DRAFT CONSERVATION PLAN

for the

COOK INLET BELUGA WHALE (*Delphinapterus leucas*)

March 16, 2005

U.S. Department of Commerce
National Oceanic and Atmospheric Administration

NATIONAL MARINE FISHERIES SERVICE
Protected Resources Division, Alaska Region
National Marine Mammal Laboratory, Alaska Fisheries Science Center
Office of Protected Resources

Approved: _____

James Balsiger, Administrator, Alaska Region, National Marine Fisheries Service

Date:_____

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Lead Agency: U.S. Department of Commerce
National Oceanic and Atmospheric Administration
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Alaska Region
Juneau, Alaska

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Abstract: The Cook Inlet beluga whale stock declined dramatically between 1994 and 1998. Results of aerial surveys indicated that the 1998 estimate of Cook Inlet beluga whales (n = 347 whales) represented a decline of 47 percent from the 1994 estimate (n = 653). In response to this significant decline, National Marine Fisheries Service (NMFS) published a proposed rule to designate the Cook Inlet stock of beluga whales as depleted under the Marine Mammal Protection Act, 1972, as amended (MMPA) on October 19, 1999 (64 FR 56298). The final depleted designation was published on May 31, 2000 (65 FR 34590). Following the depleted determination, NMFS proposed regulations limiting the harvest of beluga whales in Cook Inlet, Alaska, on October 4, 2000 (65 FR 59164). A Final Environmental Impact Statement was released with the final proposed regulations in July 2003.

The MMPA requires the Secretary of Commerce to prepare a conservation plan for any species or stock designated as depleted under that Act, and this Conservation Plan is being written to promote the conservation and recovery of these whales. The goals and objectives of the Conservation Plan can be achieved only if a long-term commitment is made to support the actions recommended herein. The shared resources and cooperative involvement of federal, state, and local governments, industry, academia, non-governmental organizations, Alaska Natives, and other invested individuals will be required throughout the recovery period. NMFS makes this Conservation Plan available to the public for review and comment.

The goal of this Conservation Plan will be met when the Cook Inlet stock of beluga whales is at abundance levels that justify re-designation as a non-depleted stock.

FORWARD: July 2004, Anchorage, Alaska.

Tourists watch as people fish for silver salmon at the confluence of Ship Creek and Knik Arm, within the Municipality of Anchorage. The more observant of these visitors may see several pale objects appear in the near shore surf. In a short time many more white, and also grayish, forms appear. Now there seem to be hundreds, stretching across Knik Arm and up as far as the dock face at the Port of Anchorage. The objects become animals, breathing vapor into the cool air and occasionally making audible squeals. The tourists are seeing the Cook Inlet (CI) beluga whale, also called white whales. The reclusive yet gregarious beluga whales are small whales (up to 15 feet) common to many regions of Alaska. Five separate stocks are recognized. The CI stock is the smallest in number of the five, and shares the Inlet with the State's largest cities, industrial centers, and transportation hubs. The CI beluga whale is one of southcentral Alaska's most valuable living natural resources, in terms of Native subsistence and culture, tourism, and perhaps as a bellwether to the many changes this region has experienced in the last century.

CI beluga whale numbers have declined significantly, from perhaps as many as 1,300 to a present population of fewer than 370. The National Marine Fisheries Service (NMFS), as the federal agency with trust responsibility for these whales, has designated the CI beluga whale as a depleted stock. NMFS has worked cooperatively with Native hunters to establish sustainable subsistence harvest levels. We have also initiated a research program to understand the ecology of the CI beluga whale and to provide a scientific framework for management. These actions were largely first-response measures intended to prevent further declines. Now, it becomes necessary to develop a comprehensive plan which addresses all aspects of the CI beluga whale.

NMFS is writing this Conservation Plan as a guide to be followed to achieve the full recovery of this stock. The Conservation Plan will reflect the biology, science, and management of the CI beluga whale, along with the traditional wisdom and knowledge of Alaska Natives to augment western science. This Conservation Plan is not a scientific document, many supporting research studies have been published elsewhere and are referenced here. Rather, the Conservation Plan builds on existing science and other information to provide guidance for management, indicate gaps in our knowledge, and identify necessary research. There are many parties with special interests and positions with respect to these whales, including Cook Inlet area local governments, the oil and gas industry, shipping interests, recreational users, tourism groups, environmental organizations, Alaska Native tribes and villages, the State of Alaska, and other federal agencies. NMFS has attempted to fully involve these parties in the development of this Conservation Plan, and will continue to consult them as it is enacted during the coming years.

While our intent is to provide guidance now, NMFS also believes this Conservation Plan should be dynamic. As new information is obtained, new actions should be identified and incorporated in the Conservation Plan. The Conservation Plan should be reviewed and the relative success of its actions in protecting CI beluga whales should be periodically assessed. Adjustments can be made or additional steps taken if future abundance estimates remain static or decrease. NMFS recommends review of the Conservation Plan at least every five years.

NMFS wants this Conservation Plan to be useful and effective in achieving its purpose. Specific, implementable tasks have been included whenever possible, against which progress can be reasonably measured. NMFS encourages the reader to think beyond this plan (which necessarily has its own limitations) by exploring all opportunities to facilitate recovery. This might include such things as considering CI beluga whales when discussing local water quality issues, or evaluating a shoreline development project. It could mean simply taking out-of-state visitors to see these whales. Other readers may explore ways to improve educational aspects. Recreational boaters might become more aware of CI beluga whales when on the water. We are hopeful our combined efforts will insure the CI beluga whale will remain as a permanent part of our environment.

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EXECUTIVE SUMMARY

DRAFT CONSERVATION PLAN
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COOK INLET BELUGA WHALE (*Delphinapterus leucas*)

The Marine Mammal Protection Act, 1972, as amended (MMPA) requires the Secretary of Commerce to prepare a conservation plan to promote the conservation and recovery of any species or stock designated as depleted under that Act.

The Cook Inlet beluga whale stock may once have numbered as many as 1,300 but declined dramatically during the last decade. Results of aerial surveys indicated a decline of 47 percent between 1994 and 1998. In response to this significant decline, National Marine Fisheries Service (NMFS) designated the Cook Inlet stock of beluga whales as depleted under the MMPA on May 31, 2000 (65 FR 34590). Subsequent surveys between 1999 and 2003 have resulted in abundance estimates from 313 to 435, with no clear trend. Harvests from this stock have been severely restricted (0-2 whales annually) since 1999, but the population has not shown significant response. Considerable concern remains regarding the recovery of this stock

This Conservation Plan reviews and assesses the known and possible factors influencing the Cook Inlet beluga whale. The natural factors included stranding events, predation, parasitism and disease, habitat capacity and environmental change. Human-induced factors were subsistence harvest, commercial fishing, pollution, vessel traffic, tourism and whale watching, coastal development, noise, oil and gas activities, and scientific research.

This Plan develops and presents a Conservation Strategy to guide federal and other actions toward the goal of recovering this stock to a population of no fewer than 780 whales. Recovery actions and recommendations are developed under three recovery objectives.

This Plan describes the current status of the Cook Inlet beluga whale under the Federal Endangered Species Act of 1972, and makes recommendations for initiation of a Status Review of this stock for possible listing under that Act.

While this goal of this Plan is to recover this stock to a population of no fewer than 780 whales, the time frames associated with this recovery will depend on the growth rate within this population. NMFS models indicate recovery will require at least 30 years under the most optimal conditions.

THIS PLAN SHOULD BE CITED AS FOLLOWS:

National Marine Fisheries Service. 2005. Draft conservation plan for the Cook Inlet beluga whale (*Delphinapterus leucas*). National Marine Fisheries Service, Juneau, Alaska.

ADDITIONAL COPIES MAY BE OBTAINED FROM:

National Marine Fisheries Service
Office of Protected Resources
709 W. 9th Street
P.O. Box 21668
Juneau, AK. 99802-1668

This Conservation Plan can also be downloaded from NMFS Alaska Region website: http://www.fakr.noaa.gov

ACRONYMS AND ABBREVIATIONS

ABWC	Alaska Beluga Whale Committee
ADFG	Alaska Department of Fish and Game
AMMTAP	Alaska Marine Mammal Tissue Archival Project
ANO	Alaska Native organization
CI	Cook Inlet
CIMMC	Cook Inlet Marine Mammal Council
CV	Coefficients of Variation
dB	Decibel(s)
DDT	Dichloro-diphenyl-trichloroethane
DFO	Department of Fisheries and Oceans, Canada
EPA	Environmental Protection Agency
ESA	Endangered Species Act, as amended
GIS	Geographic Information System
K	Carrying Capacity
kHz	KiloHertz
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MNPL	Maximum Net Productivity Level
NEPA	National Environmental Policy Act
NIST	National Institute of Science and Technology
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

OC	Organochlorines
OSP	Optimum Sustainable Population
PBR	Potential Biological Removal
PCB	Polychlorinated Biphenyls
PSP	Paralytic Shellfish Poisoning
Rmax	Maximum theoretical net productivity rate
SAR	Stock Assessment Reports
SPOT	Satellite Position Only Tag
TDR	Time Depth Recorder
TNC	The Nature Conservancy
TWK	Traditional Wisdom and Knowledge
USCOE	United States Corps of Engineers.

INTRODUCTION

1. PURPOSE OF THIS PLAN

The Marine Mammal Protection Act (MMPA) of 1972, as amended, requires the Secretary of Commerce to prepare a conservation plan for any species or stock designated as depleted under that Act. The CI beluga whale was designated as depleted on May 31, 2000 (65FR 34590), and this Conservation Plan is being written to promote the conservation and recovery of these whales. The goals and objectives of the Conservation Plan can be achieved only 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 invested individuals will be required throughout the recovery period.

2. BIOLOGY AND LIFE HISTORY

A. Species Description

Beluga whale, *Delphinapterus leucas*, are circumpolar in distribution and occur in seasonally ice-covered arctic and subarctic waters. Beluga whales occur seasonally in much of Alaska, except the Southeast panhandle region and the Aleutian Islands. Five distinct stocks occur in Alaska: Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea, Bristol Bay, and Cook Inlet (Angliss et al. 2001).

The beluga whale is a small, toothed whale in the family Monodontidae. Beluga whales may reach a length of 16 feet, although the average adult size is more often 12-14 feet in length. Native hunters have reported that some CI beluga whale may reach 20 feet in length (Huntington 2000). Males may weigh about 1,500 kg (3,307 pounds) and females 1,360 kg (2,998 pounds) (Nowak 1991). 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. Beluga whale lack a dorsal fin and do not typically produce a visible "blow" on surfacing. Native hunters report these whales often surface with only the blowhole out of the water. For these reasons they are often obscure and difficult to see.

Beluga whales typically give birth to a single calf every two to three years, after a gestation period of approximately 14 months. Most of the 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 within Cook Inlet 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. 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). Mating follows the calving period. Reports on the age of sexual maturity vary from 10 years for females to 15 for males (Suydam et al. 1999), to 4 to 7 years for females and 8 to 9 years for males (Nowak 1991). Beluga whales may live more than 30 years (Burns and Seaman 1986).

Beluga whales are covered with a thick layer of blubber that accounts for as much as 40 percent of its body mass (Sergeant and Brodie 1969). This fat provides thermal protection and stores energy. Native hunters in Cook Inlet have stated that beluga whale blubber is thinner in the early spring than later in the summer. This suggests that feeding in the upper Inlet, principally on fat-rich fish such as eulachon (*Thaleichthys pacificus*) and salmon (*Oncorhynchus* spp.), is very important to the energetics of these animals. NMFS has measured blubber thickness in excess of 10 cm on a CI beluga whale.

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 it 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 conducted through the lower jaw to the middle and inner ears, then to the brain. Beluga whales are reported to have acute vision both in and out of water and, as their retinas contain both rods and cones, are believed capable of seeing color (Herman 1980).

Beluga whales are extremely social animals that typically migrate, hunt, and interact together. Nowak (1991) reports the average pod size as 10 animals, although beluga whales may occasionally form larger groups, often during migrations. Groups of 10 to several hundred beluga whales have often been observed during summers in Cook Inlet (Figure 1). It is not known whether these represent distinct social divisions. Native hunters have stated that beluga whale form family groups and suggest that there are four types of beluga whales in Cook Inlet, distinguished by their size and habits (Huntington 2000).

The CI stock is the most isolated, based on the degree of genetic differentiation between the CI beluga whale stock and the four other stocks (O'Corry-Crowe et al. 1997). This suggests that the Alaska Peninsula has long been an effective barrier to genetic exchange. The lack of observations of CI beluga whales along the southern side of the Alaska Peninsula (Laidre et al. 2000) also supports this conclusion. Murray and Fay (1979) suggested that this stock has been isolated for several thousand years, an idea which has since been corroborated by genetic data (O'Corry-Crowe et al. 1997).

B. Population Status

The CI stock of beluga whales 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

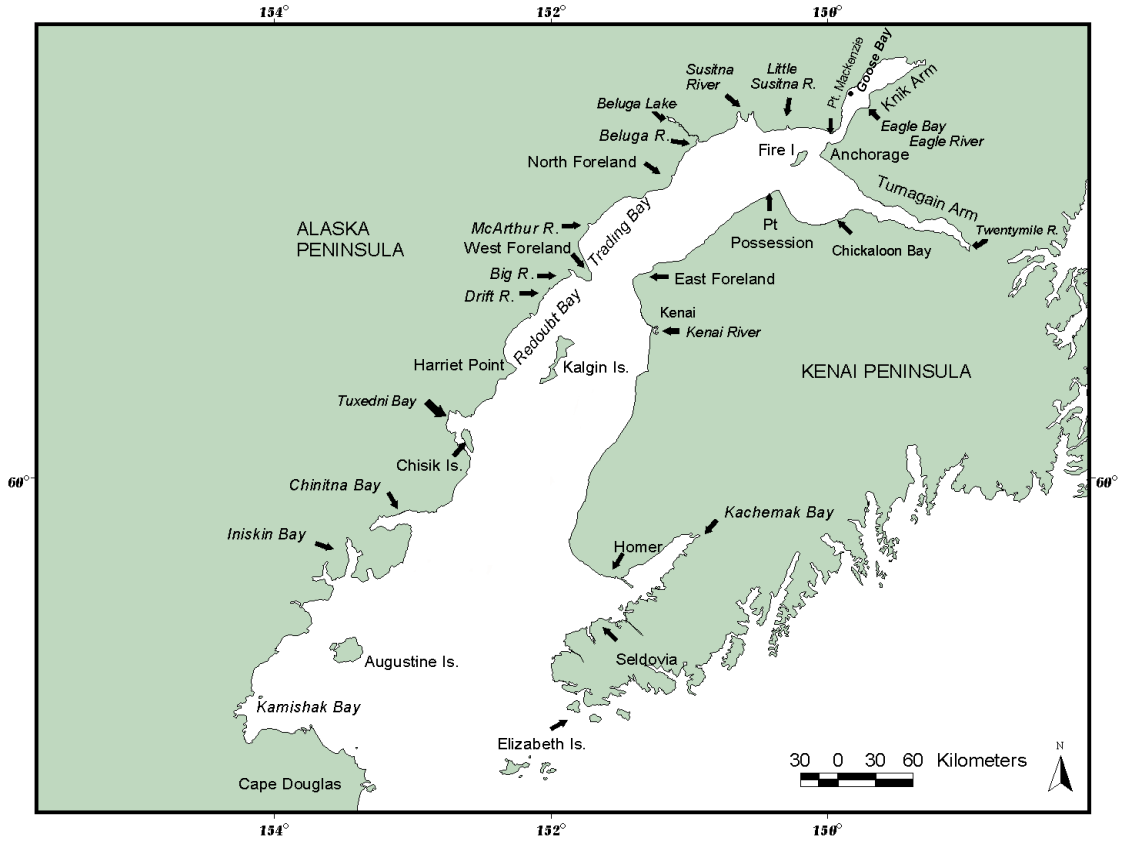

Figure 1. Map of Cook Inlet.

information on the number 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. Because no reliable abundance surveys were conducted prior to the 1990's, scientist must estimate this historical limit. Abundance surveys of CI beluga whales prior to 1994 were often incomplete, highly variable, and involved non-systematic 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 CI 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. Calkins (1984), based on surveys of the upper Inlet between May and August of 1982, estimated that 200-300 beluga whales were seen in one area. Hazard (1988) stated that an estimate of 450 whales may be conservative because much of Cook Inlet was not surveyed in these efforts.

An aerial survey of Cook Inlet in August 1979 resulted in a minimum direct count of 479 beluga whales (Calkins 1989). Using a correction factor of 2.7 developed for estimating submerged whales under similar conditions in Bristol Bay, a minimum abundance of 1,293 whales was estimated. Since this is the most complete survey of the Inlet prior to 1994 (although important areas of upper Cook Inlet were not included in this effort), and incorporated a correction factor for animals missed during the survey in the estimate, the Calkins summary provides the best available data for estimating historical abundance of beluga whales in the Inlet. NMFS has adopted 1,300 as the value for the carrying capacity (*K*) to be used for management purposes.

NMFS began comprehensive, systematic aerial surveys of a beluga whale 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 and 1998, from an estimate of 653 whales to 347 whales (Hobbs et al. 2000b). The annual abundance surveys conducted each June in 1999, 2000, 2001, 2002, 2003 and 2004 have resulted in abundance estimates of 367, 435, 386, 313, 357 and 366 whales, respectively (Figure 2. Hobbs et al. 2000b, NMFS unpublished data).

As seen in Figure 2, the CI beluga whale stock declined dramatically between 1994 and 1998. Results of aerial surveys conducted by the National Marine Mammal Laboratory, National Marine Fisheries Service (NMFS) indicated that the 1998 estimate of CI beluga whales (n = 347 whales) represented a decline of 47 percent from the 1994 estimate (n = 653). In response to this significant decline, NMFS initiated a status review of the CI beluga whale stock pursuant to the MMPA and the Endangered Species Act (ESA) on November 11, 1998 (63 FR 64228). NMFS has since designated the CI stock of beluga whales as depleted under the MMPA. That designation indicates the stock is below its Optimum Sustainable Population (OSP). The stock has not been listed under the ESA.

Harvests from this stock have been severely restricted (1-2 whales annually) since 1999, due to both the voluntary efforts of the Native hunters and federal law. Despite this, the population has not shown significant response (growth). There is considerable concern regarding the population biology for small cetacean stocks such as the CI beluga whale, both for its recovery and its existence. NMFS has worked extensively with experts, including the Native hunters, to employ the best available science and traditional knowledge in our management and conservation efforts here. This includes workshops by Alaska Beluga Whale Committee, Alaska Scientific Review Group, and by the technical working group appointed by an administrative law judge to consider a harvest management plan which would provide for both the continuation of traditional subsistence practices and the recovery of the CI beluga whales.

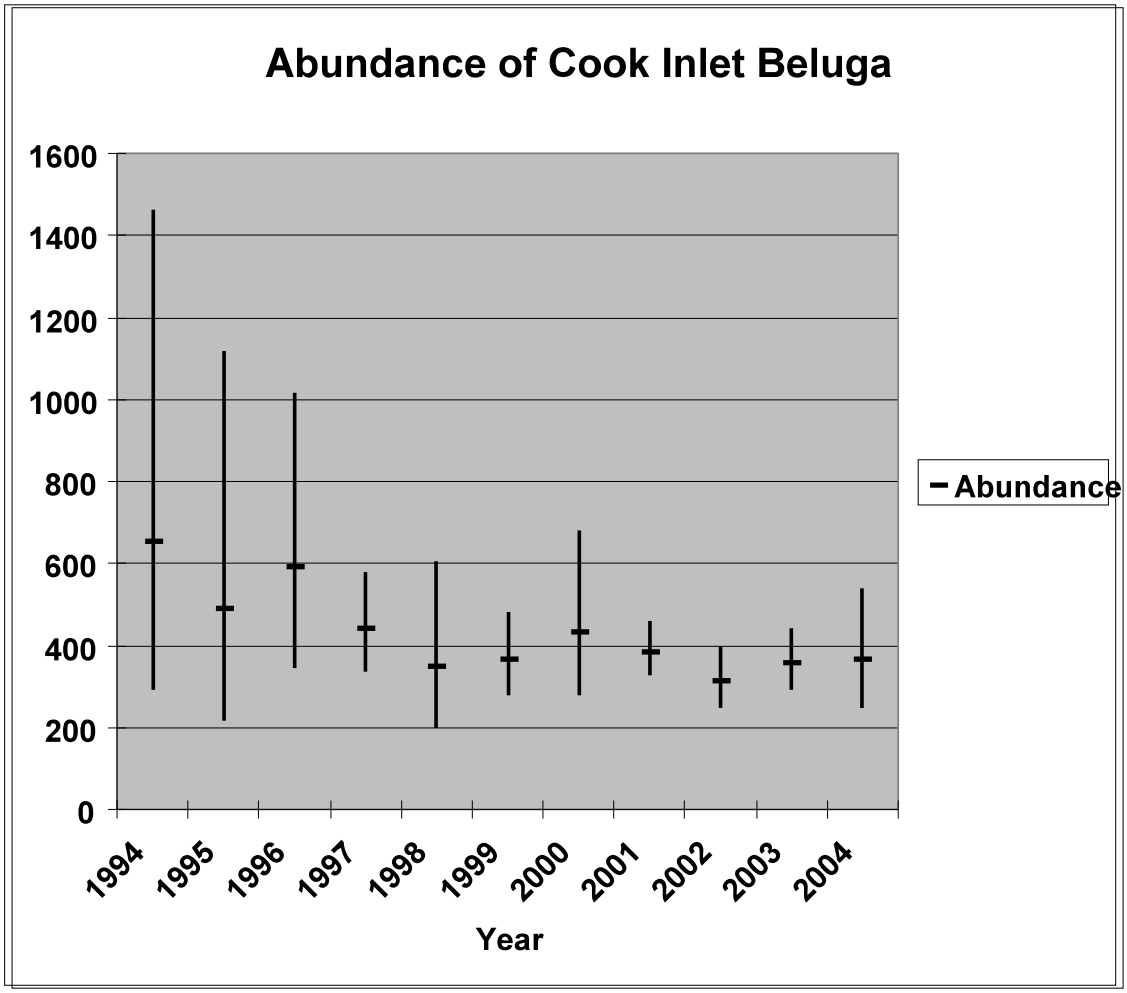

Figure 2. Annual estimates of abundance for CI beluga whales as determined by aerial surveys in June and July. NMFS. The vertical bar with each estimate represents the 95 percent confidence interval for the estimate (Hobbs et al. 2000b, NMFS unpublished data).

The growth of this population can be modeled using several factors, including the size of the population, population demographics (age and gender), the maximum per capita growth rate, its carrying capacity, and extraneous factors (environmental, unusual mortality), among others (see section G. Recovery). Little data are available to determine these factors, although NMFS has estimated *K* as 1,300 and maximum theoretical net productivity rate (*Rmax)* between 2 and 6 percent. However, recent abundance data indicate a 75 percent probability the stock is recovering at a rate less than 2 percent (MMC 2004). Confidence limits (Figure 2) do not allow for a precise determination as to whether this stock is increasing, or at what rate. In fact, there is a small probability the stock may be increasing. NMFS has committed to conducting annual systematic abundance surveys which should reduce uncertainties in population status and growth

over time.

C. Distribution and Movement

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 seasonal migrations, while others remain in relatively small areas year round. Sightings from 1976 to 1979, 1997 (Calkins 1983; MMS 1999), 1999-2002[1], results from recent satellite tracking data during August through March (Hobbs et al. In review), and monthly aerial surveys conducted between June 2001 and June 2002 (Rugh et al. 2004) indicate that beluga whales are present in Cook Inlet year round.

Beluga whales are often sighted in the upper Inlet beginning in late April or early May. Their movements are coincidental with eulachon runs in the Susitna River on the west side of the Inlet and Twenty Mile River in Turnagain Arm. Alaska Natives attribute this early movement into the upper Inlet to whales following the whitefish migration (Huntington 2000). Native hunters report that beluga whales once reached Beluga Lake from the Beluga River, and that beluga whales are often seen well upstream in the Kenai and Little Susitna Rivers. Beluga whales will use the Susitna and Little Susitna area and corresponding flats throughout the summer. They will also use the smaller streams along the west side of the Inlet, going in and out with the tides, following first the eulachon and king salmon (*O. tshawytscha*) runs and, later in the summer, coho (*O. kisutch*) salmon runs.

In Knik Arm, beluga whales generally are observed arriving in May and often use the area all summer, feeding on the various salmon runs and moving with the tides. There may be more intensive use of Knik Arm in August and through the fall, coinciding with the coho run. They 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. They often retreat to the lower portion of Knik Arm during low tides.

In Turnagain Arm, beluga whales follow the eulachon run early in the spring starting in April or early May, lasting into June. Beluga whales use of upper Turnagain Arm decreases in the summer and then increases in August and throughout the fall, coincidental with the coho salmon run. The Chickaloon Bay area appears to be used throughout the year. Due to the extreme tides and extensive mudflats in Turnagain Arm, beluga whales move in and out with the rising and falling tides.

Satellite transmitters attached to 14 beluga whales in upper Cook Inlet in the summers of 2000-2002 (Hobbs et al. In review) provided location and movement data through the fall and winter and into May. Figure 3 shows the movements of three beluga whale carrying satellite tags. All tagged whales remained in Cook Inlet during the tracking period. They

[1]2002. NMFS unpublished data

concentrated in rivers and bays in the upper Inlet in summer and autumn and tended to disperse offshore and move to the middle Inlet (mid-Inlet) in winter. These data also found that in August, beluga whales were concentrated in Knik Arm, along the Little Susitna River delta, or in the area of Fire Island, Point Possession, and Turnagain Arm. In September they continued to use Knik Arm and increased use of the Susitna delta, Turnagain Arm and Chickaloon Bay, and also extended use along the west coast of the upper Inlet to the Beluga River. In October, beluga whales ranged widely down the Inlet in coastal areas, reaching Chinitna Bay, and Tuxedni Bay and continued to use Knik Arm, Turnagain Arm, Chickaloon Bay, and Trading Bay (MacArthur River). November use was similar to September. In December, beluga whales moved offshore with locations distributed throughout the upper to mid-Inlet. In January, February, and March, beluga whales used the central offshore waters moving as far south as Kalgin Island and slightly beyond. Beluga whales also ranged widely during February and March with excursions to Knik and Turnagain Arms, in spite of greater than 90 percent ice coverage (Hobbs et al. In review). Monthly concentration areas are summarized in Figure 4 (Hobbs et al. In review).

Prior to satellite tagging data, the winter distribution of this stock was poorly understood due to the inability of observers to detect beluga whales in ice flows of upper Cook Inlet during winter aerial surveys (Rugh et al. 2004). Calkins (1983) postulated that the whales leave the Inlet entirely, particularly during heavy ice years. Eight dedicated aerial surveys in Cook Inlet between February 12 and March 14, 1997, resulted in only a few beluga whale sightings. The number of animals represented by these sightings has not been

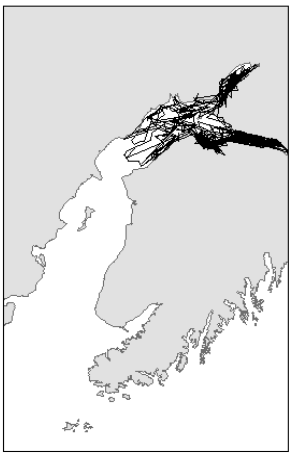

Figure 3a. Movements of beluga CI-0001 tracked between September and January 2001

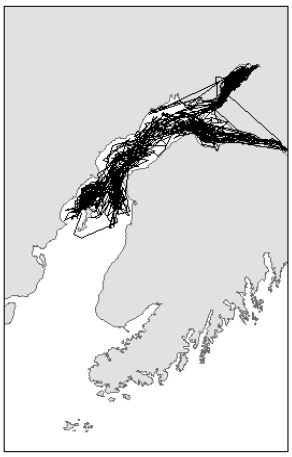

Figure 3b. Movements of beluga CI-0107 tracked between August 2001 and March 2002

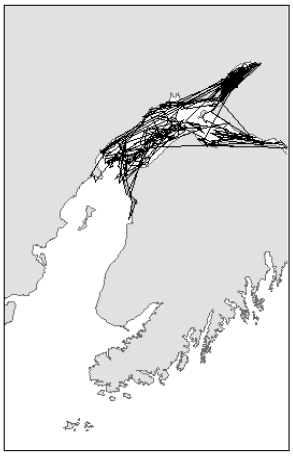

Figure 3c. Movements of beluga CI-0208 tracked between August 2002 and March 2003

Figure 3. Movement tracklines derived from satellite tags from three beluga whales tagged in 2000, 2001, and 2002. Whales were tracked beginning in late August through as late as March the following year (Hobbs et al. In review).

estimated. It is likely that the same group of whales may have been sighted repeatedly (MMS 1999). Beluga whales were observed during monthly surveys (July-April) conducted by NMFS in upper Cook Inlet during 2001-2002 (Rugh et al. 2004). The number of whales observed ranged from 204 (in August) to 10 (in January) and they were observed in Knik and Turnagain Arms during all months except February, when no whales were found. However, low counts generally correlated with periods with high ice density, so it is believed the counts were more a function of visibility of the white whales amidst sea ice than a matter of the whales leaving the Inlet (Rugh et al. 2004). Satellite data showed tagged whales remained in Knik and Turnagain Arms for most of the tracked time, venturing as far south as Redoubt Bay (October) / Kalgin Island (January), and East Foreland (December-January). Therefore, the available information indicates that CI beluga whales remain in the mid and upper Inlet during the winter months, but their range extends throughout much of the Inlet. Their winter distribution does not appear to be associated with river mouths, as it is during the warmer months.

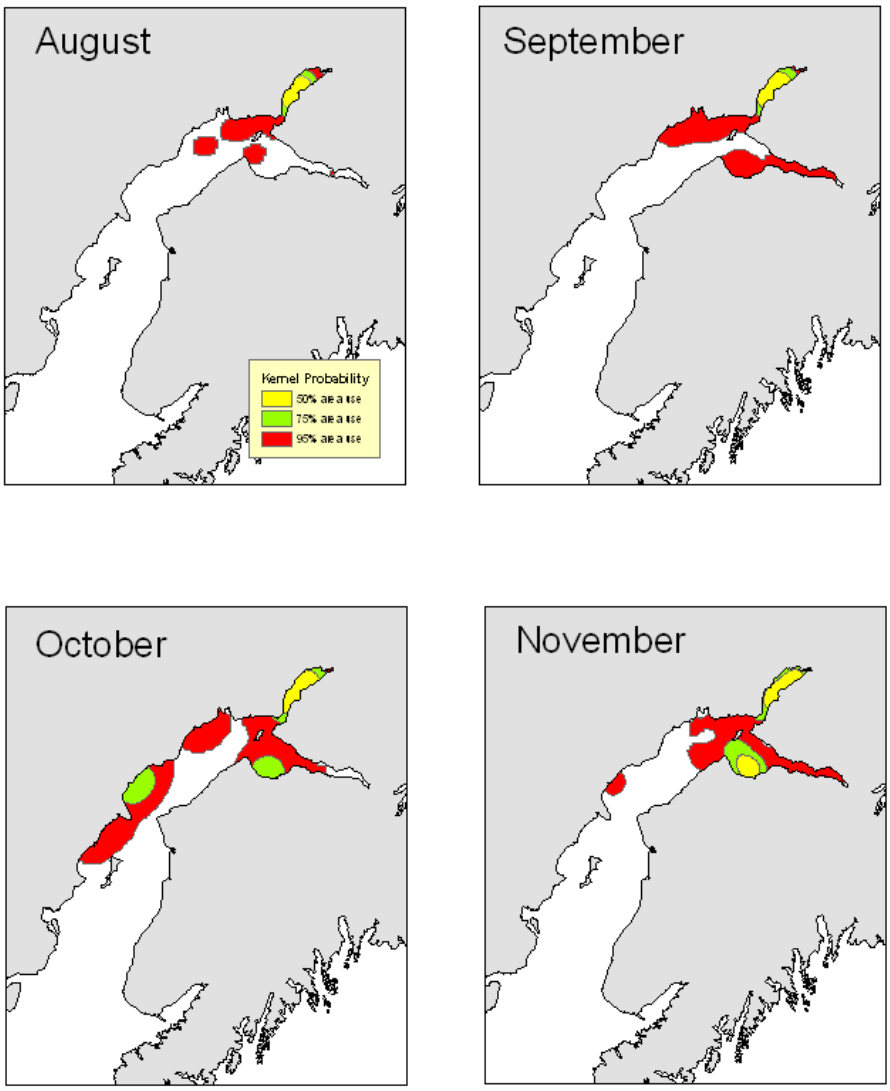

Figure 4a. Cook Inlet beluga whale area use by month (August-November) from NMFS satellite tagging data (Hobbs et al. In review).

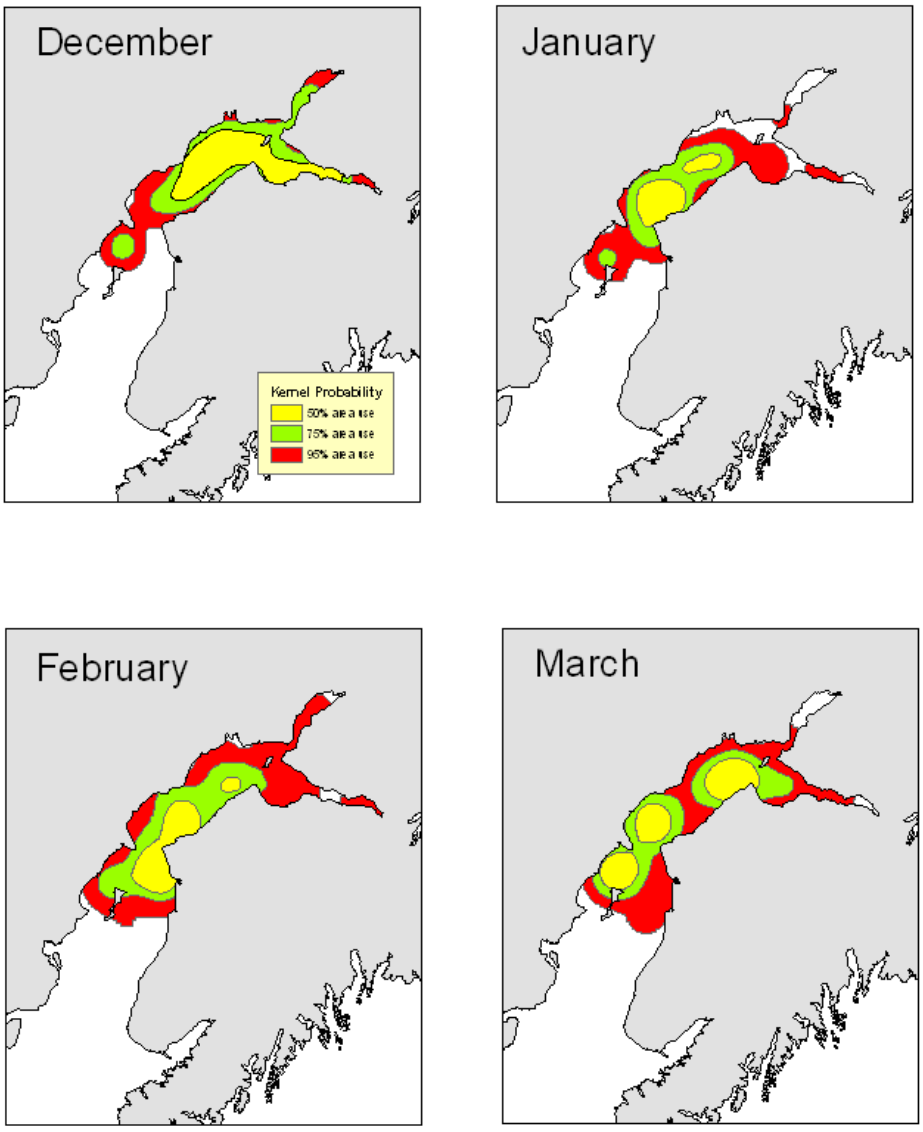

Figure 4b. Cook Inlet beluga whale area use by month (December-March) from NMFS satellite tagging data (Hobbs et al. In review).

The traditional wisdom and knowledge (TWK) of Alaska Natives (Huntington 2000) and systematic aerial survey data (Rugh et al. 2000) indicate the summer range of CI beluga whales has contracted, especially since the mid 1990s. TWK reports in the past had 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. Rugh et al. (2000) reported several sightings of beluga whales in the lower Inlet during surveys from 1993-1995, but in subsequent years, only one live beluga whale was sighted in the lower Inlet (Tuxedni Bay, 1997), and since then only one other whale has been seen south of Point Possession or North Foreland (demarcating the northernmost portion of Cook Inlet), other than in Chickaloon Bay. Surveys have shown that beluga whales are still concentrated in the upper Inlet. This shrinking distribution is probably a function of a reduced population with the remaining whales using the best habitat that offers abundant food, the best calving areas and the best escape from predation. An expanding population will refill the previously utilized areas in the lower Inlet. Therefore, maintaining quality habitats in these areas is essential to recovery of the population.

Beluga whales are occasionally seen in the Gulf of Alaska outside of Cook Inlet (Laidre et al. 2000). There have been rare sightings in Prince William Sound, around Kodiak Island, and in Shelikof Strait. There have been many sightings of a few beluga whales in the Yakutat area, approximately 640 km east of Cook Inlet. With the exception of Yakutat, there have been only 21 sightings of beluga whales collected outside of Cook Inlet in more than two decades, indicating beluga whales are extremely rare in the Gulf of Alaska (Laidre et al. 2000). On the other hand, these animals are consistently found in upper Cook Inlet, as evidenced by satellite tagging studies (Hobbs et al. In review), TWK (Huntington 2000), systematic surveys (Rugh et al. 2000), archeological studies (Mahoney and Shelden 2000), opportunistic reports (Rugh et al. 2000; NMFS unpublished data), and stranding records (Moore et al. 2000, Vos and Shelden 2005).

There are some indications the sightings of beluga whales in Yakutat Bay are of a group that remains in the area throughout the year. In May 1976, 26 beluga whales were seen near Yakutat (Fiscus et al. 1976); the Minerals Management Service (MMS) (1997) winter surveys observed 10 beluga whales off Hubbard Glacier near Yakutat; the U.S. Coast Guard reported 10 to 11 beluga whales there in November 1998; the U.S. Geological Survey reported six beluga whales in August 2000[2], and the U.S. Forest Service reported four beluga whales in June and September 2002[3]. Consiglieri and

[2]Herter, Michael. 2000. Personal communication, via B. Mahoney, NMFS, Alaska Region, Anchorage, Alaska.

[3]Lucey, William. 2002. Personal communication, via B. Mahoney, NMFS, Alaska Region, Anchorage, Alaska.

Braham (1982) also reported annual observations of these whales in Yakutat by local fishermen. However, Laidre et al. (2000) described many studies in Yakutat Bay that should have reported beluga whale sightings but did not, including aerial surveys by trained teams searching for whales and field camps that had a good view of the waters where beluga whales were seen on only some years.

Calkins (1986) believed the Yakutat sightings to be beluga whales visiting from Cook Inlet. Preliminary genetic data suggest the Yakutat whales are related to the beluga whales in Cook Inlet[4], however, the degree of interchange between these two groups is unknown. At this time for management purposes they are considered part of the CI stock of beluga whales.

D. Feeding Behavior

Beluga whales are opportunistic feeders known to prey on a wide variety of animals. They eat octopus, squid, crabs, shrimp, clams, mussels, snails, sandworms, and fish such as capelin, cod, herring, smelt, flounder, sole, sculpin, lamprey, lingcod and salmon (Perez 1990; Haley 1986; Klinkhart 1966). Natives also report that CI beluga whale feed on freshwater fish: trout, whitefish, northern pike, and grayling (Huntington 2000), and on tomcod during the spring (Fay et al. 1984).

Beluga whales in Cook Inlet 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. Beluga whales in captivity may consume 2.5-3 percent of their body weight daily, or approximately 40-60 pounds. Wild beluga whale populations, faced with an irregular supply of food or with increased metabolic needs, may easily exceed these amounts while feeding on concentrations of eulachon and salmon. Beluga whale hunters in Cook Inlet reported one whale having 19 adult king salmon in its stomach (Huntington 2000) and an adult male beluga whale had 12 adult coho salmon in its stomach at a weight of 27.8 kg (61.5 lb.)[5].

The smelt-like eulachon (also named hooligan and candlefish) is a very important food source for beluga whales in Cook Inlet. Eulachon may contain as much as 21 percent oil (total lipids) (Payne et al. 1999). These fish enter the upper Inlet in May. Two major spawning migrations of eulachon occur 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). Stomachs of beluga whales harvested from the Susitna area in spring

[4]Hobbs, Rod. 2005. Personal communication, NMML, Seattle, Washington.

[5]2002. NMFS unpublished data.

have been filled with eulachon[6]

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).

Beluga whales capture and swallow their prey whole, using their blunt teeth only to grab. These whales often feed cooperatively. At the Port of Anchorage, beluga whales have been observed positioning one whale along a rip rap dock, while a second whale herds salmon along the structure toward the stationary beluga whale[7]. The concentrations of CI beluga whales offshore of several important salmon streams in the upper Inlet is assumed to be a feeding strategy which takes advantage of the bathymetry of the area. The fish are funneled into the channels formed by the river mouths and the shallow waters act as a gauntlet for salmon as they move past waiting beluga whales. Dense concentrations of prey appear essential to beluga whale feeding behavior. Hazard (1988) hypothesized that beluga whales were more successful feeding in rivers where prey were concentrated than in bays where prey were dispersed. Fried et al. (1979) noted that beluga whales in Bristol Bay feed 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.

E. Habitat Use and Requirements

CI beluga whales occasionally move into other waters, including Shelikof Strait and the northern Gulf of Alaska. There have been rare sightings in Prince William Sound, Kodiak, and Shelikof Strait and consistent sightings of a group of up to 11 beluga whales in the Yakutat area[8]. With the exception of Yakutat, there have only been 21 sightings of beluga whales collected outside of Cook Inlet in more than two decades, indicating beluga whale are relatively rare in the Gulf of Alaska (Laidre et al. 2000). It appears, then, that these whales primarily reside in Cook Inlet, as shown by satellite tagging studies, TWK, surveys, archeological studies, anecdotal accounts, and stranding records. TWK presented by Huntington (2000) documents beluga whale use in Cook Inlet, especially the upper Inlet, from April to November. Surveys within Cook Inlet have consistently documented high use of the Inlet by beluga whales. Intensive aerial abundance surveys in Cook Inlet have been done by the National Marine Mammal Laboratory in cooperation with NMFS since 1993. Satellite tagging was used to monitor

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[6]1998. NMFS unpublished data.

[7]2000. NMFS unpublished data.

[8]At this writing, NMFS has not determined if Yakutat whales are from the CI stock. Genetic data is now being assessed by NMFS, Southwest Science Center.

movement of 14 beluga whales between July and May 2000-2003.

There is obvious and repeated use of certain habitats by CI beluga whales. From April through November whales concentrate at river mouths and tidal flat areas, moving in and out with the tides. The timing and location of eulachon and salmon runs affect beluga whale feeding behavior and have a strong influence on their summer movements. Beluga whale concentration areas correspond with prey availability. Beluga whales frequently move in and out of deeper water and between feeding, calving, and nursery areas throughout the mid and upper Inlet. Access to these areas and corridors in between these areas is important. Knik Arm, Turnagain Arm, Chickaloon River and the Susitna River delta areas are used extensively. Feeding also appears to occur in the deeper mid to upper Inlet during this time. Based on satellite tracking data, the streams on the west side of Cook Inlet are utilized by beluga whales from the Susitna River delta south to Chinitna Bay during late summer and fall.

When the CI beluga whale population was larger, more of the Inlet was used during the spring, summer and fall seasons, with more use of the Kenai River area, concentrated use of Trading Bay in June and July, many whales in the MacArthur and Beluga Rivers, and frequent sightings of beluga whales in Kachemak Bay with some whales staying all summer. This indicates these areas were important habitat, and that a recovered CI beluga whale population may expand into these areas.

Newborn beluga whales do not have the thick blubber layer of adults and the shallow tidal flats areas have warmer water temperatures which reduce thermal stress to newborns. Alaska Natives report the mouths of the Beluga and Susitna Rivers, as well as Chickaloon Bay and Turnagain Arm are calving areas for beluga whales (Huntington 2000). It is likely these areas are also utilized as nursery areas. Tidal flat areas may also provide some protection from killer whales and belugas appear to use these shallow areas to escape killer whale predation (Shelden et al. 2003).

Summertime prey availability is difficult to quantify. Known salmon escapement numbers and commercial harvest have fluctuated widely throughout the last forty years and there is no clear correlation of salmon runs and the beluga whale population numbers. Samples of harvested and stranded beluga whales have shown consistent summer blubber thicknesses. Because beluga whales do not always feed at the streams with the highest runs of fish, bathymetry and fish density may be more important than sheer numbers of fish in their feeding success. Beluga whales exhibit high site fidelity and may persist in an area with fluctuating fish runs or may tolerate disturbance from boats or other anthropogenic activity in order to feed. Continued stomach and fatty acid analysis may shed more light on feeding and prey requirements for beluga whales.

In the winter, CI beluga whales concentrate in deeper waters in mid- Inlet down to Kalgin Island with occasional forays into the upper Inlet, even to 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 limit their movements. Dive behavior indicates they make deeper dives in these areas, plausibly to feed. Data on the winter diet is limited to a necropsy of one whale found in April which had thinner blubber than beach cast beluga whales found in summer. The stomach contained saffron cod (*Eleginus gracilus*), walleye pollock (*Theragra chaloogramma)*, Pacific cod (*Gadus macrocephalus*), eulachon, tanner crab (*Chionoecetes bairdi*), bay shrimp (*Crangon franciscorum*), and polychaetes (*Nereidai* spp or *Nephtyidae* spp.). This is consistent with other populations of beluga whales that are known to feed on a wide variety of food. The thin blubber of this whale suggests that winter prey resources are not as rich as summer, and the beluga whales may be in a caloric deficit during winter, depending on blubber stored during summer to supplement the limited food resources. However, more samples are required to confirm this hypothesis. Deeper mid-Inlet winter habitats may be important to the life cycle of CI beluga whales. Prey abundance has not been quantified but Moulton (1997) identified 18 species of fish in the upper Inlet, and Robards et al. (1999) identified 50 species in Kachemak Bay and 24 species near Chisik Island in the lower Inlet.

Because the term "critical habitat" has specific legal implications associated with the ESA, this Conservation Plan will avoid use of the term. While it is difficult to quantify the importance of various habitats in terms of the health, survival, and recovery of the CI beluga whale, NMFS believes certain areas are particularly important. These include areas in which beluga whale concentrate during ice-free seasons, often associated with shallow tidal flats, river mouths or estuarine areas as previously described. The coincident occurrence of beluga whales and adult salmon returns to these waters indicates these are feeding areas. It is possible these sites provide for other biological needs, such as calving or molting. Such habitat sites and use have been reported elsewhere in Alaska, although there is not adequate information to identify these habitat attributes in Cook Inlet. A subset of these sites is considered high value habitat. These are sites where beluga whales are most consistently observed, where feeding behavior has been documented, and where dense numbers of whales occur within a relatively confined area of the Inlet.

NMFS has characterized the relative value of these habitats as part of the management and recovery strategy presented in this Conservation Plan. These are depicted in Figure 5: Type 1 habitat is termed "High Value/High Sensitivity" and includes what NMFS believes to be the most important and sensitive areas of the Inlet in terms of the CI beluga whale; Type 2 is termed High Value, and includes summer feeding areas and winter habitats in waters where whales typically occur in lesser densities or in deeper waters, where they may be less prone to harassment and disturbance. This habitat is north of a line between Point Possession and the mouth of Threemile Creek; Type 3 habitat occurs in the offshore areas of the mid and upper Inlet and also includes wintering habitat as described by the results of satellite tagging research; Type 4 habitat describes the remaining portions of the range of these whales within Cook Inlet.

Conservation of all known beluga whale habitats is a primary focus of this Plan. NMFS'

response to proposed habitat alterations will vary according to the sensitivity of the habitat. However, the objective is to preserve Type 1, High Value/High Sensitivity habitats. These classifications are based on NMFS abundance surveys, monthly aerial surveys conducted in 2001 and 2002 (Rugh et al. 2004), TWK (Huntington 2000) and satellite tracking data (Hobbs et al. In review). Current distributions may not reflect historical habitat use or importance. Additionally, these classifications may change as the population recovers and expands into other habitat areas, or as the habitat itself changes over time. These classifications will be reassessed as this Conservation Plan is periodically updated.

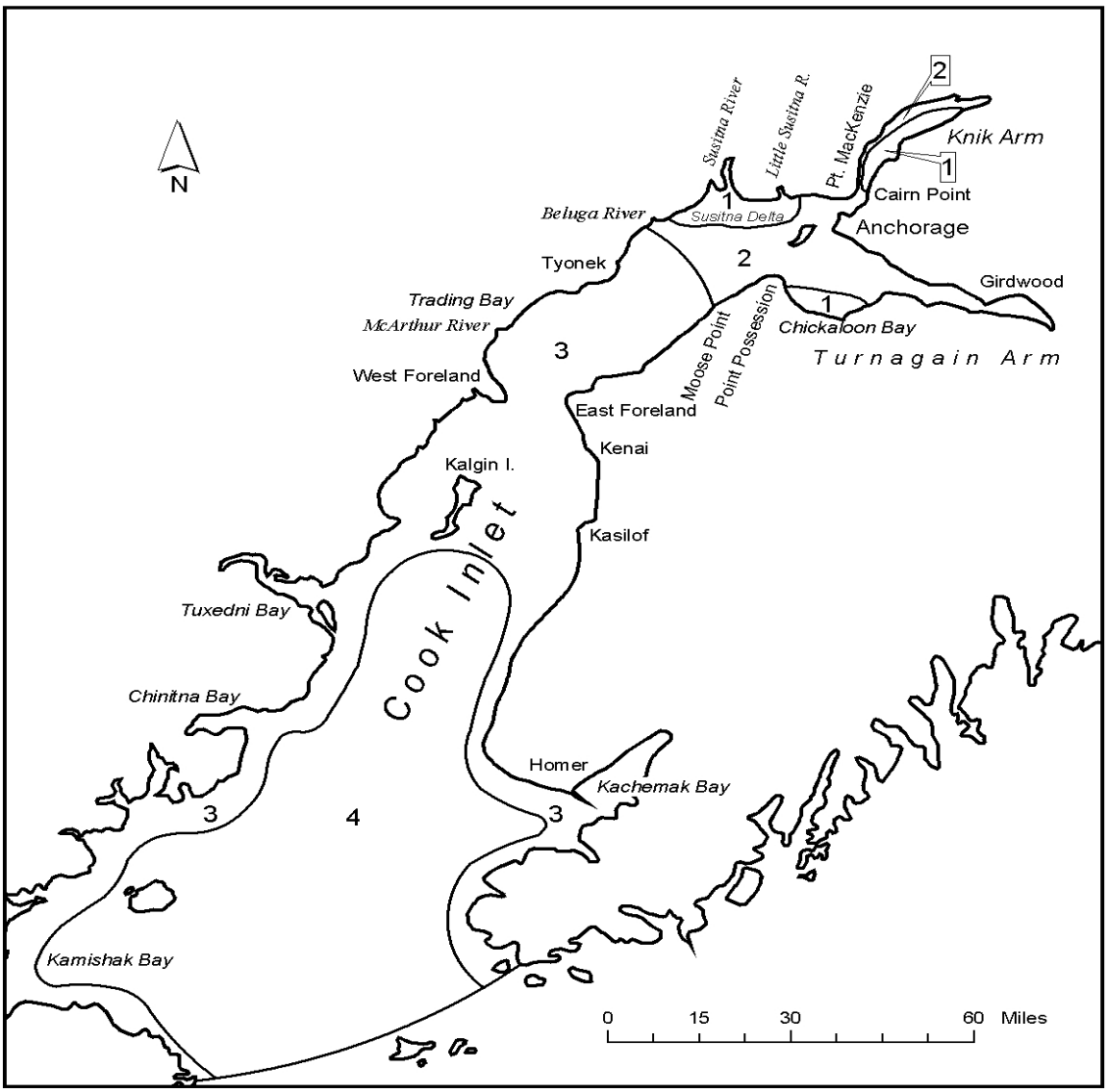

Figure 5. Habitat areas identified for CI beluga whales. NMFS considers Type 1 habitat as High Value/High Sensitivity; Type 2 is High Value; Type 3 includes winter habitat areas, secondary summering sites, and historic habitat sites; and Type 4 denotes the remainder of the known range within Cook Inlet.

F. Management

The MMPA authorizes NMFS, acting on behalf of the Secretary of Commerce, to regulate the subsistence harvest of depleted marine mammal stocks by Alaska Natives after regulations specific to a depleted stock are issued and an opportunity for notice and hearing on the record has been provided (16 U.S.C. § 1371(b)(3)). As a preliminary step toward regulating the Alaska Native subsistence harvest, NMFS issued a Final Rule on 31 May 2000 (65 FR 34590) designating the CI beluga whales as depleted within the meaning of Section 3(1) of the MMPA, as amended and codified at 16 U.S.C. § 1362(1) and the underlying regulations codified at 50 C.F.R. Part 216. However, NMFS determined that listing the CI beluga whales as "endangered" or "threatened" under the ESA was not warranted based on the best scientific data available.

Management responsibility for beluga whale in Alaska lies with the Alaska Region, Protected Resources Division. As mandated by the MMPA, NMFS is required to maintain the health and stability of marine ecosystems. The mandates of the MMPA result in a fundamental objective of management to prevent "depletion" of a species or population or to restore a population to its OSP. A species or population is said to be depleted when the Secretary of Commerce "determines that a species or population stock is below its optimum sustainable population [OSP]." OSP is "the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element" (MMPA 1995). Consistent with this mandate, three explicit goals of the MMPA are to: 1) maintain stocks at their OSP levels and as functioning elements of their ecosystems; 2) restore depleted stocks to OSP levels; and 3) reduce incidental mortality and serious injury (from commercial fisheries) to "insignificant levels approaching a zero mortality and serious injury rate" (MMPA 1995, Barlow et al. 1995).

Generally, under the MMPA, the Potential Biological Removal (PBR) level is used as a tool in the management of marine mammal stocks impacted by fisheries or other human activities. The PBR is defined as "the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population" (MMPA 1995). Estimates of human-caused mortality are compared to the PBR. In instances when the human-caused mortality of a given stock exceeds the PBR, the stock may be declared "strategic," an indication that the stock has a level of human-caused mortality and serious injury that are likely to cause the stock to be reduced below its OSP. Management efforts must be directed, principally, at preventing a stock from reaching the point of depletion. Should a stock become depleted, management efforts must be directed at returning that stock to and maintaining it at its OSP.

Although the PBR approach is used to manage human activities, primarily fisheries interactions with marine mammals, it is not considered appropriate for the management of Alaska Native subsistence harvest. Instead, NMFS has entered into a management partnership with Cook Inlet Marine Mammal Council (CIMMC) to co-manage the

subsistence use of beluga whale in Cook Inlet. The agreement between NMFS and CIMMC includes, as a principal objective, provisions for the maintenance of beluga whale population levels that will allow for long-term sustainable harvests. Alaska Natives have traditionally hunted beluga whale for subsistence food and handicrafts, building an extensive accumulation of traditional knowledge of this species (Huntington 2000). CIMMC represents Native interests on matters associated with CI beluga whales. NMFS and CIMMC have developed cooperative agreements for the co-management of the CI beluga whale stock. The 2003 agreement is presented in Appendix A.

Most recently, NMFS has promulgated regulations for the long-term harvest management of the CI beluga whale (Appendix B). That plan will provide for a limited number of allowable strikes each year for subsistence needs. The level of harvest will initially be very low (e.g., 1 to 2 whales annually), increasing gradually as the stock recovers. The objective of this harvest plan is to provide reasonable participation by Alaska Natives in traditional whale hunts, while not unreasonably delaying recovery. Figure 6 depicts the expected growth curve for this stock for two harvest levels and with no harvest.

G. Recovery

The purpose of this Conservation Plan is to recover the CI beluga whale stock. Recovery is presently defined as the abundance level which represents OSP of this stock. NMFS regulations (50CFR 216.3) clarify the definition of OSP as a population size that falls within a range from the population level of a given species or stock that is the largest supportable within the ecosystem (K) to its maximum net productivity level (MNPL). Maximum net productivity is the greatest net annual increment in population numbers or biomass resulting from additions to the population from reproduction, fewer losses due to natural mortality. NMFS has defined MNPL as 60 percent of *K* for small cetaceans.

In the rulemaking process which established this stock as depleted under the MMPA, NMFS stated that the historic abundance (*K*) for this stock is unknown. No systematic survey of abundance exists prior to 1994. However, surveys by the State of Alaska's Department of Fish and Game in 1979 provided a reasonable estimate of about 1,300 CI beluga whales. Additional evidence, especially TWK, supports the whale numbers had historically exceeded 1,000 (65 FR 34596). The 1998 abundance estimate considered in NMFS rulemaking was 347 whales. Thus, with an estimated *K* of either 1,300 or 1,000 whales, this population was well below MNPL (and therefore, OSP) by 1998.

The lowest reliable abundance estimate was 313 in 2002 (CV = 0.14; NMFS, unpublished data), which was 24 percent of *K*, based on the highest available abundance estimate

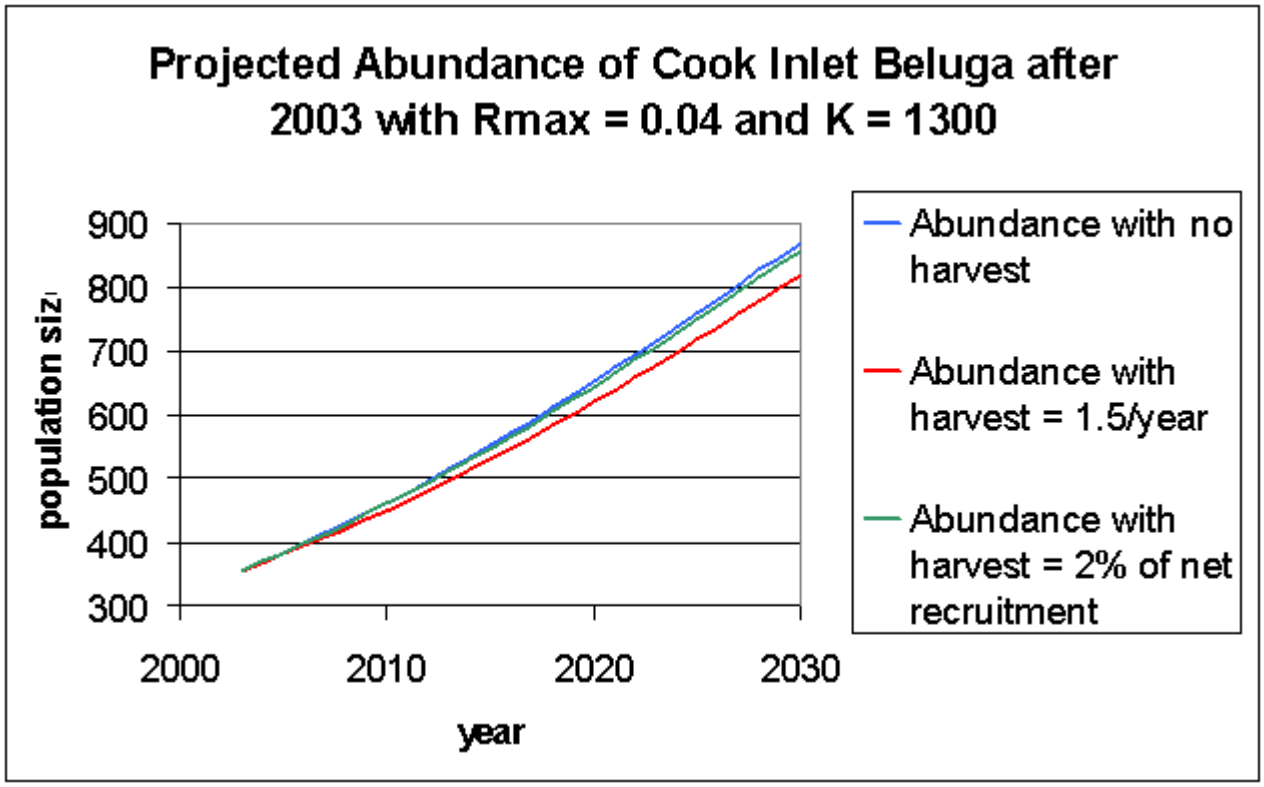

Figure 6. Projected population growth curve for CI beluga whales.

of 1,300 estimated in the 1970s (Calkins 1989). The population level at which NMFS would reconsider the depleted classification is set at 780 animals (60 percent of 1,300 whales). The latest abundance estimate (366, June 2004; CV = 0.20; NMFS, unpublished data) is 28 percent of *K* and only 47 percent of OSP. NMFS has acknowledged the lack of an accurate historical estimate for K, and finds that OSP cannot be quantified at this time, due to its uncertainty. More information on the CI beluga whale population will be collected to help determine *K* and therefore, OSP. However, for the purposes of developing this Conservation Plan, NMFS has chosen values of 1,300 for *K* and 780 for MNPL. Although these values will be reviewed and possibly revised as additional data become available, the abundance level at which this stock is considered "recovered" is 780 whales. This figure may be revised as additional data become available. However, because recovery of the CI beluga whales will require decades, and the Conservation Plan will be periodically updated, this refinement has no bearing on the content or recommendations of this Plan.

3. KNOWN AND POSSIBLE FACTORS INFLUENCING THE POPULATION

The CI beluga whale is at increased risk due to various factors, including recent subsistence harvest removals, threats from vessel traffic, small stock size, restricted summer range, and habitat alteration, among others. The recovery strategy of this

Conservation Plan is to identify those factors which influence or determine the growth and stability of this stock, assess their relative importance in recovery, and develop recommendations. Here is a discussion on those known or likely factors which are believed to have some impact on the CI beluga whale. Recommendations for those factors found to be influencing this stock are presented in Chapter 4.

A. Natural Factors

a. Stranding Events: Beluga whale stranding events in upper Cook Inlet are not uncommon. NMFS has reports of 804 strandings (both individual and mass strandings) in upper Cook Inlet since 1988 (Vos and Shelden 2005). Mass stranding events primarily occurred along Turnagain Arm, and often coincided with extreme tidal fluctuations ("spring tides") and/or killer whale sighting reports (Shelden et al. 2003). These mass stranding events involve both adult and juvenile beluga whales that are apparently healthy, robust animals. In 2003, an unusually high number of beluga whale live strandings and mortalities occurred in Cook Inlet (Table 1).

Table 1. Beluga whale stranding records for Cook Inlet (Moore et al. 2000; Vos and Shelden 2005).

	Live stranded belugas			**Dead stranded belugas***
Year	**Number of reported live belugas per event**	**Date of stranding**	**Location of live strandings**	**Total reported beluga mortalities per year**
1988	27	Oct. 23	Turnagain Arm	0
1989	0	-	-	4
1990	0	-	-	2
1991	70-80	Aug. 31	Turnagain Arm	2
1992	0	-	-	5
1993	10+	July 6	Turnagain Arm	1
1994	186	June 14	Susitna River	7
1995	0	-	-	2
1996	63 60 20-30 1 10-20	June 12 Aug. 28 Sept. 2 Sept. 8 Oct. 2	Susitna River Turnagain Arm Turnagain Arm Knik Arm Turnagain Arm	12

1997	0	-	-	3
1998	30 5	May 14 Sept. 7	Turnagain Arm Turnagain Arm	10
1999	58 12-13	Aug. 29 Sept. 9	Turnagain Arm Turnagain Arm	12
2000	8 2 15-20	Aug 27 Oct. 24 Sept. 24	Turnagain Arm Turnagain Arm Turnagain Arm	13
2001	0	-	-	10
2002	0	-	-	13
2003	2 46 26 32 9	April 18 Aug. 28 Sept. 6 Sept. 14 Oct. 6	Turnagain Arm Turnagain Arm Turnagain Arm Turnagain Arm Turnagain Arm	20
2004	0	-	-	13

* known harvested belugas are not included in the total

A 1996 mass stranding event of approximately 60 beluga whales in Turnagain Arm resulted in the known death of four adult whales. Another stranding event in August 1999 left five adult beluga whales known dead. Most recently, at least 46 beluga whales stranded in Turnagain Arm in August 2003, resulting in the deaths of at least five whales. Another 58 live beluga whales stranded in two events in Turnagain Arm the following month, with no identified mortalities. Once a whale strands, death may result from stress and/or hyperthermia from prolonged exposure. Whales which strand at higher elevations during an outgoing tide may be exposed for ten hours or more. Unless caught in an overflow channel or ponded area, the whale may have difficulty regulating body heat. An extensive network of capillaries within the flukes and flippers allows beluga whales to lose excess body heat to the environment. If these structures are out of the water, this mechanism cannot function properly and internal body heat rises. Additional stress is placed on internal organs and breathing may be difficult without the support provided by the water.

It is uncertain why beluga whales strand in Cook Inlet. Beluga whales are known to intentionally strand themselves during molting, while rubbing their skin against rocky bottoms. Beluga whales 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. Other species of whales are believed to

strand when injured or sick. NMFS has also recorded CI beluga whales on shore which display evidence of killer whale predation. Stranding data are also reported for the Saint Lawrence beluga whales (DFO 1995). Reports from the Saint Lawrence beluga whale recovery team contain certain similarities to Cook Inlet: gender ratios for stranded whales were approximately 50:50, as observed in Cook Inlet; only a few of the Saint Lawrence stranded beluga whales were emaciated; and most appeared similar to freshly killed Arctic beluga whales. A very high percentage of the Saint Lawrence whales were found to have some pathology which was attributed as cause of death. These include multi-systemic lesions, cancers, pneumonia, ulcers, and peritonitis.

NMFS has responded to stranding events many times, particularly during the last decade. NMFS, Alaska Region has developed the Alaska Marine Mammal Stranding Response Network which now includes Alaska Sealife Center and other organizations and individuals. NMFS also wrote the 1993 Turnagain Arm Stranding Response Plan (an updated version of this plan appears in Appendix C), which guides decision makers during a marine mammal stranding in these waters. Despite these actions, there is often little that can be done to meaningfully respond 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 training and specialized 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. Beluga whales may weight several thousand pounds and cannot readily be moved. There is also a concern that these animals stand a better chance for survival/recovery if not handled or disturbed, which would increase their stress levels.

Despite these limitations, NMFS believes a stranding response may sometimes benefit these whales, and intends to continue and improve the response to live beluga whales. Specific recommendations for stranding response are presented in Chapter 4 and Appendix C.

b. **Predation:** The CI beluga whale stock is preyed upon by killer whales, their only known natural predator. NMFS has received reports of killer whales in Turnagain and Knik Arms, between Fire Island and Tyonek, and near the mouth of the Susitna River (Shelden et al. 2003). Native hunters report that killer whales are usually found along the tide rip that extends from Fire Island to Tyonek (Huntington 2000). Killer whales have stranded along Turnagain Arm on at least two occasions. Six killer whales were found alive and stranded in Turnagain Arm in May 1991 and five were stranded alive in August 1993. During the stranding event in August 1993, a large male vomited a large piece of beluga whale flesh, as well as tissue from a harbor seal(s) (*Phoca vitulina*). In September 23, 2000, a

National Oceanic Atmospheric Administration (NOAA) Enforcement agent observed about four killer whales chasing a group of beluga whales in Turnagain Arm, (NMFS unpublished data). Within the next few days, two lactating females stranded with teeth marks, internal hemorrhaging, and other injuries consistent with killer whale attacks.

The number of killer whales visiting the upper Inlet appears to be small, only five and six whales involved in each observed stranding (Shelden et al. 2003). This may be a single pod which has extended its feeding territory into Cook Inlet. 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. Killer whales are described by three categories or groupings: resident, transient, and offshore. Only the transient groups are believed 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, a sighting of killer whales in proximity to beluga whales in the upper Inlet does not necessarily mean they are feeding on beluga whales.

No quantitative data exist on the level of removals from this population due to killer whale predation, or its impact (Shelden et al. 2003). However, the potential for significant impacts on the CI beluga whale population due to killer whales certainly exists, given the low abundance level of the CI beluga whale and recent changes in prey availability to killer whales throughout the Gulf of Alaska (referring to declines in pinniped populations in the Central and Western Gulf of Alaska since the mid 1970s). The annual removal of even a few beluga whales could impede recovery. A significant effect would occur if the level of predation approximates the level of recruitment in the population.

c. Parasitism and Disease: Little is presently known about the effects of disease on CI beluga whales. Some basic information exists on the occurrence of diseases in CI beluga whales, and a considerable amount of information exists for other beluga whales, toothed whales, or marine mammals in general. Bacterial infection 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). From 1983 to 1990, 33 percent of stranded beluga whales in the Saint Lawrence estuary (n = 45 sampled) were affected by pneumonia (Martineau et al. 1994). One beluga whale apparently died of the rupture of an "aneurysm of the pulmonary artery associated with verminous pneumonia" (Martineau et al. 1986).

Beluga whale populations in Alaska appear relatively free of ectoparasites, although both the whale louse, *Cyamus* sp., and acorn barnacles, *Coronula reginae*, are recorded from stocks outside of Alaska (Klinkhart 1966).

Endoparasitic infestations are more common: An acanthocephale, *Coryosoma* sp., was identified in beluga whales, and *Pharurus oserkaiae* has been found in Alaska beluga whales. *Anisakis simplex* is also recorded from beluga whales in eastern Canada, 28 of 39 beluga whales examined in the Saint Lawrence carried *A. simplex* (Klinkhart 1966, DFO, 1995). Necropsies conducted on CI beluga whales have found heavy infestations of *A. simplex* in adult whales. Approximately 90 percent of CI whales examined have had kidneys parasitized by the nematode *Crassicauda giliakiana*. This parasite occurs in other cetaceans, such as Cuvier's beaked whale. Although extensive damage and replacement to tissues have been associated with this infection, it is unclear whether this results in functional damage to the kidney (Burek 1999a). Parasites of the stomach (most likely *Contracecum* or *Anisakis*) are often present in CI beluga whales. These infestations have not been considered to be extensive enough to have caused clinical signs, although *Anisakis* worms associated with stomach ulcers in Saint Lawrence beluga whales were attributed as cause of death in two animals (DFO 1995). Also recorded within muscle tissues of CI beluga whales is *Sarcocystis* sp. The encysted (muscle) phase of this organism is thought to be benign, however, acute infections can result in tissue degeneration leading to lameness or death (Burek 1999b).

The arctic form of *Trichenella spiralis* (a parasitic nematode) is known to infect many northern species of marine mammals including polar bears, walrus, and to a lesser extent ringed seal and beluga whales (Rausch 1970). The literature on "Arctic trichinosis" is dominated by reports of periodic outbreaks among Native people (Margolis et al.1979). The effect of the organism on the host marine mammal is not known (Geraci and St. Aubin 1987). *Trichenella* has not been recorded within the CI stock of beluga whales.

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 which warrant further study. 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. The pathogens identified were marine Brucella species, cetacean poxvirus, morbillivirus, and herpesvirus. They advocate the development of standardized necropsy protocols using these and other appropriate agents. This study also notes that in long-lived species, infectious diseases that affect fecundity (fertility) or 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 has the potential to catastrophically affect their long term viability. The CI beluga whale may also be characterized by its longevity and gregarious social structure, and therefore, may present similar concerns. While parasites and the potential for infectious disease occur in CI beluga whales, no indication exists that

their occurrence has had any measurable (detrimental or adverse) impact on the survival and health of the CI beluga whale stock despite the considerable pathology that has been done. However, more work is necessary in this field.

d. Habitat Capacity and Environmental Change: NMFS has considered the potential impacts of climate change on CI beluga whales and their habitat, and the possibility it has had significant effect on this stock, or is a possible impediment to recovery. One such possibility is a change in available prey. However, salmon returns to Cook Inlet have not shown any patterns to suggest a reduction due to global warming or climate change. Data from Alaska Department of Fish and Game for upper Cook Inlet record a 49 year average harvest of 3,900,000 salmon, while the average harvest for the years 1992-2002 has been 3,600,000.

Sea surface temperature increases have been noted in the Gulf of Alaska and lower Cook Inlet, which correspond to El Nino events. Piatt et al. (1999) reported maximum zooplankton volumes in Kachemak Bay in 1998, an *El Nino* year, were one third those measured in 1997. Fish catches in that same study were highly variable, although the authors report that biomass of fish was reduced in most areas of Cook Inlet in 1998. However, this report also noted that the effects of this warming event on lower Cook Inlet were ameliorated by upwelling and tidal mixing at the entrance to Cook Inlet. It is likely the physical structure of the Inlet and its dominance by freshwater input acts to buffer these waters from *El Nino* events. Additionally, these events occur periodically. Beluga whales are referred to as a K-selected species. These have low reproductive potential (beluga whales have a single calf every three years), devote considerable time to care for their young, and are relatively long-lived. Beluga whales are usually capable of sustaining themselves during periods of hardship or change. Beluga whales are euryphagous, eating a very wide variety of prey species. They are extremely mobile, both scientific research and TWK of Native hunters say these whales may move hundreds of miles to exploit changes in prey distribution. Fat reserves on beluga whales allow for metabolic needs through periods of reduced prey availability or other adverse factors. Cook Inlet is a very dynamic environment, and experiences continual change in habitat. Observations recorded by Percy Blatchford, an experienced and knowledgeable CI beluga whale hunters, identified that the Susitna River had filled in considerably in his lifetime. He told of one persistent channel in this river that was more than 40 feet deep, but today is filled in with sediment. It may be, then, that beluga whales are well adapted to habitat change. At this time however, there are insufficient data to assess the effects (if any exists) of environmental change on the CI beluga whale.

B. Human Induced Factors

i. Subsistence Harvest: The CI beluga whale is hunted by Alaska Natives for subsistence purposes and for traditional handicrafts. The MMPA provides an exception from the prohibitions of that Act that allows for the harvest of marine

mammals by Alaska Natives for these purposes. Alaska Natives have legally harvested CI beluga whales prior to and after passage of the MMPA (1972). The effect of past harvest practices on the CI beluga whale population is significant. While a harvest occurred at unknown levels for decades, NMFS believes the levels of subsistence harvest removals increased substantially in the last twenty years. Estimates of 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 or estimated harvest rates (including estimates of whales which were struck but lost, and assumed to have perished) indicate these levels of harvest were unsustainable. Known harvest levels are presented in Figure 7. The 1996-1998 estimates include animals struck, but lost, using a ratio of 1.1 beluga whales lost for each landed. Data compiled from hunter interviews by CIMMC for the 1995 harvest identified 44 CI beluga whales landed and 26 struck and lost (CIMMC 1996). Data compiled for the 1996 harvest could only estimate that between one and two whales were lost for each beluga whale landed (CIMMC 1997). In 1997 and 1998, hunter reports to NMFS estimated that one whale was lost for each beluga whale landed. It is common for beluga whale harvest efficiencies to be low, and struck and loss estimates are variable, depending on the weather conditions and individual hunters.

Based on this information, NMFS estimated that the average annual takes in this harvest, including whales that were struck and lost, was 67 whales per year from 1994 through 1998. Annual harvest estimates for 1994 thru 1998 are 21 whales (1994), 70 whales (1995), 98 whales (1996), 70 whales (1997) and 50 whales (1998). The harvest, which was as high as 20 percent of the stock in 1996, was sufficiently high to account for the 14 percent annual rate of decline in the stock during the period from 1994 through 1998 (Hobbs et al. 2000). The last year in which unregulated subsistence harvests occurred was 1998. In 1999 and 2000, there was no harvest as a result of this legislation and a voluntary moratorium by the hunters in spring 1999. Since 1999, a moratorium was enacted (Pub. L. No. 106-31, section 3022, 113 Stat. 57, 100 (May 21, 1999)) to prohibit the harvest of CI beluga whales except through a co-management agreement between NMFS and an Alaska Native organization (ANO). This moratorium was made permanent in December 2000 (Pub. L. No. 106-553). NMFS has since promulgated regulations for the taking of CI beluga whales by Alaska Natives for the years 2001-2004 (69 FR 17973), and proposed long-term harvest regulations through recovery (Appendix B).

Additional historical perspective and information on the effects of continued subsistence harvest on the recovery of this stock are presented in two NMFS documents: July 2003 Final Environmental Impact Statement - Subsistence Harvest Management of Cook Inlet Beluga Whales and 2004 Subsistence Harvest Management Plan for Cook Inlet Beluga Whales.

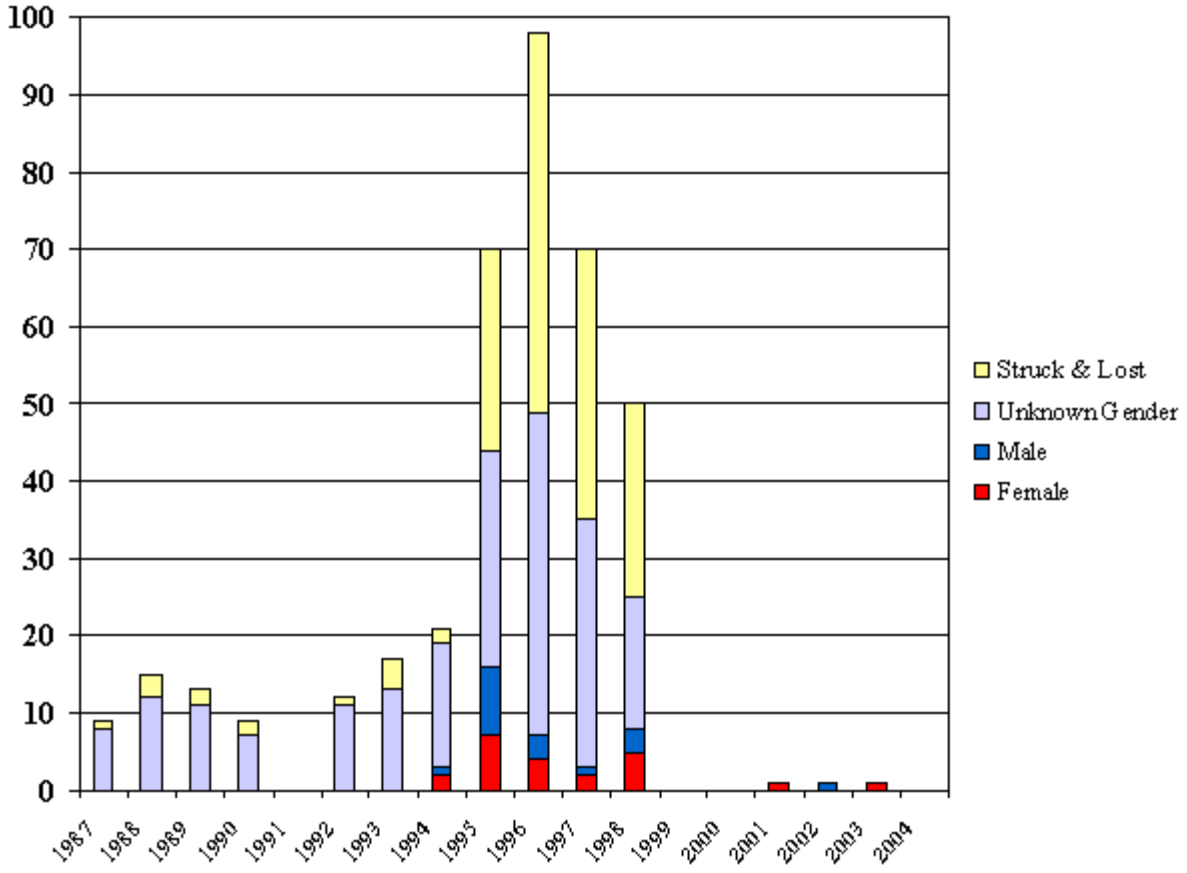

Figure 7. Subsistence Harvest of Cook Inlet Beluga Whales (ADFG 1993; CIMMC 1996 and 1997; NMFS unpublished data).

Continuation of a harvest within this depleted stock of whales may appear inconsistent with the goal of recovery. It is not. The cultural and nutritional values of subsistence harvests to Alaska Natives must be recognized in any conservation plan, and provide justification for these low levels of harvest. NMFS is cooperatively managing subsistence harvests with CIMMC, an ANO representing several Cook Inlet tribes and villages, as well as other Alaska Natives residing in the Cook Inlet areas who are not affiliated with local tribes. Federal regulations will guide subsistence harvests until this stock has recovered. Until recovered, subsistence harvests will continue at very low levels unless these removals would significantly impair recovery. Provisions are included to account for further declines in abundance, or unexpected mortality events, such as mass strandings. It is possible subsistence harvests may be halted if it is preventing recovery.

ii. **Commercial Fishing:** State and federally-permitted commercial fisheries for shellfish, groundfish, herring and salmon occur in the waters of Cook Inlet, and have varying likelihoods of interacting with beluga whales due to differences in gear type, fish species, timing, and location of the fisheries. Interactions refer to entanglements, injuries, or mortalities occurring incidental to fishing operations. Reports of marine mammal injuries or mortalities incidental to commercial fishing operations are obtained from observer programs, fisheries reporting programs, and reports in the literature. During 1990-93, 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). NMFS has also designed a rotational observer program to identify potential interaction 'hot spots' among eight Category II fisheries in Alaska. Because of the heightened concern in Cook Inlet, the program observed the two Cook Inlet Category II fisheries (salmon drift and upper and lower Cook Inlet set gill net) in 1999 and 2000.

Given the recent trend for beluga whales to be concentrated in upper Cook Inlet during summer (Rugh et al. 2000), fisheries occurring in those waters during that time could have a higher likelihood of interacting with beluga whales. The only federally managed fisheries active in the Inlet during this period are in the lower Inlet/Northern Gulf waters for groundfish and crab. No interactions between beluga whales and northern Gulf of Alaska groundfish trawl, longline or pot fisheries were reported by federal observers during 1990-2000 (Angliss et al. 2001).

State-managed commercial fisheries that occur in the upper Inlet includes razor clams, a herring gill net fishery, and salmon drift and set gill net fisheries. Prior to 1998, the herring fishery had been closed for five years, and in 1998 was open briefly during April-May to gill net gear. Harvests of herring have generally been concentrated in Tuxedni and Chinitna Bay areas (Ruesch and Fox 1999). These fisheries were not participants in the logbook reporting program. No reports of injury or mortality to beluga whales have been received from participants in these fisheries under the fisher self-reporting program during 1995-1999.

The largest fisheries, in terms of participant number and landed biomass in Cook Inlet, are the state-managed salmon drift and set gill net fisheries concentrated in the Central and Northern Districts of upper Cook Inlet. Times of operation change depending upon management requirements, but in general the drift fishery operates from late June through August, and the set gill net fishery during June through September. Seine nets are infrequently employed in Chinitna Bay. 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 CI salmon gill net fisheries has been relatively constant, the landed salmon biomass has fluctuated greatly during the past 20

years. The combined annual drift and set gill net salmon biomass landings during 1993-2002 has been less than the 20 year average.

Other fisheries also occur in the lower Cook Inlet for herring, lingcod and rockfish, and salmon. The lower CI 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, and this fishery was closed in 1999 through 2002. A mechanical/hand jig fishery for lingcod and rockfish also occurs in lower Cook Inlet state and federal waters. 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 (divided at 152°20' W longitude), with most of the catch coming from the Southern District. These fisheries were not participants in the logbook reporting program. No reports of injury or mortality to beluga whales have been received from participants in these fisheries under the fisher self-reporting program during 1995-2001.

For the drift gill net fishery, observers were deployed during all 12 fishing periods in 2000 and observed approximately 903 hauls among 160 vessels for a total of 1,584 hours observation time. In 1999, observations were made of 744 sets and/or hauls among 102 vessels (of 487 total permitted vessels) for 845 hours observation time. Over the two years of observation, an estimated total of 384 net-days was observed. No beluga whales were observed to be injured or killed in drift gillnets in either year. Moreover, beluga whales were not observed to interact (approach within 10 m) with the drift gill nets in either year. For the set net fishery, observers were deployed during all fishing periods in 2000 and observed 800 hauls from 269 permits during 2,149 hours of observation time. In 1999, observations were made of 1,450 soaks and/or hauls by 275 unique permit holders (among a total of 556 fishing permits) for a total fo 1,545 hours observation time. During the two year program, an estimated 614 net days were observed. No beluga whales were observed to be injured or killed in set gillnets in either year. Although a few 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.

Personal-use gill net fisheries also occur in Cook Inlet and have been subjected to many changes since 1978 (Ruesch and Fox 1999) that are summarized in Brannian and Fox (1996). NMFS is unaware of any beluga whales injured or killed in the CI personal use/subsistence gill net fisheries.

The only reports of beluga whale mortality incidental to commercial salmon gill net fishing in Cook Inlet are from the literature. Murray and Fay (1979) stated that salmon gill net fisheries in Cook Inlet caught five beluga whales in 1979. Incidental take rates by commercial salmon gill net fisheries in the Inlet was

estimated at three to six beluga whales per year during 1981-83 (Burns and Seaman 1986). Neither report, however, differentiated between the set and drift gill net fisheries. In contrast, there have been no recent and verified reports of incidentally caught beluga whales in Cook Inlet. No reports of injuries or mortalities incidental to salmon drift or set gill net fishing were made during the 1990-91 logbook reporting program. There were no reports of entanglement in the observer program. Some mortalities might be expected as the population increases. However, the current rate of direct mortality due to commercial fisheries in Cook Inlet is insignificant and would not result in a delay in recovery time.

Aside from direct mortality and injury from fishing activity, commercial fisheries may compete with beluga whales 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. Native hunters have often stated their observations that beluga whales appear thin in early spring (April), and are less preferred both because of thinner blubber and because whales tend to sink rather than float when struck. Any diminishment in the ability of beluga whales to reach or utilize feeding habitat, or any reductions in the amount of prey available, may impact the energetics of these animals and delay recovery.

Beluga whales are adept predators, the TWK of Alaska Native hunters states that beluga whales follow the fish. The movements of beluga whales within the upper Inlet coincide with anadromous fish migrations. However, it is also apparent the movements and feeding distribution of beluga whales are not simply explained by when and where the most fish are. For example, beluga whales today are relatively rarely seen at the mouth of the Kenai River, despite high salmon escapements (returns) to this river. Research on beluga whales in Bristol Bay suggests these whales preferred certain streams for feeding based on the configuration of the stream channel (Frost et al. 1983). This study theorized beluga whales feeding efficiencies improve in relatively shallow channels where fish are confined or concentrated. If true, this would imply the CI beluga whales cannot simply go where the fish are, but may be at least partially dependent on a few select feeding habitats.

The current salmon management plan for the State of Alaska prosecutes Inlet fisheries through commercial set nets and drift gillnets in the lower, middle, and northern districts of the Inlet. All of these fisheries, then, occur “upstream” of the river mouths and estuaries where beluga whale typically feed. Whether the escapement into these rivers, having passed the gauntlet of the commercial fisheries, is sufficient for the well being of the CI beluga whales is unknown. The amount of fish required to sustain this population is unknown. However, data exist from captive beluga whales which give daily consumption rates of 1.5-3 percent of body weight per day. Using the high end of this range (which still may

be low, as wild animals likely have higher metabolic demands and have to hunt for prey), a population of 400 beluga whales with a normal age structure may consume approximately two million pounds of prey annually. If one assumes the majority of food consumed by CI beluga whales to be fish (rather than invertebrates) and that most of these fish are eaten during the April - October period, then this figure would be divided among a 30 week period. Eulachon spawning runs are relatively brief, on the order of five weeks, the remainder of the "summer" feeding season would concentrate on salmon. Assuming equal feeding pressure on these fish, the CI beluga whale population might consume about 300,000 pounds of eulachon and 1.6 million pounds of salmon. The size of chinook, pink, chum, and coho salmon vary considerably, and there is no information of selection or preference within these species. But if an "average" salmon weighted five pounds, this would lead to an estimated prey base of more than 300,000 salmon annually. A recovered population of 780 CI beluga whales might consume twice this figure. Any escapement necessary to meet this level would also have to consider the feeding efficiency of these whales (which is unknown). However, even if very many salmon 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. There is no indication at this time that competition with commercial fishing operations is having any significant or measurable effect on CI beluga whales.

In 1999 and 2000, a commercial venture to harvest eulachon in the lower Susitna River was approved by the Alaska Board of Fisheries. Approximately 5,000 pounds of these fish were delivered to outside markets. NMFS made recommendations to the Board of Fisheries to discontinue this fishery, which has not operated since 2000. These recommendations were made, in part, because little data existed on the eulachon runs into the Susitna River, nor had any evaluation occurred as to 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 this oil-rich food source early in the spring (preceding salmon migrations) and that large eulachon runs may occur in only a few upper Inlet streams.

iii. **Pollution:** Contaminants are a concern for beluga whale health and subsistence use (Becker et al. 2000). The principal sources of pollution in the marine environment are: 1) discharges from industrial activities that do not enter municipal treatment systems (petroleum, seafood processing, ship ballast); 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). Offshore oil production facilities currently operating in Cook Inlet support 238 wells. The Environmental Protection Agency (EPA) regulates the discharges from these offshore platforms, which include drilling muds, drill cuttings, and production waters (the water phase of liquids pumped from oil wells). Drilling fluids (muds and cuttings) discharged into Cook Inlet average 89,000 barrels annually, and contain several pollutants. At the peak of its infrastructure development, there were 15 offshore production and three onshore treatment facilities in upper Cook Inlet and approximately 368 km (230 mi) of undersea pipelines (MMS 1996).

The region is the major population center in Alaska, with a 2001 estimated population (U.S. Census Bureau) for the Anchorage Borough at 264,937, the Matanuska-Susitna Borough at 62,426, and the Kenai Peninsula Borough at 50,556. Ten communities currently discharge treated municipal wastes into Cook Inlet. Wastewater entering these plants may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, and bacteria and viruses. Of these, the Municipality of Anchorage, Nanwalek, Port Graham, Seldovia, and Tyonek receive only primary treatment, while Eagle River, Girdwood, Homer, Kenai, and Palmer receive secondary treatment (NOAA 2003). The Municipality of Anchorage's Asplund treatment works holds a waiver from EPA from secondary treatment requirements. It has a design flow of 58 million gallons per day of treated primary effluent, discharging into lower Knik Arm.

Beginning in 1992, tissues from CI beluga whales have been collected and analyzed for contaminants as part of the Alaska Marine Mammal Tissue Archival Program (AMMTAP). These samples were compared to samples taken from beluga whale 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 (PCB's), chlorinated pesticides, and heavy metals. The Arctic and CI beluga whale had much lower concentrations of PCB's and DDT (∑PCB's and ∑DDT were an order of magnitude lower) than the Saint Lawrence animals. When compared to the Arctic Alaska samples, the CI beluga whale had about one-half the concentrations of ∑PCB's and ∑DDT (∑PCB's averaged 1.49 mg/kg wet mass, s = .070, and 0.79, s = 0.56, mg/kg wet mass, and ∑DDT averaged 1.35 mg/kg, s = 0.73, and 0.59, s = 0.45 mg/kg in males and females, respectively). Becker et al. (2000) compared tissue levels of total PCB's (∑PCBs), total DDT (∑DDT), chlordane compounds, hexachlorobenzene, dieldrin, mirex, toxaphene, and hexachlorocyclohexene in these beluga whale stocks and found the CI beluga whales had the lowest concentrations of all.

Polybrominated diphenyl ethers (PBDE) are structurally similar to PCB's which have been identified in other toothed whales in the Pacific northwest. These

compounds are used as flame retardants and unlike PCB's, are still being manufactured. They may have the potential for various impacts to beluga whales similar to PCB's. No measurements exist of tissue concentrations of PBDE for the CI beluga whale at this time.

Hepatic concentrations of cadmium, and mercury were lower in the CI population as compared to the Arctic Alaska populations (most cadmium values were less than 1 mg/kg and mercury values were between 0.704 and 11.42 mg/kg wet mass). Hepatic methylmercury levels (0.34-2.11 mg/kg wet mass) are similar to other Arctic Alaska populations. Hepatic copper levels were two to three times higher in the CI animals (3.97-123.8 mg/kg wet mass) than the Arctic Alaska animals and similar to the Hudson Bay animals. The effects of lower concentrations of PCB's and chlorinated pesticides on animal health may be of less significance for the CI animals than for other beluga whale populations. The toxicological implication of high copper levels is unknown (Becker et al. 2000). Becker et al. (2000) concludes 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.

iv. **Vessel Traffic:** Most of Cook Inlet is navigable, and used by various classes of water craft. 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. Port facilities in Cook Inlet are found at Anchorage, Point Mackenzie, Tyonek, Drift River, East Foreland/Nikiski, Kenai, Anchor Point, and Homer. The Drift River facility is used primarily as a loading platform for the shipment of crude oil. The docking facility is connected to a shoreside tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. The Port of Nikiski on the east side of the Kenai Peninsula has three medium draft piers and two shallow draft wharves. Activity here includes the shipping of anhydrous ammonia, dry bulk urea, liquified natural gas, and petroleum products and the receiving of sulfuric acid, caustic soda, and crude oil as well as support for offshore oil and gas.

The Port of Anchorage is a deep draft facility which is 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 which is heavily used by beluga whales. Recently another port has been built in lower Knik Arm, the Point MacKenzie Port is presently configured as a barge port, however, long range plans call for a

bulk loading facility with deep-draft capability. Several improved and unimproved small boat launches exist along the shores of upper Cook Inlet. The Municipality of Anchorage maintains a ramp and float system for small watercraft near Ship Creek. Other launches occur near the Knik River bridge and at old Knik. The Matanuska-Susitna Borough is proposing to construct a small boat launch at Port MacKenzie.

With the exception of the Fire Island Shoals near Anchorage and the Port of Anchorage, no large-vessel routes nor port facilities in Cook Inlet occur in high value beluga whale habitats. Large vessels generate in-water noise which may impact beluga whales, but are not expected to be a significant concern with respect to ship strikes of whales.

Beluga whales are susceptible to ship strikes. In the Saint Lawrence, numerous scars and fresh wounds have resulted from collisions, and two beluga whales have died from these strikes (DFO Canada 1995). In Cook Inlet, the presence of beluga whales, especially while in and near river mouths, predisposes them to strikes by high speed water craft associated with sport and commercial fishing and general recreation. Beluga whales feeding in the upper Inlet commonly swim in very shallow water, often less than five feet deep. Vessels which operate near these whales have an increased probability of striking one. The mouths of the Susitna and Little Susitna River in particular are areas where small vessel traffic and whales commonly occur. Beluga whales with propellor scars are observed in the Inlet. A stranded beluga whale examined in 1999 had an injury consistent with an old propeller injury (Burek 1999c). NOAA Enforcement agents investigated a report of a jet skier approaching and striking beluga whales in Knik Arm in 1994. Jet skies have also been seen along Turnagain Arm, an area of Cook Inlet rarely used by conventional water craft. Small vessels introduce higher frequency noise into the water column than do large commercial ships. This higher-frequency noise is more detectable to beluga whales, and capable of harassing or disturbing whales. 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 which are heavily utilized by beluga whales during the summer months. It is probable this traffic has also increased the level of harassment within this population. Presently there are no restrictions on speed limits, areas in which vessels may operate, nor on the type or horsepower of vessels in the upper Inlet.

v. **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. Several commercial whale watching ventures have been started during the last decade, although 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 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 operators will go where the whales are. No strong conclusive scientific evidence has been presented to demonstrate that whale watching presents an important threat to beluga whales (DFO 1995). Yet, NMFS has often witnessed avoidance and overt behavioral reactions by CI 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. NMFS believes concern is warranted for whale watching operations which approach beluga whales close enough to harass, or which enter into confined or important habitat areas (i.e., High Value/High Sensitivity areas, Figure 5). NMFS believes it is possible to accommodate commercial whale watching charters without significant effect to the CI beluga whale. It would be unreasonable to restrict such operations to areas in which beluga whales are not common, but NMFS also wishes to restrict these operations in High Value/High Sensitivity habitats.

vi. **Coastal Development:** The southcentral region of Alaska is the state's most populated and industrialized area. Cities, villages, ports, airports, treatment plants, refineries, highways, and railroads are often situated on or very near to Cook Inlet. Beluga whales are not uniformly distributed throughout the Inlet, but are predominantly found in nearshore waters. Here, beluga whales must compete with people for nearshore habitats. 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 discharges (water quality), bridges, boat traffic, and in-water noise.

A quick look at existing development indicates essentially all beluga whale habitats in Cook Inlet remains intact. Even in Knik Arm, which is the most-developed area of the Inlet and heavily utilized by beluga whales, less than two miles of the approximately 75 mile coastline has been developed. Extensive

sections of Turnagain Arm shoreline have been developed (rip rap and railroad construction). However, we were unable to assign any significance to this alteration in terms of the health of this stock. The Nature Conservancy (TNC) considered marine aquatic habitat needs in their 2003 Cook Inlet Basin Ecoregional Assessment. In that document, TNC developed habitat conservation goals for the CI beluga whale. Their assessment of habitat found the goals for beluga whales were 98 percent met, indicating habitat is not likely to be a limiting factor at this time.

Presently, there is not sufficient understanding of the CI beluga whale's habitat requirements necessary to fully assess the effects of coastal development. Bulkheads may reduce shallow feeding habitat, but may concentrate fish in ways which provide beluga whales with a feeding advantage. NMFS biologists have observed cooperative feeding behavior by beluga whales in Knik Arm in which one whale remains along a vertical bulkhead while a second whale moves in a circular pattern, driving fish into the first animal (NMFS unpublished data). Despite insufficient information, it seems reasonable and prudent to advocate some standards relating to coastal development.

Dredging along coastal waterways has been identified as a concern with respect to the Saint Lawrence beluga whales (DFO Canada 1995). There, dredging of up to 600,000 cubic meters of sediments may re-suspend contaminants into the water column. The Saint Lawrence beluga whales have been seriously impacted by such pollutants. 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 (more than 844,000 cubic yards in 2003 at the Port of Anchorage), the material does not contain harmful levels of contaminants. Chemical analysis of these sediments in 2003 found pesticides, PCB's, petroleum hydrocarbons to be 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 addition to general recommendations for coastal development, NMFS believes this Plan would benefit by addressing development along Knik Arm. While approximately 98 percent of Knik Arm remains undeveloped, several planned or proposed projects have been recently identified in a relatively confined portion of lower Knik Arm including: a commercial ferry and docking facility between Port McKenzie and Anchorage; a major expansion of the Port of Anchorage; expansion of Port McKenzie; expanded dredging off the port to support deep-draft vessels; and a causeway and bridge crossing north of the existing Port of Anchorage. Knik Arm is an important feeding area for beluga whales during much of the summer months, especially High Value/High Sensitivity habitat of the upper Knik Arm between Eagle Bay and Eklutna River (Figure 5). Whales

ascend lower Knik Arm on the flooding tide, feeding on salmon, then fall back with the tide to hold in waters off and north of the Port. The primary concern is to insure unrestricted passage along Knik Arm for beluga whales. NMFS has no evidence that whale movements are being physically or behaviorally affected at this time. However, there is concern with various aspects of Knik Arm development, which include:

*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 McKenzie.
*Increased ship traffic due to expansion of both ports, new boat launches, and operation of a commercial ferry.
*Increased need for vessel anchorage off both ports.
*Increased in-water noise levels due to port operations and construction.
*Increased dredging requirements with port expansions.
*Possible causeway construction to Fire Island.
*High in-water noise due to construction (e.g., pile driving, dredging).
*Physical loss of habitat due to landfill.
*Increased water velocities due to constriction of Knik Arm by bridge/causeway development.

Recommendations for minimizing the impacts of this development are presented in Chapter 4.

vii. **Noise:** Beluga whales are known to be among the most adept users of sound of all marine mammals. This is, perhaps, not startling when considering that the beluga whale is often found in waters with very poor visibility and lives in northern latitudes where darkness extends over many months. Beluga whales use sound rather than sight for many important functions, and have evolved this use to very sophisticated levels. Beluga whales use sound to communicate, locate prey, and navigate and may make different sounds in response to specific stimuli. Beluga whales produce high frequency sounds which they use as a type of sonar, producing a series of signals which are concentrated and directed through a structure located on the whales head (the melon), and whose returning echoes are received through the lower jawbone and transmitted to the brain. This echolocation is used for finding and pursuing prey, and is likely useful in navigating through ice-laden waters.

In Cook Inlet, beluga whales must compete acoustically with anthropogenic sounds. Sources of such noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging. Particular concern may be warranted for certain activities in Knik Arm which produce noise, including: expansion of the Port of Anchorage, a proposed

causeway and bridge across the Knik Arm, and a proposed marine ferry. The effects, if any, 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 frequencies. Sound also attenuates more rapidly in shallow waters and over soft bottoms (sand and mud). Much of upper Cook Inlet is generally a poor acoustic environment because of its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002).

This Conservation Plan devotes considerable attention to noise because: sound is very important to beluga whales; significant sources of anthropogenic noise are present throughout much of the Inlet; and such noise may adversely impact these animals. Research on captive animals has found beluga whales hear best at relatively high frequencies between10 and 100 kHz (Blackwell and Greene 2002). This is generally above the level of much industrial noise. However, beluga whale may hear sounds down to 40-75 Hz, although the noise would have to be very loud. The beluga whale's hearing falls off rapidly above 100 kHz. Whenever noise exceeds background or ambient levels, it may be detectable by whales. 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. It is not likely that anthropogenic noise levels in Cook Inlet would kill beluga whales.

Although captive beluga whales have provided some insight to their hearing and the levels of noise which might damage their hearing capabilities, there is much less information on how noise might impact beluga whales behaviorally in the wild. Alaska Native beluga whale hunters with the CIMMC have said that the CI beluga whale 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[9]. Beluga whales have been observed to react to noise from ships and icebreakers in the Canadian arctic at ranges on 35-50 kilometers (LGL and Greeneridge 1986). Conversely, beluga whales appear to be relatively tolerant of intensive fishing vessel traffic in Bristol Bay, Alaska and beluga whales are commonly seen during summer at the Port of Anchorage, Alaska's busiest port. While noninjurious consequences, such as beluga whale avoiding an area of boat traffic, may seem unimportant, displacement from sensitive feeding or calving habitats could be very harmful to

[9] NMFS unpublished data

the recovery of this stock.

A 2001 acoustic research program within upper Knik Arm identified underwater noise levels (broadband) as high as 149 dB re: 1µ Pa.(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: 1µ Pa. that NMFS has adopted for behavioral impacts for beluga whales. Observations of beluga whale off the Port of Anchorage suggest these whales are not normally harassed by such noise, although it is also possible that in order to feed, the whales are tolerating noise which would otherwise disturb them. Interestingly, the 2001 acoustic study found ambient underwater sound levels lowest at two locations which are highly used by beluga whales, the mouth of the Susitna River and east Knik Arm, near Birchwood.

The 2001 acoustics study also investigated noise associated with 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 noise between 2 and 10 kHz was measured as high as 85 dB re: 1µ Pa. out to19 kilometers. This noise could be audible to beluga whales. The conclusions of this acoustics study were that overall, the sounds measured in Cook Inlet would not be expected to have more than a minor effect on the beluga whales living in the vicinity.

The acoustics study did not address marine geophysical seismic activity in Cook Inlet, although it is known to occur. A project was proposed in 2003 for a 2D and 3D seismic exploration program offshore in Cook Inlet in areas north near Tyonek, the Forelands area, areas off Anchor Point, and areas west of the Clam Gulch Critical Habitat Area. Seismic exploration is associated with both state and federal offshore tracts. Geophysical seismic has been described as one of the loudest man-made underwater noise sources, and has the potential to harass or harm marine mammals, including beluga whales. NMFS has and will continue to request that the State of Alaska's Lessee Advisory and MMS' Notice to Lessees regarding offshore seismic operations identify that these activities may result in the taking of marine mammals, including beluga whales. Such taking is prohibited by the MMPA unless otherwise authorized.

h. Oil and Gas: Much of the Cook Inlet region overlies important 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 1950's. At the peak of its infrastructure development, there were 15 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 closed in 1992 as CI production continuously declined. The offshore production facilities currently operating in Cook Inlet support 238 wells. These platforms are

within the mid-Inlet, south of the Native Village of Tyonek. Approximately 6-7 new wells are drilled annually. EPA regulates the discharges from these offshore platforms, which include drilling muds, drill cuttings, and production (formation) waters. Drilling fluids (muds and cuttings) discharged into Cook Inlet average 89,000 barrels annually, and contain several pollutants.

Alaska Department of Natural Resources 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. The 2001-2002 spring sales did not include the 124 "beluga whale tracts" that were deferred as a result of litigation on the Cook Inlet Areawide final finding. These deferred tracts were located in the Susitna River delta, mouths of the Kenai and McArthur River, and Chickaloon Bay.

MMS conducted Sale 191, a federal Oil and Gas lease sale within the Cook Inlet portion of Alaska's Outer Continental Shelf, on May 19, 2004. Sale 191 offered 2.5 million acres between 3 and 30 miles offshore. Ths lease area is in lower Cook Inlet, largely between Kalgin Island and Cape Douglas. Beluga whales occur within the sale area, but there is little information on seasonal presence, movements, or habitat use. MMS's Environmental Studies Program is funding an acoustic research project to detect whales in the sale area. If beluga whales can be detected acoustically, it would greatly add to the understanding of their movements and distribution.

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. Oil spills that occurred while CI beluga whales were present could result in 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 through residual oil from a spill even if they were not present during the oil spill. Most likely, the effects of oil would be irritation to the respiratory membranes and absorption of hydrocarbons into the bloodstream (Geraci 1990). If an oil spill were concentrated in nearshore areas, it is possible that a beluga whale could inhale enough vapors from a fresh spill to affect its health. Inhalation of petroleum vapors can cause pneumonia in humans and animals due to large amounts of foreign material (vapors) entering the lungs (Lipscomb et al. 1994). 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 interstitial pulmonary emphysema (accumulation of bubbles of air within connective tissues of the

lungs). Crude oil evaporation rates are greatest during the first few days after an oil spill (Meilke 1990). Evaporation rates and exposure to oil may be an important factor to the impacts beluga whales may experience from inhalation of vapors.

Whales may also contact oil as they surface to breathe, but the effects of oil contacting skin are largely speculative. Experiments in which *Tursiops* were exposed to petroleum products showed transient damage to epidermal cells, and that cetacean skin presents a formidable barrier to the toxic effects of petroleum (Bratton 1993). Geraci (1990) reviewed a number of studies pertaining to the physiologic and toxic impacts of oil on whales and concluded there was no 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 there was a correlation between the loss of killer whales and the *Valdez* spill, but 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 CI 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 population could be exposed.

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 marine discharge of drilling muds and cuttings, produced waters, gray waters, and sanitary waste.

i. **Research:** NMFS research on CI beluga whales has resulted in an improved understanding of their ecology and biology. This has resulted in an extensive body of publications and research papers, as presented in Appendix E. Because many important aspects of the biology of CI 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 their research program throughout the range of this stock. This would certainly include continuing annual abundance surveys. Other research activities may include: satellite tagging to investigate seasonal movements, dive and migration patterns; biopsies of individual whales to obtain tissue samples for research into genetics; a population age and growth model; forage fish analysis; fatty acid analysis; and behavioral-telemetry studies associated with disturbance and avoidance of human activities. Research may be conducted at federal, state,

and/or private levels.

Any research which may take a beluga whale, including a take by harassment or disturbance, will require authorization under the MMPA. 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.

4. CONSERVATION STRATEGY AND STEP DOWN OUTLINE

This goal of this Conservation Plan is to recover the CI stock of beluga whales. Three objectives are proposed which are aimed at restoring and maintaining the Cook Inlet beluga whale to its OSP level as mandated by the 1988 amendments to the MMPA. This section presents recommendations for action on subjects discussed in Chapter 3, Known and Possible Factors Influencing the Population. Where possible, specific tasks are identified and funding estimates are offered for certain efforts. Some actions can be implemented now, while others are long-term measures which may depend on future research or agreements. Priorities were assessed by considering the significance of the issue in terms of the stability and recovery of this stock, the expected benefits/success of the proposed actions, the measurability of results, the availability of adequate scientific support and data, and the feasibility of the action. The issues and recommended management and scientific actions were not prioritized or limited by cost and funding availability, although financial matters will necessarily determine which actions may be implemented.

It is important to note that despite the research that has been conducted on CI beluga whales, many basic and critical details of the ecology of the CI beluga whale remain unknown. This lack of knowledge is, in itself, an impediment to recovery and must be addressed along with more tangible issues. Therefore, this Plan includes a strategy to increase our understanding of these whales.

Finally, the reader is reminded that past subsistence harvests occurred at unsustainably high levels and management of this use remains the foremost priority in our recovery strategy. NMFS is working with co-managers to develop a long-term management program during the recovery period for the CI beluga whale.

Objective I. Identify and eliminate or mitigate factors responsible for the decline of the Cook Inlet beluga whales, or which may be preventing their recovery.

I.a. Stranding Events:

ISSUE:
Individual or mass strandings by CI beluga whales may impair recovery of this stock.

OBJECTIVES:

Understand the cause of stranding events within this stock. Respond appropriately to strandings.

MANAGEMENT ACTIONS:
NMFS believes it is necessary to respond to stranding events to reduce stress and deaths, record numbers of mortalities for subsistence management, and acquisition of scientific data. NMFS will continue this effort, and expand upon present protocols as appropriate. The reason(s) for strandings should be determined. This will require a comprehensive review of the literature and existing data from CI stranding events, as well as acquisition of additional information. It would be helpful to gather experts together to assess these data, including necropsy reports and the traditional knowledge of Native hunters. NMFS recommends the following measures:

*NMFS will convene a forensics workshop to assess causalities of stranding events within this population and make recommendations for response actions.
*NMFS will revise the current Turnagain Arm response plan (Appendix C) to address beluga whale response throughout Cook Inlet.
*NMFS will expand current protocols for necropsy of stranded whales.
*NMFS will maintain contracts for veterinary support for stranding events.
*NMFS will acquire appropriate biological samples during stranding response.
*NMFS will develop a notification/distribution network with Alaska Natives to harvest edible portions from stranding mortalities.
*NMFS will develop a metadata catalog from stranding data which incorporates stranding reports, age, gender, biopsy/necropsy findings, tissue analysis, and other data by animal.

RESEARCH ACTIONS (APPENDIX D): B5, C2, E2, E3

***Killer Whales in Cook Inlet**
Objectives: 1) Identify individual killer whales in upper Cook Inlet through photo-id or genetic samples. 2) Monitor killer whale use of upper Cook Inlet. 3) Determine if belugas have options to escape in Turnagain Arm and if there have been changes over the years. Supports1b, 2a,b,c,d, 3a,b.
Justification: Killer whale sightings in upper Cook Inlet have increased (Shelden et al. 2003). If killer whale attacks on belugas have also increased, this may have a significant impact on the population that is not represented in the current mortality models. It is suspected that belugas may respond to killer whale attacks by retreating to shallow water. Depending on how long belugas then remain in shallow waters, this avoidance of deeper waters may result in a loss of habitat for the CI beluga whales and greater risk of mortality during a stranding.
If shallow water habitat is an important refuge for beluga from predation by killer whales then development that fills shallow areas or channelizes flow may increase the vulnerablity of beluga to predation. Study of the behavior of belugas and killer whales and their interactions in the upper inlet are necessary to quantify this impact.
Methods: Photograph individual killer whales opportunistically whenever they are

reported in upper Cook Inlet. If a killer whale strands or is approachable by boat, a biopsy sample will be collected. Photo id and biopsy can be used to determine whether the killer whales are mammal eaters or fish eaters. When mammal eating killer whales are observed in the upper inlet, monitor them sufficiently to determine where and when attacks on belugas occur. Satellite tags for killer whales are underdevelopment. As these become available this project could attach tags to killer whales in the upper inlet to document their movements.
Product: Estimate mortality of beluga resulting from killer whale attacks.
Cost: $5K-$30K/yr depending on the level of response per incident.
Five-year project status: Ongoing
Funding: currently not funded.
Project lead: NMML

***Disease, Pathology, Health Index**
Objective: 1) Determine baseline disease exposure in population 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) comparison to other beluga populations in Alaska. Supports 3b,d,e,f,g,h,i
Justification: The presence of disease in the CI beluga whale population could have a significant impact on survival and reproduction, and thus population status and recovery. Few published data are available on disease exposure and occurrence in beluga in general or the CI beluga whales in particular. Although stranded animals are tested for some disease agents, a comprehensive study designed to determine the prevalence of disease in general CI beluga whale population has not been completed. Research on declining numbers of pinnipeds in Alaska waters elucidated the potential for detecting environmental perturbations using blood chemistry or blood proteins (Fadely et al. 1997, Zenteno-Savin et al. 1997). Research on dolphins in the ETP tuna fishing areas have shown that stress hormones in the skin may be useful estimating handling stress. These techniques may be applicable to beluga but will require some testing and development before they would be useful. As the population recovers, hypotheses regarding the impact of changing nutritional prey base and correlation between individual health condition and changes in prey availability can be examined. these techniques will not be used to clinically diagnose individual belugas as unhealthy, but rather used to detect possible health trends in populations based on blood chemistry perturbations or changes in other observable parameters.
Methods: Currently, a protocol has not been developed for Cook Inlet belugas. Thus initially this project would be developing new methods or modifying existing methods for the CI beluga whales. NOAA Fisheries/PR2 has a program for cetacean health assessment, we will begin there as a point of departure for developing a health assessment protocol. Blood has been drawn from a few captured beluga but a more reliable method is required. Once a regular blood collection method is available the next step would be to develop specific baseline blood chemistry and hematology reference ranges, to be used as a health indicator, for areas of concern (i.e. declining populations) in Alaska waters. Blood will be drawn into various Vacutainer blood container tubes (heparinized, EDTA,

and serum). Whole blood will be centrifuged and the plasma separated and frozen at -80 °C. Blood smears made from EDTA tubes will be used for differential counting. Approximately 1 mL heparinized plasma will be used for determination of standard plasma chemistries: sodium (Na), potassium (K), chloride (Cl), calcium (Ca), phosphate, cholesterol, glucose, protein, blood urea nitrogen (BUN), albumin, creatinine, globulin, bilirubin, lactate dehydrogenase (LDH), alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatinine phosphokinase (CPK), gammaglobulin transferase (GGT), and alkaline phosphatase (AP). Blowhole swabs and anal swabs are fairly simple but a regular collection is required.
Where possible similar samples will be collected from other beluga populations in Alaska for comparison.
Product: A peer-reviewed manuscripts published. Base line health parameters for comparison as the population reaches carrying capacity and comparison to other populations.
Cost: Collection: AKR personnel 2 X 45 days/year + supplies, lab analysis and veterinary consultation $45K/year.
Five-year project status: In development
Funding: not funded
Project lead: Alaska Region

***Estimating age, age of maturation, and indices of growth from teeth**
Objective: Assess the growth patterns of belugas using patterns in the deposition of material in teeth. Supports 1c,d, 2b,e
Justification: Growth layer groups in teeth can be used to determine the age and possibly the age at sexual maturity or first reproduction. Age to length and age to body mass relations are important components of estimates of K and OSP. Age at first reproduction is an important parameter for population dynamics modeling.
Methods: Teeth will be obtained from subsistence-harvested animals and dead stranded animals. The teeth will be cut into thin sections and mounted on glass slides. Two independent readers will assess age by counting the growth layers of the teeth and examining for a transition zone in the widths of the cementum layers.
Products: This study will provide estimates of the age structure of the subsistence harvest and the average age at maturation and when compared to other measurements length at age and body mass at age relations.
Cost: personnel 1X 20-80 days/yr, $5K-$25K/year
Five-year project status: Teeth will be collected from harvested and beach cast beluga. Approximately 10-15 samples per year are available. Every two or three years, once a significant sample had collected the accumulated sample would be aged. A recent Master's degree project examined teeth from Cook Inlet.
Funding: $0K
Project lead: Alaska Region

***Cook Inlet Beluga Strandings**

Objective: 1) Document the historic and current events of beluga strandings to determine possible patterns and identify causes. 2) Update the NOAA Fisheries Turnagain Arm Stranding Response Plan for live marine mammals. 3) Identify new protocols for live beluga strandings to include collection of biological information. Supports 1c,d, 2b,e
Methods: Information on stranded belugas in Cook Inlet has been collected by incidental reporting to state and federal agencies since 1988, but the network for assimilating sighting reports has had increased support during the last few years. By reviewing old reports, mapping stranding locations, and evaluating causes of strandings, patterns maybe identified to better prepare for future stranding events.
The current NOAA Fisheries Turnagain Arm Stranding Response Plan for live strandings should be updated. A new plan will be written, coordinated with the Forest Service and other interested parties.
Strandings provide an important opportunity to access biological materials from live and dead belugas, including blood and biopsies. Live strandings may also be an opportunity to tag a whale with a satellite transmitter.
Product: The final report will identify stranding events as recorded historically; it will continue to be updated annually. This report will include maps of stranding sites, information on causes of strandings, number of belugas involved, health of stranded animals, and NOAA Fisheries response.
A cooperative effort with the Conservation Team will produce a Turnagain Arm Stranding Response Plan. This plan will identify who, when, and how people should respond to live beluga strandings.
A report on protocols to identify the health of the live beluga and what actions would be allowed.
Cost: personnel 1X 15 days/yr, $5K-$15K/year
Five year project status: A stranding historical report will be written; the Turnagain Arm Stranding Response Plan for live strandings.
Funding: $0K
Project Lead: Alaska Region

Ib. Predation

ISSUE:
Killer whale predation of CI beluga whales may impair recovery.

OBJECTIVES:
Improve present understanding of killer whale predation on CI beluga whales.

MANAGEMENT ACTIONS:
NMFS recommends the following measures:

*NMFS will monitor the occurrence and behavior of killer whales in upper Cook Inlet.

RESEARCH ACTIONS (APPENDIX D): A2, (B5 previously listed under section I.a.)

***Population trends analysis**
Objective: Estimate population trends for the CI beluga whale stock and recovery time to OSP. Satisfies: 1b. Supports: 2b, e
Justification: Trend analysis of abundance time series are necessary to determine whether beluga numbers are increasing, stable, or decreasing. This trend information is fundamental to an understanding of population status (Gerber *et al.* 1999) and to the implementation of the PBR approach to management under the MMPA and managing subsistence harvest under co-management. Population trends may indicate adjustments to research objectives are needed, and they may monitor the effectiveness of management measures that are intended to assure the recovery of the CI beluga to OSP.
Methods: Abundance data from standardized aerial surveys and other data, such as observed gray to white ratio, number of new calves, etc., are included in a stochastic population projection model. Bayesian parameter estimation is used to estimate population model parameters and the distribution of recovery times.
Product: Results will provide estimates of beluga population growth rate, recovery time, impacts of various harvest policies, and other human activities.
Cost: Personnel: 1 X 30 days. Funds: $6-14K
Five-year project status: Trend estimates will be calculated annually after each abundance estimate is completed.
Funding: $0K/yr
Project lead: NMML

I.c. Subsistence Harvest

ISSUE:
Subsistence harvest within the CI beluga whale population by Alaska Natives may impair recovery.

OBJECTIVES:
Recover the CI beluga whales while providing continued opportunity for traditional subsistence harvest.

MANAGEMENT ACTIONS:
NMFS has worked extensively with various constituents in the subsistence management of the CI beluga whale. This began in 1996 with cooperative talks between local Alaska Native hunters and the Anchorage field office staff. In consideration of uncertainty regarding the stability of this stock and what was then an unregulated harvest, hunters with the CIMMC proposed and agreed to a voluntary stand down from traditional harvests in 1999. Subsequently, the MMPA was revised that the taking of a CI beluga whale under the exemption provided in 101 (b) shall be considered a violation of the MMPA unless such taking occurs pursuant to a cooperative agreement between NMFS and affected ANOs. Cooperative agreements were developed which provided for continued subsistence harvests at levels which were considered not to impair recovery of this stock. NMFS pursued federal regulation of this harvest under the MMPA, producing

a Final Environmental Impact Statement on the action in July 2003. Subsistence harvest regulations for the years 2001-2004 were promulgated on April 6, 2004 (69 FR 17973). Currently, regulations for the long-term harvest management of CI beluga whales are being developed. These regulations are presented in Appendix B. NMFS recommends the following measures:

*NMFS will continue to cooperatively manage the subsistence harvest of CI beluga whales with participating ANOs.
*NMFS will promulgate regulations governing the long-term harvest of CI beluga whales.

RESEARCH ACTIONS (APPENDIX D): A1, A3, F1, (A2 previously listed under section I.b.)

***Abundance calculations, including aerial surveys and video analyses**
Objective: Estimate abundance of belugas in Cook Inlet. Satisfies:1a; Supports 1b,c, 2a,e.
Justification: Annual abundance estimates are considered the highest research priority to monitor population status. Accurate annual abundance estimates are considered by the Alaska Scientific Review Group (AKSRG) to be the highest priority for research.
Methods: Each year in early summer (usually the first two weeks of June), NOAA Fisheries biologists conduct an aerial survey of all of coastal areas in Cook Inlet (within 3 km of shore) as well as offshore transects, effectively covering approximately 30 percent of the inlet waters. The standard altitude is 270 m (800 ft), and flight speed is 185 km/hr (100 knots), with surveys usually done in a twin-engine Aero Commander with bubble windows. Paired, independent searches are conducted by two observers on the shoreward side of the aircraft, providing a check of sightability of whale groups. A third observer searches from the other side of the aircraft, and a fourth makes data entries into a computer which automatically collects date, time, and location via a Global Positioning System (GPS). After a whale group is spotted, the aircraft is flown around the group in a racetrack pattern until four independent counts have been made by each of two pairings of observers. Because areas in the northern section of Cook Inlet, where almost all of the whales are found, are surveyed 3-5 times per season, some groups may be counted 40-60 times per year. In addition, a digital video camera records the whale group for analysis in the laboratory later. Most of these videoed passes are examined multiple times. The video allows counters to go through the tapes at whatever speed is necessary for an accurate count. These counts can then be corrected for animals not at the surface during the carefully measured counting intervals (see A3) and whales probably missed at the surface because they were too small (see A4).
Product: The total abundance of Cook Inlet belugas will be estimated annually. This estimate will comprise minimum population sizes in the form of the actual numbers of belugas counted on aerial surveys (also treated as the index count), counts adjusted for covariates, and estimates of abundance obtained by correcting for the proportion of the population unavailable to be counted during the aerial surveys.

Cost: Personnel: 4 people X 12 days (field operations); 2 people X 60 days (field prep, data analysis, and report writing); Funds: $85K
Five-year project status: Aerial surveys will continue to be conducted annually in a consistent manner, allowing for trend analysis (see A2). Abundance estimates will be produced annually and will be included in the respective annual reports.
Funding: $80K FY2005
Project lead: NMML

***Dive behavior study**
Objectives: 1) Quantify dive interval and time at surface data as a function of animal's age, sex, location, season, and behavior. 2) Develop corrections for the beluga counts made during aerial surveys to estimate group sizes. 3) Calibrate summarized dive data from satellite tags. Supports: 1a, 3a,g,h,i.
Justification: Beluga dive behavior is highly variable as a function of season, location, 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. When groups are counted and video-taped from an aircraft (see above), an unknown number of animals beneath the water surface are missed. A specific correction method has been developed for video and counts from and is applied to this census data to obtain a population estimate for publication in the Stock Assessment Reports (SARs) and for use in the calculation of a Potential Biological Removal (PBR). This method depends heavily on the average dive interval of the beluga. Currently, this value is estimated from a total of only 10 hours of dive interval data on five beluga collected in 1994 and 1995 (Lerczak et al. 2000). This limited data set has been questioned in public meetings, may be biased by 20 percent or more, and is clearly the weakest component of the abundance estimate. More data are needed.
Methods: In the week prior to the annual aerial surveys (which occur in June), time depth recorders (TDR) and satellite tags will be attached to up to 4 belugas. TDRs record depth, velocity, light, and temperature at discrete sampling intervals (every second) and facilitate the calculation of a correction factor based on the proportion of time spent at the surface where they can be seen from and aircraft. The location of each tagged beluga will be compared to the flight records to determine when each tagged whale was in a group that was being counted. TDR data from these counting periods will be analyzed to determine if the whales changed behavior when the plane was overhead, and the entire series of depth data will be analyzed to determine average dive intervals relative to age sex, location, and tidal height and direction. This information will be used to refine the correction methods for belugas missed because they were not counted during the survey, yielding a more accurate estimate of the number of belugas in an area.
The tags will be attached using a suction cup system, the satellite tags will be recovered after they fall off the beluga and attached to other beluga in the population through the survey period. Two to four SLTDRs will be deployed each year.
Product: This study will provide improved correction methods for counts during aerial surveys, and it will produce dive profile data to relate to summarized data from satellite

tags and to foraging, traveling, resting, and other behaviors observed from the air.
Cost: Personnel: 2 X 30 days, Funds: $40K (this is in addition to the Distribution and Movement project cost).
Five-year project status: Current plans call for conducting a scaled down version of this project at least twice before 2009 using the same schedule as the aerial assessment surveys for abundance.
Funding: $21K in FY2005 from MMC.
Project lead: NMML

***Harvest monitoring and mortality estimation**
Objective: Determine the total number of belugas harvested by Alaska Natives. Include records of sex and age of harvested animals plus numbers of whales struck but lost. Supports 2e, 3d,e
Justification: The MMPA requires an estimate of the annual human-caused mortality and serious injury of marine mammal stocks by source. The subsistence harvest of belugas represents one source of human-induced mortality or serious injury. Belugas are a traditional subsistence food of Alaska Natives in many coastal Alaska communities. In addition to being a food source, belugas represent a significant part of the cultural and spiritual basis of Native communities. Alaska Natives may take marine mammals for subsistence use under both the MMPA (Section 101(b)) and the Endangered Species Act (Section 10(e)). Native takes for subsistence or handicraft purposes are generally not subject to regulatory control unless a stock is depleted (MMPA) or unless Native takes are substantially disadvantaging the stock (ESA).
Methods: Subsistence harvest levels are determined using either direct observation or hunter reporting coordinated with CIMMC.
Product: A time-series of the total subsistence takes, including the number of animals taken and struck and lost. Records will include summaries of takes listed by sex, reproductive status, and age class.
Five-year project status: One or two whales will be harvested per year for the foreseeable future. Monitoring and recording will continue at the current level.
Project lead: Alaska Region, in consultation with CIMMC

I.d. Commercial Fishing

ISSUE:
Commercial fishing in Cook Inlet may adversely affect beluga whales.

OBJECTIVES:
Minimize or avoid adverse effects of commercial fishing on CI beluga whales.

MANAGEMENT ACTIONS:
NMFS recommends the following measures:

*Manage fishing operations likely to have an impact on beluga whales.

*Periodically monitor interaction between beluga whales and commercial fisheries.
*Interact with the State Board of Fisheries in planning Cook Inlet commercial harvests.
*Encourage the State of Alaska to expand its sonar counters and escapement surveys for upper Cook Inlet.

Because some of these actions may be outside federal authorities, all responsible parties are not identified at this time.

RESEARCH ACTIONS (APPENDIX D): B2, D1, D2, D3, F2

***Characterize beluga habitat**
Objective: 1) Describe and quantify habitat factors associated with beluga distribution and abundance. 2) Predict future habitat limitations. 3) Collaborate with comanagement partners, ADF&G, and other interested parties to develop a comprehensive Cook Inlet environmental database. Satisfies: 3a,b,c. Supports: 2b, 3d,e,f,g,h,i.
Justification: Data on beluga habitat is collected in association with other studies; however, no comprehensive set of habitat characteristics for beluga is available. Habitat data are useful to develop both research and management activities. Information of this nature can be used in research to assess whether observed trends in habitat use originate from natural causes or human activities. These data are useful for management purposes to aid in evaluation of impacts from proposed offshore oil and gas development, vessel traffic, and other human activities. Such an evaluation is needed to develop conservation measures in sensitive beluga sites. A GIS format of habitat maps will also allow for better assessment of complex interactions involving other species and other resource concerns.
Methods: Preliminarily, data will be compiled from existing sources, including via Traditional Ecological Knowledge. These data will include information on substrate, bathymetry, fishing areas, vessel traffic lanes, estimated subsistence mortality level, estimated mortality incidental to commercial fisheries, major freshwater streams, and locations of human coastal communities. Specific habitat data may also be actively collected such as sonification of the water by human activity or to otherwise fill in gaps in the available data. These data will be consolidated into a GIS format and related to the spatial distribution, movements, food habits, and dive behavior. Carrying capacity will be estimated (through an ecosystem energetics model such as EcoPath) by comparing the current habitat used by belugas relative to the total estimated habitat available.
Product: A GIS database will be developed showing habitat characteristics associated with distribution patterns and abundance of belugas in Cook Inlet. Estimates of K, OSP, and an assessment of current status of the population relative to these parameters will be calculated.
Cost: Personnel:1.2 FTE/year; other $30-50K/year for several years.
Five-year project status: Unfunded, MS degree student has begun a Thesis project
Funding:$0K per year
Project lead: NMML

***Food item analysis**
Objective: Determine temporal and spatial dietary prey composition for beluga through analysis of stomach contents. Supports 3a,b,c,d,f,g,h,i
Justification: Current and comprehensive diet data are lacking and diet may be a limiting factor as the population approaches carrying capacity. Examination of stomachs yields information on recent dietary intake.
Methods: Stomach samples are collected opportunistically from subsistence harvested animals or strandings. Analysis is done by contract to experienced laboratories.
Product: Manuscript(s) published in the peer-reviewed literature that describe the observed diet.
Cost: AKR personnel 1 X 20 days/year + supplies and analysis $12K/year.
Five-year project status: Stomachs are collected when available but current harvest is one or two whales per year**.**
Funding: $12K/year
Project lead: Alaska Region

***Diet analysis**
Objective: Determine temporal and spatial prey composition in CI beluga whale diets through analysis of blubber and blood fatty acid signatures, contaminant signatures and stable isotope analysis. Supports 3a,b,c,d,f,g,h,i
Justification: Prey is digested differentially, and some diagnostic hard parts may be retained in the stomach and thus over-represented in stomach contents (Pitcher 1980b, Harvey 1989). Also, stomach likely only reflect 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. Recent techniques of fatty acid signature analysis have been applied as an additional, and complementary, method of studying the diet composition of harbor seals (Iverson *et al*. 1997). Similar methods may be aplicable to beluga. 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. Similar analyses are possible with contaminant loads as each prey species carry different concentrations of heavy metals and organochlorines. Stable isotope analysis will not give prey preference at the level of detail the fatty acids or contaminants can but it is inexpensive and acts as a check that the total diet diet composition is reasonable.
Methods: Blubber and skin samples will be collected during capture for tagging, from subsistance harvest and stranded and beach cast beluga. Prey samples will also be collected to obtain prey fatty acid profiles for comparison to fatty acid profiles. Blubber and prey samples will be processed at NWFSC and analysed for fatty acids signature in addition fatty acid signature analyses will be conducted in the laboratory of Sara Iverson, Dalhousie University, Canada. Contaminants will be analysed at NWFSC. Stable isotope analysis will be conducted at a contracted facility. Captive beluga studies will be conducted to determine analysis parameters.
Product: A manuscript published in the peer-reviewed literature. An essential

component of analysis to estimate K and OSP.
Cost: personnel 2 X 60 days, $40K-$70K/year
Five-year project status: Blubber and prey sample collection began in FY01 initial analyses have now been completed. Five to 10 blubber samples are available each year so it is anticipated that two or three years will be necessary to collect a representative sample of the CI beluga whales. Captive animal studies have not been undertaken and would require one to two years to provide results.
Funding: $0K/yr
Project lead: NMML, NWFSC, Alaska Region support

***Forage fish analysis**
Objectives: Identify food availability for belugas 1) salmon run strengths and numbers in Cook Inlet, 2) eulachon run strengths and numbers in Cook Inlet; and 3) winter prey species. Supports 3a,b,c,d,f,g,h,i
Justification: Cook Inlet beluga whales occur throughout the year in the northern portion of Cook Inlet. Trophic 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 the apex predators, 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 trophic linkages.
Methods: The project will identify and review available data on potential beluga prey species in Cook Inlet. 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 data analyst will collaborate with the Alaska Department of Fish and Game and other groups to identify and compile available data sets into a GIS format that is usable by this project. Life history, size at age and other data will be used to convert counts and other indexes to biomass estimates. Where possible data will be converted to biomass distributions by date and area. The GIS analysis will compare prey availability to the observed beluga distribution patterns. Based on this initial analysis, a sampling plan will be developed to: 1) determine prey species available to beluga by season and location; 2) collect data to estimate biomass from available fisheries and/or escapement data; 3) estimate biomass in areas frequented by beluga for which no data are available by area and season. Because a comprehensive survey is not possible, this project will identify index sites for seasonal sampling and focus initial efforts on developing a species list and collecting samples for fatty acid comparison to existing blubber samples. Site selection will be based on preliminary analysis of the individual contribution of anadromous fish runs and potential fall and spring feeding areas. Fieldwork will be conducted as a collaborative effort among ADF&G, NOAA Fisheries and others.
Prey samples collected during the project will be included in an ongoing NOAA Fisheries Cook Inlet beluga fatty acid analysis project. Currently NMFS has analyzed blubber samples from 15 Cook Inlet beluga and over 200 prey samples representing several runs of salmon, a eulachon run, and a few miscellaneous species; a wider range of samples are

needed to complete this analysis.
Results from the fatty acid analysis will be compared to prey availability and biomass estimates to determine beluga prey preference and available prey biomass
Product: will include a report summarizing the collected data and providing the derived prey base biomass estimates, A GIS database of the fish biomass distribution and a peer reviewed scientific publication presenting the results of the study. The report and database will be completed at the end of the third year of the project, the peer reviewed publication will be completed within one year of the completion of the project.
Cost: $70-90K/year for three years.
Five-year project status: A joint project with ADF&G is under development and seeking funding of $70K-$90K/year to review fishery data for upper CI and to develop a GIS database to estimate prey species biomass by time and location. If this project is funded, this database should be developed by 2006, and initial estimates of K and OSP available by 2007.
Funding: $0K
Project lead: NMML and Alaska Region

***Incidental take by commercial fisheries**
Objective: Determine the level of incidental take in commercial fisheries. Supports 2b,e 3b,e,i
Justification: The Marine Mammal Protection Act (MMPA) requires that a species or population stock not be permitted to diminish below its optimum sustainable population and that measures be immediately taken to replenish any species or population stock which has already diminished below that point. Section 118 of the MMPA specifically mandates that the incidental mortality or serious injury of marine mammals, including harbor seals, occurring in the course of commercial fishing operations be reduced to insignificant levels approaching a zero mortality and serious injury rate. Fisheries are classified according to the degree of interaction with marine mammals. Should the level of human-induced mortality exceed the potential biological removal (PBR) level and the stock be declared "strategic" the commercial fisheries which interact with that species would be required to reduce the incidental mortality and serious injury of that stock taken incidentally in the course of commercial fishing operations to a level below the PBR calculated for that stock. As a result data must be collected on the level of incidental serious injury and mortality occurring in commercial fisheries. This information is also required in the annual stock assessment reports. Currently few data are available on the incidental take of belugas in commercial fisheries.
Methods: Current methods include reporting via a self reporting system and directed observer coverage in some commercial fisheries. Estimated observer coverage levels in fisheries are calculated based on a statistical model that incorporates fishing effort and PBR levels of a reference species.
Product: An estimate of the number of belugas taken incidental to commercial fisheries.
Five-year project status: The self report system for commercial fisheries continues on an annual basis. The marine mammal observer program is currently focusing on Category II fisheries (those fisheries having occasional incidental mortality and serious

injury of marine mammals) in Alaska on a rotating schedule. During the summers of 1999 and 2000, dedicated marine mammal observers were placed in the set and drift gillnet salmon fisheries in Cook Inlet (Merklein and Fadely 2001). In 2001 and 2002, observer coverage was moved to the set gillnet fisheries near Kodiak and Yakutat. All incidental takes of marine mammals, including belugas, will be documented.
Project lead: Alaska Region

I.e. Vessel Traffic

ISSUE:
Vessels have potential to harass or injure beluga whales due to noise or ship strikes.

OBJECTIVES:
Prevent disturbance or injury to CI beluga whales due to vessel operations in Cook Inlet.

MANAGEMENT ACTIONS:
At this time, NMFS does not believe large vessels, commercial shipping, or commercial fishing vessels are presenting significant concerns with respect to the recovery of the CI beluga whale. Noise from these vessels is discussed separately. Small water craft may be of concern, however. The factors associated with small craft which may impact beluga whales include: 1) in-water noise occurs at higher frequencies which are more readily detected by beluga whales, 2) small water craft are more likely to alter course and heading to intercept or approach beluga whales, 3) small water craft can operate in confined and remote areas which are not navigable by large vessels and many of these coastal sites are high-use areas for CI beluga whales, 4) small recreational water craft are commonly used to reach many of the important anadromous fish streams entering Cook Inlet, areas which provide important seasonal feeding habitat, and 5) small craft operate at high speeds capable of striking and injuring beluga whales.

It is presently unknown whether small boat operations in Cook Inlet are having significant adverse impacts on beluga whales. Further, it is unclear what, if any, authority the federal government has to control such operation. Any overt actions which can be shown to harass or harm beluga whales would constitute a "take" in violation of the MMPA. However, it is unlikely most such takes would be witnessed or reported. The federal government alone has limited authority to close a body of water to boat traffic in order to protect beluga whale habitats, nor to restrict vessel speeds or type of vessel[10].

[10]Section 112(e) of the MMPA states that the Secretary (of Commerce) may "develop and implement conservation or management measures" to alleviate impacts on rookery, mating grounds, or other areas of similar ecological significance which may be causing the decline or impeding the recovery of a strategic stock. The CI beluga whale stock is designated under the MMPA and is thus considered a strategic stock. The limits of federal authority under section 112(e) are largely untested.

Public education, distribution of habitat sensitivity information, and outreach and cooperation with recreational boating organizations is recommended, along with monitoring. NMFS recommends the following measures:

*Develop informational signs and post them at launches.
*Communicate with local recreational boating groups regarding ways to navigate with less potential to harass whales.
*Monitor small craft activity in important beluga whale habitat areas.

Because some of these actions may be outside federal authorities, all responsible parties have not been identified at this time.

RESEARCH ACTIONS (APPENDIX D): B1, F3, F4

***Distribution and Movement**
Objective: Document the distribution and movement patterns of Cook Inlet belugas throughout their annual cycle. Satisfies:2a,3a. Supports 1c,d,2b,d, 3c,h,i.
Justification: Knowledge of the spatial and temporal patterns of the CI beluga whale will provide a better understanding of their ecology. This knowledge is required to assess the extent of habitat utilized by and critical to these whales.
Methods: 5 to 10 ARGOS tags designed to last one year or longer will be deployed each year on belugas at various times and locations. In addition, monthly or bimonthly aerial surveys will be conducted to determine the distribution of groups of beluga throughout the inlet. The tag location data will be analyzed to determine the effectiveness of the aerial survey, and the survey data will be used to determine the fraction of the population represented by each tag.
Product: Results will describe the year-round general movement and habitat use patterns of Cook Inlet belugas. Data will be entered into a GIS database for Cook Inlet which will be analyzed to create an average distribution by month or other time interval, and total whale-days for each location will be estimated.
Cost: Personnel: 6 X 10 days + 2 X 60 days cost $30K. Tags $40K. Survey cost: $60K; other $10K.
Five-year project status: To date, 17 beluga have been tagged with ARGOS tags in Cook Inlet (1 whale in June 1999; 2 whales in September 2000; 7 whales in August 2001; 8 whales in August 2002). Survey and tagging projects in Cook Inlet are planned for the years 2006 and 2007.
Funding: $140K/year
Project lead: NMML

***Habitat Impact**
Objective: Determine the effect of vessel presence, oil development, coastal development, over flight and other human activities on habitat available to CI beluga whales. Supports 3a,b,c,d,e,f,g,h,i

Justification: Habitat loss may occur for a variety of reasons: 1) Ensonification by vessel traffic or drilling or dredging, 2) Changes in channels or tidal areas due to dredging or filling or 3) interference by fishing, sightseeing or other vessel traffic.
Methods: Various research methods will be applied, depending on the respective impacts to be studied. Initially this task will focus on studies of impacts of noise. Efforts will be coordinated with the Minerals Management Service. Tagged whales (see A3) may provide evidence of responses to impacts (opportunistically) if tag data show a whale entering and leaving an ensonified area.
Product: Quantify potential impacts relative to proposed activities.
Five-year project status: An acoustic survey of noise sources in the upper inlet was conducted in FY01 (Greenridge Sciences, Inc 2001).
Funding: $0K
Project lead: NMML

***Industry in Cook Inlet**
Objectives: 1) Identify harbor use in Knik Arm (Port of Anchorage and Point MacKenzie) and collect the baseline data on ship and boat activity, especially before possible increases with cruise ships, tour boats, ferries, and shipping. 2) Identify oil spill risks as related to chronic leaks, age of pipelines and equipment, and PAH information at set sampling sites: Anchorage, Kenai, and Eagle River. 3) Evaluate oil and gas lease sales in upper (state) and lower (federal) Cook Inlet. Supports: 3b,c,d,e,f,g,h,i
Justification: 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. The project proposes a proactive approach to collect the necessary data so that consideration for impact on the beluga population can inter into the planning process at an early stage.
Methods: Various depending on the proposed projects.
Project lead: Alaska Region with support from NMML.

I.f. Tourism and Whale Watching

ISSUE:
Commercial whale watching ventures often seek out high value and high use whale habitats and may approach whales at distances which cause harassment and disturbance.

OBJECTIVES:
Whale watching should not result in harassment or disturbance, nor displace beluga whales from important habitat areas.

MANAGEMENT ACTIONS:
Although potential is high, no commercial whale watching operations currently are known to operate in upper Cook Inlet. Recommended actions should be implemented now, however, to conserve beluga whales and to achieve fairness with future operators.

Recommendations are also provided to encourage interpretive signs along coastal trails and highway pull outs. NMFS recommends the following measures:

*NMFS will develop beluga whale watching guidelines for upper Cook Inlet.
*Prohibit commercial whale watching vessels from High Value/High Sensitivity habitat (Type 1).
*Protect important habitat areas from disturbance by whale watching.
*Encourage whale watching vessels to operate in areas already exposed to vessel traffic and noise, such as lower Knik Arm.
*Monitor the effects of these operations on beluga whales.
*If necessary, NMFS will seek restrictions on the number of whale watching vessels operating in upper Cook Inlet.
* Work with the Municipality of Anchorage, Alaska Department of Transportation, and others to encourage the development of informational signage regarding beluga whales in Cook Inlet, as well as shore-based whale viewing opportunities.

Because some of these actions may be outside federal authorities, all responsible parties have not been identified at this time.

RESEARCH ACTIONS (APPENDIX D): B3, (B2and F3 previously listed under sections I.d. and I.e. respectively)

***Calving**
Objective: Determine season and location of calving and rearing activities. Supports 1c,d, 2b,e, 3a,c,d,e,f,g,h,i
Justification: Calving and rearing through the first year are particularly vulnerable periods of a beluga's life. Areas used by the CI beluga whales for calving and rearing may be considered critical habitat and require special protection. Calving rate is an important measure of population health and required for age structured population models.
Methods: Calving and rearing areas will be determined during annual abundance estimate aerial surveys under A1 and possibly other dedicated photo and video aerial surveys. Further data collection under B1 would allow assesment of calf mortality and location of rearing grounds. Initial experiments have been conducted to develop methods to identify new calves from the air and count them reliably. Experiments will be conducted in 2005 using aerial video and photography to develop and test a survey protocol to get repeatable results.
Product: Annual time series of calf counts and estimates of calving rates and calf survival for use in population models.
Cost: Add-on to A1. $18K annually. Add-on to B1. $20K annually if monthly aerial surveys.
Five-year project status: Annual surveys will be conducted under A1.
Funding:$0K per year
Project lead: NMML

I.g. Noise

ISSUE:
Anthropogenic activities may increase ambient noise levels in the water, which could reduce the ability of CI beluga whales to feed, communicate, and navigate. High levels of noise have the potential to harm or kill these animals.

OBJECTIVES:
Insure beluga whales are not injured or killed directly or indirectly by noise. Mitigate other actions to minimize or reduce disturbance and harassment to whales due to noise.

MANAGEMENT ACTIONS:
NMFS recommends the following measures:

*Use available federal laws (MMPA, Fish and Wildlife Coordination Act, National Environmental Policy Act (NEPA), other) to restrict noise capable of harassment or injury to CI beluga whales. NMFS will review and comment on applicable permits and seek specific conditions to reduce or avoid impact. Seasonal stipulations will be incorporated into project permits to avoid unintentional taking of beluga whales. Whenever seasonal restrictions cannot be met, NMFS will either recommend denial of the work or adoption of mitigating measures, along with a comprehensive monitoring program. 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 predetermine ranges of the source (seismic) boat, and acoustic monitoring of the source and the attenuation of noise from the array.

From what is known about the hearing sensitivity of beluga whales and the movements, distribution, and habitat value of the CI beluga whales, NMFS believes it makes sense to takes steps to minimize the likelihood for noise to adversely impact these whales to minimize the possibility of injury or possible abandonment of important habitats. Additionally, it is important to monitor lesser noise sources which may impact beluga whales to understand what, if any, impacts they present and improve our understanding of these whales.

* Utilize NMFS Acoustic Guidelines[11] to predict noise levels for injury and harassment and to develop mitigative measures to reduce impact by species and type of noise. NMFS has developed acoustic guidelines (currently in draft) 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. Using

[11] These guidelines are currently in development and have not been promulgated as policy of NMFS.

multiple pulse sources (such as seismic geophysical exploration or pile driving), beluga whales would be theoretically injured by a single pulse which exposed a whale to levels of 230 dB re: 1µ Pa. or greater. The guidelines consider beluga harassment thresholds to begin at exposure levels at or above 160 dB re: 1µ Pa. Exposure levels depend on the source level and frequency, the duration of the sound, the location of the receptor (whales), and attenuation of sound in water. Research has found spreading loss/attenuation within Knik Arm to be between 14 and 21 dB re: 1µ Pa. per tenfold change in distance.

NMFS will apply these criteria in evaluating in-water construction and other actions with the potential to introduce noise into Cook Inlet. NMFS will recommend against any activities which exceed the injury (termed as Level A) thresholds unless it can be demonstrated that beluga whales would not be subjected to such noise because of the separation distance between the whales and the activity, seasonal restrictions, or other mitigative measures which would avoid injurious take. For noise which falls below the Level A threshold but meets or exceeds Level B (i.e., capable of causing behavioral reactions, harassment, or non-serious injury), NMFS would address these on a case by case basis. NMFS would normally object to Level A or B takes due to noise within habitat identified as High Value/High Sensitivity (Figure 5). The effects of noise in these areas may be reduced to acceptable levels through time restrictions or other mitigation measures. NMFS would also use Level B effects as support for recommendations that activities be permitted under the MMPA small take provisions (also known as Incidental Harassment Authorization). These MMPA authorizations require monitoring programs to quantify the level of take and to reduce adverse impacts.

RESEARCH ACTIONS (APPENDIX D): (B2, F3, and F4 previously listed under sections I.d., I.e., and I.e. respectively)

I. h. Oil and Gas

ISSUE:
Areas of Cook Inlet contain oil and gas reserves. Both state and federal lands have been leased, explored, and/or developed over the last three decades. The mid-Inlet contains approximately 16 oil or gas platforms. Various oil and gas support activities and infrastructure also exists here, such as: storage tanks at Drift River, the Nikiski refinery, and POL (Petroleum, Oil, and Lubricants) facilities at port locations. Impacts to CI beluga whales associated with oil and gas include ship traffic, oil spills, pollution, seismic research, in-water noise, and physical habitat alteration.

OBJECTIVES:
Avoid oil and gas activities within high value beluga whale habitats. Mitigate oil and gas activities so as not to harass or injure CI beluga whales.

MANAGEMENT ACTIONS:

Because the upper Inlet contains concentrations of beluga whales, provides important foraging habitat, and is where calves are born and reared, NMFS has developed specific recommendations for the State of Alaska relative to the State lease sales. These recommendations were premised on three divisions of habitat types or usage. The Conservation Plan's characterization of beluga whale habitat values (Figure 5) differs from the habitat descriptions used to develop these earlier recommendations. These have been modified as follows:

* Oil and gas exploration and development (permanent or temporary) should not occur within High Value/High Sensitivity (Type 1) and High Value (Type 2) habitat areas, unless it occurs on upland areas (above Mean Higher High Water datum).
* Within Type 3 habitat, oil and gas-related activities should be assessed on a case-by-case basis. In Type 3 habitat areas where CI beluga whales are or have been commonly found (e.g., the mouth of the Kenai River, Kachemak Bay, Tuxedni Bay), NMFS will recommend no permanent surface entry or structures be allowed in water. All temporary activities and structures (e.g., exploration drilling) should occur only between November 1 and April 1 of each year.
*No recommendations are offered for Type 4 habitat. However, these will also be reviewed on a case-by-case basis.

We believe adoption of these recommendations by the State of Alaska provide adequate measures to conserve and recover the CI beluga whale.

Oil and gas leasing within federal waters of Cook Inlet also presents concern for the CI beluga whales. However, because these tracts are offshore and south of Kalgin Island (i.e., within the southern portions of Cook Inlet) they may have less impact on known beluga whale habitats, which are generally within three miles of shore and along the northern portion of the Inlet. NMFS will continue to advocate that CI beluga whale be included in MMS's research programs investigating the effects of leasing and development within Cook Inlet. NMFS and MMS should also re-evaluate the lease sale conditions and Notice to Lessees for adequacy in addressing CI beluga whale protection and mitigation measures.
Recommendations for marine discharge of pollutants and seismic research are presented in separate sections on this chapter.

RESEARCH ACTIONS (APPENDIX D): C1, (B1, B2, F3, and F4 previously listed under sections I.e., I.d., I.e., and I.e. respectively)

***C1 Contaminant analysis**
Objective: Determine current contaminant loads. Supports 2b,d 3a,b,d,e,f,g,h,i
Justification: The contamination of belugas by persistent pesticides and heavy metals is of concern to the health of the population in Cook Inlet. Levels of many of these contaminants have been shown to be lower than in other populations in western Alaska. In other species, persistent organochlorine pollutants have been shown to produce

toxicological effects, including reproductive dysfunction and immunosuppression. The body of knowledge available for other animal systems is much more extensive than for marine mammals. 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. The continuation of the study of contaminant loads in Cook Inlet belugas, will provide the basis for further scientific exploration into the effects of various chemical compounds on health.

Methods: To examine current levels of metals and organochlorines (OC), samples of blubber (from a standard area on the ventral surface), kidney, and liver will be collected from subsistence-hunted belugas and beach-cast carcases. Samples of blubber will also be collected from whales captured for tagging.

Age and blubber thickness of belugas, and water and lipid content of samples will also be measured to increase precision of estimates and aid interpretation of results. Examination of samples from both sexes and various lengths or ages, which is often positively correlated to contaminant levels. Because OC residue concentrations are inversely related to blubber thickness (as fat is metabolized the contaminants in the remaining tissue become more concentrated; reviewed by Addison 1989), blubber thickness will be an important covariate in data analysis. Blubber thickness will be measured during biopsy or by ultrasound.

Samples may be sub-sampled following protocols developed by the National Marine Mammal Tissue Bank to prevent contamination of samples. After sub-sampling, excess samples will be archived at the National Marine Mammal Tissue Bank to be available for future contaminant work. Levels of 209 PCB congeners, total PCB, DDT and metabolites, and 22 other OC pesticides in blubber; and levels of 19 trace metals in kidney and/or liver will be analyzed by an appropriate analytical laboratory which participates in the quality assurance program at the National Institute of Standards and Technology.

Collection of samples will reduce costs and provide current numbers for comparison with published data from Alaska and elsewhere.

Product: Data will show contaminant levels in Cook Inlet beluga, and these will be compared to other areas.

Cost: Collection: AKR personell 2 X 40 days/year + supplies and shipping $35K/year.

Five-year project status: Ongoing

Funding: $35K/yr AKR with analysis by NIST and NWFSC

Project lead: NIST, NWFSC

I. i. Research

ISSUE:

Present scientific knowledge of CI beluga whale biology and ecology is insufficient. Some aspects of some research projects (such as tagging) may harass, injure, or kill beluga whales.

OBJECTIVES:

Continue and expand the comprehensive research program for CI beluga whales. Avoid injury or death within this stock due to research activities. Minimize harassment of beluga whales due to research efforts.

MANAGEMENT ACTIONS:
Appendix D presents the Cook Inlet Beluga Whale Research Plan (Research Plan), which sets out a recommended research program intended to address those issues considered most critical to the recovery of CI beluga whales and to advance our understanding of their ecology. This Research Plan also sets priorities based on the degree to which a particular study would be expected to contribute to recovery. Implementation of the Research Plan is, in itself, a conservation action. NMFS recommends the following research conservation measures:

*NMFS will implement the Research Plan (subject to available funding).
*NMFS will monitor all research on CI beluga whales to ensure that individual or cumulative effects of research are not inconsistent with recovery.
*NMFS will conduct periodic scientific workshops for the presentation of results of research on CI beluga whales.
*NMFS will regularly seek consultation with appropriate ANOs regarding TWK to augment western science.
*NMFS will work with Alaska Native co-managers to maximize scientific value from legally-harvested beluga whales.

Research activities may harass or harm beluga whales. NMFS believes some level of harm (i.e., harassment) is justifiable and necessary. Placing satellite tracking tags on whales cannot be done without harassing the animal. However, it is also possible to reduce or eliminate some adverse effects by modifying research plans. Aerial surveys might cause harassment of whales if flown at low attitude, however, the standard survey altitude of 244 m (800 feet) does not appear to disturb beluga whales, especially when considering the immense amount of air traffic common to the northern portions of Cook Inlet. NMFS recommends the following measures:
*NMFS will advocate all research of CI beluga whales utilize non-invasive methodologies whenever practicable.
*NMFS will review applications for MMPA scientific research permits for CI beluga whales. Applications should demonstrate consideration of alternative research methodologies which reduce potential harassment or takings.

RESEARCH LINKS (APPENDIX D): A4, B4, E1, (F3 previously listed under section I.e.)

***Monitoring recovery status by proportions of dark vs white whales**
Objectives: Estimate recovery time and probability of extinction (via gray-white ratio study and population modeling).

Justification: This study provides an index of the recovery of the beluga stock, by monitoring the proportion of young vs mature whales.
Methods: High resolution digital video and still cameras are used from an aircraft to capture images of belugas in Cook Inlet. Later these images will be imported onto a computer, using software such as Imovie®, and analyzed via programs such as Image Pro Plus® with scaled readings of intensity values for pixels within selected areas of interest. The sum of all white whales observed will be divided by the sum of all whales observed, with a 95 percent CI calculated using a nested bootstrap. After defining the proportion of adult whales in the population, an age structured model will be used to define a statistic for monitoring the recovery of the population (e.g., Litzky 2001).
Product: Statistics generated from this study will provide an index of the relative health and growth potential of the Cook Inlet stock of belugas.
Cost: Personnel: 1 X 40 days/yr. Funds: $6K
Five-year project status: This project will be conducted annually in conjunction with and on the same schedule as the aerial assessment surveys for abundance.
Funding: $0K/yr
Project lead: NMML

***Capture and Handling Protocols and Tag Design and Attachment Development**
Objective: 1) Improve the longevity and utility of the satellite tags and minimize the impact to the beluga. 2) Identify risks to whales or humans when capturing and holding belugas for tagging, health assessments, and when doing biopsies, and risks to humans when handling dead whales, and develop protocols to minimize these risks. Supports: 1c,d, 2a, 3a,b,c,d
Justification: To date, the longest surviving beluga tag has lasted 10 months. For year-round habitat studies, it would be extremely useful to have tags that remained on the whales more than a year. Also, current tag attachments require capturing and holding a whale for nearly an hour. Only in parts of Cook Inlet is it feasible to use this method. A remote deployment version of the tag using a crossbow or airgun would be useful when attempting to tag belugas in areas other than in Knik Arm or the Susitna Delta. There is concern that during the handling of whales, physical injury or transfer of disease from humans to beluga or between belugas may impact individual whales.
Methods: Various tag designs will be tested for performance under a variety of conditions using experimental and engineering procedures. Beluga in aquaria will be studied to determine the movement of water over their dorsal features, using a video to document the performance of suction cup attached streamers. These data will be used to determine the best locations for attachment. Collaboration with other beluga researchers will be necessary to insure the most efficient use of the few whale tagging opportunities that arise each year. Experts on live handling of belugas and other cetaceans will be consulted to develop safe handling protocols.
Product: Tag designs and attachments with improved longevity and utility and minimal impact to the beluga. Reduced risk to beluga and associated calves during capture and handling.
Cost: Personnel: 2 X 30 days; Funds: $20K-$40K/yr

Five-year project status: A workshop conducted at NMMLin FY 02 to evaluated capture and handling techniques and current tag designs for beluga and planned future modification experiments. A workshop convened at the SMM biennial meeting in FY 04 reviewed safety and health issues of capture and handling techniques for small cetaceans in general. Design efforts continue at NMML at a minimal cost level.
Funding: $1K/yr
Project lead: NMML

***Female reproductive biology**
Objective: Estimate age-specific reproductive rates of female belugas in Cook Inlet including age of sexual maturation and pregnancy rates. Supports 1c,d, 2b,e
Justification: 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. Also, age is important to understanding contaminant data. Therefore, it is important to monitor these parameters and to take advantage of samples available from the subsistence harvest to do so.
Methods: Reproductive tracts including uteri and ovaries will be collected from female beluga taken in the subsistence harvest. Uterine scars and counts of corpora in ovaries will be used to estimate the state of maturity and recent reproductive history of each beluga.
Product: Estimates of age-specific reproductive rates of female belugas.
Cost: personnel 2 X 5 days, $1K/year
Five-year project status: Specimen material has been collected since 1995. One or two samples a year are available from the subsistence harvest and beach cast carcases.
Funding: $0K
Project lead: Alaska Region

***Stock Identification, Subdivision, and Forensics**
Objectives: (1) determine the relationship between interbreeding and dispersal patterns among sub-populations (i.e. accept or reject the panmixia hypothesis); (2) Use geographic and temporal strata to look for evidence of genetic subdivision; and (3) develop sampling methods necessary to collect samples from free swimming beluga. Supports 1c,d.
Background: Microsatellites are a class of highly variable nuclear markers that have revolutionized the study of breeding systems, social organization and population structure. In contrast to the maternal inheritance of mtDNA haplotypes, microsatellite alleles are inherited from both the mother and father. Thus, by combining the analysis of variation at these loci with that of mtDNA, a more complete understanding of grouping, mating, and movement patterns may be achieved. To date over 500 samples from 36 separate locations in Alaska and Canada, including 86 from Cook Inlet have been analyzed for sequence in the mtDNA control region. Over 400 of these belugas have also been assayed for variation at eight micorsatellite loci.

Justification: As with mtDNA, initial analysis has revealed structure on a broad geographic scale. We have found that the number of samples greatly influences the reliability of estimates of genetic subdivision. Small sample size increases the variance in the test statistic thus increasing the probability of a type II error of falsely not rejecting the null hypothesis of panmixia. There is therefore a need to increase sample size from a number of areas. Boosting sample size and distribution will also enable us to investigate population structure on a micro-geographic scale and determine if stocks are demographically and/or reproductively independent by comparing findings from nuclear markers with those from mtDNA to distinguish between actual (i.e., emigration) dispersal and effective (i.e., interbreeding) dispersal. Individual microsatellite loci vary in their ability to reveal population structure, a feature that is related, in part, to how polymorphic they are. It is therefore necessary to continue to screen for variation at a large number of independent loci with differing levels of polymorphism.

Methods: Many samples are already available at SWFSC but new samples are required from several areas. Samples will be gathered from harvest, live capture operations, and by focused biopsy studies. The collection of samples will be co-ordinated with the relevant agencies and institutions. Necessary samples sizes can not be determined at this time so a feasability study was funded with FY01 funds.

Tissue storage and molecular techniques will be as described in previous reports. Briefly, tissue samples will be stored in 20 percent DMSO and saturated salt. Total DNA will be extracted and archived using standard protocols. Following quantitation of DNA (and sequence analyses of mtDNA, see part 1), alleles at a minimum of 11 polymorphic microsatellite loci will be amplified by the PCR, separated on an automated sequencer, and sized with the aid of Genescan 3.1 software.

As with the mtDNA study, geographic strata to be tested with the microsatellite data will be based primarily on distribution, abundance, and movement patterns. Other factors that may influence or reflect movement patterns are also being considered in this process. Frequency-based (F_{st}, $Ç^2$) statistics will be used to assess levels of genetic differentiation.

Product: A series of reports and a scientific manuscript or manuscripts detailing the population genetic structure based on patterns of microsatellite variation and how this pattern compares with the mtDNA findings. The analyses will be based on the strata used in the mtDNA studies.

Cost: $20K to $70K/yr depending on sample size and level of detail sought.

Five-year project status: Ongoing beluga genetic work coordinated with the ABWC and other organizations will be continued. A feasability study for a similar project was undertaken in 2004 by the ABWC at a field location in Bristol Bay.

Funding: None at this time

Project lead: SWFSC and NMML with support by Alaska Region

***Mating Systems within CI Beluga Whales**

Objectives: Determine the mating system of Cook Inlet belugas, and relate findings to the analysis of stock structure of the species in Alaska. Satisfies 1c,d

Background: Little is known about the mating system of beluga, primarily because of 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 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. Results of this study of mating systems in Cook Inlet may be applied to other populations in Alaska.

Justification: Resolving the relationship between reproductive success and mating frequency can aid in the estimation of effective population size (N_e), an index of relevance to investigations of stock identity, and dispersal in this species. N_e is smaller than N; for example, when only a portion of adult males contribute to next year's cohort of calves. A small N_e in turn increases the rate of genetic divergence among strata due to the greater effects of genetic drift within the population. Harvest data shows a male to female ratio of 1:1; however, sex was rarely determined in this sample set. With the information we have at present, males were not targeted, although white whales were, so excessive harvest impacted N_e to a greater extent than the fraction of the population harvested would indicate and may have caused genetic forcing as well.

Methods: Samples will be collected either directly by biopsy during tagging operations (see A.3, Dive behavior study) and dedicated biopsy surveys or from whales taken in the harvest or found dead. Samples will be preserved in a 20 percent DMSO and salt solution or snap frozen and returned directly to the lab.

Various laboratory procedures, many developed at SWFSC, will be used to extract, amplify, and sequence an array of genetic markers, including mtDNA, microsatellites, and gender. (See sections 1, 3, and 5 above for details). Paternity assessment and relatedness will be estimated using a number of standard statistical packages as well as a number of techniques currently under development.

Product: A series of peer-reviewed theses and reports and a scientific manuscript or manuscripts detailing the findings of the current research will be published.

Cost: $10K-$40K/year

Five-year project status: This project will be an extension of the Stock Identification and Subdivision study. Necessary samples sizes will be determined by the feasability study described under the Stock Identification and Subdivision study.

Funding: Not currently funded.

Project lead: SWFSC and NMML

I.j. Oil Spills

ISSUE:

Oil spills may impair the recovery of the CI beluga whale.

OBJECTIVES:

Avoid activities with higher potentials for oil spills within high value beluga whale habitats (Types 1 and 2, Figure 5). Prevent oil spills within all beluga whale habitats. Reduce any adverse effects on beluga whales from oil spill response actions.

MANAGEMENT ACTIONS:
NMFS recommends the following measures:
*NMFS will participate in the state and federal Oil Spill Response notification network.
*Develop recommendations to the U.S. Coast Guard and their Scientific Support Coordinator to protect beluga whales and habitat during spills and spill response.
*Develop protocols for hazing beluga whales from oiled areas of Cook Inlet.
*NMFS will investigate methods to monitor hydrocarbons in CI beluga whales.

Because some of these actions may be outside federal authorities, all responsible parties have not been identified at this time.

RESEARCH LINKS (APPENDIX D): (C1, F3, F4 previously listed under sections I.h., I.e., and I.e., respectively)

I.k. Enforcement

ISSUE:
Enforcement of state and federal law is essential to conservation and recovery of CI beluga whales.

OBJECTIVES:
Enforce present laws pertaining to CI beluga whales.

MANAGEMENT ACTIONS:
NMFS recommends the following measures:
*Maintain enforcement presence on Cook Inlet to reduce illegal takes, including harassment.
*Educate public on legal prohibitions on take.
*Provide signage at major access points to report illegal activity.
*Improve state and federal collaborative enforcement effort for upper Cook Inlet
*Increased funding.
*Work with ANO's on tribal enforcement.

Because some of these actions may be outside federal authorities, all responsible parties have not been identified at this time. NMFS's Law Enforcement Office's plan for CI beluga whale is presented in APPENDIX E.

I.l. Outreach and Education

ISSUE:

Lack of knowledge and understanding of issues behind CI beluga whales.

OBJECTIVES:
Educate various public on CI beluga whale issues.

MANAGEMENT ACTIONS:
NMFS recommends the following measures:
*Develop an educational strategy to inform and stimulate citizen involvement in CI beluga whale issues.
*Develop stakeholder identification and participation.
*Create a community education program, and coordinate with other interested organizations to develop educational outreach programs.

I.m. Marine Discharges and Pollution

ISSUE:
Discharge of pollutants into Cook Inlet may impair water quality or adversely affect beluga whales. These whales are often associated with nearshore waters adjacent to some metropolitan areas.

OBJECTIVES:
Insure marine point-source discharges are consistent with the recovery of the CI beluga whale. Encourage action to reduce non-point (runoff) pollution into Cook Inlet.

MANAGEMENT ACTIONS:
EPA authorizes point-source discharges into Cook Inlet. The Municipality of Anchorage treatment facility currently holds an EPA permit to discharge 58 million gallons per day. This facility has received a waiver from the secondary treatment requirements of the Clean Water Act to discharge treated primary effluent into Knik Arm, 800 feet offshore in approximately 15 feet of water. The waiver is based, in part, on the extreme mixing characteristics of upper Cook Inlet, high initial dilution rates, and a general absence of resident or sensitive biota. NMFS recommends the following measures:

*NMFS will consult with EPA on all National Pollution Discharge Elimination System (NPDES) permits for discharge of pollutants into Cook Inlet, strongly advocating the habitat requirements of the beluga whales.
* NMFS will recommend denial of any NPDES permit requests within High Value/High Sensitivity habitat.

Because some of these actions may be outside federal authorities, all responsible parties have not been identified at this time.

RESEARCH ACTIONS (APPENDIX D): (B2, C1, F3 previously listed under section I.d., I.h., and I.e. respectively)

I.n. Habitat Alteration and Coastal Development

ISSUE:
Development of Cook Inlet's coastal regions may reduce the quality and quantity of habitat for CI beluga whales.

OBJECTIVES:
Protect High Value/High Sensitivity beluga whale habitat from development. Conserve beluga whale habitats throughout Cook Inlet. Minimize disturbance to whales from coastal construction.

MANAGEMENT ACTIONS:
NMFS regularly comments or coordinates for various federal actions (under various laws such as MMPA, Fish and Wildlife Coordination Act, NEPA, and others) including development permits for coastal dredging and filling through the U.S. Army Corps of Engineers and for discharges through EPA. NMFS will continue to provide federal action agencies with specific recommendations to conserve the CI beluga whale. NMFS recommendations will be premised on the following:

*Development should not hinder or restrict movement of beluga whales.
*Development should not result in significant increases in water velocities, which could act as a barrier or deterrent to beluga whales (especially calves).
*Development should not result in increased water temperatures beyond normal ranges.
*Development should not occur in nursery areas, predator avoidance habitats (escape terrain), or important feeding areas (i.e., Type 1, High Values/High Sensitivity habitat).
*Development should not predispose whales to harassment.
*Development should not result in increased exposure to pollutants.
*Development should not have an unmitigable adverse effect on CI beluga whales due to noise.

RESEARCH LINKS (APPENDIX D): (B2, B3, F3, F4 previously listed under section I.d., I.f., I.e., and I.e. respectively)

I.o. Knik Arm Development

ISSUE:
Coastal development along Knik Arm may diminish habitat value.

OBJECTIVES:
Maintain the habitat values for CI beluga whales within Knik Arm.

MANAGEMENT ACTIONS:
To address Knik Arm development, NMFS recommends the following measures:

* Maintain and manage upper Knik Arm (north of Cairn Point) to maintain its unique value as beluga whale habitat. Seek to prohibit permanent development within High Value/High Sensitivity portions of upper Knik Arm. Vessel operations may be restricted in these waters whenever there is a high probability their presence would harass beluga whales.
*Ensure unrestricted movement along Knik Arm for beluga whales through consultation and coordination under the Fish and Wildlife Coordination Act, NEPA, and the MMPA for all coastal development projects.
*NMFS will advocate that CI beluga whales be considered as a planning element for any construction activities proposed for Knik Arm, and recommend major project sponsors conduct thorough research on the effects of their work on these whales.
*Monitor in-water noise levels in lower Knik Arm.
*Monitor the physical loss of habitat due to coastline development in Knik Arm.
*Regulate construction noise to reduce potential impacts to beluga whales.
*Prohibit causeways or other constrictions which could significantly alter water currents.

Because some of these actions may be outside federal authorities, all responsible parties have not been identified at this time.

RESEARCH LINKS (APPENDIX D): B1, B2, F3,F4 previously listed under sections I.e., I.d., I.e., and I..e. respectively)

I.p. Legal and Administrative Conservation Measures

ISSUE:
Coordinate conservation efforts with other agencies under applicable law to ensure human activity is consistent with the policies and purposes of the MMPA

OBJECTIVES:
Develop mechanisms for cooperative conservation efforts.

MANAGEMENT ACTIONS:
*Monitor federal actions for potential impacts to CI beluga whales.
*Consult with other agencies under federal law, including MMPA section 112(e).
*Distribute Conservation Plan to federal, Native, state, and local agencies and other interested parties.
*Develop co-management agreements under MMPA sections 112 and 119.
*Establish Conservation Plan Coordinator position.

Objective II. Continue and, as necessary, expand research or management programs to monitor trends and detect natural or human related causes of changes in the Cook Inlet stock of beluga whales and its habitat

NMFS recognizes that monitoring will be a common and critical component to this recovery strategy, as well as integral to several specific management actions and scientific research. Therefore, we are including this section which describes prominent monitoring efforts, identifies responsible parties, and presents information of funding aspects. Additionally, specific and general monitoring recommendations appear in Chapter 4.

II.a. Subsistence Harvest

This Plan has previously described past and current actions associated with management of subsistence harvests of CI beluga whales by Alaska Natives. Because the stock is currently depleted, and because our ability to manage this stock depends on accurate information on mortalities, monitoring of subsistence harvests is important. NMFS and our Alaska Native co-management partner have incorporated monitoring and reporting provisions into co-management agreements. This required Native hunters to report on all whales struck, landed, or struck and lost. Additionally, Native hunters are required to collect the jawbone from all harvested beluga whales to be used by NMFS for scientific purposes including genetic analysis, gender determination, and ageing. The hunters must also notify NMFS before hunting, so that additional biological sampling can occur when a whale is landed.

This monitoring effort also includes collection of samples under the AMMTAP. This program was established to be a long-term reference collection of marine mammal tissues. AMMTAP uses very stringent protocols for sample collection, preparation, and analysis and can analyze components at extremely small levels. Samples are collected from very fresh specimens, prepared under exacting conditions using titanium instruments and teflon containers, frozen in liquid nitrogen, and stored in cryogenic chambers at the National Institute of Science and Technology (NIST). A portion of all samples received are analyzed for a variety of contaminants, including heavy metals and chlorinated hydrocarbons. The AMMTAP database now has specimens from more than 32 CI beluga whales.

Monitoring of subsistence harvests will also include tissue samples analysis by NMFS's Northwest and Alaska Marine Science Center in Seattle, Washington.

The responsible party for this monitoring will be NMFS, in cooperation with co-management partners and NIST. Funding for this monitoring is not quantified, but will come out of agency program funding.

II.b. Habitat Condition

The concept of "recovery" depends on the ability of the habitat to support a given number of beluga whales (K). It is not reasonable to try to rebuild this stock to numbers which cannot be sustained by the available habitat. There are many habitat attributes which need to be monitored in order to understand the changes within the CI stock of beluga whales. These include water quality, physical aspects of the habitat, prey resources, acoustics, and others.

At this time, NMFS does not propose to undertake new monitoring of physical habitat or water quality. Rather, we will rely on coordination and consultation with other federal, state, and private agencies and organizations who perform such monitoring.

Paralytic Shellfish Poisoning (PSP) and demoic acid are naturally-occurring toxins associated with certain micro-organisms. These compounds are present in Cook Inlet, and can cause mortality in shellfish and other marine invertebrates. There are also numerous cases of marine mammals being injured or killed from ingesting fish carrying these agents. We have no evidence of such effect within beluga whales. The State of Alaska, Department of Environmental Conservation, regularly tests certain areas of Cook Inlet for PSP and DA. Ths monitoring research is funded in part by commercial shellfish industry and provides a long term database for this water quality issue. It is useful to review these monitoring reports in light of other water quality monitoring and the health indices of beluga whales.

Prey base cannot easily be measured or monitored. NMFS will advocate research into this subject (see Research Plan B2, D3), as well as encourage more monitoring of adult salmon returns into streams entering the mid and upper Inlet.

II.c. Abundance and Distribution

NMFS considers it necessary to monitor abundance within this population. It is desirable to obtain accurate estimates for several purposes, including subsistence harvest management, recovery objectives, and the need for further protective measures such as ESA listing. Abundance monitoring also present opportunity to collect other information such as distribution, age distribution (based on coloration), behavior, etc. NMFS's National Marine Mammal Laboratory and Alaska Regional Office have conducted aerial surveys of beluga whales in Cook Inlet each June/July since 1993. The methodology for these surveys is described in Rugh (1999). A May 13, 2001 letter to NMFS from the Scientific Review Group strongly urged NMFS to continue these annual surveys. Aerial surveys are proven to be the most efficient method for collecting distribution and abundance data for beluga whales in Cook Inlet (Rugh et al.1999.).

Distribution is fundamental to our understanding of the whales' ecology. This allows NMFS to identify important habitats and migratory movements. As previously described in Chapter 2, NMFS has placed satellite and radio tags on beluga whales in Cook Inlet to study their movements. These data have shown that at least some of these whales remain in the mid and upper Inlet year round, rather than moving well into the lower Inlet or Gulf of Alaska during winter months. These data are too few to characterize the entire population, but verify that Cook Inlet provides beluga whale habitat during all seasons.

Abundance surveys and monthly distributional surveys flown by NMFS have identified high density/high use habitat sites, largely within upper Cook Inlet. While the same sites consistently show this intensive use by beluga whales during summer months, there has been considerable variation in the use of any one site, both within and between years.

This variability may be due to changes in fish runs, as TWK of Native hunters informs us.

II.d. Contaminants

As previously described, NMFS and NIST have studied contaminant levels within this population. The results do not indicate pollution or contaminants are presently contributing significantly to the decline, nor preventing the recovery, of these whales. NMFS believes it is important to periodically monitor these levels, and will continue to obtain tissue samples to be sent to NIST for archival and/or analysis. Research item C1 in Appendix D details continuation of contaminant monitoring of beluga whale tissues. Additionally, several commenters have expressed interest in the levels of hydrocarbons in CI beluga whale tissues. NMFS will investigate the feasibility for analysis of hydrocarbons within these whales, and add this to the sampling and analytical protocols if indicated.

Objective III Assess the implementation of the Conservation Plan, based on implementation of Conservation Actions and completion of high priority studies.

III.a. Coordinate efforts with tribes, other agencies, and countries

NMFS must continue to support and provide for cooperative management agreements with tribes and tribally-recognized organizations to further enhance the probability of recovery and to make optimal use of Native traditional knowledge and wisdom.

III.b. Alaska Native Sentinel Program

The Island Sentinel Program of the Pribilof Island's optimizes local resident observation of biological events occurring on the island when government biologists are not on the islands. It provides year-round observations of marine mammal abundance and distribution on and around the islands, while identifying environmental anomalies. It has engaged local residents as sentinels promoting the importance of stewardship and responsibility for understanding the Pribilof Islands' many life systems in a holistic fashion. The Program acts as a repository for a significant number of observations of the Pribilof ecosystem dealing with many different but interrelated environmental issues and has been 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 going to be a key element for continuing (and expanding) the Sentinel Program at other locations.

NMFS proposes to engage the local Native communities, Cook Inlet Treaty Tribes, and other Alaska Native Organizations towards the development of a Cook Inlet Sentinel Program with purposes similar to those of the Pribilof Program.

III.c. Promote joint research and collaborative programs

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.

III.d. Education and outreach programs as conservation actions

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. Such programs can be implemented through the co-management process with the Tribal governments when feasible. 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 the recovery of Cook Inlet beluga whales. 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.

III.e. Distribute Conservation Plan

The approved Conservation Plan and implementation schedule, should be sent to appropriate agencies, Native organizations, tribes, individuals, organizations, and governments.

III.f. Enforce existing regulations

In addition to its role in directly protecting animals, enforcement of regulations are an important educational tool. However, the successful enforcement of regulations requires extensive field work and is expensive. If information is gathered that is likely to result in successful conviction of violators of federal regulations, such cases should be given high priority. It is essential that violators are prosecuted in a timely fashion so that the seriousness of regulations and the effectiveness of enforcement are made evident.

5. IMPLEMENTATION SCHEDULE

The Implementation Schedule follows outlines, actions, and estimated costs for the conservation program for CI beluga whales, as set forth in this Conservation Plan. It is a guide for meeting the conservation goals outlined in this Plan. This schedule indicates action descriptions, action priorities, action start, duration of actions, and estimated costs.

Priorities presented in the Implementation Schedule are assigned as follows:

Priority 1	Actions that must be taken to prevent further declines within the population.
Priority 2	Actions that must be taken to foster recovery and conserve habitat quality.
Priority 3	All other actions necessary to provide full conservation of the population.

COOK INLET BELUGA WHALE COST IMPLEMENTATION SCHEDULE								
			Estimate Fiscal Year (FY) Costs Thousands of dollars ($K)					
Objective	**Priority**	**Time**	**FY1**	**FY2**	**FY3**	**FY4**	**FY5**	**Comments**
I. Identify, eliminate or mitigate factors responsible for the decline of the Cook Inlet beluga whales, or which may be preventing their recovery								
STRANDING EVENTS								**-----**
Monitor Killer Whales in Cook Inlet	3	As needed						$5-30 K / year
Disease, Pathology, Health Index	3	Annually	45	45	45	45	45	
Estimating Age, Age of Maturity, and Indices of Growth from Teeth	3	Annually	-	25	15	5	5	
Cook Inlet Beluga Strandings	2	As needed						$5-15 K / year
Turnagain Arm Response Plan	2	As funded	20	14	-	-	8	
Stranding Workshop (forensics, protocols, network, subsistence, etc.)	3	As needed	-	35	15	-	-	
Contracts (veterinary, Native, etc.)	3	As needed	8	8	15	18	22	
Biological Samples (collection, tests, etc.)	2	As needed	15	15	18	18	20	
Create and Update Stranding Catalog	3	Annually	15	12	5	5	8	
PREDATION								**-----**
Population Trends of Belugas	2	Annually	6	8	10	12	14	

SUBSISTENCE HARVEST								**-----**
Abundance Calculations, including Aerial Surveys and Video Analyses	2	Annually	n/a	n/a	n/a	n/a	n/a	already calculated
Dive Behavior Study	3	Annually	21	25	30	-	25	
Harvest Monitoring and Mortality Estimation	1	As needed	15	15	15	18	20	
Promulgate Harvest Regulations	1	Immediatel y	20	16	-	-	-	
COMMERCIAL FISHING								**-----**
Characterize Beluga Habitat	2	As funded						$30-50 K / year
Food Item Analysis	2	As funded	12	12	12	12	12	
Diet Analysis	2	As funded						$40-70 K / year
Forage Fish Analysis	2	As funded						$70-90 K / year
Incidental Take by Commercial Fisheries	2	As funded						not identified (page 58)
Interact with State Board of Fisheries on Commercial Fishing and Impacts to Belugas	3	Annually	-	10	20	15	20	
Work with State to Expand Cook Inlet Fish Surveys	3	As funded						$50-100 / year
VESSEL TRAFFIC								**-----**
Distribution and Movement	1	As funded	-	140	140	-	100	
Habitat Impact	2	As funded						not identified (page 60)

Industry in Cook Inlet	1	As funded	-	25	30	30	35	
Monitor Boat Activity in Cook Inlet	2	As funded	-	20	20	20	20	
Outreach (signs, boating groups)	3	Immediatel y	-	30	20	8	8	
TOURISM / WHALE WATCHING								**-----**
Calving	2	Annually	18	18	20	20	20	
Develop Plan (guidelines, prohibitions)	2	Immediatel y	20	20	6	6	10	
Monitor Tourism Activities	2	As needed						$10-40 / year
Outreach (signs, viewing opportunities)	3	Immediatel y	-	25	15	5	5	
NOISE								**-----**
Enforce NMFS Acoustic Guidelines and Other Necessary Laws (NEPA, MMPA)	2	As needed	20	40	40	20	20	
OIL AND GAS								**-----**
Contaminant Analysis	1	Annually	35	35	35	35	35	
Establish Protected Areas	1	Immediatel y	35	35	25	10	10	
Project Reviews (NEPA, MMPA, etc.)	2	Annually	20	20	25	25	30	
RESEARCH								**-----**

Monitoring Recover Status by Proportions of Dark vs White Whales	2	Annually	6	6	6	6	6	
Capture and Handling Protocols and Tag Design and Attachment Development	3	As funded						$20-40 / year
Female Reproductive Biology	2	Annually	1	1	1	1	1	
Stock Identification, Subdivision, and Forensics	2	As funded						$20-70 K / year
Mating Systems within Cook Inlet Beluga	2	As funded						$10-40 K /year
Government to Government Meetings with Alaska Native Organizations	1	Immediatel y	10	25	25	14	14	
Implement NMFS Research Plan	2	As funded	n/a	n/a	n/a	n/a	n/a	already calculated
Monitor and Evaluate all Studies on Cook Inlet Belugas	3	Annually	50	50	40	40	50	
Scientific Workshops	3	As funded	-	50	-	50	-	
Collection of Information on Harvested Belugas	2	As needed	5	5	6	7	9	
OIL SPILLS								-----
Develop Oil Spill Response Plan	2	Immediatel y	-	50	40	15	15	
Monitor Hydrocarbons in Belugas	1	Immediatel y	60	60	60	60	60	

ENFORCEMENT								**-----**
Monitor Cook Inlet for Illegal Activity	1	Annually	50	25	25	25	25	
Outreach and Education (signs, etc)	3	As funded	-	20	20	13	13	
Collaborate Efforts with State and Other Federal Agents	3	Annually	10	10	15	15	19	
Government to Government with Tribal Enforcement Issues	2	Annually	10	10	10	10	10	
OUTREACH AND EDUCATION								**-----**
Create a Community Education Program	3	As funded	-	-	50	15	15	
MARINE DISCHARGES AND POLLUTION								**-----**
Project Reviews (NPDES, etc.)	2	As needed	10	10	15	15	20	
HABITAT ALTERATION AND COASTAL DEVELOPMENT								**-----**
Project Reviews (NEPA, MMPA, CWA, FWCA, etc.)	2	As needed	15	15	20	20	25	
KNIK ARM DEVELOPMENT								**-----**
Project Reviews (NEPA, MMPA, CWA, FWCA, etc.)	2	As needed	10	10	15	15	15	
Develop Management and Monitoring Plan for Knik Arm	2	Immediatel y	-	25	25	13	13	

LEGAL AND ADMINISTRATIVE CONSERVATION MEASURES								**-----**
Monitor and Advise with Other Parties on Federal Actions in Cook Inlet	2	Annually	-	20	20	30	30	
Distribute Draft Conservation Plan and Final Conservation Plan in 2005.	2	Immediatel y	20	-	-	-	-	
Develop Co-management Agreement(s) under MMPA, Section 112 and 119	2	Immediatel y	30	50	20	20	20	
Create Conservation Plan Coordinator Position	High	Immediatel y	100	100	100	100	100	
II. Continue and, as necessary, expand research or management programs to monitor trends and detect natural or human related causes of changes in the Cook Inlet stock of beluga whales and its habitat								
SUBSISTENCE HARVEST								**-----**
HABITAT CONDITION								**-----**
ABUNDANCE AND DISTRIBUTION								**-----**
CONTAMINANTS								**-----**
III. Assess the implementation of the Conservation Plan, based on implementation of Conservation Actions and completion of high priority studies.								
COORDINATE EFFORTS WITH TRIBES, OTHER AGENCIES, AND COUNTRIES								-----
ALASKAN NATIVE SENTINEL PROGRAM								

PROMOTE JOINT RESEARCH AND COLLABORATE PROGRAMS								
EDUCATION AND OUTREACH PROGRAMS AS CONSERVATION ACTIONS								
DISTRIBUTE CONSERVATION PLAN								
ENFORCE EXISTING REGULATIONS								

6. ENDANGERED SPECIES ACT STATUS REVIEW OF COOK INLET BELUGA WHALES

On March 3, 1999, NMFS received two petitions to list the CI stock of beluga whales as endangered under the ESA. The petitions requested that NMFS promulgate an emergency listing under section 4 (b)(7) of the ESA, designate critical habitat for CI beluga whales, and take immediate action to implement rulemaking to regulate the harvest of these whales. NMFS determined these petitions presented substantial information which indicated the petitioned action(s) may be warranted (64 FR 17347, April 9, 1999). Subsequently, on June 22, 2000 NMFS determined the petitioned listing was not warranted because legislative and management actions had been taken to reduce subsistence harvests to levels that would allow recovery. That determination was later upheld in a court decision (Cook Inlet Beluga Whale, et al. v. Daley, No. 00-1017 (D.C. August 20, 2001). During this petition review, NMFS established the CI beluga whale is a Distinct Population Segment and therefore, a species as defined under section 3(15) of the ESA (65FR 121, June 22, 2000).

The CI beluga whale was, until recently, listed as a candidate species under the ESA. This action was taken on August 31, 1988 (52 FR 33516). Candidate species are defined to be species for which substantial information is available to support a listing, but have not yet been proposed for listing. NMFS has since instituted a new classification system which restricts the term "candidate species" to those for which a petition to list has been received and for which NMFS has initiated the review process (69 FR 19975). Other species which are of concern but are not actively under listing review (e.g., CI beluga whale) are now classified as "Species of Concern." Because the CI beluga whale stock is designated as depleted and strategic under the MMPA, it is currently listed as a Species of Concern.

The ESA defines endangered species as a species "in danger of extinction throughout all or a significant portion of their range in the foreseeable future." Section 4(a)(1) of the ESA explicitly requires that any determination of the status of a species consider the following five factors:

A) the present or threatened destruction, modification, or curtailment of its habitat or range;
B) overutilization for commercial, recreational, scientific, or educational purposes;
C) disease or predation;
D) the inadequacy of existing regulatory mechanisms; and
E) other natural or manmade factors affecting its continued existence.

That is, to be listed, a species must be threatened or endangered *because* of one of these five factors. Addressing the five factors is a necessary component of the criteria identified here when considering listing the CI beluga whale. A brief summary of current knowledge on CI beluga whales in these subject areas is provided here, as well as indications of the types of information needed and determinations made if a proposal is made to list.

A) The present or threatened destruction, modification, or curtailment of its habitat or range.
As discussed in Chapter Three, some potential for degradation of CI beluga whale habitats comes from a variety of sources. Shoreline development has occurred throughout much of the Inlet, although this is not extensive. Anthropogenic noise has probably altered this habitat in a way that could be

detected by beluga whales, although various observations suggest that marine mammals can habituate to even quite high levels of sound (Geraci and St. Aubin 1980). Whether real-life sources of noise negatively impact behavior to the point that it diminishes reproductive success and population productivity is unclear. Portions of the Inlet have been developed for oil production, while other areas are now open to leasing and exploration. Oil spills have occurred in Cook Inlet and remains a probability.

B) Overutilization for commercial, recreational, scientific, or educational purposes.
Past harvesting practices within the CI stock of beluga whales is considered to be a major contributing factor to its decline. However, no commercial hunting has occurred for several decades nor is it expected to occur again.

Scientific activities on CI beluga whales frequently involve close approaches to the animals for the purpose of tagging, genetic sampling, or behavioral studies. These activities are controlled by permits in both U.S. and Canadian waters, and potential negative impact on the animals is considered in the permitting process. While the potential for disturbance, harassment, injury, or death exists for scientific research, the overall impact from this activity is likely minimal at this time. However, permitting of scientific research should be monitored closely to ensure adverse effects from the research are minimal or nonexistent.

C) Disease or predation.
As noted earlier in this plan, disease is not known to be a factor in the decline of the CI beluga whale. However, due to the small size of this stock and their gregarious social nature, introduction of a highly virulent and transmissible pathogen has the potential to catastrophically affect their long term viability. Predation by killer whales has been documented within this stock, and may occur at levels which are significant in terms of recovery.

D) The inadequacy of existing regulatory mechanisms.
Beluga whales are currently protected under the MMPA, and are designated as a depleted stock. This status necessitates preparation of a Conservation Plan for the purposes of conserving and recovering the stock to its OSP. They are also listed as a strategic stock under MMPA. The MMPA provides mechanisms for protecting these animals from takings, and protects important habitats to a limited extent. The need for or adequacy of regulatory mechanisms for vessel operations within High Value/High Sensitivity habitat requires further analysis.

E) Other natural or manmade factors affecting its continued existence.
Aside from the factors discussed here and elsewhere in this plan, no other natural factors are known to be negatively impacting the recovery of CI beluga whales at this time. However, other factors may be identified later that directly or indirectly threaten the species.

In any contemplated listing action, the best available information (data) must be used, and justification provided regarding these or any other factors. If ESA listing for CI beluga whales is contemplated, threats represented in any of the five listing areas (factors) need to be present. At the time of this writing, there is evidence that one or more of these factors would apply to this stock.

Additionally, the Status Review and NMFS' June 2000 finding that ESA listing was not warranted were premised on at least two findings which may justify further review. First, the only factor then known to be responsible for the decline in abundance was subsistence harvest. As discussed (above), other factors are now thought to have the potential to impact the CI beluga whale. Second, the 2000 Review employed simulation modeling efforts which demonstrated this stock was not likely to decline further if the harvest was controlled. Abundance estimates since harvest management began in 1999 have not shown significant growth, challenging this assumption.

The National Marine Mammal Lab (NMML) has developed population models which consider the effects of various harvest plans in terms of the growth and recovery of the CI beluga whale. In these models, NMML scientists have identified several indices which should be considered in establishing a threshold below which further harvest removals would present unacceptable consequence to recovery and survival. The factors considered in this lower threshold included 1) an Allee effect, 2) inbreeding depression, 3) loss of genetic variability, 4) vulnerability to environmental perturbations due to reduced range, 5) vulnerability to environmental perturbations due to reduced population size, and 6) vulnerability to demographic stochasticity due to reduced population size. These same factors are necessary considerations in determining the status of these whales under the ESA, and warrant further analysis.

In consideration of the factors described above, and because it has been five years since the last Status Review for these whales occurred, we believe it is appropriate to again assess this stock for possible listing under the ESA. Therefore, NMFS will initiate a formal Status Review for the CI beluga whale commensurate with the development of this Conservation Plan. Specific time frames for this Review will be developed over the coming months.

7. SUMMARY AND CONCLUSIONS

The recovery of the CI beluga whale will require decades. During the early phase of recovery this stock will exist at a precarious level of abundance from which further declines may not be recoverable. Challenges to the recovery of these whales include our imperfect understanding of the reason(s) this stock has declined, and of which measures are most needed for its rebuilding. Recovery may be delayed or prevented by actions which impact the whales directly (such as hunting, ship strikes, predation by killer whales, or strandings) or which effect their habitat (reductions in prey species, oil spills, marine discharges). Some of these concerns have a more-pronounced effect on the CI beluga whales than others. Certain impacts to recovery are difficult in that they have no easy "fix." There appears to be little that can be done to prevent killer whales from eating beluga whales, for example, or to keep beluga whales from stranding. NMFS has taken action to address harvest within this stock, which we considered to be the largest single impediment to recovery. The impact of many other issues confronting the CI beluga whale, and the efficacy of this Plan, may not become known until more research and monitoring has occurred over the coming years. Until then, this Plan has attempted to identify and prioritize actions necessary to begin the recovery process. We recognize the list of actions is probably incomplete, as is our present knowledge of the ecology and biology of these whales. However, we believe this Plan is *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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9. LIST OF PREPARERS

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APPENDIX A. 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 2003

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 (CI) stock of beluga whales 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 with CIMMC under section 119 (16 U.S.C. 1388) of the Marine Mammal Protection Act of 1972 (MMPA). Section 3022 of the 1999 Emergency Supplemental Appropriations Act (Pub. L. 106-31) provided a temporary requirement that the hunting of Cook Inlet beluga whales for subsistence uses by Alaska Natives must be conducted pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations; this requirement for a cooperative agreement was subsequently made permanent by section 627 of Pub. L. 106-553. Additional guidance is provided by Executive Order #13084 of May 14, 1998 ("Consultation and Coordination with Indian Tribal Governments," 63 FR 27655), Presidential Memorandum of April 29, 1994 "Government-to-Government Relations with Native American Tribal Governments," U.S. Department of Commerce Memorandum "American Indian and Alaska Native Policy of the U.S. Department of Commerce" of March 30, 1995, and the "Memorandum of Agreement for Negotiation of Marine Mammal Protection Act, section 119 Agreements" of 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 CI stock of beluga whales; to meet the subsistence needs and customs, traditions, and culture of Alaska Natives by providing an opportunity for a limited harvest of the CI beluga whale by the Native Village of Tyonek (NVT) during 2003; and to promote scientific research on the CI beluga whale stock and their 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 CI beluga whales. CIMMC is composed of Cook Inlet village representatives and hunters who hunt CI 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.

On May 21, 1999, Pub. L. 106-31 required that the taking of a CI beluga whale shall occur pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations. This authority expired on October 1, 2000.

On December 21, 2000, the requirement, established in May 1999, for a cooperative agreement was made permanent.

V. MANAGEMENT OF COOK INLET BELUGA WHALES

The Parties agree that the Native harvest of CI beluga whales during the calendar year 2003 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 which 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 insure against the loss of the whale.

3. All CI beluga whale hunting shall occur on or after July 1, 2003 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 hunt.

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

6. 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 and with current practice of NVT, 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 of non-edible by-products of a beluga whale taken under a permit authorized herein for use as handicrafts or clothing.

8. Upon harvesting a CI beluga whale, the whaling captain shall remove and retain the lower jawbone, and must make the jawbone available to CIMMC or NMFS within 24 hours of the harvest. CIMMC shall thereafter provide the jawbone to NMFS Anchorage office within three days of the harvest. The whaling captain shall also provide the harvest information to CIMMC or NMFS within 30 days.

9. All hunters shall comply with the provisions of this agreement and any permit issued by CIMMC. Non-compliance with any provisions may result in the loss of hunting privileges for CI beluga whales and prosecution.

10. Any unauthorized striking of a CI 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 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. 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 CI beluga whale.

VI. RESPONSIBILITIES OF CIMMC

A. CIMMC, in cooperation with NMFS, will manage the CI beluga whale subsistence harvest. The authority and responsibilities of CIMMC are 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 CI whale shall notify, as soon as practical, the other party to this agreement of the enforcement action.

C. CIMMC, in consultation with NMFS, may conduct research on the biology, natural history, and traditional knowledge of the CI 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 as specified in VII.B. below.

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 CI 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 CI 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 applicable to the Native harvest of beluga whales.

IX. OTHER PROVISIONS

A. Nothing herein is intended to conflict with current NOAA or NMFS directives. 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, 2003. 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	James W. Balsiger Date
Chairman,	Administrator, Alaska Region
Cook Inlet Marine Mammal Council	National Marine Fisheries Service
PO Box 82009	P.O. Box 21688
Tyonek, AK 99682	Juneau, AK 99802-1668

APPENDIX B. HARVEST MANAGEMENT PLAN

RESERVED

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, 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 insure 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.

Beluga whale

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 whale 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 insure 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: 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°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 1940's. 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 animals 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

O.A	Stranded animals are cetaceans (e.g., beluga, killer, or minke whale or harbor porpoise)	Go to 1
O.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°F and/or bright sunshine	Go to 3
2.B	Temperatures less than or at 50°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 (See attached).	

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 (See attached).
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 fear 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 sized 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 (See attached).
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 (See attached).
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 (See attached).

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 271-3711 or the Juneau Regional Office, Tel. (907) 586-7236, FAX 586-7131.

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 are 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	586-7236
	OFFICE
Barbara Mahoney	271-3448
Brad Smith	271-3023
Daniel Vos	271-6379

NOAA ENFORCEMENT	
Mike Adams	271-1823
Matt Clark	271-1823
Les Cockreham	271-1823
Kevin Heck	271-1823
Mark Kirkland	271-1823

APPENDIX D. COOK INLET BELUGA WHALE RESEARCH PLAN

COOK INLET BELUGA WHALE RESEARCH PLAN

prepared by:
National Marine Mammal Laboratory (NMML)
Alaska Fisheries Science Center
NOAA Fisheries
Department of Commerce

with:
Alaska Region, Protected Resources Division (AKR/PR)
Northwest Fisheries Science Center (NWFSC)
Southwest Fisheries Science Center (SWFSC)

24 February 2005

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Introduction

The small population (or stock) of belugas, *Delphinapterus leucas,* in Cook Inlet is geographically and genetically isolated from four other populations that occur around Alaska (Hazard, 1988; O'Corry-Crowe et al., 1997). Unlike the other stocks in Alaska, belugas in Cook Inlet occupy a relatively restricted body of water and do not migrate large distances. They are exposed to one of the highest concentrations of humans in Alaska in that the city of Anchorage borders some of the belugas' primary habitats. In this way, they may be considered a corollary to the small population of belugas that inhabits the St. Lawrence River estuary in eastern Canada (Sergeant, 1986; Kingsley, 1998; Lesage et al., 1999). A recent decline in abundance (Hobbs et al., 2000), distribution (Rugh et al., 2000), viability (Hill and DeMaster, 1999), and availability to Alaska Native hunters (Huntington, 2000) has aroused concern for the Cook Inlet beluga stock. The documented decline of this stock through the 1990s (Hobbs et al., 2000) and its designation as depleted under the Marine Mammal Protection Act (Fed. Regist., 65:34590-34597) has been attributed, in part, to overexploitation by subsistence hunters (Mahoney and Shelden, 2000).

Research on belugas is funded through the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NOAA Fisheries). Beluga research in Cook Inlet is carried out principally by three groups: the National Marine Mammal Laboratory (NMML) at NOAA Fisheries, Alaska Fisheries Science Center; NOAA Fisheries, Northwest Fisheries Science Center (NWFSC); the NOAA Fisheries Alaska Region, Protected Resources Division (AKR/PR); and the NOAA Fisheries Southwest Fisheries Science Center (SWFSC). These research efforts are conducted in cooperation with the Cook Inlet Marine Mammal Council (CIMMC) and the Alaska Beluga Whale Committee (ABWC). Under provisions of the Marine Mammal Protection Act of 1972 (MMPA) and the Endangered Species Act of 1973 (ESA), scientific research of marine mammals requires a formal permit (as per 50 CFR Part 216). Accordingly, NOAA Fisheries has conducted studies of belugas in Cook Inlet through September 2003 under MMPA Research Permit 782-1438 which allows for Level B harassment of whales during aerial surveys and Level A harassment during tagging operations. A new permit has been applied for and should be available in 2004.

Research efforts by NOAA Fisheries focus on beluga population abundance estimation, trends in abundance, distribution, stock identification, general biology and life history, and human interactions. Additional research has also been conducted on belugas by some conservation organizations, Minerals Management Service (MMS), the Alaska Department of Fish and Game (ADF&G), and the Alaska Beluga Whale Committee (ABWC). While there are a number of entities involved in both research and management issues concerning belugas in Cook Inlet, the content of this Cook Inlet Beluga Research Plan is restricted to research funded through NOAA Fisheries and conducted or proposed by NOAA Fisheries.

Management

The MMPA authorizes NOAA Fisheries, acting on behalf of the Secretary of Commerce, to regulate Alaska Native subsistence harvest of depleted marine mammal stocks after regulations specific to a depleted stock are issued and an opportunity for notice and hearing on the record has been provided (16 U.S.C. § 1371(b)(3)). As a preliminary step towards regulating the Alaska Native subsistence harvest, NOAA Fisheries issued a Final Rule on 31 May 2000 (65 FR 34590) designating the Cook Inlet beluga whales as depleted within the meaning of Section 3(1) of the MMPA, as amended and codified at 16 U.S.C. § 1362(1) and the underlying regulations codified at 50 C.F.R. Part 216. However, NOAA Fisheries determined that listing the Cook Inlet beluga whales as "endangered" or "threatened" under the Endangered Species Act was not warranted based on the best scientific and commercial data available.

Management responsibility for belugas in Alaska lies with the Alaska Region, Protected Resources Division. As mandated by the MMPA, NOAA Fisheries is required to maintain the health and stability of marine ecosystems. The mandates of the MMPA result in a fundamental objective of management to prevent "depletion" of a species or population or to restore a population to its optimum sustainable population (OSP). A species or population is said to be depleted when the Secretary of Commerce "determines that a species or population stock is below its optimum sustainable population [OSP]." OSP is "the number of animals which will result in the maximum productivity of the population or the species, keeping in mind the carrying capacity of the habitat and the health of the ecosystem of which they form a constituent element" (MMPA 1995). Consistent with this mandate, three explicit goals of the MMPA are to: 1) maintain stocks at their OSP levels and as functioning elements of their ecosystems; 2) restore depleted stocks to OSP levels; and 3) reduce incidental mortality and serious injury (from commercial fisheries) to "insignificant levels approaching a zero mortality and serious injury rate" (MMPA 1995, Barlow et. al 1995).

Generally, under the MMPA, the Potential Biological Removal (PBR) level is used as a management tool to ensure that a stock impacted by fisheries or other human activities will be restored to its OSP. The PBR is defined as "the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population" (MMPA 1995). Estimates of human-caused mortality are compared to the PBR. In instances when the human-caused mortality of a given stock exceeds the PBR, the stock may be declared "strategic," an indication that the stock has a level of human-caused mortality and serious injury that is likely to cause the stock to be reduced below its OSP. Management efforts must be directed, principally, at preventing a stock from reaching the point of depletion. Should a stock become depleted, management efforts must be directed at returning that stock to and maintaining it at its OSP.

Although the PBR approach is used to manage human activities, primarily fisheries interactions with marine mammals, it is not considered appropriate for the management of Alaska Native subsistence harvest. Instead, NOAA Fisheries has entered into a management partnership with the CIMMC to co-manage the subsistence use of belugas in Cook Inlet. The agreement between NOAA Fisheries and the CIMMC includes, as a principal objective, provisions for the maintenance of beluga population levels that will allow for long-term sustainable harvests. Native Alaskans traditionally hunt belugas for subsistence food and handicrafts and have an accumulation of traditional knowledge associated with this species (Huntington 2000). The CIMMC represents Native interests on matters associated with CI belugas. On 23 May 2000, NOAA Fisheries entered into an interim cooperative agreement with CIMMC to co-manage the Cook Inlet beluga stock. The interim agreement allowed for the harvest of 1 beluga during 2000, noting that any whale that was struck but lost also counted against this harvest limit. The harvest was allocated to the Native Village of Tyonek by the CIMMC, however, the hunts were not successful. The agreement expired on 31 December 2000. As a part of the regulation of the harvest of belugas in Cook Inlet, NOAA Fisheries published a notice of proposed rulemaking in the Federal Register on October 4, 2000 (see Taking of Cook Inlet, Alaska, Stock of Beluga Whales by Alaska Natives, 65 FR 59164-59170 (proposed October 4, 2000), to be codified at 50 C.F.R. Part 216). The proposed rule's objective is to recover the depleted stock of Cook Inlet beluga whales to its OSP level while preserving the traditional subsistence use of the marine mammals by Alaska Natives to support their cultural, spiritual, social, economic, and nutritional needs. Six strikes over a four year period (2001-2004) will be allocated by NOAA Fisheries through co-management agreements. Four of the strikes, not to exceed one per year, are to be allocated to the Native Village of Tyonek. The remaining two strikes will be allocated to other Cook Inlet subsistence hunters, with no more than one strike being allocated during any single year.

The 1994 amendments to the MMPA (Section 117) require that NOAA Fisheries produce a Stock Assessment Report (SAR) on the status of each species under its jurisdiction. Certain key population parameters are required to describe the status of the stock, including population size. Minimum population estimates are also needed for the calculation of a PBR level, also required in the SARs.

To meet the management objectives, mandated by the MMPA and defined within the co-management agreement, specific information must be available to managers. Management must: 1) be able to identify a discrete group of animals (i.e., a stock or population); 2) describe the status of this unit, including minimum population estimates and the trend in abundance; 3) estimate human-induced mortality levels, including those resulting from commercial fisheries and subsistence removals; and 4) understand the species' biology and ecology to determine how the species may be affected by environmental stochasticity. The principal categories of research presented in this plan are designed to provide information to meet the management objectives.

Purpose of the Cook Inlet Beluga Research Plan

This document is intended to:

1) Identify specific research questions, and rank them in relation to management information requirements (see "Research Objectives in Support of Conservation Goals");

2) Define specific projects and experiments capable of answering these questions, and integrate them into a comprehensive research effort;

3) Develop a time-line and scope, and identify contingencies for each project relative to the management information requirements, available funding, and personnel;

4) Describe anticipated products from this research and relate them to management information requirements;

5) Describe additional research projects that are currently unfunded, but for which funds are being sought.

A Research Plan will provide the opportunity for effective evaluation of existing beluga research and a vehicle for modifications to research in response to evolving management objectives. The timescale is intended to be a five-year outlook; although the document may be revised annually. A five-year timescale was chosen to fit with budgeting cycles within the agency and provide a full development of multi-year projects so that future funding needs can be anticipated well in advance.

It is anticipated that this document will:

1) Facilitate dialogue, coordination, and collaboration among NOAA Fisheries-funded beluga researchers and NOAA Fisheries managers through the process of annually reviewing, evaluating, and updating the Research Plan;

2) Act as a basis for integration of non-NOAA Fisheries funded research into a comprehensive and collaborated design, avoiding duplication of efforts among beluga researchers; and

3) Serve a useful role in the co-management process by drawing together the current and proposed descriptions of beluga research projects funded by NOAA Fisheries. In doing so, the plan should enhance communication between NOAA Fisheries and the CIMMC by describing NOAA Fisheries-funded research plans and priorities. Similarly, the plan is expected to provide helpful information to the Alaska Scientific Review Group about NOAA Fisheries-funded beluga research.

The Research Plan begins with a list of management objectives with specific research questions. The projects and experiments needed to answer these are listed below. Several different experiments may be necessary to answer specific questions and some experiments will contribute information to answer several different questions. The specific projects are organized according to broad research categories with individual tasks outlined in greater detail. Each task includes research category overview, objectives, justification, methods, product, five-year project status, and project lead. The scope of research projects includes both short- and long-term tasks, depending on the nature of the investigation. An integrated time-line is given at the end. This Research Plan will be evaluated and revised annually as research and management objectives are met, needs evolve, and funding commitments change.

Conservation Goals and Objectives

The current conservation goal will be met when the population of Cook Inlet belugas has increased to the level where it is no longer considered depleted under the MMPA. The lowest reliable abundance estimate was 313 in 2002(CV = 0.14; NOAA Fisheries, unpubl. data), which was 24 percent of the carrying capacity, based on the highest available abundance estimate of 1,300 estimated in the 1970s (Calkins 1989). The population level at which NOAA Fisheries would reconsider the depleted classification, the optimum sustainable population (OSP), is set at 780 (60 percent of 1,300). The latest abundance estimate (366 in June 2004; CV = 0.20; NOAA Fisheries, unpubl. data) is 28 percent of the carrying capacity and only 47 percent of OSP.

Research Objectives in Support of Conservation Goals

1) Detect changes in the beluga population.

Research questions:

a) What is the current abundance?

b) What is the trend in abundance?

c) What is the current effective population size of CI beluga whales?

d) Is the CI beluga whale a panmictic population?

2) Assure rapid recovery to OSP.

Research questions:

a) What is the current annual range of CI beluga whales?

b) Are the current estimates of carrying capacity (K) and OSP reasonable?

c) What was the historic range of this population?

d) Is this range still available to the CI beluga whales?

e) What is a reasonable harvest level for CI beluga whales?

3) Ensure that habitat is available for recovery.

Research questions:

a) What are the current annual habitat use patterns of CI beluga whales?

b) Has beluga habitat been degraded significantly in the recent past, and if so, is the change human-caused or due to natural causes?

c) Are there sufficient habitat resources to sustain the current population?

d) Is the population healthy?

e) What are the human impacts on this population?

f) What elements in their habitat can be realistically changed for the better?

h) Is oil and gas development compatible with the recovery?
i) Is development in lower Knik Arm compatible with recovery?
j) Are any fishing activities impacting this population?

RESEARCH CATEGORIES

A. ABUNDANCE AND TREND ESTIMATION

Overview:

Abundance and distribution of this stock have been the focus of NOAA Fisheries-funded studies. Annual aerial surveys since 1993 have shown that beluga whales in Cook Inlet are very concentrated in a few river mouths along the northern portions of the inlet in June/July (Rugh et al. 2000). Corrections for subsurface whales not visible to aerial observers (availability bias) have been developed from dive interval data collected via VHF radio tags using suction cup attachments (Lerczak et al. 2000). However, more sampling is needed to refine this critical correction factor and to relate dive interval patterns to behaviors that are identifiable to aerial observers. Satellite tags with time depth recorders (TDRs) can provide information on movements and diving behavior (Laidre et al. 2002) that may be important to corrections for missed whales and missed groups.

A1. Abundance calculations, including aerial surveys and video analyses

Objective: Estimate abundance of belugas in Cook Inlet. Satisfies:1a; Supports 1b,c, 2a,e.

Justification: Annual abundance estimates are considered the highest research priority to monitor population status. Accurate annual abundance estimates are considered by the Alaska Scientific Review Group (AKSRG) to be the highest priority for research.

Methods: Each year in early summer (usually the first two weeks of June), NOAA Fisheries biologists conduct an aerial survey of all of coastal areas in Cook Inlet (within 3 km of shore) as well as offshore transects, effectively covering approximately 30 percent of the inlet waters. The standard altitude is 270 m (800 ft), and flight speed is 185 km/hr (100 knots), with surveys usually done in a twin-engine Aero Commander with bubble windows. Paired, independent searches are conducted by two observers on the shoreward side of the aircraft, providing a check of sightability of whale groups. A third observer searches from the other side of the aircraft, and a fourth makes data entries into a computer which automatically collects date, time, and location via a Global Positioning System (GPS). After a whale group is spotted, the aircraft is flown around the group in a racetrack pattern until four independent counts have been made by each of two pairings of observers. Because areas in the northern section of Cook Inlet, where almost all of the whales are found, are surveyed 3-5 times per season, some groups may be counted 40-60 times per year. In addition, a digital video camera records the whale group for analysis in the laboratory later. Most of these videoed passes are examined multiple times. The video allows counters to go through the tapes at whatever speed is necessary for an accurate count. These counts can then be corrected for animals not at the surface during the carefully measured counting intervals (see A3) and whales probably missed at the surface because they were too small (see A4).

Product: The total abundance of Cook Inlet belugas will be estimated annually. This estimate will comprise minimum population sizes in the form of the actual numbers of belugas counted on aerial surveys (also treated as the index count), counts adjusted for covariates, and estimates of abundance obtained by correcting for the proportion of the population unavailable to be counted during the aerial surveys.

Cost: Personnel: 4 people X 12 days (field operations); 2 people X 60 days (field prep, data analysis, and report writing); Funds: $85K
Five-year project status: Aerial surveys will continue to be conducted annually in a consistent manner, allowing for trend analysis (see A2). Abundance estimates will be produced annually and will be included in the respective annual reports.
Funding: $80K FY2005
Project lead: NMML

A2. Population trends analysis
Objective: Estimate population trends for the CI beluga whale stock and recovery time to OSP. Satisfies: 1b. Supports: 2b, e
Justification: Trend analysis of abundance time series are necessary to determine whether beluga numbers are increasing, stable, or decreasing. This trend information is fundamental to an understanding of population status (Gerber *et al.* 1999) and to the implementation of the PBR approach to management under the MMPA and managing subsistence harvest under co-management. Population trends may indicate adjustments to research objectives are needed, and they may monitor the effectiveness of management measures that are intended to assure the recovery of the CI beluga whales to OSP.
Methods: Abundance data from standardized aerial surveys and other data, such as observed gray to white ratio, number of new calves, etc., are included in a stochastic population projection model. Bayesian parameter estimation is used to estimate population model parameters and the distribution of recovery times.
Product: Results will provide estimates of beluga population growth rate, recovery time, impacts of various harvest policies, and other human activities.
Cost: Personnel: 1 X 30 days. Funds: $0K
Five-year project status: Trend estimates will be calculated annually after each abundance estimate is completed.
Funding: $0K/yr
Project lead: NMML

A3. Dive behavior study
Objectives: 1) Quantify dive interval and time at surface data as a function of animal's age, sex, location, season, and behavior. 2) Develop corrections for the beluga counts made during aerial surveys to estimate group sizes. 3) Calibrate summarized dive data from satellite tags. Supports: 1a, 3a,g,h,i.
Justification: Beluga dive behavior is highly variable as a function of season, location, 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. When groups are counted and video-taped from an aircraft (see above), an unknown number of animals beneath the water surface are missed. A specific correction method has been developed for video and counts from and is applied to this census data to obtain a population estimate for publication in the Stock Assessment Reports (SARs) and for use in the calculation of a Potential Biological Removal (PBR). This method depends heavily on the average dive interval of the beluga. Currently, this value is estimated from a total of only 10 hours of dive interval data on five beluga collected in 1994 and 1995 (Lerczak et al. 2000). This limited data set has been questioned in public meetings, may be biased by 20 percent or more, and is clearly the weakest component of the abundance estimate. More data are needed.

Methods: In the week prior to the annual aerial surveys (which occur in June), time depth recorders (TDR) and satellite tags will be attached to up to 4 belugas. TDRs record depth, velocity, light, and temperature at discrete sampling intervals (every second) and facilitate the calculation of a correction factor based on the proportion of time spent at the surface where they can be seen from and aircraft. The location of each tagged beluga will be compared to the flight records to determine when each tagged whale was in a group that was being counted. TDR data from these counting periods will be analyzed to determine if the whales changed behavior when the plane was overhead, and the entire series of depth data will be analyzed to determine average dive intervals relative to age sex, location, and tidal height and direction. This information will be used to refine the correction methods for belugas missed because they were not counted during the survey, yielding a more accurate estimate of the number of belugas in an area.
The tags will be attached using a suction cup system, the satellite tags will be recovered after they fall off the beluga and attached to other beluga in the population through the survey period. Two to four SLTDRs will be deployed each year.
Product: This study will provide improved correction methods for counts during aerial surveys, and it will produce dive profile data to relate to summarized data from satellite tags and to foraging, traveling, resting, and other behaviors observed from the air.
Cost: Personnel: 2 X 30 days, Funds: $40K (this is in addition to the Distribution and Movement project cost).
Five-year project status: Current plans call for conducting a scaled down version of this project at least twice before 2009 using the same schedule as the aerial assessment surveys for abundance.
Funding: $21K in FY2005 from MMC.
Project lead: NMML

A4. Monitoring recovery status by proportions of dark vs white whales
Objectives: Estimate recovery time and probability of extinction (via gray-white ratio study and population modeling).
Justification: This study provides an index of the recovery of the beluga stock, by monitoring the proportion of young vs mature whales.
Methods: High resolution digital video and still cameras are used from an aircraft to capture images of belugas in Cook Inlet. Later these images will be imported onto a computer, using software such as Imovie®, and analyzed via programs such as Image Pro Plus® with scaled readings of intensity values for pixels within selected areas of interest. The sum of all white whales observed will be divided by the sum of all whales observed, with a 95 percent CI calculated using a nested bootstrap. After defining the proportion of adult whales in the population, an age structured model will be used to define a statistic for monitoring the recovery of the population (e.g., Litzky 2001).
Product: Statistics generated from this study will provide an index of the relative health and growth potential of the Cook Inlet stock of belugas.
Cost: Personnel: 1 X 40 days/yr. Funds: $6K
Five-year project status: This project will be conducted annually in conjunction with and on the same schedule as the aerial assessment surveys for abundance.
Funding: $0K/yr
Project lead: NMML

B. BELUGA DISTRIBUTION AND HABITAT USE

Overview: The distribution of CI beluga whales in the inlet is well documented for June (Rugh et al. 2000) but poorly known for the remainder of the year, especially in winter. Effective management depends on understanding the distribution and movements of the beluga throughout the year and relating this information to habitat features that are critical to the CI beluga whales. A contraction of the CI beluga whale distribution has occurred over the last four decades (Rugh et al. 2000). It is unknown if this a result of changing habitat, predation avoidance (Shelden et al. 2003), or a shift of a reduced population into the preferred habitat areas. Documenting the current annual distribution and monitoring changes as the population recovers will be an important component of the overall recovery plan, and it is essential to estimating the carrying capacity (K) of Cook Inlet for beluga. Data on distribution, movements, and dive behavior will be integrated with food habits and various external data to create a spatial habitat data base. This integration will provide the basis for examining multi-factor relationships between beluga and their environment. The Geographic Information Systems (GIS) application will facilitate examination of spatial interactions that are of specific interest to management.

B1. Distribution and Movement

Objective: Document the distribution and movement patterns of Cook Inlet belugas throughout their annual cycle. Satisfies:2a,3a. Supports 1c,d,2b,d, 3c,h,i.

Justification: Knowledge of the spatial and temporal patterns of the CI beluga whales will provide a better understanding of their ecology. This knowledge is required to assess the extent of habitat utilized by and critical to these whales.

Methods: 5 to 10 ARGOS tags designed to last one year or longer will be deployed each year on belugas at various times and locations. In addition, monthly or bimonthly aerial surveys will be conducted to determine the distribution of groups of beluga throughout the inlet. The tag location data will be analyzed to determine the effectiveness of the aerial survey, and the survey data will be used to determine the fraction of the population represented by each tag.

Product: Results will describe the year-round general movement and habitat use patterns of Cook Inlet belugas. Data will be entered into a GIS database for Cook Inlet which will be analyzed to create an average distribution by month or other time interval, and total whale-days for each location will be estimated.

Cost: Personnel: 6 X 10 days + 2 X 60 days cost $30K. Tags $40K. Survey cost: $60K; other $10K.

Five-year project status: To date, 17 beluga have been tagged with ARGOS tags in Cook Inlet (1 whale in June 1999; 2 whales in September 2000; 7 whales in August 2001; 8 whales in August 2002). Survey and tagging projects in Cook Inlet are planned for the years 2006 and 2007.

Funding: $140K/year

Project lead: NMML

B2. Characterize beluga habitat

Objective: 1) Describe and quantify habitat factors associated with beluga distribution and abundance. 2) Predict future habitat limitations. 3) Collaborate with comanagement partners, ADF&G, and other interested parties to develop a comprehensive Cook Inlet environmental database. Satisfies: 3a,b,c. Supports: 2b, 3d,e,f,g,h,i.

Justification: Data on beluga habitat is collected in association with other studies; however, no comprehensive set of habitat characteristics for beluga is available. Habitat data are useful to develop both research and management activities. Information of this nature can be used in research to assess whether

observed trends in habitat use originate from natural causes or human activities. These data are useful for management purposes to aid in evaluation of impacts from proposed offshore oil and gas development, vessel traffic, and other human activities. Such an evaluation is needed to develop conservation measures in sensitive beluga sites. A GIS format of habitat maps will also allow for better assessment of complex interactions involving other species and other resource concerns.
Methods: Preliminarily, data will be compiled from existing sources, including via Traditional Ecological Knowledge. These data will include information on substrate, bathymetry, fishing areas, vessel traffic lanes, estimated subsistence mortality level, estimated mortality incidental to commercial fisheries, major freshwater streams, and locations of human coastal communities. Specific habitat data may also be actively collected such as sonification of the water by human activity or to otherwise fill in gaps in the available data. These data will be consolidated into a GIS format and related to the spatial distribution, movements, food habits, and dive behavior. Carrying capacity will be estimated (through an ecosystem energetics model such as EcoPath) by comparing the current habitat used by belugas relative to the total estimated habitat available.
Product: A GIS database will be developed showing habitat characteristics associated with distribution patterns and abundance of belugas in Cook Inlet. Estimates of K, OSP, and an assessment of current status of the population relative to these parameters will be calculated.
Cost: Personnel:1.2 FTE/year; other $30-50K/year for several years.
Five-year project status: Unfunded, MS degree student has begun a Thesis project
Funding:$0K per year
Project lead: NMML

B3. Calving
Objective: Determine season and location of calving and rearing activities. Supports 1c,d, 2b,e, 3a,c,d,e,f,g,h,i
Justification: Calving and rearing through the first year are particularly vulnerable periods of a beluga's life. Areas used by the CI beluga whale for calving and rearing may be considered critical habitat and require special protection. Calving rate is an important measure of population health and required for age structured population models.
Methods: Calving and rearing areas will be determined during annual abundance estimate aerial surveys under A1 and possibly other dedicated photo and video aerial surveys. Further data collection under B1 would allow assesment of calf mortality and location of rearing grounds. Initial experiments have been conducted to develop methods to identify new calves from the air and count them reliably. Experiments will be conducted in 2005 using aerial video and photography to develop and test a survey protocol to get repeatable results.
Product: Annual time series of calf counts and estimates of calving rates and calf survival for use in population models.
Cost: Add-on to A1. $18K annually. Add-on to B1. $20K annually if monthly aerial surveys.
Five-year project status: Annual surveys will be conducted under A1.
Funding:$0K per year
Project lead: NMML

B4. Capture and Handling Protocols and Tag Design and Attachment Development

Objective: 1) Improve the longevity and utility of the satellite tags and minimize the impact to the beluga. 2) Identify risks to whales or humans when capturing and holding belugas for tagging, health assessments, and when doing biopsies, and risks to humans when handling dead whales, and develop protocols to minimize these risks. Supports: 1c,d, 2a, 3a,b,c,d
Justification: To date, the longest surviving beluga tag has lasted 10 months. For year-round habitat studies, it would be extremely useful to have tags that remained on the whales more than a year. Also, current tag attachments require capturing and holding a whale for nearly an hour. Only in parts of Cook Inlet is it feasible to use this method. A remote deployment version of the tag using a crossbow or airgun would be useful when attempting to tag belugas in areas other than in Knik Arm or the Susitna Delta. There is concern that during the handling of whales, physical injury or transfer of disease from humans to beluga or between belugas may impact individual whales.
Methods: Various tag designs will be tested for performance under a variety of conditions using experimental and engineering procedures. Beluga in aquaria will be studied to determine the movement of water over their dorsal features, using a video to document the performance of suction cup attached streamers. These data will be used to determine the best locations for attachment. Collaboration with other beluga researchers will be necessary to insure the most efficient use of the few whale tagging opportunities that arise each year. Experts on live handling of belugas and other cetaceans will be consulted to develop safe handling protocols.
Product: Tag designs and attachments with improved longevity and utility and minimal impact to the beluga. Reduced risk to beluga and associated calves during capture and handling.
Cost: Personnel: 2 X 30 days; Funds: $20K-$40K/yr
Five-year project status: A workshop conducted at NMMLin FY 02 to evaluated capture and handling techniques and current tag designs for beluga and planned future modification experiments. A workshop convened at the SMM biennial meeting in FY 04 reviewed safety and health issues of capture and handling techniques for small cetaceans in general. Design efforts continue at NMML at a minimal cost level.
Funding: $1K/yr
Project lead: NMML

B5. Killer Whales in Cook Inlet
Objectives: 1) Identify individual killer whales in upper Cook Inlet through photo-id or genetic samples. 2) Monitor killer whale use of upper Cook Inlet. 3) Determine if belugas have options to escape in Turnagain Arm and if there have been changes over the years. Supports1b, 2a,b,c,d, 3a,b.
Justification: Killer whale sightings in upper Cook Inlet have increased (Shelden et al. 2003). If killer whale attacks on belugas have also increased, this may have a significant impact on the population that is not represented in the current mortality models. It is suspected that belugas may respond to killer whale attacks by retreating to shallow water. Depending on how long belugas then remain in shallow waters, this avoidance of deeper waters may result in a loss of habitat for the CI beluga whale and greater risk of mortality during a stranding.
If shallow water habitat is an important refuge for beluga from predation by killer whales then development that fills shallow areas or channelizes flow may increase the vulnerablity of beluga to predation. Study of the behavior of belugas and killer whales and their interactions in the upper inlet are necessary to quantify this impact.
Methods: Photograph individual killer whales opportunistically whenever they are reported in upper Cook Inlet. If a killer whale strands or is approachable by boat, a biopsy sample will be collected. Photo id and biopsy can be used to determine whether the killer whales are mammal eaters or fish eaters. When mammal

eating killer whales are observed in the upper inlet, monitor them sufficiently to determine where and when attacks on belugas occur. Satellite tags for killer whales are underdevelopment. As these become available this project could attach tags to killer whales in the upper inlet to document their movements.
Product: Estimate mortality of beluga resulting from killer whale attacks.
Cost: $5K-$30K/yr depending on the level of response per incident.
Five-year project status: Ongoing
Funding: currently not funded.
Project lead: NMML

C. POPULATION HEALTH AND CONDITION

C1. Contaminant analysis

Objective: Determine current contaminant loads. Supports 2b,d 3a,b,d,e,f,g,h,i
Justification: The contamination of belugas by persistent pesticides and heavy metals is of concern to the health of the population in Cook Inlet. Levels of many of these contaminants have been shown to be lower than in other populations in western Alaska. In other species, persistent organochlorine pollutants have been shown to produce toxicological effects, including reproductive dysfunction and immunosuppression. The body of knowledge available for other animal systems is much more extensive than for marine mammals. 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. The continuation of the study of contaminant loads in Cook Inlet belugas, will provide the basis for further scientific exploration into the effects of various chemical compounds on health.
Methods: To examine current levels of metals and organochlorines (OC), samples of blubber (from a standard area on the ventral surface), kidney, and liver will be collected from subsistence-hunted belugas and beach-cast carcases. Samples of blubber will also be collected from whales captured for tagging.
Age and blubber thickness of belugas, and water and lipid content of samples will also be measured to increase precision of estimates and aid interpretation of results. Examination of samples from both sexes and various lengths or ages, which is often positively correlated to contaminant levels. Because OC residue concentrations are inversely related to blubber thickness (as fat is metabolized the contaminants in the remaining tissue become more concentrated; reviewed by Addison 1989), blubber thickness will be an important covariate in data analysis. Blubber thickness will be measured during biopsy or by ultrasound.
Samples may be sub-sampled following protocols developed by the National Marine Mammal Tissue Bank to prevent contamination of samples. After sub-sampling, excess samples will be archived at the National Marine Mammal Tissue Bank to be available for future contaminant work. Levels of 209 PCB congeners, total PCB, DDT and metabolites, and 22 other OC pesticides in blubber; and levels of 19 trace metals in kidney and/or liver will be analyzed by an appropriate analytical laboratory which participates in the quality assurance program at the National Institute of Standards and Technology.
Collection of samples will reduce costs and provide current numbers for comparison with published data from Alaska and elsewhere.
Product: Data will show contaminant levels in Cook Inlet beluga, and these will be compared to other areas.
Cost: Collection: AKR personell 2 X 40 days/year + supplies and shipping $35K/year.
Five-year project status: Ongoing
Funding: $35K/yr AKR with analysis by NIST and NWFSC
Project lead: NIST, NWFSC

C2. Disease, Pathology, Health Index

Objective: 1) Determine baseline disease exposure in population 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) comparison to other beluga populations in Alaska. Supports 3b,d,e,f,g,h,i

Justification: The presence of disease in the CI beluga whale population could have a significant impact on survival and reproduction, and thus population status and recovery. Few published data are available on disease exposure and occurrence in beluga in general or the CI beluga whale in particular. Although stranded animals are tested for some disease agents, a comprehensive study designed to determine the prevalence of disease in general CI beluga whale population has not been completed. Research on declining numbers of pinnipeds in Alaska waters elucidated the potential for detecting environmental perturbations using blood chemistry or blood proteins (Fadely et al. 1997, Zenteno-Savin et al. 1997). Research on dolphins in the ETP tuna fishing areas have shown that stress hormones in the skin may be useful estimating handling stress. These techniques may be applicable to beluga but will require some testing and development before they would be useful. As the population recovers, hypotheses regarding the impact of changing nutritional prey base and correlation between individual health condition and changes in prey availability can be examined. these techniques will not be used to clinically diagnose individual belugas as unhealthy, but rather used to detect possible health trends in populations based on blood chemistry perturbations or changes in other observable parameters.

Methods: Currently, a protocol has not been developed for Cook Inlet belugas. Thus initially this project would be developing new methods or modifying existing methods for the CI beluga whales. NOAA Fisheries/PR2 has a program for cetacean health assessment, we will begin there as a point of departure for developing a health assessment protocol. Blood has been drawn from a few captured beluga but a more reliable method is required. Once a regular blood collection method is available the next step would be to develop specific baseline blood chemistry and hematology reference ranges, to be used as a health indicator, for areas of concern (i.e. declining populations) in Alaska waters. Blood will be drawn into various Vacutainer blood container tubes (heparinized, EDTA, and serum). Whole blood will be centrifuged and the plasma separated and frozen at -80C. Blood smears made from EDTA tubes will be used for differential counting. Approximately 1 mL heparinized plasma will be used for determination of standard plasma chemistries: sodium (Na), potassium (K), chloride (Cl), calcium (Ca), phosphate, cholesterol, glucose, protein, blood urea nitrogen (BUN), albumin, creatinine, globulin, bilirubin, lactate dehydrogenase (LDH), alanine aminotransferase (ALT), aspartate aminotransferase (AST), creatinine phosphokinase (CPK), gammaglobulin transferase (GGT), and alkaline phosphatase (AP). Blowhole swabs and anal swabs are fairly simple but a regular collection is required.

Where possible similar samples will be collected from other beluga populations in Alaska for comparison.

Product: A peer-reviewed manuscripts published. Base line health parameters for comparison as the population reaches carrying capacity and comparison to other populations.

Cost: Collection: AKR personell 2 X 45 days/year + supplies, lab analysis and veterinary consultation $45K/year.

Five-year project status: In development

Funding: not funded

Project lead: Alaska Region

D. PREY BASE

Overview: Although belugas are known to eat a variety of fish and invertebrates, a complete understanding of diets of CI beluga whales throughout the year is lacking. Diet varies seasonally, by location, and probably annually, but data on these variations are largely incomplete. Currently it is believed that beluga do their primary feeding on large runs of anadromous fish, salmon and eulechon in the late spring and summer feeding during fall and winter may be limited to resident species and at levels insufficient to maintain biomass developed during the summer. Initial data on the movement patterns of juveniles suggest that they may need to forage more actively during the winter than mature beluga. A complete picture of the annual feeding cycle of the CI beluga whale is essential to a full understanding of habitat factors critical to the maintenance of this population.

D1. Food item analysis

Objective: Determine temporal and spatial dietary prey composition for beluga through analysis of stomach contents. Supports 3a,b,c,d,f,g,h,i

Justification: Current and comprehensive diet data are lacking and diet may be a limiting factor as the population approaches carrying capacity. Examination of stomachs yields information on recent dietary intake.

Methods: Stomach samples are collected opportunistically from subsistence harvested animals or strandings. Analysis is done by contract to experienced laboratories.

Product: Manuscript(s) published in the peer-reviewed literature that describe the observed diet.

Cost: AKR personnel 1 X 20 days/year + supplies and analysis $12K/year.

Five-year project status: Stomachs are collected when available but current harvest is one or two whales per year.

Funding: $12K/year

Project lead: Alaska Region

D2. Diet analysis

Objective: Determine temporal and spatial prey composition in CI beluga whale diets through analysis of blubber and blood fatty acid signatures, contaminant signatures and stable isotope analysis. Supports 3a,b,c,d,f,g,h,i

Justification: Prey is digested differentially, and some diagnostic hard parts may be retained in the stomach and thus over-represented in stomach contents (Pitcher 1980b, Harvey 1989). Also, stomach likely only reflect 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. Recent techniques of fatty acid signature analysis have been applied as an additional, and complementary, method of studying the diet composition of harbor seals (Iverson *et al*. 1997). Similar methods may be aplicable to beluga. 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. Similar analyses are possible with contaminant loads as each prey species carry different concentrations of heavy metals and organochlorines. Stable isotope analysis will not give prey preference at the level of detail the fatty acids or contaminants can but it is inexpensive and acts as a check that the total diet diet composition is reasonable.

Methods: Blubber and skin samples will be collected during capture for tagging, from subsistance harvest and stranded and beach cast beluga. Prey samples will also be collected to obtain prey fatty acid profiles for comparison to fatty acid profiles. Blubber and prey samples will be processed at NWFSC and analysed for

fatty acids signature in addition fatty acid signature analyses will be conducted in the laboratory of Sara Iverson, Dalhousie University, Canada. Contaminants will be analysed at NWFSC. Stable isotope analysis will be conducted at a contracted facility. Captive beluga studies will be conducted to determine analysis parameters.
Product: A manuscript published in the peer-reviewed literature. An essential component of analysis to estimate K and OSP.
Cost: personnel 2 X 60 days, $40K-$70K/year
Five-year project status: Blubber and prey sample collection began in FY01 initial analyses have now been completed. Five to 10 blubber samples are available each year so it is anticipated that two or three years will be necessary to collect a representative sample of the CI beluga whales. Captive animal studies have not been undertaken and would require one to two years to provide results.
Funding: $0K/yr
Project lead: NMML, NWFSC, Alaska Region support

D3. Forage fish analysis
Objectives: Identify food availability for belugas 1) salmon run strengths and numbers in Cook Inlet, 2) eulachon run strengths and numbers in Cook Inlet; and 3) winter prey species. Supports 3a,b,c,d,f,g,h,i
Justification: Cook Inlet beluga whales occur throughout the year in the northern portion of Cook Inlet. Trophic 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 the apex predators, 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 trophic linkages.
Methods: The project will identify and review available data on potential beluga prey species in Cook Inlet. 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 data analyst will collaborate with the Alaska Department of Fish and Game and other groups to identify and compile available data sets into a GIS format that is usable by this project. Life history, size at age and other data will be used to convert counts and other indexes to biomass estimates. Where possible data will be converted to biomass distributions by date and area. The GIS analysis will compare prey availability to the observed beluga distribution patterns. Based on this initial analysis, a sampling plan will be developed to: 1) determine prey species available to beluga by season and location; 2) collect data to estimate biomass from available fisheries and/or escapement data; 3) estimate biomass in areas frequented by beluga for which no data are available by area and season. Because a comprehensive survey is not possible, this project will identify index sites for seasonal sampling and focus initial efforts on developing a species list and collecting samples for fatty acid comparison to existing blubber samples. Site selection will be based on preliminary analysis of the individual contribution of anadromous fish runs and potential fall and spring feeding areas. Fieldwork will be conducted as a collaborative effort among ADF&G, NOAA Fisheries and others.
Prey samples collected during the project will be included in an ongoing NOAA Fisheries Cook Inlet beluga fatty acid analysis project. Currently NMFS has analyzed blubber samples from 15 Cook Inlet beluga and over 200 prey samples representing several runs of salmon, a eulachon run, and a few miscellaneous species; a wider range of samples are need to complete this analysis.

Results from the fatty acid analysis will be compared to prey availability and biomass estimates to determine beluga prey preference and available prey biomass
Product: will include a report summarizing the collected data and providing the derived prey base biomass estimates, A GIS database of the fish biomass distribution and a peer reviewed scientific publication presenting the results of the study. The report and database will be completed at the end of the third year of the project, the peer reviewed publication will be completed within one year of the completion of the project.
Cost: $70-90K/year for three years.
Five-year project status: A joint project with ADF&G is under development and seeking funding of $70K-$90K/year to review fishery data for upper CI and to develop a GIS database to estimate prey species biomass by time and location. If this project is funded, this database should be developed by 2006, and initial estimates of K and OSP available by 2007.
Funding: $0K
Project lead: NMML and Alaska Region

E. LIFE HISTORY/GENERAL BIOLOGY

Overview : Life history data are used in population models and assessments of health and can be compared to other similar populations to identify unique and shared traits of the CI beluga whales. Research requiring handling or dissections can only be done on a limited number of samples per year, so it is important to capitalize on each opportunity.

E1. Female reproductive biology

Objective: Estimate age-specific reproductive rates of female belugas in Cook Inlet including age of sexual maturation and pregnancy rates. Supports 1c,d, 2b,e
Justification: 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. Also, age is important to understanding contaminant data. Therefore, it is important to monitor these parameters and to take advantage of samples available from the subsistence harvest to do so.
Methods: Reproductive tracts including uteri and ovaries will be collected from female beluga taken in the subsistence harvest. Uterine scars and counts of corpora in ovaries will be used to estimate the state of maturity and recent reproductive history of each beluga.
Product: Estimates of age-specific reproductive rates of female belugas.
Cost: personnel 2 X 5 days, $1K/year
Five-year project status: Specimen material has been collected since 1995. One or two samples a year are available from the subsistence harvest and beach cast carcases.
Funding: $0K
Project lead: Alaska Region

E2. Estimating age, age of maturation, and indices of growth from teeth

Objective: Assess the growth patterns of belugas using patterns in the deposition of material in teeth. Supports 1c,d, 2b,e

Justification: Growth layer groups in teeth can be used to determine the age and possibly the age at sexual maturity or first reproduction. Age to length and age to body mass relations are important components of estimates of K and OSP. Age at first reproduction is an important parameter for population dynamics modeling.
Methods: Teeth will be obtained from subsistence-harvested animals and dead stranded animals. The teeth will be cut into thin sections and mounted on glass slides. Two independent readers will assess age by counting the growth layers of the teeth and examining for a transition zone in the widths of the cementum layers.
Products: This study will provide estimates of the age structure of the subsistence harvest and the average age at maturation and when compared to other measurements length at age and body mass at age relations.
Cost: personnel 1X 20-80 days/yr, $5K-$25K/year
Five-year project status: Teeth will be collected from harvested and beach cast beluga. Approximately 10-15 samples per year are available. Every two or three years, once a significant sample had collected the accumulated sample would be aged. A recent Master's degree project examined teeth from Cook Inlet.
Funding: $0K
Project lead: Alaska Region

E3. Cook Inlet Beluga Strandings
Objective: 1) Document the historic and current events of beluga strandings to determine possible patterns and identify causes. 2) Update the NOAA Fisheries Turnagain Arm Stranding Response Plan for live marine mammals. 3) Identify new protocols for live beluga strandings to include collection of biological information. Supports 1c,d, 2b,e
Methods: Information on stranded belugas in Cook Inlet has been collected by incidental reporting to state and federal agencies since 1988, but the network for assimilating sighting reports has had increased support during the last few years. By reviewing old reports, mapping stranding locations, and evaluating causes of strandings, patterns maybe identified to better prepare for future stranding events.
The current NOAA Fisheries Turnagain Arm Stranding Response Plan for live strandings should be updated. A new plan will be written, coordinated with the Forest Service and other interested parties.
Strandings provide an important opportunity to access biological materials from live and dead belugas, including blood and biopsies. Live strandings may also be an opportunity to tag a whale with a satellite transmitter.
Product: The final report will identify stranding events as recorded historically; it will continue to be updated annually. This report will include maps of stranding sites, information on causes of strandings, number of belugas involved, health of stranded animals, and NOAA Fisheries response.
A cooperative effort with the Conservation Team will produce a Turnagain Arm Stranding Response Plan. This plan will identify who, when, and how people should respond to live beluga strandings.
A report on protocols to identify the health of the live beluga and what actions would be allowed.
Cost: personnel 1X 15 days/yr, $5K-$15K/year
Five year project status: A stranding historical report will be written; the Turnagain Arm Stranding Response Plan for live strandings.
Funding: $0K
Project Lead: Alaska Region

F. HUMAN INTERACTIONS

Overview:

The research categories addressed above focus on beluga biology and ecology. The following research tasks examine direct anthropogenic impacts to belugas. Tasks 1 and 2 reflect the specific need, as mandated in the MMPA, to obtain estimates of human-caused mortality and injury to belugas. The two sources of direct human-induced beluga mortality and injury in Alaska occur from subsistence removals and, potentially, through commercial fisheries interactions. The 3rd task reflects the growing concern about the potential impacts to belugas from vessel disturbance, and the 4th task focuses on potential problems resulting from industrial development, particularly petroleum extraction.

F1. Harvest monitoring and mortality estimation

Objective: Determine the total number of belugas harvested by Alaska Natives. Include records of sex and age of harvested animals plus numbers of whales struck but lost. Supports 2e, 3d,e

Justification: The MMPA requires an estimate of the annual human-caused mortality and serious injury of marine mammal stocks by source. The subsistence harvest of belugas represents one source of human-induced mortality or serious injury. Belugas are a traditional subsistence food of Alaska Natives in many coastal Alaska communities. In addition to being a food source, belugas represent a significant part of the cultural and spiritual basis of Native communities. Alaska Natives may take marine mammals for subsistence use under both the MMPA (Section 101(b)) and the Endangered Species Act (Section 10(e)). Native takes for subsistence or handicraft purposes are generally not subject to regulatory control unless a stock is depleted (MMPA) or unless Native takes are substantially disadvantaging the stock (ESA).

Methods: Subsistence harvest levels are determined using either direct observation or hunter reporting coordinated with CIMMC.

Product: A time-series of the total subsistence takes, including the number of animals taken and struck and lost. Records will include summaries of takes listed by sex, reproductive status, and age class.

Five-year project status: One or two whales will be harvested per year for the foreseeable future. Monitoring and recording will continue at the current level.

Project lead: Alaska Region, in consultation with CIMMC

F2. Incidental take by commercial fisheries

Objective: Determine the level of incidental take in commercial fisheries. Supports 2b,e 3b,e,i

Justification: The Marine Mammal Protection Act (MMPA) requires that a species or population stock not be permitted to diminish below its optimum sustainable population and that measures be immediately taken to replenish any species or population stock which has already diminished below that point. Section 118 of the MMPA specifically mandates that the incidental mortality or serious injury of marine mammals, including harbor seals, occurring in the course of commercial fishing operations be reduced to insignificant levels approaching a zero mortality and serious injury rate. Fisheries are classified according to the degree of interaction with marine mammals. Should the level of human-induced mortality exceed the potential biological removal (PBR) level and the stock be declared "strategic" the commercial fisheries which interact with that species would be required to reduce the incidental mortality and serious injury of that stock taken incidentally in the course of commercial fishing operations to a level below the PBR calculated for that stock. As a result data must be collected on the level of incidental serious injury and mortality occurring in commercial fisheries. This information is also required in the annual stock assessment reports. Currently few data are available on the incidental take of belugas in commercial fisheries.

Methods: Current methods include reporting via a self reporting system and directed observer coverage in some commercial fisheries. Estimated observer coverage levels in fisheries are calculated based on a statistical model that incorporates fishing effort and PBR levels of a reference species.
Product: An estimate of the number of belugas taken incidental to commercial fisheries.
Five-year project status: The self report system for commercial fisheries continues on an annual basis. The marine mammal observer program is currently focusing on Category II fisheries (those fisheries having occasional incidental mortality and serious injury of marine mammals) in Alaska on a rotating schedule. During the summers of 1999 and 2000, dedicated marine mammal observers were placed in the set and drift gillnet salmon fisheries in Cook Inlet (Merklein and Fadely 2001). In 2001 and 2002, observer coverage was moved to the set gillnet fisheries near Kodiak and Yakutat. All incidental takes of marine mammals, including belugas, will be documented.
Project lead: Alaska Region

F3. Habitat Impact
Objective: Determine the effect of vessel presence, oil development, coastal development, over flight and other human activities on habitat available to CI beluga whales. Supports 3a,b,c,d,e,f,g,h,i
Justification: Habitat loss may occur for a variety of reasons: 1) Ensonification by vessel traffic or drilling or dredging, 2) Changes in channels or tidal areas due to dredging or filling or 3) interference by fishing, sightseeing or other vessel traffic.
Methods: Various research methods will be applied, depending on the respective impacts to be studied. Initially this task will focus on studies of impacts of noise. Efforts will be coordinated with the Minerals Management Service. Tagged whales (see A3) may provide evidence of responses to impacts (opportunistically) if tag data show a whale entering and leaving an ensonified area.
Product: Quantify potential impacts relative to proposed activities.
Five-year project status: An acoustic survey of noise sources in the upper inlet was conducted in FY01 (Greenridge Sciences, Inc 2001).
Funding: $0K
Project lead: NMML

F4. Industry in Cook Inlet
Objectives: 1) Identify harbor use in Knik Arm (Port of Anchorage and Point MacKenzie) and collect the baseline data on ship and boat activity, especially before possible increases with cruise ships, tour boats, ferries, and shipping. 2) Identify oil spill risks as related to chronic leaks, age of pipelines and equipment, and PAH information at set sampling sites: Anchorage, Kenai, and Eagle River. 3) Evaluate oil and gas lease sales in upper (state) and lower (federal) Cook Inlet. Supports: 3b,c,d,e,f,g,h,i
Justification: 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. The project proposes a proactive approach to collect the necessary data so that consideration for impact on the beluga population can inter into the planning process at an early stage.
Methods: Various depending on the proposed projects.
Project lead: Alaska Region with support from NMML.

G. STOCK IDENTIFICATION

Overview: Scientists at the SWFSC have been using molecular genetic techniques to investigate population subdivisions and to identify tissue samples to species, stock, family group, gender and/or individual. Variations in both mitochondrial and nuclear (microsatellite) markers are being examined to resolve population structure and estimate levels of dispersal which will provide the framework for delineating stock boundaries. The different properties of the two types of marker may also determine whether separate stocks are demographically and/or reproductively independent by distinguishing between actual (i.e., emigration) and effective (i.e., interbreeding) dispersal. Currently, five stocks of belugas are recognized in Alaskan waters (O'Corry-Crowe et al. 1997). These stocks were initially delineated by their summering grounds (Frost and Lowry 1990). The CI beluga whale is the most physically isolated stock and the most genetically distinct as well (O'Corry-Crowe et al. 1997).

The SWFSC studies on genetic stock divisions in belugas were initiated in 1990. These studies were supported by the NOAA Fisheries Office of Protected Resources with assistance from other sources. Over the succeeding years, as sample numbers and coverage increased, a genetic picture has emerged, confirming the hypothesis of five distinct stocks of belugas in Alaska. The null hypotheses of a panmictic population extending across the range of the species and panmixia within current PBR boundaries were both unequivocally rejected. Now, with sufficient samples available for analyses, significant genetic subdivisions have been demonstrated between CI beluga whales and the other four stocks in western Alaska. This means that demographically insignificant levels of interchange occur between CI beluga whales and the western Alaska beluga whales. Confidence in this observation links to the fundamental property of genetic studies: they have little statistical power to discriminate population subdivision in the presence of more than a few dispersers per generation.

The implications of this geographic stratification is that removal of belugas by subsistence hunting in Cook Inlet, will not likely be compensated by migration from nearby less-exploited areas.

Molecular genetic tools are also being used to estimate levels of genetic diversity and investigate mating systems and patterns of dispersal within stocks. Diversity indices may be informative indicators of a population's evolutionary history and current ability to deal with environmental change and disease, while the resolution of beluga mating systems will aid in estimating effective population size, $N_{e,}$ a parameter of relevance to recovery of the population to pre-exploitation levels. Knowledge of mating systems within the CI beluga whales may indicate population substructure with implications for management of recovery.

G1. Stock Identification, Subdivision, and Forensics

Objectives: (1) determine the relationship between interbreeding and dispersal patterns among sub-populations (i.e. accept or reject the panmixia hypothesis); (2) Use geographic and temporal strata to look for evidence of genetic subdivision; and (3) develop sampling methods necessary to collect samples from free swimming beluga. Supports 1c,d.

Background: Microsatellites are a class of highly variable nuclear markers that have revolutionized the study of breeding systems, social organization and population structure. In contrast to the maternal inheritance of mtDNA haplotypes, microsatellite alleles are inherited from both the mother and father. Thus, by combining the analysis of variation at these loci with that of mtDNA, a more complete understanding of grouping, mating, and movement patterns may be achieved. To date over 500 samples from 36 separate locations in Alaska and Canada, including 86 from Cook Inlet have been analyzed for sequence in the mtDNA control region. Over 400 of these belugas have also been assayed for variation at eight micorsatellite loci.

Justification: As with mtDNA, initial analysis has revealed structure on a broad geographic scale. We have found that the number of samples greatly influences the reliability of estimates of genetic subdivision. Small

sample size increases the variance in the test statistic thus increasing the probability of a type II error of falsely not rejecting the null hypothesis of panmixia. There is therefore a need to increase sample size from a number of areas. Boosting sample size and distribution will also enable us to investigate population structure on a micro-geographic scale and determine if stocks are demographically and/or reproductively independent by comparing findings from nuclear markers with those from mtDNA to distinguish between actual (i.e., emigration) dispersal and effective (i.e., interbreeding) dispersal. Individual microsatellite loci vary in their ability to reveal population structure, a feature that is related, in part, to how polymorphic they are. It is therefore necessary to continue to screen for variation at a large number of independent loci with differing levels of polymorphism.

Methods: Many samples are already available at SWFSC but new samples are required from several areas. Samples will be gathered from harvest, live capture operations, and by focused biopsy studies. The collection of samples will be co-ordinated with the relevant agencies and institutions. Necessary samples sizes can not be determined at this time so a feasability study was funded with FY01 funds.

Tissue storage and molecular techniques will be as described in previous reports. Briefly, tissue samples will be stored in 20 percent DMSO and saturated salt. Total DNA will be extracted and archived using standard protocols. Following quantitation of DNA (and sequence analyses of mtDNA, see part 1), alleles at a minimum of 11 polymorphic microsatellite loci will be amplified by the PCR, separated on an automated sequencer, and sized with the aid of Genescan 3.1 software.

As with the mtDNA study, geographic strata to be tested with the microsatellite data will be based primarily on distribution, abundance, and movement patterns. Other factors that may influence or reflect movement patterns are also being considered in this process. Frequency-based (F_{st}, $Ç^2$) statistics will be used to assess levels of genetic differentiation.

Product: A series of reports and a scientific manuscript or manuscripts detailing the population genetic structure based on patterns of microsatellite variation and how this pattern compares with the mtDNA findings. The analyses will be based on the strata used in the mtDNA studies.

Cost: $20K to $70K/yr depending on sample size and level of detail sought.

Five-year project status: Ongoing beluga genetic work coordinated with the ABWC and other organizations will be continued. A feasability study for a similar project was undertaken in 2004 by the ABWC at a field location in Bristol Bay.

Funding: None at this time

Project lead: SWFSC and NMML with support by Alaska Region

G2. Mating Systems within CI beluga whales

Objectives: Determine the mating system of Cook Inlet belugas, and relate findings to the analysis of stock structure of the species in Alaska. Satisfies 1c,d

Background: Little is known about the mating system of beluga, primarily because of 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 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. Results of this study of mating systems in Cook Inlet may be applied to other populations in Alaska.

Justification: Resolving the relationship between reproductive success and mating frequency can aid in the estimation of effective population size (N_e), an index of relevance to investigations of stock identity, and dispersal in this species. N_e is smaller than N; for example, when only a portion of adult males contribute to next year's cohort of calves. A small N_e in turn increases the rate of genetic divergence among strata due to the greater effects of genetic drift within the population. Harvest data shows a male to female ratio of 1:1; however, sex was rarely determined in this sample set. With the information we have at present, males were not targeted, although white whales were, so excessive harvest impacted N_e to a greater extent than the fraction of the population harvested would indicate and may have caused genetic forcing as well.
Methods: Samples will be collected either directly by biopsy during tagging operations (see A.3, Dive behavior study) and dedicated biopsy surveys or from whales taken in the harvest or found dead. Samples will be preserved in a 20 percent DMSO and salt solution or snap frozen and returned directly to the lab. Various laboratory procedures, many developed at SWFSC, will be used to extract, amplify, and sequence an array of genetic markers, including mtDNA, microsatellites, and gender. (See sections 1, 3, and 5 above for details). Paternity assessment and relatedness will be estimated using a number of standard statistical packages as well as a number of techniques currently under development.
Product: A series of peer-reviewed theses and reports and a scientific manuscript or manuscripts detailing the findings of the current research will be published.
Cost: $10K-$40K/year
Five-year project status: This project will be an extension of the Stock Identification and Subdivision study. Necessary samples sizes will be determined by the feasability study described under the Stock Identification and Subdivision study.
Funding: Not currently funded.
Project lead: SWFSC and NMML

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APPENDIX E. NATIONAL MARINE FISHERIES SERVICE ENFORCEMENT PLAN FOR COOK INLET BELUGA WHALES

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
OFFICE FOR LAW ENFORCEMENT

2002 COOK INLET BELUGA WHALE ENFORCEMENT PLAN

Introduction

The National Oceanic and Atmospheric Administration (NOAA), Office for Law Enforcement (OLE) is 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 (CI) beluga whale. In 2000, the CI beluga whales was designated as depleted under the Marine Mammal Protection Act (MMPA) of 1972. OLE conservation and protection efforts began in 2000 and will continue throughout their recovery period (estimated 20-30 years).

Authority

Enforcement authority for NOAA actions related to intentional and unintentional takes of beluga whales, including harassment, illegal harvests, and attempted illegal harvests falls under the MMPA as delineated at 16 United States Code (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

Under the MMPA, "take" is defined at Title 50–Code of Federal Regulations–PArt 216.3 as "harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect or kill, any marine mammal."

Mission

Stop illegal takes of CI beluga whales from any source. Our mission also includes stopping any act of pursuit, torment, or annoyance which has the potential to injure a CI beluga whale; or has the potential to disrupt their behavioral patterns, including, but not limited to, migrations, breathing, breeding, feeding, or sheltering.

Components for Protection and Conservation

Our enforcement effort will consist of COPPS, patrols, and reward.

Community Oriented Policing and Problem Solving

Public outreach and education through meetings and liaisons 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 the beluga whale issues, and the need to report suspected harassment and takes of these animals, we hope to enhance the effectiveness of our enforcement resources by incorporating the "eyes and ears" of the public to assist in deterring and detecting illegal activity.

Air Patrols

Air patrols continue to be the best method for detecting violations and strandings. Air patrols also provide for sighting of beluga whale pods which will assist the research by the National Marine Fisheries Service, Protected Resources Division.

Boat Patrols

During 2004, boat patrols will be conducted in the upper CI area. Additionally, patrols will contact set net sites for information on beluga whale locations and provide that information to PRD.

Vehicle Patrols

Vehicle patrols will be conducted in the upper CI area to deter harassment or take of beluga whales. Vehicle patrols will also report and respond to marine mammal strandings.

Reward

The MMPA allows for rewards for information leading to conviction of persons who violate that Act. The beluga whale reward poster offers up to $2,500 and will be posted throughout CI. We will publicize the use of the NOAA National Hotline and our local enforcement number for reporting violations 24 hours a day.

APPENDIX F. NATIONAL MARINE FISHERIES SERVICE PUBLICATIONS AND REPORTS ON COOK INLET BELUGA WHALES

Department of Commerce
- **National Institute of Standards and Technology**

National Oceanic and Atmospheric Administration
- **National Marine Fisheries Service, Alaska Region**
- **National Marine Mammal Lab**
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