in Alaska. However, prey studies in Washington and British Columbia found the diet of harbor porpoise to include cephalopods and a wide variety of fish, including Pacific herring, smelt, eelpout, eulachon, pollock, Pacific sand lance, and gadids (Gearin *et al.* 1994, Walker *et al.* 1998).

The total estimated annual food consumption by the population during summer in the EBS is 1,000 mt, of which 800 mt (85 percent) is fish (based on the estimated average pelagic abundance of 1,500 animals) (Perez and McAlister 1993). Captive, non-lactating harbor porpoises of various age and sex classes were found to consume between 750 and 3,250 grams of fish per day (equivalent to 4 to 9.5 percent of their body weight) (Kastelein *et al.* 1997). Rates of consumption depended on the caloric content of the fish as well as the age, body weight, exercise level, and individual basal metabolic rates. Wild harbor porpoises are expected to need more energy for thermoregulation and locomotion than did the animals in this study.

Management Overview

Most marine mammals, including porpoises, fall under the jurisdiction of the NOAA Fisheries and are protected under the MMPA. Harbor porpoise are not considered a strategic stock under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. However, there is no subsistence harvest of harbor porpoise (Angliss *et al.* 2001).

Past and Present Human Effects and Management Measures

Direct Mortality: Incidental Take in Groundfish Fisheries

The NOAA Fisheries observers monitored incidental take on the 1990 to 1998 BSAI and GOA groundfish trawl, longline, and pot fisheries. During this period, 21 to 31 percent of the GOA longline catch occurred within the range of the southeast Alaska harbor porpoise stock (Angliss *et al.* 2001). No incidental mortalities were recorded by observers, and logbook data for the GOA and Bering Sea harbor porpoise stocks. For all three stocks, a reliable mortality estimate rate incidental to commercial fisheries was considered unavailable because of the absence of observer placements in several fisheries.

Direct Mortality from Incidental Take in External Fisheries

An annual mean take of harbor porpoise is 3 mortalities documented from logbook records from the southeast Alaska salmon drift-gillnet fishery (1990 to 1998). No other fisheries report incidental take of this porpoise.

Comparative Baseline

Harbor porpoise is a common species in the BSAI and GOA but has little interaction with the groundfish fisheries. There is little competitive overlap between the ground fisheries and harbor porpoise prey. Annual incidental take in the groundfish fisheries rarely, if ever, occurs. This species is not classified as a strategic stock under the MMPA and is not an ESA-listed species. The past/present effects on harbor porpoise are summarized in Table 3.8-24.

Status of Cumulative Effects Analysis

The low level of interaction between the harbor porpoise and the groundfish fisheries and lack of incidental take, harbor porpoise will not be considered as a separate species in the analysis of Alternative in Chapter 4, but would be address with the toothed whale groups.

3.8.25 Dall's Porpoise (*Phocoenoides dalli*)

Life History and Distribution

Dall's porpoises are endemic to the northern North Pacific Ocean and adjoining seas, inhabiting both pelagic and nearshore habitats. The species is common along the entire coast of North America as far south as 32°N (Morejohn 1979). In the Bering Sea, sightings are infrequent north of 62°N (Nishiwaki 1966). They are present in the BSAI and GOA area all year round although there may be some seasonal onshore-offshore movements.

One stock of Dall's porpoise is recognized in Alaskan waters (Hill *et al.* 1997), although a separate Bering Sea stock has been suggested, based on differences in reproductive timing and parasite associations (Amino and Miyazaki 1992, Kasuya and Ogi 1987, Walker 1990, Walker and Sinclair 1990) and preliminary genetics analyses (Winans and Jones 1988). The Alaska stock of Dall's porpoise is estimated at 417,000. This number, however, may be overestimated as much as fivefold because of vessel attraction behavior (Hill *et al.* 1997, Turnock and Quinn 1991). There is no reliable data on population trends for this species (Angliss *et al.* 2001).

Trophic Interactions

Food habits data from the western Aleutian Islands suggest a diet composed primarily of cephalopods and myctophid fishes (Crawford 1981). The total estimated annual food consumption by the population during summer in the EBS is 169,000 mt, of which 84,500 mt (50 percent) is fish (Perez and McAlister 1993).

Management Overview

Most marine mammals, including porpoises, fall under the jurisdiction of the NOAA Fisheries and are protected under the MMPA. The MMPA established a moratorium on the taking of all marine mammals in the U.S. except for subsistence use by Alaska Natives. There is no subsistence take of Dall's porpoise by Alaska Natives. Dall's porpoise are not considered a strategic stock under the MMPA nor are they listed as threatened or endangered under the ESA.

Past and Present Human Effects and Management Actions

<u>Direct Mortality from Incidental Take by Groundfish Fisheries</u>

Six different commercial fisheries operating within the range of the Alaska stock of Dall's porpoise were monitored for incidental take by NOAA Fisheries observers during 1990 to 1998. No mortalities were observed in pot fisheries or in the GOA longline fishery. The mean annual (total) mortality was 6.0 for the Bering Sea groundfish trawl fishery, 1.2 for the GOA groundfish trawl fishery, and 1.6 for the Bering Sea groundfish longline fishery (Angliss and Lodge 2002).

Direct Mortality from External Fisheries

The Alaska Peninsula/Aleutian Island salmon drift gillnet fishery took an estimated 28 porpoises in 1990. Other state-managed salmon gillnet fisheries have low occurrences of incidental take but these data are based on limited self-reports and are considered unreliable for quantitative estimates (Angliss and Lodge 2002).

Comparative Baseline

Dall's Porpoise is a common species in the BSAI and GOA and interacts with the groundfish fisheries on a regular basis. Annual incidental take in the groundfish fisheries is relatively low for the large populations size in this region. There is little overlap between the prey of Dall's porpoise and the fish targeted by the groundfish fisheries. This species is not classified as a strategic stock under the MMPA and is not an ESA-listed species. The past/present effects on Dall's porpoise are summarized in Table 3.8-25.

Status of Cumulative Effects Analysis

Considering the low level of incidental take in the groundfish fisheries and their very limited overlap in prey species, Dall's porpoise will not be carried forward as separate species in analysis of Alternatives in Chapter 4 but will be grouped with the toothed whale group.

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