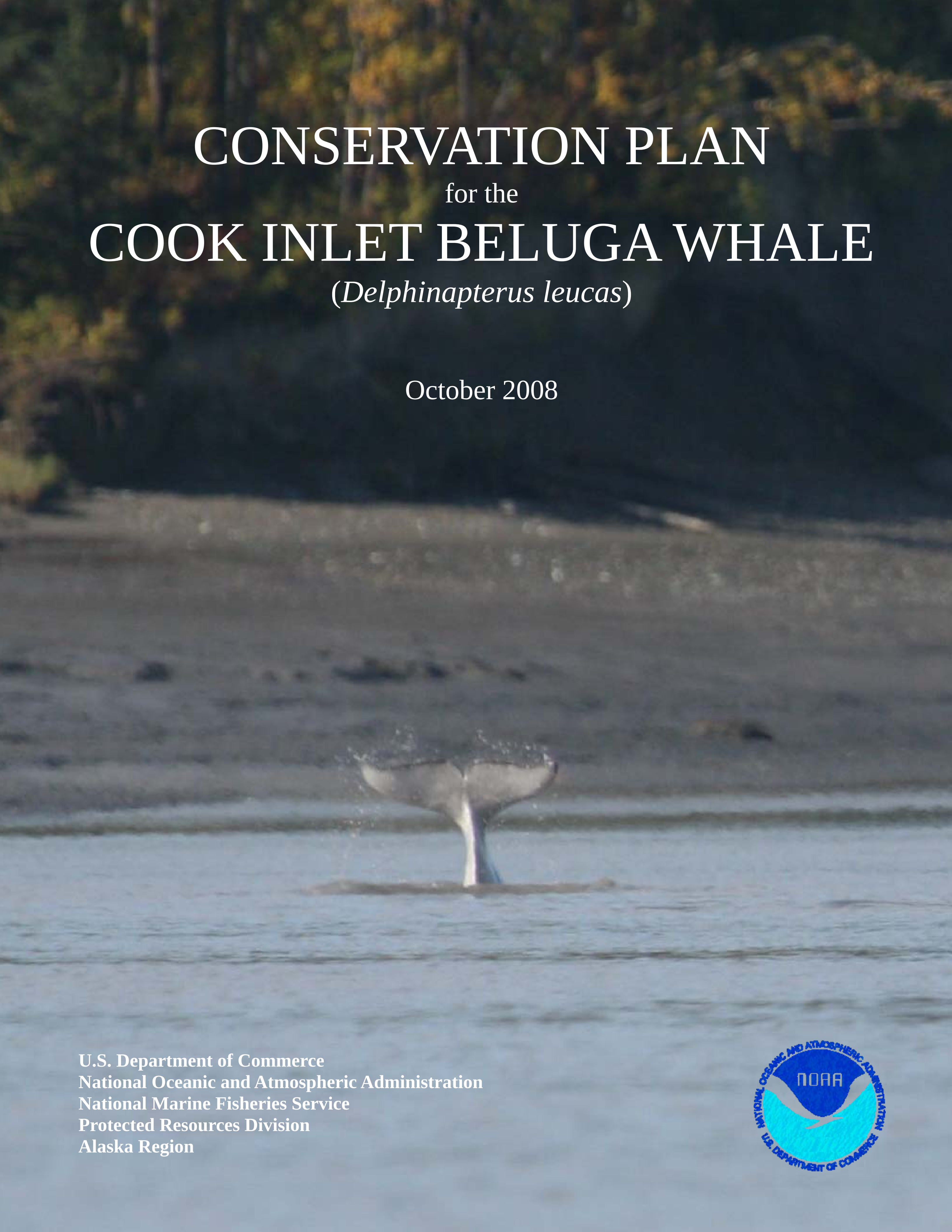

CONSERVATION PLAN
for the
COOK INLET BELUGA WHALE
(*Delphinapterus leucas*)

October 2008

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Protected Resources Division
Alaska Region

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THIS PLAN SHOULD BE CITED AS FOLLOWS:

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This Conservation Plan can also be downloaded from NMFS Alaska Region website:
http://www.alaskafisheries.noaa.gov/protectedresouces/whales/beluga/managment.htm

Cover photo (Cook Inlet beluga whale near Eagle River) by Christopher Garner, U.S. Army, Fort Richardson, Alaska, 2007.

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EXECUTIVE SUMMARY

Current Species Status

The Marine Mammal Protection Act of 1972, as amended (MMPA) requires the Secretary of Commerce to prepare a Conservation Plan to promote the conservation and restoration of any species or stock designated as "depleted" under the MMPA. Management responsibility for beluga whales in Alaska has been delegated by the Secretary of Commerce to the National Marine Fisheries Service (NMFS), Alaska Region.

The Cook Inlet beluga whale stock was estimated at 1,300 animals in 1979 (Calkins 1989). Abundance surveys conducted from 1994 to 2008 have resulted in population estimates ranging from a low of 278 animals to a high of 653 animals, with a current abundance estimate of 375 animals (see Figure 10). Aerial survey results indicated a 47 percent decline between 1994 and 1998. In response to this significant decline, NMFS designated the Cook Inlet beluga whale stock as depleted under the MMPA on May 31, 2000 (65 FR 34590). Subsequent surveys between 1999 and 2008 have demonstrated a further decline of 1.5 percent per year. Although harvests from this stock have been severely restricted (0-2 whales annually; 5 total) since 1999, considerable concern still remains regarding the conservation of Cook Inlet beluga whales.

Concerned that the stock may not be recovering as expected, in March 24, 2006 NMFS announced its intention to reevaluate the status of the Cook Inlet belugas (71 FR 14836). That status review, completed and published in November 2006, drew several significant conclusions about the stock's tenuous predicament. First, the review concluded that the contraction of the range of this population northward into the upper Inlet makes the population far more vulnerable to any catastrophic events that affect that area. Second, the population was not growing at two to six percent per year as had been anticipated with the cessation of unregulated hunting. Third, should this discrete and unique population not survive, it would be "highly unlikely" that other belugas would repopulate Cook Inlet. Based on models that incorporated the latest information available on Cook Inlet belugas, the 2006 status review predicted a 68 percent probability the Cook Inlet belugas will continue to decline and become extinct during the next 300 years (26 percent probability of extinction in 100 years) unless factors that determine their growth and survival were improved to allow for recovery (Hobbs et al. 2006).

On April 20, 2007, NMFS published a proposed rule to list the Cook Inlet beluga whale as an endangered species under the Endangered Species Act (ESA; 72 FR 19854). NMFS released another status review in April 2008, which upheld the conclusions drawn in the 2006 review. However, the most realistic model in the 2008 review predicted a 79 percent extinction probability in 300 years (39 percent probability of extinction in 100 years). On April 22, 2008, NMFS decided to postpone the ESA listing decision until October 2008 (73 FR 21578). Should the Cook Inlet belugas be listed as endangered, a separate process to develop a recovery plan, as required for an endangered species, would be initiated.

Distribution

Belugas generally occur in shallow, coastal waters, and while some populations make long seasonal migrations, Cook Inlet belugas reside in Cook Inlet year round. Data from satellite tagged whales documented that belugas concentrated in the upper Inlet at rivers and bays in the summer and fall, and then tended to disperse offshore and move to mid Inlet waters in the winter. The Traditional Ecological Knowledge (TEK) of Alaska Natives and systematic aerial survey data document a contraction of the summer range of Cook Inlet belugas. While belugas were once abundant and frequently sighted in the lower Inlet during summer, they are now primarily concentrated in the upper Inlet. This constriction is likely a function of a reduced population seeking the highest quality habitat that offers the most abundant prey, most favorable feeding topography, the best calving areas, and the best protection from predation. An expanding population would likely expand its range back into the lower Inlet. Thus, maintaining quality habitat in these areas is essential to the conservation of this population.

Valuable Habitat

NMFS has stratified Cook Inlet into three regions based upon patterns of beluga habitat use, and has labeled them as valuable habitat types 1, 2, and 3 (Figure 9). Type 1 habitat encompasses habitats with intensive beluga use from spring through fall, and which are important foraging and nursery habitats. Type 1 habitat includes all of Cook Inlet northeast of a line drawn from three miles southwest of the Beluga River across to Point Possession. Type 2 habitat is based on less concentrated spring and summer beluga use, and known fall and winter use areas. Type 2 habitat is located south of Type 1 habitat and north of a line at 60.2500 north latitude. It also extends south along the west side of the Inlet following the tidal flats into Kamishak Bay around to Douglas Reef, and includes an isolated section within Kachemak Bay. Type 3 habitat encompasses the remaining portions of Cook Inlet not designated as Type 1 or 2; the southern boundary is an opening into the Gulf of Alaska approximately 85 km across from Cape Douglas to Elizabeth Island. While Type 1 habitat is clearly the most valuable of the three habitat types based on the frequency of use and as feeding and calving habitats, the relative values of Types 2 and 3 habitats are difficult to distinguish because we have limited information about Cook Inlet belugas' wintering habitats and which features in these two habitat types are the most important to belugas. We have, however, classified these two habitat types separately based on observations of frequency of use and for management purposes.

Potential Threats

This Conservation Plan reviews and assesses the known and possible factors influencing the Cook Inlet beluga whales. Natural factors may include stranding events, predation, parasitism and disease, and environmental change. Human-induced factors may include subsistence harvest, poaching, fishing, pollution, vessel traffic, tourism and whale watching, coastal development, noise, oil and gas activities, and scientific research.

The documented decline of the Cook Inlet beluga whale population during the mid-1990s could be explained by subsistence harvest removals at a level that this small population could not sustain. Since that time, cooperative efforts between NMFS and subsistence users have dramatically reduced subsistence harvests. These harvest reductions should have allowed the Cook Inlet beluga population to recover had subsistence harvests been the only factor limiting the population at that time. Abundance data collected during the past several years, however, indicate that the population is not increasing as expected. It is not known what specific factor or combination of factors continue to limit this population's growth.

Conservation Program and Actions

NMFS has already implemented several management measures in an effort to curb the decline of the Cook Inlet beluga stock. Such measures include regulating subsistence harvests; developing a stranding response plan and a law enforcement plan; cooperating with other agencies to develop oil spill contingency plans; and regularly reviewing proposed state and federal permits and actions that may affect Cook Inlet beluga whales.

While much has been done to improve our knowledge of Cook Inlet beluga whales, there are still gaps in our knowledge and understanding which preclude a definitive analysis of factors limiting their recovery and which hinder effective management actions.

The goal of this Conservation Plan is to restore the Cook Inlet beluga whale stock to a healthy, viable population that no longer is designated as depleted under the MMPA. This goal will be met when there is an increasing or sustained population of at least 780 whales (i.e., the stock maintains its minimum optimal sustainable population, OSP, level), and appropriate habitat is available that will support a restored population. It is imperative that beluga habitat is protected as well, otherwise the restored population may experience another decline and require redesignation as depleted.

The conservation strategy NMFS will employ to reach this goal is to (1) improve our understanding of the biology of Cook Inlet beluga whales and the factors limiting the population's growth; (2) stop direct losses to the population; (3) protect valuable habitat, and (4) evaluate the effectiveness of these strategies and the success of the conservation actions in restoring the Cook Inlet beluga whale population.

Recommendations of actions for filling in the knowledge and management gaps were developed under six objectives. Specific actions under these objectives are covered in section III - Conservation Actions. The six over-arching objectives are:

- Objective 1: Monitor the Cook Inlet beluga whale population
- Objective 2: Improve knowledge of Cook Inlet belugas to determine which factors are limiting recovery
- Objective 3: Refine knowledge of Cook Inlet beluga whale habitat requirements and describe their range, distribution, and migration
- Objective 4: Reduce direct injuries and mortalities
- Objective 5: Protect valuable habitat
- Objective 6: Implement and evaluate the effectiveness of the Cook Inlet Beluga Whale Conservation Plan

While the goal of this plan is to restore this stock to a healthy population of no fewer than 780 whales, the time frames associated with this goal will depend on the growth rate within this population. Because the population has continued to decline 1.5 percent per year since the subsistence harvest was regulated in 1999, the date of recovery cannot be estimated. Costs for a fully funded conservation program for the first five years are estimated at $8,421-$8,821K. After this time, gaps in our current knowledge, population trends, and adaptive management actions need to be reassessed.

I. BACKGROUND

Management responsibility for beluga whales in Alaska lies with the Secretary of Commerce and has been delegated to National Marine Fisheries Service (NMFS) (see Appendix A for federal regulations relevant to Cook Inlet belugas). In response to the dramatic decline in the Cook Inlet beluga stock between 1994 and 1998 (Figure 10), NMFS initiated a status review of the Cook Inlet beluga whale pursuant to the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) on November 19, 1998. In early 1999, NMFS received three petitions to designate Cook Inlet belugas as depleted under the MMPA and/or as endangered under the ESA from the Alaska Department of Fish and Game (ADFG) and other tribal and non-governmental organizations. In May of 2000, NMFS designated the Cook Inlet beluga whale population as below its optimal sustainable population (OSP)[1] and, hence, depleted[2] within the meaning of the MMPA. Based on the best scientific data available at the time, NMFS determined that listing Cook Inlet beluga whales as endangered or threatened under the ESA was not warranted, but did determine them to be a distinct population segment.

Concerned that the stock had not recovered as expected, NMFS announced its intention to reevaluate the status of the Cook Inlet belugas in March 2006. The 2006 status review (Hobbs et al. 2006) drew several significant conclusions about the stock's abundance and trends. First, the review concluded that the reduced range into the upper Inlet makes Cook Inlet belugas far more vulnerable to catastrophic events that have the potential to kill or injure a significant portion of the population. Second, the population did not grow as anticipated after imposition of harvest regulations and reductions in 1999, but had declined 4.1 percent per year from 1999 through 2006. Third, should this discrete and unique population not survive, it was deemed highly unlikely that other belugas would repopulate Cook Inlet. Based on models that incorporated the latest data available at the time, the 2006 status review predicted a 68 percent probability that the Cook Inlet beluga would continue to decline and become extinct within the next 300 years (with a 26 percent probability of extinction within the next 100 years), unless factors that determine beluga whale growth and survival were altered to improve the stock's chances to recover (Hobbs et al. 2006).

Based on the findings of the 2006 status review, and consideration of unknown factors that may affect this species, NMFS published a proposed rule to list the Cook Inlet beluga whale as an endangered species under the ESA on April 20, 2007 (72 FR 19854). NMFS completed another status review in April 2008 (Hobbs et al. 2008), which supported the conclusions set forth in the 2006 status review. The most realistic prediction model presented in the 2008 status review, however, documented higher probabilities of extinction than those presented in the 2006 status review; the 2008 models showed a 79 percent probability of extinction within 300 years and a 39 percent probability of extinction within 100 years.

On April 22, 2008, NMFS elected to postpone the ESA listing decision until October 2008 (73 FR 21578) to allow for consideration of the 2008 abundance estimate. Should the Cook Inlet belugas be listed as endangered, a Recovery Plan would be prepared under the ESA and critical

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[1] OSP is "a population size which falls within a range from the population level of a given species or stock which is the largest supportable within the ecosystem to the population level that results in maximum net productivity" (50 CFR 216.3).

[2] A species or population is said to be depleted under the MMPA when the Secretary of Commerce "determines that a species or population stock is below its optimum sustainable population".

habitat will be designated, unless such designation would not be prudent (e.g., when identification of critical habitat could place the species at higher risk).

The MMPA requires the Secretary of Commerce to prepare a Conservation Plan for any species or stock designated as depleted under the MMPA and for which NMFS has management responsibility. The purpose of this Conservation Plan is to conserve and restore the Cook Inlet beluga whale population to its minimum OSP of 780 whales. The goals and objectives of the Conservation Plan can be achieved if a long-term commitment is made to support the respective actions recommended herein. The shared resources and cooperative involvement of federal, state, and local governments, industry, academia, non-governmental organizations, Alaska Natives, and other individuals will be required throughout the recovery period. This Conservation Plan is an important step in the overall conservation of Cook Inlet beluga whales.

This Conservation Plan reviews and assesses the known and possible threats influencing Cook Inlet beluga whales. Natural threats include stranding events, predation, parasitism and disease, and environmental change. Potential human impacts include subsistence harvest, poaching, fishing, pollution, vessel traffic, tourism and whale watching, coastal development, noise, oil and gas activities, and scientific research. In addition to identifying and assessing threats, this Plan also defines our strategies for restoring the Cook Inlet beluga whales to OSP and identifies specific conservation actions to aid in that effort.

A. Brief Overview

The beluga whale is a northern hemisphere species, ranging primarily over the Arctic Ocean and some adjoining seas, where they inhabit fjords, estuaries, and shallow water in Arctic and subarctic oceans. Some belugas seek out shallow coastal waters in summer, and in winter remain near the ice edge. Except for a small population in the Gulf of Saint Lawrence, Canada, this species is exclusively a subarctic and Arctic inhabitant. Belugas are found seasonally throughout Alaskan waters, except the Aleutian Islands and the Southeast panhandle region. Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985). Alaskan waters are home to five beluga stocks distinguished by their respective summer range (Figure 1): the Beaufort Sea, the eastern Chukchi Sea, the eastern Bering Sea, Bristol Bay, and Cook Inlet (Angliss and Outlaw 2007). Of the five stocks in Alaska, the Cook Inlet stock is the most isolated.

The most recent abundance estimates of the five distinct beluga whale stocks in Alaska are: Beaufort Sea, 32,453 belugas; eastern Chukchi Sea, 3,710 belugas; eastern Bering Sea, 14,898 belugas; Bristol Bay, 1,619 belugas; and Cook Inlet, 375 belugas (Angliss and Outlaw 2005; NMFS unpubl. data). The degree of genetic differentiation between the Cook Inlet stock and the other four Alaska beluga stocks indicates the Cook Inlet stock is the most isolated (O'Corry-Crowe et al. 1997, 2002). This suggests that the Alaska Peninsula has long been an effective physical barrier to genetic exchange. The lack of Cook Inlet beluga whale observations along the southern side of the Alaska Peninsula (Laidre et al. 2000) also supports this conclusion. Murray and Fay (1979) suggested this stock has been isolated for several thousand years, which has since been corroborated by genetic data (O'Corry-Crowe et al. 1997, 2002). During spring and summer months, beluga whales in Cook Inlet (Figure 2) are typically concentrated near

Figure 1. Map of summer distributions of the five distinct beluga stocks in Alaska.

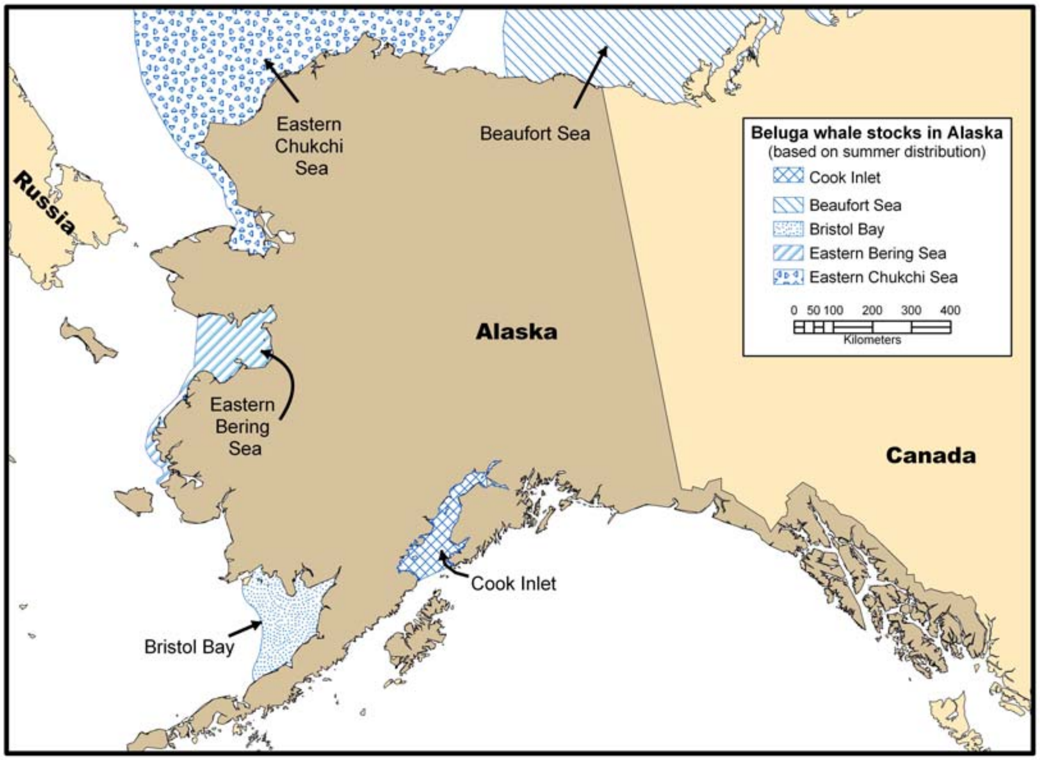
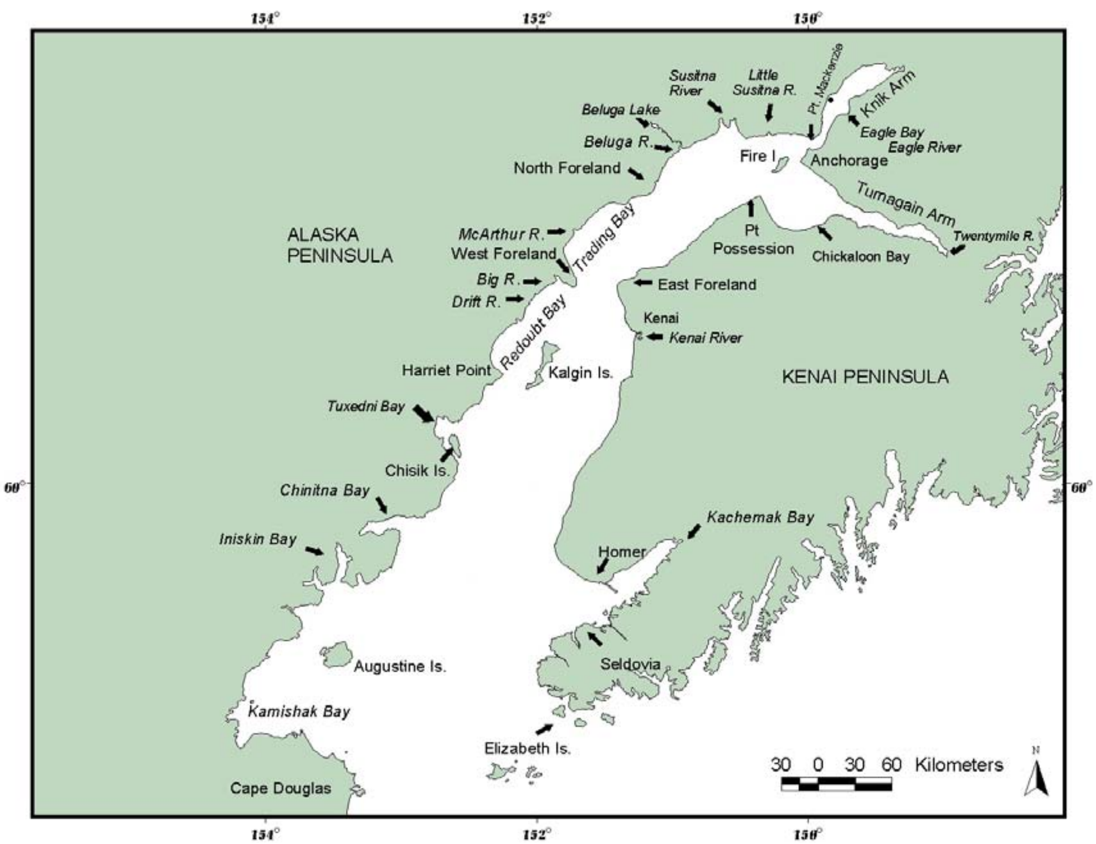


Figure 2. Map of Cook Inlet



river mouths in upper Cook Inlet (Rugh et al. 2000, 2005c). Although the exact winter distribution of this stock is unknown, there is evidence that some, if not all, of this population inhabits Cook Inlet year round (Hansen and Hubbard 1999; Rugh et al. 2000; Hobbs et al. 2005).

A review of cetacean surveys conducted in the Gulf of Alaska from 1936 to 2000 revealed only 31 sightings of belugas among 23,000 cetacean sightings, indicating that very few belugas occur in the Gulf of Alaska outside of Cook Inlet (Laidre et al. 2000). Beluga whales occur in Yakutat Bay and it appears that the group remains in the area throughout the year (Fiscus et al. 1976; Consiglieri and Braham 1982; Hansen and Hubbard 1999; O'Corry-Crowe et al. 2006). Genetic samples from Yakutat belugas suggest that the Yakutat whales may be more closely related to each other than whales sampled in other areas (O'Corry-Crowe et al. 2006), and are not likely to be random whales traveling from the Cook Inlet population. This genetic information, taken with the sighting data and behavioral observations, suggests that a small beluga group may be resident in the Yakutat Bay region year round, and that these whales have a unique ecology and a restricted seasonal home range. As such, it is unlikely that management decisions for the Yakutat group can be made using information from Cook Inlet belugas (O'Corry-Crowe et al. 2006). Therefore, this Conservation Plan will focus only on the belugas inhabiting Cook Inlet and does not further address the belugas of Yakutat Bay.

B. Description and Taxonomy

The beluga whale (*Delphinapterus leucas*) is a small, toothed whale in the family Monodontidae, a family it shares with only the narwhal. Belugas are also known as "white whales" because of the white coloration of the adults (the word "beluga" is derived from the Russian word for white, just as the word *leucas* in the species' scientific name is the Latin word for white). Calves are born in the summer and remain with their mothers for about 24 months. Calves are born dark gray to brownish gray and become lighter with age. Adults become white to yellow-white at sexual maturity, although Burns and Seaman (1986) report females may retain some gray coloration for as long as 21 years. McGuire et al. (2008) reported seeing ten photo-identified mothers that were still gray, thus suggesting that coloration is not a definitive indicator of maturity. Native hunters have reported that some Cook Inlet beluga whales may reach 20 feet in length (Huntington 2000), although the average adult size is more often 12-14 feet. Belugas are sexually dimorphic with males being larger than females of the same age (Burns and Seaman 1986). Males weigh up to 1,500 kg (3,307 pounds) and females 1,360 kg (2,998 pounds) (Nowak 1991).

Beluga whales have a well-developed sense of hearing and echolocation. These whales hear over a large range of frequencies, from about 40-75 Hertz (Hz) to 30-100 kiloHertz (kHz) (Richardson 1995), although their hearing is most acute at middle frequencies between about 10 kHz and 75 kHz (Fay 1988). Most sound reception takes place through the lower jaw which is hollow at its base and filled with fatty oil. Sounds are received and conducted through the lower jaw to the middle and inner ears, then to the brain. Complementing their excellent hearing, beluga whales have one of the most diverse vocal repertoires of all marine mammals. They are capable of making a variety of vocalizations (e.g., whistles, buzzes, groans, roars, trills, peeps, etc.) which leads to their nickname as sea canaries. Their vision is also reported to be well developed; they appear to have acute vision both in and out of water and, as their retinas contain both rod and cone cells, are believed to see in color (Herman 1980).

Belugas exhibit a number of traits that appear to be adaptations to the cold environment. Unlike most whales, the cervical vertebrae in belugas are not fused, which allows them to turn their necks and nod their heads, and may help increase maneuverability in icy waters. Belugas also lack dorsal fins (thus the word "*apterus*" in their scientific name meaning without a fin) which allows them to swim freely under ice and reduces heat loss to the cold waters. Instead, belugas have a tough dorsal ridge with little or no nerve endings – an advantage when breaking through sea ice. Another adaptation to the cold environment is the beluga's thick insulating blubber layer, which accounts for as much as 40 percent of its body mass (Sergeant and Brodie 1969). In October 2007, while examining a dead-stranded Cook Inlet beluga, NMFS recorded blubber thickness up to 18 cm. This fat provides thermal protection and stores energy. Other cold-water adaptations designed to reduce heat loss are a relatively small head, fluke, and flippers.

Beluga whales are extremely social animals that typically migrate, hunt, and interact together. Nowak (1991) reported an average group size of 10 animals, although beluga whales may occasionally form larger groups, often during migrations. Groups of 10 to more than 100 beluga whales have been observed during summers in Cook Inlet. It is not known whether these represent distinct social divisions, however, Native hunters have stated that beluga whales form family groups (Huntington 2000).

C. Life History

Given that beluga whales have low reproductive potential, devote considerable time to care for their young, and are relatively long-lived, they are considered a K-selected species. Although some life history data are available for Cook Inlet belugas, there are considerably more data from several other beluga populations available in the literature (summarized in Table 1).

Beluga age is assessed by counting the number of growth layer groups (GLGs) in their teeth, much like counting rings in a tree trunk. There has been recent discussion as to whether belugas produce one GLG per year or two. The initial hypothesis that two GLGs per year were deposited by belugas was made by Sergeant (1959), and has been supported by many successive studies (Brodie 1969, 1982; Sergeant 1973; Goren et al. 1987; Brodie et al. 1990; Heide-Jørgensen et al. 1994). The deposition of two layers per year would make belugas unique among toothed whales. Based upon re-evaluation of previous studies, analyses of two captive belugas, and new teeth-aging techniques, several studies hypothesize that belugas only deposit one GLG per year (Hohn and Lockyer 1999; Stewart et al. 2006; Lockyer et al. 2007; Luque et al. 2007). Adopting a single GLG per year would result in doubling previous estimates, with associated changes to vital rate factors such as longevity, age at reproduction/adulthood, calving intervals, age at first birth, etc. NMFS has adopted a single GLG per year as representing one year of age.

Historically, it was believed that beluga whales might live more than 30 years (Burns and Seaman 1986), however, given the shift in thinking regarding GLGs, it is now believed

Table 1. Review of female beluga life history parameters found in the published literature.

Parameters	Data		Source(s)
Age at sexual maturity	8-15 growth layer groups (GLGs) 0% at 8-9 GLGs 33% at 10-11 GLGs 94% at 12-13 GLGs 9.1 ± 2.8 GLGs		1,2,3,4,5,6, 6[a] 7
Age at color change (gray to white)	12 GLGs 22 GLGs		1 2
Age at 1st conception	54% at 8-9 GLGs 41% at 10-11 GLGs 94% at 12-13 GLGs		6[b]
Age at senescence	42-43 GLGs		1
Pregnancy and birth rates	with small fetuses: 0.055 at 0-11 GLGs 0.414 at 12-21 GLGs 0.363 at 22-45 GLGs 0.267 at 46-57 GLGs 0.190 at 58-77 GLGs	with full-term fetuses or neonates: 0.000 at 0-11 GLGs 0.326 at 12-21 GLGs 0.333 at 22-45 GLGs 0.278 at 46-51 GLGs 0.182 at 52-57 GLGs 0.125 at 58-77 GLGs	6
Lifespan	>60 GLGs (oldest female estimated at 70+ GLGs) 64-65 GLGs 60-61 GLGs 50-51 GLGs		6 8 1 2
Adult annual survival	0.96-0.97 0.955 (based on pilot whale data) 0.935 0.91-0.92 0.906 (includes both natural and human-caused mortality) 0.84-0.905 (based on body length and lifespan)		9 10 11 12 6 13
Immature annual survival	0.0905 (for neonates in the first half year of life)		2
Reproductive rate	0.010-012 0.11 (based on annual calf production rates) 0.13 (based on annual calf production rates) 0.09 (based on annual calf production rates) 0.09-0.12 (based on annual calf production rates) 0.09-0.14 (based on calf counts) 0.12 (based on calf counts) 0.08-0.14 (based on calf counts) 0.06-0.10 (based on calf counts) 0.08-0.10 (based on calf counts) 0.08 (unknown)		14[c] 6 2 1 5 5 15, 2 16 17 10 18
Calving interval	< 3 years 2 years and 3 years		6[d] 2[e]

1. Brodie 1971; 2. Sergeant 1973; 3. Ognetov 1981; 4. Seaman and Burns 1981; 5. Braham 1984; 6. Burns and Seaman 1986; 7. Khuzin 1961 (cited in Ohsumi 1979); 8. Béland et al. 1992; 9. Brodie et al. 1981; 10. Lesage and Kingsley 1998; 11. Allen and Smith 1978; 12. Ohsumi 1979; 13. Perrin 1982; 14. Ray et al. 1984; 15. Davis and Evans 1982; 16. Davis and Finley 1979; 17. Breton-Provencher 1981.

a. Alaskan sample (n=52). Sampling occurred in June, a time when most Alaskan belugas are born, it is possible that non-pregnant four year olds would have conceived prior to their 5th birth date. b. Alaskan sample (n=22). c. Based on a review of the literature. Adopted by the International Whaling Commission. d. For some females this was a tentative conclusion based on high conception rates noted in some females between the ages of 6 and 22 years. e. The age of two years was for 25 percent of mature females in eastern Canada (7 of 29 sampled); presumed after noting pregnancies occurring during lactation and three years for 75 percent of mature females in eastern Canada. Sergeant (1973) concludes that “overlap of pregnancy and previous lactation is infrequent so that calving occurs about once in three years.”

that beluga whales may live more than 60 years. Reports on the age of sexual maturity vary from 4 to 10 years for females and 8 to 15 years for males (Nowak 1991; Suydam et al. 1999), although these estimates may have been based on two GLGs per year. Gestation is 14-14.5 months with a single calf born in late spring or early summer. The lactation period is known to last longer than one year, with some estimates of weaning not occurring for about two years; thus the entire reproductive process on average takes three years (Sergeant 1973). Depending on the age of the mother, however, the calving interval may be as short as two years or as long as fours years (Table 1).

While mating is assumed to occur sometime between late winter and early spring, there is little information available on the mating behavior of belugas. Most calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins 1983), although Native hunters have observed calving from April through August (Huntington 2000). Alaska Natives described calving areas as the northern side of Kachemak Bay in April and May, off the mouths of the Beluga and Susitna rivers in May, and in Chickaloon Bay and Turnagain Arm during the summer (Huntington 2000). The warmer waters from these freshwater sources may be important to newborn calves during their first few days of life (Katona et al. 1983; Calkins 1989). Surveys conducted during 2005 to 2007 in the upper Inlet by LGL, Inc. documented neither localized calving areas nor a definitive calving season since calves were encountered in all surveyed locations and months (April-October) (McGuire et al. 2008). The warmer, fresher coastal waters may also be important areas for belugas' seasonal summer molt.

D. Prey Species

Beluga whales are adept predators and are extremely mobile. They capture and swallow their prey whole, using their blunt teeth only to grab. In addition to feeding independently, belugas are also known to feed cooperatively. In one instance, beluga whales at the Port of Anchorage were observed positioning one whale along a rip rap dock, while a second whale herded salmon along the structure toward the stationary beluga whale (NMFS unpubl. data). NMFS has also received opportunistic reports of belugas feeding cooperatively at Port MacKenzie.

Belugas are opportunistic feeders and prey on a wide variety of animals. Stomach content analyses have shown that Cook Inlet belugas eat octopus, squid, crabs, shrimp, clams, mussels, snails, sandworms, polychaetes, and various fish such as cod, herring, smelt (such as capelin and eulachon), flounder, sole, sculpin, pollock, lamprey, lingcod and salmon (Klinkhart 1966; Haley 1986; Perez 1990; NMFS unpubl. data). Alaska Natives also report that Cook Inlet beluga whales feed on freshwater fish: trout, whitefish, northern pike, and grayling (Huntington 2000), and on tomcod during the spring (Fay et al. 1984). Cod are opportunistic epibenthic feeders and consume a variety of prey species including polychaetes, shrimp, amphipods, and other fish including walleye pollock and flatfish (see Clausen 1981; Seaman et al. 1982; Cohen et al. 1990). Thus many of the invertebrates and possibly some of the fish species found in the stomachs of belugas may be the result of secondary ingestion.

Cook Inlet belugas feed on a wide variety of prey species, focusing on specific species when they are seasonally abundant (Table 2). Eulachon (locally referred to as hooligan or candlefish) is an important early spring food resource for beluga whales in Cook Inlet, as evidenced by the stomach of a beluga hunted near the Susitna River in April 1998 that was filled exclusively with eulachon (NMFS unpubl. data). These fish first enter the upper Inlet in April, with two major spawning migrations occurring in the Susitna River in May and July. The early run is estimated at several hundred thousand fish and the later run at several million (Calkins 1989).

In the summer, as eulachon runs begin to diminish, belugas rely heavily on several species of salmon as a primary prey resource. Beluga whale hunters in Cook Inlet reported one whale having 19 adult king salmon in its stomach (Huntington 2000). NMFS (unpubl. data) reported a 14 foot 3 inch male with 12 coho salmon, totaling 61.5 pounds, in its stomach.

The seasonal availability of energy-rich prey such as eulachon, which may contain as much as 21 percent oil (Payne et al. 1999), and salmon is very important to the energetics of belugas (Abookire and Piatt 2005; Litzow et al. 2006). Native hunters in Cook Inlet have stated that beluga whale blubber is thicker after the whales have fed on eulachon than in the early spring prior to eulachon runs. In spring, the whales were described as thin with blubber only 2-3 inches (5-8 cm) thick compared to the fall when the blubber may be up to 1 ft (30 cm) thick (Huntington 2000). Eating such fatty prey and building up fat reserves throughout spring and summer may allow beluga whales to sustain themselves during periods of reduced prey availability (e.g., winter) or other adverse impacts by utilizing the energy stored in their blubber to meet metabolic needs. Mature females have additional energy requirements. The known presence of pregnant females in late March, April, and June (Mahoney and Shelden 2000; Vos and Shelden 2005) suggests breeding may be occurring in late spring into early summer. Calves depend on their mother's milk as their sole source of nutrition and lactation lasts up to 23 months (Braham 1984), though young whales begin to consume prey as early as 12 months of age (Burns and Seaman 1986). Therefore, the summer feeding period is critical to pregnant and lactating belugas. Summertime prey availability is difficult to quantify. Known salmon escapement numbers and commercial harvests have fluctuated widely throughout the last forty years, however, samples of harvested and stranded beluga whales have shown consistent summer blubber thicknesses.

In the fall, as anadromous fish runs begin to decline, belugas again return to consume the fish species found in nearshore bays and estuaries. This includes cod species observed in the spring diet as well as other bottom-dwellers such as Pacific staghorn sculpin, and flatfishes such as starry flounder and yellowfin sole (Table 2). This change in diet in the fall is consistent with other beluga populations that are known to feed on a wide variety of food. Pacific staghorn sculpin are commonly found near shore in bays and estuaries on sandy substrate (Eschmeyer et al. 1983). Flatfish are typically found in very shallow water and estuaries during the warm summer months and move into deeper water in the winter as coastal water temperatures cool (though some may occur in deep water year-round) (Morrow 1980).

Stomach samples from Cook Inlet belugas are not available for winter months, December through March. Dive data from belugas tagged with satellite transmitters suggest that during the winter whales are feeding in deeper waters (Hobbs et al. 2005), possibly on such prey species as flatfish, cod, sculpin, and pollock. Data on the late winter/early

Table 2. Prey species identified by month from 21 Cook Inlet beluga stomachs collected between 1995-2007. ✓ = number of whale(s) found with that prey item in their stomach; n = number of stomachs sampled each month.

Prey found in stomachs	April (n=2)	May (n=2)	June (n=1)	July (n=2)	August (n=3)	September (n=5)	October (n=5)	November (n=1)
Invertebrates				✓			✓	
Polychaete (jaws and eggs)	✓							
Shrimp	✓							
Crab	✓							
Fishes								
Long nose sucker					✓			
Pacific staghorn sculpin							✓	
Cod species						✓	✓	
Saffron cod	✓					✓	✓	
Pacific cod	✓	✓						
Walleye pollock	✓						✓	
Eulachon	✓✓							
Yellowfin sole flounder					✓		✓	
Starry flounder							✓	
Chum salmon					✓✓		✓	
Coho salmon				✓	✓	✓		
Salmon species.	✓	✓		✓✓	✓✓	✓✓✓		
Unidentified fish		✓					✓✓	
Other								
Gravel			✓			✓	✓	✓
Wood, vegetation	✓							
Sea lice *Caligus* sp.				✓	✓		✓	
Parasitic worms (e.g. nematodes)	✓		✓	✓	✓	✓	✓✓	✓

spring diet are limited to a necropsy of one whale found April 1, 2003, which had thinner blubber than beach cast beluga whales found in the summer. This beluga stomach contained saffron cod, walleye pollock, Pacific cod, eulachon, tanner crab, bay shrimp, and polychaetes (NMFS unpubl. data). The thin blubber of this whale may suggest that winter prey resources are not as rich, nor as abundant, as in the summer. If this is the case, successful acquisition of at least some prey in winter may be particularly important for whales to survive through this period of relatively harsher conditions, and perhaps, critically so, in years when summer resources may be more closely tied to fluctuating localized habitat conditions. Hence, there is a need to understand fine-scale ecological relationships for these prey species. However, more samples are required to confirm this hypothesis.

While prey abundance has yet to be quantified, several studies have addressed prey availability: Morsell et al. (1983) identified 18 species of fish in upper Knik Arm; Moulton (1997) identified 18 species of fish in upper Cook Inlet; Pentec Environmental (2005) identified 19 species in Knik Arm, and Robards et al. (1999) identified 50 species in Kachemak Bay and 24 species near Chisik Island in the lower Inlet. Herring may be another important forage fish for beluga whales, as identified by a 1993 smolt survey of the upper Inlet which found juvenile herring to be the second-most abundant fish species collected. These herring were primarily caught along the northwest shore, including the Susitna delta (Moulton 1994).

The northern pike was not found in any of Cook Inlet's tributaries until the 1960s, when it was illegally introduced. It has since expanded its range tremendously and is now widespread throughout the southcentral area and the Kenai Peninsula. The invasive northern pike has impacted many salmonid populations in these areas and has even been caught by commercial salmon fishermen in upper Cook Inlet waters. We do not know to what extent the northern pike may have impacted eulachon and salmon populations in Cook Inlet.

E. Distribution and Movements

1. General Overview

Beluga whales generally occur in shallow, coastal waters, often in water barely deep enough to cover their bodies (Ridgway and Harrison 1981). Some beluga whale populations make long range seasonal migrations (Richard et al. 2001; Suydam et al. 2001), while others remain in relatively small areas year round. In Cook Inlet, belugas remain year-round, as evidenced by satellite tagging studies (Hobbs et al. 2005), monthly aerial surveys conducted between June 2001 and June 2002 (Rugh et al. 2004), systematic aerial surveys (Rugh et al. 1999, 2000, 2004, 2005a,b,c, 2007), boat and land based observations (Speckman and Piatt 2000; Funk et al. 2005; Cornick and Kendall 2008; McGuire et al. 2008), traditional ecological knowledge of Alaskan Natives (TEK) (Huntington 2000), opportunistic reports (Rugh et al. 2000; Pers. Comm. T. Otis, ADFG 2008 via J. Wilder, NMFS; Pers. Comm. S. Baird, KBRR 2008 via M. Migura, NMFS; NMFS unpubl. data), and stranding records (Vos and Shelden 2005; NMFS unpubl. data).

Both scientific research and Native hunter TEK say beluga whale movements exploit changes in prey distribution (i.e., belugas follow their prey). For instance, the movements of belugas within upper Cook Inlet coincide with anadromous fish migrations; they often aggregate near the mouths of rivers and streams where salmon runs occur. Calkins (1989) recovered 13 salmon tags from the stomach of an adult beluga whale found dead in Turnagain Arm. These salmon had been tagged in upper Susitna River.

There is obvious and repeated use of certain habitats by Cook Inlet beluga whales. Intensive aerial abundance surveys conducted in June and July since 1993 have consistently documented high use of Knik Arm, Turnagain Arm, Chickaloon Bay and the Susitna River delta areas of the upper Inlet. The high use of these areas by belugas is further supported by data from satellite tagging studies.

Satellite transmitters attached to 14 beluga whales in upper Cook Inlet in the summers of 2000-2002 provided location and movement data from August into March (Hobbs et al. 2005; Figures 3-4). Belugas concentrated in upper Cook Inlet at rivers and bays in summer and fall, but tended to disperse offshore and move to mid Inlet in winter. All tagged whales remained in Cook Inlet during the tracking period. In the upper Inlet, whales often made rapid movements between distinct bays or river mouths (Figure 3). Monthly predicted distribution areas are summarized in Figure 4 (Hobbs et al. 2005). The data show that in summer and early fall, whales traveled back and forth between Knik Arm (Eagle River), Chickaloon Bay (Chickaloon River), and upper Turnagain Arm, although some whales also spent time offshore in the mid Inlet (Hobbs et al. 2005). In the fall, belugas began dispersing into the coastal areas of the mid Inlet as far as Trading, Tuxedni, and Chinitna Bays. In winter, belugas moved offshore with locations distributed throughout the upper and mid Inlet, including Knik and Turnagain Arms despite greater than 90 percent ice coverage (Hobbs et al. 2005).

Cook Inlet's semi-diurnal tides facilitate belugas' movements into feeding and nursery areas on a daily or twice daily basis (Hobbs et al. 2005). Access to these areas and to corridors between these areas is important. TEK (Huntington 2000) and Knik Arm land-based sightings (Funk et al. 2005) from Cairn Point, Eklutna, and Birchwood also indicate whale movements are strongly related to tide stage with whales moving north into the Arm at high tides and moving south out of the Arm as the tide ebbs. Cornick and Kendall (2008) found that whales moving adjacent to the Port of Anchorage were evenly distributed across the ebb and slack tidal stages during October and November of 2007. Interestingly, Cornick and Kendall (2008) never observed beluga whales in either high flood or low flood stages.

Figure 3. Movements of three individual beluga whales (a, b, c) tracked via satellite tags (Hobbs et al. 2005).

a) Sept 2000 - Jan 2001 b) Aug 2001 –Mar 2002 c) Aug 2002 – Mar 2003

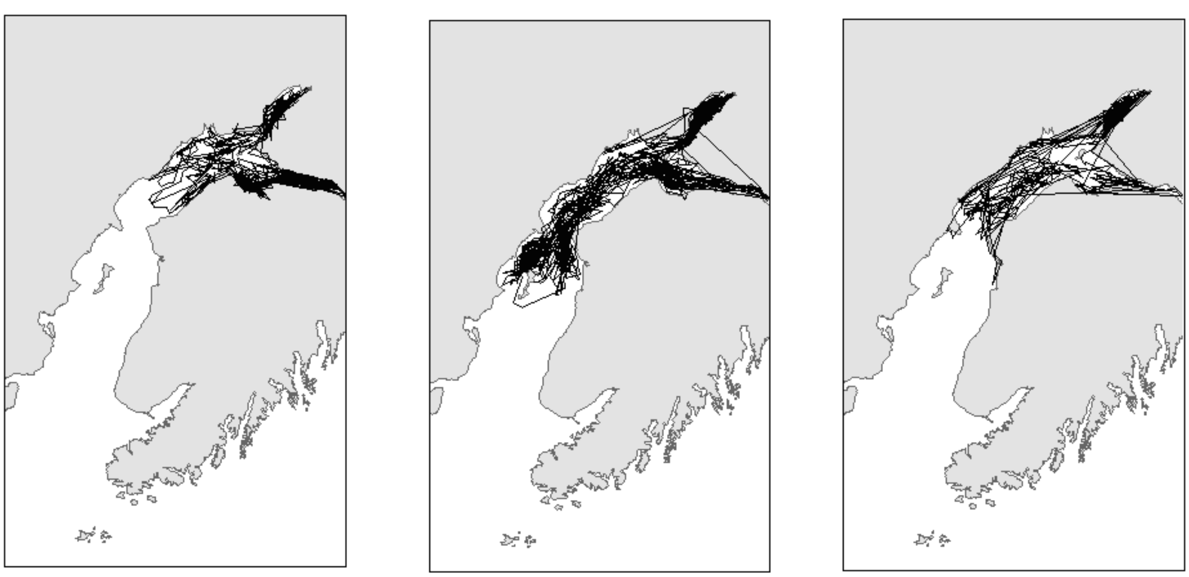
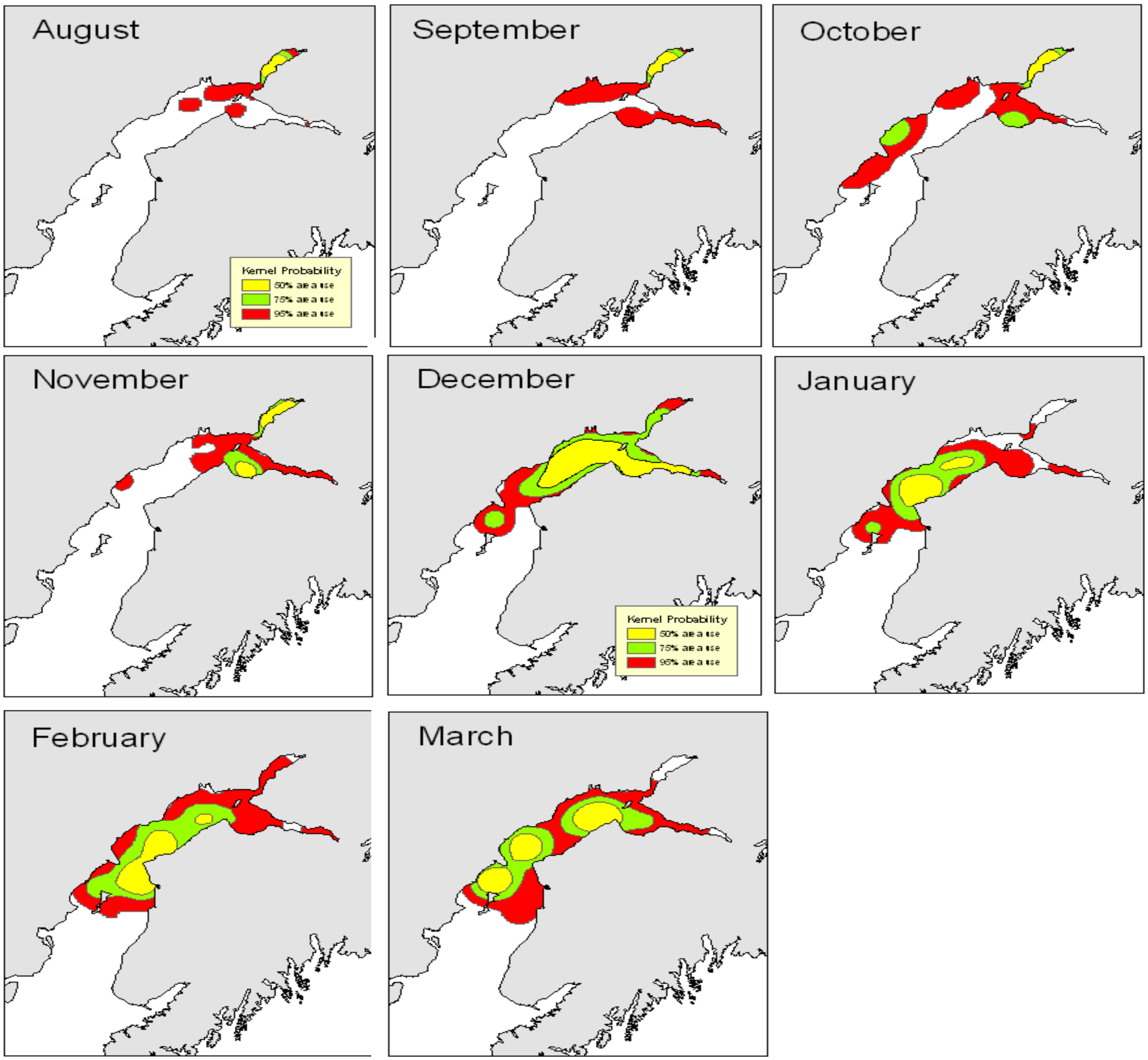


Figure 4. Predicted beluga distribution by month based upon known locations of 14 satellite tagged belugas (predictions derived via kernel probability estimates; Hobbs et al. 2005). Note the large increase in total area use and offshore locations beginning in December and continuing through March. The red area (95 percent probability) encompasses the green (75 percent) and yellow (50 percent) regions.



2. Seasonal Distributions

a. Spring/Summer: The timing and location of eulachon and salmon runs have a strong influence on belugas' spring and summer movements. Beluga whales are regularly sighted in the upper Inlet beginning in late April or early May, coinciding with eulachon runs in the Susitna River and Twenty Mile River in Turnagain Arm. In Knik Arm, beluga whales are generally observed arriving in May, but tend to concentrate near the Susitna Delta in summer (Figure 5), feeding on the various salmon runs.

In addition to frequenting the Susitna and Little Susitna rivers and corresponding flats throughout the summer, belugas also use the smaller streams along the west side of the Inlet, following first the eulachon and king salmon runs and later in the summer the coho salmon runs. Data from 14 satellite tagged beluga whales, in conjunction with TEK, indicate that during late summer and fall belugas use the streams on the west side of Cook Inlet from the Susitna River delta south to Chinitna Bay. Native hunters report that beluga whales once reached Beluga Lake, 56 km (35 miles) from the Beluga River, and that beluga whales are often seen well upstream in the Kenai and Little Susitna rivers, presumably following the fish migrations (Huntington 2000).

Summer opportunistic sightings of belugas as recently as 1996 in Kamishak Bay in the lower Inlet (Figure 6) were made during intermittent herring surveys flown between late April and early June from 1979-2002 (Pers. Comm. T. Otis, ADFG 2008 via J. Wilder, NMFS). These observations provide evidence that belugas (lone animals up to 60 whales) formerly frequented Iniskin Bay, Iliamna Bay, and Kamishak Bay in the lower Inlet in spring and summer.

b. Fall/Winter: Intensive use of Knik Arm by belugas in the fall (Figure 5) coincides with the coho run. Beluga whales regularly gather in Eagle Bay and elsewhere on the east side of Knik Arm, and sometimes in Goose Bay on the west side of Knik Arm. In October and November of 2007, Cornick and Kendall (2008) observed beluga movements and behaviors adjacent to the Port of Anchorage, confirming the presence of belugas in Knik Arm in late fall. Belugas also begin to disperse to the mid Inlet in the fall. As recently as September 2007, 25-30 belugas were sighted in Chinitna Bay by Kachemak Bay Research Reserve staff (Pers. Comm. S. Baird, KBRR, 2008 via M. Migura, NMFS) suggesting that some belugas still visit the lower inlet in the fall.

Prior to satellite tagging data, the winter distribution of this stock was poorly understood, in part because winter aerial surveys were limited in detecting beluga whales in the ice flows of upper Cook Inlet (Rugh et al. 2004). In 1983 Calkins postulated that the whales left the Inlet entirely, particularly during heavy ice years. Eight dedicated aerial surveys in Cook Inlet between February 12 and March 14, 1997 (Hansen and Hubbard 1999) resulted in only a few beluga whale sightings. Conversely, satellite data showed tagged whales used Knik and Turnagain Arms for much of the tracked time, venturing as far south as Redoubt Bay (October), Kalgin Island (January), and East Foreland (December-January) (Figure 4; Hobbs et al. 2005).

Figure 5. The location and number of beluga whales encountered during fall (August-October 2004) and summer (May-July 2005) surveys conducted in the Knik Arm and Susitna Delta areas (Funk et al. 2005).

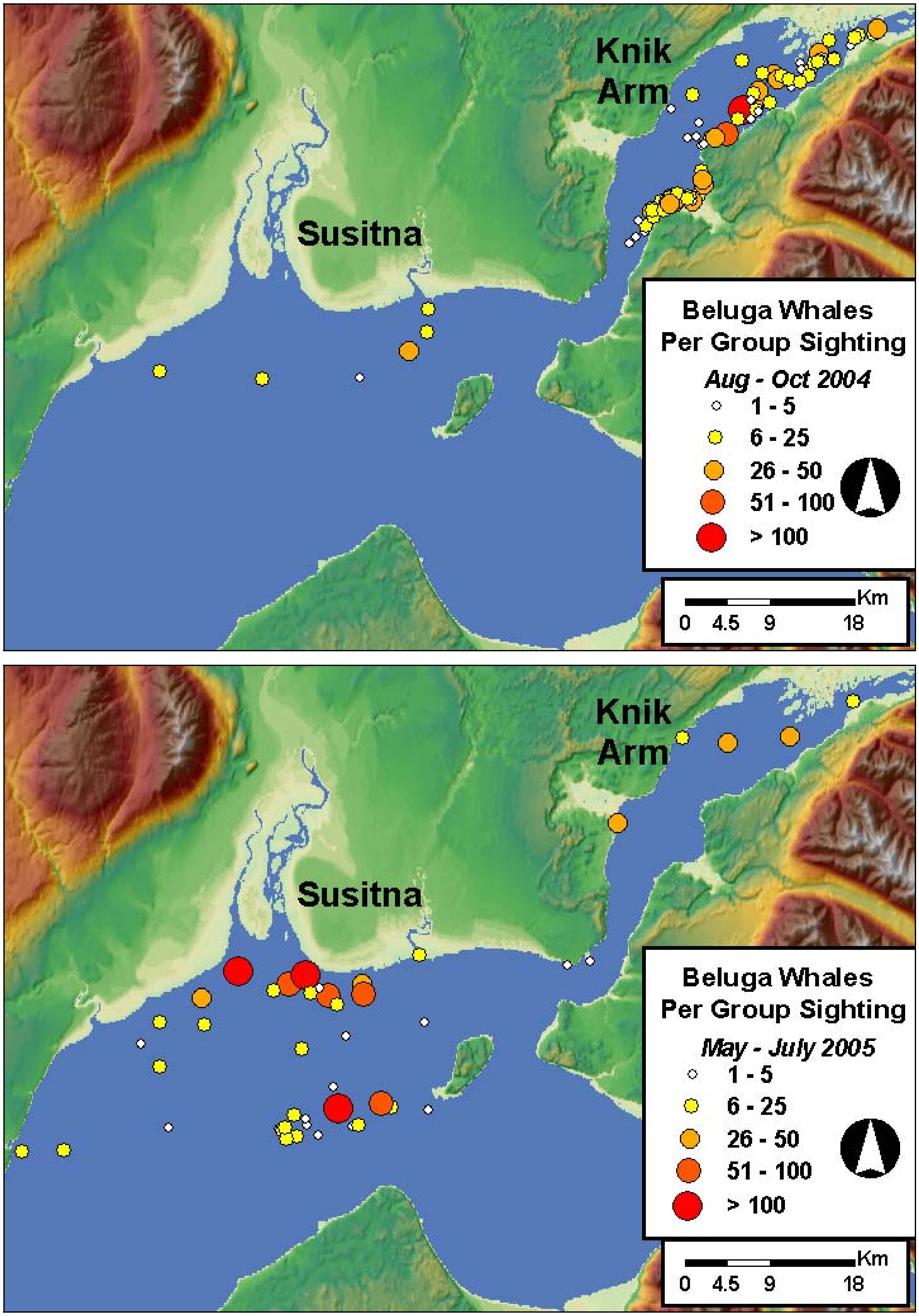
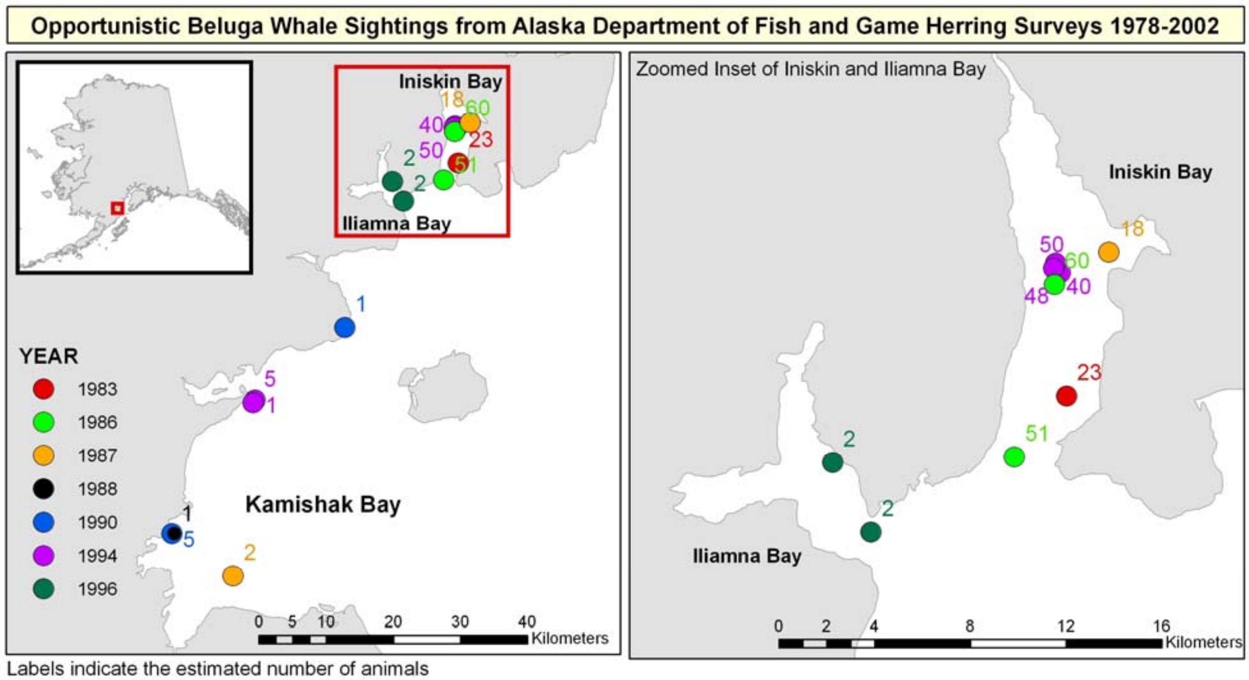


Figure 6: The location and numbers of beluga whales sighted opportunistically by ADFG in lower Cook Inlet during their annual herring surveys (flown at 1500 ft) conducted between late April and early June from 1978-2002. Note: no confirmed beluga sightings were made during ADFG's surveys after 1996.



Therefore, the available information indicates that Cook Inlet belugas move throughout much of the Inlet in the winter months. They concentrate in deeper waters in mid Inlet past Kalgin Island, with occasional forays into the upper Inlet, including the upper ends of Knik and Turnagain Arms. Although the beluga whales move into the mid to lower Inlet during the winter, ice cover does not appear to limit their movements. Their winter distribution does not appear to be associated with river mouths, as it is during the warmer months. The spatial dispersal and diversity of winter prey likely influences the wider beluga winter range throughout the mid Inlet.

3. Range Constriction

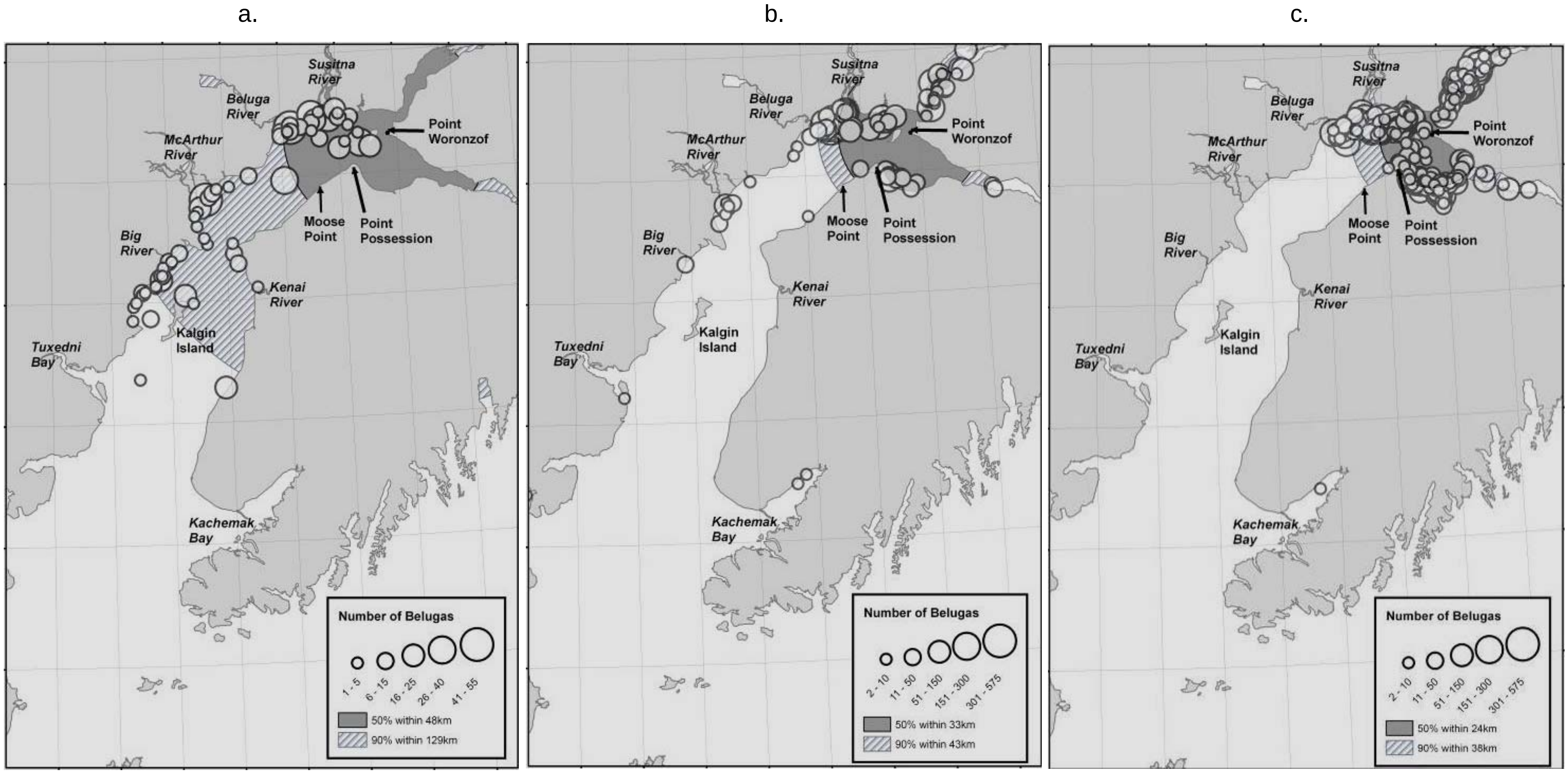
During the 1970s, the summer distribution of Cook Inlet beluga whales included the upper, mid, and parts of lower Cook Inlet, in both coastal and offshore waters (Figure 7; Harrison and Hall 1978; Murray and Fay 1979). An August 1979 survey observed beluga whales throughout Cook Inlet (Calkins 1989). Calkins (1983) indicated that belugas were "seen throughout the year in the central and lower Inlet, with heaviest use occurring in the central area". Others reported seeing hundreds of belugas continuously throughout Cook Inlet in the 1970s and 1980s, including areas where few are now found (Pers. Comm. S. Foster 1995, via B. Mahoney, NMFS). Local knowledge and other historical evidence show that prior to the 1990s belugas were regularly seen in lower Cook Inlet waters, both nearshore and offshore (Huntington 2000; Rugh et al. 2000). This information indicates that these areas were important habitats when the beluga population was larger.

The TEK of Alaska Natives familiar with Cook Inlet (Huntington 2000) and systematic aerial survey data (Rugh et al. 2000, 2005c, 2007) indicate the summer range of Cook Inlet beluga whales has contracted, especially since the mid 1990s. When the Cook Inlet beluga whale population was larger, more of the Inlet was used during the spring, summer, and fall. TEK reported groups of up to 50 beluga whales using the Kenai River; “great numbers” in Trading Bay in June and July; so many in the MacArthur River that boaters had to be careful not to hit them; many whales far up the Beluga River; and frequent sightings of beluga whales in Kachemak Bay with some whales staying all summer. While the survey conducted in August 1979 (see G. Abundance and Trends for details; Calkins 1989; N. Murray unpubl. field notes) did not include Knik or Turnagain Arm, most of the belugas counted were in the mid Inlet near the forelands and on the west side. Rugh et al. (2000) reported several sightings of beluga whales in the lower Inlet during surveys from 1993-1995.

Although NMFS has received reports of beluga sightings in lower Cook Inlet in summer as recent as 2007 (two belugas sighted near Homer, NMFS unpubl. data), annual aerial abundance surveys by NMFS have shown that beluga whales are no longer regularly observed in the lower Inlet in summer (last NMFS observation was in 2001; Rugh et al. 2005c), and are now concentrated mainly in the upper Inlet (Figure 7). Dedicated marine mammal surveys of the lower Inlet by Speckman and Piatt (2000) in late July through August 1995-1999, documented no beluga sightings south of Kalgin Island in any of the five years. This shrinking summer distribution is likely a function of a reduced population with the remaining whales using the habitat that offers the most abundant prey, the most favorable feeding topography, the best calving areas, and the best protection from predation. While telemetry data do not document areas and habitat that were used by the pre-exploited population or areas that would be used by a larger beluga population in the future (Hobbs et al. 2005), an expanding population may reoccupy the previously used areas in the lower Inlet.

Belugas have remained in the area of highest impact from hunting (on the north end of Cook Inlet, near Anchorage), and have disappeared from peripheral habitats (in the southern end of the inlet) (Figure 7). It is unknown if the current contracted distribution is a result of changing habitat (Moore et al. 2000), predator avoidance (Shelden et al. 2003), or a shift of a reduced population into preferred habitat areas (Rugh et al. 2001; Goetz et al. 2007); regardless, the result is a greater proximity to Anchorage and a smaller range. While the overall range of the population has contracted within Cook Inlet as the population has declined, whales continue to inhabit predictable locations and in patterns clearly related to time of year, the influence of tides, and the appearance of seasonally important prey resources. The contraction of the range of this population northward into the upper Inlet makes it far more vulnerable to catastrophic events with the potential to kill a significant fraction of the population.

Figure 7. Areas occupied by belugas in Cook Inlet in June and July in 1978-1979 (a), 1993-1997 (b), and 1998-2007 (c).



F. Habitat

1. Physical Habitat of Cook Inlet

Cook Inlet is a semi-enclosed tidal estuary located in southcentral Alaska. The Inlet is approximately 370 km in length and extends in a northeast/southwest orientation from Knik and Turnagain Arms in the north to the southernmost reaches of Kamishak Bay in the south (Figure 2). Cook Inlet is roughly 20,000 km^2, has 1350 km of coastline (Rugh et al. 2000) and is generally divided into upper and lower regions by the East and West Forelands.

The bathymetry of Cook Inlet is varied and consists of shoals, canyons and mudflats. Cook Inlet is generally shallow, with most waters less than 73 m (240 ft) deep, however deeper water exists along the channels and at the entrance to the Inlet near the Barren Islands, where depths range from 183-366 m (600-1200 ft; Mulherin et al. 2001). During low tides, mudflats constitute large areas of shoreline in Knik and Turnagain Arms, Chickaloon Bay, Redoubt Bay, Trading Bay, and the Susitna River Delta.

Cook Inlet experiences some of the greatest tidal fluctuations in the world (Mulherin et al. 2001), with differentials between high and low tides reaching as much as 12 m (39 ft) in extreme cases. These large tidal ranges combined with broad tidal flats can result in currents reaching 6.2 m/s, with significant changes to shorelines (Moore et al. 2000). In the summer, a large volume of freshwater enters Cook Inlet from numerous major river drainages and glacial outflows, including the Knik, Matanuska, and Susitna rivers, as well as from smaller coastal streams. These sources all deposit considerable sediment into Cook Inlet. The strong tidal currents suspend these sediments in the water and carry them throughout the Inlet. Coupled with the tidal effects and shoreline erosion, Cook Inlet waters are a highly turbid, low visibility environment.

In winter months ice fills much of upper Cook Inlet. Rivers begin to freeze in October and November and the waters of upper Cook Inlet generally freeze early in December. The large amounts of freshwater entering the Knik and Turnagain Arms contribute to the relatively higher concentrations of ice in the upper Inlet. Ice breakup in the Inlet typically begins between March and May.

2. Beluga Feeding Habitat

There is repeated use of several areas of the upper Inlet for summer and fall feeding by beluga whales. The primary “hotspots” for beluga feeding areas include the Big and Little Susitna Rivers, Eagle Bay to Eklutna River, Ivan Slough, Theodore River, Lewis River, and Chickaloon River and Bay. Many of these areas are also popular fishing locations for humans. Beluga whales exhibit high site fidelity and may persist in an area with fluctuating fish runs or may tolerate certain levels of disturbance from boats or other anthropogenic activities in order to feed.

Spring prey of Cook Inlet beluga whales includes eulachon and gadids (saffron cod, Pacific cod, and walleye pollock) (Table 2). Eulachon first enter the upper Inlet in

April, with two major spawning migrations occurring in the Susitna River in May and July. Gadids prefer shallow coastal waters and are found near and in rivers within the zone of tidal influence (Morrow 1980; Cohen et al. 1990). Adult cod exhibit seasonal movements; saffron cod move offshore during the summer for feeding while Pacific cod migrate to shallower water in the spring to feed (Cohen et al. 1990). Although not evident in the stomach contents reported in Table 2, Alaskan Natives also describe Cook Inlet belugas as feeding on anadromous steelhead trout, freshwater fish such as whitefish, northern pike, and grayling (Huntington 2000), and other marine fish such as tomcod during the spring (Fay et al. 1984). Many of these species are also abundant in the Susitna River system.

Five Pacific salmon species (Chinook, pink, coho, sockeye, and chum) spawn in rivers throughout Cook Inlet in the summer (Moulton 1997; Moore et al. 2000). During this time, anadromous smolt and adult fish concentrate at river mouths and adjacent intertidal mudflats to osmoregulate (i.e., to regulate the levels of water and salts in the body) (ADFG 2004). The coincident occurrence and concentration of beluga whales and adult salmon returns to waters of the upper Inlet from late spring throughout the summer indicates these are likely feeding areas.

Dense concentrations of prey may be essential to beluga whale foraging. Hazard (1988) hypothesized that beluga whales were more successful feeding in rivers where prey were concentrated than in bays where prey were dispersed. In upper Cook Inlet, beluga whales concentrate offshore from several important salmon streams and appear to use a feeding strategy which takes advantage of the bathymetry in the area. Research by Frost et al. (1983) on beluga whales in Bristol Bay suggested those whales preferred certain streams for feeding based on the configuration of the stream channel. Their study theorized beluga whales' feeding efficiencies improved in relatively shallow channels where fish were confined or concentrated, likely as a result of the channels formed by river mouths and shallow waters acting as a funnel to concentrate fish.

Based on the movements and feeding distribution of beluga whales, it is apparent that beluga movements are not simply explained by when and where the most fish are. For example, beluga whales today are seen less frequently at the mouth of the Kenai River, despite large salmon returns to the river. Because beluga whales do not always feed at the streams with the largest runs of fish, bathymetry and fish density may be more important than sheer numbers of fish in their feeding success. If true, this would imply Cook Inlet beluga whales do not simply go where the fish are, but are partially dependent on particular feeding habitats with appropriate topography. Fried et al. (1979) noted that beluga whales in Bristol Bay fed at the mouth of the Snake River, where salmon runs are smaller than in other rivers in Bristol Bay; however, the mouth of the Snake River is shallower, and hence may concentrate prey.

In the fall, as anadromous fish runs begin to decline, belugas again return to consume the fish species found in nearshore bays and estuaries. This includes cod species observed in the spring diet as well as other bottom-dwellers such as Pacific staghorn sculpin, starry flounder, and yellowfin sole (Table 2). Pacific staghorn sculpin are commonly found near shore in bays and estuaries on sandy substrate (Eschmeyer et al. 1983). Flatfish (e.g., starry flounder and yellowfin sole) are typically found in very shallow water and estuaries during the warm summer months and move into deeper water in the winter as coastal water temperatures cool (though some may occur in deep water year-round) (Morrow 1980).

In the winter, Cook Inlet beluga whales concentrate in deeper waters in mid Inlet past Kalgin Island and make deep feeding dives, likely feeding on such prey species as flatfish, cod, sculpin, and pollock. Saffron cod migrate inshore during winter for spawning (Cohen et al. 1990), whereas Pacific cod move to progressively deeper water as they age, spawning in deeper, offshore waters in winter (Cohen et al. 1990). In addition to various fishes, Calkins (1983) reported the presence of crustaceans off the south side of Kalgin Island. The presence of Kalgin Island south of the forelands may result in upwelling and eddies which concentrate nutrients and may provide a still-water refuge area for several migrating anadromous fishes (Calkins 1983, 1989). For instance, this area may be a late-winter staging area for eulachon before they return to streams in the upper Inlet. Given the unique oceanographic conditions and the diversity of fish and crustaceans found near Kalgin Island, the Kalgin Island area may be rich in biological productivity, and thus an important winter feeding habitat for belugas. Belugas will also occasionally travel into the upper Inlet in winter, including the upper ends of Knik and Turnagain Arms.

3. Beluga Calving Habitat

In addition to being important feeding habitats, the shallow waters of the upper Inlet may also play important roles in reproduction. Since newborn beluga whales do not have the thick blubber layer of adults, they benefit from the warmer water temperatures in the shallow tidal flats areas where fresh water empties into the Inlet, and hence it is likely these regions are used as nursery areas (Katona et al. 1983; Calkins 1989). TEK of Alaska Natives has described past beluga calving and nursery habitats as the northern side of Kachemak Bay, the mouths of the Beluga and Susitna Rivers, as well as Chickaloon Bay and Turnagain Arm (Huntington 2000).

Knik Arm is also used extensively in the summer and fall by cow/calf pairs. Surveys by LGL (Funk et al. 2005) noted a relatively high representation of calves in the uppermost part of Knik Arm. The mouth of Knik Arm has been reported to be transited in the summer and fall by cow/calf pairs (Cornick and Kendall 2008), presumably moving into the upper reaches of the Arm. McGuire et al. (2008) photographically identified 37 distinct belugas with calves in the upper Inlet during 2005-2007. However, because calves were seen in all areas of their study (Susitna River Delta, Knik Arm, Chickaloon Bay/Southeast Fire Island, and Turnagain Arm), they were unable to determine distinct calving areas (McGuire et al. 2008).

4. Other Beluga Habitats

While it is difficult to quantify the importance of various habitats in terms of the health, survival, and recovery of the Cook Inlet beluga whale, certain areas are likely to be particularly well suited to specific activities or to a suite of life sustaining functions. It is likely that the areas where beluga whales concentrate, such as shallow tidal flats, higher flow river mouths, estuarine areas, and certain areas where the level of human related disturbance is low, provide a necessary combination of physical and biological features that facilitate feeding, breeding, and nursing. Additionally, because of the topography and presence of ice in these regions in the fall and winter, they may provide important barriers to beluga predators.

The warmer, fresher coastal waters may also be important areas for belugas' seasonal summer molt (Finley 1982) due to the fact that belugas have been observed rubbing their bodies on nearshore surfaces. These shallow waters may provide conditions necessary to help facilitate the shedding of dead skin and regeneration of epidermal layers. While the predominantly muddy bottom of Cook Inlet is likely not abrasive enough to remove dead skin on its own, the combination of rubbing with the warm, fresh water could promote sloughing.

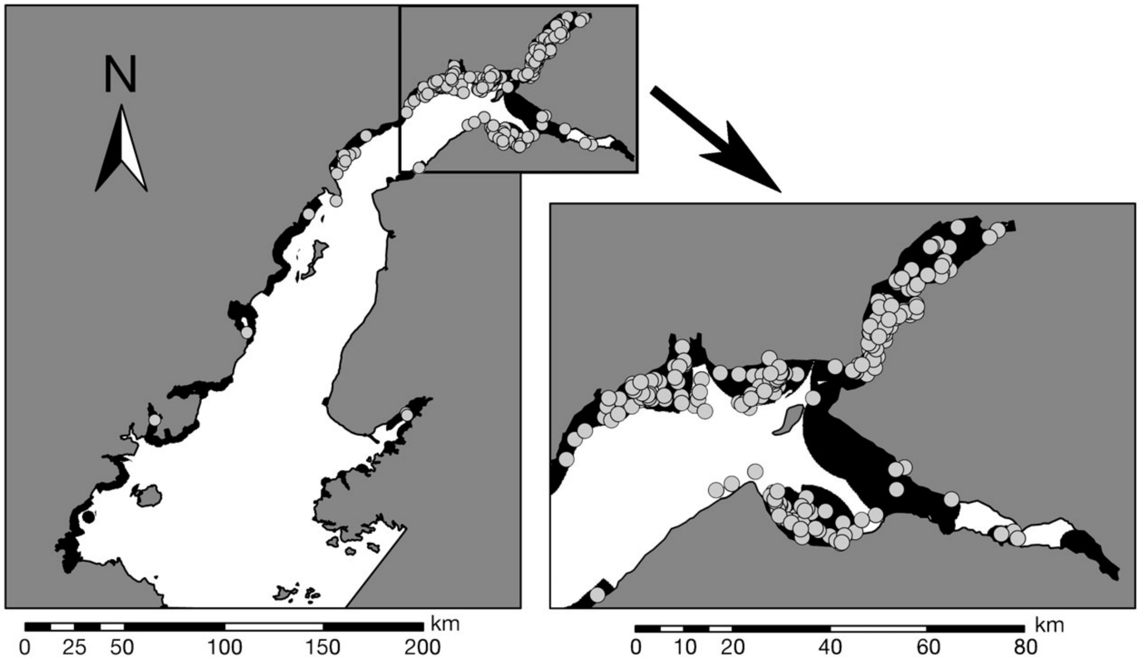
Unfortunately, current scientific knowledge of Cook Inlet beluga behavior and life history events is largely limited to anecdotal reports or opportunistic observations made in the course of other studies. Thus, additional studies are needed to test relationships between the physical, acoustic, and biological features of Cook Inlet and specific beluga life history events and activities.

5. Habitat Modeling

In an effort to predict beluga whale habitat use, Goetz et al. (2007) used predictive models to examine the relationship between three environmental variables and beluga whale distribution in Cook Inlet, based upon data collected from aerial surveys conducted from 1993-2004 (Figure 8). Bathymetry (depth from water surface to Inlet floor), proximity to mudflats, and distance from rivers (as determined by flow accumulation values) were evaluated with respect to the presence or absence of belugas as documented during aerial surveys. Modeling results suggest the distance from mudflats and distance from medium flow accumulation inlets (assumed to be rivers or streams) may be important environmental features for predicting the distribution of this population (e.g., the likelihood of finding a beluga decreases by eight percent for every 100 m away from mudflats; by six percent for every additional 500 m from medium flow inlets; and by four percent every 1000 m from high flow inlets; Goetz et al. 2007). Hence, the odds are significantly greater of spotting belugas closer to mudflats and closer to medium and high flow accumulation inlets. These results suggest that both mudflats and flow accumulation may be important environmental factors in beluga distribution in the summer. The preference for medium and high flow accumulation inlets suggests that belugas in Cook Inlet have a preference for larger river basins. In neither model did low flow accumulation inlets nor bathymetry seem to correlate with beluga distribution in the summer.

It is not known what is driving belugas' preferences for coastal areas; it may be a direct factor of mudflat locations and higher flow accumulation inlets. Alternatively, beluga preference for nearshore waters may be due to the availability and distribution of prey species in the summer (Moore et al. 2000; Pentec 2005); or for shallow waters for breeding and calving (Calkins 1989), for molting (Finley 1982), or for shelter from predators (Shelden et al. 2003). NMFS is in the process of expanding and updating these habitat modeling studies to encompass recently acquired year round beluga whale satellite telemetry data, fisheries statistics, and improved tidal, substrate, and bathymetric data.

Figure 8. Cook Inlet beluga whale habitat use (black) as predicted by the Classification and Regression Tree model with beluga sightings from summer aerial surveys (1993-2004) shown as dots (Goetz et al. 2007).



6. Valuable Habitat Descriptions

NMFS has characterized beluga whale habitats as part of the conservation strategy presented in this Conservation Plan. As a result, Cook Inlet has been stratified into three habitat regions based on differences in beluga use (Figure 9), with Type 1 habitat being the most valuable due to its intensive use by belugas from spring through fall for foraging and nursery habitat, and because it is in the upper Inlet where the greatest potential from anthropogenic impacts exists. Type 2 habitat includes areas with high fall and winter use, and a few isolated spring feeding areas. Type 3 habitat encompasses the remaining portions of the range of belugas within Cook Inlet. While Type 1 habitat is clearly the most valuable of the three types based on the frequency of use, the relative values of Types 2 and 3 habitats are difficult to distinguish because we have limited information about belugas' wintering habitats and which features in these two habitat types are the most important to belugas. We have, however, classified these two additional types separately based on observations of frequency of beluga use and for management purposes.

Management actions will be tailored to these habitat types, and NMFS's evaluation of proposed habitat alterations will vary according to the value of the habitat. These habitat classifications may change as the population recovers and expands into other areas, as the habitat itself changes over time, or as our knowledge about beluga habitat requirements improves.

a. **Type 1 Habitat:** Type 1 habitat encompasses all of Cook Inlet northeast of a line three miles southwest of the Beluga River across to Point Possession (Figure 9). These areas are full of shallow tidal flats, river mouths or estuarine areas, and are important as foraging and calving habitats. These shallow areas may also provide for other biological needs, such as molting or escape from predators. Type 1 habitat also has the highest concentrations of belugas from spring through fall as well as greatest potential for impact from anthropogenic threats. For these reasons, Type 1 habitat is considered the most valuable habitat type.

   Many rivers in Type 1 habitat have large eulachon and salmon runs. Belugas visit Turnagain Arm in early spring traveling up to 20-Mile River and Placer Creeks, indicating the importance of eulachon runs for beluga feeding. Beluga use of upper Turnagain Arm decreases in the summer and then increases again in August through the fall, coinciding with the coho salmon run. Early spring (March to May) and fall (August to October) use of Knik Arm is confirmed by studies by Funk et al. (2005). Intensive summer feeding by belugas occurs in the Susitna delta area, Knik Arm and Turnagain Arm.

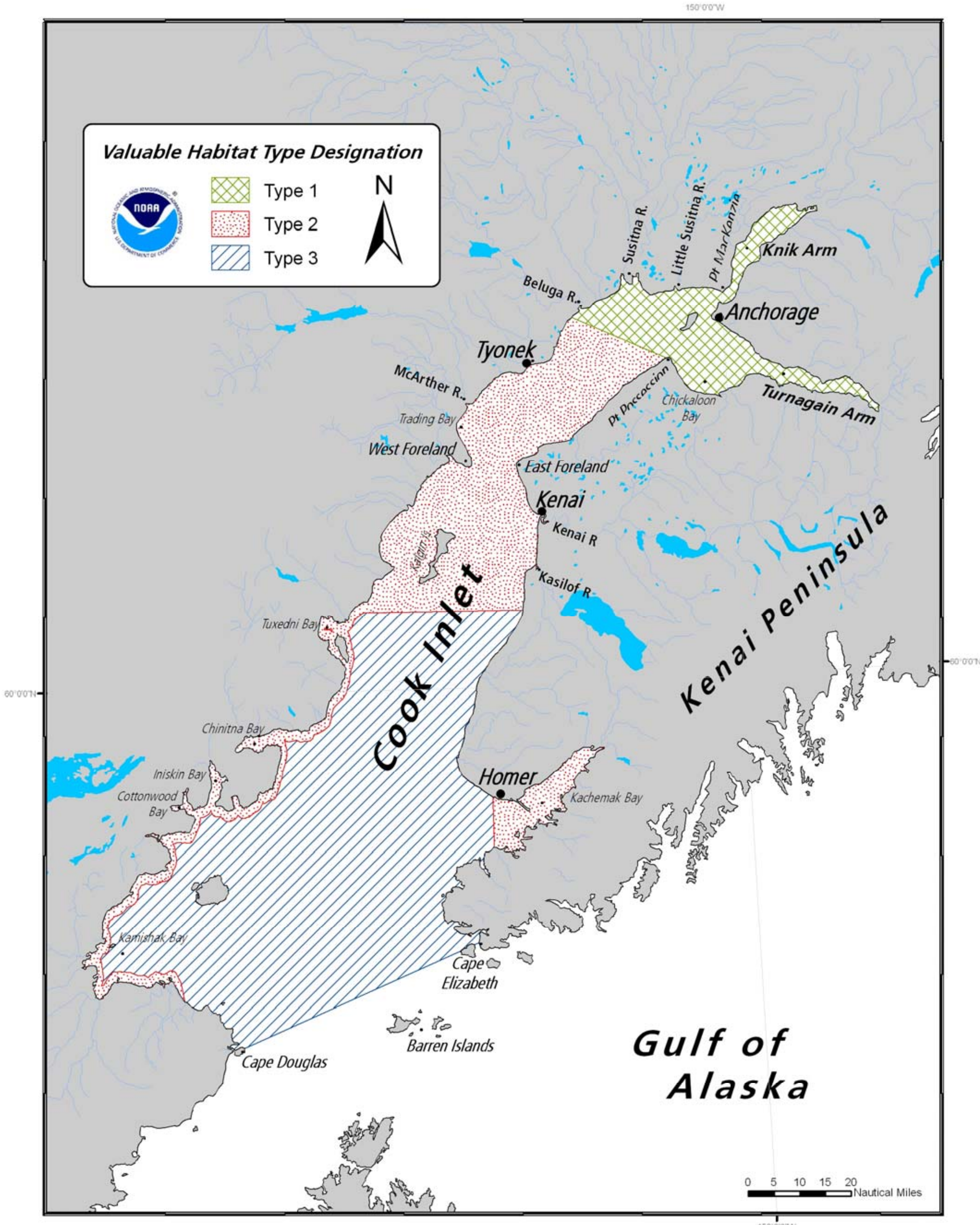
   Whales regularly move into and out of Knik Arm and the Susitna delta (Hobbs et al. 2000; Rugh et al. 2004, 2005c). The combination of satellite telemetry data and long-term aerial survey data demonstrate beluga whales use Knik Arm 12 months of the year, often entering and leaving the Arm on a daily basis (Hobbs et al. 2005; Rugh et al. 2004, 2005a,b). These surveys demonstrated intensive use of the Susitna delta area (from the Little Susitna River to Beluga River) and Chickaloon Bay (Turnagain Arm) with frequent large scale movements between the delta area, Knik Arm and Turnagain Arm. During annual aerial surveys conducted by NMFS in June-July, up to 61 percent of the whales sighted in Cook Inlet were in Knik Arm (Rugh et al. 2000, 2005c). The Chickaloon Bay area also appears to be used by belugas throughout the year.

   Belugas are particularly vulnerable to impacts in Type 1 habitat due to their concentrated use and the biological importance of these areas. Because of their intensive use of this area (e.g., foraging, nursery, predator avoidance), activities that restrict or deter access to Type 1 habitat could reduce beluga calving success, impair their ability to secure prey, and increase their susceptibility to predation by killer whales. Projects that reduce anadromous fish runs could also negatively impact beluga foraging success during this time. Furthermore, the tendency for belugas to occur in high concentrations in Type 1 habitat predisposes them to harm from such events as oil spills.

b. **Type 2 Habitat:** Type 2 habitat includes areas of less concentrated spring and summer beluga use, but known fall and winter use areas. It is located south of Type 1 habitat and north of a line at 60.2500 north latitude. It extends south along the west side of the Inlet following the tidal flats into Kamishak Bay to Douglas Reef, and includes an isolated section of Kachemak Bay (Figure 9).

   Type 2 habitat is based on dispersed fall and winter feeding and transit areas in waters where whales typically occur in smaller densities or deeper waters. It includes both near and offshore areas of the mid and upper Inlet, and nearshore

Figure 9. Valuable habitat areas (Types 1, 2, 3) identified for Cook Inlet beluga whales.



areas of the lower Inlet. Due to the roles of these area as probable fall feeding areas, Type 2 habitat includes Tuxedni, Chinitna, and Kamishak Bays on the west coast and a portion of Kachemak Bay on the east coast. Winter aerial surveys (Hansen and Hubbard 1999) sighted belugas from the forelands south, with many observations around Kalgin Island. Based on tracking data, Hobbs et al. (2005) document important winter habitat concentration areas reaching south of Kalgin Island (Figures 3 and 4). Kachemak Bay has been included in Type 2 habitat because belugas have been regularly sighted at the Homer Spit and the head of Kachemak Bay, appearing during spring and fall of some years in groups of 10-20 individuals (Speckman and Piatt 2000). Historically, belugas were common at Fox River flats, Muddy Bay, and the northwest shore of Kachemak Bay (Rugh et al. 2000, NMFS unpubl. data), sometimes remaining in Kachemak Bay all summer (Huntington 2000).

Dive behavior indicates beluga whales make relatively deeper dives (e.g., to the bottom) and are at the surface less frequently in Type 2 habitat, and hence are less frequently observed (Hobbs et al. 2005). It is believed these deep dives are associated with feeding during the fall and winter months (NMFS unpubl. data). The combination of deeper dives, consistent use of certain areas, and stomach content analyses indicate that belugas whales are actively feeding in these areas. Hence, deeper mid Inlet winter habitats may be important to the winter survival and recovery of Cook Inlet beluga whales.

c. **Type 3 Habitat:** Type 3 habitat encompasses the remaining portions of Cook Inlet where belugas are infrequently observed, and areas which are not identified as Type 1 or 2 (e.g., not including the areas along the nearshore western portion of the Inlet). Type 3 habitat is south of 60.2500 north latitude and extends to a southern boundary line, approximately 85 km across, from Cape Douglas to Elizabeth Island (Figure 9).

In the past, with a larger Cook Inlet beluga population, early surveys and reports identified that belugas used these areas (refer to E.3. Range Constriction for more information). Local knowledge and other historical evidence show that prior to the 1990s belugas were regularly seen in lower Cook Inlet waters, both nearshore and offshore (Rugh et al. 2000). This information indicates that these areas were at one time important habitat and suggests that a recovered Cook Inlet beluga whale population may use these areas again.

G. Abundance and Trends

The Cook Inlet beluga stock has probably always numbered fewer than several thousand animals, but has declined significantly from its historical abundance. It is difficult to accurately determine the magnitude of decline, because there is no available information on the abundance of beluga whales that existed in Cook Inlet prior to development of the southcentral Alaska sub-Region, nor prior to modern subsistence whaling by Alaska Natives. Unfortunately, Huntington's (2000) TEK survey did not contain any historic population estimates. Because no reliable abundance surveys were conducted prior to the 1990s, scientists must estimate the historical abundance.

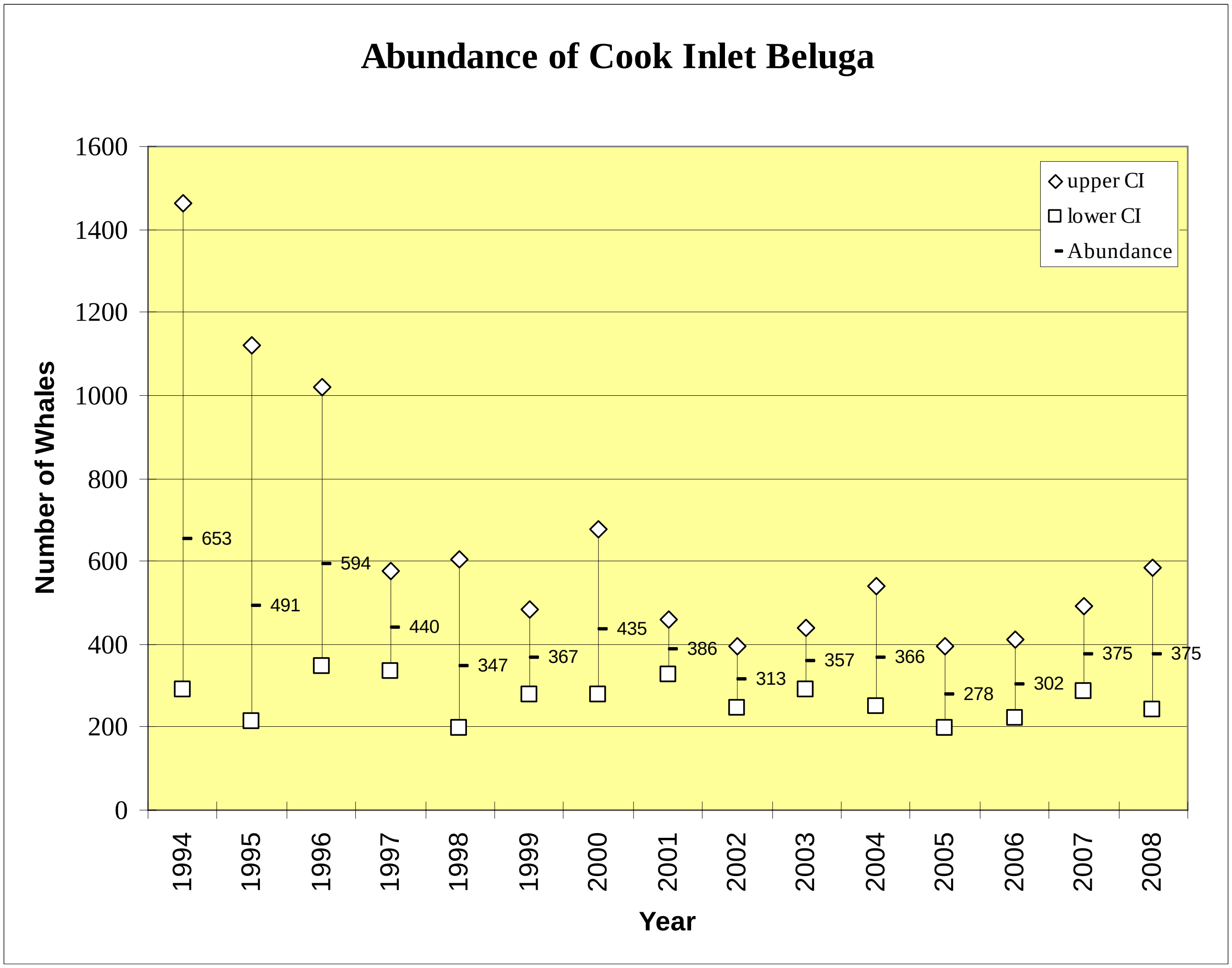
Cook Inlet beluga whale abundance surveys prior to 1993 were often incomplete, highly variable, and generally involved observations or counts only of concentrations in river mouths and along the upper Inlet. Based on aerial surveys in 1963 and 1964, Klinkhart (1966) estimated the stock at 300-400 animals, but the methodology for the survey was not described. Sergeant and Brodie (1975) presented an estimate for the Cook Inlet stock as 150-300 animals, but offer no source for this figure. Murray and Fay (1979) counted 150 beluga whales in the central Inlet on three consecutive days in August 1978 and estimated the total abundance would be at least three times that figure to account for poor visibility. A two day aerial survey of Cook Inlet in August 1979 resulted in a count of 479 beluga whales (N. Murray, unpubl. field notes). Based on surveys of the upper Inlet between May and August of 1982, Calkins (1984) estimated that a concentration of 200-300 beluga whales used the area between the mouth of the Little Susitna River to the mouth of the Beluga River. Hazard (1988) stated that an estimate of 450 whales may be conservative because much of Cook Inlet was not surveyed in these efforts.

In an attempt to find a documented estimate of the Cook Inlet beluga historic population, scientists looked to the survey with the greatest coverage of Cook Inlet. The 1979 aerial survey, while considered incomplete since Knik Arm, Turnagain Arm, and Chickaloon Bay (areas of highest beluga concentration today) were not surveyed, provides the best available scientific data with which to estimate historic abundance. On August 21, 1979, the survey included transects from Anchorage to Homer, covering the upper, middle, and lower Inlet, including Kachemak Bay; the west shore from north of Chinitna Bay to Beluga River; Kalgin Island; and most of the east shore, including the Kenai area, and yielded a count of 376 beluga whales (N. Murray, unpubl. field notes). On August 22, 1979, a sighting of 97 beluga whales in Bruin Bay (an area not surveyed the previous day due to low clouds) was added to the previous count for a total of 479 beluga whales (N. Murray, unpubl. field notes). By using a correction factor of 2.7 developed for estimating submerged whales under similar conditions in Bristol Bay (Frost et al. 1985), Calkins (1989) provided an overall abundance estimate of 1,293 whales ($479 * 2.7 \approx 1293$). Calkins' estimate, which utilized the most complete survey of the Inlet prior to 1994 and incorporated a correction factor for animals missed during the survey, provides the best available scientific method for estimating historical abundance of beluga whales in the Inlet. For management purposes, NMFS currently considers 1,300 beluga whales as a reasonable estimate of historical abundance, thus the carrying capacity (*K*) of the Cook Inlet beluga whales.

NMFS began comprehensive, systematic aerial surveys of beluga whales in Cook Inlet in 1993. Unlike previous efforts, these surveys included the upper, middle, and lower Inlet. These surveys documented a decline in abundance of nearly 50 percent between 1994 (653 whales) and 1998 (347 whales) (Figure 10; Hobbs et al. 2000). Figure 10 documents the corrected abundance estimates from annual abundance surveys conducted each June since 1994 (Hobbs et al. 2000; Rugh et al. 2005c, 2007; NMFS unpubl. data).

Monthly surveys (July-April) conducted by NMFS in upper Cook Inlet during 2001-2002 (Rugh et al. 2004), observed as few as 10 whales in January, and up to 204 whales in August with sightings in Knik and Turnagain Arms during all months except February. However, low counts generally correlated with periods of high ice density, and may be more a function of the low visibility of the white whales amidst sea ice than a matter of the whales leaving the Inlet (Rugh et al. 2004). Beluga whale abundance within Knik

Figure 10. Annual abundance estimates of Cook Inlet beluga whales as determined by aerial surveys in June and July, 1994-2008. The vertical bar with each estimate represents the 95 percent confidence interval (CI) (Hobbs et al. 2000; Rugh et al. 2005c, 2007; NMFS unpubl. data).



Arm, as assessed by fourteen years of aerial/video surveys conducted by NMML in the first weeks in June, is highly variable, ranging from 224 belugas in 1997, to 0 belugas in 1994 and 2004**.** In 2004, boat based surveys in Knik Arm reported an August abundance of about 5-130 whales, a September abundance of about 0-70 whales, and an October abundance of about 0-105 whales (Funk et al. 2005).

NMFS estimates that the Cook Inlet beluga population's maximum theoretical net productivity rate is between two and six percent (i.e., the population has the potential to increase between two and six percent per year). However, even though subsistence harvests from this stock have been restricted from zero to two whales a year since 1999, annual abundance surveys of Cook Inlet belugas document a decline in the population of 1.5 percent (1999 to 2008; NMFS unpubl. data). Differences in survey design and analytical techniques prior to 1994 rule out a precise statistical assessment of trends using the first available population estimate, however, simply comparing the estimate of 1,293 belugas in 1979 to 375 belugas in 2008 indicates a 71 percent decline in 30 years, but with unspecified confidence. NMFS has committed to conducting systematic annual abundance surveys which should reduce uncertainties in population status and growth over time.

H. Potential Threats

The Cook Inlet beluga population may be affected by various natural and anthropogenic factors, including subsistence harvest removals, pollution, predation, disease, contamination, fisheries interactions, vessel traffic, small stock size, restricted summer range, and habitat alteration (Norris 1994). Frequent use of shallow nearshore and estuarine habitats makes beluga whales particularly prone to regular interaction with human activities (Perrin 1999), and thus likely to be affected by them.

The viability of small populations, such as Cook Inlet belugas, is further compromised by the increased risk of inbreeding and the loss of genetic variability, which reduces their ability to cope with disease and environmental change (Lacy 1997; O'Corry-Crowe and Lowry 1997; Guimaraes et al. 2007). Estimates of genetic variation do not, at present, suggest that Cook Inlet belugas are highly inbred nor that a critical amount of genetic variation has been lost through genetic drift (O'Corry-Crowe et al. 1997; G. O'Corry-Crowe, unpubl. data in Lowry et al. 2006), but this population is already in a size range where eventual loss of genetic variability may be expected (Lowry et al. 2006).

The documented decline of the Cook Inlet beluga whale population during the mid-1990s has been explained by subsistence harvest removals at a level that this small population could not sustain. Since that time, cooperative efforts between NMFS and subsistence users have dramatically reduced subsistence harvests. These harvest reductions should have allowed the Cook Inlet beluga population to recover if subsistence harvests been the only factor limiting the population at that time. Abundance data collected during the past several years, however, indicate that the population is not increasing as expected with the regulation of subsistence harvests. At this time, it is unknown what specific factor, or combination of factors, continue to limit this population's growth.

While a number of known and potential threats are discussed below, the actual levels of impact of these threats has not been determined. NMFS recognizes that not enough is known about the effects of each specific threat, and as such we do not definitively know the level of impact each threat has on Cook Inlet beluga whales. Even though threats are discussed individually in the following section, Cook Inlet belugas may be affected by multiple threats at any given time, compounding the impacts of the threats. For instance, a beluga fleeing from a killer whale may swim through polluted, high-noise waters and across a ship channel in an effort to get to shallower, coastal areas that are frequented by recreational boaters. Unfortunately, without an understanding of how individual threats impact belugas, we cannot know the cumulative effects of all the threats on Cook Inlet belugas. Given our limited knowledge of the impacts of known and potential threats, the following section broadly addresses factors with the potential to impact Cook Inlet beluga whales.

1. Natural Factors

a. **Stranding:** The term stranding refers to belugas that are found in waters too shallow to permit them to swim, as well as to belugas that are found out of their natural habitats. Belugas generally strand either accidentally (e.g., they come into shallow water to avoid killer whale predation or while chasing prey and strand as the tide recedes), or as a result of disease, illness, or injury. For the purposes of this discussion, "strandings" will refer to animals that are found alive, and "dead strandings" will refer to whales that are found dead.

The extreme tidal fluctuations of upper Cook Inlet and the belugas' preferences for shallow coastal waters both predispose these animals to strandings. Belugas whales in Canada are known to intentionally strand themselves during the molting process, while rubbing their skin against rocky bottoms. Belugas may also strand purposely or accidentally to avoid predation by killer whales. Several stranding events in the upper Inlet have coincided with killer whale sightings, and NMFS has observed stranded Cook Inlet beluga whales that had evidence of killer whale predation (see I.H.1.b. Predation).

Once a whale strands, death may result from stress and/or hyperthermia from prolonged exposure out of water. Whales stranded as a result of receding tides may be exposed for ten hours or more. Without the buoyancy provided by the water, the whale's weight places additional stress on internal organs which can make breathing difficult. Unless caught in an overflow channel or tidal pond, the whales may have difficulty regulating body heat. An extensive network of blood vessels within the flukes and flippers allows beluga whales to lose excess body heat to the environment. If the flukes and flippers are out of the water, this network cannot function properly and internal body heat rises resulting in hyperthermia.

Beluga whale strandings in upper Cook Inlet are not uncommon, with a majority occurring in Turnagain Arm (Table 3). Sightings of stranded whales are often opportunistically spotted from the Seward Highway off of Turnagain Arm, or from small aircraft traveling over the Inlet. NMFS has reports of over 700 whales stranding in upper Cook Inlet since 1988 (Table 3). Mass strandings (involving two or more whales) primarily occurred in Turnagain Arm and often coincided with extreme tidal fluctuations ("spring tides") or killer whale sighting reports (Shelden et al. 2003). In 2003, an unusually high number of beluga live strandings (five separate events involving between 2 and 46+ whales) and mortalities (n=20) occurred in Cook Inlet (Vos and Shelden 2005). Other mass strandings have been reported in the Susitna Delta (Vos and Shelden 2005) and most recently on August 7, 2008 in Knik Arm (NMFS unpubl. data). These mass strandings involved both adult and juvenile beluga whales which appeared to be healthy, robust animals.

NMFS considered the significance of stranding events in our status review of this species in 2000. That assessment found stranding related mortalities had not caused the Cook Inlet beluga whale to be in danger of extinction, and was not likely to become so in the foreseeable future given the expectation that the

Table 3. Cook Inlet beluga whale stranding records from 1988 through September 19, 2008 (Vos and Shelden 2005, NMFS unpubl. data). * known subsistence harvested belugas are not included in these numbers

Year	Date & Location of Live Strandings	Number of Whales Involved	Number of Known Associated Deaths	Total Mortalities* (live + dead stranded)
1988	Oct 23 - Turnagain Arm	27	0	0
1989	-	-	-	4
1990	-	-	-	2
1991	Aug 31 - Turnagain Arm	70-80	0	2
1992	Oct 6 - Kenai River	2	2	5
1993	Jul 6 - Turnagain Arm	10+	0	3
1994	Jun 14 - Susitna River	186	0	7
1995	-	-	-	2
1996	Jun 12 - Susitna River Aug 28 - Turnagain Arm Sep 2 - Turnagain Arm Sep 8 - Knik Arm Oct 2 - Turnagain Arm	63 60 20-30 1 10-20	0 4 1 0 0	12
1997	-	-	-	3
1998	May 14 - Turnagain Arm Sep 7 - Turnagain Arm	30 5	0 0	10
1999	Aug 29 - Turnagain Arm Sep 9 - Turnagain Arm	58 12-13	5 0	12
2000	Aug 27 - Turnagain Arm Sep 24 - Turnagain Arm Oct 24 - Turnagain Arm	8 15-20 1-2	0 0 0	13
2001	-	-	-	10
2002	-	-	-	13
2003	Apr 18 - Turnagain Arm Aug 28 - Turnagain Arm Sep 6 - Turnagain Arm Sep 14 - Turnagain Arm Oct 6 - Turnagain Arm	2 46+ 26 32 9	0 5 0 0 0	20
2004	-	-	-	13
2005	Aug 24 - Knik Arm	6	1	6
2006	Sep 12 - Knik Arm	12	0	8
2007	-	-	-	15
2008	Aug 7 - Knik Arm	28-30	2	11

population would increase two to six percent per year with the restrictions placed on subsistence hunting. However, in the 2006 status review (Hobbs et al. 2006) NMFS recognized that stranding was a constant threat to the recovery of Cook Inlet belugas; this decision was upheld in the 2008 status review (Hobbs et al. 2008). The change in opinion was primarily a result of two factors. First, in 2000 the population of belugas was larger (435 whales) and expected to increase at a rate of two to six percent per year with the regulation of subsistence harvests. Given this, NMFS believed that the population could withstand limited stranding-related mortalities and still recover.

However, in 2006 NMFS officially recognized that the population was not growing as expected, but rather was declining at a rate of 4.1 percent per year since the regulation of subsistence hunting in 1999 (the 2008 status review documented a decline of 2.7 percent per year from 1999-2007). Therefore, NMFS realized that this declining population could not easily recover from multiple mortalities resulting from a mass stranding event. For instance, in 2003 there were five separate stranding events involving potentially 115 individual belugas (i.e., assuming no beluga stranded more than once); if all had died as a result of these strandings, one third of the population would have been lost in a single year. Second, in 2003 over 45 beluga whales were stranded at the far end of Turnagain Arm and were out of the water for roughly 10 hours waiting for the tide to return. From this one event, five belugas were thought to have died as a direct consequence based upon beach cast carcasses found in the following days. In 2005, the one mortality associated with the mass stranding was attributed to cardiovascular collapse resulting from extended time out of the water (NMFS unpubl. data). These mortalities changed NMFS' thinking on the risk involved in strandings and indicated 10 hours may be approaching the out of water limit for these whales. Thus, prolonged stranding events lasting more than a few hours, although not common, may under unusual circumstances (such as unusual tidal cycles, storm surge, flooding, tsunami, or earthquake uplift) result in significant mortalities. The annual abundance estimates do not indicate a high probability that this population is recovering, and NMFS now believes strandings may represent a significant threat to the conservation and recovery of these whales.

b. **Predation:** The Cook Inlet beluga whale stock is preyed upon by killer whales, their only known natural predator. NMFS has received reports of killer whales throughout Cook Inlet. In upper Cook Inlet, killer whales have been reported in Turnagain and Knik Arms, between Fire Island and Tyonek, and near the mouth of the Susitna River (Shelden et al. 2003; NMFS unpubl. data). Native hunters report that killer whales are usually found along the tide rip that extends from Fire Island to Tyonek (Huntington 2000). Killer whales are more commonly found in lower Cook Inlet and the Gulf of Alaska (Shelden et al. 2003) where they may feed on a variety of prey.

The number of killer whales reported in the upper Inlet appears to be small. This may be a single pod with five or six individuals that has extended its feeding territory into Cook Inlet. Killer whales are described by three categories or groupings: resident, transient, and offshore. Only the transient killer whales are known to feed on marine mammals. Photographs of killer whales which have stranded in Turnagain Arm indicate those whales were unidentified transients (Shelden et al. 2003). However, resident types also occur in Cook Inlet. Therefore, killer whale sightings in proximity to beluga whales in the upper Inlet do not necessarily mean they are feeding on beluga whales.

Killer whales have stranded along Turnagain Arm on at least two occasions; six killer whales were found stranded alive in May 1991 and five were stranded alive in August 1993 (Shelden et al. 2003). During the 1993 stranding event, a large male killer whale regurgitated pieces of beluga whale and harbor seal (Shelden et al. 2003). On September 23, 2000, a NOAA Enforcement agent observed approximately four killer whales chasing beluga whales in Turnagain Arm (NMFS unpubl. data). Within the next two days, two lactating female belugas stranded with teeth marks, internal hemorrhaging, and other injuries consistent with killer whale attacks (Shelden et al. 2003). On June 14, 2007, an adult beluga was chased and killed by a pod of killer whales near Anchor Point in lower Cook Inlet (NMFS unpubl. data). Killer whales were sighted in Turnagain Arm in September 2007, although no beluga predation was reported (Pers. comm. B. Smith, NMFS 2007). Most recently, NMFS received reports of a killer whale mom/calf pair sighted near Tyonek heading towards the Anchorage area on September 8, 2008. Two days later, NMFS received a report of a killer whale mom/calf pair killing a beluga whale in Turnagain Arm (NMFS unpubl. data).

Given the small population size of the Cook Inlet beluga whales, predation may have a significant effect on beluga abundance. Only opportunistic data exist on the level of removals of belugas in Cook Inlet due to killer whale predation, which appears to be at least one beluga per year (Shelden et al. 2003). The effects of killer whale predation were addressed in the 2006 status review (Hobbs et al. 2006); the models used in that status review demonstrated killer whale predation on an annual basis could significantly impact recovery, especially when combined with other sources of mortality. In addition to directly reducing the beluga population, the presence of killer whales in Cook Inlet may also increase stranding events (see I.H.1.a. Strandings). As such, NMFS considers killer whale predation to be a potentially significant threat to the conservation and recovery of these whales.

c. **Parasitism and Disease:** Infectious diseases and pathogens have been identified as among the top risks endangering species, possibly resulting in extinction (Scott 1988; Anderson and May 1992; Daszak et al. 2000; Deem et al. 2001; Harvell et al. 2002). While disease may not cause the complete extinction of the species, it can produce enough mortality to threaten the species or trigger the disappearance of local stocks or populations, increasing the risk posed by other mechanisms (de Castro and Bolker 2005). Disease alone may be unlikely to drive a species to extinction, but may be much more likely when combined with other contributing risk factors such as pollution, habitat loss, and human disturbance (Smith et al. 2006).

In a paper evaluating the threats of infectious disease on a population of killer whales in the Pacific Northwest, Gaydos et al. (2003) identified several high priority pathogens that warrant further study. The pathogens identified were marine Brucella species, cetacean poxvirus, morbillivirus, and herpes virus. These agents were identified through analysis of infectious disease reported for other killer whales, both free-ranging and captive, as well as sympatric toothed whales. Gaydos et al. (2003) advocated the development of standardized necropsy protocols. Their study also noted that in long-lived species, infectious diseases that affect reproductive success could significantly impact a population's size and viability. They found that, due to the small size of this killer whale group (the southern resident population) and their gregarious social nature, introduction of a highly virulent and transmissible pathogen had the potential to catastrophically affect the group's long term viability.

Recently, Guimaraes et al. (2007) modeled the dynamics of an infectious disease spreading through a reproductively isolated group of mammal-eating killer whales in the Pacific Northwest. Their study examined scenarios in which a disease affected only a small portion of the population up through scenarios in which the entire population was vulnerable, based on only minimal contact between animals. The work of Guimaraes et al. (2007) demonstrated that small populations, even in those in which there is seemingly little interaction amongst small isolated groups, are susceptible to population-wide disease outbreaks. The small Cook Inlet beluga whale population is also characterized by its longevity and gregarious social structure, and therefore, may face similar concerns in regards to effects of diseases and the potential for outbreaks to affect the entire population.

Information on parasites, disease agents, and pathology in belugas is available in the literature, but little has been published regarding the Cook Inlet stock, therefore, little information is available about the role these agents may play in the decline and long-term viability of Cook Inlet belugas. This has been exacerbated by small sample sizes and the poor quality of most of the Cook Inlet beluga carcasses examined up to this point (Burek et al. in prep). Between 1998 and 2007, varying degrees of necropsies and sampling have been completed on 13 Cook Inlet beluga carcasses. In many instances, carcasses were in such advanced decomposition that only minimal diagnostics could be performed; however, some data on parasites and possible diseases were collected. In the few instances of Cook Inlet whales killed during subsistence harvests, an examination was done by a biologist and tissues were sampled. The following section represents what is known about disease agents and parasites in Cook Inlet beluga whales (see Hobbs et al. 2008 for an expanded discussion).

i) *Disease Agents:*

Bacteria

Bacterial agents are a part of normal flora in many species of marine mammals, and presence of these organisms should be interpreted with caution to determine whether they are commensal organisms, pathogens or secondary invaders. According to some reports bacterial infection, particularly of the respiratory tract, is one of the most common diseases encountered in marine mammals. Bacterial pneumonia, either alone or in conjunction with parasitic infection, is a common cause of beach stranding and death (Howard et al. 1983). Due to the quality of carcasses of Cook Inlet belugas, very little bacterial culture work has been done.

At least one Cook Inlet beluga whale death was attributed to infectious disease. A female beluga stranded in September 2000 with severe parasitic pneumonia and secondary bacterial infection; liver flukes, skin infections, tongue worms, and probable sepsis (blood poisoning) were also documented (NMFS unpubl. data).

Viruses

Viruses are widespread in marine mammals and have become recognized as important causes of individual and mass mortalities, and include the morbilliviruses, influenza and possible herpes viruses (Munn 2006). Viruses can also compromise an animal's immune system and render it susceptible to secondary invaders such as bacterial agents and parasitic protozoa. While other viruses with varying effects on health have been identified in other marine mammal species, viral infections have not been well-studied in belugas.

Herpes viruses have been linked to skin lesions, esophageal lesions, encephalitis (inflammation of the brain), and neoplasia (abnormal cell growth). Herpes viruses have also been reported to cause encephalitis in harbor porpoises (Kennedy et al. 1992) and may cause large-scale mortality in belugas. These viruses have been detected in belugas and several sympatric species, and may persist in an infected host with periodic or continuous shedding. In Cook Inlet, there have been a few necropsy cases, and a few live animal reports, in which belugas had skin lesions suggestive of a herpes virus. In one necropsy case of a juvenile female, herpes virus was detected, suggesting this animal died of a systemic herpes viral infection.

Unfortunately, most Cook Inlet beluga whale carcasses have not been suitable for extensive bacterial or viral cultures, therefore little can be said about the presence or absence of these types of infectious diseases.

Fungi

Mycotic (fungal) infections in marine mammals represent a relatively small, but significant fraction of infectious diseases in marine mammals, and have been isolated from at least 27 species, including the beluga and sympatric species (Reidarson et al. 1999). Pulmonary aspergillosis is the most common mycotic infection in marine mammals and has been isolated in a captive beluga, harbor seal and killer whale (Reidarson et al. 2001). Infection with zygomycotic fungal organisms have been reported in a captive killer whale and Pacific white-sided dolphin (Robeck and Dalton 2002), and while virulent, pose a low epizootic potential and threat to Cook Inlet belugas. The probability of free-ranging belugas being exposed to fungal organisms is low compared to captive animals, given the former are less frequently in contact with terrestrial fungal sources and antibiotic usage, two well-known risk factors in captive belugas (Reidarson et al. 2001). Given this information, however, mycotic pathogens should still be considered a mild to moderate health threat to Cook Inlet belugas, especially in animals that may already have compromised immune systems from contaminants, other disease, and stressors.

Protozoa
Encysted protozoal organisms within muscle tissues of Cook Inlet belugas are commonly found. The parasite is consistent with *Sarcocystis* spp., which when found within muscle tissues of other marine mammals, is thought to be benign. Acute infections, however, can result in tissue degeneration leading to lameness or death in other species (Burek 1999b), but the effects on belugas is unknown.

ii) Parasites
Nearly every wild animal has some parasites, and the role of parasites in causing disease and mortality is often difficult to interpret. Some parasites have been implicated as causes of strandings. For example, aberrant migrations of the trematode Nasitrema through the brain have been linked to strandings (O'Shea et al. 1991; Degollada et al. 2002).

"Lung worms" often not only parasitize the lungs, but also the sinuses, ears, auditory tubes, cardiovascular system, liver, and potentially the cranial vault. Since some lung worms can be associated with secondary bacterial infections and severe pneumonia it is unclear whether lung worms alone, or only when combined with secondary bacterial infections, were involved in strandings due to pneumonia, as pneumonia is a relatively common finding in stranded cetaceans. Lung worms appear to be common in Cook Inlet belugas (indicated in 67 percent of the whales in which the lung was examined), although this is primarily based upon histologic findings at this point

In approximately 80% of Cook Inlet belugas examined, the nematode *Crassicauda giliakiana* has been seen in the kidneys. Although extensive damage and replacement to tissues have been associated with the parasite *Crassicauda* in some of the Cook Inlet belugas, it is unclear at this time whether this can result in functional damage to the kidney (Burek 1999a), or whether it is affecting the status of the population. Severe secondary effects of these parasites to other organs have not been observed to date in Cook Inlet whales, so it is most likely that under usual circumstances and levels of infestation these animals live with this parasite with no clinical effect. It is possible though that with heavy infestation, there could be replacement of enough of the kidney (2/3 to 3/4 of the kidney tissue) to affect function or obstruction of urine outflow. This severity of infestation has not been observed in the small of number of Cook Inlet beluga carcasses examined to date. Necropsies conducted on adult Cook Inlet beluga whales have found heavy infestations of a very common nematode (anisakids), commonly referred to as whaleworm, in the stomach. This parasite occurs in at least 35 other cetaceans, tends to favor the stomach, and may cause gastritis or ulcerations. These infestations have not been considered to be extensive enough to have caused clinical signs.

One Cook Inlet beluga demonstrated a grossly evident lesion in the liver (NMFS unpubl. data) which histologically was due to a liver trematode. This trematode was not identified to species, but was most likely a *Campulid* type trematode.

While parasites and the potential for infectious disease occur in Cook Inlet beluga whales, no indication exists that their occurrence has had any measurable impact on the survival and health of the Cook Inlet beluga whale stock. However, many of the carcasses were not suitable for extensive infectious diseases work-up due to the breakdown of tissues and cells, and more work is necessary in this field.

d. **Environmental Change:** Cook Inlet is a very dynamic environment which experiences continual change in its physical composition; there are extreme tidal changes, strong currents, and tremendous amounts of silt being added from glacial scouring. For example, an experienced and knowledgeable Alaska Native beluga hunter observed that the Susitna River (an area frequented by belugas, especially during fish runs) has filled in considerably over the past 40-50 years (Pers. Comm. P. Blatchford 1999 via B. Smith, NMFS). He told of one persistent channel in the river that was more than 40 feet deep but that is now filled in with sediment. Since belugas are still seen in the area today, they may be able to adapt to physical changes in their habitats.

The climate in Cook Inlet is driven by the Alaska Coastal Current (ACC; a low salinity river-like body of water flowing through the Pacific Ocean and along the coast of Alaska with a branch flowing into Cook Inlet) and the Pacific Decadal Oscillation (PDO). PDO is similar to El Niño except it lasts much longer (20-30 years in the 20th century). Warm and cool phase changes of the PDO have been correlated with changes in marine ecosystems of the northeast Pacific; warm phases have been accompanied by increased biological productivity in coastal waters of Alaska and decreased productivity off the west coast of Canada and the US, whereas cold phases have been associated with the opposite pattern.

Prior to 2004, temperatures in the Gulf of Alaska were relatively stable, but in mid 2004 temperatures warmed and stayed warm until late 2006. Sampling of oceanographic conditions (via GAK1) [3] just south of Seward, Alaska has revealed anomalously cold conditions in the Gulf of Alaska beginning winter of 2006-2007; "deep (>150m depth) temperatures are the coldest observed since the early 1970s" (Weingartner 2007). Deep water temperatures are anticipated to be even colder in winter 2007-2008 due to deep shelf waters remaining cold throughout the 2007 summer, and Gulf of Alaska temperatures in spring 2008 are predicted to be even colder than in spring 2007 (Weingartner 2007).

The change in water temperature may in turn affect zooplankton biomass and composition. Plankton are mostly influenced by changes in temperature, which may affect their metabolic and developmental rates, and possibly survival rates (Batten and Mackas 2007). Data collected by Batten and Mackas (2007) demonstrated that mesozooplankton (planktonic animals in the size range 0.2-20 mm) biomass was greater in warm conditions, and that zooplankton community

[3] Information presented here also based on information obtain from the GAK1 oceanographic station website: www.ims.uaf.edu/gak1/ (maintained by Dr. Weingartner; accessed December 2007).

composition varied between warm and cool conditions, thus potentially altering their quality as a prey resource (Batten and Mackas 2007). In Cook Inlet, mesozooplankton biomass has increased each year from 2004 to 2006, however sampling from late 2006 to early 2007 suggests biomass values are decreasing; a change most certainly driven by changes in climate (Batten 2007). Therefore, temperature changes effect changes in zooplankton, which in turn may influence changes in fish composition, and hence alter the quality and types of fish available for belugas.

El Niño events also have the potential to affect sea surface temperatures, however, the effects of a 1998 El Niño warming event on lower Cook Inlet were lessened by upwelling and tidal mixing at the entrance to Cook Inlet (Piatt et al. 1999). It is likely that the physical structure of the Inlet and its dominance by freshwater input acts to buffer these waters from periodic and short-term El Niño events.

The changing temperatures also affect the amount of ice that develops in Cook Inlet during the winter. The environment in which belugas reside makes them vulnerable to entrapment in ice at times. Belugas are more susceptible to entrapment during sudden freeze-ups, fast ice formation (Heide-Jorgensen et al. 2002), and when wind conditions change, driving ice into once open areas (Armstrong 1985). A wind-driven ice entrapment of over 1,000 belugas occurred in Seniavin Strait, Chukotka, Russia in 1984 (Armstrong 1985). Entrapments that result in mass mortalities appear to be rare, though under-reporting is possible given these incidents occur during the dark, winter months. Cook Inlet belugas, however, are well-adapted to this icy environment and have been observed entering Knik and Turnagain Arms despite the presence of greater than 90 percent cover of sea-ice (Hobbs et al. 2005). At this time however, the data are insufficient to assess effects (if any exist) of environmental change on Cook Inlet beluga whale distribution, abundance, or recovery.

2. Human Induced Factors

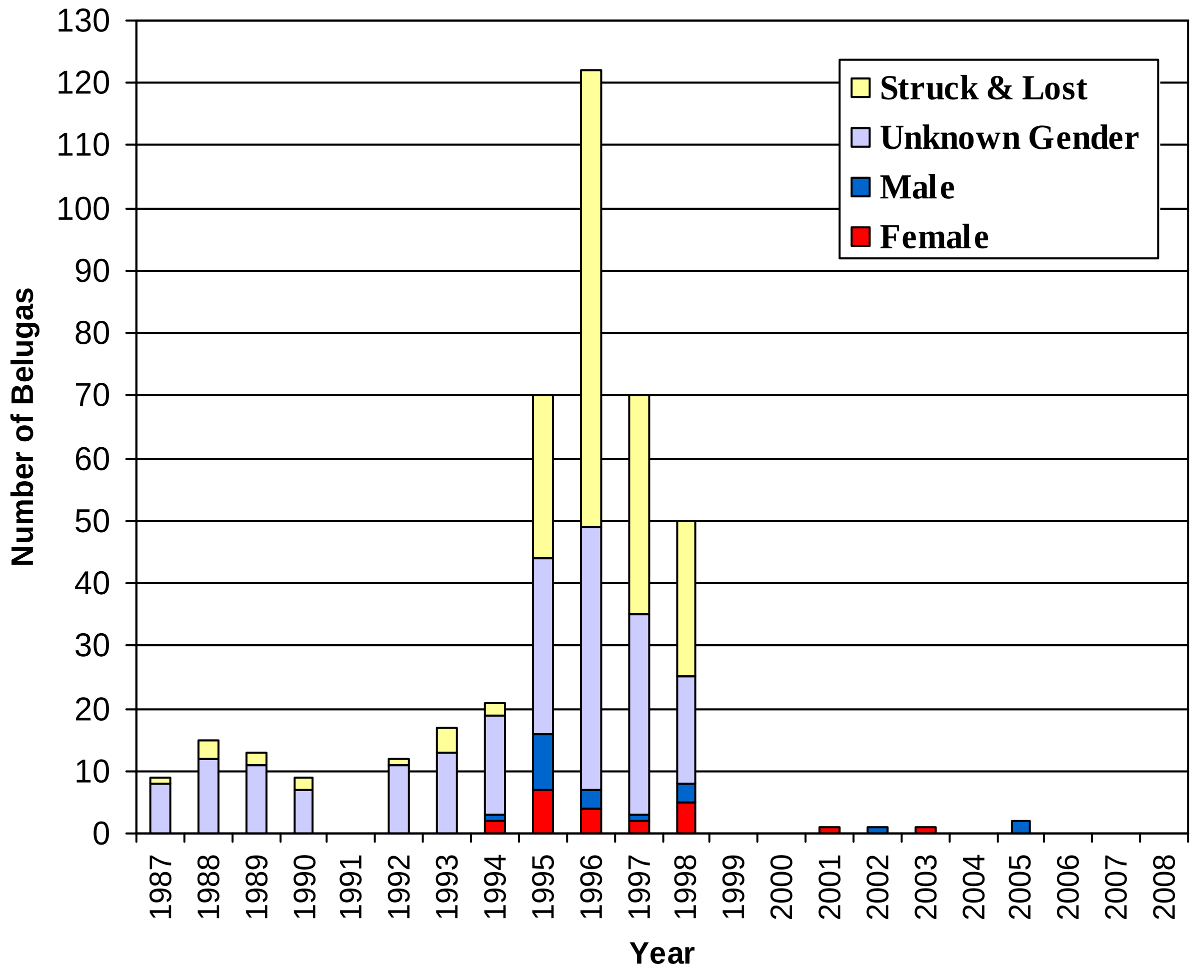
Large numbers of people in a relatively small area present added concerns to the natural environment and to Cook Inlet belugas. The upper Cook Inlet region is the major population center of Alaska, with the 2006 population of the Anchorage Borough at 278,700, the 2006 Matanuska-Susitna Borough population at 80,480, and the 2000 Kenai Peninsula Borough population at 49,691 (U.S. Census Bureau 2008).

a. Subsistence Harvest: Alaska Natives have harvested Cook Inlet beluga whales prior to and after passage of the MMPA in 1972 for cultural, subsistence, and handicraft purposes. The effect of past harvest practices on the Cook Inlet beluga whale population is significant. While a harvest occurred at unknown levels for decades, NMFS believes the subsistence harvest levels increased substantially in the 1980s and 1990s. Reported subsistence harvests between 1994 and 1998 can account for the estimated decline of the stock during that interval. The observed decline during that period and the reported and estimated harvest rates (including estimates of whales which were struck and lost, and assumed to have perished) indicate these harvest levels were unsustainable. However, the lawful Native harvest of beluga was limited to zero to 2 whales per year since 1999.

Figure 11 summarizes subsistence harvest data from 1987 to 2008 (Angliss et al. 2001, NMFS unpubl. data). A study conducted by ADFG, in cooperation with the Alaska Beluga Whale Committee (ABWC) and the Indigenous People's Council for Marine Mammals, estimated the subsistence take of belugas in Cook Inlet in 1993 at 17 whales. However, in consultation with Native elders from the Cook Inlet region, the Cook Inlet Marine Mammal Council (CIMMC) estimated the annual number of belugas taken by subsistence hunters during this time to be greater (DeMaster 1995). There was no systematic Cook Inlet beluga harvest survey in 1994. Instead, harvest data were compiled at the November 1994 ABWC meeting, including two belugas taken by hunters from Kotzebue Sound.

The most thorough Cook Inlet beluga subsistence harvest surveys were completed by CIMMC during 1995 and 1996. While some local hunters believed that the 1996 estimate of struck and lost is positively biased, the CIMMC's 1995 to 1996 take estimates are considered reliable (CIMMC 1996, 1997; Angliss and Lodge

Figure 11: Summary of known Cook Inlet beluga whale subsistence harvest from 1987-2008 (NOAA 2007; NMFS unpubl. data).



2002). Given that there was no survey during 1997 or 1998, NMFS estimated the subsistence harvest from hunter reports. The known annual subsistence harvest by Alaska Natives during 1995-1998 averaged 77 beluga whales.

The harvest, which was as high as 20 percent of the population in 1996, was sufficiently high to account for the 14 percent annual rate of decline in the population during the period from 1994 through 1998 (Hobbs et al. 2000). In 1999 there was no harvest as a result of a voluntary moratorium by the hunters that spring, and the moratorium became permanent in 2000. During 2000-2003 and 2005-2006 NMFS entered into co-management agreements for the Cook Inlet beluga subsistence harvest. Between 2000 and 2008, subsistence harvests have been 0, 1, 1, 1, 0, 2, 0, 0, and 0 whales, respectively.

b. **Poaching and Illegal Harassment:** Due to their approachable nature, the potential for poaching belugas in Cook Inlet exists. Although NOAA Enforcement is present in upper Cook Inlet, the area they have to cover is extensive. While poaching is a possible threat, no poaching incidents have been confirmed to date.

Cook Inlet is bordered by the densest human population in Alaska. This juxtaposition of people and belugas in and near coastal waters heightens the potential for harassment of belugas. NOAA Enforcement investigated several incidences of reported harassment of Cook Inlet belugas, but to date there have been no convictions. The potential, however, for both poaching and illegal harassment exists.

c. **Personal Use, Subsistence and Recreational Fishing:** Personal use and subsistence fishing are only allowed for Alaskan residents. Fish and fish parts may not be sold or bartered and are only for direct personal or family consumption, or subsistence cultural uses. Personal use gill net fisheries occur in Cook Inlet and have been subjected to many changes since 1978 (Ruesch and Fox 1999), which are summarized in Brannian and Fox (1996). Fishing for eulachon is popular in Turnagain Arm, with no bag or possession limits. The two most significant areas where eulachon are harvested in personal use fisheries are the Twentymile River (and shore areas of Turnagain Arm near Twentymile River) and Kenai River. Other areas where eulachon are harvested include the Big and Little Susitna River and their tributaries, the Placer River, and shoreline areas of Turnagain Arm and Cook Inlet north of the Ninilchik River. Annual harvests have ranged from 2.2 to 5 tons over the past decade. The personal use harvest of eulachon is possibly under-reported as some participants may confuse their harvests as being subsistence and not personal use. Currently, no subsistence records are kept for eulachon or herring harvests (ADFG 2004).

Recreational fishing is a very popular sport in Alaska, as evidenced by the intensive fishing during salmon runs and the high number of charter fishing operations. In upper Cook Inlet there are numerous recreational fishing areas targeting primarily salmon, including the hundreds of drainages of the Susitna River; the Little Susitna River; the west Cook Inlet streams; and areas around

Anchorage such as Ship Creek. Recreational fishing for salmon in Ship Creek is the most popular stream fishery in the Anchorage area. In 2005, anglers fishing in the Anchorage area represented four percent of the total statewide sport fishing effort[4]. In lower Cook Inlet, recreational fishing for groundfish such as halibut, rockfish and lingcod are also popular. There are even recreational fishers digging for littleneck clams, butter clams, and razor clams. NMFS is unaware of any beluga whales injured or killed in the Cook Inlet due to personal use, subsistence, or recreational fisheries. However, the most likely impacts from these fisheries include the operation of small watercraft in stream mouths and shallow waters, ship strikes, displacement from important feeding areas, harassment, and prey competition.

d. **Commercial Fishing:** Several commercial fisheries occur in Cook Inlet waters and have varying likelihoods of interacting with beluga whales (either directly or via competition for fish) due to differences in gear type, species fished, timing, and location of the fisheries. Interactions refer to entanglements, injuries, or mortalities occurring incidental to fishing operations. Given that beluga whales concentrate in upper Cook Inlet during summer (Type 1 and 2 habitats) (Rugh et al. 2000, 2005c), fisheries occurring in the upper Inlet could have a higher likelihood of interacting with beluga whales.

ADFG has management responsibility for most of the commercial fisheries in Cook Inlet, with the exception of halibut and a few federally managed fisheries in the lower Inlet. The state-managed fisheries in the upper and mid Inlet include salmon (both set and drift gillnet), herring (gillnet), a recently reopened dip net fishery for eulachon (a.k.a. hooligan or smelt), and a razor clam fishery. The largest fisheries in Cook Inlet, in terms of participant numbers and landed biomass, are the State-managed salmon drift and set gillnet fisheries concentrated in the Central and Northern Districts[5] in the upper and mid Inlet. Even though all five types of Pacific salmon are caught in the upper Inlet, sockeye salmon is the primary target of the salmon commercial fisheries. Times of operation change depending upon management requirements, but in general the drift fishery operates from late June through August, and the set gillnet fishery during June through September. Salmon fishery effort varies between years, and within-year effort can be temporally and spatially directed through salmon management regulations. While the number of permits fished in Cook Inlet salmon gillnet fisheries has been relatively constant, the actual number of fish caught has fluctuated greatly during the past 20 years (ranging from a high of 10.6 million in 1992 to a low of 1.8 million in 2000). The 2007 commercial harvest of salmon in upper Cook Inlet was 3.6 million, slightly higher than the 10 year average of 3.5 million harvested salmon. The sac roe herring fisheries are located in four subdistricts of the upper and mid Inlet (Upper, West, Kalgin Island, and Chinitna Bay subdistricts), however, the Upper subdistrict fishery is the most productive one. In 2007, the herring catch was 26,000 pounds. The commercial razor clam

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[4] Data from ADFG's Sport Fish website: www.sf.adfg.state.ak.gov

[5] For the reader's clarification, the term "districts" is not synonymous with our definitions of Valuable Habitat Types. Districts are referenced solely in regards to management of fisheries; see the State of Alaska, Department of Fish and Game, Commercial Fisheries website (http://www.cf.adfg.state.ak.us) for more information on districts.

fishery off the west side of the Inlet is the only remaining commercial fishery for razor clams in Alaska and takes about 400,000 pounds per year (Pers. Comm. J. Fox, ADFG 2008 via M. Migura, NMFS).

There has been a sporadic fishery for eulachon since 1978 (taking between 300-100,000 pounds in 1978, 1980, 1998 and 1999). NMFS made recommendations to the Board of Fisheries (BOF) to discontinue this fishery effective in 2000, in part due to the lack of data on the eulachon runs into the Susitna River, and due to the absence of any evaluation of the effect of this fishery on beluga whales in terms of disturbance/harassment or competition for these fish. Additionally, it was noted beluga whales may be heavily dependent on the oil-rich eulachon early in the spring (preceding salmon migrations) and that large eulachon runs may occur in only a few upper Inlet streams. The commercial fishery for eulachon was reopened in 2005, but is restricted to hand-operated dip nets in saltwaters between the Chuit River and the Little Susitna River, with a total harvest of 100 tons or less. There was no fishing effort in 2005; 45.4 tons of eulachon were caught in 2006 and 62.5 tons of eulachon were caught in 2007 (Pers. Comm. P. Shields, ADFG 2007 via B. Smith, NMFS).

In the lower Inlet, in addition to the salmon and herring fisheries, ADFG also manages commercial fisheries for groundfish (lingcod and rockfish; Pacific cod; and sablefish), and shellfish (weathervane scallops; hardshell clams; and tanner crabs). Salmon purse seine fisheries in lower Cook Inlet operate south of a line drawn west from Anchor Point within two districts, Kamishak Bay and southern Cook Inlet (divided at 152°20' W longitude), with most of the catch coming from the Southern District. The lower Cook Inlet herring sac roe fishery is of extremely short duration (often minutes to hours) taking place sometime in or near April within Kamishak Bay. Landed herring biomass has fluctuated greatly since 1977 until 1999, when this fishery was closed. The lower Inlet herring fishery will remain closed in 2008 in an attempt to allow herring biomass to rebuild. Also, a mechanical/hand jig fishery for lingcod and rockfish occurs in the lower Inlet.

The only Federally-managed fisheries active in the Inlet during the summer season are in the lower Inlet/Northern Gulf waters for groundfish and crab, and as such have limited potential for impacting belugas. No non-pelagic trawls are permitted north of a line between Cape Douglas and Point Adam, and should a federal fishery take place in lower Cook Inlet, the waters would be open only to longline or pelagic trawl gear.

Commercial fishing for halibut in Cook Inlet is managed by the International Pacific Halibut Commission[6] (IPHC). The IPHC manages stocks of Pacific halibut within agreement waters of the United States and Canada. Cook Inlet falls in regulatory area 3A, which also includes a portion of the Gulf of Alaska. In Cook Inlet, this fishery primarily operates in mid and lower Inlet waters. In 2007, a total of approximately seven million pounds of halibut were landed in Kenai, Ninilchik and Homer.

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[6] For more information on IPHC, visit their website at www.iphc.washington.edu/halcom/default.htm.

Due to the location of many of the fisheries in lower Cook Inlet (typically south of Anchor Point), their proximity to the Gulf of Alaska, and the propensity for beluga whales to concentrate in the upper Inlet in the summer, the lower Inlet fisheries are anticipated to have little direct impact on Cook Inlet beluga whales at this time.

i) Incidental Take

The term incidental take in regards to commercial fishing refers to the catch or entanglement of animals that were not the intended target of the fishing activity. Reports of marine mammal injuries or mortalities incidental to commercial fishing operations have been obtained from fisheries reporting programs (self-reporting or logbooks), observer programs, and reports in the literature. The only reports of fatal takes of beluga whales incidental to commercial salmon gillnet fishing in Cook Inlet are from the literature. Murray and Fay (1979) stated that salmon gillnet fisheries in Cook Inlet caught five beluga whales in 1979. Incidental take rates by commercial salmon gillnet fisheries in the Inlet were estimated at three to six beluga whales per year during 1981-1983 (Burns and Seaman 1986). Neither report, however, differentiated between the set gillnet and drift gillnet fisheries. There have been sporadic reports over the years of single beluga whales becoming entangled in fishing nets, however, mortalities could not be confirmed.

Another source of information on the number of beluga whales killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators by the MMPA. Logbook data are available for part of 1989-1994. During 1990-1993, certain fisheries were required to participate in a logbook reporting program, which provided information regarding fishing effort, interactions with marine mammals, and the outcome (deterred, entangled, injured, killed). Based on a lack of reported mortalities from the logbook program, the estimated minimum mortality rate of Cook Inlet belugas incidental to commercial fisheries is zero whales per year. Furthermore, during the period between 1990 and 2000, fishermen’s voluntary self-reports indicated no mortalities of beluga whales from interactions with commercial fishing operations.

Due to a heightened concern in Cook Inlet that fisheries may cause incidental mortalities of beluga whales, NMFS placed observers in the Cook Inlet salmon drift net and upper and lower Inlet set gillnet fisheries in 1999 and 2000 (Angliss and Lodge 2002). During the two years of observations, an estimated total of 384 net-days were observed for the drift gillnet fishery, and an estimated 614 net days were observed for the set net fishery. Only three sightings of beluga whales were made at set gillnet locations in the upper Cook Inlet (Moore et al. 2000; NMFS unpubl. data). Although a few other marine mammals were entangled and released, beluga whales were never observed within 10 m of a net (i.e., within a distance categorized as an interaction) in the drift or set net fisheries; therefore no beluga whale injuries or mortalities resulted from drift gillnets or set nets in either year. In consideration of the above, the current rate of direct mortality from commercial fisheries in Cook Inlet appears to be insignificant and should not delay recovery of these whales.

ii) Reduction of Prey

Aside from direct mortality and injury from fishing activities, commercial fisheries may compete with beluga whales in Cook Inlet for salmon and other prey species. There is strong indication these whales are dependent on access to relatively dense concentrations of high value prey throughout the summer months (see I.F.2. Beluga Feeding Habitat). Native hunters have often stated that beluga whales appear thin in early spring (due to utilizing the fat in their blubber layer over winter), and tend to sink rather than float when struck. Any diminishment in the ability of beluga whales to reach or utilize spring/summer feeding habitat, or any reductions in the amount of prey available, may impact the energetics of these animals and delay recovery.

NMFS recommended the closing of the commercial eulachon fishery effective the 2000 season to the BOF, due to the lack of information regarding the effect of this fishery on belugas. Given that belugas are heavily dependent upon the energy-rich eulachon in early spring, and that the runs are very short in duration and only occur in a few streams in the upper Inlet, a reduction in the availability of eulachon could be detrimental to belugas. In 2005, the BOF reopened this fishery, but stipulated that the harvest not exceed 100 tons of eulachon.

The current salmon management plan for the State of Alaska oversees Inlet fisheries in the lower, middle, and northern districts of the Inlet. Most of these fisheries occur “upstream” of the river mouths and estuaries where beluga whales typically feed. Whether the escapement into these rivers, having passed the gauntlet of the commercial fisheries, is sufficient for the well being of Cook Inlet beluga whales is unknown. Furthermore, the amount of fish required to sustain this population is unknown. However, data from captive beluga whales show daily consumption rates of 4-7 percent of body weight per day (Sergeant and Brodie 1969). Any escapement necessary to meet the needs of wild belugas would have to consider the feeding efficiency of these whales (which is unknown). However, even if large salmon runs must be present for a beluga whale to efficiently capture a single fish, this would still be a small fraction of the total salmon return. The State of Alaska carefully manages the salmon fisheries to meet escapement goals for various waters, and fisheries open and close throughout the season, presenting many opportunities for adequate numbers of salmon to reach their spawning streams. There also are salmon hatcheries operating in Cook Inlet, which have measurably added to the numbers of adult fish returning to the upper Inlet. Additional research, such as continued stomach and fatty acid analyses, may shed more light on feeding and prey requirements for beluga whales.

At this time, it is unknown whether competition with commercial fishing operations for prey resources is having any significant or measurable effect on Cook Inlet beluga whales.

e. Pollution: The principal sources of pollution in the marine environment are: 1) discharges from industrial activities that do not enter municipal treatment systems; 2) discharges from municipal wastewater treatment systems; 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products (Moore et al. 2000). Below is a brief discussion on a few of the more prominent sources for Cook Inlet, excluding the oil and gas industry (see I.H.2.f. Oil and Gas below for a detailed discussion), that have the potential to contribute pollutants to Cook Inlet.

i. Contaminants found in Belugas

Contaminants are a concern for beluga whale health and subsistence use (Becker et al. 2000). Since 1992, tissues from Cook Inlet beluga whales have been collected from subsistence harvested and stranded belugas and analyzed for contaminants as part of the Alaska Marine Mammal Tissue Archival Program (AMMTAP). These samples were compared to samples taken from beluga whales in two arctic Alaska locations (Point Hope and Point Lay), Greenland, arctic Canada, and the Saint Lawrence estuary in eastern Canada (Becker et al. 2000). Tissues were analyzed for polychlorinated biphenyls (PCBs), chlorinated pesticides (such as DDT), and heavy metals. PCB's and DDT may impair marine mammal health and reproductive abilities. Arctic and Cook Inlet beluga whales had much lower concentrations of PCBs and DDT than the Saint Lawrence animals. When compared to the arctic Alaska samples, Cook Inlet beluga whales had about one-half the concentrations of total PCBs and total DDT.

Polybrominated diphenyl ethers (PBDE) are structurally similar to PCBs and have been identified in other toothed whales in the Pacific Northwest. These compounds are used as flame retardants and unlike PCBs (and DDT), are still being manufactured. They may have the potential for various impacts to beluga whales similar to PCBs. No measurements exist of tissue concentrations of PBDE for the Cook Inlet beluga whale at this time.

Also examined were concentrations of various substances stored in the liver. Cadmium and mercury were lower in the Cook Inlet population than in the arctic Alaska populations, while levels of methylmercury were similar to other arctic Alaska populations. However, copper levels were two to three times higher in the Cook Inlet animals than in the arctic Alaska animals and similar to the Hudson Bay animals. The toxicological implication of high copper levels is unknown; however the copper levels found in the livers of Cook Inlet belugas were not high enough to be a health issue. (Becker et al. 2000). One explanation for the elevated levels in Cook Inlet belugas may be that copper apparently does not accumulate with age. The highest copper concentrations were seen in the youngest animals; the Cook Inlet belugas sampled were younger than the whales sampled from Point Lay and Point Hope (Pers. Comm. P. Becker 2008, via M. Migura, NMFS). An alternate explanation for the elevation of copper in Cook Inlet belugas is that the diet of Cook Inlet belugas may contain something different, but which has higher copper, than the diet of other beluga stocks sampled (Pers. Comm. S. Norman 2008, via M. Migura, NMFS). Regardless of the reason for the elevated copper in Cook Inlet beluga whales compared to other stocks, to date, copper has not been implicated as a potential toxin, except in manatees (in areas of intensive application of copper-based herbicides in Florida) (Pers. Comm. S. Norman 2008, via M. Migura, NMFS).

Furthermore, chemical analysis of dredging sediments in 2003 found that pesticides, PCB’s, and petroleum hydrocarbons were below detection limits, while levels of arsenic, barium, chromium, and lead were well below management levels (USCOE 2003). Cadmium, mercury, selenium, and silver were not detected. In general, it appears Cook Inlet beluga whales have lower levels of contaminants stored in their bodies than do other populations of belugas, however, the impacts of contaminants on belugas in Cook Inlet is unknown. Becker et al. (2000) concluded that little is known about the role of multiple stressors in animal health and that future research should examine their interaction and effects on population recruitment for a declining population, such as the beluga whale in Cook Inlet.

ii. Wastewater Treatment

Currently, the treated municipal wastes of ten communities are being discharged into Cook Inlet waters. Wastewaters entering these plants may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria, viruses, and other emerging pollutants of concern (EPOCs). Wastewater from the Municipality of Anchorage, Nanwalek, Port Graham, Seldovia, and Tyonek receive primary treatment, wastewaters from Homer, Kenai, and Palmer receive secondary treatment, while Eagle River and Girdwood wastewaters undergo tertiary (three stage) treatment (Moore et al. 2000). Primary treatment means that only materials that can easily be collected from the raw wastewater (such as fats, oils, greases, sand, gravel, rocks, floating objects, and human wastes) are removed, usually through mechanical means. Wastewater undergoing secondary treatment is further treated to substantially degrade the biological content of the sewage (such as in human and food wastes). Tertiary treatment plants utilize primariy and secondary treatment methods, but use additional technologies to increase the quality of the effluent discharge. According to Anchorage Water and Wastewater Utility, the discharges from the Eagle River and Girdwood facilities are “near drinking water quality”.[7]

The Municipality of Anchorage John M. Asplund Wastewater Treatment Facility (AWTF) was built in 1972 and serves the entire Anchorage area. This facility discharges primary-treated wastewater from the Anchorage municipality directly into Cook Inlet at Point Woronzof. AWTF can treat 58 million gallons per day and processes influent primarily from domestic sources, but does accept a limited amount from industrial sources (CH2M HILL 2006).

The current treatment design of AWTF provides screening, grit removal, sedimentation, skimming, and chlorination of incoming wastewater. The sludge is thickened and dewatered and, along with anything skimmed off the

[7] As stated on the Anchorage Water and Wastewater Treatment Facility website - accessed January 2008 - www.awwu.biz/website/about_us/about_us_frame.htm

surface, is incinerated. The resulting ash is then disposed of in a sanitary landfill. Chlorinated primary effluent is discharged into Knik Arm of Cook Inlet through an outfall extending 804 feet from shore. The discharge from AWTF is authorized by a National Pollution Discharge Elimination System (NPDES) permit, and by a Clean Water Act 301(h) Waiver issued by the Environmental Protection Agency (EPA) exempting this facility from requirements of the Clean Water Act (i.e., AWTF operates as a primary treatment facility, and is not required to perform secondary treatment of wastes) (CH2M HILL 2006). Monitoring programs required by the NPDES permit include assessment of the receiving waters in terms of water quality, biological and physical health, and toxins control.

Little is known about EPOCs and their effects on belugas in Cook Inlet. EPOCs include endocrine disruptors (substances that interfere with the functions of hormones), pharmaceuticals, personal care products, and prions (proteins that may cause an infection), amongst other agents that are found in wastewater and biosolids. The potential impacts on beluga whales from pollutants and EPOCs in wastewater entering Cook Inlet have not been analyzed and cannot be defined at this time.

iii. Stormwater Runoff

The Municipality of Anchorage (MOA) operates under a NPDES stormwater permit to discharge storm water into Cook Inlet. The MOA's NPDES storm water permit is a five-year term permit to discharge stormwater to Cook Inlet, and is issued jointly to the MOA and the Alaska Department of Transportation and Public Facilities (DOT) by the U.S. Region 10 EPA. The MOA Watershed Management Program (2006) report addresses coordination and education, land use policy, new development management, construction site runoff management, flood plain management, street maintenance, and best management practices. Some of the management practices addressed included: pollutant sources and controls (includes street deicer and snow disposal guidance), illicit discharge management, industrial discharge management, pesticides management, pathogens management, watershed mapping, hydrology, water quality, ecology and bioassessment, and watershed characterization. There has been no comprehensive study or analysis to determine if stormwater discharge has had a detrimental effect on belugas.

iv. Airport Deicing[8]

Deicing and anti-icing operations occur from October through May at many airports in and around Cook Inlet, especially Stevens International Airport, Merril Field, Elmendorf Air Force Base, Lake Hood and Lake Spenard. Deicing and anti-icing of aircraft and airfield surfaces are required by the Federal Aviation Administration (FAA) to ensure the safety of passengers. Depending on the application, deicing activities utilize different chemicals. For instance, ethylene glycol and propylene glycol are used on aircraft for anti-

[8] The information in the airport deicing section is taken from a March 14, 2006 Memorandum from Scott Lytle, DOT, Environmental Manager to Daniel Vos at NMFS.

icing and deicing purposes, whereas potassium acetate and urea are used to deice tarmacs and runways. All the deicing materials or their break down products eventually make it to the Inlet. The amount the deicing materials break down prior to discharging into Cook Inlet is not clearly known at this time.

The Anchorage International Airport reported usage of approximately 575,608 gallons of aircraft deicing fluids during the 2003-2004 winter season. In addition, 73,526 gallons of potassium acetate and 659 tons of urea were used for pavement deicing operations. Deicer usage varies from year to year, due to the variation in precipitation each year. The potential impacts on beluga whales from deicing agents entering Cook Inlet have not been analyzed and cannot be determined at this time.

v. Ballast Water Discharges

Ballast water releases in Cook Inlet are a concern because they can potentially release pollutants and nonindigenous organisms into the ecosystem. It is a recognized worldwide problem that aquatic organisms picked up in ship ballast water, transported to foreign lands, and dumped into non-native habitats, are responsible for significant ecological and economic perturbations costing billions of dollars.

The National Invasive Species Act of 1996 (NISA) required the Coast Guard to establish national voluntary ballast water management guidelines. To comply with NISA, the Coast Guard has established both regulations and guidelines to prevent the introduction of aquatic nonindigenous species. On July 28, 2004, the U.S. Coast Guard published regulations establishing a national mandatory ballast water management program for all vessels equipped with ballast water tanks that enter or operate within U.S. waters.

The actual amount of ship ballast water dumped into Cook Inlet was poorly documented prior to 2004. Very limited records from the National Ballast Information Clearinghouse for the period from 1999-2003 document releases of more than five million metric tons from Homer to Anchorage. Smithsonian Environmental Center staff conducting a limited survey just off the Port of Anchorage in 2004 found invasive species that were likely introduced by ballast water. The effect of invasive species from such discharges on the Cook Inlet ecosystem is unknown.

vi. Military Training at Eagle River Flats

Most of the military weapons testing areas around Cook Inlet have not been cleared of hazardous or toxic ordinances (see Moore et al. 2000). An area of particular concern is the Eagle River Flats (ERF), as beluga whales often gather in Eagle Bay between the months of May and November and have been observed in Eagle River from June to October as far inland as 1.25 miles upstream of Eagle Bay (CH2MHill 1997). The ERF is a 2,140 acre estuarine salt marsh located at the mouth of Eagle River on Fort Richardson Army Post. Glacially-fed Eagle River flows through the flats before discharging into Eagle Bay of Knik Arm in upper Cook Inlet. Anthropogenic influences on the flats include military training, both historic (Army artillery impact area since 1949) and current (winter firing of artillery into flats) as well as activities associated with the remediation of white phosphorus left from artillery shell residues.

In 1980 the presence of an unusually large number of waterfowl carcasses was observed on the flats. Growing concern over these mysterious deaths led to the 1987 formation of an interagency task force[9] charged with finding the cause of the mortality and recommending options for remediation (CH2M Hill 1997). Investigations conducted in subsequent years culminated in the identification of exposure to white phosphorous (WP) particles, deposited in ERF sediments following detonation of smoke-producing artillery ammunition, as the cause of the annual waterfowl mortality (Racine et al. 1992). In 1990, the Army stopped use of WP rounds during training in wetlands nationwide as a result of these findings.

In 1994, Fort Richardson was placed on EPA's National Priorities List under the CERCLA[10] program. A comprehensive remedial investigation completed in 1996 concluded that the primary chemical of concern was WP and recommended that remedial action concentrate on WP-contaminated ponds (i.e., hot ponds) (CH2M Hill 1997). The chosen remedial treatment was the temporary draining of water in hot ponds to allow sediment drying and consequent WP sublimation and oxidation. Remedial action began in the spring of 1999 and has resulted in the successful remediation of all previously identified hot ponds (totaling more than 56 acres). Estimated bird mortality on ERF has decreased significantly during this time period.

In addition to monitoring waterfowl mortality on ERF, much work has been done to identify possible movement of WP into Eagle River and Knik Arm. WP particles are persistent in saturated, low oxygen sediment like that found in ERF (Racine et al. 1992) and may be resuspended and potentially transported by tidal activity. Although trace amounts of WP have been detected in tidal gully sediments (but not water) all sediment and water samples from Eagle River and Knik Arm have been WP-free (CH2M Hill 1997; Collins et al. 2002).

The Army also collects and analyzes water samples taken from Eagle Bay and a "background site", Goose Bay, in an effort to monitor the discharge of ERF for other chemical constituents of military munitions. Three years of data indicated no difference in the concentrations of munitions constituents between the water released from ERF and that of the background system site. In fact, more than 95 percent of all analytical results have been less than the method detection limit (USAG-AK 2006).

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[9] Eagle River Flats task force included representatives from the U.S. Army, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, Alaska Department of Fish and Game, and Alaska Department of Environmental Conservation.

[10] Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986

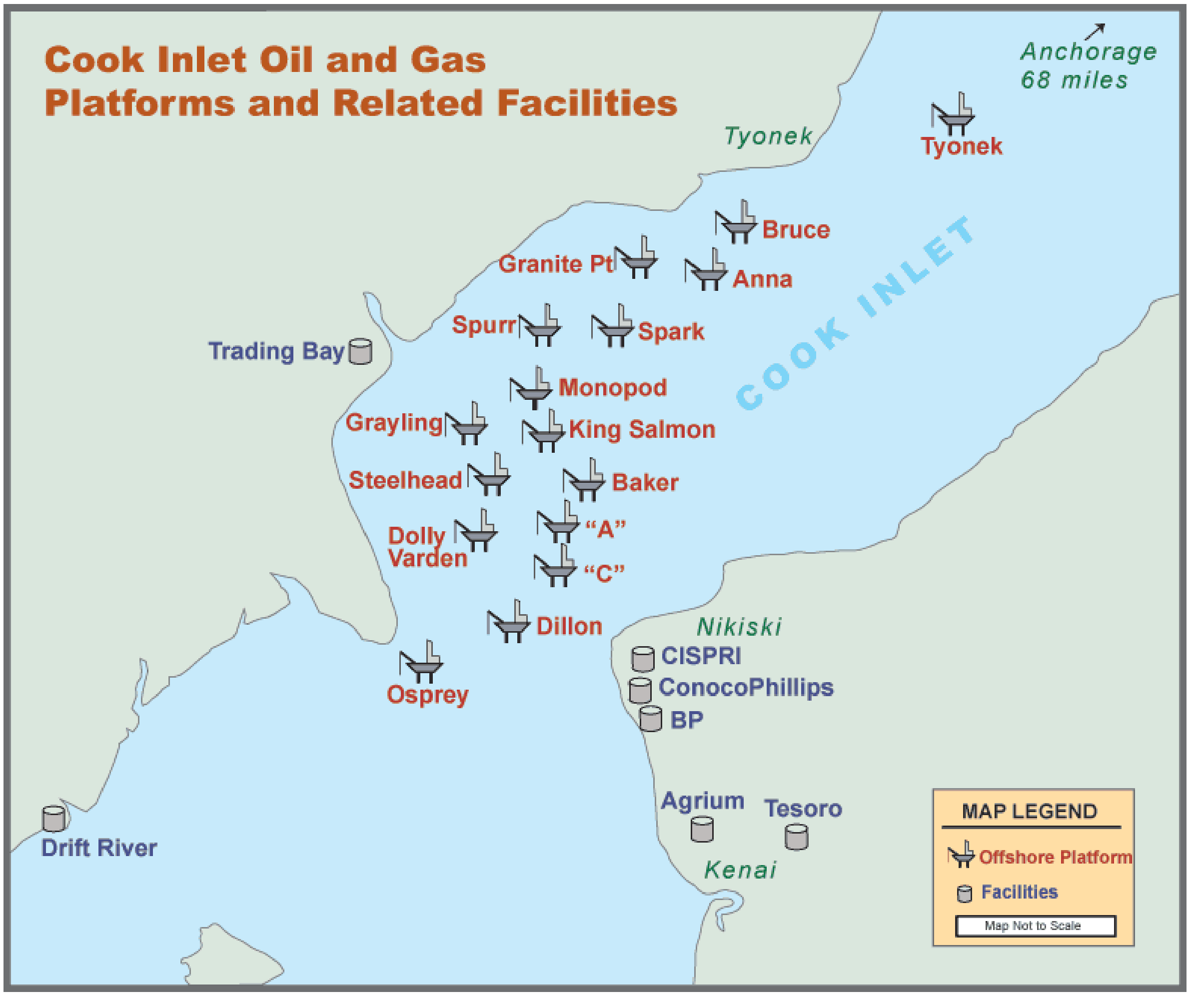
Furthermore, a series of three studies conducted on the flats found no significant evidence of bioaccumulation in either fish (sticklebacks) or macroinvertebrates collected in areas with known WP contamination (USAEHA 1994, 1995; Sparling 1994), and concluded that WP was not affecting ERF macroinvertebrate diversity, species richness, or numbers per unit area (USAEHA 1995). Given these results, in conjunction with the success of the remediation effort, the nondetection of WP (or other munitions constituents) in the water of Eagle River and Eagle Bay and the current winter-only firing restrictions on ERF, it seems unlikely that military activity on ERF is having an adverse affect on the Cook Inlet beluga stock, although this hasn't specifically been studied. However, the Army is preparing an Environmental Impact Statement to assess the potential impacts associated with resuming year-round live-fire weapons training at ERF.[11]

f. Oil and Gas: Much of the Cook Inlet region overlies reserves of oil and natural gas. Upper Cook Inlet and the Kenai Peninsula have an association with the petroleum industry that dates back to the 1950s. Most of the platforms were in place by 1967, hence the infrastructure is over 40 years old. As such, many of the pipes are aging and corroded and will need repair if their use is going to be continued. At the peak of its infrastructure development, there were 16 offshore production and three onshore treatment facilities in upper Cook Inlet and approximately 230 mi of undersea pipelines (80 mi of oil pipeline, 150 mi of gas pipeline). Some of these facilities were "shut in" (not actively producing, but not yet plugged or abandoned) in 1992 as Cook Inlet production continuously declined. The offshore production facilities operating in Cook Inlet currently support over 200 wells. There are 16 platforms in upper Cook Inlet, 12 of which are active today (Figure 12). Currently there are no platforms in the lower Inlet, and no permits have been issued for the construction of new permanent platforms anywhere within the Inlet (Pers. Comm. B. Havelock, ADNR 2008, via M. Migura, NMFS).

Alaska Department of Natural Resources (ADNR) has held an annual Cook Inlet Areawide Oil and Gas Lease Sale since 1999, and will do so through 2009. These annual sales offer tracts throughout the State waters of the Inlet, including areas above the Forelands in the Susitna River delta. Oil and gas leasing within Federal waters of Cook Inlet also presents concern for the Cook Inlet beluga whales. The U.S. Minerals Management Service (MMS) has held oil and gas lease sales in Cook Inlet in the past. However, there are currently no plans to hold a federal lease sale in Cook Inlet in the foreseeable future. At present, there is only one active federal lease in Cook Inlet, located offshore of Anchor Point.
While construction of an oil/gas facility may temporarily result in habitat loss to belugas, a natural gas blowout or oil spill in upper Cook Inlet could severely impact belugas and put the population at risk. Between 1984-1994 oil spills from offshore platforms in Cook Inlet totaled roughly 10,500 gallons, with four natural gas blowouts occurring since 1962 (ADNR as discussed in Moore et al. 2000).

[11] See the US Army Garrison, Alaska's Conservation WebPage for more information about the ERF EIS: http://www.usarak.army.mil/conservation/NEPA_FRA.htm (accessed September 2008)

Figure 12. Oil and gas platforms and related facilities in Cook Inlet. Map is not to scale. Reproduced with permission from Cook Inlet Regional Citizens Advisory Council's website (www.circac.org/CI_interactivemap.html).



The effects of oil spills on beluga whales are generally unknown, however, some generalizations can be made regarding impacts of oil on individual whales based on present knowledge. Although cetaceans are capable of detecting oil they do not seem to avoid the oil (Geraci 1990). Belugas swimming through an oil spill could be affected in several ways: skin contact with the oil; ingestion of oil; respiratory distress from hydrocarbon vapors; contaminated food sources; and displacement from feeding areas. Actual impacts would depend on the extent and duration of contact, and the characteristics (type and age) of the oil. Beluga whales could be affected by residual oil from a spill even if they were not present during the oil spill, however, the greatest potential threat to belugas from an oil spill is the inhalation of toxic vapors that concentrate above oil slicks, and in extreme cases could result in sudden death (Geraci 1990). Crude oil evaporation rates are greatest during the first few days after an oil spill (Meilke 1990), and rates and exposure to oil may be an important factor to the impacts beluga whales may experience from oil exposure. It is unclear if vapor concentrations would reach levels where serious effects, such as pneumonia, would occur. Although

Lipscomb et al. (1994) did not report finding pneumonia in sea otters that died after the Exxon *Valdez* oil spill, inhalation of vapors was suspected to have caused emphysema in the otters. Inhalation of vapors may also have played a role in the loss of killer whales after the Exxon *Valdez* oil spill (Harvey and Dahlheim 1994).

Whales may also contact oil as they surface to breathe, but the effects of oil contacting skin are largely speculative. Experiments in which bottlenose dolphins were exposed to petroleum products showed that cetacean skin presents a formidable barrier to the toxic effects of petroleum and that damage to epidermal cells was only fleeting (Bratton et al. 1993). Geraci (1990) reviewed a number of studies pertaining to the physiologic and toxic impacts of oil on whales and concluded there was no definitive evidence that oil contamination had been responsible for the death of a cetacean. Cetaceans observed during the Exxon *Valdez* oil spill in Prince William Sound made no effort to alter their behavior in the presence of oil (Harvey and Dahlheim 1994; Loughlin 1994). Dalheim and Matkin (1994) concluded that because the highest recorded mortality rate of North Pacific killer whales occurred in 1989 and 1990, which coincided with the Exxon *Valdez* oil spill, there was a correlation between the loss of killer whales and the spill, but they could not identify a clear cause and effect relationship.

Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill or during response operations. Any diminishment of feeding habitat during the summer months could adversely affect the energy balance of beluga whales. The impacts of oil exposure to Cook Inlet beluga whales would also depend upon how many animals contacted oil. If oil found its way into the upper Inlet during summer months, a significant proportion of the beluga population could be exposed.

Offshore oil production in Cook Inlet currently supports over 200 wells. In addition to oil spills (which are low-probability events), oil and gas activities may include marine geophysical (seismic) surveys; vessel operations; low-altitude aircraft operations; well drilling and logging; and the marine discharge of drilling fluids (muds and cuttings), produced waters (the water phase of liquids pumped from oil wells), gray waters, and sanitary wastes. Drilling fluids discharged into Cook Inlet average 89,000 barrels annually and contain several pollutants. The EPA regulates the discharges from these offshore platforms. NMFS will continue to review and comment on all oil and gas lease sales, and seismic exploration activities for Cook Inlet.

g. **Development:** Southcentral Alaska is the State's most populated and industrialized area. Many cities, villages, ports, airports, treatment plants, refineries, highways, and railroads are situated on or very near to Cook Inlet. Beluga whales are not uniformly distributed throughout the Inlet, but are predominantly found in nearshore waters. Where beluga whales must compete with people for use of nearshore habitats, coastline development (both construction and operation of a project) leads to the direct loss of habitat. Indirect alteration of habitat may occur due to bridges, boat traffic, in-water noise, and discharges that affect water quality. Most beluga habitat in Cook Inlet remains essentially intact, however, extensive sections of Turnagain Arm shoreline have been developed (e.g., rip rap and railroad construction), as have the shorelines of the Anchorage area.

Port facilities in Cook Inlet are found at Anchorage, Point Mackenzie, Tyonek, Drift River, Nikiski, Kenai, Anchor Point, and Homer. The Port of Anchorage is a deep draft facility, the State's largest seaport, and the main port of entry for southcentral and interior regions of the State. It exists along lower Knik Arm in an area that is heavily used by beluga whales. Contractor reports from LGL for the Port of Anchorage (Markowitz, memos to W.E. Humphries, August, September, October and November 2005) indicated that 79 percent of the whales sighted in the lower Knik Arm area entered the area immediately adjacent to the Port. The Point MacKenzie Port is presently configured as a barge port; however, plans call for a bulk loading facility with deep-draft capability. The Drift River facility is used primarily as a loading platform for shipments of crude oil. The docking facility there is connected to a shoreside tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. Nikiski is home to several privately owned docks (including those belonging to oil and gas companies such as Tesoro and Conoco Philips). Activity here includes the shipping and receiving of anhydrous ammonia, dry bulk urea, liquified natural gas, petroleum products, sulfuric acid, caustic soda, and crude oil.

Dredging along coastal waterways has been identified as a concern with respect to the Saint Lawrence beluga whales (DFO 1995). There, dredging of up to 600,000 cubic meters of sediments resuspended contaminants into the water column and seriously impacted the belugas. The Saint Lawrence beluga whale recovery plan contains recommendations to reduce the amount of dredging and to develop more environmentally sound dredging techniques. While the volume of dredging in Cook Inlet is comparable to St. Lawrence (more than 844,000 cubic yards in 2003 at the Port of Anchorage), the material does not contain harmful levels of contaminants.

Even though over 90 percent of Knik Arm remains undeveloped, several planned or proposed projects have been identified in a relatively confined portion of lower Knik Arm (see partial list below). Knik Arm is an important feeding area for beluga whales during much of the summer and fall, especially upper Knik Arm. Whales ascend to upper Knik Arm on the flooding tide, feed on salmon, then fall back with the outgoing tide to hold in waters off and north of the Port of Anchorage. The primary concern for belugas is that development may restrict passage along Knik Arm.

The potential for impact on these whales is heightened by the following aspects of actual or potential Knik Arm development projects:

- Encroachment into lower Knik Arm from the east due to expansion of the Port of Anchorage.
- Encroachment into lower Knik Arm from the west due to expansion of Port MacKenzie.
- Increased dredging requirements with port expansions.
- Increased ship traffic due to expansion of both ports in lower Knik Arm; new boat launches; and possible operation of a commercial ferry.

- Increased in-water noise levels due to port construction, port operations and the associated increased vessel traffic.
- Increased need for vessel anchorage off both ports.
- Possible causeway construction to Fire Island.
- Possible construction of Knik Arm bridge.
- High in-water noise due to construction of causeway/bridge (e.g., pile driving, dredging).
- Increased water velocities in Knik Arm due to construction of causeway/bridge.
- Physical loss of habitat due to landfill.
- In-water noise, physical loss of habitat, and possible changes in water velocities associated with installing and operating 70-100 tidal energy generators in and around the entrance to Knik Arm.

Other potential development projects in Cook Inlet include Seward Highway improvements along Turnagain Arm; the south coastal trail extension in Anchorage; Chuitna Coal project with a marine terminal; Pebble Mine with a marine terminal in Iniskin Bay; Diamond Point granite rock quarry near Iliamna and Cottonwood Bays; and the placement of a submarine fiber optic cable by ACS from Nikiski to Anchorage. This list may not include all proposed or potential development projects in the Inlet.

h. **Vessel Traffic:** Most of Cook Inlet is navigable and used by various classes of water craft which pose the threat of ship strikes to beluga whales. While ship strikes have not been definitively confirmed in a Cook Inlet beluga whale death, in October 2007 a beluga washed ashore dead with "wide, blunt trauma along the right side of the thorax" (NMFS unpubl. data), suggesting a ship strike was the cause of the injury.

Port facilities in Cook Inlet are found at Anchorage, Point MacKenzie, Tyonek, Drift River, Nikiski, Kenai, Anchor Point, and Homer. Commercial shipping occurs year round, with containerships transiting between the Seattle/Puget Sound areas and Anchorage. Other commercial shipping includes bulk cargo freighters and tankers. Various commercial fishing vessels operate throughout Cook Inlet, with some very intensive use areas associated with salmon and herring fisheries. Sport fishing and recreational vessels are also common, especially within Kachemak Bay, along the eastern shoreline of the lower Kenai Peninsula, and between Anchorage and several popular fishing streams which enter the upper Inlet. Several improved and unimproved small boat launches exist along the shores of upper Cook Inlet. The MOA maintains a ramp and float system for small watercraft near Ship Creek. Other launches are near the Knik River bridge and at old Knik. Currently, with the exception of the Fire Island Shoals and the Port of Anchorage, no large-vessel routes or port facilities in Cook Inlet occur in high value beluga whale habitats.

Due to their slower speed and straight line movement, ship strikes from large vessels are not expected to pose a significant threat to Cook Inlet beluga whales. However, smaller boats that travel at high speed and change direction often present a greater threat. In Cook Inlet, the presence of beluga whales near river mouths predisposes them to strikes by high speed water craft associated with sport and commercial fishing and general recreation. The mouths of the Susitna and Little Susitna Rivers in particular are areas where small vessel traffic and whales commonly occur. Vessels that operate near these whales have an increased probability of striking a whale, as evidenced by observations of Cook Inlet beluga whales with propeller scars (Burek 1999c).

In addition to small boats, jet skis are becoming more abundant in the Inlet. In 1994 NOAA Enforcement agents investigated a report of a jet skier approaching and striking beluga whales in Knik Arm. Jet skies have also been seen along Turnagain Arm, an area of Cook Inlet rarely used by conventional water craft. Small vessels are more likely to alter their course to approach or intercept any whales they observe. Small vessels, and especially jet skis, are also capable of operating in waters not normally available to mariners. This has added to the competition for the few sites in upper Cook Inlet that are heavily used by beluga whales during the summer months. It is probable this traffic has also increased the level of harassment of this population. Presently there are no restrictions on speed limits, areas in which vessels may operate, or on the type or horsepower of vessels allowed in the upper Inlet. Although high speed approaches to belugas generally initiate an escape response (belugas move away from the approaching boat), slower boats, even idling, may alter beluga behavior (Litzky et al. 2001). Habitat displacement, such as beluga whales avoiding an area with high boat traffic, may seem unimportant, but displacement from transit areas and from sensitive feeding or calving habitats could be very harmful to the recovery of this stock.

i. **Tourism and Whale Watching:** Tourism is a growing component of the State and regional economies, and wildlife viewing is an important part of this use. Visitors highly value the opportunity to view the region's fish and wildlife, and opportunities to view the beluga whale are especially valuable due to their uniqueness. Beluga whales are very common to upper Cook Inlet and typically occur in fairly large groups. Because these waters are easily accessible from Anchorage, this presents an excellent opportunity for whale watching. Many tour buses routinely stop at several wayside sites along Turnagain Arm in the summer, where beluga whales are seasonally observed. Although several commercial whale watching ventures have been started during the last decade, presently there are no vessel-based commercial whale watching operations in upper Cook Inlet. The popularity of whale watching and the close proximity of beluga whales to Anchorage make it probable that such operations may exist in the near future. However, it is unlikely this industry would reach the levels of intensity seen elsewhere (e.g., Hawaii, Puget Sound, Australia) because of upper Cook Inlet's climate, restricted navigability (shallow waters, extreme tides, extreme currents), limited port facilities, and seasonal darkness.

Whale watching is not, in itself, harmful to whales. It presents concerns due to vessel noise, proximity to the whales (approach distance and harassment), and intrusion into important whale habitats. People pay to see whales, and vessel operators will go where the whales are. No strong conclusive scientific evidence has been presented to demonstrate that whale watching presents a significant threat to beluga whales (DFO 1995). Yet, NMFS has often witnessed avoidance and overt behavioral reactions by Cook Inlet beluga whales when approached by vessels. Larger vessels which do not alter course or motor speed around these whales seem to cause little if any reaction. Concern is warranted for whale watching operations that approach beluga whales close enough to harass or that enter into confined or important habitat areas (i.e. Type 1 habitat; Figure 9). NMFS believes it is possible to accommodate commercial whale watching charters without significant effect to the Cook Inlet beluga whale, but some restrictions may be necessary.

j. Noise: Beluga whales use sound rather than sight for many important functions and are often found in turbid waters in northern latitudes where darkness extends over many months. Beluga whales use sound to communicate, locate prey, and navigate, and may make different sounds in response to different stimuli. Beluga whales produce high frequency sounds which they use as a type of sonar for finding and pursuing prey, and likely for navigating through ice-laden waters.

In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds. Man-made sources of noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging. The effects of man-made noise on beluga whales and associated increased "background" noises may be similar to our reduced visibilities when confronted with heavy fog or darkness. These effects depend on several factors including the intensity, frequency and duration of the noise, the location and behavior of the whale, and the acoustic nature of the environment. High frequency noise diminishes more rapidly than lower frequency noises. Sound also dissipates more rapidly in shallow waters and over soft bottoms (sand and mud). Much of upper Cook Inlet is characterized by its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002) thereby making it a poor acoustic environment.

Research on captive animals has found beluga whales hear best at relatively high frequencies, between 10 and 100 kHz (Blackwell and Greene 2002), which is generally above the level of much industrial noise. The beluga whales' hearing falls off rapidly above 100 kHz. However, beluga whales may hear sounds as low as 40-75 Hz, although this noise would have to be very loud. Anthropogenic noise above ambient levels and within the same frequencies used by belugas may mask communication between these animals. At louder levels, noise may result in disturbance and harassment, or cause temporary or permanent damage to the whales' hearing.

Although captive beluga whales have provided some insight into beluga hearing and the levels of noise that might damage their hearing capabilities, much less information is available on how noise might impact beluga whales behaviorally in the wild. Alaska Native beluga whale hunters with CIMMC have said that the Cook Inlet beluga whales are very sensitive to boat noise, and will leave areas subjected to high use. Native hunters near Kotzebue Sound report that beluga whales in that region abandoned areas in which fishing vessels were common (NMFS unpubl. data). In the Canadian high arctic, beluga whales were observed to react to ice-breaking ships at distances of more than 80 km, showing strong avoidance, apparent alarm calls, and displacement (LGL and Greeneridge 1986; Finley et al. 1990). The whales' activity patterns were apparently affected for up to two days following the event (Whitehead et al. 2000). However, in less pristine, more heavily trafficked areas belugas may habituate to vessel noise. For instance, beluga whales appear to be relatively tolerant of intensive fishing vessel traffic in Bristol Bay and are commonly seen during summer at the Port of Anchorage, Alaska's busiest port. Like bottlenose dolphins, beluga whales may shift the frequency of their echolocation clicks to avoid masking by anthropogenic noise (Au 1993; Tyack 1999, 2000).

A 2001 acoustic research program within upper Cook Inlet identified underwater noise levels (broadband) as high as 149 decibels referenced to one microPascal (149 dB re: 1 µPa)[12] (Blackwell and Greene 2002). That noise was associated with a tug boat which was docking a barge. This level of continuous noise would be below the threshold of 160 dB re: 1 µPa that NMFS has used in issuing small take authorizations under the MMPA as the threshold for harassment of beluga whales. Observations of beluga whales off the Port of Anchorage suggest that these whales are not normally harassed by such noise, although the whales may tolerate noise that would otherwise disturb them in order to feed or to conduct other biologically significant behaviors. The 2001 acoustic study also found that the mouth of the Susitna River and upper Knik Arm near Birchwood, two locations which are highly used by beluga whales, had some of the lowest recorded ambient underwater sound levels, suggesting a relationship between reduced sound levels and beluga use.

Furthermore, the 2001 acoustics study investigated noise associated with operating (not drilling) offshore oil platforms. The Phillips "A" oil platform produced underwater noise which was generally below 10 kHz. While much of the sound energy in this noise fell below the hearing thresholds of beluga whales, some noises between two and 10 kHz were measured as high as 85 dB re: 1 µPa as far out as 19 kilometers from the source. This noise is audible to beluga whales.

The acoustics study did not address marine geophysical seismic activity in Cook Inlet, although it does occur. Geophysical seismic operations were conducted in 2007 in Cook Inlet near Tyonek, the Forelands area, areas off Anchor Point, and areas west of Clam Gulch. A previous seismic program occurred near Anchor Point in the fall of 2005. Seismic exploration is associated with both State and Federal offshore tracts. Geophysical seismic activity has been described as one of the loudest man-made underwater noise sources, with the potential to harass or harm marine mammals, including beluga whales.

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[12] Decibels (dB; measurement of the intensity of sound) in water have a different relative value than decibels in air. One microPascal (µPa; measurement of sound pressure) is the standard reference pressure for underwater sound; the in air equivalent is referenced to 20 µPa. Thus, the intensity of sound in water is not equal to the intensity of sound in air (i.e., 149 dB in water is not the same as 149 dB in air, but rather is equivalent to 87 dB in air). The Center for Disease Control states that prolonged (more than 8 hours) "exposure to noise above 85 dB [in air] can cause permanent hearing loss" in humans. However, we cannot assume that beluga hearing and response is comparable to humans.

Cook Inlet also experiences significant levels of aircraft traffic. The Anchorage International Airport is directly adjacent to lower Knik Arm and has high volumes of commercial and cargo air traffic. Elmendorf Air Force Base also has a runway near and airspace directly over Knik Arm. Lake Hood and Spenard Lake in Anchorage are heavily used by recreational seaplanes. Other small public runways are found at Birchwood and Goose Bay in Knik Arm; Merril Field; Girdwood; the Kenai Municipal Airport; Ninilchik; Homer; and Seldovia. Even though sound is attenuated by water surface, Blackwell and Green (2002) found that aircraft noise can be quite loud underwater when jet aircraft are directly overhead. Richardson (1995) discovered that belugas in the Beaufort Sea would dive or swim away when low-flying (<500 m) aircraft passed directly over them. However, beluga survey aircraft flying at approximately 244 m in Cook Inlet observed little or no change in beluga swim directions (Rugh et al. 2000).

k. Research: NMFS research on Cook Inlet beluga whales has resulted in an extensive body of publications and research papers, which has greatly improved understanding of their ecology and biology. Because many important aspects of the biology of Cook Inlet beluga whales remain unknown or incompletely studied, NMFS anticipates continuing and expanding its research program throughout the range of this stock.

Research activities may include continuing the annual abundance surveys conducted by NMFS's National Marine Mammal Laboratory (NMML); satellite tagging to investigate seasonal movements or dive and migration patterns; conducting biopsies of individual whales to obtain tissue samples for genetics or contaminants research; collecting data necessary for a population age and growth model; conducting forage fish analyses; assessing fatty acids; monitoring beluga behavior with associated anthropogenic activities; and behavioral-telemetry studies associated with disturbance and avoidance of human activities. Other studies and monitoring of Cook Inlet belugas are being done in association with development of the Inlet.

Some research has the potential to kill, injure, harass, or change the behavior of belugas. This includes active activities such as capturing whales, applying satellite tags, applying suction cup dive tags, taking blood and biopsies from live animals, and any boat or in water work that changes whale behavior or movements. Other research is passive and has less potential to impact whales, including aerial surveys, shore based observations, acoustic studies (non-tagging), prey studies, habitat studies, pathology and disease studies conducted on dead animals, and contaminant studies.

Between 1999 and 2002, NMFS researchers captured and affixed satellite tags to a total of 18 Cook Inlet belugas. A few days after tagging activities in 2002, NMFS began receiving reports of a dead beluga floating upside down in the Inlet (preventing the positive identification of a satellite tag). Eight days after tagging, the flipper band identifying the whale as one of the tagged animals was recovered from the carcass by a local oil worker. However, the band was not provided to NMFS until a month after the tagging event, precluding a search for the carcass and visual verification of a satellite tag. The satellite tag from this whale only transmitted position data for 32 hours. After reviewing the dive data received for this whale, it was concluded that the whale was swimming weakly after the tagging until it died 32 to 38 hours later. The most apparent explanation for this animal's death was that the whale died as a result of the tagging (NMFS unpubl. data). Given the link of this whale's death to the tagging activities, data from other whales tagged during the same field season were analyzed. Two other animals were found to have satellite transmissions lasting less than 48 hours and with similar dive patterns as those of the known dead whale. These two whales were assumed to have died between 24 and 54 hours after tagging. While none of this data conclusively points to the death of these two whales, the most apparent explanation for the dive patterns and lack of subsequent satellite data is that these whales died as a result of the tagging. Given that there was one known death as a result of tagging activities, NMFS modified the tagging protocol to reduce potential risks to the whales in the future. Photo-identification studies by McGuire et al. (2008) reported identification of nine distinct beluga whales that had been previously fixed with satellite tags, providing data that nine of the tagged whales had survived between three and eight years after being tagged. McGuire et al. (2008) also identified three of the nine previously tagged whales as mothers with calves.

3. Threat Assessment Matrix

A threats assessment matrix (Table 4) is a useful way to evaluate various threats and presents a structured approach to assessing the relative impact of each threat on the recovery of Cook Inlet beluga whales. This matrix approach provides weighting factors to rank threats in consideration of their likelihood of occurrence, the feasibility of mitigation, and the relative impact to recovery should the threat occur.

The threats discussed all have varying probabilities of occurrence within the next five years; some are guaranteed to occur as they are ongoing events (e.g., pollution), while others have a low chance of occurrence (e.g., subsistence harvests). They also vary in their duration of occurrence. Some threats are pulse events that occur only sporadically (e.g., strandings, disease outbreaks, oil spills), while other threats are chronic events and have long-term impacts (e.g., parasites, environmental change, noise). Although the impact to recovery from each threat depends somewhat on the duration of the event (i.e., a chronic event is expected to have a greater impact than a pulse event of the same magnitude), the magnitude of the event is also an important consideration when assessing the impact to recovery. For instance, a stranding event involving a large number of whales will have a greater impact to recovery than a stranding event involving a single whale. Also, if management cannot realistically mitigate the effects of a threat, then the relative impact to recovery is higher than if mitigation efforts could control or reverse the effects of a threat. These factors were taken into consideration when assessing the relative impact to recovery of each threat on Cook Inlet beluga whales.

Table 4. Cook Inlet Beluga Whale Threats Assessment Matrix for known and potential threats FY09-FY13.

Threat (see text for specific sources of each threat)		**Probability of Event Occurring in Next Five Years**	**Feasibility of Mitigation**	**Relative Impact to Recovery (assuming event occurs)**
Natural Threats	Strandings	high	low	high
	Predation	high	low	moderate
	Parasitism and Disease	-	-	-
	• parasites	high	low	low
	• disease	unknown/low	low	high
	Environmental Change	moderate	low	unknown
Human-Caused Threats	Subsistence Harvest (legal)	low	high	low
	Poaching & Illegal Harassment	unknown	moderate	high
	Personal Use, Subsistence, and Recreational Fishing	high	moderate	low
	Commercial Fishing	-	-	-
	• lethal incidental take	low	moderate	moderate
	• prey reduction	high	moderate	high
	Pollution	high	moderate	unknown
	Oil and Gas	high	moderate	unknown
	Coastal Development (habitat loss)	high	moderate	moderate
	Vessel Traffic	-	-	-
	• ship strikes - large vessels	low	moderate	low
	• ship strikes - small vessels	moderate	moderate	moderate
	Tourism and Whale Watching	high	high	low
	Noise	high	moderate	high
	Research	high	high	moderate

II. CONSERVATION PROGRAM

In this section of the Conservation Plan, NMFS identifies conservation goals and criteria for restoring the Cook Inlet beluga population to OSP; the strategy NMFS will implement to achieve such goals; recent management measures implemented to help reach the goals; and biological constraints on research and management.

A. Conservation Goals and Criteria

Section 2 of the MMPA (13 U.S.C. 1361) states that marine mammal species, populations and/or stocks should not be permitted to fall below their OSP level, the lower range of which is presently designated at 60% of *K* for Cook Inlet belugas. In the final rule that established the Cook Inlet beluga stock as depleted under the MMPA, NMFS stated that the historic abundance for this stock was unknown. Since no systematic survey of abundance exists prior to 1994, surveys by ADFG in 1979 provided the initial estimate of 1,300 Cook Inlet beluga whales. Additional evidence, including TEK, supports a historical abundance exceeding 1,000 animals.

Although the maximum number of whales Cook Inlet could support (i.e., carrying capacity, *K*) is unknown, NMFS is using the maximum historical abundance estimate (1,300) as *K* and as an interim basis for estimating the lower limit of OSP. The population level at which NMFS would reconsider the depleted classification is set at the lower bound of OSP at 780 animals (60 percent of *K*). The 1998 abundance estimate considered in NMFS's rulemaking was 347 whales, well below OSP. In 2005, the abundance estimate of 278 whales (the lowest recorded abundance) was only 21 percent of *K*.

The goal of this Conservation Plan is to restore the Cook Inlet beluga whale stock to a healthy, viable population that no longer is designated as depleted under the MMPA. This goal will be met when there is an increasing or sustained population of at least 780 whales (i.e., the stock maintains its minimum OSP level), and appropriate habitat is available that will support a restored population. It is imperative that their habitat is protected as well, otherwise the restored population may experience another decline and require redesignation as depleted.

B. Conservation Strategy

NMFS provided the history of Cook Inlet beluga whale life history, ecology, and an assessment of the known and likely natural and anthropogenic threats to this stock in the first section of the Conservation Plan. Here, NMFS describes the conservation strategy as the framework for future Cook Inlet beluga whale recovery and conservation. NMFS's conservation strategy is to (1) improve our understanding of the biology of Cook Inlet beluga whales and the factors limiting the population's growth; (2) stop direct losses to the population; (3) protect valuable habitat, and (4) evaluate the effectiveness of these strategies and the success of the conservation actions in restoring the Cook Inlet beluga whale population.

C. Management Measures Implemented

NMFS has managed numerous projects and worked with a diverse group of constituents, partners, and agencies in an attempt to conserve and restore the Cook Inlet beluga whale population. The following discussion describes many of the management measures implemented regarding Cook Inlet beluga whales. See Appendix A for a summary of Federal Regulations specifically related to Cook Inlet beluga whales.

1. Subsistence Harvest Management

The MMPA authorizes NMFS, acting on behalf of the Secretary of Commerce, to implement subsistence harvest limits through regulation of depleted marine mammal stocks, following an administrative hearing on the record. In accordance with Public Laws 106-31 (1999) and 106-553 (2000), the annual subsistence harvest of Cook Inlet beluga whales are allowed only under cooperative management agreements between NMFS and affected Alaska Native organizations (ANO). On October 4, 2000 NMFS proposed regulations to limit the beluga harvest in Cook Inlet, Alaska. An administrative hearing was held in December 2000 and interim harvest regulations for 2001-2004 were developed and published in the Federal Register in 2004. These interim harvest regulations allowed for a limited harvest (1-2 belugas annually), regulated the use of beluga products, and established requirements for the harvests. With the collection of more information pertaining to the Cook Inlet belugas, a second administrative hearing was held in August 2004 to determine the long term harvest regime (2005 and subsequent years, until the population recovered). Following the harvest plan as recommended by the administrative law judge (ALJ), NFMS signed a co-management agreement with CIMMC in 2005 and 2006 (Appendix B) that allowed for two belugas to be successfully harvested. NMFS published the Cook Inlet Beluga Whale Subsistence Harvest Final Supplemental Environmental Impact Statement in June 2008, where four harvest alternatives were considered. A Record of Decision and harvest regulations will be published in October 2008, which will provide for a subsistence harvest plan for Alaska Natives until the Cook Inlet beluga stock recovers.

2. Turnagain Arm Marine Mammal Stranding Response Plan

NMFS has responded to stranding events many times, particularly during the last decade, and has developed an active Alaska Marine Mammal Stranding Response Network. In 1993 NMFS prepared the Turnagain Arm Stranding Response Plan (Appendix C), which guides decision makers during a marine mammal stranding in Turnagain Arm by describing protocols to be followed by NMFS when responding to stranded marine mammals. The plan was written to ensure that only authorized Stranding Response Network members, under direction from the Response Coordinator (Coordinator), respond to stranded marine mammals. NMFS must be notified of all stranding events, and will be on site to direct response actions. In the event NMFS is unable to respond, the Coordinator will determine the proper actions and initiate a response when necessary. At all times, NMFS response will be guided by three objectives: to ensure all actions do not endanger any response personnel; to minimize stress to all live stranded marine mammals; and to improve survival chances of any stranded marine mammal.

Despite these actions, there is often little that can be done to respond meaningfully to these strandings. There are many reasons for this. Human safety must be assured in any stranding response. Many areas within the upper Inlet, and Turnagain Arm in particular, present very dangerous conditions (extreme tidal ranges, quicksand, bore tides, frigid waters) which require specialized training and equipment. These sites are often remote and all but inaccessible except by helicopters. Many areas cannot be reached even by small boats due to low tides, shoals, or tidal currents. Furthermore, beluga whales may weigh several thousand pounds and cannot be easily moved. These animals may, in fact, stand a better chance for survival/recovery if not handled or disturbed in ways that would increase their stress. Regardless of these limitations, a stranding response may sometimes benefit these whales, and NMFS intends to continue and improve the response to live stranded beluga whales by expanding the Stranding Response Network, and by updating and revising the stranding response plan with up-to-date response techniques and to include all of Cook Inlet.

3. Law Enforcement Plan

The NOAA, Office for Law Enforcement (OLE) has committed to a long-term enforcement plan that encompasses traditional enforcement methods and Community Oriented Policing and Problem Solving (COPPS) to assist in the recovery of the Cook Inlet beluga whale. OLE conservation and protection efforts of Cook Inlet belugas began in 2000 and will continue throughout their recovery. The mission of OLE's plan is to stop illegal "takes" of Cook Inlet beluga whales from any source. A copy of the 2008 Cook Inlet Beluga Whale Enforcement Plan is presented in Appendix D.

4. Project Review, Environmental Analyses, and Mitigation Identification

Any action that may "take" a Cook Inlet beluga whale, including a take by harassment or disturbance, requires authorization under the MMPA (e.g., via an Incidental Harassment Authorization or Small Take Authorization). Such authorization can only be granted if an activity, by itself or in combination with other activities, would not cause a significant adverse impact on the stock. NMFS works with agencies and applicants to determine whether such actions could harm belugas or damage habitats essential to their survival, and to identify measures to avoid or minimize possible adverse effects. Activities are analyzed under the National Environmental Policy Act (NEPA).

NMFS actively participates in development planning and consultation meetings with federal, state, and private entities, and regularly reviews proposed permit applications for development projects that may affect Cook Inlet beluga whales. For example, NMFS reviews and comments on development permit applications for coastal dredging and filling through the U.S. Army Corps of Engineers, and for discharges through EPA. Because the upper Inlet contains high concentrations of beluga whales, provides important foraging habitat, and is where calves are born and reared, NMFS has also developed specific recommendations for the State of Alaska relative to the State lease sales for oil and gas. Adoption of these recommendations by the State of Alaska may help conserve and restore the Cook Inlet beluga whale. In regards to federal lease sales, NMFS continues to advocate the inclusion of Cook Inlet beluga whales in MMS's research programs investigating the effects of leasing and development within Cook Inlet.

In addition to development projects, research projects may be conducted at Federal, State, and/or private levels. Any research that may take a beluga also requires authorization under the MMPA. NMFS will continue to provide specific recommendations to mitigate detrimental effects of development and research in an effort to conserve Cook Inlet beluga whales.

5. Oil Spill Contingency Plans

NMFS, in cooperation with numerous agencies, has developed an area oil spill contingency plan (a.k.a. Unified Plan) which has been extant for over ten years. This plan is reviewed and updated as needed to ensure its applicability to ever-changing oil spill risks and to integrate experience gained from response in other regions. In January 2008, NMFS reviewed and submitted updates to Annex G (Wildlife Protection Guidelines) of the Unified Plan. The Alaska Regional Response Team's Unified Plan can be found at: http://www.akrrt.org/plans.shtml.

6. Noise Guidelines

From what is known about the hearing sensitivity of beluga whales and the movements, distribution, and habitat use of the Cook Inlet beluga whales, NMFS advocates steps to minimize the likelihood for noise to adversely impact these whales and to minimize the possibility of injury or possible abandonment of important habitats. It is important to monitor lesser noise sources that may impact beluga whales to understand what, if any, impacts they cause and to improve our understanding of these whales.

NMFS regularly reviews and comments on applicable permits and recommends specific conditions to reduce or avoid potential impacts from noise. Mitigation measures may be incorporated into project permits to avoid incidental taking of beluga whales. For example, mitigating measures for marine seismic surveys may include maximum array size restrictions (source noise levels), ramp-up procedures to avoid exposing marine mammals to very high noise levels, shut down whenever beluga whales are observed within predetermined ranges of the source (seismic) boat, and acoustic monitoring of the source and the attenuation of noise from the array. The effects of noise in other beluga habitat areas may be reduced to acceptable levels through time restrictions or other mitigation measures. NMFS will continue to request that the State of Alaska's Lessee Advisory and MMS's Notice to Lessees regarding offshore seismic operations identify that these activities may result in the taking of marine mammals, including beluga whales, and require monitoring plans. Such taking is prohibited by the MMPA unless authorized by incidental take authorizations.

NMFS is considering acoustic guidelines to determine noise levels that result in injury or harassment. For impulse sound, NMFS currently considers beluga harassment to begin at noise levels at or above 160 dB re: 1µPa, and injury to occur at or above 180 dB re: 1µPa; for continuous noise NMFS has designated 120 dB re: 1µPa as the level at which injury occurs. Recently, Southall et al. (2007) drafted acoustic guidelines for 126 species of marine mammals, divided into five functional hearing groups, for four categories of human noise: single pulse, single non-pulse, multiple pulse, and multiple non-pulse. According to this study, beluga whales (considered a "mid-frequency cetacean") subjected to single pulse or multiple pulse events, would theoretically not be injured until sound pressure levels reach 230 dB re: 1µPa or greater (Southall et al. 2007). However, until such acoustic guidelines are approved, NMFS will continue to apply the current threshold levels (e.g. injury occurs starting at 180 dB re: 1µPa) when evaluating in-water construction and other actions with the potential to introduce noise into Cook Inlet.

D. Biological Constraints on Management and Research

Monitoring and research have provided us with information to understand some basic life history, habitat associations, and threats to the population. Starting in 1988 there has been a number of papers published on Cook Inlet belugas and their habitat. Comprehensive findings, as well as individual studies, are published by NMML staff in peer-reviewed literature. Interim results may be published on the NOAA Fisheries website.

NMFS has studied the Cook Inlet belugas since 1993: conducted annual surveys every year since 1993; analyzed contaminants; regulated subsistence harvest; tagged belugas (satellite and radio tags); and gathered life history data through strandings. Abundance surveys are used to assess the population's size, distribution, and trends. Satellite tags on belugas have provided data on whale movements and habitat use. To date, 18 belugas have been tagged in Cook Inlet (one whale in June 1999; two whales in September 2000; seven whales in August 2001; and eight whales in August 2002). A stranding network for the state was developed. Necropsies and samples from subsistence harvested and stranded belugas provide data useful in life history assessments, contaminants, genetics, parasites, and disease. TEK surveys have also been useful in understanding belugas.

Although much has been done, scientific knowledge of Cook Inlet beluga whale biology and ecology is incomplete. Research and management on Cook Inlet beluga whales is constrained by certain biological aspects of the whales that make studying them and implementing effective management efforts difficult. Examples of biological constraints for beluga whales include the fact that belugas are marine mammals that live entirely in the water, have long life spans with delayed reproductive maturity, and have very few individual markings making identification of specific individuals difficult. Effective management depends on a reasonable understanding of belugas' interaction with human activities within the belugas' environment. Our incomplete understanding of Cook Inlet beluga whales increases our uncertainty and confounds efforts to implement appropriate management measures to positively affect beluga recovery.

III. CONSERVATION ACTIONS

In the mid-1990s the rapid, well-documented decrease in the population correlated with the reported subsistence harvest. Action has already been taken to reduce subsistence harvests to minimal levels. Subsequent actions identified here are aimed at gathering good abundance data, better understanding of basic beluga life history and biology, identifying and protecting habitat, and understanding, avoiding, and mitigating potential impacts to the whales.

In section II.B. "Conservation Strategy", NMFS identified four strategies aimed at restoring and protecting Cook Inlet beluga whales. NMFS has developed six objectives in an effort to meet the overall management strategy. Five objectives are aimed at understanding and restoring the Cook Inlet beluga whale to its OSP level as mandated by the 1988 amendments to the MMPA, and the sixth objective is directed towards implementation of this Conservation Plan.

STRATEGY 1: Improve understanding of the biology of the Cook Inlet beluga whale and the factors limiting the population's growth.

- Objective 1: Assess changes in the Cook Inlet beluga whale population size.
- Objective 2: Improve knowledge of Cook Inlet belugas to determine which factors are limiting recovery.
- Objective 3: Refine knowledge of Cook Inlet beluga whale habitat requirements and describe their range, distribution, and migration.

STRATEGY 2: Stop direct losses to the population.

- Objective 4: Reduce direct injuries and mortalities.

STRATEGY 3: Protect valuable Cook Inlet beluga habitat.

- Objective 5: Protect valuable habitat.

STRATEGY 4: Evaluate the effectiveness of these strategies and the success of the conservation actions in restoring the Cook Inlet beluga whale population.

- Objective 6: Implement and evaluate the effectiveness of the Cook Inlet beluga whale Conservation Plan.

A. Conservation Action Outline

Given the limited information we have on the impacts of many of the threats to Cook Inlet beluga whales, as well as our incomplete knowledge of Cook Inlet belugas themselves, the conservation actions outlined below are designed in a broad manner in an effort to fill in the "big picture" gaps. Once more specific information is available and our understanding of Cook Inlet belugas increases, the conservation actions can be revised to more specifically address individual threats.

While conservation actions were placed under the objective that was deemed most appropriate or pertinent, specific actions within each objective may also fit under other objectives. For instance, ‘conduct annual abundance surveys’ is placed under Objective 1 because we need to monitor the population’s abundance to determine if the population is increasing, decreasing, or stable, but it could also have been placed under Objective 3 because these annual surveys will also contribute information to document beluga distribution and movements. ‘Study mating systems’ is logically placed under life history (Objective 2), but it also is important in determining population trends (Objective 1), and for characterizing beluga habitat (Objective 3).

Objective 1. Assess changes in the Cook Inlet beluga whale population size

a. Continue annual abundance surveys
b. Conduct population trends analyses

Objective 2. Improve knowledge of Cook Inlet belugas to determine which factors are limiting recovery

- Characterize Cook Inlet Beluga Life History

a. Assess impacts of predation by killer whales
b. Estimate age, age of maturation, and indices of growth from teeth
c. Study female reproductive biology
d. Study mating systems
e. Study genetics for stock identification, subdivision, and forensics

- Assess Health of Cook Inlet Belugas

f. Compile disease, pathology and health index
g. Improve understanding of parasitism and disease
h. Assess contaminant loads in Cook Inlet belugas
i. Analyze polycyclic aromatic hydrocarbon contaminant levels

- Characterize Diet

j. Analyze stomach contents
k. Analyze fatty acids and stable isotopes in belugas
l. Determine fatty acid and stable isotope signatures of prey species

Objective 3. Refine knowledge of Cook Inlet beluga whale habitat requirements and describe their range, distribution and migration

- Characterize Habitat

a. Identify essential biological and physical features of important beluga habitats
b. Document beluga distribution and movement
c. Study dive behavior
d. Determine baseline environmental conditions

- Assess Prey Base and Prey Availability

e. Determine temporal and spatial shifts of prey species
f. Compare historical vs. current distribution and abundance of prey species

Objective 4. Reduce direct injuries and mortalities

a. Implement and enforce regulations for subsistence harvests
b. Enforce laws against poaching and illegal harassment
c. Update stranding response plan, respond to strandings, and analyze stranding data
d. Improve research activities and develop less invasive technology
e. Reduce injuries from vessel traffic

Objective 5. Protect valuable habitat

- Assess Impacts of Potential Threats to Habitat

a. Conduct baseline studies assessing coastal development
b. Conduct acoustic studies
c. Assess effects of the oil and gas industry
d. Assess effects of commercial fishing: prey reduction
e. Assess effects of commercial fishing: incidental take
f. Assess effects of personal use, subsistence, and recreational fishing

- Mitigate Effects of Anthropogenic Activities on Habitat

g. Mitigate pollution entering Cook Inlet
h. Mitigate habitat degradation from coastal development
i. Mitigate effects of noise
j. Mitigate effects of oil and gas activities

Objective 6. Implement and evaluate the effectiveness of the Cook Inlet Beluga Whale Conservation Plan

a. Establish a conservation coordinator position
b. Develop and implement an outreach and education program
c. Develop an Alaska Native Sentinel Program

B. Conservation Action Narrative

The objectives have been developed to support the described conservation strategy. They were written to address gaps in our understanding of Cook Inlet belugas as well as ways to identify and mitigate the threats belugas face. The individual research and management actions are written in such a way as to provide guidance for research, but not to dictate how the goals are accomplished. Each action can and should be altered to fit the best situation at the time. For instance, as we learn more about tissue sampling, a new method for testing may evolve and have specific ramifications for Cook Inlet belugas. This Conservation Plan is intended to be adaptive, and study and management recommendations should change as we learn more about Cook Inlet beluga whale ecology, identify new threats to the population, and resolve existing threats. While NMFS is actively implementing some of the recommended actions, some are only partially funded whereas others are not funded at all. Actions listed in this Plan may be addressed not only by NMFS, but also by other entities.

For each action we included specific tasks for the next five years (FY 2009-FY 2013) and assigned a priority level. Priorities were based upon the following definitions:

Priority 1: Actions that must be taken to prevent further declines of the population.
Priority 2: Actions that must be taken to improve our knowledge of Cook Inlet beluga whales, to restore the population, and to conserve habitat quality.
Priority 3: All other actions necessary to provide for full conservation of the species.

Estimated costs (see Table 5) and availability of funds were not considered when prioritizing conservation measures, although financial concerns will necessarily determine which actions may be implemented. Some actions can be implemented now, while others are long-term measures which may depend on future research or agreements.

1. **Objective 1 – Assess changes in the Cook Inlet beluga whale population size.** The population abundance forms the basis for designing appropriate management and research objectives. These activities are not directly related to understanding or addressing possible causes of the population's decline or rate of recovery, but are necessary to monitor the population and ascertain the effectiveness of the conservation strategy and actions. The importance of monitoring the population size via these actions is realized by their priority one designation.

    a. **Continue annual abundance surveys**
    The Alaska Scientific Review Group, the Marine Mammal Commission, and the Alaskan Native community all consider annual abundance estimates to be the highest research priority to monitor population status. The total abundance of Cook Inlet belugas should be estimated annually. This estimate should comprise minimum population sizes in the form of the actual numbers of belugas counted on aerial surveys (treated as the index count), counts adjusted for covariates, and abundance estimates obtained by correcting for the proportion of the population unavailable to be counted during the surveys. In addition to aerial surveys, promising techniques are being developed to photo-identify individual Cook Inlet beluga whales which may in the future contribute to population estimates.
    Actions: Estimate abundance of belugas in Cook Inlet.
    Priority: 1

    b. **Conduct population trends analyses**
    Trend analysis of abundance time series is necessary to determine whether the beluga population is increasing, stable, or decreasing. This trend information is fundamental to an understanding of population status, for management under the MMPA, and for management of the subsistence harvest. Results will provide estimates of beluga population growth rate, recovery time, impacts of various harvest policies, and other human activities. Population trends may indicate adjustments to research objectives are needed, and monitor the effectiveness of management measures to recover the Cook Inlet beluga stock to OSP.
    Actions: Estimate population trends for the Cook Inlet beluga whale stock and recovery time to OSP.
    Priority: 1

2. **Objective 2 – Improve knowledge of Cook Inlet belugas to determine which factors are limiting recovery.** Understanding basic Cook Inlet beluga life history and biology are essential to assessing population health and growth. Population growth may be affected by abnormal age structure, abnormal gender ratio, natural mortality, high stranding mortality, low fecundity, low calf survival, predation, disease, etc. Much of this data is gathered through necropsies of dead stranded or subsistence harvested animals. By improving our basic knowledge of Cook Inlet beluga biology and ecology, we will be able to better define which factors are limiting their recovery.

    - **<u>Characterize Cook Inlet Beluga Life History</u>**

    a. **Assess impacts of predation by killer whales**

Killer whale sightings in upper Cook Inlet have increased. If killer whale predation occurs at a rate equivalent or greater than beluga reproduction, it could prevent recovery or reduce the beluga population. Scientists suspect that belugas avoid killer whale attacks by retreating to shallow water. If shallow water habitat is an important refuge for beluga from predation then any development that disturbs shallow areas or channelizes flow, may increase the vulnerability of beluga to predation. The more time belugas remain in shallow waters the greater risk for strandings with the outgoing tide. Study of beluga and killer whale behavior and their interactions in upper Cook Inlet is necessary to quantify this impact.

Actions: 1) Identify killer whales in upper Cook Inlet through photo-identification or genetic samples to determine if they are “transients” or “residents”. 2) Monitor killer whale use of Cook Inlet. 3) Identify the level of killer whale predation on Cook Inlet belugas. 4) Determine if belugas have options to escape killer whale predation. 5) Determine if predation avoidance habitat has changed.

Priority: 1

b. Estimate age, age of maturation, and indices of growth from teeth.

Growth layer groups in teeth can be used to determine growth patterns and age of belugas. Combined with female reproductive analyses, the age at sexual maturity or first reproduction may be derived. Age and growth are important parameters for population dynamics modeling.

Actions: Assess the growth patterns and age of belugas.

Priority: 1

c. Study female reproductive biology

The age of maturation of mammals has been shown to depend upon conditions for growth; good conditions produce relatively larger and fatter animals that mature earlier than those faced with poor conditions early in life. Trends in the mean age of maturation for a population may signify changes in resource availability. Age-specific pregnancy rates are closely related to fecundity, a vital rate that is fundamental to population dynamics. Therefore, it is important to monitor these parameters and collect samples available from the subsistence harvested and stranded belugas.

Actions: Estimate age-specific reproductive rates of female belugas in Cook Inlet including age of sexual maturation and pregnancy rates.

Priority: 2

d. Study mating systems

Little is known about the beluga mating system, primarily due to the difficulty in observing mating in the wild and the limitations of using individual mating success in estimating reproductive success. Although female reproductive success can be measured directly in terms of calf production and survival, male reproductive success is impossible to determine from observation, particularly as mating frequency may not be a good index of the number of offspring an individual male has fathered. With the advent of modern molecular genetic tools, such as DNA fingerprinting, it is now possible to accurately measure male reproductive success and thus determine the mating system of a population by

estimating the variance in male reproductive success. Resolving the relationship between reproductive success and mating frequency can also aid in the estimation of effective population size, an index of relevance to investigations of stock identity, and dispersal in this species. Furthermore, abundance of calves, the timing of the calving season, and neonate mortality can be critical to understanding reproductive success.
Actions: 1) Determine the mating system of Cook Inlet belugas and relate findings to the analysis of stock structure of the species in Alaska. 2) Record beluga calf occurrence to determine calving rate and the timing of calving in Cook Inlet. 3) Estimate neonate mortality.
Priority: 3

e. Study genetics for stock identification, subdivision, and forensics
Molecular genetic investigation will provide much needed understanding on population viability and individual fitness in these whales. The sampling and re-sampling of live whales and the rapid analysis of variation in multiple markers is essential to collecting much needed information on beluga whale population dynamics, life history, ecology, and behavior. Through mark-recapture, DNA fingerprinting efforts and associated genetic screening, we can reconstruct this population's history, resolve it's relationships with other populations, and determine pedigrees and reproductive success through which we can determine the genetic basis to population trend and future viability. This information may also prove useful to law enforcement personnel by being able to determine if a beluga was taken from Cook Inlet vs. another region (i.e., forensics).
Actions: 1) Resolve the evolutionary, demographic, and reproductive relationships between the Cook Inlet population and other beluga populations. 2) Investigate spatial and temporal patterns of subdivisions within the Cook Inlet beluga population. 3) Estimate historical population size from patterns of genetic diversity. 4) Collect and analyze tissue samples from a substantial portion of the population to: reconstruct pedigrees; screen for genetic components of quantitative and qualitative traits (e.g., disease resistance); and determine mating systems. 5) Conduct genetic mark-recapture studies to estimate population size, population trend, and life history parameters.
Priority: 3

- <u>**Assess Health of Cook Inlet Belugas**</u>

f. Compile disease, pathology and health index
The presence of disease (including parasites) in the Cook Inlet beluga whales could have a significant impact on their survival and reproduction, and thus population status and recovery. Few published data are available on disease exposure and occurrence in belugas in general, with even less known about disease in Cook Inlet beluga whales. Although stranded animals are tested for some disease agents, a comprehensive study designed to determine the prevalence of disease in Cook Inlet beluga whales has not been completed. Techniques developed for other marine mammals to detect possible health trends in populations based on blood chemistry perturbations or changes in other observable parameters may be applicable to belugas but will require some testing and development before they would be useful. This information would also

provide baseline health parameters for comparison as the population reaches carrying capacity and for comparison to other beluga populations.
Actions: 1) Determine baseline disease exposure for Cook Inlet beluga. 2) Develop protocols to collect a standardized health assessment using gross inspection, histology, urine, tissue, blood, blowhole swab, anal swab, skin sample or other appropriate methods. 3) Compare Cook Inlet belugas to other beluga populations.
Priority: 1

g. Improve understanding of parasitism and disease
Little is known about disease in belugas of Cook Inlet. Due to the small population size and their close associations with other individuals, a disease outbreak has the potential to impact a large proportion of the population. The presence of disease and parasites in the Cook Inlet beluga whales could have a significant impact on their survival and reproduction, thus impacting population status and recovery.
Actions: Understand the impacts of parasitism and disease on Cook Inlet belugas.
Priority: 2

h. Assess contaminant loads in Cook Inlet belugas
The contamination of Cook Inlet belugas by persistent pesticides and heavy metals is of concern to the health of the population. Because belugas are high on the food chain, the bioaccumulation of lipid soluble pesticides could produce adverse effects, as observed in other marine and terrestrial mammals. It is important to periodically monitor these levels, and continue to obtain tissue samples for archival and/or analysis. Contaminant analysis will be expanded as new concerns arise and new protocols are developed. The continuation of a contaminant study for Cook Inlet belugas will provide the basis for further scientific exploration into the effects of various chemical compounds on health.
Actions: Determine current contaminant loads carried by Cook Inlet belugas.
Priority: 2

i. Analyze polycyclic aromatic hydrocarbon (PAH) contaminant levels
Levels of PAH contamination in Cook Inlet beluga whales and their environment are a concern to the health of the population. PAH levels have not been measured in Cook Inlet, yet oil and gas exploration, development, and production has been operating in Cook Inlet since the 1950s. While beluga tissue assessment is important, understanding the sediment levels of PAH contamination is equally critical. The approach of looking at body burdens in addition to looking at environmental levels in sediments gives a better picture of the potential risk of exposure to belugas. PAH contaminants become available through sediment re-suspension and also through tropic level accumulation in prey.
Actions: Determine current PAH contaminant loads in Cook Inlet belugas and in nearby sediments.

- PAH studies are being conducted in FY 2008.

Priority: 2

- **Characterize Diet**

j. Analyze stomach contents
Current and comprehensive diet data are lacking, and diet may be, or may become, a limiting factor if prey species are impacted. Examination of stomach contents yields information on recent dietary intake and will help to determine temporal and spatial dietary prey composition.
Actions: Determine temporal and spatial dietary prey composition for belugas through analysis of stomach contents.
Priority: 2

k. Analyze fatty acids and stable isotopes in belugas
Prey is digested differentially, and some diagnostic hard parts may be retained in the stomach and thus over-represented in stomach contents. Also, stomach contents likely reflect only the contents of a recent meal from a particular area and may not represent the temporal or spatial variation of foraging efforts and prey consumption. Fatty acid signatures in prey species have been shown to be reflected in the lipid profile of higher trophic level predators. An understanding of shifts in diet composition over time and space and in specific cohorts may contribute to an understanding of area-specific population declines. Stable isotope analysis will not give prey preference at the same level of detail as the fatty acids, but it is inexpensive and acts as a check that the total diet composition is reasonable.
Actions: Determine prey composition in Cook Inlet beluga whale diets through analysis of blubber and blood fatty acid signatures and stable isotope analysis.
Priority: 3

l. Determine fatty acid and stable isotope signatures of prey species
Each prey species has a unique signature for fatty acids and stable isotopes. In order to successfully track which species belugas eat based on these signatures, we must first determine the signature produced by each. The validity of Objective 2k is dependent upon this information.
Actions: Identify the unique signatures of each beluga prey species.
Priority: 3

3. **Objective 3 – Refine knowledge of Cook Inlet beluga habitat requirements and describe their range, distribution and migration.** Beluga habitat not only includes where the animals go but also the resources they need to thrive. Identification and protection of important beluga habitat is a cornerstone to recovering this population. Important components of habitat include seasonal foraging areas, prey abundance and concentrations, calving and nursery areas, escape cover from killer whales, water quality, suitable acoustic environment, and transit areas. Many attributes need to be monitored to understand habitat changes and associated changes within the Cook Inlet stock of beluga whales. Prey base cannot easily be measured or monitored. Ultimately we need to identify key biological and physical needs of Cook Inlet belugas and identify key areas for population recovery.

- **<u>Characterize Habitat</u>**

a. Identify essential biological and physical features of important beluga habitats
Data on beluga habitat are collected in association with other studies, however, no comprehensive set of habitat characteristics for the Cook Inlet beluga is available. Information assessing the value of specific habitat features to Cook Inlet belugas will aid researchers and managers in evaluating the effects of particular actions on belugas as well as determining which habitat features are the most important to protect to aid in beluga recovery.
Actions: 1) Describe and quantify habitat factors associated with beluga distribution and abundance. 2) Predict habitat limitations. 3) Collaborate with co-management partners, ADFG, and other interested parties to develop a comprehensive Cook Inlet environmental database.
Priority: 2

b. Document beluga distribution and movement
Knowledge of the spatial and temporal patterns of the Cook Inlet belugas will provide a better understanding of their ecology. Data on the winter habits of belugas in Cook Inlet is especially limited. This knowledge is required to assess the extent of habitat utilized by and critical to these whales. Records of seasonal beluga distribution are needed to assess habitat requirements in months other than June, which is already well documented through the annual abundance surveys. Results should describe the year-round general movement and habitat use patterns of Cook Inlet belugas and may include a combination of aerial survey data with satellite tagging data.
Actions: 1) Document the distribution and movement patterns of Cook Inlet belugas throughout the year. 2) Conduct monthly habitat use aerial surveys. 3) Analyze and compile data from various sources to better define seasonal habitat use.
Priority: 2

c. Study dive behavior
Beluga dive behavior is variable as a function of age, gender, location, tidal height and direction, season, and individual. Quantified dive intervals, times at depth, frequency of dives, correlation of behavior among individuals, and variation over temporal scales all have implications for habitat use studies and corrections of aerial counts of group size.
Actions: 1) Quantify dive intervals and time spent at surface as a function of an animal's age, sex, location, season, and behavior. 2) Develop corrections for the beluga counts made during aerial surveys to estimate group sizes.
Priority: 2

d. Define baseline environmental conditions
Cook Inlet is a very dynamic environment that continually changes. These changes may impact belugas by changing their habitat, carrying capacity, or prey assemblages due to climate change, regime shifts, or natural causes. The effects of habitat change on Cook Inlet beluga whales are unknown, but it is possible that it has had significant effect on this stock, and may be an impediment to recovery

(e.g., results in a change in available prey).
Actions: 1) Analyze changes in habitat and fish assemblages in Cook Inlet. 2) Determine baseline values of bathymetry, especially in tidal flat areas in Knik Arm, Turnagain Arm, and the Susitna delta areas, and assess changes over time. 3) Document the changes in climate and oceanographic conditions over time. 4) Compare changes in beluga distribution and habitat use over time with changes in environmental conditions.
Priority: 3

- **Assess Prey Base and Prey Availability**

e. Determine temporal and spatial shifts of prey species
Cook Inlet beluga whales occur throughout the year in Cook Inlet. Interactions among the whales and the available forage base are poorly understood. Much of the forage base is available only seasonally and provides a critical component of the annual energy cycle, not only for belugas, but for the entire Cook Inlet region ecosystem. To provide appropriate approaches to human use and interactions with both game and nongame resources in Alaska, it is important to understand these relationships. Prey samples collected during the project could also be included in a Cook Inlet beluga fatty acid analysis project (see Objectives 2k and 2l).
Actions: Identify food availability for Cook Inlet belugas: 1) salmon run strengths and populations; 2) eulachon run strengths and populations; and 3) availability of other prey species.
Priority: 2

f. Compare historical vs. current distribution and abundance of prey species
A comprehensive compilation of diet data for Cook Inlet belugas is lacking, but data is available in a variety of forms including fishery statistics from commercial, sport and subsistence harvests; surveys; weir counts; carcass surveys of salmon escapement; biological and ecological sampling projects; and other miscellaneous studies. A comparison of historic vs. current prey availability and distribution is necessary since a reduced prey base may be a factor limiting beluga recovery, especially if historic prey abundance was significantly greater than current levels.
Actions: Collaborate with ADFG to compile a comprehensive comparison of temporal and spatial distributions of current prey resources with historic distributions.
Priority: 2

4. **Objective 4 – Reduce direct injuries and mortalities**. NMFS has management responsibility to ensure as few belugas as possible are injured or killed as a result of anthropogenic activities. The actions listed below seek to protect belugas from direct takes, lethal and non-lethal, as defined under the MMPA.

a. Implement and enforce regulations for subsistence harvests
The Cook Inlet beluga whale is hunted by Alaska Natives for subsistence purposes and for traditional handicrafts. In addition to being a food source, belugas represent a significant part of the cultural and spiritual basis of Native communities. The effect of past harvest practices on the Cook Inlet beluga whale

population is significant. NMFS partnered with affected Native communities to develop a plan for a long term harvest regime, under the process administered by the ALJ. In June 2008, NMFS released the Cook Inlet Beluga Whale Subsistence Harvest Final Supplemental Environmental Impact Statement presenting a set harvest plan.
Actions: 1) Implement harvest regulations of Cook Inlet beluga whales in a manner to provide continued opportunity for traditional subsistence harvest while allowing the population to recover. 2) Work with Alaskan Natives to collect scientific data from the subsistence harvests.
Priority: 1

b. Enforce laws against poaching and illegal harassment
Given the potential for poaching or harassment of beluga whales in Cook Inlet, enforcement of State and Federal law is essential to the conservation and recovery of Cook Inlet beluga whales.
Actions: 1) Improve State and Federal collaborative enforcement efforts for upper Cook Inlet. 2) Educate public on legal prohibitions on take; provide signage at major access points to report illegal activity. 3) Work with ANO's on tribal enforcement.
Priority: 1

c. Update the stranding response plan, respond to strandings, and analyze stranding data
It is necessary to respond to stranding events to reduce stress and deaths of live stranded whales, to record numbers of stranded animals and associated mortalities, and to acquire scientific data. Stranded animals present an opportunity to gather important life history, disease, parasite, and contaminant information. NMFS will continue to respond to beluga stranding events and expand upon present protocols as appropriate, including collecting samples for analysis of histology, contaminants, biotoxins, virology, immunology, bacteriology, age, life history, and genetics. Development of new techniques and improved protocols will enhance the success of the stranding response for live animals, as well as allow for the collection of more useful data from dead animals.
Actions: 1) Revise and expand the Turnagain Arm Marine Mammal Stranding Response Plan to identify new protocols for live beluga strandings; to expand protocols for dead stranded whale necropsies; and to include strandings throughout Cook Inlet. 2) Respond to strandings of live and dead whales and collect appropriate data. 3) Document historic and current beluga strandings to determine possible patterns and improve understanding of beluga strandings (causation; consequences; mitigation). 4) Develop a notification/distribution network with Alaska Natives to harvest edible portions from stranding mortalities.
Priority: 2

d. Improve research activities and develop less invasive technology
Because many important aspects of the biology of Cook Inlet beluga whales remain unknown or incompletely studied, and because management of this stock through recovery will require knowledge of annual abundance levels, NMFS anticipates continuing and expanding its research program throughout the range of this stock. While some research has little to no impact on the whales, some

research activities may harass or harm beluga whales. NMFS supports the design and use of less invasive technology that still provides valuable research data but with reduced impact to belugas. The handling of whales also raises concerns for the possibility of physical injury or transfer of disease from humans to beluga or between belugas.
Actions: 1) Continue and expand the comprehensive research program for Cook Inlet beluga whales. 2) Identify and minimize harassment of beluga whales due to research efforts. 3) Improve research techniques and equipment to reduce risk of injury or death to belugas and humans. 4) Develop sampling methods necessary to collect samples from free swimming belugas.
Priority: 2

e. Reduce injuries from vessel traffic
Most of Cook Inlet is navigable and used by various classes of water craft. At this time, NMFS has no indications that commercial shipping vessels, commercial fishing vessels, or other large vessels are presenting significant concerns in regards to ship strikes. Small watercraft may be of greater concern, however, due to their increased maneuverability, high speeds, and small size providing them the ability to access remote or coastal areas often used by belugas.
Actions: 1) Reduce disturbance or injury to Cook Inlet beluga whales due to vessel operations in Cook Inlet. 2) Monitor vessel traffic activity in important beluga habitats, especially by small watercraft. 3) Educate local recreational boating groups regarding ways to navigate with less potential to harm whales. 4) Minimize harassment, disturbance, and displacement of beluga whales from important habitat areas due to tourism or whale watching activities by developing whale watching guidelines specifically for belugas in upper Cook Inlet.
Priority: 3

5. **Objective 5 – Protect valuable habitat.** Restoring the Cook Inlet beluga whale to its OSP also involves protection of habitat needed to support a population of 780 whales. Thus, this section attempts to understand the impacts of anthropogenic activities on beluga habitat, and addresses mitigation efforts to protect valuable habitat.

- **<u>Assess Impacts of Potential Threats to Habitat</u>**

a. Conduct baseline studies assessing coastal development
Development of the coastline leads to direct loss of habitat due to landfills, docks, wharves, and the like. Indirect alteration of habitat may occur due to bridges, boat traffic, in-water noise, and discharges that affect water quality. Baseline data are required to determine the impacts of numerous planned and proposed development projects. Follow up studies are required to identify mitigation measures where development has impacted the beluga population. This action proposes a proactive approach to collect the necessary data so that consideration for impact on the beluga population can enter into the planning process at an early stage.
Actions: 1) Document and map the areal extent of development in the upper Inlet. 2) Identify harbor use in Knik Arm and collect baseline data on ship and boat activity. 3) Map and categorize where all point source discharges are

entering the upper Inlet. 4) Conduct a comprehensive study to analyze EPOC's and cumulative effects of pollutants.

- Studies associated with Port McKenzie, the Port of Anchorage, and KABATA have been initiated.

Priority: 2

b. Conduct acoustic studies

In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds. Sources of anthropogenic noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging. Ensonification by vessel traffic or drilling, pile driving, or other activities may alter beluga movements or avoidance of areas important to the life history of these whales.

Actions: Assess the effects of vessel presence, oil development, coastal development, and other human activities on the acoustic environment of Cook Inlet beluga whales.

Priority: 2

c. Assess impacts of the oil and gas industry

In Cook Inlet, oil was discovered in 1957. By 1967 most of the existing platforms were in place and operational. Much of the infrastructure is over 40 years old, and many of the pipes are aging and corroded. There are currently 16 platforms in upper Cook Inlet, 12 of which are still active. The other four are "shut in", and while not active, have not been plugged or abandoned. Potential impacts to Cook Inlet beluga whales associated with oil and gas include oil spills, pollution, ship traffic, seismic research, in-water noise, and physical habitat alteration. This conservation action is primarily focused on oil spills as the other potential impacts listed here are covered under other action items.

Actions: 1) Assess the risk of oil spills as related to chronic leaks, age of pipelines and equipment in Cook Inlet. 2) Evaluate oil and gas lease sales in upper (State) and lower (Federal) Cook Inlet for their impact to Cook Inlet beluga whales and their habitat.

Priority: 2

d. Assess effects of commercial fishing: prey reduction

Commercial fisheries in Cook Inlet may adversely affect beluga whales through competition of preferred fish species (notably eulachon and salmon). These highly fatty fish are an essential component of beluga diets, and studies have shown that belugas are more successful at capturing prey when prey are in dense concentrations. Therefore, any reductions in the amount of prey available may impact the energetics of these whales and delay recovery.

Actions: Determine and minimize adverse effects of commercial fishing on Cook Inlet beluga whales due to reduction of beluga prey.

Priority: 2

e. Assess effects of commercial fishing: incidental take

State and Federally-permitted commercial fisheries have varying likelihoods of interacting with beluga whales due to differences in gear type, species fished, timing, and location of the fisheries. Interactions with belugas can occur from

entanglements, injuries, or mortalities occurring incidental to fishing operations. Since Cook Inlet belugas are considered a strategic stock by the MMPA, the commercial fisheries that interact with them are required to reduce the incidental mortality and serious injury to a level below the potential biological removal level.
Actions: 1) Determine the level of incidental take of belugas in commercial fisheries. 2) Mitigate incidental take of belugas to an insignificant level if necessary.
Priority: 3

f. Assess effects of personal use, subsistence, and recreational fishing
The most likely impacts from these fisheries include the operation of small watercraft in stream mouths and shallow waters, ship strikes, displacement from important feeding areas, and harassment. While NMFS is unaware of any beluga whales injured or killed in Cook Inlet from personal use, subsistence, or recreational fishing activities, further research needs to be conducted to determine if this type of fishing is impacting beluga recovery by precluding access to and use of important habitats and prey resources.
Actions: Determine if personal use, subsistence, or recreational fishing is detrimentally impacting the Cook Inlet beluga population.
Priority: 3

- **Mitigate Effects of Anthropogenic Activities on Habitat**

g. Mitigate pollution entering Cook Inlet
Discharge of pollutants into Cook Inlet may impair water quality and adversely affect beluga whales, which are often associated with nearshore waters adjacent to metropolitan areas. Evaluating pollutants and their sources is the focus of this analysis, whereas monitoring and evaluating contaminant loads within belugas is included under health assessment in Objective 2.
Actions: 1) Work with EPA to ensure marine point-source discharges are consistent with the recovery of the Cook Inlet beluga whale. 2) Recommend against any discharge in Cook Inlet beluga habitat that would be harmful to the whales or impair their recovery. 3) Encourage action to reduce non-point (runoff and storm drain) pollution into Cook Inlet. 4) Encourage the development of new technologies for airport deicing agents that are chemical-free. 5) Encourage the Port of Anchorage to comply with ballast water requirements and to meet the best technologically feasible standards.
Priority: 2

h. Mitigate habitat degradation from coastal development
Belugas are not uniformly distributed throughout the Inlet, but are found predominantly in coastal waters. Here, belugas must compete with people for use of nearshore habitats. Presently, there is insufficient data about the Cook Inlet belugas' habitat requirements to fully assess the effects of coastal development, but development of Cook Inlet's coastal regions may reduce the quality and quantity of habitat for Cook Inlet beluga whales.
Actions: 1) Provide federal agencies with specific recommendations to conserve Cook Inlet belugas in regards to construction and operation of development

projects. 2) Work with developers to mitigate activities that reduce the quality of, or restrict belugas' access to valuable habitat. 3) Protect Type 1 and 2 beluga whale habitat from loss of habitat function. 4) Work towards conservation of beluga whale habitats throughout Cook Inlet. 5) Minimize disturbance to whales from coastal construction.
Priority: 2

i. Mitigate effects of noise
Beluga whales are known to be among the most adept users of sound of all marine mammals. Man-made sounds may increase ambient noise levels in the water, which could reduce the ability of Cook Inlet beluga whales to feed, communicate, and navigate. Furthermore, high levels of noise have the potential to harm or kill belugas.
Actions: 1) Evaluate the impacts of activities that create noises with the potential to cause significant injury to or mortality of beluga whales. 2) Mitigate actions to minimize or reduce disturbance and harassment to whales due to noise.
Priority: 2

j. Mitigate effects of oil and gas activities
Both State and Federal lands of Cook Inlet have been leased, explored, and/or developed for oil and gas over the last three decades. Potential impacts to Cook Inlet beluga whales associated with oil and gas include ship traffic, oil spills, pollution, seismic research, in-water noise, and physical habitat alteration. In Type 1 habitat, beluga whales are concentrated in a relatively small area and are vulnerable to impacts. Belugas are less concentrated in Type 2 and 3 habitats in the summer, but are still susceptible to harassment and disturbance from oil and gas activities.
Actions: 1) Minimize oil and gas activities within Type 1 beluga whale habitat. 2) Work with industry to minimize oil and gas activities within Type 2 and 3 habitats that harass or injure Cook Inlet beluga whales. 3) Work with industry to minimize oil spills within all beluga whale habitats. 4) Update and implement the Cook Inlet Oil Spill Response Plan and the Wildlife Protections Guidelines to reduce potential injuries and mortalities of belugas resulting from oil spills and spill response actions.
Priority: 2

6. **Objective 6 - Implement and evaluate the effectiveness of the Cook Inlet Beluga Whale Conservation Plan.** These activities are not directly related to understanding or addressing possible causes of the population's decline or rate of recovery, but are necessary for addressing administrative matters related to implementation of the Plan and for informing the public.

a. Establish a conservation coordinator position
Opportunities exist to cooperatively work with other agencies, the State, Native organizations, local agencies, industry, and universities to implement the Conservation Plan. Working jointly with organizations interested in and affected by beluga research promotes the highest quality results. Collaboration among Tribes, academic institutions, Federal agencies, international research

organizations, and environmental groups promotes efficient use of resources and expertise as well as utilizing cutting-edge research techniques and information exchange. Collaboration also promotes local capacity-building based on a clear understanding of real needs for supporting effective research aimed at answering critical management issues. A Conservation Plan Coordinator could actively implement the Conservation Plan and update it as needed, and could coordinate Federal, State, university, industry and other studies and disseminate information.
Actions: 1) Provide oversight in implementing and evaluating the effectiveness of the conservation strategy and actions. 2) Update the Conservation Plan based on the effectiveness of the conservation strategy and actions. 3) Develop mechanisms for cooperative research and conservation efforts. 4) Promote joint research and collaborative programs with tribes, other agencies, and countries.

- Co-management agreements for subsistence harvest have been implemented.

Priority: 3

b. Develop and implement an outreach and education program
A key aspect to successfully implementing management actions based on solid scientific evidence is to coordinate the education and outreach of public and various groups that are going to be affected by management actions.
Effective education programs foster public support regarding the integrated science-based program being implemented as a result of this Plan and the management actions that are implemented to promote Cook Inlet beluga whale recovery. Communicating the results of research is important, but conveying them in a manner appropriate to the particular audience is the key aspect of educational programs for various groups. Such programs can be implemented through the co-management process with the Tribal governments when feasible.
Actions: Educate the public on Cook Inlet beluga whale issues.
Priority: 3

c. Develop an Alaska Native Sentinel Program
The program would engage the local residents as sentinels promoting the importance of stewardship and responsibility for understanding of Cook Inlet ecology in a holistic fashion. The Program would act as a repository for a significant number of observations of the ecosystem dealing with many different but interrelated environmental issues and would be a central system that is locally implemented. The value of this program is its integration of observations and insights based on practices of indigenous cultures, with science based recording of those observations. Standardization of data collection to support comparisons among areas and different times of years is a key element of the program. The Island Sentinel Program of the Pribilof Islands could be used as a model for Cook Inlet. It provides year-round observations of marine mammal abundance and distribution on and around the islands, while identifying environmental anomalies.
Actions: Utilize local Native observations of biological events as a tool for ecological monitoring.
Priority: 3

C. Cost Implementation Schedule

The cost implementation schedule (Table 5) outlines actions and estimated costs for the conservation program for Cook Inlet beluga whales over the next five years (FY 2009 – FY 2013), as set forth in this Conservation Plan. It is a guide for meeting the conservation goals and criteria outlined in this Plan. This schedule includes action descriptions, action priorities, duration of actions, and estimated costs. The fact that this schedule only covers the next five years in no way implies that the Cook Inlet beluga whale population will be restored to OSP within five years, but rather that the plan and conservation activities should be reassessed at that time. Many of the listed activities will likely be continued beyond the five year scope of this schedule, even if they are listed as only occurring once in five years (e.g., studying environmental changes obviously is a long-term activity, but only needs to be completed once every five years to provide useful information). However, if we obtain significant new data that alters our understanding of Cook Inlet belugas or the threats impacting them before the five year mark, we may adjust these actions and timeline to make use of the best available information.

Table 5: Cook Inlet Beluga Whale Cost Implementation Schedule for FY 2009 – FY 2013. Costs are estimated in thousands and are increased 5% each year. Duration refers to how many times the action should occur in five years (2/5 means twice in five years).

			ESTIMATED COSTS (K)				
CONSERVATION ACTION	**PRIORITY**	**DURATION**	**FY09**	**FY10**	**FY11**	**FY12**	**FY13**
1. Assess changes in the Cook Inlet beluga whale population size							
a. Continue annual abundance surveys	1	5/5	140	147	154	162	170
b. Conduct population trends analyses	1	5/5	12	13	13	14	15
2. Improve knowledge of Cook Inlet belugas to determine which factors are limiting recovery							
• **Characterize Cook Inlet beluga life history**							
a. Assess impacts of predation by killer whales	1	2/5	100				122
b. Estimate age, age of maturation, and indices of growth from teeth	2	1/5					50
c. Study female reproductive biology	2	2/5	10				12
d. Study mating systems	3	1/5					60
e. Study genetics for stock identification, subdivision, and forensics	3	2/5	50				61
• **Assess health of Cook Inlet belugas**							
f. Compile disease, pathology, and health index	2	5/5	45	47	50	52	55
g. Improve understanding of parasitism and disease	2	1/5				100	
h. Assess contaminant loads in Cook Inlet belugas	2	5/5	10	11	11	12	12
i. Analyze polycyclic aromatic hydrocarbon contaminant levels	2	2/5	35◊				116
• **Characterize diet**							
j. Analyze stomach contents	2	5/5	13	14	14	15	16
k. Analyze fatty acids and stable isotopes in belugas	2	2/5			70		77
l. Determine fatty acid and stable isotope signatures of prey species	3	2/5			200		221
3. Refine knowledge of Cook Inlet beluga whale habitat requirements and describe their range, distribution and migration							
• **Characterize habitat**							
a. Identify essential biological and physical features of important beluga habitats	2	3/5	83	86	91		
b. Document beluga distribution and movements	2	5/5	70	74	140	85	154
c. Study dive behavior	2	2/5		40		44	
d. Determine baseline environmental conditions	3	1/5			100		
• **Assess prey base and prey availability**							
e. Determine temporal and spatial shifts of prey species	2	3/5		90	95	100	
f. Compare historical vs. current distribution and abundance of prey species	2	1/5			200		

Table 5 continued.

CONSERVATION ACTION	PRIORITY	DURATION	ESTIMATED COSTS (K) FY09	FY10	FY11	FY12	FY13
4. Reduce direct injuries and mortalities							
a. Implement and enforce regulations for subsistence harvest	1	5/5	5	5	6	6	6
b. Enforce laws against poaching and illegal harassment	1	5/5	200	210	221	232	243
c. Update stranding response plan, respond to strandings, analyze data	2	As needed*	123¤	66	69	73	77
d. Improve research activities and develop less invasive technology	3	2/5			40	42	
e. Reduce injuries from vessel traffic	3	3/5	32		35		37
5. Protect valuable habitat							
• **Assess impacts of potential threat on habitat**							
a. Conduct baseline studies assessing coastal development	2	1/5				100–500	
b. Conduct acoustic studies	2	2/5		200		221	
c. Assess effects of the oil and gas industry	2	As needed*	200		221		
d. Assess effects of commercial fishing: prey reduction	2	5/5	5	5	6	6	6
e. Assess effects of commercial fishing: incidental take	3	5/5	1	1	1	1	1
f. Assess effects of personal use, subsistence, and recreational fishing	3	5/5	5	5	6	6	6
• **Mitigate effects of anthropogenic activities on habitat**							
g. Mitigate pollution entering Cook Inlet	2	As needed*			200		
h. Mitigate habitat degradation from coastal development	2	5/5	100	105	110	116	122
i. Mitigate effects of noise	2	As needed*	9	9	10	10	11
j. Mitigate effects of oil and gas activities	2	As needed*	9	9	10	10	11
6. Implement and evaluate the effectiveness of the Cook Inlet Beluga Whale Conservation Plan							
a. Establish a conservation coordinator	3	5/5	100	105	110	116	122
b. Develop and implement an outreach and education program	3	5/5	10	11	11	12	12
c. Develop an Alaska Native Sentinel Program	3	5/5	50	53	55	58	61
		TOTAL (K)	**1417**	**1306**	**2249**	**1593-1993**	**1856**

* actual costs and actions necessary cannot be estimated at this time and will be determined on an as needed, case by case basis

◊ a 2-year PAH study was commenced in FY08; $35 K in FY09 represents the remaining estimated costs to complete that study

¤ FY09 funds are higher because the updated stranding response plan will be finalized in FY09

IV. CONCLUSION

At minimum, it will require decades to restore the Cook Inlet beluga whale population to OSP. During the early phases of this plan, the stock will exist at a precarious level of abundance from which we may not be able to prevent further declines. We will be challenged by our imperfect understanding of the reasons for this stock's decline and, consequently, by our uncertainty about which measures are most necessary for it's rebuilding. Recovery may be delayed or prevented by actions which affect the whales directly (such as ship strikes, predation by killer whales, or strandings) or indirectly by affecting their habitat (reductions in prey species, oil spills, coastal development). Some of these concerns likely have a more pronounced effect on the Cook Inlet beluga whales than others, and some have no easy "fix." There is little we can do to prevent killer whales from preying on belugas, for example, or to prevent belugas from stranding.

NMFS has taken action to reduce the subsistence harvest of belugas, which had been seen as the largest single impediment to recovery. The impact of other issues confronting the Cook Inlet beluga whale - and the efficacy of this Plan - may not become known until we have conducted more research and monitoring over the coming years. Until then, this Plan attempts to identify and prioritize actions necessary to begin the recovery process. We recognize that the list of actions is probably incomplete, as is our present knowledge and understanding of the ecology and biology of these whales. However, this Plan is believed to be *appropriate* to our current state of knowledge and the abundance level of this stock, *comprehensive* in nature by combining management and applied research for many different issues, and *adaptive* through subsequent revisions and updates. The *effectiveness* of this Plan awaits future assessment.

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APPENDIX A: Federal Regulations Concerning Cook Inlet Beluga Whales

Date	Action	Regulation
August 31, 1988	Cook Inlet (CI) belugas included in the List of Candidate Vertebrate and Invertebrate Marine Species	53 FR 33516
November 19, 1998	NMFS initiated a status review of CI belugas	63 FR 64228
March 1999	NMFS received petitions to list CI belugas as endangered under ESA	
April 9, 1999	NMFS agreed petitions are warranted	64 FR 17347
May 21, 1999	MMPA amended to require cooperative agreements to harvest CI belugas between NMFS and affected Alaska Native organizations	Pub. L. No. 106-31, section 3022, 113 Stat. 57, 100
October 19, 1999	NMFS proposed designating the CI belugas as depleted under MMPA	64 FR 56298
May 31, 2000	CI belugas listed as depleted under the MMPA	65 FR 34590
June 22, 2000	NMFS determined ESA listing not warranted; established CI belugas as a distinct population segment and thus as a "species" as defined under the ESA	65 FR 38778
October 4, 2000	NMFS proposed regulations to regulate subsistence harvests	65 FR 59164
December 21, 2000	MMPA amendment (May 21, 1999) on harvest of CI belugas made permanent	Pub. L. No. 106-553, 114 Stat. 2762, 2762A-108
September 26, 2003	NMFS released a Notice of Availability of Subsistence Harvest Management of CI Beluga Whales Final Environmental Impact	68 FR 55604
April 6, 2004	NMFS released final interim regulations to govern the subsistence harvest of CI belugas for Alaska Natives	69 FR 17973
April 15, 2004	CI belugas transferred from the Candidate Species List to the newly created Species of Concern List	69 FR 19975
March 16, 2005	NMFS completed a draft Conservation Plan for CI belugas	70 FR 12853
March 24, 2006	NMFS initiated a status review to determine if CIB should be listed under the ESA	71 FR 14836
March 29, 2006	NMFS published a Notice of Intent to prepare a Supplemental Environmental Impact Statement (SEIS) for the CI Beluga Whale Subsistence Harvest	71 FR 15697
April 2006	NMFS received a petition to list CIB as endangered under ESA	
August 7, 2006	NMFS agreed petitions are warranted	71 FR 44641
April 20, 2007	NMFS published a proposed rule to list CI belugas as endangered under ESA	72 FR 19854
December 28, 2007	NMFS released a Notice of Availability of the CI Beluga Whale Subsistence Harvest Draft SEIS	72 FR 73798
April 22, 2008	NMFS postponed the ESA listing decision six months	73 FR 21578
June 20, 2008	NMFS published the CI Beluga Whale Subsistence Harvest Final SEIS	73 FR 35113

APPENDIX B: 2006 Co-management Agreement

AGREEMENT
between the
NATIONAL MARINE FISHERIES SERVICE
and the
COOK INLET MARINE MAMMAL COUNCIL
for the
CO-MANAGEMENT OF THE COOK INLET STOCK OF BELUGA WHALE
for the YEAR 2006

I. PARTIES

This document constitutes an agreement between the National Marine Fisheries Service (NMFS) and the Cook Inlet Marine Mammal Council (CIMMC), otherwise referred to as the Parties.

CIMMC is an association, chartered by the Cook Inlet Treaty Tribes, which represents these Tribes and Alaska Native marine mammal subsistence hunters within the Cook Inlet area who are registered with CIMMC.

The Cook Inlet beluga whale stock applies to all beluga whales occurring in waters of the Gulf of Alaska north of 58 degrees North latitude including but not limited to, Cook Inlet, Kamishak Bay, Chinitna Bay, Tuxedni Bay, Prince William Sound, Yakutat Bay, Shelikof Strait, and off Kodiak Island and freshwater tributaries to those waters.

II. AUTHORITIES

A. NMFS has the authority to enter into this agreement pursuant to section 119 of the Marine Mammal Protection Act of 1972 (MMPA), 16 U.S.C. 1388. Guidance is provided by the Presidential Memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Government); Executive Order 13175, November 6, 2000 (Consultation and Coordination with Indian Tribal Governments); the American Indian and Alaska Native Policy of the U.S. Department of Commerce, March 30, 1995; and the Memorandum of Agreement for Negotiations of Marine Mammal Protection Act Section 119 Agreements, August, 1997.

B. CIMMC has the authority to enter into this agreement under its charter and authorizing resolutions from Alaska tribal governments. Further, CIMMC is recognized as an Alaska Native organization under the MMPA and, as such, may enter into this agreement to co-manage the subsistence use of marine mammals by Alaska Natives.

III. PURPOSES

The purposes of this agreement between NMFS and CIMMC are to promote the recovery of the Cook Inlet stock of beluga whales while at the same time providing an opportunity for a limited harvest of the Cook Inlet beluga whale by the Native Village of Tyonek (NVT) during 2006, and to promote scientific research on the Cook Inlet beluga whale stock and its habitat.

IV. BACKGROUND

In 1972, the MMPA was passed by Congress and provided an exemption which allows the taking of marine mammals by Alaska Natives provided such taking is for subsistence purposes or done for purposes of creating and selling authentic Native articles of handicraft and clothing. Such taking may not be accomplished in a wasteful manner.

In 1994, CIMMC was established to facilitate cooperation and communication among beluga whale subsistence hunters, scientists, and the government regarding the conservation and management of Cook Inlet beluga whales. CIMMC is composed of Cook Inlet village representatives and hunters who hunt Cook Inlet beluga whales.

In April 1994, the MMPA was amended to include section 119 "Marine Mammal Cooperative Agreements in Alaska." Section 119 formalizes the rights of Alaska Native organizations to participate in conservation-related co-management of subsistence resources and their use. Section 119 also authorized the appropriation of funds to be transferred by NMFS to Alaska Native organizations to accomplish these activities.

Section 3022 of Pub. L. 106-31, 113 Stat. 100 (May 21, 1999), as extended by section 627 of Pub. L. 106-553 (December 21, 2000), prohibits the taking of Cook Inlet beluga whales except pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations.

V. MANAGEMENT OF COOK INLET BELUGA WHALES

The Parties agree that the Cook Inlet beluga whale harvest, during the calendar year 2006, shall consist of one (1) strike, which is allocated to NVT. A strike is defined as hitting a whale with a harpoon, lance, bullet or other object. Upon striking a whale, subsequent strikes on that same whale are not counted against the strike limit.

Harvest Practices

1. Only whaling boats and captains authorized under a permit issued by CIMMC may participate in the harvest allocated under this agreement. An Elder or experienced hunter shall be present and shall direct the harvest for each beluga whaling boat. This will reduce the chance of striking a calf, a female accompanied by a calf, or of striking a whale in an area or in a manner that may result in the loss of the whale.

2. Each whaling vessel must have aboard the following equipment: harpoon and attached rope/float and at least 30 feet of nylon rope or equivalent, to help ensure against the loss of the whale.

3. All Cook Inlet beluga whale hunting shall occur on or after July 1, 2006 to minimize the possibility of harvesting a pregnant female.

4. CIMMC, NVT, or the person or persons holding a permit for the strike shall notify NMFS Enforcement, Anchorage office, 24 hours prior to the initiation of that day’s hunt.

5. The intentional or negligent taking of a maternally dependent calf, or a female beluga whale accompanied by a maternally dependent calf, is prohibited.

6. The beluga whale shall be struck with a harpoon and float prior to shooting. This is intended to reduce struck and loss.

7. Consistent with the desire of CIMMC in regards to this agreement, the current practice of NVT, and the Cook Inlet hunting community, the sale of the beluga whale, or parts thereof, harvested under this agreement, shall not be permitted; provided that nothing herein is intended to prohibit the use or sale of non-edible by-products of a beluga whale taken under a permit authorized herein for the creation of traditional handicrafts or clothing.

8. Upon harvesting a Cook Inlet beluga whale, the whaling captain shall contact NMFS. This will allow NMFS to attend the whale and collect the necessary biological information (teeth, stomach, tissue samples, skin, etc.) for analysis. The whaling captain shall also provide the time and location of harvest.

9. All hunters shall comply with the provisions of this agreement and any permit issued by CIMMC. Non-compliance with any provisions by a hunter may result in the loss of his/her hunting privileges for Cook Inlet beluga whales and prosecution.

10. Any unauthorized striking of a Cook Inlet beluga whale by a member of CIMMC shall be counted against the strikes allocated to CIMMC. If such a strike occurs prior to the hunt conducted legally under a CIMMC Harvest Permit that Harvest Permit will be voided and no further hunting shall occur under this agreement.

11. In the event of any unusual loss of beluga whales through strandings or other causes, NMFS, CIMMC and NVT shall enter into consultation to determine whether to proceed with the hunt permitted by this agreement. Such determination shall be made based upon the best available information and consistent with the primary goals of the parties as set forth in Section III of this agreement. Consistent with the above consultation, NMFS may suspend further hunting at any time if it finds unanticipated deaths within this stock are too high to permit additional removals consistent with recovery of the Cook Inlet beluga whales.

VI. RESPONSIBILITIES OF CIMMC

A. CIMMC, in cooperation with NMFS, will manage the Cook Inlet beluga whale subsistence harvest consistent with the authority and responsibilities of CIMMC specified by this agreement. CIMMC may provide for monitors to be aboard the whaling vessel to verify and report on the strike.

B. CIMMC and NMFS shall communicate on an as-needed basis concerning matters related to the enforcement of this agreement or the Harvest Permit. Any party to this agreement which initiates an enforcement action for a violation of a prohibition involving Native take of the Cook Inlet beluga whale shall notify, as soon as practical, the other party to this agreement of the enforcement action.

C. CIMMC may obtain a permit to conduct research on the biology, natural history, and traditional knowledge of the Cook Inlet population of beluga whales. NMFS personnel may participate in such data collection. All information collected under this section shall be shared between CIMMC and NMFS.

D. No financial commitment on the part of CIMMC is authorized or required by this agreement.

VII. RESPONSIBILITIES OF NMFS

A. NMFS has primary responsibility within the United States Government for the management of beluga whales. NMFS may assert its Federal authority to enforce any provisions of the MMPA that are applicable to the Native harvest of beluga whales. Such assertion of Federal authority will be preceded by consultation with CIMMC.

B. NMFS and CIMMC shall communicate on an as-needed basis concerning matters related to the enforcement of this agreement or the Harvest Permit. Any party to this agreement which initiates an enforcement action for a violation of a prohibition involving Native take of the Cook Inlet beluga whale shall notify, as soon as practical, the other party to this agreement of the enforcement action.

C. NMFS, in consultation with CIMMC, may conduct research on the biology, natural history, and traditional knowledge of the Cook Inlet population of beluga whales. CIMMC personnel may participate in such data collection. All information collected under this section shall be shared between CIMMC and NMFS.

D. No financial commitment on the part of NMFS is authorized or required by this agreement.

VIII. REGULATION AND ENFORCEMENT

NMFS recognizes the existing tribal authority to regulate tribal members during the conduct of the subsistence harvest of beluga whales. CIMMC recognizes the Secretary of Commerce's authority to enforce the provisions of the MMPA and other Federal laws applicable to the Native harvest of Cook Inlet beluga whales.

IX. OTHER PROVISIONS

A. Nothing herein is intended to conflict with current NOAA or NMFS directives or the directives of CIMMC. If the terms of this agreement are inconsistent with existing laws, regulations, or directives of either of the Parties, then those portions which are determined to be inconsistent shall be invalid, but the remaining terms and conditions not affected by the inconsistency shall remain in full force and effect. At the first opportunity for review of the agreement, all necessary changes will be accomplished by either an amendment to this agreement or by a new agreement, whichever is deemed expedient to the interest of both Parties.

B. Should disagreements arise over the provisions of this agreement, or amendments or revisions thereto, that cannot be resolved at the operating level, the area(s) of disagreement shall be stated in writing by each Party and presented to the other Party for consideration. If agreement on interpretation cannot be reached within a reasonable time, a special meeting or teleconference shall be held to resolve the issues. This meeting shall include representatives of NMFS and CIMMC.

X. ADOPTION, DURATION, AND MODIFICATION

This agreement will become effective when signed by both Parties, may be amended at any time by written agreement of both Parties, and shall expire on December 31, 2006. Either Party may terminate this agreement by giving 45 days prior written Notice of Termination to the other Party.

XI. SIGNATORIES

The parties hereto have executed this agreement as of the last written date below:

Peter Merryman Date	Robert D. Mecum Date
Chairman,	Acting Administrator, Alaska Region
Cook Inlet Marine Mammal Council	National Marine Fisheries Service
P.O. Box 82009	P.O. Box 21688
Tyonek, AK 99682	Juneau, AK 99802-1668

APPENDIX C. Turnagain Arm Marine Mammal Stranding Response Plan

TURNAGAIN ARM MARINE MAMMAL STRANDING RESPONSE PLAN

NATIONAL MARINE FISHERIES SERVICE

This booklet describes protocols to be followed by the National Marine Fisheries Service (NMFS) in responding to stranded marine mammals in Turnagain Arm and upper Cook Inlet. It is important that only authorized Turnagain Arm Stranding Response Network members, under direction from the Response Coordinator (Coordinator) respond to stranded marine mammals. NMFS must be notified of all stranding events, and will be on the site to direct response actions. In the event NMFS is unable to respond, the Coordinator will determine the proper actions and initiate a response when necessary. At all times, NMFS response will be guided by three objectives; to ensure all actions do not endanger any response personnel; to minimize stress to all live stranded marine mammals, and to improve survival chances of any stranded marine mammal.

I. INTRODUCTION

Several species of marine mammals are found in upper Cook Inlet, including the waters of Knik and Turnagain Arms. The most common of these are beluga whales. Other marine mammals observed less frequently are minke whales, killer whales, harbor porpoise, harbor seals, and sea lions. Except for beluga whales, these animals are thought to be seasonal residents, journeying into the upper Inlet to feed or to have their young. Live strandings occur during the open water months (May through October), particularly August and September, with extreme tidal ranges, extensive tidal flats, and treacherous currents. Unlike stranding events in other parts of the country, where whales may show a deliberate purpose in coming ashore, the marine mammals of upper Cook Inlet are believed to strand accidentally on low tides. Because of this, their chances for survival are often very good. Because of this, our primary emphasis in these marine mammal strandings is to minimize stress or injury to the animals until they can re-enter the waters with the incoming tide. Under extreme circumstances, smaller animals could be transported for rehabilitation and released at a later date.

The following paragraphs describe the species of marine mammals known to strand in the upper Inlet.

<u>Beluga whale</u>
The beluga whale is a small toothed whale which feeds on a wide variety of organisms. Adult males may reach 14 feet and weigh 2,000 pounds. Females may reach 13 feet and weigh about 1,000 pounds. Adults are a uniform white, while calves are brown to slate-gray. Whitening of the skin begins by age six and is usually complete by age 13. Approximately 400-600 beluga whales live in Cook Inlet. Beluga whales are often found in large aggregations. Its spring presence in the upper Inlet is thought to be for calving, molting, and feeding on salmon and eulachon (hooligan) near the mouths of several rivers. From satellite tagging data, we now know that beluga whale remain in the upper Inlet, including Knik and Turnagain Arms throughout the year.

Killer whale
Killer whales are medium-sized toothed whales with very distinctive coloration patterns of black and white. They have a prominent dorsal (back) fin which may stand six feet in males and three feet in females. Adult males may reach 30 feet in length, and females about 23 feet long. Efficient predators, killer whales usually travel in pods or family groups of a few to as many as 30 animals. Pods are structured around a dominant female rather than large males, and responders should consider this in assessing possible action. For example, other pod members may be reluctant to leave an area if the pod leader remains stranded.

The presence of killer whales in Knik and Turnagain Arms has been recorded during recent years. Transient killer whales feed on marine mammals and resident killer whales feed on fish. There has been proof, through beluga whale strandings and eye witness reports that transient killer whales visit upper Cook Inlet to prey on beluga whale, and possibly on the other marine mammals. It may be that one or more pods have now learned of the availability of prey in the upper Inlet, and returns seasonally.

Minke whale
The minke whale is the smallest of the baleen whales. These whales have no teeth but sieve food through rows of baleen suspended from the roof of their mouths. The minke averages 25-30 feet in length and is black to dark gray in color with a lighter belly and a whitish band around the flipper. They also have a series of throat grooves under the lower jaw which allow the mouth to expand while feeding. Minke feed on invertebrates and small fish. They are usually found alone or in groups of two to four animals. Minke whales are thought to enter the upper Inlet to feed on fish during the spring and summer months.

Harbor porpoise
The harbor porpoise is the smallest cetacean (whales, porpoises, and dolphins) in the North Pacific. Commonly 3 to 4 feet long, these toothed animals may weight about 100 pounds. They are dark grey or brown with a lighter underside and have a small triangular dorsal fin. Harbor porpoises often are found in groups up to 10 animals, and may concentrate near river mouths to feed. They are reported in Turnagain Arm, sometimes at the mouth of the Twenty Mile River.

Harbor seal
The harbor seal is the most abundant seal in southcentral Alaska and recognizable by their small size (4 to 6 feet) and round, earless head. Their color is variable but often mottled brown or gray. The harbor seal is seasonally found in the upper Inlet, particularly the Susitna delta (Beluga River to Little Susitna River) and Chickaloon River, most likely follows migrating eulachon and salmon.

Steller sea lion
The sea lion has been listed as an endangered species, protected under the Endangered Species Act. The sea lion is a large animal, 8 to10 feet in length, with a yellowish-brown color and heavy muzzle. The head is large, with visible external ears. They feed on a variety of prey, most often small fish (including eulachon) and salmon. They are also uncommon to the upper Inlet, although single individuals have been reported in Susitna River and Turnagain Arm.

II. PHYSIOLOGICAL EFFECTS OF STRANDING

Stranded marine mammals present a challenge to biologists in evaluating whether they require assistance and if so, what manner of response is appropriate. In upper Cook Inlet, stranded animals are usually not in a life-threatening situation. In such instances these animals should be monitored from a distance, but otherwise not disturbed further. The additional stress caused by humans approaching marine mammals or attempting to rescue them may cause more injury than the stranding itself. Under moist and cool conditions, most stranded animals can survive several days. However, there are times when stranded animals may not survive without assistance. NMFS will respond to such situations, provided that human life and safety are not endangered by the response effort.

Strandings of marine mammals in upper Cook Inlet differ from those often experienced and reported from the Atlantic and Pacific coasts, which may involve mass strandings for various or unknown reasons in which animals are determined to come ashore. Often these animals may be sick or injured, or following the lead of a sick animal. Tidal ranges are often slight, and highly intrusive measures are necessary to rescue these marine mammals. Also, stranded animals are subject to sun and high air temperatures which place great stress on their ability to regulate internal body temperatures. In these cases, animals are often lost due to heat strokes. Large whales, such as sperm or humpbacks, are so large that they require the buoyancy of water to support their mass. Out of water, breathing itself may be difficult.

By contrast, strandings in upper Cook Inlet appear to be accidental, often the result of venturing into shallow waters during feeding activity or predator avoidance, and then stranded when the tide goes out. Animals not otherwise injured by the stranding are likely to be freed by the incoming tide. The local climatic conditions may lessen the effects of strandings, as cooler air, water temperatures, wind, and cloud cover may reduce the likelihood of hyperthermia. Finally, the whales and porpoise found in this area are small animals that can sustain temporarily being out of water. None the less, there is a need to respond to strandings in upper Cook Inlet to evaluate the animals' condition and the feasibility of human intervention.

Hyperthermia is a major concern with stranded marine mammals, as their insulative layers of fat and inability to sweat causes internal body temperature to rise. Larger whales have proportionately less surface area than small whales, and have the greatest problems in losing excess heat when stranded. Whales have a network of vessels in the tail flukes and flippers that allow for the blood to cool. The Coordinator will consider the species involved, the weather conditions, access, and the position of the whale, in assessing response actions. If the whale is exposed on a warm or sunny day, it may be necessary to cool the animal by digging holes, for the flukes and flippers, and allowing them to fill with cold water.

Breathing rates are not a good indication of stress, and stranded whales will often slow their breathing to a point where observers may become concerned or assume the animal has died. Marine mammals have considerable ability to control their breathing, and stranded whales may only breath every 15 minutes or longer.

Stranded whales are able to recover sooner if they have been in an upright position rather than lying on their sides. Such whales become disoriented when returned to water and may have difficulty swimming. If necessary, the Coordinator will attempt to return whales to an upright position by firmly pressing against them, making sure the flippers are tucked against the body to avoid injury.

Marine mammals are very susceptible to stress during stranding, and the Coordinator will ensure they are kept as calm as possible. By law (Marine Mammal Protection Act of 1972, as amended), no one is allowed to harass marine mammals, including stranded animals, without proper authority. NOAA Enforcement will keep onlookers from approaching the animals and to keep any undesired disturbance away, especially dogs, motorcycles or ATV's, and aircraft.

Whales should never be towed outside of water. Small whales like porpoise, and possibly beluga whale, can be placed onto a canvas sling which can then be carried or dragged to the water. They may also be rolled for short distances when this would return them to water. To do this, the whale should be oriented parallel with the shore and a hole dug to accept the dorsal fin, if necessary. Make sure the flippers are against the body and pause for several minutes after each roll for the animal to reorient. This method itself may damage the whale and should be used only when water is very near and the animal is in danger of hyperthermia. Also, larger whales are capable of movement and thrashing which could seriously injure humans: the Coordinator should be alert to this when approaching or handling animals.

Seals and sea lions often come ashore to breed, give birth, molt, and rest. Pups are often left on shore during feeding excursions by the mother which may last a day or more. The presence of these animals on shore should not in itself, mean anything is wrong. Adult seals and sea lions can be very dangerous, and should be approached only for the most extreme circumstances.

The following species narratives describe the physiological effects of strandings on these animals and specific indications of stress.

Beluga whale
The Cook Inlet population of beluga whales is unique in that it is geographically and genetically isolated from other beluga whale in Bristol Bay and along the arctic coast for several thousand years. These animals may be genetically adapted to the environment of the Inlet, able to withstand occasional stranding. However, existing data is not sufficient to support this theory.

Beluga whale have adapted to life in an extremely stressful and changing environment. They are found in water temperatures from 30 to 64^{o}F, and have a remarkable ability to regulate blood flow through their arteries. They use this ability, and their insulative layer of blubber, to control internal body temperature. Because of this, heat stroke is rarely a life-threatening issue to stranded beluga whales. Seagulls and possibly eagles may prey on stranded whales, breaking through the skin, particularly near the eyes, blowhole, and vent. The outer layer of skin is shed annually during spring and summer months. During this time, beluga whale have been known to rub on gravel to facilitate molting, and the skin becomes pock marked and rough.

Beluga whale strandings in upper Cook Inlet are recorded as going back to the 1940s. It is likely these animals commonly strand while pursuing feed in shallow mudflat areas. A beluga whale stranded near Kenai in October 1992 survived for 72 hours before dying.

Killer whale
Killer whales have stranded infrequently in Alaska, although documented accounts at the mouth

of the Yukon River near Kotlik in 1982 and on Nunivak Island in 1984 involved the death of one or more killer whales. Six killer whales stranded on tidal flats in Turnagain Arm in May 1991 and five stranded again in August 1993. These were the first such events recorded in Turnagain Arm, and all survived but one large male, accessible to the public, dogs, and people who wanted to help.

Minke whale

Stranded minke whales have been reported along Turnagain Arm for several years. Dead minke have been found in both Turnagain and Knik Arms, although the cause of death has not been determined.

Harbor porpoise

No live strandings of harbor porpoises are recorded from upper Cook Inlet, although dead individuals have been collected in Turnagain Arm. At least one stranded harbor porpoise showed signs of predation.

Harbor Seal

Seals can survive out of water for extended periods. Therefore, most seals are not endangered by stranding. Harbor seal pups are left on the beach for long periods of times while their mother forages for food. Healthy pups need to be observed for 24 hours to determine if their mom has abandoned them, or just went to feed. Adult seals should be observed for signs of stress, injury, illness, gunshots, and especially entanglement with commercial fishing gear. Adult animals that appear lethargic or display unusual actions may be ill and should be treated cautiously. No stranded harbor seals have been reported in the upper Inlet.

Steller sea lion

Steller sea lions can survive out of water for extended periods. Therefore, most sea lions are not endangered by stranding. They should be observed for signs of stress, injury, illness, gunshots, and especially entanglement with commercial fishing gear. Adult animals that appear lethargic or display unusual actions may be ill and should be treated cautiously. Few sea lions have been observed along the shore in upper Cook Inlet.

III. STRANDING RESPONSE GUIDELINES

The following guidelines should be used by the Coordinator to determine the need for, and type of action to be taken during a stranding event. Each stranding event is unique, and these guidelines will not address all situations that may arise. The Coordinator and Turnagain Arm Stranding Response Network should not panic or take impulsive actions during stranding events. Strandings are often drawn out events, and decisions and actions made in haste will usually make matters worse.

Turnagain Arm and upper Cook Inlet are very dangerous environments of swift currents, bore tides, cold temperatures, and quicksand-like tide flats which have trapped and killed. ONLY TRAINED AND PROPERLY EQUIPPED PEOPLE AUTHORIZED BY NMFS SHOULD ATTEMPT TO RESPOND TO STRANDED MARINE MAMMALS. Individuals can best aid these animals by contacting NMFS and NOAA Enforcement

It is often difficult to tell whether a stranded whale is alive, as the animal may show no movement or obvious breathing. Often the only sure way to tell is by observing for a period of time to detect movement.

STRANDING GUIDELINES

1. On notification of stranded marine mammals, the Coordinator will travel to the stranding site and assess the situation, using the parameters in the Response Decision Flow Chart.

2. Notify NMFS of all marine mammal strandings at these numbers: (907) 271-5006 and (907) 360-3481. Identify your self, describe the event, the specific location, and include all pertinent factors (which may affect the animal's welfare or response actions).

3. If the stranding is near the Seward Highway contact Alaska State Troopers: (907) 783-0972.

4. The Coordinator will develop response decisions using the chart below and the informed advice of veterinarians and other trained experts.

RESPONSE DECISION FLOW CHART

0.A	Stranded animals are cetaceans (e.g., beluga, killer, or minke whale or harbor porpoise) Go to 1
0.B	Stranded animals are pinnipeds (e.g., harbor seals or sea lions) Go to 6
1.A	Cetaceans are in water, sufficient to cover flukes or flippers Go to 5
1.B	Cetaceans are exposed or will become so with outgoing tide Go to 2
2.A	Temperature greater than 50^{o}F and/or bright sunshine Go to 3
2.B	Temperatures less than or at 50^{o}F and/or cloud cover Go to 5
3.A	Time to next high tide, greater than six (6) hours Go to 4
3.B	Time to next high tide, less than six (6) hours Go to 5
4.A	Cetaceans approachable with no human safety concerns. Approach whales cautiously from midpoint of body, avoid tail flukes and head. If feasible, photograph animals for identification purposes (photograph prominent scars, dorsal fins, saddle patches on left side of killer whales, or other markings). If on their side, attempt to move whales to an upright position. When conditions and resources allow, attempt to return animals to water. Otherwise, apply wet coverings to dorsal surfaces, leaving the blowhole clear. When available, apply Vitamin E ointment or zinc oxide on exposed surfaces in danger of drying. DO NOT apply sun protection creams or oils. Minimize harassment of animals and avoid unnecessary touching. NOAA Enforcement will take active measure to prevent non-authorized persons from approaching the marine mammals. Marine Mammal Stranding Report shall be completed.
4.B	Cetaceans not approachable or unsafe conditions Go to 5
5	NO direct action is taken to respond to stranded cetaceans. Observe animals from a distance until they have re-floated with the tide or until conditions change. Minimize harassment or disturbance to whales. If feasible, photograph animals for identification purposes (photograph prominent scars, dorsal fins, saddle patches on left side of killer whales, or other markings). NOAA Enforcement will take active measure to prevent non-authorized persons from approaching the marine mammals. Marine Mammal Stranding Report shall be completed.

6.A	Pinniped is an adult Go to 7
6.B	Pinniped is a juvenile or pup Go to 9
7.A	Pinniped is entangled in fishing gear or otherwise signs of gross injury are observed Go to 8
7.B	Pinniped is not entangled and/or no gross injuries are observed Go to 5
8.A	Pinniped is approachable on foot, and incapable of large movements. The Coordinator will work with Veterinarians to disentangle gear. Extreme caution is necessary due to the size and power of these animals. Seals and sea lions can inflict bites and may injure an inattentive person. Pinnipeds may also carry viral and bacterial infections which could be transmitted to humans. Marine Mammal Stranding Report shall be completed.
8.B	Pinniped is in water and not approachable on foot. The animals may be snared and towed to land only if it is not capable of strong swimming movements. Otherwise, NO ACTION should be taken. NOAA Enforcement will take active measure to prevent non-authorized persons from approaching the marine mammals. Marine Mammal Stranding Report shall be completed.
9.A	Pinniped entangled in gear or otherwise signs or gross injuries are observed Go to 8
9.B	Pinniped not entangled in gear or no gross injury observed. DO NOT attempt to capture or approach pinniped. Pinniped pups are regularly abandoned by their mothers. This might be a temporary situation, its mother may return to attend to her pup. The pup should be monitored for about 24 hours before action is taken. Even if the animal is observed to be alone for long periods (exceeding 24 hours) no action is needed. NOAA Enforcement will take active measure to prevent non-authorized persons from approaching the marine mammals. Marine Mammal Stranding Report shall be completed.

MARINE MAMMAL STRANDING REPORT

NMFS compiles data from marine mammal strandings throughout the United States and North America. This information allows NMFS to assess the effect of strandings on marine mammal populations and may help NMFS to better respond to strandings in the future. Responders should attempt to complete as much of the Marine Mammal Stranding Report as possible, and mail or FAX the information to NMFS at the following locations: Anchorage Field Office, Tel. (907) 271-5006, FAX 271-3030 or the Juneau Regional Office, Tel. (907) 586-7235, FAX 586-7012.

V. SALVAGE EDIBLE PORTIONS

In the event of the death of a beluga whale during a stranding, NMFS will attempt to make such animals available to Alaska Natives for harvesting of foodstuffs and/or handicraft purposes. NMFS will contact the appropriate Alaska Native Organization(s) (ANO) and provide information on the stranding as soon as is practical. The ANO will then distribute call-out information as they see fit and retrieve any usable portions or parts from the stranded animals.

COMMAND AND PROCEDURES

The **Response Coordinator** (Coordinator) is the designated National Oceanic Atmospheric Administrator (NOAA) official in charge during a marine mammal stranding in Turnagain Arm. The Coordinator will be a National Marine Fisheries Service (NMFS) employee or NOAA Enforcement Agent. The Coordinator will participate on-site during most responses. However, if needed (ex., large response situations), the Coordinator will manage the operation through command staff.

The Coordinator is responsible for the following actions:

1. Obtain accurate information of the stranding event.
   The Coordinator will collect the stranding information as reported and then verify the information with an onsite visit.

2. Analyze information and develop response objectives and strategies.
   NMFS and NOAA Enforcement will analyze the stranding event to determine a safe and logical course of action.

3. Determine personnel and equipment needs.
   Personnel and equipment needs shall be assembled as needed.

4. Notify Alaska State Troopers
   The Coordinator will contact Alaska State Troopers to inform them of the stranding event, on the chance they have not been told. The Coordinator will keep the State Troopers informed of activities that may affect the Seward Highway along Turnagain Arm (ex., vehicles, people).

5. Notify the Turnagain Arm Stranding Response Network
   Working through NMFS, the Turnagain Arm Stranding Response Network will organize qualified volunteers. The Turnagain Arm Stranding Response Network shall be informed of stranding events and will work with the Coordinator on the course of action decided for the stranding (ex., monitoring, safety, rescue).

6. Obtain needed logistical support, including aircraft
   The Coordinator shall arrange logistical support as necessary, including aircraft (ex., airplanes, helicopter).

The Coordinator is responsible for coordination within NMFS and NOAA Enforcement. The Coordinator will also have the list of NMFS and NOAA Enforcement personnel for on-site response, as well as a list of the Turnagain Arm Stranding Response Network members.

On site, the Coordinator may direct specific response actions of agency personnel, Turnagain Arm Stranding Response Network members, and support functions. Necessary equipment shall be delivered and available as requested.

A Veterinarian will be consulted by the Coordinator for each response. The Coordinator will consider recommendations by the Veterinarian in determining course of actions.

PERSONNEL

NATIONAL MARINE FISHERIES SERVICE	
Anchorage Field Office	271-5006
Stranding cell phone	360-3481
Juneau Regional Office	586-7235
	OFFICE
Barbara Mahoney	271-3448
Mandy Migura	271-1332
Brad Smith	271-3023
NOAA ENFORCEMENT	
Mike Adams	271-1823
Matt Clark	271-1823
Les Cockreham	271-1823
Kevin Heck	271-1823
Mark Kirkland	271-1823

APPENDIX D. NOAA OLE Cook Inlet Beluga Whale Enforcement Plan

National Marine Fisheries Service
Alaska Enforcement Division

2008 COOK INLET BELUGA WHALE ENFORCEMENT PLAN

October 01, 2007 – September 31, 2008

Primary and Emergency Contact List

Contact	Responsibilities	Office	Cell
ASAC Kevin Heck	Primary emergency contact	907-271-5745	-
EO Les Cockreham	Operational Planning	907-271-3021	-
SA Jason Couse	Investigations	907-271-5765	-
Lt Tory Oleck	Alaska State Troopers	907-761-7139	-
SA Rory Stark	USFWS	907-271-2825	-
SA Vince Pallozzi	AFT	907-271-5742	-
US Marshal Service	Arrests	907-271-5154	-

Authority

Act
Marine Mammal Protection Act of 1972
Enforcement authority for National Oceanic Atmospheric Administration (NOAA) actions related to an illegal harvest or attempted illegal harvest during this operation falls under the Marine Mammal Protection Act (MMPA) as delineated at 16 U.S.C. 1377. Other potential criminal statutes to be investigated are the Lacey Act (16 U.S.C. 3371- underlying MMPA violation) and Conspiracy (18 U.S.C. 371).

Regulations
50 CFR 216 Regulations Governing the Taking and Importation of Marine Mammals
Under the MMPA, "take" is defined at 50 CFR 216.3 as "harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect or kill, any marine mammal . . . " Native hunters are not allowed to subsistence hunt for Cook Inlet beluga whales, unless it is permitted by the Co-Management Agreement between the National Marine Fisheries Service (NMFS) and the Cook Inlet Marine Mammal Council (CIMMC).

50 CFR 229 Authorization for Commercial Fisheries under the Marine Mammal Protection Act of 1972
There are over 1,300 Cook Inlet salmon set or drift gillnet permits issued by the Alaska State Department of Fish and Game. All Cook Inlet salmon set or drift gillnet permits are listed by the NMFS as Category II fisheries. The owner of a Cook Inlet salmon set or drift gillnet permit is required to obtain an Authorization Certificate and report marine mammal interactions to the NMFS.

Mission

Stop all illegal takes of Cook Inlet beluga whales from any source.

2008 Threat Level: HIGH

The threat level for 2008 is defined as HIGH since strikes will not be permitted and any hunting or attempting to hunt a Cook Inlet beluga whale will be in violation of the MMPA. A co-management agreement will not exist between the NMFS and the CIMMC in 2008.

The threat level reflects the possibility of illegal take during a given year. It is based on an assessment of the number of strikes[1] Native groups are permitted by the co-management agreement with the NMFS. The threat level can be upgraded or downgraded during a given year as circumstances change due to investigations, violations, and intelligence. There are three possible threat levels for a given year:

> Threat Level HIGH: No strikes are allowed for the Native Village of Tyonek (NVT) or the Alaska Native Marine Mammal Hunter's Committee (ANMMHC).
>
> Threat Level MODERATE: The NVT is allocated one strike and the ANMMHC is not allocated a strike.
>
> Threat Level LOW: Both the NVT and the ANMMHC are given one strike each.

Patrols, surveillance, liaison, and community outreach will be conducted throughout 2008.

AED Performance Goals for 2006		
Activity	Patrol high threat areas	200 hours
Activity	Conduct surveillance	100 hours
Activity	Respond to complaints	with in 24 hours
Activity	COPPS outreach and education	125 hours
Milestone	Prepare end of year summary	1st Quarter
Milestone	Prepare operations plan for coming year	1st Quarter

[1]The NVT and ANMMHC are permitted to strike, or shoot at one beluga whale. If a beluga is lost after a strike, a second strike is not permitted on a different beluga.

Geographic Analysis of Threat Areas

High Threat Areas
The major threat areas are listed in priority. Also listed are areas of interest where beluga activity may occur.

> ***Priority 1. Susitna River*** is the most remote area that meets all the factors as a major threat area. The river mouth is 20 miles from Anchorage by crossing Cook Inlet. The area is not accessible by road, and the nearest road system is at Deshka Landing, which is approximately 30 miles up-river from the mouth. The area of concern is the mouth of the Susitna and is approximately 5 miles wide and 12 miles long. Public use and surveillance of the area is extremely limited due to the hazardous nature of the river and the tides. Belugas can be found throughout the spring and summer, in and around the mouth of the river. The best method of patrolling is by vessel, and then by aircraft.

> ***Priority 2. Little Susitna River*** is the second most remote area that meets all the threat area factors. The river mouth is about 12 miles away from Anchorage by crossing Cook Inlet. The Little Susitna is accessible by road only at the state park boat ramp, about 13 miles up-river. The mouth is less than a mile wide and offers no concealment for the first three miles. The banks of the river are ten to twenty feet high mud walls with no natural camping areas. Belugas near or in river mouth have a high potential for harassment from sportsmen boat traffic to and from the area. After about 5 miles up-river, natural camping areas can be found in abundance and are heavily used by the public. The river is patrolled by state park rangers. The best method of patrolling the river is by jet boat, and then by aircraft.

> ***Priority 3. Ship Creek Boat Ramp*** is the main launch and recovery area for any boats using upper Cook Inlet.

Areas of Interest
The areas require patrolling due to possible beluga activity, strandings, and level A&B harassment. Level A&B harassment is expected to increase in future years due to an increase in development and research activities in Upper Cook Inlet.

> ***Any Cook Inlet salmon set or drift net site*** has the potential for a take by fishing gear, or illegal deterrence (such as shooting by firearm). Vehicle patrol and vessel patrol are the most effective methods of covering individual sites.

> ***Knik Arm, Turnagain Arm, and Kachemak Bay*** are under heavy surveillance by the public in vehicles, boats, and aircraft. Aircraft and vessel patrols are an effective method to cover large areas.

> ***The Beluga River and the Lewis River*** do not offer well concealed areas and are under moderate surveillance by aircraft and sportsmen. Aircraft patrols are the most effective method for patrolling these rivers.

Components of the Action Plan

Our law enforcement effort will consist of three components: Patrol, Investigation, and COPPS.

<u>Patrol</u>

Air patrols

Report all air patrol activity in a LEADS ACI Report. Non-District 3 personnel will forward a copy of the ACI Report to the District 3 ASAC.

Boat Patrols

Report all boat patrol activity in a LEADS ACI Report. Non-District 3 personnel will forward a copy of the ACI Report to the District 3 ASAC.

Vehicle Patrols

Report all vehicle patrol activity in a LEADS ACI Report. Non-District 3 personnel will forward a copy of the ACI Report to the District 3 ASAC.

<u>Intelligence Gathering/Investigation</u>

One SA will be assigned to beluga operations from October 1, 2006 through September 30, 2007 in an effort to improve our ability to collect and disseminate intelligence, develop informants, conduct covert surveillance, and aggressively investigate all reports of alleged illegal "takes" of CI belugas. The assigned SA will be critical in maintaining continuity in the beluga operations, seeking out informants, and developing intelligence necessary to prevent illegal hunting or harassment in Cook Inlet.

A minimum of one Enforcement Officer (EO) will also be assigned for the same period with responsibility for initiating and continuing our COPPS efforts, conducting patrol from various available platforms, and coordinating daily operations with local, state, and other federal organizations. Other EOs will support the COPPS efforts and patrolling through TDY assignments as needed.

All intelligence findings will be reported in LEADS in an Incident Report. Non-District 3 personnel will forward a copy of the Incident Report to the District 3 ASAC.

<u>Community Oriented Policing and Problem Solving (COPPS)</u>

Public outreach and education conducted through meetings with Native hunters, and liaison with other enforcement agencies in the CI area will continue to be crucial to the success of enforcement efforts. We intend to build on public awareness which was raised by efforts in previous years. By raising the awareness of the public to beluga issues, and the need to report suspected harassment and takes of these animals, we hope to enhance the effectiveness of our limited enforcement resources by incorporating the "eyes and ears" of the public to assist in deterring and detecting illegal activity. Recommended public outreach and education projects are:

1. Media service announcements and distribution of beluga reward posters in the CI area;

2. Contact with local charter services, "flight seeing" charters, tour groups with educational information, and enforcement contact information;

3. Conducting outreach and education in beluga crime prevention at shows and events.

Partnership meetings with appropriate local, state, and federal law enforcement agencies in the CI area will be conducted to provide updated information on the CI beluga situation, OLE's mission as it relates to belugas, and appropriate points of contact for questions and enforcement-related information. These meetings will also be used to solicit assistance in effectively conducting our enforcement mission during 2008. In addition, the Anchorage field office will continue to develop relationships with enforcement agencies in an effort to increase assistance in protecting CI beluga whales. The initial round of beluga-related liaison meetings with local enforcement agencies will begin in March 2008.

Outreach to Native hunters in the CI area will continue in an effort to ensure they are aware of the increased enforcement emphasis and to develop a mutual understanding of the beluga conservation in Cook Inlet. Meetings are also coordinated with PRD staff and CIMMC during the spring of 2008.

Report all COPPS and liaison activities in a LEADS ACI Report. Non-District 3 personnel will forward a copy of the ACI Report to the District 3 ASAC.

2008 Action Plan

The Action Plan is an outline of recommended actions to be implemented during FY 2008. From October to November hunter and research vessel activity may still occur. January to March, Cook Inlet is normally impassable by small boats due to ice flows. April may still experience ice in Cook Inlet, but April and May are traditional spring months for hunting activities. Ship Creek Boat Launch will not be in operation until mid-May. Vessel operations before mid May may be limited to the Deshka Boat Launch, 30 miles away from the Susitna River mouth. Operations in the Susitna River may be difficult during April and May due to melting ice flows and flooding that could occur from heavy snow falls and cold weather.

January 2008

- Submit 2007 Operation Beluga Watch Annual Report
- Submit 2008 Cook Inlet Beluga Enforcement Plan

February 2008

- Attend the Anchors Aweigh Boat Show in Anchorage, February 1-10, 2008, and conduct crime prevention outreach and education.

March 2008

- CIMMC Meeting (Date not announced)

April 2008

- Begin air patrol operations.
- Coordinate operational information and intelligence with other agencies. If possible, form a joint task force to respond to any threat.

- Begin COPPS outreach and education with media, travel services, air tour services, and state and federal park rangers.
- Respond to all beluga strandings.
- Attended the 2008 Great Alaska Sportsmen Show in Anchorage, April 3-6, 2008 and conduct beluga crime prevention outreach and education

May 2008

- Meet with other LE agencies.
- Training of oil platform employees south of the Cook Inlet Forelands
- Provide replacement Beluga Reward signs to Alaska State Park Ranger

June 2008

- Patrolling and other activities
- Begin monitoring set and drift net sites.

July 2008

- Meet with the NVT and ANMMHC if necessary.
- Provide liaison between NVT, ANMMHC and PRD to confirm that no hunting will occur in 2008.
- Operation Beluga Watch presentation for LE agencies.

August 2008

- Conduct patrols and LE activities.
- Increase patrol of Knik Arm for level A & B harassment

September 2008

- Continue patrols. Reduce vehicle patrols cease vessel patrols if weather continues to deteriorate.
- Meet with the NVT and the ANMMHC if necessary.
- Continue patrols of Knik Arm for level A & B harassment.
- Attend the Alaska State Fair in Palmer, August 21 – September 1, 2008.
- Prepare for the Alaska Federation of Native Convention that will be held in Anchorage, October 2008.

APPENDIX E: Acronyms and Abbreviations

ABWC	Alaska Beluga Whale Committee
ACC	Alaska Coastal Current
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
ALJ	Administrative Law Judge
AMMTAP	Alaska Marine Mammal Tissue Archival Project
ANO	Alaska Native organization
AWTF	John M. Asplund Wastewater Treatment Facility
BOF	Board of Fisheries
CI	Cook Inlet
CIMMC	Cook Inlet Marine Mammal Council
COPPS	Community Oriented Policing and Problem Solving
dB	Decibel
DDT	Dichloro-diphenyl-trichloroethane
DFO	Department of Fisheries and Oceans, Canada
DOT	Alaska Department of Transportation and Public Facilities
EPA	Environmental Protection Agency
EPOC	Emerging Pollutant of Concern
ERF	Eagle River Flats
ESA	Endangered Species Act, as amended
FAA	Federal Aviation Administration
GLG	Growth Layer Group
Hz	Hertz
IPHC	International Pacific Halibut Commission
K	Carrying Capacity
KABATA	Knik Arm Bridge and Toll Authority
KBRR	Kachemak Bay Research Reserve
kHz	KiloHertz
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MNPL	Maximum Net Productivity Level
MOA	Municipality of Anchorage
NEPA	National Environmental Policy Act
NISA	National Invasive Species Act
NMFS	National Marine Fisheries Service (also NOAA Fisheries)
NMML	National Marine Mammal Laboratory
NPDES	National Pollution Discharge Elimination System
NOAA	National Oceanic and Atmospheric Administration
OLE	NOAA Office of Law Enforcement
OSP	Optimum Sustainable Population
PAH	Polycyclic Aromatic Hydrocarbons
PBR	Potential Biological Removal
PCB	Polychlorinated Biphenyls
PDO	Pacific Decadal Oscillation
TEK	Traditional Ecological Knowledge
USCOE	United States Corps of Engineers.
WP	White Phosphorous