DRAFT

FEDERAL ACTIONS ASSOCIATED WITH MANAGEMENT AND RECOVERY OF COOK INLET BELUGA WHALES

ENVIRONMENTAL IMPACT STATEMENT

October 2000

Lead Agency:	National Oceanic and Atmospheric Administration National Marine Fisheries Service Alaska Region Juneau, Alaska
Responsible Official:	James W. Balsiger Regional Administrator
For Further Information Contact:	Alaska Regional Office National Marine Fisheries Service P.O.Box 21668 Juneau, Alaska 99802 (907) 586-7235

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Abstract: The National Marine Fisheries Service (NMFS) proposes to undertake a program to manage and recover the Cook Inlet (CI), Alaska, stock of beluga whales. The abundance estimates for this stock indicated a decline of nearly 50 percent between 1994 and 1998, leading NMFS to designate the stock as depleted under the Marine Mammal Protection Act (MMPA) on May 31, 2000 (65 FR 34590). The recovery of the CI beluga whale stock is dependent on the identification of those factors which have caused this stock to decline and on the identification and implementation of measures to control those factors.

A review of the natural and anthropogenic factors potentially impacting the stock of CI beluga whales indicates that subsistence harvest is the most likely cause of the decline observed between 1994 and 1998. The magnitude of decline, approximately 300 animals, is consistent with estimates of harvest over this same period, i.e, approximately 316 animals. To address this critical issue, legislation was passed on May 21, 1999, that prohibited the taking of a CI beluga whale under the exemption provided in section 101(b) of the Marine Mammal Protection Act [16 U.S.C. 1371 (a)] between the date of the enactment of this Act and October 1, 2000, unless such taking occurs pursuant to a cooperative agreement between NMFS and affected Alaska Native organizations (ANOs) (Public Law 106-31, 113 Stat.100, hereafter referred to as Public Law 106-31). In support of the hypothesis that over-harvest is the principal cause of the decline, the

population estimate in 1999 was 357 whales. While the 1994-1999 decline remains significant, a slight increase in the 1999 abundance estimate followed the moratorium imposed by Public Law 106-31. We believe that increase was the result of the moratorium, supporting the need to limit the subsistence harvest.

However, there is a demonstrated traditional and historic use of beluga whales in Cook Inlet by the Village of Tyonek, other Cook Inlet Native villages, and Alaskan Natives. This subsistence harvest plays an important part in Native culture. The maintenance of this culture is dependent in part on continued access to subsistence resources, including beluga whales. Thus, two goals exist with respect to the management of this stock: to recover their numbers to OSP and to allow for continued subsistence use during this recovery. NMFS believes these are not mutually exclusive goals.

NMFS proposes to manage and conserve this depleted stock in part, by regulating the subsistence harvest of CI beluga whales by Alaskan Natives. Federal authority to regulate the harvest derives from (1) Public Law 106-31, and (2) Section 101 (b) of the MMPA, which authorizes the regulation of subsistence harvests of depleted species. The principle management action proposed is to limit Native subsistence harvest of CI beluga whales. Annual harvest levels could be specified through a regulation and implemented through a co-management agreement under section 119 of the MMPA.

The impact of differing subsistence harvest levels has been evaluated through a model which examines the length of time it would take for the stock to recover under different harvest strategies. The harvest levels evaluated range from no strikes; annual subsistence harvest levels of one (1) strike per year, during 2000-2007, increasing to two (2) strikes per year from 2008 to recovery; two (2) strikes per year; to 2 percent of annual recruitment, which provides for variable levels of harvest dependent upon the estimated population size. The proposed preferred alternative by NMFS provides for the continuation of the subsistence harvest of CI beluga whales through regulation and a co-management agreement that would authorize the harvest level to two beluga whales per year until the stock is no longer depleted under the MMPA.

The impacts of other anthropogenic factors on CI beluga whales were also considered. No current population-level effects are thought to be occurring due to man-induced factors except for the harvests. The upper Cook Inlet region is important habitat to this stock, and NMFS believes that the potential pressures from activities need continued monitoring with the recovery of the beluga whales in mind. However, with the exception of the subsistence harvest, none of the other identified activities can be directly linked to the recent decline in CI beluga whales, nor does any of the information available support a deleterious impact on the health of the beluga whales or any impact that would inhibit the recovery of the whales. Accordingly, NMFS concludes that the cumulative impacts of activities other than subsistence harvest are minimal.

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ABBREVIATIONS AND ACRONYMS

ABWC	Alaska Beluga Whale Committee
AEWC	Alaska Eskimo Whaling Commission
AMMTAP	Alaska Marine Mammal Tissue Archival Project
ANMMHC	Alaska Native Marine Mammal Hunter Committee
ANO	Alaskan Native organization
BOD	Biochemical Oxygen Demand
CI	Cook Inlet
CIMMC	Cook Inlet Marine Mammal Council
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act, as amended
K	Carrying Capacity
LOEC	Lowest Observed Effect Concentration
MMPA	Marine Mammal Protection Act
MNPL	Maximum Net Productivity Level
MOA	Municipality of Anchorage
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPDES	National Pollution Discharge Elimination System
NOAA	National Oceanic and Atmospheric Administration

OCSEAP	Outer Continental Shelf Environmental Assessment Program
OSP	Optimum Sustainable Population
RIR	Regulatory Impact Review
RFA	Regulatory Flexibility Act
Rmax	Maximum theoretical net productivity rate

SUMMARY

June 2000 Draft Environmental Impact Statement for Federal Actions Associated with Management and Recovery of the Cook Inlet Beluga Whale Stock

Description of the Proposed Action

The National Marine Fisheries Service (NMFS) proposes to undertake a program to manage and recover the Cook Inlet (CI), Alaska, stock of beluga whales. The abundance estimates for this stock indicated a decline of nearly 50 percent between 1994 and 1998, leading to the proposal by NMFS to designate the stock as depleted under the Marine Mammal Protection Act (MMPA). NMFS promulgated final regulations designating the CI beluga as depleted under the MMPA on May 31, 2000 (65 FR 34590).

Because the CI beluga whale stock is depleted, any Federally-approved harvest plan would constitute a major action subject to the requirements of the National Environmental Policy Act (NEPA), and, therefore, could not be finalized until an Environmental Impact Statement (EIS) has been prepared. This draft EIS (DEIS), therefore, is being written to address actions taken by NMFS to manage and recover this stock. The principle management action proposed is to limit Native subsistence harvest of CI beluga whales.

NMFS proposes to manage and conserve this depleted stock in part, by regulating the subsistence harvest of CI beluga whales by Alaskan Natives. Federal authority to regulate the harvest derives from (1) Public Law 106-31 which prohibits the hunting of CI beluga whales prior to October 1, 2000 except pursuant to cooperative agreement between NMFS and Alaskan Native organizations (ANO), and (2) Section 101 (b) of the MMPA, which authorizes the regulation of subsistence harvests of depleted species. Annual harvest levels could be specified through a regulation and implemented through a co-management agreement under section 119 of the MMPA.

Alternatives Considered

The impact of differing subsistence harvest levels has been evaluated through a model which examines the length of time it would take for the stock to recover under different harvest strategies. The harvest levels range from no strikes; annual subsistence harvest levels of one (1) strike per year, during 2000-2007, increasing to two (2) strikes per year from 2008 to recovery; two (2) strikes per year; to 2 percent of annual recruitment, which provides for variable levels of harvest dependent upon the estimated population size. A harvest plan would be intended to provide for the cultural/subsistence needs of Alaskan Natives while not significantly extending the time required for this stock to recover.

Additionally, this DEIS presents an assessment of the impacts of other anthropogenic activities that occur in Cook Inlet and that might impact the CI beluga whales, or their habitat. This assessment includes a discussion of the cumulative impacts and evaluates the need for measures for the protection and conservation of important CI beluga whale habitat.

Summary of Major Environmental Impacts

Alternative 1 (zero harvest) would result in the diminishment of cultural values, traditions, and nutritional needs within the local Cook Inlet Native community and the Native Village of Tyonek. Alternatives 2-4 would result in the annual strikes of one to two adult beluga whales from a stock which has been significantly exploited in recent history, and which is now depleted. The level of removal under these alternatives would meet NMFS' intent to provide opportunity for continued Native harvest while not significantly extending the time to recovery of this depleted stock of beluga whales. Allowable harvest levels under alternative 5 are based on a percent of recruitment and, therefore, the number harvested each year would increase as the population increases. This alternative results in a significant delay of recovery by greater than 50 years. Alternative 6 (the no-action alternative) would result in no Federal harvest restrictions.

Areas of Controversy

The removal of any animals from a stock that is depleted to this level is a matter of concern. NMFS has received several petitions to list the CI stock of beluga whale as an endangered species under the Endangered Species Act (ESA). There may be objections to any Federal action to authorize a continued harvest within this stock. A determination on whether to list CI beluga whales under the ESA will be made based, in part, on the discussion of the issues provided in this DEIS.

Many parties responding to the NMFS scoping notice for the EIS identified a need to consider other anthropogenic factors, in addition to hunting, within the NEPA process. Such factors as oil and gas development, urbanization, vessel traffic, and noise may impact this stock. These matters are addressed within Chapter 4 of this DEIS.

Required Actions or Approvals

If the preferred alternative is selected, NMFS would approve and sign a cooperative agreement under section 119 of the MMPA. While a harvest in 2000 has been authorized under the provisions of Public Law 106-31, through an agreement between NMFS and the Cook Inlet Marine Mammal Council (CIMMC, Appendix I), any subsequent harvest would occur pursuant to final regulations under section 101(b) of the MMPA and following a hearing on the record before an Administrative Law Judge.

NMFS has scheduled a hearing regarding these proposed regulations before Administrative Law Judge Parlen McKenna, to commence at 9:00 a.m., on December 5, 2000, in Anchorage, Alaska, at the Federal Building. A pre-hearing conference is scheduled at 9:00 a.m., on November 21, 2000.

Filing Deadlines: By November 1, 2000, any interested person or party must file a notice of intent to participate, a witness list and a detailed narrative of their position.
By November 6, 2000, each interested party must submit any direct testimony and any documentary evidence. By November 15, 2000, any rebuttal testimony and documentary evidence must be filed.

All filings, including those of NMFS, become part of the record. The record for the proposed rule and the DEIS is available at NMFS, Office of Protected Resources, Silver Spring, Maryland, and NMFS, Anchorage, Alaska [See ADDRESSES]. All filings by all parties will be available on the NMFS, Protected Resources website [See Addresses].

ADDRESSES: All original filings and written comments should be filed at: Division Chief, Marine Mammal Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Silver Spring, MD 20910. One copy should also be filed at: ALJ Docketing Center, 40 South Gay Street, Room 412, Baltimore, Maryland 21202-4022. Fax copies are accepted at (410) 962-1746 or -1742. Another copy should also be filed at: Judge Parlen McKenna, U.S. Coast Guard Island, Building 54-C, Alameda, California 94501, email PmcKenna@D11.USCG.mil, (510) 437-3361, fax (510)437-2717.

FOR FURTHER INFORMATION CONTACT: Barbara Mahoney, NOAA/NMFS, Alaska Region, Anchorage Field Office, (907) 271-5006, fax (907) 271-3030, or Michael Payne, NOAA/NMFS, Alaska Region, (907) 586-7235, fax (907) 586-7012, or Thomas Eagle, Office of Protected Resources, (301) 713-2322, ext. 105, fax (301) 713-4060.

Chapter 1 Purpose of and Need for Action

1.1 Introduction

The MMPA was enacted for the purpose of ensuring the long-term survival of marine mammals by establishing Federal responsibility for their conservation and management. The MMPA imposed a general moratorium on the taking of marine mammals. However, section 101(b) of the MMPA contains an exemption from the MMPA's take prohibition which allows Alaskan Natives to harvest marine mammals for subsistence use and for purposes of traditional Native handicraft. Under the MMPA, the Federal Government may not regulate Native subsistence harvest unless 1) the stock in question is depleted, and 2) specific regulations are issued (16 U.S.C. 1371). The proposed action, therefore, is to formulate and enact a plan for the Federal management and recovery of the depleted stock of CI beluga whale. The management objectives are twofold: to recover this depleted stock to its Optimum Sustainable Population level, and to provide for the continued traditional subsistence use by Alaskan Natives to support their cultural and nutritional needs.

Section 101(b) of the MMPA provides an exemption from the Acts' take prohibitions allowing Alaskan Natives to harvest marine mammals for subsistence or for purposes of Native handicraft. The CI beluga whale stock is hunted by Alaskan Natives, some of whom reside in communities on or near Cook Inlet and some of whom are from other Alaskan towns and villages. The whales concentrate off the mouths of several rivers entering upper Cook Inlet during the ice-free season, making them especially vulnerable to hunting. Most hunters use small motorboats launched from Anchorage, and hunt near these river mouths. The most common hunting technique is to isolate a whale from a group and pursue it into shallow waters. Whales are shot with high powered rifles and may be harpooned to aid in recovery. The muktuk (skin with some of the underlying blubber attached) flippers, and tail flukes are normally harvested for food, while some hunters may also retain the meat.

The CI stock of beluga whales is genetically and geographically isolated from other Alaskan populations of beluga whales. NMFS has conducted annual surveys of the CI beluga whale between 1994 and 1998. Results of these surveys indicated that the CI beluga whale stock had declined dramatically since 1994. The 1998 estimate of 347 whales represents a decline of 47 percent from the 1994 estimate (n = 653). The overharvest of beluga whales in Cook Inlet for subsistence purposes is believed to be the primary factor responsible for the decline.

Responding to the dramatic decline in this stock, NMFS initiated a Status Review of the Cook Inlet stock pursuant to the ESA on November 11, 1998. The CI beluga whales' present status and health was reviewed and recommendations were made for possible designation as depleted under the MMPA and/or listing as endangered or threatened under the ESA. The comment period on the status review (November 19, 1998 through January 19, 1999) was initiated at the same time that workshops were being convened to review beluga whale stocks throughout Alaska. The workshops were held by the Alaska Beluga Whale Committee (November 16-17, 1998) and the Alaska Scientific Review Group (November 18-20, 1998), a body established under the MMPA to provide scientific advice to NMFS regarding marine mammal conservation. To further ensure the status review was comprehensive and based on the best available scientific data, the closure of the public comment period was followed by a NMFS-sponsored workshop that reviewed relevant scientific information on this stock and received additional public comments and recommendations on March 8-9, 1999, in Anchorage, Alaska. The proceedings and abstracts of presentations from that workshop are summarized at Moore et. al. (1999).

On March 3, 1999, NMFS received a petition from seven organizations and one individual to list the CI stock of beluga whale as "endangered" under the Endangered Species Act of 1973, as amended (ESA). This petition requested emergency listing under section 4 (b)(7) of the ESA, designation of critical habitat, and immediate action to implement regulations to regulate the subsistence harvest of these whales. NMFS determined that these petitions presented substantial information which indicated the petitioned action(s) may be warranted (64 FR 17347, April 9, 1999).

Historically, harvest levels have been largely unreported. There are no reliable mortality estimates prior to 1994. Prior to 1994 the harvest estimates do not include an estimate of those struck but lost, nor do they represent a complete effort of harvest. However, during a study between 1995 and 1997 conducted with Native hunter groups, NMFS estimated that the average annual harvest (including struck and lost whales) of CI beluga whales averaged 77 whales per year. Applying the struck but lost rate to harvest data from 1994 through 1998 resulted in an average annual harvest of 65 whales. Harvest at these rates could account for the 15 percent per year decline observed between 1994 and 1998.

At the time of the petitions, Federal regulations did not exist to control the subsistence harvest, and cooperative management agreements were not in place. To address this critical issue, Senator Stevens of Alaska introduced the following legislation:

> Notwithstanding any other provision of law, the taking of a CI beluga whale under the exemption provided in section 101(b) of the Marine Mammal Protection Act [16 U.S.C. 1371 (a)] between the date of the enactment of this Act and October 1, 2000, shall be considered a violation of such Act unless such taking occurs pursuant to a cooperative agreement between the National Marine Fisheries Service and affected Alaska Native organizations.

President Clinton enacted the bill on May 21, 1999 (Public Law 106-31). Therefore, in order for a harvest to occur prior to October 2000, NMFS and an ANO need to enter into an agreement which provides for the management of the beluga whale harvest. At the time of the legislation, NMFS had not signed an agreement with an ANO. Therefore, the subsistence harvesting of the CI beluga whale stock is prohibited until October 1, 2000, or until an agreement was signed.

Subsequent to the harvest prohibition, NMFS conducted a survey in June 1999. The abundance estimate from this survey was 357 whales. While the declining trend from 1994-1998 remained significant, the 1999 estimate was not significantly different from the 1998 estimate of 347 whales, and indicated a slight increase in the population size. It is believed that this apparent result is due to the moratorium that was in place in 1999 as a result of Public Law 106-31.

As a result of the abundance data, and other information presented in the status reviews, NMFS published a proposed rule to designate the Cook Inlet, Alaska, stock of beluga whales as depleted under the MMPA on October 19, 1999 (64 FR 56298). The final depleted designation was published on May 31, 2000 (65 FR 34590).

NMFS also entered into a co-management agreement with CIMMC on May 23, 2000. CIMMC is an organization comprised of Native Alaskans residing in the Cook Inlet region who share an interest in local marine mammals. CIMMC includes Cook Inlet treaty tribes, Native hunters, and concerned Alaskan Natives. CIMMC was established to protect cultural traditions and promote conservation, management, and utilization of Cook Inlet marine mammals by Alaskan Natives. The agreement and any harvest during 2000 would fall under the provisions of Public Law 106-31. The agreement is presented in Appendix A. NMFS anticipates developing similar agreements with CIMMC to address the management of this stock from 2001 to recovery, although other ANOs may also become involved with the future co-management of CI beluga whales.

1.2 Purpose of the Action

Because the CI beluga whale stock is depleted, any long-term Federally-approved harvest plan is considered a major action subject to the requirements of NEPA and, therefore, cannot be authorized until an EIS has been prepared. The primary management action proposed is to limit Native subsistence harvest of CI beluga whales through Federal regulation. Major issues associated with this action include the level of harvest and its effects on the recovery of this stock, the impacts of various harvest levels on Native culture, and how Native subsistence harvest may be managed. This DEIS also considers the potential impacts of other anthropogenic activities in Cook Inlet on the beluga whale stock.

NEPA compliance on subsequent (annual) Federal actions on beluga whale harvests may proceed by tiering those actions, where appropriate, to this document.

1.3 Need for the Action

Two primary reasons exist which support the need for the proposed action. The first is to recover this stock to a level where it is no longer considered depleted under the MMPA. The main objective here will be to prevent the continued decline in the population from excessive harvesting. Public Law 106-31, limiting all subsistence harvest to that occurring under a cooperative agreement between affected ANOs and NMFS, expired on October 1, 2000, unless extended. To reduce the possibility of excessive harvest and to conserve the CI beluga whale stock, it is necessary to have one or more mechanisms in place to regulate this take after this legislation expires. In the absence of any action by NMFS, the future of this harvest, and the CI stock of beluga whales, is uncertain.

Management could be achieved through voluntary and cooperative efforts within the Native community, through organization and development of harvest restrictions which provide for the recovery of the stock. However, no area-wide tribal authorities, or traditional Native laws, exist which apply to the harvesting of CI beluga whales. Because of this, a Native Alaskan may harvest belugas from Cook Inlet without the approval of any local tribal authority or governing body. The Federal government, through NMFS, has a trust responsibility for CI beluga whales. While Alaskan Native co-management of Alaska's marine mammals has generally proven to be very successful, reliance on strictly voluntary measures may not satisfy the Federal Government's trust responsibility for CI beluga whales. As a result, NMFS believes that the recovery of this stock also requires Federal action to protect and conserve the stock and its habitat.

Secondly, there is a need to recognize the importance of the CI beluga whale to Native culture and nutrition, and to provide for the continued opportunity to harvest these whales within the recovery phase. The subsistence harvest and use of the beluga whale is a component of Alaskan Native culture. The importance of the harvest transcends the nutritional or economic value of the whale, and provides identity to the cultures which now harvest the whales. Native hunters have stated their willingness to reduce harvest levels during the recovery period, but also express their belief that the skills, knowledge, and traditions associated with the subsistence hunting of these whales needs to be passed on to younger generations.

Chapter 2. Alternatives Including the Proposed Action

2.1 General Considerations

The alternatives are presented in Section 2.2. These alternatives were developed through an iterative process which considered the known factors presently, or potentially, impacting the CI beluga whale stock and its recovery, and through comments in the scoping process. For those factors found to have such impacts, alternatives were developed and assessed. Much of the deliberative information on the effects of these factors appears in subsequent sections of this document. Initially, NMFS considered the two primary factors believed to have the greatest potential to affect the recovery of the beluga whale stock: subsistence harvest by Alaskan Natives and the impacts to, and conservation of, important beluga whale habitat.

A principal objective of this document is to assess the consequences of alternatives to recover this depleted stock to its Optimum Sustainable Population level, and to provide for the continued traditional subsistence use by Alaskan Natives to support their cultural and nutritional needs. Appendix A includes an Agreement between NMFS and CIMMC for the cooperative management of the CI beluga whale stock for the year 2000. A similar agreement will be proposed for management of this stock from 2001 through recovery.

The NMFS/CIMMC Agreement for 2000 represents a sharing of responsibilities and is intended to provide the necessary authorities to oversee this harvest while allowing Native Alaskans to manage many aspects of the hunt. The Agreement minimizes wasteful practices and improves the efficiency of the harvest. Hunting will be confined to certain periods to reduce the possibility of harvesting pregnant females. Taking of calves, or females with calves, will be prohibited. This will reduce the chances of striking a calf, or female accompanied by a calf, or of striking a whale in an area or manner which may result in the loss of the whale. The sale of edible portions will be prohibited. These, and several other conditions to the hunt, that have been agreed upon and specified in the Agreement, will greatly improve harvest efficiency. Some of the requirements will be contained in Federal regulations under MMPA, while others will remain the responsibility of CIMMC.

One important provision of the Agreement is the requirement for the parties to consult whenever any unusual event has occurred which might affect the impact of each year's harvest on recovery, such as a mass stranding or oil spill. The harvest would not proceed after such an event until NMFS and the CIMMC had both given their approval. The recovery objectives within this DEIS will provide the guidance for any assessment of the biological impact of these unusual events.

The impacts of these alternatives are evaluated from information and analyses presented in Chapters 3 (Affected Environment) and 4 (Environmental and Socio-cultural Consequences). The environmental consequences section (Chapter 4) of the DEIS discusses the impacts of the alternatives on stock recovery. Chapter 4 also reviews the socio-cultural impacts of the harvest on the traditional Native Alaskan cultures of Cook Inlet. Chapter 4 of this document also addresses other issues that may impact beluga whales and their habitat in Cook Inlet.

2.2 Alternatives

2.2.1 Alternative 1 - Zero harvest

Alternative 1 is to harvest no whales until such time as the stock recovers to the Maximum Net Productivity level (MNPL) which corresponds to the lower limit of the Optimum Sustainable Population (OSP). The goal of the alternative is to maximize the recovery potential of the CI beluga whale stock. NMFS would not enter into any cooperative agreements under this alternative. NMFS would, however, establish Federal regulations controlling Native subsistence harvest such that no whales would be harvested until the CI beluga whale stock had recovered to no less than 780 animals (OSP), or MNPL for a stock whose carrying capacity (K) is 1,300 individuals (See Chapter 4.1 for the Biological Model).

NMFS would implement this alternative jointly with Alaskan Natives through a cooperative agreement under section 119 of the MMPA that would specify the level of harvest as zero strikes annually and would address other aspects of co-management.

2.2.2. Alternative 2

Alternative 2 establishes a harvest at one (1) strike annually, until the stock had recovered to a population of no less than 780 animals (MNPL for a stock with $K = 1{,}300$). The goal of Alternative 2 is to allow the traditional subsistence harvest of CI beluga whales by Alaskan Natives to continue while recovering this stock.

Under this alternative, NMFS would promulgate regulations that would limit the taking of CI beluga whales by Alaskan Natives. Also, hunting would only occur under the terms of a co-management agreement. These regulations would (1) specify the level of allowable take as described by this alternative; (2) require all hunting to occur on, or after, July 15 to minimize the harvest of pregnant females; (3) prohibit the taking of calves or beluga accompanied by a dependent calf; and (4) prohibit the sale of edible portions of CI beluga whales. The initial strike would fall under the controlling Federal authority provided by Public Law 106-31.

This harvest would be administered jointly between NMFS and Alaskan Natives through a cooperative agreement under section 119 of the MMPA. The cooperative agreement would specify the level of harvest as one (1) strike annually per calendar year. A strike would be considered any event in which a bullet, harpoon, spear, or other device intended to take a whale comes in contact with a beluga whale. Multiple strikes on a single whale would be considered one strike.

Any subsistence harvest under this alternative would occur only after a cooperative agreement under section 119 of the MMPA had been signed.

2.2.3 Alternative 3

Alternative 3 is the same as Alternative 2 except that regulations would be established which provide for one (1) strike annually for eight consecutive years, after which time the harvest would be increased to two (2) strikes annually, until the stock had recovered to a population of no less than 780 animals. This alternative would also allow the traditional subsistence harvest of CI beluga whales by Alaskan Natives to continue while recovering this stock.

The initial strike would fall under the controlling Federal authority provided by Public Law 106-31. NMFS would administer this harvest jointly with Alaskan Natives through a cooperative agreement under section 119 of the MMPA that would specify the level of harvest as one (1) strike annually for eight consecutive years, after which time the harvest would be increased to two (2) strikes annually until the stock had recovered to a population no less than 780 animals.

2.2.4 Alternative 4 (NMFS Preferred Alternative)

Alternative 4 establishes Federal regulations controlling Native subsistence harvest at two (2) strikes annually, until the stock had recovered to a population of no less than 780 animals (MNPL for a stock with $K = 1{,}300$). Under Alternative 4, NMFS would establish an annual harvest level at two (2) strikes, until the stock had recovered to a minimum population level of 780 animals.

2.2.5 Alternative 5

Alternative 5 allocates a fixed-percentage of whales to be harvested based on the recruitment rate. This alternative provides a greater opportunity for the traditional subsistence harvest of the CI beluga whale stock. This alternative also allows the recovery of the stock to continue, albeit at a slower rate. Under this alternative NMFS would promulgate regulations to set an annual harvest at one half the maximum rate of recruitment (e.g., 2 percent of recruitment) until the stock had recovered to 780 animals (MNPL for a stock with $K = 1{,}300$). This alternative would require annual monitoring.

NMFS would administer this harvest jointly with Alaskan Natives through a cooperative agreement under section 119 of the MMPA.

2.2.6 Alternative 6 - The No-Action Alternative

Under this “no action” alternative, there would neither be a harvest plan nor harvest limits. NMFS would not issue regulations regarding this subsistence harvest, nor would NMFS sign any cooperative agreement with any ANO which included provisions for the harvest of CI beluga whales. NMFS would not take action to regulate Alaska Native harvest of CI beluga whales.

2.3. Alternatives Considered and Rejected

NMFS has not considered any alternatives that would result in habitat modification or further management actions that would require special consideration be given to the beluga whale habitat in Cook Inlet. See Chapter 4 for further discussion.

Chapter 3 Affected Environment

The purpose of this chapter is to describe the existing environment, including conditions and trends, that may be affected by the preferred alternative. Descriptions focus on the physical features of Cook Inlet, Alaska, living marine resources, and habitat. The following description(s) of the physical environment of Cook Inlet provides a setting for subsequent discussions on the environmental impacts of each alternative. These descriptions are necessary for understanding how the alternatives being considered may affect the marine resources of Cook Inlet.

A thorough presentation on the Cook Inlet Region of Alaska is presented in University of Alaska's 1974 Alaska Regional Profiles: Southcentral Alaska (UAF 1974), and the Minerals Management Service's Final Environmental Impact Statement for the Cook Inlet Planning Area Oil and Gas Sale 149 (MMS 1996). The reader is referred to these documents for a more detailed discussion on the Region's natural and human-made environments. Much of the following discussion is derived from the Regional Profiles and MMS (1996).

3.1 Physical Description of the Cook Inlet Region

Cook Inlet is a large tidal estuary which flows into the Gulf of Alaska. This shallow estuary is approximately 220 miles long, 30 miles wide, and generally only 200 feet (60m) deep. The Inlet is surrounded by several mountain ranges (the Aleutian and Alaska Ranges and the Kenai, Chugach, and Talkeetna Mountains). As such, Cook Inlet lies within a transition zone. The upper Inlet is characterized by a maritime climate that transitions to a continental climate in the lower reaches of Cook Inlet. The upper Inlet is also generally drier and cooler than the lower Inlet. Anchorage experiences average winter temperatures of 15F and a summer average of 55F, while Homer (near the southern end of the Inlet) has winter and summer average temperatures of 20F and 50F, respectively. Summer temperatures for the Cook Inlet Region average between the low 40's F and mid 60's F, while winter temperatures range between 4F and the low 40'sF (Selkregg, 1974).

Cook Inlet is a seismically-active region, categorized in seismic risk zone 4, defined as areas susceptible to earthquakes with magnitudes 6.0 to 8.8 and where major structural damage will occur (USCOE, 1993). Five active volcanoes are found along the mountain ranges bordering the western side of the Inlet. All of these volcanoes are considered to be capable of major eruptions. The region is underlain by several faults, and has experienced over 100 earthquakes of magnitude >6 since 1902 (MMS, 1996, IIIA-1). The March 1964 earthquake caused considerable damage to the region and altered many waterways through changes in land levels. The area may be subjected to tsunamis and seiches as these events cause large-scale displacement of the Inlet's waters.

The Cook Inlet Region contains substantial quantities of mineral resources including coal, oil and natural gas, sand and gravels, cooper, silver, gold, zinc, lead, and other minerals. The Inlet's coal is principally lignite, the largest field being the Beluga River deposit in the vicinity of the Beluga and Yentna Rivers, containing an estimated 2.3 billion tons (USCOE, 1993). Oil and gas deposits occur throughout the region, with estimated reserves of 76.9 billion barrels of petroleum and 14.6 trillion cubic feet of natural gas (USCOE, 1993). Six fields in the Cook Inlet region are active; five of which are located offshore in the middle Inlet. These are the Granite Point, Trading Bay, McArthur River, Middle Ground Shoal, and Redoubt Shoal fields.

Finally, the region is the major population center in the State as well as the most agriculturally-developed area of the State.

3.1.1 Water Quality and Properties

The Inlet is a complex estuary of the Gulf of Alaska. The relatively fresh, turbid waters of the upper Inlet come from several tributaries, with some of the region's largest waterways emptying into the northern reaches of the Inlet. The three primary rivers are the Knik, Matanuska, and Susitna Rivers with a combined peak discharge of about 90,000 m3/sec. in July through August (MMS, 1996, IIIA-5). Upper Inlet waters meet and mix near mid-Inlet with more-saline waters from the northern Gulf of Alaska. This mixture then flows along the western Inlet to Shelikof Strait. The salinity, temperature, and suspended sediment levels vary significantly within the upper Inlet as freshwater input decreases in winter.

Cook Inlet has the second highest tides in all of the Americas, exceeded only by the Bay of Fundy in Nova Scotia. Tidal forces may be extreme, and are the main force driving surface circulation in Cook Inlet. Mean diurnal range of tide at Anchorage is 29 feet. Strong currents and swirls in the upper Inlet make navigation difficult. Mid-Inlet currents may reach 8 ft/second or more. During winter months, ice is a dominant physical force within the Inlet, forming sea ice, beach ice, stamukhi ice[1], and river ice. Sea ice generally forms in October to November, increasing from October to February from the West Forelands to Cape Douglas. The southern portion of the Inlet is generally open in winter. By January, much of the upper Inlet may experience 70-90% ice cover, although this reach rarely freezes solid because of the enormous tidal range. Ice has generally left the upper Inlet by early April, but may persist into May.

All surface waters in the Region are acceptable for most uses, although they typically carry high silt and sediment loads, particularly during summer. Marine waters are well-oxygenated, with concentrations in surface waters from about 7.6 ml/l in the upper Inlet to 10 ml/l in the southwest Inlet (MMS, 1996, IIIA-9). Mean annual freshwater input to Cook Inlet exceeds 18.5 trillion gallons. Freshwater sources often are glacially-born waters which carry high suspended sediment loads, as well as a variety of metals such as zinc, barium, mercury, and cadmium. Barium is also the major component of drilling muds. MMS (1996, IIIA-11) considered four studies of Cook Inlet water quality. These found that levels of hydrocarbons in the water column were generally low, often less that the method detection limit. Elevated methane levels were observed in waters from Trading Bay in the upper Inlet, an area with oil and natural gas fields. Saturated hydrocarbon

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[1]Stamukhi ice is formed by overhanging pieces of deposited beach ice breaking off with tidal action, to be redeposited along the shoreline and adding subsequent layers of new ice.

levels from waters collected in 1993 from the upper Inlet were below detection limits, although detected in treated production waters from Trading Bay. Polynuclear Aromatic Hydrocarbons were often less than detection or reporting limits, although treated production waters again held elevated levels. *In situ* bioassay of sand dollar fertilization rates using waters from eight sampling locations in Cook Inlet found reductions within tests using waters from the two northernmost stations, although suspended sediment material may have contributed to the toxicity. Larval survival was not significantly different from the control, except for one station in Kachemak Bay which had a survival rate less than 10% of the control.

3.2 Biological Resources

The Cook Inlet region supports a wide variety of fish and wildlife. Prominent wildlife include black and brown bear, wolf, moose, caribou, dall sheep, mountain goat, waterfowl, and several species of whales and dolphins. Approximately 38 species of terrestrial mammals occur in the upper or lower Cook Inlet region. Ten mainland species that use the marine coastal environments to some degree include the river otter, brown bear, black bear, red fox, arctic fox, wolf, coyote, mink, wolverine, and moose. None of these species should be directly affected by management actions associated with the recovery or management of CI beluga whales.

Freshwater, anadromous, and marine fish are common to the region. The following sections are taken from the MMS, 1996, Final EIS on the Cook Inlet Oil and Gas Planning Area Sale - 149. The reader is referred to that document for a more detailed discussions of the biology of the Cook Inlet region.

3.2.1 Anadromous Fish

Five species of Pacific salmon and several species of trout occur in Cook Inlet and its tributary waters: Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*), pink (*O. gorbushka*) and chum (*O. keta*) salmon spawn and rear within freshwater drainages of the Inlet while also utilizing the marine waters of the Inlet to migrate, rear, and feed. Salmon in this region afford a high value to the commercial-fishing industry. The eulachon, *Thaleichthys pacificus*, is an important forage species which spawns in many of the streams and rivers entering Cook Inlet.

3.2.1.1 Pink Salmon

Pink salmon, at maturity, are the smallest of the five species of Pacific salmon, averaging about 1.4 to 2.3 kg (3-5 lb), and to 76 cm (30 in) in length. Spawning pink salmon reach Cook Inlet in early July. Each female has an average egg complement of about 1,500 to 1,900, and the eggs hatch in late February. The yolk-sac fry remain in stream gravels until early spring, at which time they migrate to the ocean. Out-migration from upper Inlet streams begins in late May and peaks in June (Moulton, 1994). Pink salmon rear in the North Pacific Ocean for two winters before returning to the Cook Inlet region to spawn and die.

Additionally, pink salmon exhibit cyclical population variations within Cook Inlet, with larger numbers occurring during the even-number years.

3.2.1.2 Chum Salmon

Chum (dog) salmon range to 100 cm (40") in length (McPhail and Lindsey, 1970) and 1 to 6 kg (6.6-13.2 lb) in weight. Food consists of a variety of macroscopic organisms that inhabit the pelagic marine waters where this species migrates. Chum salmon enter the lower Cook Inlet region beginning in early July, and the spawning runs continue through early August. Chum salmon spawn in many streams throughout the region; with the eggs deposited in stream gravels. Egg complement is 2,000 to 4,300, and the eggs hatch in early spring. Chum salmon fry then move downstream to the ocean where they remain for three to four winters before returning to their natal streams to spawn and die. During 1999, chum salmon catch in upper Cook Inlet totaled 178,955 fish.

3.2.1.3 Coho Salmon

Coho salmon are the last of the Pacific salmon to return to Cook Inlet to spawn. Coho salmon enter the region in late July, and the runs continue into October and November. Coho salmon range to 96 cm (38 in) in length and average about 2.7 to 5.4 kg (6-12 lb) in weight (McPhail and Lindsey, 1970). The eggs (ranging from 2,500-5,000 per fish) are deposited in stream gravels, and the fry remain in the stream for two winters before migrating to the ocean. This migration usually occurs annually from March through June. Coho salmon remain in the North Pacific Ocean for two to three winters before returning to spawn in their natal stream. Coho salmon harvest in the upper Inlet totaled 123,587 in 1999.

3.2.1.4 Rainbow Trout and Steelhead

Formerly classified with the genus *Salmo* (trouts), the rainbow trout is now assigned to the genus *Oncorhynchus* because it is more closely related to other species in this genus. The anadromous sea-run race of this species, the steelhead, is unevenly distributed throughout the lower Cook Inlet region. Information on the steelhead in Alaska tends to be limited to those few areas where larger populations support well-known sport fisheries. The Anchor River and Deep Creek on the Kenai Peninsula support fishable runs. The steelhead enter freshwater over a considerable period of time, generally from early fall into the winter months. Spawning occurs in the spring, with larger females having egg complements of as many as 7,600 eggs. Steelhead probably enter the ocean after a year in freshwater streams. While small numbers may be taken incidental to the commercial-salmon catch and in the commercial ocean-trawl fisheries, most of the harvest occurs by sport fishermen.

3.2.1.5 Sockeye Salmon

The sockeye (red) salmon is probably the most important commercial-salmon species in the Cook Inlet region. Sockeye salmon range to 84 cm (33") in length and to about 7 kg (15.5 lb) in weight

(McPhail and Lindsey, 1970). These fish migrate in large schools over much of the North Pacific Ocean and into the eastern Bering Sea. Adult sockeye salmon spawn in Cook Inlet beginning in late June and the runs continue through early August. Sockeye salmon usually spend two or three winters in the North Pacific Ocean before returning to spawn and die. In the ocean, sockeye salmon consume a variety of macroscopic fauna from the pelagic zone. The sockeye salmon harvest in upper Cook Inlet totaled 2,668,933 fish in 1999.

3.2.1.6 Chinook (king) Salmon

The largest of the Pacific salmon species at maturity, chinook salmon range to 57 kg (126 lb) in weight and 147 cm (58 in) in length (McPhail and Lindsey, 1970). Spawning chinook salmon enter Cook Inlet during early May and are present in some spawning streams by the end of that month. During this same period, chinook salmon smolt are migrating downstream.

Chinook salmon spawn in late June through late July in most areas. Egg complements may be as high as 8,000; however, 4,000 to 5,000 are more common. The eggs are deposited in stream gravels, where they incubate for several months. Chinook salmon rear in freshwater for two winters before their seaward migration, and they may spend three to four years in the ocean. Chinook salmon prey on other finfish, herring, capelin, eulachon and similarly-sized fish species in the marine environment. Smaller chinook salmon consume a variety of macroscopic fauna found in pelagic waters, e.g., amphipods, euphausids. The chinook salmon harvest totaled 14,155 fish in the upper Inlet in 1999.

3.2.1.7 Eulachon

The eulachon, or candlefish, is a small (up to 23 cm in length) smelt-like forage fish found throughout much of Cook Inlet. Eulachon are anadromous and move nearshore in early May where they spawn in river drainages throughout Cook Inlet. Depending on size of the spawning fish, egg complements range from 17,300 to 39,600 per fish, with an average of about 25,000 eggs per fish. The eggs are deposited on stream gravel and they hatch in about 30 to 40 days (depending on water temperature). The larvae then move downstream to enter marine waters.

Currently, there are no biomass estimates for this species. A commercial dipnet fisheries for this species in the lower Susitna River in 1999 resulted in a harvest of 50 tons of eulachon (ADFG 1999a).

3.2.2 Marine Mammals

Fifteen species of non-endangered marine mammals are resident or occur seasonally in upper or lower Cook Inlet. Of these, only the harbor seal, beluga whale, killer whale, and harbor porpoise are commonly observed in the upper Inlet.

3.2.2.1 Harbor Seals

Harbor seals are present in coastal waters throughout Cook Inlet. Although primarily a nearshore species, harbor seals have been sighted up to 100 km offshore (Fiscus et al., 1976). Present in almost all nearshore marine habitats, they concentrate in estuarine and other protected waters (Pitcher and Calkins, 1979). They most frequently haul out on protected habitats including cobble and sand beaches, offshore rocks and reefs, tidal mudflats and sandbars, and floating and shorefast ice (Pitcher, 1977; Pitcher and Calkins, 1979; Frost, Lowry, and Burns, 1982). Harbor seals seasonally frequent freshwater streams and lakes during anadromous fish runs. Their presence in the upper Inlet appears to be seasonal. They are commonly observed and hunted along the Susitna River delta and other tributaries to the upper Inlet during salmon migrations.

Harbor seals are opportunistic feeders and their diet varies with season and location. The preferred diet of harbor seals in the Gulf of Alaska consists of pollock, octopus, capelin, eulachon, and herring. Other prey species include cod, flatfishes, shrimp, salmon, and squid (Hoover, 1988).

Harbor seals in the northern Gulf of Alaska have declined in some areas by 78 percent during the past two decades (Fadely, et al., 1997). Causes of this decline are unknown but may include natural population fluctuations or cycles, reduced environmental carrying capacity and prey availability due to natural or human causes, predation, subsistence harvests, direct fishery related mortality, entanglement in marine debris, pollution, and emigration (Hoover-Miller, 1994). Native Alaskans report seeing fewer harbor seals in the Susitna River delta now than in the past (Huntington, 1999).

Major harbor seal-haulout sites in the Cook Inlet region are found in the lower portion of the Inlet. Pupping and breeding occurs at most major haulouts and varies temporally from May through July in Alaska. Harbor seals molt following the reproductive period. The peak season for molting in the Gulf of Alaska occurs from July to September (Pitcher and Calkins, 1979).

3.2.2.2 Killer Whales

Killer whales (*Orcinus orca*) are found throughout the world (Leatherwood and Dahlheim, 1978). Killer whales are typically found in pods of 2 to 50 individuals (Bigg, 1982). Concentrations in Alaska occur near landmasses, along the continental shelf, in Prince William Sound, near Kodiak Island, around the Aleutian Islands, and in southeast Alaska (Braham and Dahlheim, 1982).

A minimum population estimate for killer whales in Prince William Sound, Shelikof Strait, and Southeast Alaska is 286 whales, with about 100 whales estimated for Shelikof Strait (Leatherwood et al., 1984). More recent data indicate that there are as many as 251 photo-identified whales in Prince William Sound, but some of those whales may be from Kodiak (Matkin, Steiner, and Ellis, 1989; Matkin and Ellis, 1990). Recently a transient pod of killer whales from Prince William Sound has decreased in size by approximately 50 percent. This transient pod feeds exclusively on marine mammals. Given recent declines in seals and sea lions throughout the central and western Gulf of Alaska, the remaining killer whales from this pod, or other transient killer whales, may be entering Cook Inlet in search of beluga whales more frequently now than in previous decades.

During the 1990s killer whales were documented by NMFS in Cook Inlet primarily as the result of stranding events. Six whales stranded in Turnagain Arm in May 1991. Five whales stranded again in August 1993. There were mass stranding events in 1996 and again in 1999. Also, Native Alaskan hunters report seeing killer whales in the upper Inlet between Fire Island and the Village of Tyonek. Other reports indicate that, while killer whales have been seen in the Inlet for decades, their frequency of occurrence in the upper Inlet has increased in recent years.

Killer whales have one of the most diverse diets of all marine mammals (Lowry et al., 1982). They prey on fishes and other marine mammals including salmon, cods, seals, sea lions, walruses, fur seals, whales, and porpoises. However, if the killer whales entering Cook Inlet are part of a transient pod, they would likely prefer marine mammals given results of prey studies on transient killer whale pods found elsewhere..

3.2.2.3 Harbor Porpoise

The harbor porpoise is the smallest cetacean species in the eastern North Pacific, reaching a maximum length of five feet (Leatherwood, Evans, and Rice 1972). It is normally found in bays, river mouths, and shallow nearshore areas.

Three stocks are recognized in Alaska; Bering Sea, Southeast, and Gulf of Alaska (Hill and DeMaster, 1998). The current abundance estimate for the Gulf of Alaska stock is 8,497 (Hill and DeMaster, 1998). A 1991 aerial survey effort covering Cook Inlet waters resulted in an abundance estimate of 136 (Dahlheim et al., 1992). Harbor porpoises have been observed in harbors, bays, and river mouths. They also are sometimes reported in the upper Inlet along Turnagain Arm (e.g., off the Placer and Twenty-mile Rivers) in the spring and early summer, possibly feeding on eulachon.

3.2.2.4 Beluga Whales

Beluga whales are circumpolar in distribution and occur in seasonally ice-covered arctic and sub-arctic waters. In Alaska, beluga whales are found in marine waters from Yakutat to the Alaska-Canada border in the Beaufort Sea. These comprise five distinct stocks; Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea, Bristol Bay, and Cook Inlet (Hill and DeMaster, 1998). Of these, the Cook Inlet stock is now considered to be 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). The observed differences in mitochondrial DNA found the Cook Inlet stock was the most genetically distinct of the Alaska beluga stocks, suggesting the Alaska Peninsula may be an effective barrier to genetic exchange. The lack of observations of beluga whales along the southern side of the Alaska Peninsula also support this finding. Murray and Fay (1979) postulated that this stock has been isolated for several thousand years.

(i) Life History: The beluga whale is a small, toothed whale in the family Monodontidae, the only other member of which is the narwhal. Beluga whales may reach lengths of 16 feet, although adult size is more often 12-14 feet. Native hunters report some whales may reach 20 feet.

Males may weigh about 1,500 kg, or 3,307 pounds and females 1,360 kg or 2,998 pounds (Nowak, 1991). Calves are born dark gray to brownish gray and become lighter with age. Adults become white to yellow-white upon sexual maturity, although Burns and Seaman (1986) report females may retain some gray coloration for as long as 21 years. Beluga whales 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. Calves are gray to brownish gray at birth. 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, 1999). Alaskan 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, Rough, and Richardson, 1983; Calkins, 1989). Mating shortly follows the calving period. Reports on the age of sexual maturity vary from ten years for females and 15 for males (Suydam, Burns, and Carroll, 1999), to four to seven years for females and eight to nine 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 believe that beluga whale blubber is thinner in the early spring than later in summer, suggesting that feeding in the northern Inlet, principally on fat-rich fish such as eulachon and salmon, is very important to the energetics of these animals. NMFS has measured blubber thickness to be in excess of 9 cm on CI beluga whales.

Beluga whales have well-developed senses of hearing and echolocation. These whales hear over a large range of frequencies, from about 40-75 Hertz to 30-100 kilohertz (Richardson, 1995) although it is most acute at middle frequencies between about 10 kHz to 75 kHz (Fay, 1988). At low frequencies, beluga hearing is limited by hearing thresholds, rather than ambient noise. Above a few kilohertz, however, ambient noise may limit hearing by these whales. Most sound reception takes place through the lower jaw, which is hollow at its base and filled with fatty oil. Sounds are received through this structure and conducted through the lower jaw to the middle and inner ears and 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 which typically migrate, hunt, and interact together. Nowak (1991) reports average pod size as ten animals, although belugas may occasionally form much larger groups, often during migrations. Within Cook Inlet, groups of 10 to more than 100 beluga whales are typically observed during the summer. It is unclear whether these represent distinct social divisions. Native hunters have stated that beluga whales form family groups, and that there are four types of belugas in Cook Inlet, distinguished by their size and habits

(Huntington, 1999).

(ii) Stock Abundance: Abundance surveys of CI beluga whales prior to 1994 were often incomplete, highly variable, and involved non-systematic observations or counts of concentrations in river mouths and along the upper Inlet. Based on aerial surveys in 1963 and 1964, Klinkhart (1966) estimated the stock at 300-400 animals, but the methodology for the survey was not described. Sergeant and Brodie (1975) presented an estimate for the Cook Inlet stock as 150-300 animals, but offer no source for this figure. Murray and Fay (1979) counted 150 beluga whales in the central Inlet on 3 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) reported on surveys of the upper Inlet between May and August of 1982, and estimated 200-300 belugas were seen in one concentration 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, he presented a minimum abundance estimate of 1,293 whales. Since this is the most complete survey of the Inlet prior to 1994, and incorporated a correction factor for animals missed during the survey in the estimate, the Calkins summary provides the best available data for estimating the carrying capacity of the Inlet.

NMFS began systematic aerial surveys of beluga whales in Cook Inlet in 1994. Unlike previous efforts, these surveys included the upper, middle, and lower Inlet. Using both observers and videotape, this method also developed correction factors to account for whales not observed due to coloration (calves and juveniles are gray colored and do not contrast with the Inlet water), diving patterns, or because whales were missed by the survey track. These surveys have continued annually and have tracked a decline in abundance of nearly 50 percent between 1994 and 1999.

(iii) Distribution and Movements of CI Beluga Whales: 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. It is presently unknown whether this stock migrates seasonally from Cook Inlet and, if so, where it goes. Sightings from 1976 to 1979 and in 1997 indicate that at least some beluga whales are present in Cook Inlet year round, although they are not likely to occupy the northernmost reaches (Calkins, 1983; MMS, 1999)

The whales begin to return to the upper Inlet in April and early May, commensurate with the eulachons' returning migrations to several streams entering the northern portion of Cook Inlet. It appears that a relatively few discrete sites exist within upper Cook Inlet which are very important in terms of feeding habitat for the Cook Inlet stock of beluga whales. Alaska Natives attribute this early movement into the upper Inlet to whales following the whitefish migration (Huntington, 1999). Beluga whales congregate at the mouths of several larger river systems during early spring, feeding on eulachon, salmon smolt, and adult salmon. The beluga whales typically form several large groups during this period, and may reside in and near the Susitna River, the Little Susitna

River, Turnagain Arm, and several streams to the west of the Susitna River.

Beluga whales may ascend these river systems: Native hunters report belugas once reached Beluga Lake from the Beluga River, and belugas are often seen well upstream in the Kenai and Susitna Rivers. By the end of June the beluga whales may disperse throughout much of the upper Inlet. Important feeding and concentration areas at this time include the Eagle River estuary, Chikaloon River mouth, and Ship Creek mouth, as well as the sites used earlier in the spring.

A satellite tag was placed on a beluga whale captured near the mouth of the Little Susitna River in late May of 1999. This adult male was subsequently tracked over the next three months, signals from the tag ended on September 17. This animal remained in the upper Inlet during this entire period, and was observed within a large group of about 90-100 beluga whales at the mouth of the Little Susitna River from late May to mid June. The whale remained off the Susitna River and in Knik and Turnagain Arms until the tag quit transmitting.

The whales begin to leave the upper Inlet sometime in mid to late October, although small groups or individual animals are seen near Anchorage well into November.

The winter distribution of this stock is poorly understood. Calkins (1983) postulated that the whales leave the Inlet entirely, particularly during heavy ice years. Ten dedicated aerial surveys between February 12 and March 14, 1997 resulted in only a few beluga whale sightings in Cook Inlet. The number of animals represented by these sightings is not reported but clustered sightings near Kalgin Island suggest the same group or individuals may have been sighted repeatedly.

Beluga whale sightings outside of Cook Inlet (but in the northern Gulf of Alaska region) further indicate that the CI beluga whale stock ranges well beyond the inlet in the winter. These sightings include sporadic observations of beluga whales near Yakutat, 640 km southeast of Cook Inlet. Twenty one adult and five juvenile beluga whales were seen near Yakutat in May of 1976 (Fiscus, Brahan, and Mercer, 1976). The MMS 1997 winter surveys observed 10 beluga whales off Hubbard Glacier near Yakutat, and the U.S. Coast Guard reported sighting 10 to 11 beluga whales there in November 1998. These beluga whales are believed to be part of the Cook Inlet stock that move out of the inlet in winter and return again in spring. Consiglieri and Braham (1982) reported annual observations of these whales by local fishermen. Calkins (1986), however, found these observations to be unsupported and believed the Yakutat sightings to be belugas from the Cook Inlet stock.

Beluga whale sightings have also occurred in Shelikof Strait, Kodiak Island, Resurrection Bay and Prince William Sound. However, sightings in these locations are rare and involve relatively few animals. For example, a single beluga whale was observed in Aialik Bay near Seward in 1988 (Morris, 1992). Another single whale was reportedly seen near Montague Strait in 1978 (Harrison and Hall, 1978) and in St. Matthew's Bay in 1998 (pers com D. Janka). An exception is a report in Calkins (1986) of approximately 200 beluga whales observed in July 1983 in western Prince William Sound near Knight Island.

(iv) Feeding Behavior: Beluga whales are opportunistic feeders, and are 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, and salmon (Perez, 1990; Haley, 1986; Klinkhart, 1966). Cook Inlet Natives also report that CI beluga whales feed on freshwater fish; lingcod, trout, whitefish, northern pike, and grayling (Huntington, 1999), and on tomcod during the spring (Fay et al., 1984). Calkins (1989) reported recovering 13 fish tags from the stomach of an adult beluga whale found dead in Turnagain Arm. These salmon had been tagged in the Susitna River. In captivity, beluga whales may consume 2.5-3 percent of their body weight daily, or 40-60 pounds. Wild beluga whale populations, faced with an irregular supply of food, may easily exceed these amounts while feeding on concentrations of eulachon and salmon. Cook Inlet beluga whale hunters reported one whale having nineteen adult king salmon in its stomach (Huntington, 1999).

The smelt-like eulachon (also named hooligan and candle fish) is undoubtedly a very important food source for beluga whales in Cook Inlet. Eulachon may contain as much as 21% 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 millions (Calkins, 1989). Stomachs of beluga whales harvested from the Susitna area in spring have been filled with eulachon.

Salmon smolt are also an important prey item, as large numbers leave these river systems in spring and summer and are available to the belugas. Pink and chum salmon are most numerous during June and July, and all five species of Pacific salmon are present in the upper Inlet. Interestingly, a 1993 smolt survey of the upper Inlet found juvenile herring to be the second-most abundant fish species collected; these being primarily caught along the northwest shore, including the Susitna delta (Moulton, 1994).

Beluga whales capture and swallow their prey whole, using their teeth only to grab. These whales often feed cooperatively. At the Port of Anchorage, beluga whales have been observed to feed by positioning one whale along a rip rap dock, while a second whale herds salmon along the structure towards the stationary beluga whale. 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 gauntlet formed by the river mouths and the shallow waters. Dense concentrations of prey appear essential to beluga whale feeding behavior. Hazard (1988) reported that beluga whales were more successful feeding in rivers where prey were concentrated than in bays where prey were dispersed. Frost et al. (1983) 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 the prey.

(v) Natural Mortality: Three sources of natural mortality are considered in this section, strandings, predation and disease.

(1) Stranding Events: Beluga whales commonly strand in upper Cook Inlet. NMFS estimates that over 590 whales have stranded (both individual and mass strandings)in upper Cook

Inlet since 1988[2]. Mass stranding events have most commonly occurred along Turnagain Arm, often coinciding with extreme tidal fluctuations ("spring tides"). These mass stranding events involve both adult and juvenile beluga whales.

A 1996 mass stranding event of approximately 60 beluga whales in Turnagain Arm resulted in the death of four adult whales. Another stranding event of approximately 70 whales in August 1999 left five belugas dead, again all adults. Once a whale strands, death may result from stress and 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 body heat to the environment. If these structures are out of the water, this mechanism cannot function properly and body heat rises. Additional stress is placed on internal organs and breathing may be difficult without the support provided by the water.

(2) Predation: The CI beluga whale stock is predated by killer whales. 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. Native hunters report that killer whales are usually found along the tide rip that extends from Fire Island to Tyonek (Huntington, 1999). 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. During a stranding in August 1993 one killer whale vomited a large piece of beluga whale flesh. The number of killer whales visiting the upper Inlet appears to be small; five and six whales involved in each stranding. This may be a single pod which has recently extended its feeding territory to this region. Killer whales are more commonly found in lower Cook Inlet and the Gulf of Alaska where they may feed on a variety of prey, including beluga whales.

(3) Disease: 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 St. Lawrence estuary (n = 45 sampled) were affected by pneumonia (Martineau et al., 1994). One beluga whale apparently died from the rupture of an "aneurysm of the pulmonary artery associated with verminous pneumonia" (Martineau et al., 1986).

Beluga whales 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 Alaskan beluga whales. Anisakis simplex is also recorded from belugas in eastern Canada (Klinkhart, 1966). Results of

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[2]This estimate includes 44 beluga whale carcasses found along the shoreline which had been harvested for subsistence.

necropsies from CI beluga whales have found heavy infestations in adult whales. Approximately 90 percent of CI beluga whales examined have had kidneys parasitized by the nematode Crassicauda giliakiana. This parasite also occurs in other cetaceans. Although extensive damage and replacement to tissues has 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, however, been considered to be extensive enough to have caused clinical signs. 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 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.

3.3 Social, Economic, and Cultural Environment

Cook Inlet has been affected by human use for centuries. These activities represent a wide variety of features that have the potential to result in cumulative affects, to a greater or lesser extent, on the alternatives that will be considered in this document. The impacts of these features will be discussed in Chapter 4, section 4.9.

3.3.1 Major Communities

There are 17 communities within the Cook Inlet region with populations of at least 100 individuals. The Municipality of Anchorage is the largest city within the Cook Inlet area, with a population exceeding 250,000. These population estimates include the communities of Girdwood, Eagle River, Bird, Indian, Birchwood, and Chugiak. Eklutna, counted separately from Anchorage, had a 1996 population of 429. It is the center of trade, finance, and transportation for Alaska.

Cook Inlet Communities and Populations

Municipality of Anchorage	**257,780**
Kenai Peninsula Borough	**46,790**

Matanuska-Susitna Borough	**50,759**
Kenai	**6,950**
Homer	**4,064**
Seldovia	**667**
Anchor Point	**1,121**
Clam Gulch	**93**
Eklutna	**429**
Kasilof	**523**
Knik	**445**
Nanwalek (English Bay)	**167**
Ninilchik	**480**
Nikiski	**3,013**
Port Graham	**176**
Salamatof	**1,011**
Tyonek	**148**

Source: Ak. Dept. Natural Resources

The local economy is supported primarily by trade, services and government. Mining, agriculture, and fishing also contribute to the economy in relatively small percentages. Anchorage is also Alaska's largest Native village, with more than 19,000 Natives (ADCRA, 1997). In 1990, 111,000 civilians were employed in Anchorage, and an estimated 10,000 military personnel and their dependents were stationed at local military bases of Fort Richardson and Elmendorf Air Force Base.

The Kenai Peninsula Borough consists of 31 communities with a total 1997 population estimate of 52,448. Many of the communities have fewer than 300 people. Several of these communities are primarily Alaskan Native villages. The towns of Kenai, Soldotna, Sterling, and Homer are the largest in this borough. Most of the economy is supported by the private sector, of which retail trade, manufacturing, oil and gas extraction, and commercial fishing are major contributors.

The Matanuska-Susitna Borough contains approximately seventeen communities. The largest communities are Palmer and Wasilla. Located close to the larger Anchorage area, approximately 40 percent of the borough's work force commutes to Anchorage. Most of the borough's communities are located off of Cook Inlet.

3.3.2 Oil and Gas Development

The upper Cook Inlet and Kenai Peninsula have an association with the petroleum industry that dates back to the 1950's. A history of this association has been reviewed in MMS (1996) and the following was taken largely from that document. The first discovery in the region took place onshore in 1957, when oil was discovered on the Kenai Peninsula from the Swanson River #1 well. Except for the Beaver Creek Unit, which began producing oil in 1972, all other oil-producing fields are located in State waters. The Cook Inlet region produced 80 million barrels of oil (Mmbbl) at the height of production in 1970. Production had declined to 24.7 Mmbbl by 1983 and by 1991 production had declined to just over 15 MMbbl annually. Producible quantities of natural gas were first discovered in 1959 in what is now the Kenai Gas Field. Gas production in the Cook Inlet region did not begin until 1960. By 1983 annual natural gas production had reached 196.4 billion cubic feet (Bcf). By 1992 production had fallen to approximately 125 Bcf.

At the peak of its infrastructure development, there were 15 offshore production and 3 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 Cook Inlet production continuously declined.

Existing Cook Inlet production (off- as well as onshore) is handled through the Trading Bay production facility, the Tesoro Refinery, the Phillips-Marathon LNG (liquefied natural gas) plant, and the Union Chemical plant. The last three facilities are located at Nikiski, Alaska, north of the city of Kenai. The Trading Bay facility pipelines its received crude-oil production to the Drift River Terminal. The Drift River Terminal stores and loads at least 9 MMbbl annually. Almost all of the Drift River crude is transported to Olium, California.

The Tesoro Refinery can process up to 80,000 bbl per day. Recent refinery production has been augmented by North Slope oil tankered from Valdez. Almost all Tesoro’s output is consumed within Alaska. A products pipeline links the Nikiski refinery with the Tesoro fuel depot located at the Port of Anchorage. Tesoro’s refined products include multigrades of gasoline, propane, Jet A, Diesel, No. 2 Diesel, JP4, and No.6 fuel oil.

The Phillips Marathon LNG plant was constructed in 1969 and liquefies 1 million tons of LNG annually. It is the United States’ only natural gas liquefaction plant. Produced LNG is shipped by tanker to Japan (Tokyo Electric) by 80,000-m^3 carriers on an average of once every 10 days. Natural gas produced from the Kenai Gas Field is pipelined into Anchorage for domestic consumption; gas produced from the Beluga River field is used onsite at the Beluga River power plant.

The Union Chemical company plant can process gas to produce more than 1.1 million tons of ammonia and a similar quantity of urea pills and granules (for fertilizer). Some of the produced urea is used in Alaska. The rest is shipped to the U.S. West Coast in tankers and bulk freighters.

The offshore production facilities currently operating in Cook Inlet support 238 wells. These platforms are within the middle Inlet, south of the village of Tyonek. Approximately 6-7 new wells are drilled annually. The Environmental Protection Agency 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.

3.3.3 Vessel Traffic and Shipping

Much of upper Cook Inlet is unsuited to many navigational uses. Extreme tides and currents, shallow shoal areas, and the presence of sea ice place limitations on vessel traffic. Nonetheless, the Inlet is a vital navigational route between much of Alaska and the lower 48 states. The following discussion is taken from PN&D, 1993, unless otherwise noted.

Port facilities in Cook Inlet are found at Anchorage, Knik, Point Mackenzie, Tyonek, Drift River, East Foreland/Nikiski, Kenai, Anchor Point, and Homer. 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 is 1,428 nautical miles from Seattle, Washington. The Port of Anchorage provides both containership and general cargo berthing and two petroleum product docks. A recreational boat launch facility at the mouth of Ship Creek is operated by the Municipality of Anchorage during ice-free months.

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 Point Mackenzie Port is currently being developed in lower Knik Arm across from the Port of Anchorage. Commuter ferry service between Anchorage and Port MacKenzie is planned for 2001. While presently constructed as a barge port, Port MacKenzie's long range plan calls for a bulk loading facility into -50' MLLW. Near term activities will include across-the-dock loading of construction materials for developing an industrial park and exporting modular homes, logs, wood chips, and gravel. When deepened, future use of this facility will include the export of resources such as coal, and increased export of wood chips and logs.

3.3.4 Cultural Environment: The History of Beluga Whale Hunting in Cook Inlet

The selection of an alternative is significant in terms of maintaining a subsistence heritage or link between CI beluga whales and Alaskan Natives. For that reason, a traditional and contemporary overview of the subsistence harvest of beluga whales in Cook Inlet is appropriate prior to discussing each of the alternatives in the following section.

Throughout the Cook Inlet basin and specifically in Knik Arm and the Kenai River, archeological research has found items both from the Dena'ina Athabaskan and historic Eskimo cultures. The Pacific Eskimos occupied Cook Inlet as late as between 1000 - 1500 A.D. (Ackerman, 1975). The Dena'ina[3], also called the Tanaina, is one of the Athabaskan peoples of Alaska that live in the Cook Inlet region. The Dena'ina moved to the Cook Inlet area to escape the harsher extremes of the interior (Chandonnet, 1985).

Historically the Dena'ina Indians lived in an area that extended around Cook Inlet and inland, west to Iliamna Lake and Lake Clark, north to the Devil's Canyon in the Susitna River and the Matanuska River drainage, east to the Kenai Mountains, and south to Kachemak Bay. Unique among Alaskan Athabaskan people, the Dena'ina live along the Pacific Ocean and exploited the marine resources, as well as lake, riverine, and interior environments. The good climate and constant supply of adequate food made it possible for the Dena'ina to live in semi-sedentary villages throughout the Cook Inlet region.

The Dena'ina seasonally crossed the Inlet in skin covered single- or double-holed kayaks and the larger open boat, the *badi*, that resembled the Eskimo *umiak*. In Knik and Turnagain Arms, with the dangerous bore tides, the Dena'ina rarely traveled far by boat. The Dena'ina originally learned how to make and use both types of boats from their Eskimo neighbors (Ackerman, 1975).

Cook Inlet offered a rich supply of marine resources such as beluga whales, sea lions, seals, porpoise, and sea otter that fed on salmon, eulachon, herring, cod, halibut, and shellfish. The Dena'ina did not hunt the larger whales, as it was said that they lacked the proper magic to kill them (Ackerman, 1975). Instead this meat was obtained by trade. However, if they found a beached whale, it was used.

(i) Beluga whale use: The beluga whale provided meat and oil to the hunter's family and dogs. The meat was generally cut into strips and dried. The blubber was rendered into oil and put into containers with lids for the winter. Their sinews were made into ropes and string for bow, because the beluga sinew string is strong (Pete, 1987). Their stomachs were used as oil containers. Beluga (and bear) intestines were made into gut parkas for wet weather gear (Ackerman, 1975). Belugas were an important food source for the upper and outer Inlet Dena'ina, especially before the moose arrived in the Inlet region in the late 1800's (Kari and Kari, 1982). As important as the meat was, it was the whale blubber and oil that were of even greater economic importance (Fitzhugh and Crowell, 1988).

The blubber from the beluga whale was rendered into oil to store other foods or used in lamps for heat and light. Kalifornsky (1991) reported that cooked clams were placed in a beluga stomach and covered with oil to preserve the clams over the winter. The clams were then washed in hot

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[3]Russian scholars recorded the word *Dena'ina* with an initial "t," often spelling it "Tnana". Cornelius Osgood used the spelling "Tanaina" in his 1937 ethnology. The spelling *Dena'ina* is the modern orthography (the apostrophe is the glottal stop). This word means 'the people' and is cognate with the Navajo term *dine*' of the same meaning (Ackerman, 1975).

water and cooked during the winter months. The meat is eaten fresh, dried, roasted, boiled, and ground. The skin and a layer of fat (*kimmuq*, or muktuk) are eaten raw, pickled, canned, or boiled. The ivory teeth are used in a variety of functions and were important trade items (Fitzhugh and Crowell, 1988). Whale bone was used in Native art (e.g., masks) and handicraft work.

(ii) Historical Methods of Hunting Beluga Whales in Cook Inlet: The *Susi Kaq* "sand island mouth" (the Susitna Delta area, including Big Island and the west channel of the lower Susitna)(Pete 1987) was an important spring camping area on the Inlet at the mouth of the Susitna River. Dena'ina gathered to hunt beluga, ducks, and geese, to fish for salmon and eulachon, and to trade.

Beluga whales were hunted between May and August at the mouths of the rivers and streams (Pete, 1987). It required several hunters to successfully harvest the beluga whale. The upper Inlet Dena'ina method of catching the small white beluga whale seems to be unique in North America, not borrowed from the Eskimo or Alutiiq people (Pete, 1987). The Dena'ina used the tidal flats in the Susitna Delta to hunt beluga whales. According to Pete's (1987) description, the hunters erected a *yuyqul* (beluga spearing trees), which are dead spruce trees, root side up, in the mud during a low tide. Each spruce tree had many ropes extending from it and five or more people would pull on each rope to lift the tree up. The sinew ropes were then secured to stakes. The hunters climbed into the "nest" formed by the tree roots (Fall *et al*., 1984) to wait for the beluga that would swim by with the incoming tide. The hunters had harpoons fitted with a toggle point and attached with braided sinew ropes (about 25 fathoms long) to floats (usually inflated sealskin). Similar gear was used to hunt Steller sea lions at Kachemak Bay. During the incoming tide, the beluga whales would chase the salmon and the hunters would strike the beluga whale many times as it came by (Pete, 1987). The struck whales with the attached floats were pursued by the hunters in boats until the whales tired and could be killed by a hunter with a boneheaded spear. The whales were then taken to shore and butchered.

With the introduction of firearms around the turn of the century, the Dena'ina abandoned the *yuyqul* and weir methods for beluga whale hunting, and used boats and firearms to shoot beluga whales at the shallow river mouths. The three-man skin kayaks and baidarkas were used on the Inlet, as late as the turn of this century, to hunt seal, beluga whales, ducks and to collect clams (Kalifornsky, 1991).

Beluga whales were hunted in Kachemak Bay, at Halibut Cove in the 1920's (Stanek, 1996). Hunters would line up along the point and shoot the belugas and seals as they swam in with the tide. The animals were retrieved from the lagoon where they floated, from the beaches where they stranded, and from the shallow waters where they sank. Kalifornsky (1991) reports that beluga whales were regularly hunted at the mouth of the Kenai River before 1929.

Stanek (1996) reports that the residents of Tyonek historically used another method to hunt beluga whales. A fence or weir was constructed at the Beluga River and a movable dam made of poles placed in "Takasitna Harbor," which may have been Tuxedni Bay. The beluga whales and seals chased the fish upstream with the incoming tide. The movable poles were then placed to trap the animals behind these structures with the outgoing tide and they were then harvested.

Beluga whales were a major part of Tyonek's diet prior to the 1940s. The Village of Tyonek hunted six or seven whales annually in the 1930's and 1940's (Pete, 1987). Between the late 1940's and 1978 there was little interest in beluga whales or any other marine mammal hunting as a result of the growing number of moose in the area. Since 1979, however, the beluga whale hunt has been re-established in Tyonek. The meat and blubber are shared throughout the village (Fall *et al.*, 1984).

(iii) Contemporary Beluga Whale Hunting: In the late 1700's there were about 5,000 or more people around the Cook Inlet area (Ackerman, 1975). Today there are only about 1,000 people of Dena'ina ancestry living in the villages of Eklutna, Knik, Kenai, Seldovia, Tyonek, Pedro Bay, Nondalton, Lime Village, and Stony River, as well as in Anchorage. About 60 percent of Alaska's population lives within the traditional lands of the Dena'ina (Matanuska Valley, Anchorage Municipality, and the Kenai Peninsula). In this dynamic region, about 30,000 people are Alaska Natives.

The Cook Inlet marine mammal hunters who hunt beluga whales consist of (1) the Dena'ina of Tyonek, who continue their historical hunting of belugas near their village, (2) hunters who have lived in other parts of Alaska, but have made the Cook Inlet area their home, and (3) visitors to the Cook Inlet area from other parts of the state. As the participants increase in these hunter groups, the demand for CI beluga whale grew. However, the actual number of CI beluga whale hunters is unknown due to the dispersal of hunting "communities" and hunting locations.

The Village of Tyonek has their customary local rules which guide their beluga whale hunters. These rules commonly guide aspects of the hunt such as seasons, hunting areas, harvest methods, the social group hunting, selection of types of animals, processing of animals, uses of parts of the animals, and distribution of products.

Presently, a significant portion of the hunters are not originally from the Cook Inlet area, although they hunted beluga whales in their villages, and continued to hunt beluga whales when they moved to the Cook Inlet area (Anchorage, Matanuska Valley, or Kenai Peninsula). There is some development of a "community" from similar geographic areas, but most hunters are independent. Other hunters, who are not local residents but regularly visit the Cook Inlet area, hunt with family or friends in Cook Inlet where beluga whales are available all season.

Beluga whales are now hunted with high power rifles from April through October. Most of the hunting occurs between May and August at the Susitna Delta area (Little Susitna River, west to the Beluga River). Kachemak Bay is usually hunted in April and May, especially if the ice has not yet left the upper Inlet. Knik Arm and Chickaloon River are occasionally hunted in late summer and early fall, through October. The hunters always collect the muktuk, and sometimes collect the meat and blubber for food, and bones and teeth for handicrafts. The hunters wait at camp for the whales to enter shallow water, or chase whales already in the shallow waters. The dark, murky waters of upper Cook Inlet prevent detection of submerged whales, so the hunters follow the beluga whale's "covenough," or, wake, that is created by the whale in shallow water. As the whale breaches, the hunters generally shoot, then harpoon immediately after, or harpoon first and then shoot. When the whale is dead, the hunters attach a line through the lower mandible or around its tail to tow it to shore.

The flippers and tail are considered a delicacy by some people, and are generally removed first. The muktuk is taken from the whale in large strips, about 24" to 36" in length and 18' to 24" in width. The blubber is removed in square chunks. If any meat is collected, it is the back strap and ribs. The remaining skeleton, meat, and organs are left on site, or if near a village (like Tyonek) can be used for dog food. The muktuk, blubber, and meat are shared throughout the village (Tyonek) and between family and friends. In Anchorage, portions are kept and shared with family and friends. CI beluga whale parts have been sold in Anchorage to Alaska Native food stores, sold within the Anchorage Native community, and sold to Alaska Natives who live outside the Anchorage area.

With the rise of alternative means of subsistence, reliance on whales as a primary food source diminished, but the importance of whaling in economic and cultural terms never disappeared (Fitzhugh and Crowell, 1988). Alaskan Natives continue to share the meat and blubber in traditional patterns that reaffirm social ties and provide a strong sense of ethnic identity (Fitzhugh and Crowell, 1988). The use of the beluga whale and other wild resources continues to be economically, nutritionally, and culturally valuable to the Dena'ina and other Alaska Natives in the Cook Inlet area.

Chapter 4 Environmental Consequences

This chapter evaluates the probable environmental, biological, cultural, social and economic consequences of the alternatives and reviews those activities that could impact CI beluga whales through cumulative impacts to the stock. Generally, the direct biological consequences of the alternatives concern the impacts of harvest on the recovery of the CI beluga whales. Cultural and social impacts, or consequences, would be realized within local Alaskan Native communities who are dependent on subsistence resources.

There are no apparent consequences of any of the following alternatives on the physical environment of Cook Inlet, or on activities other than hunting, that are ongoing in Cook Inlet.

Any alternative which provides for a strike would require than a co-management agreement be signed between NMFS and an ANO prior to that strike. In the process of negotiating the agreement, beneficial results may be achieved through the development and adoption of guidelines or requirements intended to reduce struck and loss rate in the harvest, avoid wasteful practices, and minimize interference with other uses of the Inlet. Some examples of such measures would include requiring elders or experienced whaling captains to be part of each whaling crew, timing the harvest to reduce the likelihood of pregnant females being taken, requiring whales to be harpooned with attached floats, requiring equipment to retrieve struck whales (e.g. come-alongs, block and tackle, rope, deadmen) and designation of hunting areas which may reduce harassment of whales from important habitat. The presence of an experienced hunter would increase the likelihood that these measures would be accomplished.

Co-management of Alaska's marine mammals has generally proven to be successful in allowing self-determination among Native Alaskans in their subsistence harvest practices while allowing for the necessary conservation of important stocks. The endangered bowhead whale is harvested under such an agreement between the Alaska Eskimo Whaling Commission (AEWC) and NOAA. Under that agreement, the bowhead whale harvest has been successfully harvested under the direction of the AEWC, and the bowhead stock has increased steadily. The AEWC is responsible for monitoring and reporting on the harvest, as well as enforcing certain actions within their membership, while Federal authority is retained.

4.1 Biological Model of Effects of Harvest Alternatives on the Recovery Time of CI Beluga Whales

A logistic growth population model was used to project the recovery of the population (expressed in terms of years to recovery) under each of the alternatives. The model is based on the assumptions that (1) the population will grow to a maximum size, referred to as the carrying capacity, if no harvest occurs; (2) the per capita natural rate of increase of the population declines as the population increases in size; (3) hunting-related mortality does not affect reproduction in the year that it occurs and impacts males and females equally; and (4) immigration and emigration do not occur (see Laidre et al., 2000; O'Corry-Crowe et al., 1997).

Annual change in the population was then modeled as,

$$N_{y+1} = N_y + N_y R_{MAX}\left[1-\left(\frac{N_y}{K}\right)^z\right] - H_y$$

where N_y is the abundance in year y, H_y is the total harvest-related mortality in year y, and z is a shape parameter that determines the ratio of the MNPL of the population to *K*. MNPL is at the lower end of the optimal sustainable population (OSP) range.

Two possible scenarios were considered to model the annual harvest mortality: (1) harvest remained constant (albeit at different harvest levels) from year to year (H_y = H); and (2) the harvest was a constant fraction of the population from year to year (H_y = h N_y rounded to the nearest whole number). The model requires five parameters: N_{1999}, either H or h, R_{MAX}, *K* and z. The initial population size, N_{1999}, was set to 357 whales, the estimated abundance from the 1999 aerial survey.

The following five harvest policy options were considered: (1) no harvest until recovery, H_y = 0; (2) H_y = one whale per year; (3) H_y = one whale for the years 2000 to 2007, then two whales in 2008 and thereafter; (4) H_y = two whales per year; or (5) a per capita harvest rate h = 2 percent per year with hN_y rounded to the nearest whole number. The maximum per capita growth rate, R_{MAX}, was set at 4 percent, *K* was set to 1,300 (the maximum estimate prior to 1994 that incorporated a correction factor to the actual number of animals observed during a survey (Calkins, 1989), and z was set to 2.4.

$$N_{y+1} = N_y + N_y(0.04)\left[1-\left(\frac{N_y}{1300}\right)^{2.4}\right] - H_y$$

Using the model described above the size of the population can be estimated for any year and harvest policy by iterative calculation of the population size and harvest each year from the population size in the previous year. The time to recovery can be estimated by repeating this calculation until a population of 780 whales (the lower level of OSP assuming *K* = 1,300 whales) is reached (Table 1).

The percent increase in recovery time is calculated as:

$$\frac{\begin{pmatrix}\text{year of recovery}\\\text{with harvest policy}\end{pmatrix} - \begin{pmatrix}\text{year of recovery}\\\text{with no harvest}\end{pmatrix}}{\begin{pmatrix}\text{year of recovery}\\\text{with no harvest}\end{pmatrix} - 1999} \times 100$$

The estimated population sizes at ten year intervals are given in Table 2. Although the model begins in the year 1999 there was no harvest, so all of the harvest policies show the same population size in the year 2000.

A more informative way to look at the impacts of each alternative is to compare the predicted reduction in population growth rate (expressed as a percentage delay) to the anticipated population size with no harvest (Table 3).

HARVEST ALTERNATIVES

Table 1. Estimated Delay in Recovery Time to a Population Size of 780 Whales for Different Alternatives

	No Harvest	1 Whale Per Year (2000-07) 2 Whales Per Year (2008+)	2 Whales Per Year	2 Percent of Population Per Year
Year of Recovery	2022	2024	2025	2054
Percent Delay in Recovery Time	0	9%	13%	145%

A more informative way to look at the impacts of each alternative is to compare the predicted change in the per capita population growth rate (expressed as a percentage change) to the anticipated growth rate of the population with no harvest (Table 3). Note that in the first three decades the harvested populations grow at a slower rate than the unharvested population. After 30 years the harvested population is approaching the carrying capacity and its growth rate is naturally reduced. At this time harvested populations have a higher growth rate and increase at a much faster rate. Another measure of the recovery is to compare the predicted reduction in population size (expressed as a percentage reduction) under different harvest alternatives to that of the no harvest option (Table 4).

Table 2. Estimated Population Size by 10-Year Intervals for Different Alternatives

Year	No Harvest	1 Whale Per Year (2000-07) 2 Whales Per Year (2008+)	2 Whales Per Year	2% of Population Per Year
2000	371	371	371	371
2010	533	522	510	441
2020	738	701	689	518
2030	954	899	888	599
2040	1125	1070	1061	682
2050	1225	1181	1176	756

Table 3. The Predicted Percent Change in the Per Capita Population Growth Rate for each Alternative Compared to the No-harvest Alternative in the Same 10-year Interval During the Entire Recovery Period

Year	No Harvest	1 Whale Per Year (2000-07) 2 Whales Per Year (2008+)	2 Whales Per Year	2% of Population Per Year
2000	0%	0%	0%	0%
2010	0%	-8%	-13%	-52%
2020	0%	-10%	-13%	-58%
2030	0%	-9%	-11%	-59%
2040	0%	-7%	-8%	Year-58%
2050	0%	-5%	-6%	-54%

Table 4. Percent Reduction of Total Population Size Under Different Alternatives Compared to the Predicted Population Size in the Same Yea r with no Harv est.

Year	No Harvest	1 Whale Per Year (2000-07) 2 Whales Per Year (2008+)	2 Whales Per Year	2% of Population Per Year
2000	0%	0%	0%	0%
2010	0%	-3%	-4%	-17%
2020	0%	-5%	-7%	-30%
2030	0%	-6%	-7%	-37%
2040	0%	-5%	-6%	-39%
2050	0%	-4%	-4%	-38%

It is the intent of NMFS to adopt an alternative that would not significantly increase time to recovery (as compared to a no harvest scenario) yet allow for, and maximize to the extent practicable, a traditional harvest.

4.2 Evaluation of Alternative 1 - No Harvest

Under Alternative 1 there would be no harvest until the Cook Inlet stock was recovered to a population of 780 animals, the lower level of OSP, and the population level at which the depleted determination would be reconsidered.

Under this alternative, human-caused mortalities would be eliminated, or significantly reduced, until the CI beluga whale stock has recovered. The stock's recovery would be affected by natural mortality.

Under this alternative, the stock would require 22 years to recover, the least amount of time for all alternatives.

4.2.1 Biological Consequences

Alternative 1 has few direct biological effects. A harvest would not occur and whales would not be removed from this population by hunting. Assuming an initial stock size equal to that of the 1999 estimate (357 whales), then applying the trajectory model, the time to recovery (when the population estimate reaches the lower end of OSP or 780 whales) would be 22 years.

Several indirect biological effects have been identified as a possible result of selecting Alternative 1. The unavailability of CI beluga whale for subsistence harvest by Alaskan Natives might place additional hunting pressure on other marine mammal stocks in Cook Inlet. Of these other marine mammals, only the harbor seal occurs regularly in upper Cook Inlet and increased harvest for subsistence uses is expected. Similarly, there may be increased pressure on the harvest of beluga whales from other stocks throughout Alaska. The stock considered most likely as an alternative source of beluga whale muktuk for those living in the Cook Inlet region would be from Bristol Bay because of its proximity and ease of shipping to Anchorage. The muktuk from one beluga whale harvested in Bristol Bay was delivered to the Anchorage Native community in 1999. That whale had been incidentally caught in a fishing net and was sent to a local hunter who then distributed it to Alaskan Natives in both Tyonek and Anchorage. In another instance, muktuk from a beluga whale taken in October 1999 on the Naknek River was subsequently sold in Anchorage[4]. Some level of importation of beluga whale products into the Cook Inlet region may be expected. The four other Alaskan beluga stocks are currently healthy and could support an additional small level of harvest. However, the subsistence use of these stocks is managed through an agreement between NMFS and the Alaska Beluga Whale Committee, who would address any management or tribal concerns associated with this trade.

Without a beluga whale harvest additional subsistence take of waterfowl and fish in the region may occur. However, it is difficult to predict whether or not there would be an increased harvest of other subsistence species. Traditional Native foods consist of a variety of things that are not necessarily equivalent on a pound for pound bases, i.e, beluga muktuk would not be replaced by a pound of fish or seal. Therefore, there may be little interest among hunters in harvesting more of these other resources than they currently do. Also, the amount of these resources harvested is determined in part by their availability, which is not expected to change.

Despite the loss of the opportunity to harvest beluga whales, Alaskan Natives would be expected to continue to utilize Cook Inlet for purposes of subsistence hunting, fishing, and gathering. These activities may include large game hunting (moose and bear), hunting of fur bearing animals, waterfowl hunting, marine mammal hunting (mainly harbor seals), fishing for salmon and eulachon (smelt) and plant and berry picking. The harvest and use of these foods are activities with significant social and cultural meaning as well as having economic importance.

4.2.2 Social and Cultural Consequences

Alternative 1 is expected to impact traditional Native culture in at least two ways. Alaskan Natives who have recently participated in the hunting of CI beluga whales would not have the opportunity to harvest this resource. The cessation of traditional hunting for a period of over 20 years would mean that a generation would pass before beluga whale hunting continues. Consequently, the knowledge and tradition of this harvest would also skip a generation. Native hunters have expressed their belief that such knowledge must be passed on first-hand, and that the tradition

[4]In this instance, 400 pounds of meat and muktuk from a mature female beluga whale from the Naknek River in Bristol Bay was shipped to Anchorage and sold at $4 a pound by the hunter.

would die if no hunting occurs for many years. Social standing within the Native community is based, in part, on the station of an individual. Whaling captains, and those who secure and distribute Native foods, are highly regarded. Those hunters who have relied on beluga whales as part of their annual Native food source, or for money through sale of edible portions, would be adversely affected by this alternative. The cultural aspects of this harvest would continue to erode under this alternative, if the traditional skills and knowledge associated with this hunt are lost through time. Without direct experience in this harvest, these skills may not be taught and passed on with the consequence that when hunting resumed after recovery the low skill levels of the hunters could result in inefficient and wasteful harvest practices.

4.3 Evaluation of Alternative 2

Under Alternative 2, NMFS would establish a harvest level at one (1) strike annually, until the stock had recovered to no less than 780 animals. This would require approximately 23 years (*Rmax* = 4 percent, *K* = 1,300).

4.3.1 Biological Consequences

The direct biological consequence of this alternative would be the removal of one (1) adult whale annually from this population. With this level of harvest, however, the impact would delay the rate at which the CI beluga whale stock would recover by approximately 4 percent. Removing one whale per year as a result of a subsistence harvest would require 23 years to recover this stock compared to 22 years under Alternative 1.

The projected population growth rate is reduced by approximately 6 percent initially (over the first ten year intervals from Table 3) when one whale is harvested annually. The predicted abundance would be reduced by 3 percent or less during the first ten year interval (Table 4).

The increase in recovery time and decrease in population growth are not considered significant by NMFS. The remaining indirect biological effects of considering this alternative are similar to those identified for Alternative 1.

4.3.2 Social and Cultural Consequences

Under Alternative 2, a few Alaskan Natives who have recently participated in the hunting of CI beluga whales would have the opportunity to harvest this resource. Additional Alaskan Natives would benefit as the harvested beluga whale could be shared with others. Native hunters have expressed their belief that the skills, cultural values, and knowledge associated with this harvest must be passed on first-hand to younger generations.

Those hunters who have relied on the beluga for money would be adversely impacted by this alternative, as the agreement would prohibit such sales. The intent of this harvest is to enrich and maintain the cultural tradition of hunting. The traditional skills and knowledge associated with this hunt would not be lost, and direct experience in this harvest would continue to be taught and passed on.

4.4 Evaluation of Alternative 3

Under Alternative 3, NMFS would establish a harvest level at one (1) strike annually for eight consecutive years, after which the harvest would be increased to two (2) strikes annually until the stock had recovered to a population of no less than 780 animals. This would require approximately 24 years.

4.4.1 Biological Consequences

The direct biological consequence of this alternative would be similar to those considered under Alternative 2. This level of harvest requires approximately 24 years to recover the stock to 780 animals. Compared to the "no harvest" alternative, this would take two additional years, or extend the time to recovery by 9 percent (Table 1).

The projected population growth rate is reduced by approximately 7 to 8 percent during the first 20 years (Table 3) when one whale is struck annually for eight years, after which the strike increase to two per year. The predicted abundance level would be reduced by approximately 4 percent (Average of 10-year intervals, Table 4).

The increase in recovery time and decrease in population growth are not considered significant by NMFS. The remaining indirect biological effects are similar to those identified for Alternatives 1 and 2.

4.4.2 Social and Cultural Consequences

Generally, the social and cultural consequences of Alternative 3 during the first eight years of implementing this alternative are similar to those identified for Alternative 2 (only one whale is struck). However, after Year 8, (when two whales could be taken) the harvest of two whales would provide consequences similar to those identified for Alternative 4.

4.5 Evaluation of Alternative 4 - The Preferred Alternative

Under Alternative 4, NMFS would establish an annual harvest level at two (2) strikes, until the stock had recovered to a population no less than 780 animals. This would require approximately 25 years. Compared to the "no harvest" alternative, this would extend the time to recovery by three years or approximately 13 percent (Table 1).

4.5.1 Biological Consequences

The direct biological consequence of this alternative would be similar to Alternatives 2 and 3. This level of harvest requires approximately 25 years to recover the stock to OSP. The projected population growth rate is reduced by approximately 12 percent in the first decade and 7 percent in the second decade (average of ten year intervals, Table 3) when two whales are harvested annually. The predicted decrease in abundance is not more than 7 percent during any ten year period (average decrease over 50 year period = 6 percent, Table 4).

The remaining indirect biological effects are similar to those identified in previous alternatives.

4.5.2 Social and Cultural Consequences

Alternative 4 provides for a traditional harvest while not significantly increasing the time to recovery for the CI beluga whale stock. This alternative would extend the time to recovery (compared to the "no harvest" alternative) by three years (from 25 years to 22 years). Under this alternative, neither the reduction in population growth rate (10 percent over recovery period) nor the decrease in abundance (7 percent over recovery period) are considered significant by NMFS.

Other social and cultural consequences of this alternative are similar to those in Alternatives 2 and 3. This is the alternative that most closely approaches the stated objectives of NMFS and is therefore, the preferred alternative.

4.6 Evaluation of Alternative 5

Alternative 5 would establish an annual harvest level (strikes allowed) at one-half the predicted annual recruitment, until the stock had recovered to a population no less than 780 animals. This would require approximately 55 years.

4.6.1 Biological Consequences

Alternative 5 would significantly delay the recovery of CI beluga whales. This alternative would require 55 years to recover this stock to 780 whales. This alternative would extend the time to recovery by 139 percent compared to the number of years it would take to reach this level under the zero harvest alternative. It would initially cause a reduction in population growth rate by greater than 50 percent (Table 3). This alternative would cause the CI beluga whale stock to remain at or near its present population size for a longer period of time than the other harvest alternatives. During this time, the viability of the stock is at risk, as it may be more vulnerable to catastrphic events. The increase in recovery time and decrease in population growth are considered significant by NMFS.

The indirect biological effects of this alternative are similar to those identified for previous alternatives.

4.6.2 Social and Cultural Consequences

Of the alternatives in which Federal harvest management is proposed, this alternative would result in the least impact to traditional Native culture, by allowing more access to this resource. NMFS projections indicate (based on an initial recruitment rate of 4 percent) this alternative would provide for approximately seven (7) to fifteen (15) whales to be harvested each year over the next 50 years).

This increased level of harvest would allow the knowledge and tradition of the harvest to be passed on to younger generations, and would insure the cultural aspects of the harvest are maintained.

4.7 Evaluation of Alternative 6

NMFS would not take any action to establish a harvest plan for the CI beluga whale stock and no harvest limits or guidelines would be established under this "no action" alternative, . NMFS would not issue regulations to govern this subsistence harvest, nor would NMFS sign any cooperative agreement with any ANO which included provisions for the harvest of CI beluga whales.

4.7.1 Biological Consequences

The stock would likely continue to decline under this Alternative (although no harvest would occur prior to October 2000) as NMFS would neither regulate the harvest nor enter into any co-management agreements under Public Law 103-31. Following the expiration of Public Law 103-31 hunting could resume unrestricted. Hunting pressure would normally be expected to decrease as stocks decline.

4.7.2 Social and Cultural Consequences

Alternative 6 would have the least impact to traditional Native culture, at least initially, by allowing for more access to this resource. The long-term consequences of this alternative could, however, have the most harmful biological and cultural consequence of any of the alternatives considered.

4.8 Potential Cumulative Impacts on Cook Inlet Beluga Whales from all Cook Inlet Activities

This section examines all factors that have been identified that may contribute to the cumulative impact on the beluga whale stock, and its habitat in the Inlet. The actions discussed in this assessment include the subsistence harvest; natural mortality due to strandings, predation and disease; prey availability in Cook Inlet; potential interactions with state fisheries in Cook Inlet; oil and gas development in the Inlet and adjacent lands; municipal activities; commercial vessel traffic; impacts from noise; and potential impacts from NMFS research activities.

It seems likely that over time a qualitative effect from municipal, commercial and industrial activities in the Inlet on the water quality and substrate may affect CI beluga whales. However, NMFS can not, at this time, translate that qualitative likelihood into a statement of impact on the beluga whale population, or to the health of beluga whales in the Inlet. With the exception of subsistence harvest, none of the identified activities can be directly linked to the recent decline in CI beluga whales, nor does any of the information available support a deleterious impact on the health of the beluga whales or any impact that would inhibit the recovery of the whales. Accordingly, NMFS concludes that the cumulative impacts of activities other than subsistence harvest are minimal.

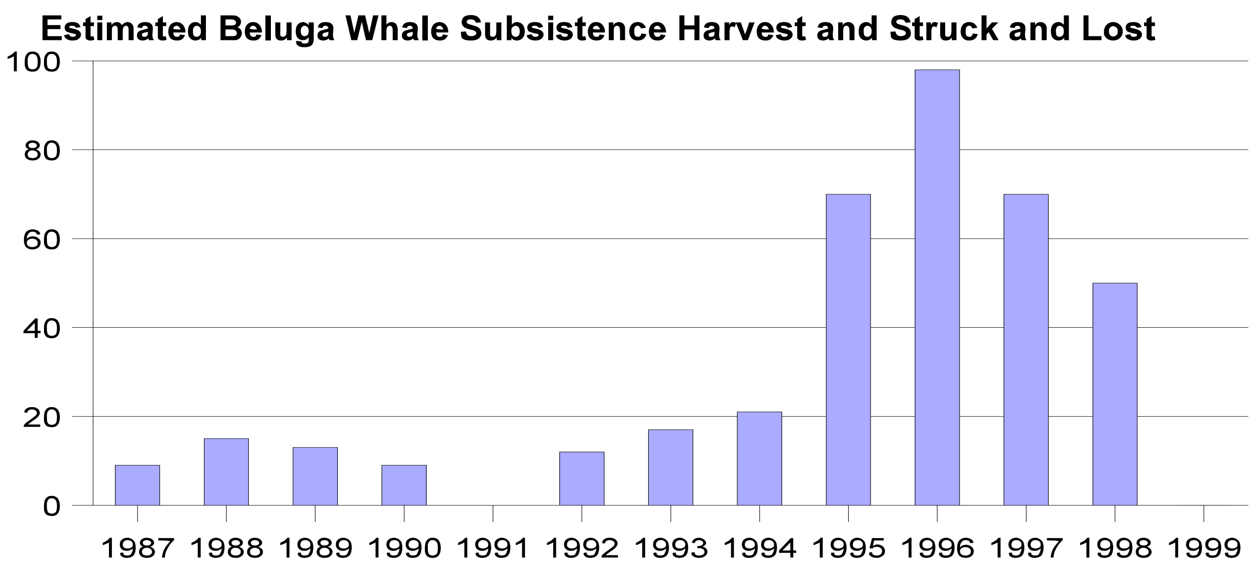
The following provides a summary of factors that were reviewed for this analysis. However, and with the exception of the subsistence harvest, there were no direct, or apparent consequences of the following activities on the CI beluga whale population, at this time.

4.8.1 Subsistence Harvest

The CI beluga whale stock is hunted by Alaska Natives. The hunters may be broadly divided into two groups; hunters from Cook Inlet-area tribes and villages (of Athabascan descent) and hunters living or visiting the Cook Inlet region from northern tribes and villages (these hunters are of Eskimo descent). The number of Eskimo, or non-area, hunters greatly exceeds that of the Cook Inlet tribal hunters, although no detailed estimates exist. NMFS believes there were approximately 16 Eskimo whaling crews in 1997. The CIMMC has estimated the number of people currently hunting beluga whales to be approximately 50. It is common for whalers to be accompanied by friends and relatives while on hunting trips. Of the six Cook Inlet Treaty Tribes and villages, only the Native village of Tyonek has regularly harvested beluga whales in recent history. Tyonek’s harvest of beluga whales has been modest; residents there report about six to seven whales were taken annually during the 1930's and 1940's, but very little beluga hunting occurred between the 1940's and the late 1970's (Stanek, 1994). About three were taken in 1979, and one whale was harvested annually between 1981 and 1983 (ADFG, undated). Recently, Tyonek’s harvest has averaged one to two beluga whales each year. The Beluga and Theodore Rivers are major hunting areas for this village.

The primary hunting areas for beluga whales in Cook Inlet are within upper Cook Inlet, off the mouths of several river systems. Traditional Native hunting camps exist on two islands in the delta of the Susitna River. Beginning in April, hunters use small motorboats launched from Anchorage to access these camps and hunt in or near the river mouths. Crews are often small, two to four persons, although hunters may also hunt in groups. A common hunting technique is to isolate a whale from a group and pursue it into shallow waters (DeMaster *et al.*, 1999). Whales are shot with high powered rifles and may be harpooned to aid in retrieval of the whale. Most of the product obtained from these whales is used for human consumption. The type and quantity of portions retained by the hunters are largely determined by the customs and practices of the hunter, which may culturally determined. While some Alaskan Native villages typically remove both skin and muscle, others do not like the taste of the meat and retain only the maktak. The maktak, or skin and underlying fat layer, is most-often retained and is desired above other portions. Maktak is dried and/or frozen and is eaten raw or cooked (usually by boiling). The muscle tissues of beluga are sometimes retained, and the meat preserved by drying. The tail flukes and flippers are also highly-valued and are usually kept. Teeth may be used for carving and the creation of traditional handicrafts.

The Native Village of Tyonek describes their customary use of the beluga whale (ADFG, undated): "The flippers and tail were removed and discarded. The skin and blubber were removed by making parallel cuts the length of the carcass about 16 inches apart. As these strips of blubber were fleshed from the animal they were cut into blocks approximately 24" in length. After the blubber was removed exposing the flesh, the backstrap was cut from the backbone. The ribs with the meat remaining on them were then separated from the backbone, exposing the internal organs. The liver, heart, and inner tenderloins were then removed. The remaining skeleton and internal



organs were either used for dog food or returned to the Inlet. The blubber and meat were cut into smaller portions and shared throughout the village."

Historically, subsistence harvest levels of CI beluga whales have been largely unreported. There are no reliable estimates of harvest prior to 1994. Estimated harvest for the years 1987-1999 are presented in Figure 1. The sources of these figures include estimates by ADFG, reports from CIMMC, and data compiled by NMFS based on reports from hunters and direct observations of harvested whales. The large difference in the number of beluga whales harvested before and after 1995 is due, in large part, to improved efforts in reporting and the application of a correction factor for struck and lost whales.

The 1995-1998 estimates include animals struck, but lost, using a ratio of one beluga whale lost for each landed. Struck and loss estimates may be highly variable, although CIMMC (1997) reported that this may be between one and two for each whale landed. Data compiled by CIMMC for the 1995 harvest estimated strike and loss at less than 1:1; 44 CI beluga whales landed and 26 struck and lost (CIMMC, 1996). It is not uncommon for beluga harvest efficiencies to be low. Native hunters, themselves, reported an increase in the number of struck and lost beluga whales, evidenced by whales observed washed up on shore along the west side of the Inlet (Huntington, 1999). An efficient harvest in Cook Inlet is confounded by the turbidity of the water, large tidal fluctuations and currents.

Based on this information, NMFS estimated that the average annual take in this harvest including whales that were struck and lost was 65 whales per year from 1994 through 1998. The estimated annual average harvest from 1995 thru 1997 (including struck but lost) was 87 whales. Annual harvest estimates for 1994 thru 1998 are 21 whales (1994), 68 whales (1995), 123 whales (1996), 70 whales (1997) and 42 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. In 1999, there was no subsistence harvest as a result of this legislation, and in combination with the voluntary moratorium by the hunters in spring.

The numbers of animals harvested between 1994 and 1998 can account for the estimated decline of the stock during that interval. Therefore, the annual harvest estimates and rate of decline from 1994 through 1998 clearly indicate that the harvest was unsustainable prior to restriction in 1999. At such a level of decline (15 percent per year), this stock would be reduced by 50 percent of its current level within five years. Therefore, the protection of this stock of beluga whales is directly related to the control of the harvest

The sale of edible portions of subsistence-harvested marine mammals within Anchorage is not prohibited by Federal law, as Anchorage is classified as a Native Alaskan village. Some maktak from subsistence harvests has appeared in Native food stores in the Anchorage area. At least some of this maktak was identified by DNA analyses as having come from CI beluga whales. Some hunters have sold beluga meat and maktak by word-of-mouth within the local Native community. One Native hunter said he supported his family by hunting beluga whales and selling the meat and maktak to Native families (Anchorage Daily News, 1994). While the amount of CI beluga whale products sold commercially in Anchorage and elsewhere has not been determined, one local Anchorage retailer estimated selling approximately 3,000 pounds of maktak annually. A single adult beluga may provide 400 pounds of maktak. By this measure, this retailer may have sold the maktak from seven beluga whales. Not all of this may have come from CI beluga whales. However, from June through November 1998, NMFS analyzed nine samples of beluga maktak sold in Anchorage. Genetic analysis of these samples determined that they came from five (5) individual beluga whales, all of which came from the Cook Inlet stock (pers com. O'Corry-Crowe).

4.8.2 Stranding Events

Strandings are not uncommon to the CI beluga whale stock. NMFS estimates that over 590 whales have stranded (both individual and en masse) in upper Cook Inlet since 1988[5]. Mass stranding events have most commonly occurred along Turnagain Arm and have often coincided with extreme tidal fluctuations ("spring tides"). These mass strandings involve both adult and juvenile beluga

[5]This estimate includes 44 beluga whale carcasses found along the shoreline which had been harvested for subsistence.

whales.

Beluga whale mortalities have been observed during these stranding events. A 1996 mass stranding of approximately 60 beluga whales in Turnagain Arm resulted in the death of four adult whales. Another stranding of approximately 70 whales in August of 1999 left five adult beluga whales dead. The causes for these deaths are not known, but may have to do with stress and 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 pooled area, the whale may have difficulty regulating body heat. An extensive network of capillaries within the flukes and flippers allows beluga whales to lose body heat to the environment. If these structures are out of the water, this mechanism cannot function properly and body heat rises. Additional stress is placed on internal organs and breathing may be difficult without the support provided by the water.

Mortality due to individual stranding events are generally considered in the population model discussed in this Chapter as natural mortality and, therefore, considered into the *Rmax* calculation. Mortality due to a mass stranding event is not considered in the model. A significant mortality due to a mass stranding event could significantly impede recovery. Such a mortality has not occurred, and has not been a significant factor in the recent abundance trends for this stock of whales. Even the 1996 mass stranding event of 60 whales resulted in only four mortalities. Therefore, mass stranding events are not believed to be a causal factor that has reduced this stock to depleted levels.

4.8.3 Commercial Fisheries Interactions with Beluga Whales

(i) Commercial Fisheries: 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, timing, and location of the fisheries. Incidental interactions refer to entanglements, injuries, or mortalities occurring incidental to fishing operations.

Reports of marine mammal injury or mortality 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 the amount of fishing effort and interactions with marine mammals and the outcome (deterred, entangled, injured, killed). Data from this program were difficult to interpret due to sampling problems (Young *et al*. 1993), and tended to underestimate actual incidental mortality rates (Credle *et al.,* 1994). This program was replaced by the 1994 MMPA amendments with a fisher self-reporting program, in which all commercial fishers are required to notify NMFS of injuries or mortalities to marine mammals occurring during the course of commercial fishing. This program became effective in 1995, and is currently in operation. In general, however, significantly fewer reports have been received under this program than expected based on the logbook reporting program and on results from observer programs. Thus, annual mortality rates derived from these programs should be considered minimum estimates (Hill and DeMaster, 1998).

Given the recent distributional trend for beluga whales to be concentrated in upper Cook Inlet during summer (Rugh *et al.*, 1999), fisheries occurring in those waters during that time could have a higher likelihood of interacting with beluga whales. However, the only fisheries active in the Inlet during that period are in the lower Inlet/North 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 1990-99 (Hill and DeMaster, 1998).

Other fisheries also occur in the lower Cook Inlet for herring sac roe, lingcod and rockfish, and salmon. The lower Cook Inlet herring sac roe fishery is of extremely short duration (often minutes to hours) taking place sometime in or near April within Kamishak Bay. Landed herring biomass has fluctuated greatly since 1977, and this fishery was closed in 1999 and 2000. A mechanical/hand jig fishery for lingcod and rockfish also occurs in lower Cook Inlet state and federal waters. Salmon purse seine fisheries in the 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 1995-99.

Upper Cook Inlet commercial fisheries include a razor clam hand-dig fishery, 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 1995-99.

The largest fisheries, in terms of participant number and landed biomass in Cook Inlet, are the 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 years effort can be temporally and spatially directed through salmon management regulations. In general, however, though the number of permits fished in Cook Inlet 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 1993-97 has been less than the 20 year average of 15,960 metric tons.

In the southern part of the Inlet, the commercial set gill net salmon fisheries are limited to five beach areas on the southern shore of Kachemak Bay, where approximately 25 permit holders operate sites (Bucher and Hammarstrom 1996). Salmon fisheries in lower Cook Inlet are generally in operation during May-August.

NMFS 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 began observing the two Cook Inlet Category II fisheries (salmon drift and upper and lower Cook Inlet set gill net) in 1999.

Observers were deployed on the first drift gill net opening of June 28. Limited set gill net fisheries had been operating in the upper Cook Inlet since June 7, but observers were not placed until June 27. Thus, fishing effort associated with approximately 239 of 11,300 deliveries was unobserved during this period. Observers were placed on drift vessels during each of the eight regular and nine corridor-only fishing periods, and during emergency order extended fishing periods.

Summaries of effort and marine mammal sightings presented here are based upon a preliminary review of data. For the drift gill net fishery, 141 net-days (in which a net is fished at least six hours in a 24 hour period) were observed of a target 180 net-days coverage, and 256 net-days were observed of a target 300 net-days coverage for the set gill net fishery. In the drift fishery, observations were made of 744 sets and/or hauls of 102 unique permits for a total of 845 hours observation time. Among the set fishery, 1450 observations were made of soaks and/or hauls of 275 unique permits totaling 1545 hours of observation time. Observation of these two fisheries will also occur in 2000.

Marine mammals were observed within 300m of a net by observers 43 times (about 6 percent of the observations) during drift gill net sets, and 107 times (about 7 percent of the observations) during set gill net sets. Of these, only three sightings were of beluga whales, each from an observer at a set gill net sight in upper Cook Inlet. However, beluga whales were not observed within 10m of a net (*i.e.*, within a distance categorized as an 'interaction') in the drift (35 individual marine mammals observed) or set (78 individual marine mammals observed) fisheries. Consequently, of three observed entanglements between gill nets and marine mammals, none involved beluga whales.

The only reports of beluga whale mortality caused 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. An incidental take rate 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.

(ii) Personal-Use 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). The most consistent recent personal-use fishery is the use of single ten-fathom gill nets for salmon in the Tyonek Subdistrict of the Northern District (Ruesch and Fox, 1999). Personal-use gill nets have also been allowed within waters approximately 1.5 miles of the Kasilof River. In 1995, personal-use gill nets were allowed in most areas open to commercial salmon set gill net fishing. Most of this area was closed to personal gill net use in 1996. Personal-use salmon set gill net fisheries are also found in the Port Graham subdistrict of lower Cook Inlet. NMFS is unaware of any beluga whales injured or killed in the Cook Inlet personal use/subsistence gill net fisheries.

In summary, as part of the requirements under the MMPA to quantify the impacts commercial fisheries have on marine mammal stocks, NMFS designed a rotational observer program to identify potential interactions between commercial fisheries and marine mammals in Alaska. Because of the heightened concern of potential impacts to beluga whales in Cook Inlet, the program began observing the two Cook Inlet gill net fisheries (salmon drift, and upper and lower Cook Inlet set gill net fisheries) in 1999. The only incidences of beluga whale mortality caused incidental to commercial salmon gill net fishing in Cook Inlet derive from reports in the literature when the distribution and abundance of the whales were both much greater.

In contrast, there have been no recent observed reports of incidentally caught beluga whales in Cook Inlet. Only three sightings of beluga whales were reported, each from an observer at a set gill net sight in upper Cook Inlet. This may be due, at least in part, to the concentration of fishing effort in the lower Inlet when whales are observed in the upper Inlet. There have been no other verified reports of injury or mortality to beluga whales by any personal- use or other commercial fishery operating in or near Cook Inlet, and no observed or verified reports of incidental catch among the commercial gill net fisheries during reporting programs instituted between 1990-91, and 1995 to the present.

Therefore, it appears that beluga whales have been caught in nets in the past but given their current distribution (relative to the distribution of the fishery), there have not been any reports of mortality due to entanglement in recent years. As the stock increases and the whales expand their summer range into areas formerly used, mortalities from incidental entanglement could increase. NMFS will continue to monitor these fisheries in 2000 to determine if mortalities increase as a result of entanglement.

4.8.4 Oil Spills

Petroleum production, refining, and shipping in Cook Inlet present a possibility for oil and other hazardous substances to be spilled, and to impact the CI beluga whale stock. The Outer Continental Shelf Environmental Assessment Program estimated 21,000 barrels of oil were spilled in the Inlet between 1965 and 1975, while 10,000 barrels were spilled from 1976 to 1979 (MMS, 1996, IIIA-11). In July, 1987, the tanker *GLACIER BAY* struck an uncharted rock near Nikiski, Alaska, discharging an estimated 1,350 to 3,800 barrels of crude oil into the Inlet (USCG, 1988). Beluga whales are commonly found in the area where this spill occurred.

Data do not exist which describe any behavioral observations or deleterious effect of these spills to beluga whales or accurately predict the effects of an oil spill on beluga whales. Some generalizations, however, can be made regarding impacts of oil on individual whales based on present knowledge.

An oil spill that occurred while beluga whales were present in Cook Inlet could result in skin contact with the oil, ingestion of oil, respiratory distress from hydrocarbon vapors, contaminated food sources, and displacement from feeding areas (Geraci, 1990). 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 open water (e.g. within tide rips), it might be possible for a beluga whale to inhale enough vapors from a fresh spill to affect its health. While there are no reliable data on the effects of petroleum vapor inhalation on cetaceans, inhalation of vapors in excess of 10,000 ppm is rapidly fatal to humans (Ainsworth, 1960; Wang and Irons, 1961). 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). Although pneumonia was not found 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).

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 *et al.*, 1993). Geraci and St. Aubin's (1985) investigations found that exposure to petroleum did not make a cetacean vulnerable to disease by altering skin microflora or by removing inhibitory substances from the epidermis.

Geraci (1990) reviewed a number of studies pertaining to the physiologic and toxic impacts of oil on whales and concluded no evidence exists that oil contamination had been responsible for the death of a cetacean. Cetaceans observed during the *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).

Following the *VALDEZ* oil spill, daily vessel surveys of Prince William Sound were conducted from April 1 through April 9, 1989, to determine the abundance and behavior of cetaceans in response to the oil spill (Harvey and Dahlheim, 1994). During the nine surveys, 80 Dall's porpoise, 18 killer whales, and two harbor porpoise were observed. Oil was observed on only one individual, which had oil on the dorsal half of its body and appeared stressed due to its labored breathing pattern. A total of 37 cetaceans were found dead during and after the *VALDEZ* oil spill, but cause of death could not be linked to exposure to oil (Loughlin, 1994). Dalheim and Matkin (1994) reported 14 killer whales missing from a resident Prince William Sound pod over a period coincident with the *VALDEZ* oil spill. They note it is likely nearly all resident killer whales swam through heavily oiled sections of the Sound, and that the magnitude of that loss was unprecedented. That study concluded a correlation existed between the loss of these whales and the spill, but could not identify a clear cause and effect relationship.

Toxicity of crude oil decreases with time as the lighter, more harmful, aromatic hydrocarbons such as benzene evaporate. Acute chemical toxicity (lethal effects) of the oil is greatest during the first month following a spill. Sublethal effects may be observed in surviving birds, mammals, and fish for years after the spill. Sublethal and chronic effects include reduced reproductive success, blood chemistry alteration, and weakened immunity to disease and infections (Spies *et al.*,1996).

Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill. Concentrations of beluga whales near the mouths of several major river systems entering Cook Inlet may represent a feeding strategy to utilize areas with the highest availability of prey. Such areas may be critical to the energetics of this stock, and spills (and response activities) which would displace whales from these areas could adversely affect their well-being. Over a three-month period, Caldwell and Caldwell (1982) fed 335 ml of hydraulic oil to bottlenose dolphins (~4 ml/day). The subjects did not reject the fish containing oil capsules. They were necropsied after the experiment and no lesions attributable to oil were detected. While the results do not permit conclusions about the effects of oil ingestion on beluga whales, it is noteworthy that dolphins accepted contaminated prey. The sense of smell in marine mammals is almost absent. Some olfactory structures have been identified in beluga whales, but whether they can be used to detect contaminated prey is unknown (Hazard, 1988).

Generally, oil and petroleum product production, refining, and shipping in Cook Inlet present a possibility for oil and other hazardous substances to be spilled, and to impact the CI beluga whale stock. Data do not exist which describe any behavioral observations or deleterious effect of these spills to individual beluga whales. Therefore, it is difficult to accurately predict the effects of an oil spill of CI beluga whales. Even a decade after the *VALDEZ* oil spill, the relationship to that event and the trends in the marine mammal populations of Prince William Sound is poorly understood. It is likely that the indirect effects of a spill on the availability of prey, or prey habitat, could have a greater impact on beluga whales than any direct impact. Whales could be affected through residual oil from a spill even if they were not present during the oil spill but the effects are largely speculative. Therefore, accurately predicting the effects of an oil spill on CI beluga whales is difficult.

4.8.5 Other Pollutants

The principle sources of pollution in the marine environment are 1) discharges from municipal waste-water treatment systems; 2) discharges from industrial activities that do not enter municipal treatment systems (petroleum and seafood processing); 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products. Natural and man-made pollutants entering the Inlet are diluted and dispersed by the currents associated with the tides, estuarine circulation, wind-driven waves and currents (MMS,1996,IIIA-7).

Pollutants may be classified as chemical, physical, and biological. Chemical pollutants include organic and inorganic substances. The decomposition of organic substances uses oxygen and, if enough organics are present, the concentration of oxygen could be reduced to levels that would threaten or harm oxygen-using inhabitants of the water column.

The discharge of soluble inorganic substances may change the pH or the concentration of trace metals in the water, and these changes may be toxic to some marine plants and animals. Physical pollutants include suspended solids, foam, and radioactive substances. Suspended solids may inhibit photosynthesis, decrease benthic activity, and interfere with fish respiration. Foam results from surface active agents and may cause a reduction in the rate of oxygen-gas transfer from the atmosphere into the water. Biological pollutants may cause 1) waterborne disease by adding viruses, protozoa, or bacteria to the receiving waters or 2) excessive biological growth.

(i) Produced Waters: Produced waters constitute the largest source of naturally occurring and manmade substances discharged into the waters of Cook Inlet. The characteristics of the produced waters, as well as other discharges—except drilling muds and cuttings—described in this section are based on information obtained during the Cook Inlet Discharge Monitoring Study that, basically, was conducted between April 10, 1988, and April 10, 1989 (EBASCO Environmental, 1990a; 1990b). These waters are part of the oil/gas/water mixture produced from the wells and contain a variety of dissolved substances. Also, chemicals are added to the fluids that are part of various activities including waterflooding; well workover, completion, and treatment; and the oil/water separation process. Before discharging into Cook Inlet, produced waters pass through separators to remove oil from the waters. The treatment process removes suspended oil particles from the waters., but the effluent contains dissolved hydrocarbons or those held in colloidal suspension (Neff and Douglas, 1994). Although the discharge of produced waters is an issue of concern, the toxicity of produced waters, as indicated in the Monitoring Study, ranged from only slightly toxic to practically non-toxic (to shrimp) and would not, therefore, be expected to impact beluga whales.

(ii) Drilling Muds and Cuttings: An EPA NPDES general permit authorizes the discharge of approved generic drilling muds and additives into waters of Cook Inlet. Drilling muds consist of water and a variety of additives; 75 to 85 percent of the volume of most drilling muds currently used in Cook Inlet is water (Neff, 1991).

When released into the water column, the drilling muds and cuttings discharges tend to separate into upper and lower plumes (Menzie, 1982). The discharge of drilling muds at surface ensures dispersion and limits the duration and amount of exposure to organisms (NRC, 1983). Most of the solids in the discharge, more than 90 percent, descend rapidly to the seafloor in the lower plume. The seafloor area in which the discharged materials are deposited depends on the water depth, currents, and material particle size and density (NRC, 1983). In most OCS areas, the particles are deposited within 500 ft below the discharge site; however in Cook Inlet, which is considered to be a high-energy environment, the particles are deposited in an area that is >500 ft below the discharge site (NRC, 1983). Small particles of drilling mud—several centimeters in diameter—also may settle to the seafloor immediately following a discharge but would disperse within a day. The upper plume contains the solids and water-soluble components that separate from the material of the lower plume and are kept in suspension by turbulence.

Since 1962, there were about 546 wells drilled in Cook Inlet. One Continental Offshore Stratigraphic Test (COST) Well and 11 exploration wells were drilled in Federal waters and 75 exploration and 459 development and service wells were drilled in State waters—mainly in upper Cook Inlet (State of Alaska, AOGCC, 1993). From 1962 through 1970, 292 wells were drilled (62 exploration and 230 development and service) (State of Alaska, AOGCC, 1993). From 1971 through 1993, the number of wells drilled per year has ranged from 3 to 20; the average number drilled per year is about 11.

The toxicity (96-hr LC_{50}) of the muds used to drill 39 production wells in Cook Inlet between August 1987 and February 1991 ranged from 1,955 to >1,000,000 ppm for a marine shrimp (Neff, 1991). Concentration levels >10,000 are considered practically nontoxic and between 1,000 and 10,000 are slightly toxic. The percentages of the wells with toxicities >10,000 was 89 percent of the total number. Therefore, 89 percent of the muds from this production were considered non-toxic to shrimp. The remaining 11 percent exceeded toxic levels for the test subjects. Given the results of these studies, the toxicity levels of production muds are not considered to be toxic to beluga whales and, as a result, not likely to adversely impact beluga whales.

(iii) Heavy Metals and Organic Compounds: NMFS has obtained biological samples from twenty eight CI beluga whales since 1992 under protocols developed for the Alaska Marine Mammal Tissue Archival Project[6] (AMMTAP). From these collections, selected tissues have been analyzed for Polychlorinated Biphenyls (PCBs) and trace elements, including heavy metals[7] in liver and kidneys. As has been found for beluga whales from other regions in Alaska, Canada, and Greenland, the CI beluga whales were found to have relatively high concentrations of mercury, selenium, and silver in their livers. These levels are much higher than one finds in ringed seals, harbor seals, bowhead whales, and walrus in Alaska. However, as compared to other Alaskan beluga whale stocks (Eastern Chukchi Sea and Eastern Beaufort Sea), the levels of these three metals, as well as cadmium, were much lower in the Cook Inlet animals (Becker *et al.*, in press). These elements accumulate in liver tissue and increase with age of the animal. The uptake and bioaccumulation of these elements are determined by many factors, of which the position of the beluga whale in the food web and the diet of the animal probably plays a major role (Becker *et al.*, 1999).

Concentrations of PCB congeners and chlorinated pesticides were found to be lower in the blubber of beluga whales from Cook Inlet than from beluga whales from Point Lay (Eastern Chukchi Sea stock) and Point Hope (Eastern Beaufort Sea stock), Alaska. Generally, CI beluga whales are "cleaner" than other beluga whale populations throughout the Arctic and the eastern United States. A comparison of tissue concentrations of persistent organic contaminants, heavy metals, and other

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[6]The Alaska Marine Mammal Tissue Archival Project began in 1987, and is now conducted by the U.S. Geological Survey, National Marine Fisheries Service, and the National Institute of Standards and Technology. This project includes the collection, analysis, and archival of marine mammal tissues.

[7]Instrumental neutron activation analysis is routinely used to measure 37 elements (Na, Mg, Al, Cl, K, Ca, Sc, V, Mn, Fe, Co, Cu, Zn, As, Se, Br, Rb, Sr, Mo, Ag, Cd, Sn, Sb, I, Cs, Ba, La, Sm, Eu, Tb, Hf, Ta, Au, Hg, Th, and U).

elements between CI beluga whales and other beluga whales in North America confirms that the Cook Inlet animals are very distinct from other populations and stocks of this species. The Cook Inlet animals had much lower concentrations of PCBs and chlorinated pesticides than those which have been reported from the Eastern Beaufort Sea and Eastern Chukchi Sea stocks. In the case of heavy metals and other elements, cadmium, mercury, selenium, vanadium, and silver were much lower in the livers of Cook Inlet animals than in the other beluga whale stocks. Due to the lower concentrations of PCBs and chlorinated pesticides in Cook Inlet beluga whales, their effects on the animals health may be less significant for Cook Inlet animals than for the other beluga whale stocks.

(iv) Municipal Wastes and Urban Runoff: 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's John M. Asplund treatment center, English Bay, Port Graham, Seldovia, and Tyonek receive only primary treatment[8], while Eagle River, Girdwood, Homer, Kenai, and Palmer receive secondary treatment. The maximum permitted wastewater discharge for (1) Anchorage is 44 million gallons per day (GPD) and (2) the other communities is a range from 10 thousand to 1.6 million GPD. The EPA is currently in the process of re-issuance for the Asplund facility discharge permit. For Anchorage, the effluent limitations requested for the daily discharge of BOD and total suspended solids in the wastewater are 90,100 pounds per day (lb/d) and 57,000 lb/d, respectively. Based on the daily maximums presently permitted for these ten communities, they could release about 16.38 million pounds of BOD and 13.82 million pounds of suspended solids into Cook Inlet annually.

Monitoring studies performed for the Municipality of Anchorage assessed the contribution of this effluent to waters of the upper Inlet using both hydrodynamic and transport modeling, and estimated the effluent contribution to be on the order of 0.01 to 1 per cent of the background concentrations. The Municipality of Anchorage has asserted that riverine discharge into the upper Inlet can easily account for most of the dissolved and virtually all of the total recoverable metals in the receiving water(AWWU, 1999). Bioassay of marine invertebrate species found the lowest observed effect concentration (LOEC) in echinoderms ranged from 5 to 10 percent effluent, and in molluscs ranged from 5 to 10 per cent effluent for survival and 0.5 to 10 per cent effluent for abnormalities. The Municipality reported the effluent is non-toxic at dilutions greater than 20:1 (they estimate the minimum initial dilution at 180:1)

Determining the impact of municipal discharges on the beluga whale stock is not possible. The rivers entering Knik Arm alone carry an estimated 20 million tons of sediment annually (Gatto, 1976). Therefore the suspended loading that naturally occurs in the extreme upper Inlet parallels

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[8]The Clean Water Act requires all publicly owned treatment works to have secondary-level treatment by July 1977. Subsequent amendments to that act allow EPA to modify this requirement. The MOA was granted a permit in 1985 to continue primary treatment. That permit expired in 1990, and the Municipality has applied for renewal. The EPA allows the operation of this facility to continue until a new permit is issued.

that which is discharged by the Municipality of Anchorage. However, this is not wastewater and the impacts of minimally treated wastewater on the beluga whales is not known. Given the relatively low levels of contaminants found in CI beluga whale tissues, municipal discharge levels are not believed to be having a significant impact on the beluga whale population. However, the impacts of minimally treated wastewater on the beluga whales is not known.

4.8.6 Noise

Upper Cook Inlet is one of the most industrialized and urbanized regions of Alaska. As such, noise levels may be high. The common types of noises in upper Cook Inlet include sounds from vessels, aircraft, construction equipment such as diesel generators, bulldozers, and compressors, and from activities such as pile-driving.

Any sound signal in the ocean is detectable by marine mammals only if the received level of the sound exceeds a certain detection threshold (Richardson *et al*., 1995). If the sound signal reaching a marine mammal is weaker than the background noise level, it may not be detected. This concept is important in understanding the effects of noise on whales in at least two areas: 1) the audibility of an industrial noise is dependent in part on the background (ambient) noise levels, and 2) as industrial noises add to the level of background noise, they may prevent or diminish the effectiveness of communication between whales or between whales and their environment.

Considering the depth of the animal being exposed to noise is also important. The noise level from a source when measured within a few feet of the surface is significantly lower than the noise level when measured at depths of 16.4 to 33 ft (5 to 10 m). For example, a marine mammal at the surface will experience a received noise level approximately 30 dB less than the received level for an animal at the same distance from the noise source, but at a depth of 33 ft (10 m).

(i) Aircraft Noise: Richardson *et al*., (1995) and Richardson and Malme (1993) provided summaries on aircraft sound in water. When reporting a source level for an aircraft, the standard range of 984 ft (300 m), rather than 3.2 ft (1 m), is assumed, because "the concept of a 1-m source level for underwater noise from an aircraft is not very meaningful" (Richardson *et al*., 1995b). The surface area of sound transmission from air to water is described by a cone where the apex of the cone is the aircraft, and the cone has an aperture of 26 degrees. In general, underwater noise from aircraft is loudest directly beneath the aircraft and just below the water's surface, and sound levels from the same aircraft are much lower underwater than the sound levels in air. The duration of the noise is short, because noise is generally reflected off the water surface at angles greater than 13 degrees from the vertical. Helicopters tend to be noisier than fixed-wing aircraft. The amount of noise entering the water depends primarily on aircraft altitude and the resultant 26 cone, sea surface conditions, water depth, and bottom conditions (Richardson *et al*., 1995).

Monitoring results of aircraft noise levels are complicated due to variables that are inherent in such analyses, including monitoring equipment averaging times, aircraft types and operations (i.e. power setting, propeller pitch, altitude changes), meteorological conditions, and aircraft altitude. There are no data on the level of received sound that do and do not disturb toothed whales (Richardson *et* *al*., 1995). The response of beluga whales to airplanes and helicopters varies with social context, distance from the aircraft, and aircraft altitude. Because the underwater noise generated by an aircraft is greatest within the 26 degree cone directly beneath the craft, whales often react to an aircraft as though startled, turning or diving abruptly when the aircraft is overhead. Richardson *et al*., (1995) reports beluga whales not reacting to aircraft flying at 500m, but at lower altitudes of 150-200m these animals dove for longer periods and sometimes swam away. Feeding belugas were less prone to disturbance. NMFS aerial surveys are normally flown at an altitude of 500 feet, using fixed-wing single and twin engine aircrafts. Belugas are rarely observed to react to even repeated overflights at this altitude. The main approaches to the Anchorage International Airport, Elmendorf Airforce Base, and Merrill Field are at least partially over the upper Inlet, including Knik Arm. Commercial and military jet airplanes often overfly these waters at relatively low altitudes. Despite this traffic, beluga whales are common to these same waters and are often observed directly under the approach corridors off the north end of International Airport and the west end of Elmendorf Air Force Base.

(ii) Ship and Boat Noise: Ships and boats create high levels of noise both in frequency content and intensity level. Ship traffic noise can be detected at great distances. High speed diesel-driven vessels tend to be much noisier than slow speed diesel or gasoline engines. Small commercial ships are generally diesel-driven, and the highest 1/3-octave band is in the 500 to 2,000 Hz range. Tugs can emit high levels of underwater noise at low frequencies. Small outboard motor driven watercraft, such as those commonly used for recreational purposes in the upper Inlet, typically produce noise at much higher frequencies (e.g. 6300 Hz) and may, therefore, have the highest potential to interfere with beluga whales.

(iii) Noise from Offshore Drilling and Production: Sound produced by oil and gas drilling and production in Cook Inlet may be a significant component to the noise in the local marine environment. Gales (1982) summarized noise from eleven production platforms. The strongest tones from four production platforms were at very low frequencies, between ~4.5 and 38 Hz, at ranges of 6-31 meters.

Various studies and observations suggest that beluga whales are relatively unaffected by these activities. Beluga whales are regularly seen near drill sites in Cook Inlet (Richardson et al., 1995: McCarty 1981). Stewart et al. (1982) reported that beluga whales in Snake River, Alaska, did not appear to react strongly to playbacks of oil industry-related noise at levels up to 60 dB above ambient. Stewart, Awbrey, and Evans (1983) conducted similar playback experiments in Nushagak Bay, Alaska in 1983 and found that beluga whale movement and general activity were not greatly affected, especially when the source of the noise was constant.

Beluga whales did swim faster and respiration rates sometimes increased within 1.5 km of the sound projector. During playback experiments in the Beaufort Sea, migrating beluga whales approached the sound projector and showed no overt reactions until within 200-400 meters, even though the noise was detectable by hydrophone up to 5km away (Richardson et al., 1990, 1991). Richardson et al., (1995) observed these results may be an example of the degree to which beluga whales can adapt to repeated or on-going man-made noise when it is not associated with negative consequences.

(iv) Noise from Seismic Geophysical Exploration: Geophysical exploration of Cook Inlet for oil and gas deposits is often accomplished using boat-based seismic survey. Seismic surveys produce some of the loudest noises in the marine environment caused by intense bursts of underwater compressed air which may propagate energy for great distances. The noise produced by these surveys is at very low frequencies, often below 100 Hz. This is below the optimum hearing range of beluga whales. Higher frequencies are absorbed in water more than lower frequencies; the energy loss being proportional to the square of the frequency. Seismic sound propagation is also dependent on bottom structure, and soft substrates such as found in the upper Inlet absorb sound better than hard, reflective material. Finally, seismic sound is poorly transmitted through shallow waters, such as exists near the mouths of the Susitna River.

Therefore sounds from seismic exploration in the upper Inlet may be poorly transmitted through the water and may have little direct impact on beluga whales. However, seismic sound may be very loud, with some sound energy at higher frequencies overlapping that of the beluga whale. Therefore it is possible that beluga whales might hear, and may react, to an active seismic vessel in certain areas and under certain conditions. Presently no data exists to characterize the noise from seismic exploration in Cook Inlet. NMFS observed beluga whales in Cook Inlet approximately 20 nmi. from an active seismic vessel in June 1995, and reported no reactions (Moore et al., 1999).

(v) Summary of the Impacts of Noise on CI Beluga Whales: Because sound is a critical sense to beluga whales, high levels of noise may have significant and adverse effects. However, evaluation and prediction of human-made noise impacts on marine mammals is difficult. This situation is partially a result of complications introduced by the natural variability in animal behavioral responses. Estimating acoustic environmental impact on animals requires interpretation and integration of results from many disciplines including, but not necessarily limited to, the study of how sound waves interact with the environment (physical acoustics), how animals hear sounds with their ears (anatomy and physiology), and how animals use sounds for such things as communicating, navigating and finding food (bioacoustics, psychoacoustics, and behavioral ecology).

One of the most obvious behavioral responses to industrial noise is to avoid the area by swimming away from or detouring around the noise source. Two other behavioral responses, habituation and sensitization, also are important when discussing the potential reactions of beluga whales to multiple exposures to a noise stimulus. Richardson *et al*., (1995) provided examples of beluga whales becoming habituated to noise from frequent vessel traffic in the St. Lawrence River and to salmon fishing boats in Bristol Bay. Habituation refers to the condition in which repeated experiences with a stimulus that has no important consequence for the animal leads to a gradual decrease in response. Sensitization refers to the situation in which the animal shows an increased behavioral response over time to a stimulus associated with something that has an important consequence for the animal.

Whales tend to show little response to vessels that move slowly and are not heading toward them

(Richardson *et al*., 1995). However, beluga whales will often leave an area in which vessel noise is related to hunting (Sergeant and Brodie, 1975; Huntington, 1999). Native hunters in Cook Inlet report beluga whales actively avoid approaching skiffs powered by outboard motors, particularly during the summer and fall. Many researchers report that beluga whales commonly flee from fast and erratically moving small boats. Elsewhere, beluga whales have been observed to tolerate large vessel traffic (e.g., in the St. Lawrence River), and intensive commercial fishing vessel activity (in Bristol Bay). Beluga whales are commonly found immediately adjacent to the Port of Anchorage during summer months, often very near containerships and tugs which are docking, maneuvering, or underway.

This information may indicate that these whales are either not disturbed by such activity, that they habituate to such activity, or that (from Blane, 1990) the continued use of some high vessel-use areas by feeding and traveling beluga whales reflects the value of these areas to the whales, and should not be interpreted as meaning that the whales were undisturbed. This conclusion would seem to be supported by the observation that beluga whales did not abandon an area within upper Cook Inlet even when they were being hunted and pursued (Shelden, 1995). A large group of beluga whales remained in or near the mouth of the Little Susitna River for several weeks during June of 1999. During this period, many small motor boats sport fishing for chinook salmon move between Anchorage and the Little Susitna River.

CI beluga whales appear to display a strong fidelity to certain sites. They are similar in this respect to the Bristol Bay stock. It is generally believed in western and northern Alaska, however, that modernization of coastal communities, with its associated noise, is causing beluga whales to pass farther from shore and to abandon traditional sites (Burns and Seaman, 1986). Conclusions here are difficult, other than that the beluga whales tolerance to vessel activity appears to be highly variable.

To what extent, if any, noise production in the Cook Inlet area has had an effect on the current distribution or trends of these animals is not clear. It does not appear that noise represents an immediate threat of extinction or endangerment. Over the long-term, disturbance from noise, if it precluded belugas from foraging sites, could have an effect which would be expressed as a lower productivity rate due to low level, or chronic, stress symptoms that would inhibit successful foraging. However, no indication exists that this is happening. Given the fidelity of these whales to specific foraging sites in the upper Inlet, it appears that the need to prey on available forage is stronger than the possible impacts of disturbance from noise, or other factors, in those locations. This has also been witnessed in other whale populations.

4.8.7 Disease

Little is presently know about the effects of disease on CI beluga whales. Bacterial infection of the respiratory tract is one of the most common diseases encountered in marine mammals. However, a considerable amount of information exists on the occurrence of diseases in CI beluga whales, and other beluga whale populations, and the affect(s) of these diseases on the species.

Bacterial infection of the respiratory tract is one of the most common diseases 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 belugas in the St. Lawrence estuary (n = 45 sampled) were affected by pneumonia (Martineau t al., 1994). One beluga apparently died from 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 Alaskan beluga whales. Anisakis simplex is also recorded from belugas in eastern Canada (Klinkhart, 1966). Necropsies conducted on CI beluga whales have found heavy infestations 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 has 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 CIB. These infestations have not, however, been considered to be extensive enough to have caused clinical signs.

Sarcocystis sp. have also been found in muscle tissue from CI beluga whales. The encysted (muscle) phase of this organism is thought to be benign. The arctic form of Trichenella spiralis (a parasitic nematode) is known to infect many northern species including polar bears, walrus, and to a lesser extent ringed seals 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).

Therefore, parasites, and the potential for diseases, do occur in CI beluga whales. However, no indication exists that the occurrence of parasites or disease has had any measureable (detrimental or adverse) impact on the survival and health of beluga whale populations despite the considerable pathology that has been done on this species.

4.8.8 Predation

Killer whales are the only natural predator of beluga whales in Cook Inlet. Several commenters suggested that the potential for significant impacts on the CI beluga whale population by killer whales cannot be ruled out given 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). They further suggested that even a small increase in predation could result in population decline or impede recovery.

The number of killer whales visiting the upper Inlet appears to be small given the numbers that occasionally strand in the Inlet. However, predation by killer whales on CI beluga whales was considered by some commenters to be a mortality factor that may have contributed to the CI beluga whale declines in recent years. 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. Native hunters report killer whales are usually found along the tide rip that extends from Fire Island to Tyonek (Huntington, 1999).

No quantitative data exist on the level of removals from this population due to killer whale predation, or its impact. However, killer whale pods are known to prey selectively on either salmon, or marine mammals, including beluga whales in Cook Inlet. During a killer whale stranding in Turnagain Arm in August 1993, one observer reported that a killer whale vomited pieces of beluga flesh. Declines of sea lions and seals throughout the central Gulf of Alaska (including lower Cook Inlet) may have resulted in a partial dietary shift from pinnipeds to beluga whales in Cook Inlet during recent years. This result may account for some of the more recent sightings of killer whales in Cook Inlet. The whales may be seeking beluga whales as prey in the absence of the once plentiful harbor seals and sea lions. However, killer whales also prey on salmon, a prey of beluga whales. Therefore, seeing killer whales in proximity to beluga whales in the Inlet does not necessarily imply that they are searching for beluga whales.

Quantifying the impact of predation by killer whales on CI beluga whales is difficult. Anecdotal reports often highlight the larger, more sensational, mortalities on beluga whales due to killer whales, thereby overestimating their impact. Further, these reports are dated (i.e, they are from the early 1980s when beluga whales were more abundant). For that reason, they are of minimal value when trying to assess current impacts to the population of beluga whales in Cook Inlet.

The loss of a few beluga whales could impede recovery, as suggested by the petitioners. However, in order for killer whale predation to have an impact significant enough to result in a decline in the population trajectory would require a level of total mortality due to predation that approximates the level of recruitment in the population. No indication exists that natural mortality in the CI beluga whale population exceeds levels considered normal for other small cetacean populations. Therefore, predation by killer whales is not likely having a significant impact on the recovery of the CI beluga whale population. The most recent information indicates that more killer whales were present in the Inlet in the past than at present. However, the number of sightings in recent years have increased. As a result, more sightings are made of smaller groups of animals. These whales may be part of a pod that preys exclusively on marine mammals and are, therefore, of concern. However, mortality due to this factor is not considered to be significant enough to drive the population towards endangerment in the foreseeable

4.8.9 Commercial Harvest

Klinkhart (1966) reported a commercial venture that harvested about 100 beluga whales from Cook Inlet in the 1930's. These whales were netted in the Beluga River and used for meat and oil. Guided sport hunting for beluga whales out of Anchorage enjoyed some popularity during the 1960's (Anchorage Daily Times, 1965), however, no information exists on the level of this harvest. These activities have not had any impact on CI beluga whales in recent decades.

4.8.10 Vessel Strikes

The presence of beluga whales in and near river mouths entering upper Cook Inlet predisposes them to strikes by high speed water craft associated with sport and commercial fishing and general recreation. The mouths of the Susitna and Little Susitna River in particular are areas where such vessel traffic and whales commonly occur. NMFS enforcement agents investigated a report of a jet skier approaching and striking belugas in Knik Arm in 1994. A stranded beluga whale examined in 1999 had an injury consistent with an old propeller injury (Burek, 1999c). There are no data available to quantify this impact for the CI stock of beluga whales but it is not believed to have had a significant impact on the population.

4.8.11 Tourism

Tourism is a growing component of the State and regional economies, and wildlife viewing is an important component of this use. Visitors value the opportunity to view the region's fish and wildlife highly, and opportunities to view the beluga whale are especially important due to their uniqueness. Many tour buses routinely stop at several wayside sites along Turnagain Arm in the summer, where beluga whales are often seen. Presently there are no vessel-based commercial whale watching ventures operating in upper Cook Inlet. However, the popularity of whale watching and the close proximity of the activity, and beluga whales, to Anchorage makes if probable such operations will exist in the near future. NMFS will monitor any commercial whale watching operations that may develop. Any potentially significant impacts would be mitigated by consultation with tour operators, development of guidelines to avoid harassment, or development of regulations to avoid takings. The impact of this activity, if any, is generally considered to be positive because of the educational component of whale watching. Based on studies elsewhere, NMFS does not believe that any impacts from this activity are detrimental to the population. No indication exists that land-based tourism (vehicle traffic along Turnagain Arm) has had any effect on the CI beluga whale stock.

4.8.12 Prey Availability

Beluga whales in Cook Inlet actively feed in areas of the northern Inlet where prey species would be expected to form concentrations. The arrival of beluga whales into the northern Inlet also coincides with the eulachon migration, and soon afterwards with salmon out-migrations and the first king salmon spawning runs. Hazard (1988) stated that beluga whales in the Bering Strait form dense aggregations which are dependent on concentrations of food organisms.

NMFS biologists have sampled stomachs from subsistence-harvested whales, and have found a significant portion of these to contain salmon and eulachon. Native hunters' observations are that the whales occurrence in Cook Inlet is dependent upon fish runs. Feeding behavior is commonly observed near stream mouths, evidenced by salmon jumping in front of whales, whale "lunges" or sudden turns and acceleration, and salmon swimming onto shore near the whales.

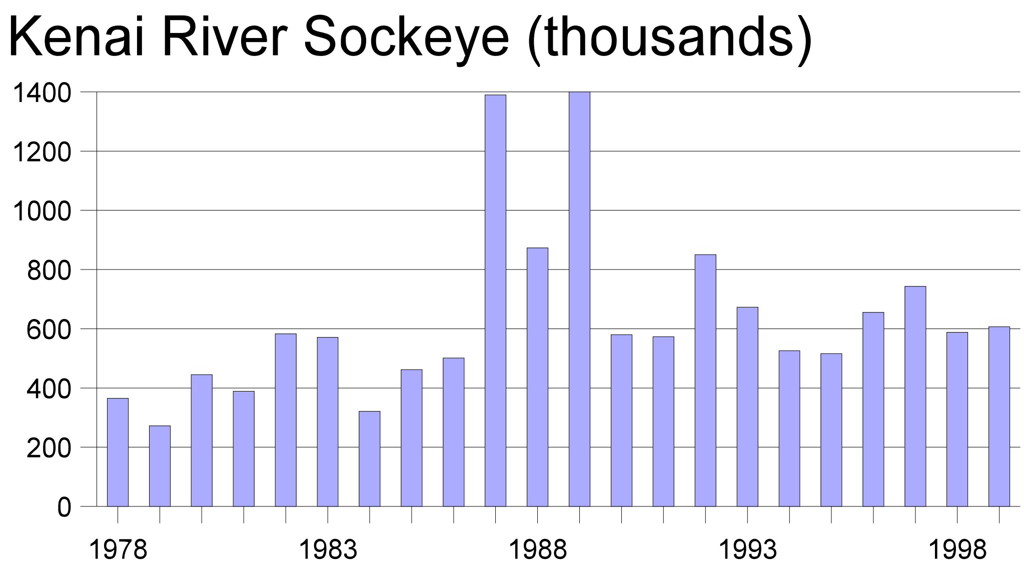
NMFS placed a tracking transmitter on an adult beluga whale in 1999, and this animal remained in and near the mouth of the Little Susitna River for several weeks between May and June in 1999. This whale was observed swimming among a group of approximately 90 beluga whales. The whales moved into the central region of the upper Inlet and into Knik Arm during the times coho were returning to the Little Susitna River.

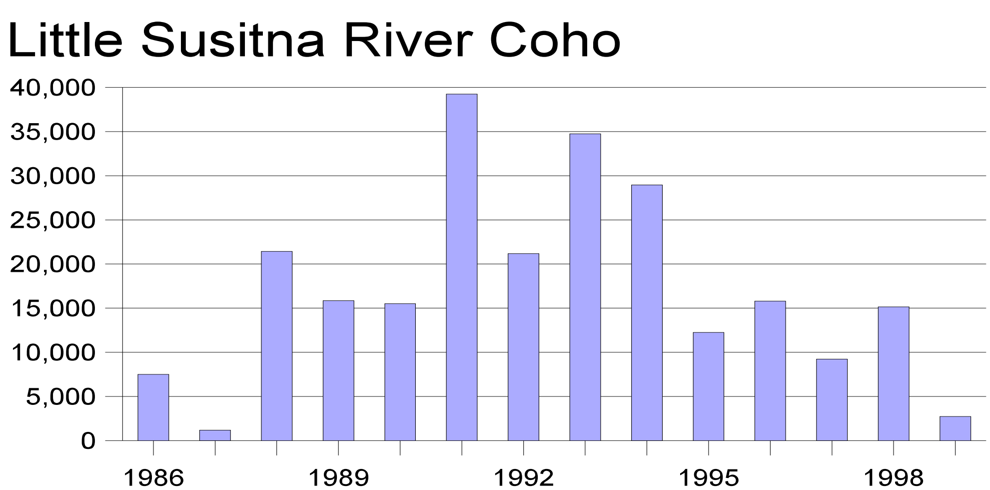
If the occurrence and distribution of these whales within Cook Inlet is assumed to be, in large part, related to prey distribution and availability, then the occurrence and distribution of these runs is extremely important to CI beluga whales. Several commenters stated their belief that the fish runs have declined dramatically within Cook Inlet during the last decade, and that this decline has caused fewer beluga whales to visit the upper Inlet. Native observations reported in Huntington (1999) suggest that severe declines in fish runs have occurred in Cook Inlet during the past few years and that changes in fish distribution of beluga whales in Cook Inlet..

Several anadromous waterways entering Cook Inlet are monitored by ADFG. Adult salmon escapements by years for selected species are presented in the following figures for three such index streams: the Yentna River, Little Susitna River, and Kenai River (Fox and Shields, 2000). These data were derived from the total counts for these river drainages, normalized for consistent effort. The Yentna River is a major tributary to the Susitna River. Sockeye returns to the Yentna have remained above average over the period of observed decline for CI beluga whales: 1994-1998. Coho salmon returns to the Little Susitna River have declined over this same period, and the 1999 escapement was one of the lowest recorded. The State of Alaska has conducted a coho enhancement project on this system, stocking smolt during 1988- 1996. NMFS placed a tracking transmitter on an adult beluga whale in 1999, and this animal remained in and near the mouth of the Little Susitna River for several weeks between May and June in 1999. This whale was observed swimming among a group of approximately 90 beluga whales. The whales moved into the central region of the upper Inlet and into Knik Arm during the times coho were returning to the Little Susitna River. The State of Alaska has conducted a coho enhancement project on this system, stocking smolt during 1988-1996.

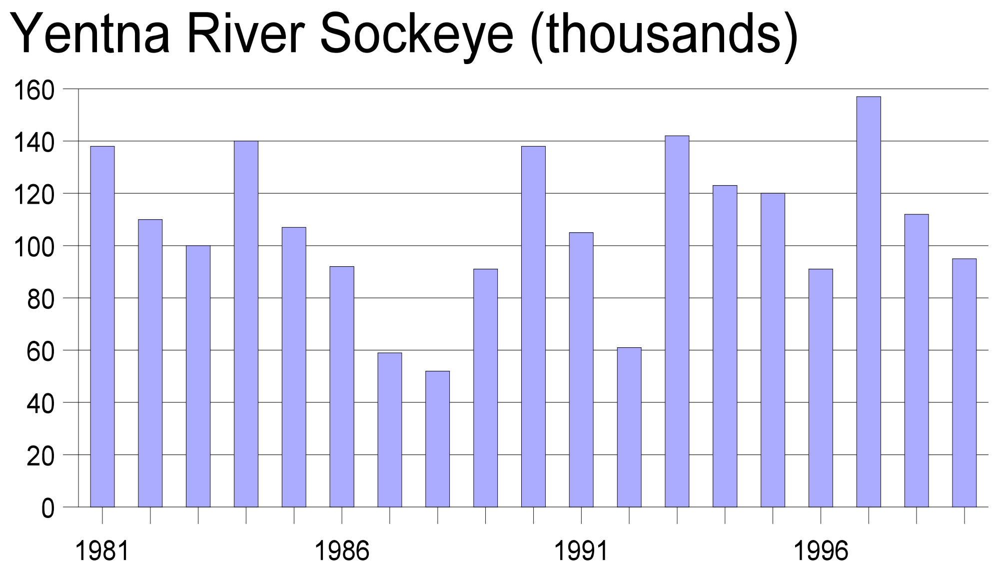
Finally, the Kenai River sockeye escapements for the period 1978-1999 (through August 1) are presented. This above-average escapement rate occurred during the period of time that the decline in CI beluga whales was observed: 1994-1999. Despite these escapements, NMFS has received several reports of fewer beluga whales being observed in the Kenai River when compared to the 1970s and 1980s. However, this observation could be the result of a reduced population of beluga whales in Cook Inlet in recent years, and have little to do with fish abundance or availability during eight of the last ten years is noteworthy. The 1999 upper Cook Inlet harvest of sockeye salmon reached 2.7 million fish, compared to the ten year average of 3.8 million and the forty-four year average of 2.4 million. The 1997 sockeye catch exceeded four million fish.

Escapements for the Kenai River sockeye salmon. Source: ADFG (Fox and Shields, 2000)





Escapements for the Little Susitna River coho salmon. Source: ADFG (Fox and Shields, 2000)



Escapements for the Yentna River sockeye salmon. Source: ADFG (Fox and Shields, 2000)

The fact that the forty-four year average harvest of sockeye salmon (1954-1999) has been exceeded Herring are also an important component of the beluga whales diet, in that they are a lipid-rich fish which occurs in concentrations. During a study of salmon smolt within the upper Inlet, juvenile herring (ages 0 and 1) were the most consistently caught species, and were second in abundance of all species encountered (Moulton, 1994). Herring spawning occurs along the western side of lower Cook Inlet, and supports a local commercial fishery for sac-roe. This fishery was closed in 1999 because of declining herring biomass. The ADFG estimated the current stock size at 6,000 to 13,000 tons (ADFG, 1999b).

No data are available to quantify the levels of forage fish (e.g., eulachon) present in upper Cook Inlet. A commercial venture to harvest eulachon in the lower Susitna River operated during 1999. This fishery was limited to fifty (50) tons (ADFG, 1999a) but will be reviewed annually because of the importance of this fish to beluga whales..

Therefore, a preliminary review of escapement data of Pacific salmon in Cook Inlet does not suggest recent returns have suffered significant declines. Rather they suggest that the salmon runs have remained constant over the past decade, or increased, and should not have adversely impacted beluga whales simply due to biomass availability. To what extent herring and eulachon are significant in the diet of beluga whales is not known, but they likely are important prior to the salmon runs. However, this information does highlight the importance of foraging areas to beluga whales and, given that the beluga whales forage to a great extent in the upper Inlet, the importance of the continued health of these fish runs and their natal rivers. Maintaining the health of the spawning rivers may be as significant to the beluga whale as is the health of the remaining Inlet. Therefore activities that occur in the upland drainage areas of the major spawning rivers, such as the Kenai and Susitna River basin, are likely as significant to beluga whales as are activities in the estuarine and saltwater portions of Inlet. These activities have, and will continue to be, monitored by NMFS with focus being on the impact of these activities on beluga whale prey.

4.8.13 Research

Because many important aspects of the biology of CI beluga whales remain unknown, or are incompletely studied, and because management of this stock through recovery will require knowledge of annual abundance levels, NMFS anticipates continuing and possibly expanding their research program in upper Cook Inlet and elsewhere throughout the range of this stock. This would certainly include continuing annual abundance surveys. Other research may include tagging beluga whales to investigate seasonal movements and migration patterns, biopsy darting of individual whales to obtain tissue samples for research into the stocks' genetics, and behavioral-telemetry studies associated with disturbance and avoidance of human activities. Research may occur at Federal, state, and private levels.

NMFS is required to ensure that these activities will not have harmful impacts to the beluga whale stock. Any research which may take a beluga whale, including 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.

4.9 Impacts on Endangered or Threatened Species

The ESA provides for the conservation of endangered and threatened species of fish, wildlife, and plants. The program is administered jointly by NMFS for most marine species, and the US Fish and Wildlife Service (FWS) for terrestrial and freshwater species.

The ESA procedure for identifying or listing imperiled species involves a two-tiered process, classifying species as either threatened or endangered, based on the biological health of a species. Threatened species are those likely to become endangered in the foreseeable future [16 U.S.C. § 1532(20)]. Endangered species are those in danger of becoming extinct throughout all or a significant portion of their range [16 U.S.C. § 1532(20)]. The Secretary of Commerce, acting through NMFS, is authorized to list marine mammal and fish species. The Secretary of the Interior, acting through the FWS, is authorized to list all other organisms. Species listed as threatened or endangered under the ESA that occur in waters off Alaska are presented in the following table.

In addition to listing species under the ESA, the critical habitat of a newly listed species must be designated concurrent with its listing to the maximum extent prudent and determinable [16 U.S.C. § 1533(b)(1)(A)]. The ESA defines critical habitat as those specific areas that are essential to the conservation of a listed species and that may be in need of special consideration. The primary benefit of critical habitat designation is that it informs Federal agencies that listed species are dependent upon these areas for their continued existence, and that consultation with NMFS on any Federal action that may affect these areas is required.

On March 3, 1999, NMFS received a petition from seven organizations and one individual to list the CI stock of beluga whale as “endangered” under the Endangered Species Act of 1973, as amended (ESA). This petition requested emergency listing under section 4 (b)(7) of the ESA, designation of critical habitat, and immediate action to implement regulations to regulate the subsistence harvest of these whales. NMFS determined that these petitions presented substantial information which indicated the petitioned action(s) may be warranted in April 1999 (64 FR 17347). Upon further review, and taking into account management measures put in place to restrict the subsistence harvest following receipt of the petition, and this proposed action, NMFS has made a determination that an ESA listing is not warranted (64 FR 38778). Therefore, none of the alternatives proposed in this action negatively impacts any ESA listed species or its habitat.

4.10 Coastal Zone Management Act of 1972 (CZMA)

Implementation of the preferred alternative would be conducted in a manner consistent, to the maximum extent practicable, with the Alaska Coastal Management Program within the meaning of Section 30 (c) (1) of the CZMA and its implementing regulations.

4.11 Regulatory Impact Review

The requirements for all regulatory actions specified in Executive Order (E.O.) 12866 are summarized in the following statement from the order:

> In deciding whether and how to regulate, agencies should assess all costs and benefits of available regulatory alternatives, including the alternative of not regulating. Costs and benefits shall be understood to include both quantifiable measures (to the fullest extent that these can be usefully estimated) and qualitative measures of costs and benefits that are difficult to quantify, but nevertheless essential to consider. Further, in choosing among alternative regulatory approaches, agencies should select those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity), unless a statute requires another regulatory approach.

E.O. 12866 requires that the Office of Management and Budget review proposed regulatory programs that are considered to be "significant". The preferred alternative is not considered a "significant regulatory action" because it does not: (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise policy issues arising out of the President's priorities or the principles set forth in this Executive Order. Based on these criteria , NMFS determines that the preferred alternative is not significant for purposes of E.O. 12866.

Species currently listed as endangered or threatened under the ESA and occurring in waters off Alaska

Common Name	Scientific Name	ESA Status
Northern Right Whale	*Balaena glacialis*	Endangered
Bowhead Whale [1]	*Balaena mysticetus*	Endangered
Sei Whale	*Balaenoptera borealis*	Endangered
Blue Whale	*Balaenoptera musculus*	Endangered
Fin Whale	*Balaenoptera physalus*	Endangered
Humpback Whale	*Megaptera novaeangliae*	Endangered
Sperm Whale	*Physeter macrocephalus*	Endangered
Snake River Sockeye Salmon	*Onchorynchus nerka*	Endangered
Short-tailed Albatross	*Phoebastria albatrus*	Endangered
Steller Sea Lion	*Eumetopias jubatus*	Endangered and Threatened [2]
Snake River Fall Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Snake River Spring/Summer Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Puget Sound Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Lower Columbia River Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Upper Willamette River Chinook Salmon	*Onchorynchus tshawytscha*	Threatened
Upper Columbia River Spring Chinook Salmon	*Onchorynchus tshawytscha*	Endangered
Upper Columbia River Steelhead	*Onchorynchus mykiss*	Endangered
Snake River Basin Steelhead	*Onchorynchus mykiss*	Threatened
Lower Columbia River Steelhead	*Onchorynchus mykiss*	Threatened
Upper Willamette River Steelhead	*Onchorynchus mykiss*	Threatened
Middle Columbia River Steelhead	*Onchorynchus mykiss*	Threatened
Spectacled Eider	*Somateria fishcheri*	Threatened
Steller's Eider	*Polysticta stelleri*	Threatened

[1] The bowhead whale is present in the Bering Sea area only.
[2] Steller sea lion are listed as endangered west of Cape Suckling and threatened east of Cape Suckling.

The Regulatory Impact Review is also designed to provide information to determine whether the proposed regulation is likely to be "economically significant." The preferred alternative is not considered to have a significant economic effect since it does not result in any of the impacts described above.

4.11.1 Non-consumptive Resource Use

While no market exists within which CI beluga whales are "traded" (in the traditional economic sense), they nonetheless have had economic value to a few subsistence users. They also have a large cultural value to Alaskan Natives, as well as a large non-consumptive value to the non-Native public. In general, it can be demonstrated that society places economic value on (relatively) unique environmental assets, even if those assets are never directly exploited. That is, for example, society places real (and measurable) economic value on simply "knowing" that, in this case, CI beluga whales are flourishing in their natural environment.

A substantial literature has developed which describes the nature of these non-use values to society. In fact, it has been demonstrated that these non-use economic values may include several dimensions, among which are "existence" value, "option" value, and "bequest" value. As the respective terms suggest, society places an economic "value" on, in this case, the continued *existence* of beluga whales in Cook Inlet; society further "values" the *option* it retains through the continued existence of the resource for future access to the CI beluga whale population; and society places "value" on providing future generations the opportunity to enjoy and benefit from this resource. These estimates are additive and mutually exclusive measures of the value society places on these natural assets, and are typically calculated as "willingness-to-pay" or "willingness-to-accept" compensation (depending upon with whom the implicit ownership right resides) for non-marginal changes in the status or condition of the asset being valued.

Quantitatively measuring society's non-use value for an environmental asset (e.g., belluga whales), is a complex but technically feasible task. However, in the current situation, an empirical estimation of these values is unnecessary, because the MMPA and the ESA implicitly assumes that society automatically enjoys a *"net benefit"* from any action which protects marine mammal species (including the habitat they rely upon), and/or facilitates the recovery of populations of such species (or their habitat). Therefore, it is neither necessary nor appropriate to undertake the estimation of these benefits. It is sufficient to point out that these very real "non-use" values to society from conservation measures for CI beluga whales do exist. Therefore, the effect of implementing the preferred alternative is likely to produce an overall net social and economic benefit.

4.12 Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA), first enacted in 1980, was designed to place the burden on the government to review all regulations to ensure that, while accomplishing their intended purposes, they do not unduly inhibit the ability of small entities to compete. The RFA recognizes that the size of a business, unit of government, or nonprofit organization frequently has a bearing on its ability to comply with a federal regulation. Major goals of the RFA are: (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require that agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting impacts on small entities as a group distinct from other entities and on the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action.

On March 29, 1996, President Clinton signed the Small Business Regulatory Enforcement Fairness Act. Among other things, the new law amended the RFA to allow judicial review of an agency's compliance with the RFA. The 1996 amendments also updated the requirements for a final regulatory flexibility analysis, including a description of the steps an agency must take to minimize the significant economic impact on small entities. Finally, the 1996 amendments expanded the authority of the Chief Counsel for Advocacy of the Small Business Administration (SBA) to file *amicus* briefs in court proceedings involving an agency's violation of the RFA.

In determining the scope, or 'universe', of the entities to be considered in an IRFA, NMFS generally includes only those entities, both large and small, that can reasonably be expected to be directly or indirectly affected by the proposed action. If the effects of the rule fall primarily on a distinct segment, or portion thereof, of the industry (e.g., user group, geographic area), that segment would be considered the universe for the purpose of this analysis. NMFS interprets the intent of the RFA to address negative economic impacts, not beneficial impacts, and thus such a focus exists in analyses that are designed to address RFA compliance. NMFS has determined that this proposed rulemaking does not have negative economic impacts to small entities as defined and, as such, an Initial Regulatory Flexibility Analysis, pursuant to 5 USC 603, is not required.

4.13 Executive Order 13084-Consultation and Coordination with Indian Tribal Governments

This proposed rule is consistent with policies and guidance established in Executive Order 13084 of May 14, 1998 (63 FR 27655). E.O. 13084 requires that if NMFS issues a regulation that significantly or uniquely affects the communities of Indian tribal governments and imposes substantial direct compliance costs on those communities, NMFS must consult with those governments, or the Federal government must provide the funds necessary to pay the direct compliance costs incurred by the tribal governments. NMFS has taken several steps to consult and inform affected tribal governments and solicit their input during development of these proposed regulations including the development of a co-management agreement with the Cook Inlet Marine Mammal Council which provides for the harvest of 1 whale during 2000. This proposed rule does not impose substantial direct compliance costs on the communities of Indian tribal governments.

4.14 Conclusions and Recommendations

The recovery of the CI beluga whale stock is dependent on the identification of those factors which have caused this stock to decline and on the identification and implementation of measures to control those factors. A review of the natural and anthropogenic factors potentially impacting the stock of Cook Inlet beluga whales indicates that subsistence harvest is the most likely cause of the decline observed between 1994 and 1998. The magnitude of decline, approximately 300 animals, is consistent with estimates of harvest over this same period, i.e, approximately 316 animals. It is not possible to determine when the decline in this stock of beluga whales actually began, or what the level of subsistence harvest removals was prior to the recent estimates. However, considering the reported level of this harvest in recent years, and the length of time that beluga whale hunting has been going on in the Inlet, it is likely the decline began prior to 1994.

In support of the hypothesis that over-harvest is the principal cause of the decline, the population estimate in 1999 was 357 whales. While the 1994-1999 decline remains significant, a slight increase in the 1999 abundance estimate followed the moratorium imposed by Public Law 106-31. We believe that increase was the result of the moratorium, supporting the need to limit the subsistence harvest.

There is, however, a demonstrated traditional and historic use of beluga whales in Cook Inlet by the Village of Tyonek, other Cook Inlet Native villages, and Alaskan Natives. This subsistence harvest plays an important part in Native culture. The maintenance of this culture is dependent in part on continued access to subsistence resources, including beluga whales. Thus, two goals exist with respect to the management of this stock: to recover their numbers to OSP and to allow for continued subsistence use during this recovery. NMFS believes these are not mutually exclusive goals.

Alternatives 2-4 would provide an opportunity for the continued subsistence harvest of beluga whales in the Inlet with minimal impact. The impact of Alternatives 2 and 3 on the recovery period (when compared with zero harvest) would be to extend the recovery period by two years. Both alternatives are consistent with the intent to provide for a harvest that would not significantly delay the recovery of this stock to the lower level of OSP while allowing for a harvest. Alternative 4 has a delay in recovery time, expressed in years to recovery, of 3 years or 13 percent. It is also the alternative that maximizes the number of whales that can be struck (2 whales) without significantly impacting the recovery of this stock. Therefore, NMFS concludes that the continuation of the subsistence harvest of CI beluga whales through regulation and a co-management agreement that would authorize the harvest level to two beluga whales per year until the stock has recovered (Alternative 4) should be selected as the preferred alternative.

The impacts of other anthropogenic factors on CI beluga whales also have been considered. While direct impacts to individual CI beluga whales may occur, such impacts are currently unreported or occur at very low levels, and are not believed to impact recovery. No current population-level effects are thought to be occurring due to man-induced factors except for the harvests. The upper Cook Inlet region is important habitat to this stock, and NMFS believes that the potential pressures from activities need continued monitoring with the recovery of the beluga whales in mind. However, at this time there is no demonstrated relationship, direct or indirect, between these activities and the recent trends in the stock of CI beluga whales.

Chapter 5. Consultation and Coordination

5.1 Summary of Public Involvement

A Scoping Meeting was held in the Anchorage on December 16, 1999. This meeting was advertised in the Anchorage Daily News, and notifications of the meeting were mailed to over 120 interested parties. During this meeting, NMFS biologists and scientists from NMFS/AFSC, National Marine Mammal Laboratory, presented an overview of the Cook Inlet stock of beluga whale and answered questions regarding abundance estimates, population dynamics, and cooperative management. Public testimony was received from attendees during the meeting. Written scoping comments were received until January 19, 2000. A summary of the comments received during the testimony and comment period are listed below by each of the commenters.

5.2 Issues and Concerns Raised by the Public and Agencies

In the course of conducting the scoping meeting described above, and through written comments, various issues were identified. These issues have been addressed in either this DEIS or the proposed and final rules designating CI beluga whales as depleted. Comments that focus on the ESA petition and/or the need to list the CI beluga whale stock as endangered under the ESA have been addressed in the response to the petition on whether, or not, to list CI beluga whales under the ESA. All comments will be compiled and responses provided by NMFS in the final EIS.

5.3 Summary of Comments

<u>I. Cook Inlet Marine Mammal Council</u>

The consumption of traditional Native foods is essential to the preservation of Alaska's indigenous people and their culture.

<u>II. National Audubon Society</u>

NMFS population models lack inputs specific to the Cook Inlet stock of beluga whales. The determination and assessment of harvest levels should be done through a risk-assessment process rather than a deterministic model.

NMFS should describe how they determined the recovery factor used for the CI beluga whales in the 1999 Stock Assessment Report, and why the Scientific Review Group recommendation of 0.1 for the recovery factor was not used in that report.

NMFS should not set their priority as having a subsistence harvest, but to recover the stock. Recovery objectives must be clearly defined in the DEIS.

Because of modeling uncertainty, harvest limits should be set based on observed recovery rates, and adjusted depending on how recovery is proceeding.

The DEIS should discuss the significance of a small population in terms of vulnerability and recovery.

The DEIS must assess the habitat needs of the CI beluga whale stock and impacts to that habitat.

The DEIS must evaluate cumulative impacts to the CI beluga whale stock.

The DEIS should evaluate killer whale predation on the CI beluga whale stock.

The DEIS should evaluate the protective measures of the ESA vs. MMPA.

<u>III. Native Village of Tyonek</u>

The EIS should have the preferred alternative of a continuing harvest of 2 belugas per year, to be allocated to the Village of Tyonek.

A cessation of beluga hunting would prevent the knowledge, customs, and skills from being passed on to younger generations, and would prevent vital nutritional needs from being met.

Hunting of the CIBW should occur under a co-management plan with CIMMC.

The DEIS should acknowledge the growth of Tyonek, and allow for the possibility of increased harvests in this case.

<u>IV. Center for Marine Conservation</u>

The DEIS should evaluate all activities which might adversely impact the CIBW, including oil and gas exploration and development, fishing interaction, prey availability, urban discharges, vessel operations, and subsistence harvests.

NMFS should adopt the SRG recommendation for recovery factor (0.1) in determining the PBR levels for the CI beluga whale stock.

<u>V. Resource Development Council</u>

NMFS should establish de-listing criteria.

They support co-management as the ultimate solution to this issue.

<u>VI. Marathon Oil Company</u>

The DEIS should use existing science and acknowledge anecdotal information.

The DEIS should address the 1998 NMFS formula for CI beluga whale abundance estimates (i.e., the correction factor) and how the formula affects raw survey counts.

<u>VII. Alaska Oil and Gas Association</u>

The DEIS should identify and resolve remaining impediments toward completion of a co-management agreement.

The DEIS should use existing science and acknowledge anecdotal information; NMFS should not mix science with anecdotal information.

The EIS should address the NMFS formula used in abundance estimates.

The DEIS should include data regarding water quality studies in Cook Inlet.

<u>VIII. Cetacean Society International</u>

Why didn't NMFS use the minimum population estimate (217) in its assessment?

NMFS should declare a deadline for the proposed EIS.

<u>IX. Comments from Individuals</u>

The DEIS should consider compliance, monitoring , and enforcement issues associated with any harvest alternatives.

NMFS should develop a more-refined model for the CI beluga whale which include removals due to continued predation by killer whales and the age structure of this stock, which could affect recovery times.

Low fish returns are causing the CI beluga whales to starve.

NMFS should develop a conservation plan to bring all parties and concerns together.

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