

**ENDANGERED SPECIES ACT: SECTION 7 CONSULTATION
BIOLOGICAL OPINION**

Action Agency: U.S. Department of Transportation, Federal Highways Administration

Activity: Knik Arm Crossing, Anchorage, Alaska

Consulting Agency: National Marine Fisheries Service, Alaska Region

Date Issued: November 30, 2010

Approved By: Robert O. Mecum Acting RA

The U.S. Department of Transportation, Federal Highways Administration (FHA), has requested formal consultation on the Knik Arm Crossing (KAC) Project at Anchorage, Alaska by letter dated July 1, 2010. This document constitutes NMFS' opinion on the effects of that action on the endangered species in accordance with section 7 of the ESA. Specifically, this opinion analyzes the effects of the Knik Arm Crossing on the endangered Cook Inlet beluga whale (*Delphinapterus leucas*) (73 FR 62919, October 22, 2008). In formulating this Biological Opinion, NOAA Fisheries used information presented in the FHA's June 2010 Biological Assessment of the Knik Arm Crossing, the October 2008 Conservation Plan for the Cook Inlet Beluga Whale, the 2008 Status Review and Extinction Risk Assessment of Cook Inlet Belugas (*Delphinapterus leucas*), and the 2008 Final Supplemental Environmental Impact Statements for the Cook Inlet Beluga Whale Subsistence Harvest, A Review of Beluga Whale Behavior and Response to In-Water Structures prepared for the Knik Arm Bridge and Toll Authority, along with other research relating to beluga whales and information provided by NOAA's National Marine Mammal Laboratory, the State of Alaska, and the traditional knowledge of the Alaska Native community.

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 *et. seq.*) requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species, or result in the destruction or adverse modification of any critical habitat of such species. When the action by a federal agency may affect a protected species, that agency is required to consult with either the National Marine Fisheries Service (NMFS) or the US Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected. Formal consultations on most listed marine species are conducted between the action agency and NMFS. Consultations are concluded after NMFS' issuance of a biological opinion (opinion) that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its critical habitat. If jeopardy or destruction or adverse

modification is found to be likely, the opinion must identify the reasonable and prudent alternatives to the action, if any, that would avoid jeopardizing any listed species and avoid destruction or adverse modification of designated critical habitat. If jeopardy is not likely, the opinion may also include an incidental take statement (ITS), which specifies the amount or extent of incidental take that is anticipated from the proposed action. Non-discretionary reasonable and prudent measures to minimize the impact of the incidental take are included along with the implementing terms and conditions, and conservation recommendations are made.

TABLE OF CONTENTS

I. Description of the Proposed Action	1
II. Status of the Species	6
III. Environmental Baseline.....	17
IV. Effects of the Action	32
V. Cumulative Effects.....	54
VI. Synthesis and Integration	56
VII. Conclusions.....	71
VIII. Conservation Recommendations	71
IX. Reinitiation of Consultation	72
X. Incidental Take Statement	72
XI. Literature Cited.....	72

Presentation of the Analysis in this Opinion

Biological opinions are constructed around several basic sections that represent specific requirements placed on the analysis by the ESA and implementing regulations. These sections contain different portions of the overall analytical approach described here. This section is intended as a basic guide to the reader of the other sections of this opinion and the analyses that can be found in each section. Every step of the analytical approach described above will be presented in this opinion in either detail or summary form.

Description of the Proposed Action – This section contains a basic summary of the proposed Federal action and any interrelated and interdependent actions. This description forms the basis of the first step in the analysis where we consider the various elements of the action and determine the stressors expected to result from those elements. The nature, timing, duration, and location of those stressors define the action area and provide the basis for our exposure analyses.

Status of the Species – This section provides the reference condition for the species and critical habitat at the listing and designation scale. These reference conditions form the basis for the determinations of whether the proposed action is not likely to jeopardize the species or result in the destruction or adverse modification of critical habitat. Other key analyses presented in this section include critical information on the biological and ecological requirements of the species and critical habitat and the impacts to species and critical habitat from existing stressors.

Environmental Baseline – This section provides the reference condition for the species and critical habitat within the action area. By regulation, the baseline includes the impacts of past, present, and future actions (except the effects of the proposed action) on the species and critical habitat. This section also contains summaries of the impacts from stressors that will be ongoing in the same areas and times as the effects of the proposed action (future baseline). This information forms part of the foundation of our exposure, response, and risk analyses.

Effects of the Proposed Action – This section details the results of the exposure, response, and risk analyses NMFS conducted for listed species and elements, functions, and areas of critical habitat.

Cumulative Effects – This section summarizes the impacts of future non-Federal actions reasonably certain to occur within the action area, as required by regulation. Similar to the rest of the analysis, if cumulative effects are expected, NMFS determines the exposure, response, and risk posed to individuals of the species and features of critical habitat.

Synthesis and Integration – In this section of the opinion, NMFS presents the summary of the effects identified in the preceding sections and then details the consequences of the risks posed to individuals and features of critical habitat to the species or Distinct Population Segment at issue. Finally, this section concludes whether the proposed action may result in jeopardy to the continued existence of a species or the destruction or

adverse modification of designated critical habitat.

Legal and Policy Framework

The purposes of the ESA, “...are to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved, to provide a program for the conservation of such endangered species and threatened species, and to take such steps as may be appropriate to achieve the purposes of the treaties and conventions set forth in subsection (a) of this section.” To help achieve these purposes, the ESA requires that, “Each Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat...”

Jeopardy Standard

The “jeopardy” standard has been further interpreted in regulation (50 CFR 402.02) as a requirement that Federal agencies insure that their actions are not likely to result in *appreciable reductions in the likelihood of both the survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution*. It is important to note that the purpose of the analysis is to determine whether or not appreciable reductions are reasonably expected, but not to precisely quantify the amount of those reductions. As a result, our assessment often focuses on whether a reduction is expected or not, but not on detailed analyses designed to quantify the absolute amount of reduction or the resulting population characteristics (abundance, for example) that could occur as a result of proposed action implementation.

For the purposes of this analysis, NMFS equates a listed species’ probability or risk of extinction with the likelihood of both the survival and recovery of the species in the wild for purposes of conducting jeopardy analyses under section 7(a)(2) of the ESA. A designation of a high risk of extinction indicates that the species faces significant risks from internal and external processes that can drive a species to extinction. The status assessment considers and diagnoses both the internal and external processes affecting a species’ extinction risk.

The parameters of productivity, abundance, and population spatial structure are important to consider because they are predictors of extinction risk, the parameters reflect general biological and ecological processes that are critical to the survival and recovery of the listed species, and these parameters are consistent with the “reproduction, numbers, or distribution” criteria found within the regulatory definition of jeopardy (50 CFR 402.02).

Destruction or Adverse Modification Standard

For critical habitat, NMFS does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the analysis with respect to critical habitat. NMFS will evaluate “destruction or adverse modification” of critical habitat by determining if the action reduces the value of critical habitat for the conservation of the species.

Additional requirements on the analysis of the effects of an action are described in regulation (50 CFR 402) and our conclusions related to “jeopardy” and “destruction or adverse modification” generally require an expansive evaluation of the direct and indirect consequences of the proposed action, related actions, and the overall context of the impacts to the species and habitat from past, present, and future actions as well as the condition of the affected species and critical habitat [for example, see the definitions of “cumulative effects,” “effects of the action,” and the requirements of 50 CFR 402.14(g)]. Recent court cases have reinforced the requirements provided in section 7 regulations that NMFS must evaluate the effects of a proposed action within the context of the current condition of the species and critical habitat, including other factors affecting the survival and recovery of the species and the functions and value of critical habitat.

Consultations designed to allow Federal agencies to fulfill these purposes and requirements are concluded with the issuance of a biological opinion or a concurrence letter. Section 7 of the ESA and the implementing regulations (50 CFR 402), and associated guidance documents (*e.g.*, USFWS and NMFS 1998) require biological opinions to present: (1) a description of the proposed Federal action; (2) a summary of the status of the affected species and its critical habitat; (3) a summary of the environmental baseline within the action area; (4) a detailed analysis of the effects of the proposed action on the affected species and critical habitat; (5) a description of cumulative effects; and (6) a conclusion as to whether it is reasonable to expect the proposed action is not likely to appreciably reduce the species’ likelihood of both surviving and recovering in the wild by reducing its numbers, reproduction, or distribution or result in the destruction or adverse modification of the species’ designated critical habitat.

Consultation History

Communication between FHA/KABATA and NMFS regarding the KAC project has been ongoing since 2004. NMFS served as a Cooperating Agency for the FHA’s 2007 EIS written for this project. In association with project scoping and preparation of the Draft EIS, six Interdisciplinary Team meetings were held between January and September 2005. NMFS participated in all six meetings. This team was established to provide study information and receive input on issues to be addressed in the EIS. Representatives from both the cooperating and participating agencies took part and provided key input, such as preliminary corridor concepts, ongoing project studies, cumulative effects methodology, natural environment resource components, crossing concepts, screening criteria, and potential impacts related to the KAC project. Additionally, many topic meetings focusing on areas of special interest or jurisdiction of specific agencies also took place with small groups of team members.

The FHA requested initiation of formal consultation for the KAC project by letter dated July 1, 2010. NMFS agreed to initiate consultation by letter dated August 5, 2010. FHA has requested that this consultation be expedited to meet their December 20, 2010 internal deadline for a Record of Decision under NEPA.

Term of this Opinion

This opinion will be valid upon issuance and remain in force until re-initiation may

become necessary. Consultation will be re-initiated if there are 1) significant changes in the type of activities, 2) new information indicates these actions are impacting the Cook Inlet beluga whale and its critical habitat to a degree or in a manner not previously considered, or 3) new species or critical habitats become listed under the ESA. Because critical habitat has not been designated for the Cook Inlet beluga, this document will be a conference opinion on the proposed project. Upon issuance of a final rule designating critical habitat for Cook Inlet beluga whales and if appropriate, NMFS will issue a letter confirming this conference opinion to be the biological opinion for this critical habitat.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the federal action (50 CFR §402.02). The action area is typically larger than the project area and extends out to a point where no measurable effects from the project occur. The action area for the KAC project is defined based on the project footprint and the limits of the project's effects on the environment. The action area includes those areas potentially exposed to the effects of project construction, such as underwater noise and sediment suspension, and areas exposed to the effects of project operation, including underwater noise resulting from bridge traffic, sediment deposition in Knik Arm, and indirect effects caused by land development resulting from the project.

While other aspects of construction (e.g., turbidity) and operation (e.g., underwater noise, stormwater, sediment deposition) will cause impacts to the environment, FHA and KABATA determined the periphery of the action area within Knik Arm by considering the activity(ies) whose impacts will extend farthest from the project: those caused by temporary pile-driving noise. FHA and KABATA anticipate impact pile driving will create the highest noise levels of all construction activities. Noise associated with impact driving of temporary piles during construction could extend 23 miles before attenuating to ambient levels, based on estimated transmission-loss calculations. This estimated distance of KAC construction noise attenuation to ambient levels (125 dB re 1 μ Pa) assumes a constant attenuation value; in reality, attenuation will be variable because of changes in environmental conditions along this sound path (e.g. changes in bathymetry, salinity, substrate type). The action area thus encompasses all areas that may be affected by underwater sounds equal to or greater than 125 dB re 1 μ Pa as a result of the proposed action. This area includes all of Knik Arm and portions of upper Cook Inlet within this soundfield. The direct and indirect effects of this action on the endangered Cook Inlet beluga whale are expected to be confined to the action area.

I. DESCRIPTION of the PROPOSED ACTION

The Alaska Division of the Federal Highway Administration and Knik Arm Bridge and Toll Authority plan to construct the Knik Arm Crossing project, which consists of a new bridge and approaches connecting the KAC to existing transportation infrastructure (Figure 1).

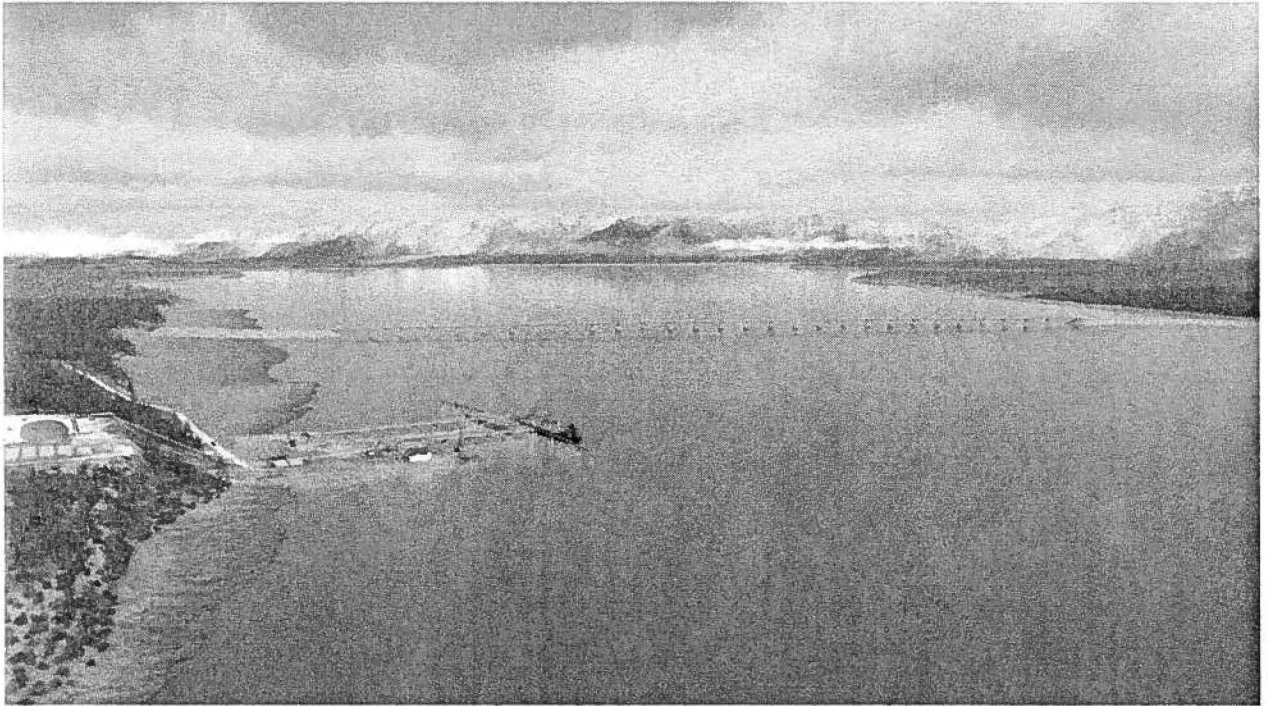


Figure 1. Rendering of the proposed Knik Arm Crossing. This is of an earlier design, and does not depict the increased inter-pier distance of 275 feet. The existing Port MacKenzie is in the foreground.

The KAC design will employ an 8,200-foot-long, pier-supported bridge with armored gravel fill approaches that extend seaward from the eastern and western sides of Knik Arm. The bridge will be supported on piers with 275-foot spans. A navigable opening will be provided that meets dimensions required by the USCG (estimated at 250 feet wide by 50 feet above mean higher high water [MHHW]). Bridge height will be approximately 80 feet above mean lower low water (MLLW) at the navigable opening.

The armored-fill bridge approaches will be approximately 300 to 500 feet wide at seabed, 2,000 feet long on the western shore, and 3,300 feet long on the eastern shore. An 80-foot-wide paved road will be constructed on the approaches. The approach from the western bluff will be approximately 70 feet high and extend from the bluff to connect to the western side of the pier-supported bridge. On the Anchorage side, the fill approach will curve and run southward along the shoreline around Cairn Point to the northern edge of the future Port of Anchorage (POA) expansion.

The KAC will accommodate four lanes of traffic and a multiuse pathway. The functional classification of the Crossing will be a rural principal arterial highway, with a design speed of 70 mph. Project construction is planned to occur in two phases. Phase 1 is anticipated to begin in 2012 and to last 5 years (with a sixth year possible because of construction delays associated with weather conditions, construction logistics, beluga shut-down periods, etc.). Phase 2 will be constructed when increased traffic volumes warrant the additional capacity. All in-water construction work in Knik Arm will occur during Phase 1.

Drilled-shaft technology for the large-diameter, permanent bridge piers will be used as opposed to driven piles, significantly reducing in-water noise exposure. Drilled shafts will be constructed using oscillators to place 116 shafts comprising 29 piers (4 shafts per bridge pier). A detailed description of the proposed plan may be found in the Biological Assessment (BA) for this consultation (HDR 2010).

II. STATUS OF THE SPECIES (RANGEWIDE)

NMFS has determined the Cook Inlet beluga whale to be the only threatened or endangered species likely to occur in the action area. The Cook Inlet Distinct Population Segment (DPS) of beluga whale was listed as endangered under the ESA in 2008. This opinion will consider the potential effects of the above described actions on this species. Cook Inlet beluga whales are also designated as depleted and strategic under the Marine Mammal Protection Act (MMPA).

It has been noted that during the fall of 2009 one Steller sea lion was observed in transit near the action area. This was an extremely rare occurrence, and there is very little likelihood that a Steller sea lion will enter the action area in the future. Therefore, no ESA-listed species other than beluga whales were reviewed in this opinion.

Cook Inlet Beluga Whale – Range

The range of Cook Inlet beluga whales has been defined as the waters of the Gulf of Alaska north of 58° N and freshwater tributaries to these waters, based on available scientific data in 2000 (65 FR 34590, 31 May 2000; MMPA Sec. 216.15(g)). Few beluga sightings occur in the Gulf of Alaska outside Cook Inlet. Laidre et al. (2000) summarized available information on prehistoric to current beluga whale distribution in the Gulf of Alaska, and, with the exception of Yakutat, sightings have been rare and sporadic given the extent of the survey efforts. There were 169,550 cetacean sightings recorded in the Gulf of Alaska prior to the year 2001, excluding Cook Inlet, and only 44 were beluga (Laidre et al. 2000), indicating they are extremely rare in the Gulf of Alaska outside Cook Inlet. Calkins (1989) described beluga whales in Cook Inlet, Prince William Sound, Yakutat Bay, and throughout the coastal waters of the Gulf of Alaska, from the northern portions of Kodiak Island to Yakutat.

A detailed description of the Cook Inlet beluga whale biology may be found in the Conservation Plan (NMFS 2008), and the Proposed Listing Rule (72 FR 19854, April 20, 2007).

Cook Inlet Beluga Whale – Description and Taxonomy

The beluga whale is a small, toothed whale in the family Monodontidae, a family it shares with only the narwhal. Beluga whales are also known as “white whales” because of the adults’ white coloration. Beluga calves are born dark to brownish gray and lighten to white or yellow-white with age. Adult Cook Inlet beluga whales average between 12 and 14 ft in length, although Native hunters have reported some may reach as much as 20 ft (Huntington 2000). Adult beluga males may weigh up to 3,300 pounds while females are typically smaller, weighing up to 3,000 pounds (Nowak 2003). The cervical vertebrae in beluga whales are not fused, allowing them to turn and nod their heads. Instead of a

dorsal fin, beluga whales have a tough dorsal ridge. They also exhibit a relatively small head, fluke, and flippers.

Cook Inlet Beluga Whale – Biology and Behavior

While mating is assumed to occur sometime between late winter and early spring, there is little information available on the beluga whale mating behavior. Beluga whales typically give birth to a single calf every two to three years, after a gestation period of approximately 14 months. Most calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins 1983), although Native hunters have observed calving from April through August (Huntington 2000). Alaska Natives described calving areas as the northern side of Kachemak Bay in April and May, off the mouths of the Beluga and Susitna rivers in May, and in Chickaloon Bay and Turnagain Arm during the summer (Huntington 2000). Young beluga whales are nursed for two years and may continue to associate with their mothers for a considerable time thereafter (Reeves et al. 2002). The warmer waters from these freshwater sources may be important to newborn calves during their first few days of life (Katona et al. 1983; Calkins 1989). Surveys conducted from 2005 to 2007 in the upper Inlet by LGL, Inc., documented neither localized calving areas nor a definitive calving season, since calves were encountered in all surveyed locations and months (April-October) (McGuire et al. 2008). The warmer, fresher coastal waters may also be important areas for beluga whales' seasonal summer molt.

Sexual maturity can vary from 4 to 10 years for females and 8 to 15 years for males. It is believed that beluga whales may live more than 30 years, although recent discoveries pertaining to ageing techniques may lead scientists to effectively double these estimates.

Beluga whales normally swim about 2 to 6 miles per hour, but when pursued, can attain a speed of 14 miles per hour. While they usually surface to breathe every 30 to 40 seconds, radio-tracking studies show that they also routinely dive for periods of 9.3 to 13.7 minutes and to depths of 66 to 1,140 ft, presumably for feeding (Nowak 2003).

Beluga whales have a well-developed sense of hearing and echolocation. Most sound reception takes place through the lower jaw, which is hollow at its base and filled with fatty oil. Sounds are conducted through the lower jaw to the middle and inner ears, then to the brain. Beluga whales can hear over a large range of frequencies, from about 40 Hz to 150 kilohertz (kHz) (Au 1993; Johnson 1967; Johnson et al. 1989; Scheifele 1987; White et al. 1978). Their most acute hearing occurs at frequencies between about 9 kHz and 90 kHz. Beluga whales conduct communication and echolocation at relatively high frequencies where they have a lower hearing threshold and greater hearing sensitivity. Studies have shown beluga whales to emit communication calls with an average frequency range from about 2.0 to 5.9 kHz. Echolocation is generally conducted at frequencies greater than 40 kHz. Studies have shown that beluga whales generally produce signals with peak frequencies of 40 to 120 kHz during echolocation, and the intensity of the signal can change with location and background noise levels. Echolocation is presumably used to avoid obstacles and to search for prey (Nowak 2003).

Complementing their excellent hearing is the fact that beluga whales have one of the most diverse vocal repertoires of all marine mammals. They are capable of making a variety of vocalizations, including whistles, buzzes, groans, roars, trills, etc., which lead to their nickname as sea canaries. Their vision is reported to also be well developed; they appear to have acute vision both in and out of water and, as their retinas contain both rod and cone cells, and are believed to see in color (Herman 1980).

Beluga whales are extremely social animals that typically interact together in close, dense groups. Groups of 10 to more than 100 whales have been observed in Cook Inlet. It is unknown whether these represent distinct social divisions (NMFS 2008) although Reeves et al. (2002) mentioned the groups are often of the same sex and age class. Traditional knowledge also suggests that beluga whales maintain family groups (Huntington 2000).

Cook Inlet Beluga Whale – Population Abundance and Trends

The Cook Inlet beluga whale population has probably always numbered fewer than several thousand animals, but in recent years has declined significantly from its historical abundance (NMFS 2008). It is difficult, however, to accurately determine the magnitude of decline due to the paucity of information on the beluga whale population that existed in Cook Inlet prior to development of the region, or prior to modern subsistence whaling by Alaska Natives. With no reliable abundance surveys conducted prior to the 1990s, scientists must estimate historical abundance based on what little data exist. Relying on a survey conducted in portions of Cook Inlet during 1979, Calkins (1989) estimated a population of 1,293 beluga whales. This overall abundance estimate provided by Calkins represents the best available information on historical abundance. For management purposes, NMFS currently considers 1,300 beluga whales as a reasonable estimate of historical abundance.

Comprehensive, systematic aerial surveys of beluga whales in Cook Inlet began in 1994 with the goal of determining the overall abundance and population trend for the species. A decline in abundance of around 47 percent, from an estimate of 653 whales to 347 whales, was documented between 1994 and 1998 (Hobbs et al. 2000). After measures were established in 1999 to regulate subsistence harvests, NMFS expected that the population would grow at a rate between 2 and 6 percent. Abundance estimates from aerial surveys (1999 – 2008) indicate this level of growth did not occur (Fig. 2). Looking at the population estimates since the regulation of subsistence harvests (1999 – 2009) NMFS has documented a population decline of 1.49 percent per year. The 2010 population abundance estimate was 340 whales. A precise comprehensive statistical assessment of population trend is not possible given differences in survey methods and analytical techniques prior to 1994. A straight comparison of the 1,293 beluga estimate from 1979 to the 321 beluga whales estimated for 2009 would indicate a 75 percent decline in 31 years, but with unspecified confidence. NMFS has committed to conducting systematic annual abundance surveys which should reduce uncertainties in population status and growth over time.

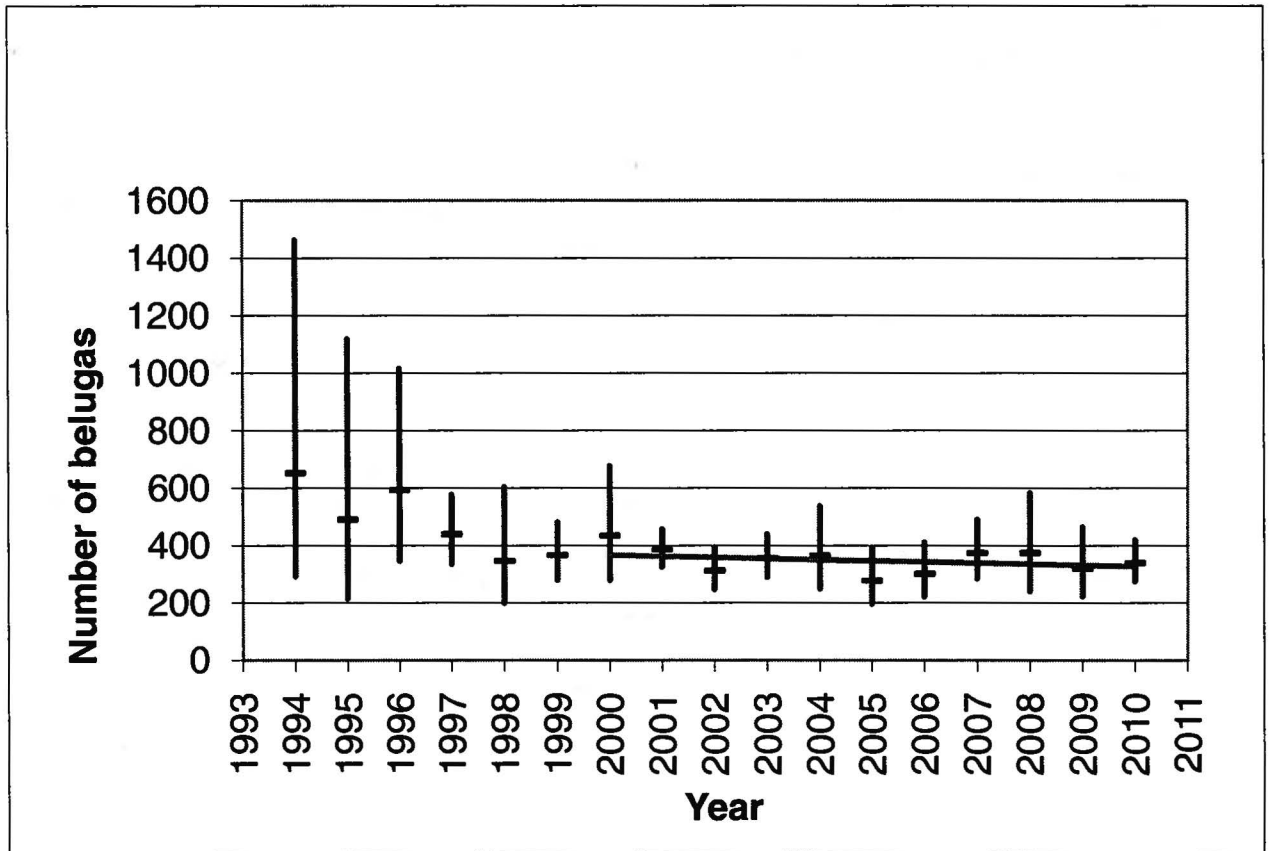


Figure 2. Abundance estimates for beluga whales in Cook Inlet with 95 percent confidence intervals (vertical bars). In the years since a hunting quota was in place (1999-2009), the rate of decline (red trend line) has been -1.49 percent per year.

Within Knik Arm, beluga abundance is highly variable. Fourteen years of aerial surveys conducted during the first weeks of June by NMFS show beluga abundance ranging from 224 to 0 whales (NMFS 2008). Surveys conducted by boat in 2004 reported variable abundance counts in Knik Arm for August through October; 5-130 whales in August, 0-70 whales in September, and 0-105 whales in October (Funk et al. 2005).

Cook Inlet Beluga Whale – Population Viability Analysis and Extinction Risk Assessment

The National Marine Mammal Laboratory published the 2008 Status Review and Extinction Risk Assessment of Cook Inlet Beluga Whales (*Delphinapterus leucas*) (Review). That document included an update of a November 2006 Status Review and responded to issues raised by a panel of independent experts regarding the earlier Status Review. The conclusions of the 2008 Review were:

- The contraction of the Cook Inlet beluga whale population range northward into

upper Cook Inlet makes it far more vulnerable to catastrophic events which have the potential to kill a significant fraction of the population

- The population is not growing at 2 percent to 6 percent per year as had been anticipated since the cessation of unregulated hunting.
- The population is discrete and unique with respect to the species, and if it should fail to survive, it is highly unlikely that Cook Inlet would be repopulated with beluga whales. This would result in a permanent loss of a significant portion of their range.
- The importance of seasonal anadromous fish runs in Cook Inlet to beluga whales is evident. The bulk of their annual nutrition is acquired during the summer months.
- Beluga whales in Cook Inlet are unique in Alaska given their summer habitat is in close proximity to the largest urban area in the state.
- While the impact of disease and parasitism on this population has not been quantified, this population is at greater risk because of its small size and limited range, such that a novel disease would spread easily through this population.
- The population viability analysis (PVA) shows a 26 percent probability of extinction in 100 years (for the model assuming one predation mortality per year and a 5 percent annual probability of an unusual mortality event killing 20 percent of the population). It is likely the Cook Inlet beluga population will continue to decline or go extinct during the next 300 years unless factors that determine its growth and survival are altered in its favor.

The Review also reaffirmed NMFS's earlier position that the Cook Inlet beluga whale stock is discrete and significant in terms of the ESA, and constitutes a species under the definitions of the ESA. The Review included a PVA model that was the most-detailed of any such models for Cook Inlet beluga whales, being age and gender based, and focused on the behavior of a declining population at sizes less than 500 whales. Small population effects, demographic stochasticity, Allee effects, predation mortality, and unusual mortality events were modeled explicitly. The PVA employed 20 sub-models with 11 various assumptions: different predation levels, unusual mortality events, Allee effects, habitat loss, counting/survey errors, and other factors. For each sub-model, 100,000 trials were run to provide a statistical distribution of the stochastic and deterministic variables of the model in order to allow for analysis. The PVA results were then used in the Extinction Risk Analysis (ERA) to estimate the probabilities for the stock to become extirpated within certain time frames. The ERA found that, for the sub-model judged to be the best approximation for the current population, the extinction probability was 26 percent within 100 years.

An important outcome of the ERA was that the extinction probabilities increased dramatically when predation was set for more than one beluga whale mortality per year. We do not have adequate data to accurately evaluate the removal levels from this stock due to killer whale predation or other factors, but we believe annual mortalities could very easily exceed this threshold. This finding has particular significance in assessing the cumulative risks to the Cook Inlet beluga whales. The Environmental Baseline section

has discussions on factors (stressors) known to be, or thought to be, impacting this population. The individual and cumulative contribution of these stressors must be carefully considered in assessing the consequences of this proposed action.

Distribution and Habitat Use

Little information is available on the beluga whale distribution in Cook Inlet prior to 1970; however, in the 1970s and 1980s, beluga sightings occurred across much of lower and upper Cook Inlet (Calkins 1984). For instance, sightings in the Kenai River area were common, and beluga concentrations were reported in Trading Bay and Kachemak Bay (Calkins 1984).

To identify current Cook Inlet beluga habitat use, particularly in winter, Cook Inlet beluga whales were tracked with satellite tags from 1999 through 2003. Data from satellite tagged whales documented that Cook Inlet beluga whales concentrate in the upper Inlet at rivers and bays in the summer and fall, and then tend to disperse into deeper waters, moving to lower Inlet locations in the winter. Beluga whales remain year-round in Cook Inlet, but demonstrate seasonal movement within the Inlet. The timing and location of eulachon and salmon runs have a strong influence on beluga whales' spring and summer movements. Beluga whales are regularly sighted in the upper Inlet beginning in late April or early May, coinciding with eulachon runs in the Susitna River and Twenty Mile River in Turnagain Arm. Belugas may remain in the upper Inlet into the fall, but appear to move west and south, coinciding with the coho run. Beluga whales regularly gather in Eagle Bay and elsewhere on the east side of Knik Arm, and sometimes in Goose Bay on the west side of Knik Arm.

During winter months, these whales concentrate in deeper waters in the lower Inlet past Kalgin Island, with occasional forays into the upper Inlet, including the upper ends of Knik and Turnagain Arms. Winter distribution does not appear to be associated with river mouths, as it is during the warmer months. The spatial dispersal and diversity of winter prey likely influences the wider beluga winter range throughout the Inlet.

Traditional Ecological Knowledge (TEK) of Alaska Natives and systematic aerial survey data document a contraction of the summer range of Cook Inlet beluga whales (Rugh et al. 2010). While beluga whales were once abundant and frequently sighted in the mid and lower Inlet during summer, they are now primarily concentrated in the upper Inlet. This constriction is likely a function of a reduced population seeking the highest quality habitat that offers the most abundant prey, most favorable feeding topography, best calving areas, and the best protection from predation. An expanding population would likely use the Inlet more extensively.

In Knik Arm, beluga whales generally are observed arriving in May and often use the area all summer to feed on various salmon runs, moving with the tides. There is more intensive use of Knik Arm in August and through the fall, coinciding with the coho run. Beluga whales often gather in Eagle Bay between the months of May and November (Hobbs et al. 2005) and have been observed in Eagle River from June to November as far inland as 1¼ miles upstream (CH2M Hill 1997). The whales gather elsewhere on the east

side of Knik Arm and sometimes in Goose Bay on the west side of Knik Arm. Beluga whales often retreat to the lower portion of Knik Arm during low tides (NMFS 2008). Access to these areas and to corridors between these areas is important.

While it is difficult to quantify the importance of various habitats in terms of the health, survival, and recovery of the Cook Inlet beluga whale, NMFS believes certain areas are particularly important. For instance, during ice-free months beluga whales often concentrate near shallow tidal flats, river mouths, or estuarine areas (NMFS 2008). Beluga whales in Cook Inlet often aggregate near the mouths of rivers and streams where salmon runs occur during summer and fall. Their winter distribution does not appear to be associated with river mouths, as it is during the warmer months. Alaska Natives described calving areas within Cook Inlet as the northern side of Kachemak Bay in April and May, off the mouths of the Beluga and Susitna rivers in May, and in Chickaloon Bay and Turnagain Arm during summer (NMFS 2008).

Cook Inlet Beluga Whale – Feeding

Both scientific research and Alaska Native TEK say beluga whales may move hundreds of miles to exploit changes in prey distribution (i.e., beluga whales follow their prey). For instance, beluga whale movements within upper Cook Inlet coincide with anadromous fish migrations where beluga whales often aggregate near the mouths of rivers and streams where salmon runs occur.

Dense concentrations of prey appear essential to beluga whale feeding behavior, but the relationship between beluga whale concentrations and salmon concentrations is not fully known (NMFS 2008). Beluga whales exhibit high site fidelity and may persist in an area with fluctuating fish runs or may tolerate certain levels of disturbance from boats or other anthropogenic activities in order to feed. On the other hand, it is apparent the movements and feeding distribution of beluga whales are not simply explained by when and where the most fish are. For example, beluga whales today are seen less frequently at the mouth of the Kenai River, despite high salmon returns to the river. Because beluga whales do not always feed at the streams with the highest runs of fish, water depth and fish density may be more important than sheer numbers of fish in their feeding success (NMFS 2008). In upper Cook Inlet, beluga whales concentrate offshore from several important salmon streams and appear to use a feeding strategy which takes advantage of the bathymetry in the area. The channels formed by the river mouths and the shallow waters act as a funnel for salmon as they move past waiting beluga whales. Dense concentrations of prey may be essential to beluga whale foraging. Hazard (1988) hypothesized that beluga whales were more successful feeding in rivers where prey were concentrated than in bays where prey were dispersed. Fried et al. (1979) noted that beluga whales in Bristol Bay fed at the mouth of the Snake River, where salmon runs are smaller than in other rivers in Bristol Bay. However, the mouth of the Snake River is shallower, and hence may concentrate prey. Research on beluga whales in Bristol Bay suggests these whales preferred certain streams for feeding based on the configuration of the stream channel (Frost et al. 1983). This study theorized beluga whales' feeding efficiencies improve in relatively shallow channels where fish are confined or concentrated. The waters of upper Knik Arm are predominately shallow mudflats cut by narrow tidal guts and channels. Being adjacent to

several anadromous fish streams, this area contains these physical and biological features which provide important feeding habitat.

Cook Inlet beluga whales are opportunistic feeders and feed on a wide variety of prey species, focusing on specific species when they are seasonally abundant. Eulachon is an important early spring food resource for beluga whales in Cook Inlet. Eulachon first enter the upper Inlet in April, with two major spawning migrations occurring in the Susitna River in May and July. The early run is estimated at several hundred thousand fish and the later run at several million (Calkins 1989).

Five Pacific salmon species (Chinook, chum, coho, pink, and sockeye) spawn in rivers throughout Cook Inlet in the summer (Moulton 1997, Moore et al. 2000). Salmon escapement numbers and commercial harvests have fluctuated widely throughout the last 40 years and there is no clear correlation between salmon runs and beluga whale population numbers; however, samples of harvested and stranded beluga whales have shown consistent summer blubber thicknesses (NMFS unpubl. data). The occurrence of beluga whale concentrations and adult salmon returns throughout the spring and summer indicates these are likely important feeding opportunities.

In the summer, as eulachon runs begin to diminish, beluga whales rely heavily on salmon as a primary prey resource. Beluga whale hunters in Cook Inlet reported one whale having 19 adult king salmon in its stomach (Huntington 2000). In July 2005, NMFS (unpubl. data) observed a 4.3 m (14 ft 3 in) male with 12 coho salmon, totaling 27.9 kg (61.5 lbs), in its stomach.

In the fall, as anadromous fish runs begin to decline, beluga whales again return to consume the fish species found in nearshore bays and estuaries. This includes cod (*Gadus*) species as well as other bottom-dwellers, such as Pacific staghorn sculpin (*Leptocottus armatus*), and flatfishes (*Pleuronectiformes spp.*), such as starry flounder (*Platichthys stellatus*) and yellowfin sole. This change in diet in the fall is consistent with other beluga populations known to feed on a wide variety of food. Flatfish are typically found in very shallow water and estuaries during the warm summer months and move into deeper water in the winter as coastal water temperatures cool (though some may occur in deep water year-round).

In the winter, Cook Inlet beluga whales concentrate in deeper waters in lower Inlet past Kalgin Island and make deep feeding dives, likely to feed on such prey species as flatfish, cod, sculpin (*Cottidea spp.*), and pollock. The narrowing of the Inlet in this area and the presence of Kalgin Island just south of the forelands may cause upwelling and eddies that concentrate nutrients or act as a “still-water shelter area” for migrating anadromous fish such as salmon, eulachon, and smelt, which are known beluga prey species. The Kalgin Island area may also be rich in biological productivity; for instance, crustaceans are known to occur south of the island (Calkins 1983). The Kalgin Island area may serve as a late-winter staging area for eulachon prior to migration to their natal streams in upper Cook Inlet. If these fish and crustaceans generally are present in this area during late winter, they may be an important food source for beluga whales in the winter. Saffron

cod migrate inshore during winter for spawning (Cohen et al. 1990). Pacific cod move to progressively deeper water as they age, spawning in deeper, offshore waters in winter (Cohen et al. 1990). Beluga whales will also occasionally travel into the upper Inlet in winter, including the upper ends of Knik and Turnagain Arms.

The seasonal availability of energy-rich prey such as eulachon, which may contain as much as 21 percent oil (Payne et al. 1999), and salmon are very important to the beluga whale energetics (Abookire and Piatt 2005; Litzow et al. 2006). Native hunters in Cook Inlet have stated that beluga whale blubber is thicker in the summer, after the whales have fed on eulachon and salmon, than in early spring prior to anadromous fish runs. In spring, the whales were described as thin with blubber only 5 – 8 cm (2 – 3 in) thick compared to the fall when the blubber may be up to 30 cm (1 ft) thick (Huntington 2000). Eating such fatty prey and building up fat reserves throughout spring and summer may allow beluga whales to sustain themselves during periods of reduced prey availability (e.g., winter) or other adverse impacts, by using the energy stored in their blubber to meet metabolic needs. Mature females have additional energy requirements.

Cook Inlet Beluga Whale – Breeding and Calving Habitat

Very little is known about beluga whale breeding behavior, and it is difficult to identify beluga breeding habitat with any certainty. The shallow waters of the upper Inlet may play an important role in reproduction. Since newborn beluga whales do not have the thick blubber layer of adults, they benefit from the warmer water temperatures in the shallow tidal flats areas where fresh water empties into the Inlet, and hence it is likely these regions are used as nursery areas. TEK of Alaska Natives report that the mouths of the Beluga and Susitna Rivers, as well as Chickaloon Bay and Turnagain Arm, are calving and nursery areas for beluga whales (Huntington 2000).

The known presence of pregnant females in late March, April, June, and July (Mahoney and Sheldon 2000; Vos and Sheldon 2005, NMFS unpubl. data) suggests breeding may occur in late spring into early summer. Calves depend on their mother's milk as their sole source of nutrition, and lactation lasts up to 23 months (Braham 1984), though young whales begin to consume prey as early as 12 months of age (Burns and Seaman 1986). Therefore, the summer feeding period is critical to pregnant and lactating beluga whales.

Knik Arm is also used extensively in the summer and fall by cow/calf pairs. Surveys by LGL (Funk et al. 2005, McGuire and Kaplan 2009) noted a relatively high representation of calves in the uppermost part of Knik Arm. The mouth of Knik Arm has been reported to be transited in the summer and fall by cow/calf pairs (Cornick and Kendall 2008), presumably moving into the upper reaches of Knik Arm. McGuire et al. (2008) photographically identified 37 distinct beluga whales with calves in the upper Inlet during 2005-2007. Calves were seen in all areas of their study (Susitna delta, Knik Arm, Chickaloon Bay/Southeast Fire Island, and Turnagain Arm), and they were unable to determine distinct calving areas (McGuire et al. 2008). However, when corrected for effort, Knik Arm had the largest number of calf sightings within the areas observed.

Cook Inlet Beluga Whale – Proposed Critical Habitat Designation

Beluga whales generally occur in shallow, coastal waters, often in water barely deep enough to cover their bodies (Ridgway and Harrison 1981). While it is difficult to quantify the importance of various habitats in Cook Inlet for the health, survival, and recovery of the beluga whale, NMFS believes certain areas are particularly important.

At present, no critical habitat has been designated for the Cook Inlet beluga whales. A proposed rule to designate critical habitat for the Cook Inlet beluga whales under the ESA was published in 2009 (Figure 3); however, no final rule has been issued. The proposed critical habitat includes two geographic areas of marine habitat in Cook Inlet comprising 7,809 square kilometers (74 FR 230) and are bounded by Mean Higher High Water (MHHW) datum on the upland. Also included in the proposed designation are the lower reaches of the Susitna River, Little Susitna River, Chickaloon River and Kenai River. Other tidally influenced tributaries of Cook Inlet are not included in the proposal.

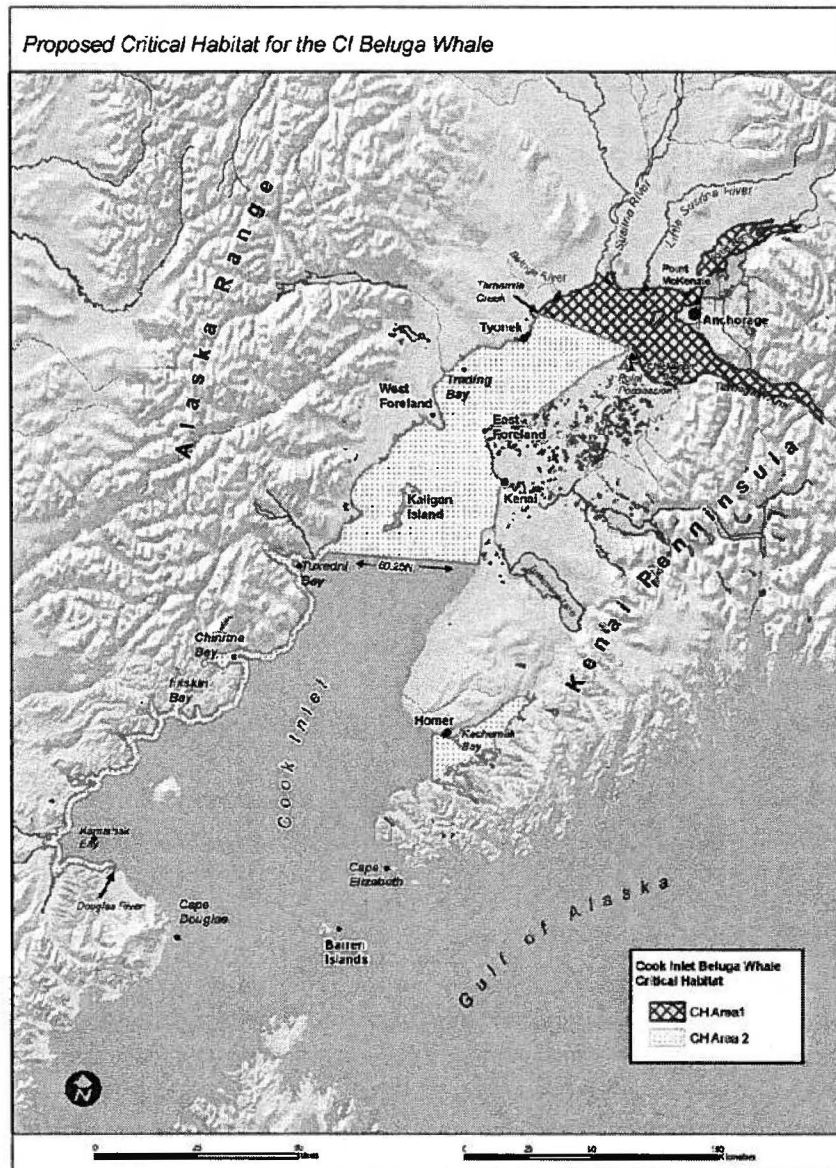


Figure 3. Proposed critical habitat for the Cook Inlet beluga whale

The proposed Area 1 comprises 1,918 square kilometers of marine habitat in Cook Inlet extending northeast of a line drawn from a point at the mouth of Threemile Creek ($61^{\circ} 08.5$ N, $151^{\circ} 04.4$ W) to a point at Point Possession ($61^{\circ} 02.1$ N, $150^{\circ} 24.3$ W). Also included are waters of the Susitna River south of latitude $61^{\circ} 20.0$ N, Little Susitna River south of latitude $61^{\circ} 18.0$ N, and Chickaloon River north of latitude $60^{\circ} 53.0$ N.

The proposed Area 2 comprises 5,891 square kilometers of Cook Inlet marine waters south of a line drawn from a point at the mouth of Threemile Creek (61° 08.5 N, 151° 04.4 W) to a point at Point Possession (61° 02.1 N, 150° 24.3 W). Also included in Area 2 are waters within two nautical miles seaward of MHHW along the western shoreline of Cook Inlet between latitude 61° 25 N and the mouth of the Douglas River (59° 04 N, 153° 46.0 W), all waters of Kachemak Bay east of longitude 151 40.0 W, and the waters of the Kenai river downstream of the Warren Ames bridge in the city of Kenai.

The proposed ruling also includes designation of five environmental attributes that are deemed essential to the conservation of the CI beluga whale. These attributes, or primary constituent elements, are:

- Shallow intertidal and subtidal waters of Cook Inlet (depths less than 30 ft at MLLW) that are within five miles of high and medium flow anadromous fish streams
- Fish species deemed to be the primary prey species of the Cook Inlet beluga, include: Chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), chum salmon (*O. keta*), coho salmon (*O. kisutch*), Pacific eulachon (*Thaleichthys pacificus*), Pacific cod (*Gadus macrocephalus*), walleye pollock (*Theragra chalcogramma*), saffron cod (*Eleginus gracilis*), and yellowfin sole (*Platichthys stellatus*)
- The absence of toxins or other agents of a type or amount harmful to beluga whales
- Unrestricted passage within or between critical habitat
- The absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales

III. ENVIRONMENTAL BASELINE

By regulation, the environmental baseline for opinions includes the past and present impacts of all state, Federal, or private actions and other human activities in the action area, the anticipated impacts from all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR §402.02). The environmental baseline for this opinion includes the effects of several activities that affect the survival and recovery of threatened and endangered species in the action area. The following information summarizes the primary human and natural phenomena in Cook Inlet that are believed to affect the beluga whale status and trends in the action area.

The Cook Inlet beluga whale population may be affected by various natural and anthropogenic factors, including: subsistence harvest removals, strandings, pollution, predation, disease, contamination, fisheries interactions, shipping and vessel traffic, small stock size, restricted summer range, and habitat loss or alteration. While a number of known and potential threats have been identified, there is not enough known about the effect of each specific threat to definitively know the level of impact that each threat has

on the Cook Inlet beluga whale (NMFS 2008). In addition, Cook Inlet beluga whales may be affected by multiple threats at any given time, compounding the impacts of the individual threats (NMFS 2008).

The documented decline of the Cook Inlet beluga whale population during the mid-1990s has been attributed to subsistence harvest removals at a level that this small population could not sustain. In response, cooperative efforts between NMFS and subsistence users have dramatically reduced subsistence harvests. These harvest reductions should have allowed the Cook Inlet beluga population to recover. However, abundance data collected during the past several years show that the population is not recovering as expected following the promulgation of subsistence harvest regulations.

Cook Inlet Beluga Whales and Habitat

Knik Arm and the action area are regularly used by Cook Inlet beluga whales. Beluga whales appear to use the crossing site primarily for transit and milling, with some foraging, as they follow prey north into upper Knik Arm in August. Fewer beluga whales have been observed in the project area during the months of June and July, although past NMFS aerial monitoring has recorded up to 61% of all beluga observations within Knik Arm during those months. Beluga whales remain visible in Eagle Bay until ice cover in November, and satellite-tagged whales were tracked within Knik Arm during winter months, although such excursions were rare. Beluga whales appear to remain in Knik Arm as long as ice-free conditions persist, as this habitat could provide increased foraging opportunity before winter, increased protection for calves from predation, or both (Cornick and Saxon-Kendall 2009).

Beluga whale movements within Knik Arm are highly correlated with tides (Funk et al. 2005). Whales ascend to upper Knik Arm on the flooding tide, feed on salmon, and hold in the waters by Eagle Bay and the mouth of Six Mile Creek during incoming and outgoing mid tides. Beluga whales in the lower reaches of Knik Arm tend to stay close to shore, following the tide through the narrows within 1 km of either shoreline. Whales moving up Knik Arm tend to prefer the eastern shoreline, following the channel along Eagle Bay, while whales moving out of Knik Arm tend to hug the western shoreline (Cornick and Saxon-Kendall 2009).

Boat and land-based observations were conducted in Knik Arm from July 2004 through July 2005 (Funk et al. 2005). Land-based observations were conducted from nine stations along the shore of Knik Arm. The three primary stations were located at Cairn Point, Point Woronzof, and Birchwood. The majority of the beluga whales were observed north of Cairn Point, and temporal use of Knik Arm was related to tide height. During the study period, most beluga whales stayed in the upper portion of Knik Arm north of Cairn Point. Approximately 90 percent of observations occurred during the months of August through November, and only during this time were whales consistently sighted in Knik Arm. The relatively low number of sightings throughout the rest of the year suggested the whales were using other portions of Cook Inlet. In addition, relatively few beluga whales were sighted in the spring and early to mid-summer months. Beluga whales predominantly frequented Eagle Bay (mouth of Eagle River), Eklutna, and the stretch of

coastline in between, particularly when they were present in greater numbers.

The most commonly observed behaviors by beluga whales in Knik Arm include traveling, feeding (often suspected feeding behavior), diving, and resting (Markowitz, et al. 2005). Much of the mid to upper portions of Knik Arm are shallow mudflats with sharply cut tidal channels. Beluga whales utilize such areas near the mouths of anadromous fish streams as feeding habitat. Eagle Bay, north east of the KAC, is a notable beluga site in that it is near the mouth of an important salmon stream, Eagle River, and provides a deep channel that is utilized by these whales during incoming and low tides.

Human Induced Factors

The upper Cook Inlet region is the major population center of Alaska, with the 2008 Municipality of Anchorage population at 279,243, the Matanuska-Susitna Borough at 62,426, and the Kenai Peninsula Borough at 50,556 (U.S. Census Bureau). Such large numbers of people in a relatively small area present added concerns to the natural environment and to Cook Inlet beluga whales.

Development

Southcentral Alaska is the State's most populated and industrialized area. Many cities, villages, ports, airports, treatment plants, refineries, highways, and railroads are situated on or very near to Cook Inlet. This development has resulted in both the loss and alteration of near shore beluga habitat and changes in habitat quality due to vessel traffic, noise, and pollution. There is concern that increased development may prevent beluga whales from reaching important feeding areas in upper Knik Arm. Frequent use of shallow near shore and estuarine habitats makes beluga whales particularly prone to regular interaction with human activities (Perrin 1999), and are thus likely to be affected by those activities.

Beluga whales are not uniformly distributed throughout Cook Inlet, but are predominantly found in near shore waters. Where beluga whales must compete with people to use near shore habitats and coastline development (both construction and operations) leads to the direct loss of this preferred habitat. Indirect alteration of habitat may occur due to bridges, boat traffic, in-water noise, and discharges that affect water quality. Most beluga habitat in Cook Inlet remains essentially intact, however, extensive sections of Turnagain Arm shoreline have been developed (e.g., rip rap and railroad construction), as have the shorelines in the Anchorage area.

Port facilities in Cook Inlet are found at Anchorage, Mackenzie, Tyonek, Drift River, Nikiski, Kenai, Anchor Point, and Homer. The Port of Anchorage (POA) is a deep draft facility, Alaska's largest seaport and the main port of entry for southcentral and interior regions. It exists along eastern lower Knik Arm in an area that is heavily used by beluga whales. Operations began at the POA in 1961 with a single berth. Since 1964, the POA has expanded to a five-berth terminal that moves more than four million tons of material across its docks each year (POA 2009). Construction associated with the current Marine Terminal Development Project has been ongoing on a seasonal basis since 2006, and has

included both in-water and out-of-water activities in four areas (North Backlands, Barge Berths, South Backlands, and North Extension). The POA Intermodal Expansion Project will rebuild and enlarge docking facilities, improve loading/unloading facilities, provide additional working space to handle shipped fuel, freight and other materials, and improve access by road and rail transportation serving the Port. The new expanded POA will provide efficient transport of goods into and out of Anchorage for the next 50 years and more.

In-water activities during the POA Expansion Project have an annual take authorization of 34 whales. During 2009 construction work at the port, a total of thirteen (13) beluga whales were reported to have been taken. These takes were determined by the presence of these animals within the designated harassment zones, and not by behavioral criteria.

POA maintenance dredging has occurred annually since 1965. The current operations and maintenance plan at the POA authorizes the Corps to dredge to -35 ft MLLW. The footprint dredged at the POA fluctuates annually, varying from 95 acres in 1999 to 117 acres in 2004. Over the last nine years the average size of the dredged footprint has been about 100 acres. The amount of dredging required maintaining the Port varies from year to year, with a maximum of about 2.1 million cubic yards (cy) of material dredged in 2004. Maintenance dredging is conducted by one or more dredges and lasts from mid-May through November, depending on the weather. Two to five barge trips per day transport about 1,500 cy of material from each dredge to the disposal site (USACE 2008). Dredging along coastal waterways has been identified as a concern with respect to the Saint Lawrence beluga whales (DFO 1995). There, dredging of up to 600,000 cubic meters of sediments re-suspended contaminants into the water column and seriously affected the beluga whales. The Saint Lawrence beluga whale recovery plan contains recommendations to reduce the dredge amount and to develop more environmentally sound dredging techniques. While the volume of dredging in Cook Inlet is comparable to St. Lawrence (more than 844,000 cy in 2003 at the POA), the material does not appear to contain harmful levels of contaminants (USACE 1995, 2008).

Port MacKenzie is along western lower Knik Arm and development began in 2000 with the construction of a barge dock. The first shipments arrived in July 2001. Additional construction has occurred since then and Port MacKenzie currently consists of a 500-foot bulkhead barge dock, a 1,200-foot deep-draft dock with a conveyor system, a landing ramp, and over 8,000 acres of adjacent uplands; however, plans call for a bulk loading facility with deep-draft capability. The Drift River facility in Redoubt Bay is used primarily as a loading platform for shipments of crude oil. The docking facility there is connected to a shoreside tank farm and designed to accommodate tankers in the 150,000 deadweight-ton class. Nikiski is home to several privately owned docks (including those belonging to oil and gas companies such as Tesoro and Conoco Philips). Activity at Nikiski includes the shipping and receiving of anhydrous ammonia, dry bulk urea, liquefied natural gas, petroleum products, sulfuric acid, caustic soda, and crude oil.

Joint Base Elmendorf-Richardson

This military installation at Anchorage is home to both Air Force and Army forces. The

base maintains and operates a runway near and airspace directly over Knik Arm. Aircraft noise can be loud within the action area. Cargo is routinely transported between the POA and this base, including the off-loading of jet fuel. The Eagle River Flats Impact Area (ERFIA) has been used for weapons training since the 1940s. Recent acoustic research has found noise from detonations on the ERFIA can exceed 160 dB re: 1 μ Pa within Cook Inlet, including high-use areas in Eagle Bay. Currently, live-fire weapons training within ERFIA is restricted to winter months only, when specified ice conditions are met. However, the Army is proposing resumption of year-round activity here and has released a draft Environmental Impact Statement for that purpose. NMFS is currently consulting under the ESA with the Army on the effects of this resumption on Cook Inlet beluga whales.

Vessel Traffic

Most of Cook Inlet is navigable and used by various classes of water craft. Vessels traveling in Knik Arm and Cook Inlet can be a threat to beluga whales. The potential for ship strikes exists whenever ships and beluga whales are in the area at the same time. While ship strikes have not been definitively confirmed in a Cook Inlet beluga whale death, in October 2007 a dead whale washed ashore with “wide, blunt trauma along the right side of the thorax” (NMFS 2008), suggesting a ship strike was the cause of the injury. Vessel traffic can also produce noise disturbance to beluga whales and pollution from the vessels may decrease the quality of their habitat.

There are eight port facilities located in Cook Inlet (Anchorage, Point MacKenzie, Tyonek, Drift River, Nikiski, Kenai, Anchor Point, and Homer). Commercial shipping occurs year round, with container ships transiting between the Seattle/Puget Sound areas and Anchorage. Other commercial shipping includes bulk cargo freighters and tankers. Currently, with the exception of the Fire Island Shoals and the POA, no other large-vessel routes or port facilities in Cook Inlet occur in high value beluga whale habitat. Various commercial fishing vessels operate throughout Cook Inlet, with some very intensive use areas associated with salmon and herring fisheries. Sport fishing and recreational vessels travel between Anchorage and several popular fishing streams that enter the upper Inlet. Several improved and unimproved small boat launches exist along the shores of upper Cook Inlet and the Knik Arm, including a float system for small watercraft near Ship Creek, maintained by the Municipality of Anchorage. Other launches are near the Knik River Bridge and the community of old Knik.

Due to their slower speed and straight-line movement, ship strikes from large vessels are not believed to pose a significant threat to Cook Inlet beluga whales. Beluga whales are regularly sighted in and around the POA (Rugh et al. 2005) passing near or under vessels (Blackwell and Greene 2002), indicating that these animals may have a high tolerance of large vessel traffic. However, smaller boats that travel at high speed and change direction often present a greater threat. In Cook Inlet, beluga whales concentrate near river mouths, predisposing them to strikes by high speed watercraft associated with sport fishing and general recreation. High-speed vessels operating in these whale concentration areas have an increased probability of striking a whale, as evidenced by observations of Cook Inlet beluga whales with propeller scars (Burek 1999, McGuire et al. 2009). Small boats and

jet skis, which are becoming more abundant in Cook Inlet and the Knik Arm, are also more likely to approach and disturb any whales that are observed.

Noise

Beluga whales are known to be among the most adept users of sound of all marine mammals, and use sound rather than sight for many important functions. They are often found in turbid waters in northern latitudes where darkness extends over many months. Beluga whales use sound to communicate, locate prey, and navigate, and may make different sounds in response to different stimuli. Beluga whales produce high frequency sounds that they use as a type of sonar for finding and pursuing prey, and likely for navigating through ice-laden waters.

In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds. Human-induced noises include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, shore based activities, dredging, filling, and other events. The effects of human-caused noise on beluga whales and associated increased background noises depend on several factors including the intensity, frequency, and duration of the noise, the location and behavior of the whale, and the nature of the acoustic environment. High frequency noise diminishes more rapidly than low frequency noises. Sound also dissipates more rapidly in shallow waters and over soft bottoms (sand and mud). Much of upper Cook Inlet is characterized by its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002), thereby making it a poor environment for propagating acoustics.

Cook Inlet also experiences significant levels of aircraft traffic from the Ted Stevens Anchorage International Airport, JBER, and several smaller runways. Lake Hood and Spenard Lake in Anchorage are heavily used by recreational seaplanes. Even though sound is attenuated by the water surface, Blackwell and Greene (2002) found aircraft noise can be loud underwater when jet aircraft are directly overhead. Richardson (1995) discovered that beluga whales in the Beaufort Sea will dive or swim away when low-flying (less than 500 m) aircraft passed directly above them. However, beluga survey aircraft flying at approximately 244 m (800 ft) in Cook Inlet observed little or no change in beluga swim directions (Rugh et al. 2000). This is likely because beluga whales in Cook Inlet have habituated to routine small aircraft overflights. Beluga whales may be less sensitive to aircraft noise than vessel noise, but individual responses may be highly variable and depend on previous experiences, beluga activity at the time of the noise, and characteristics of the noise.

Water Quality and Pollution

The waters of Knik Arm are brackish, with salinities ranging from 4 to 6 practical salinity units (equivalent to grams of dissolved solids per kg of seawater) north of Cairn Point. Water temperatures range from freezing (about 31°F) to 63°F or more (in surface pockets observed during the summer months). Measurements of suspended sediment also vary. Several locations near the river mouths exhibit concentrations of up to 1,000 milligrams of sediment per liter (mg/L) between water surface and depths of 15 ft while sediment concentrations at greater water depths have measured more than 4,000 mg/L (Smith et al.

2005). The average natural turbidity of upper Cook Inlet and Knik Arm typically ranges from 400 to 600 nephelometric turbidity units. The turbulent nature of the system mixes the water and maintains relatively high dissolved oxygen concentrations throughout the entire water column.

At the mouths of the streams and rivers that flow into Knik Arm, fresh water interacts with the sea water to create an identifiable zone. Since the sea water is denser, the fresh water floats on top until it is mixed by tides and currents, creating a freshwater lens that is sometimes less turbid than the sea water. The lenses extend relatively short distances from the river mouths in the direction of the current and may provide important fish habitat.

The Conservation Plan for the Cook Inlet Beluga Whale (NMFS 2008) states contaminants are a concern for the sustained health of Cook Inlet beluga whales. The principal sources of pollution in the marine environment are: 1) discharges from industrial activities not entering municipal treatment systems; 2) discharges from municipal wastewater treatment systems; 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products (Moore et al. 2000). Contaminants released into the beluga whales' habitat can affect their overall health (Becker et al. 2000). Cook Inlet beluga whales appear to have lower levels of contaminants stored in their bodies than do other beluga whale populations; however, the impacts of contaminants on beluga whales in Cook Inlet are unknown (NMFS 2008). Becker et al. (2000) concluded that little is known about the role of multiple stressors in animal health and that future research should examine their interaction and effects on recruitment in declining populations such as the Cook Inlet beluga whale.

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

Also examined were concentrations of various substances stored in the liver. Cadmium and mercury were lower in the Cook Inlet population than in the Arctic Alaska populations, while levels of methyl-mercury were similar to other Arctic Alaska populations. However, copper levels were two to three times higher in the Cook Inlet animals than in the Arctic Alaska animals and similar to the Hudson Bay animals.

Becker et al. (2000) also compared tissue levels of total PCBs, total DDT, and a variety of

other chemicals in these beluga whale stocks and found that Cook Inlet beluga whales had the lowest concentrations of all. The effects of lower concentrations of PCBs and chlorinated pesticides on animal health may be of less significance for the Cook Inlet animals than for other beluga whale populations. Becker et al. (2000) concluded that little is known about the role of multiple stressors in animal health and that future research should examine their interaction and effects on population recruitment for a declining population, such as the beluga whale in Cook Inlet.

Storm water runoff has the potential to carry numerous pollutants from the Municipality of Anchorage into Cook Inlet. Runoff can include pollution coming from streets, construction and industrial areas, and airports. Runoff can also carry hazardous materials from spills and contaminated sites into Cook Inlet. The effect of these pollutants on beluga whales is unknown. Numerous releases of petroleum hydrocarbons have been documented by the POA, JBER, and the Alaska Railroad Corporation. The POA transfers and stores petroleum oils, as well as other hazardous materials and all significant spills and leaks that occurred at the POA since 1992 have been reported. Past spills have been documented at each of the bulk fuel facilities within the POA, and also on JBER's property (POA 2003a and POA 2003b). JBER is listed on the National Priorities List because of its known or threatened releases of hazardous substances, pollutants, or contaminants. Spills have also been reported at the Alaska Rail Road Corporation rail yard. In 1986, petroleum seeped into Ship Creek from the nearby rail yard, and several oil spills occurred in 2001 (ADEC 2009). Freight handling activities have historically caused numerous surface stains and spills at the rail yard. Information on additional spills in the area can be found on ADEC's Contaminated Sites Database website (<http://www.dec.state.ak.us/spar/csp/>).

Deicing and anti-icing chemicals are used from October through May and may be used on aircraft, tarmacs, and runways at the five airports in Anchorage (Stevens International Airport, Merrill Field, JBER, Lake Hood, and Lake Spenard). Deicing and anti-icing of aircraft and airfield surfaces are required by the Federal Aviation Administration to ensure the safety of passengers. Depending on the application, deicing activities utilize different chemicals. For instance, ethylene glycol and propylene glycol are used on aircraft for anti-icing and deicing purposes, whereas potassium acetate and urea are used to deice tarmacs and runways. Much of the deicing materials or their break down products eventually enters Cook Inlet. The potential impacts on beluga whales from deicing agents entering Cook Inlet have not been analyzed and cannot be determined at this time.

Ten communities currently discharge treated municipal wastes into Cook Inlet. Wastewaters entering these plants may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria and viruses, and other emerging pollutants of concern (EPOCs). Wastewater from the Municipality of Anchorage, Nanwalek, Port Graham, Seldovia, and Tyonek receive only primary treatment, while wastewaters from Eagle River, Girdwood, Homer, Kenai, and Palmer receive secondary treatment (NMFS 2008). Primary treatment means that only materials easily collected from the raw wastewater (such as fats, oils, greases, sand, gravel, rocks, floating objects,

and human wastes) are removed, usually through mechanical means. The primary effluent is discharged directly into Cook Inlet, where it becomes diluted. The effect of the effluent's pollutants on beluga whales is unknown and there have been limited studies to determine this effect. Wastewater undergoing secondary treatment is further treated to substantially degrade the biological content of the sewage (such as in human and food wastes).

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

Discharges of wastes from vessels are regulated by the United States Coast Guard. Potential discharges include oily waste, sewer water, gray water (e.g., shower water), and garbage. Gray water and sewer water, provided that they are free from oil waste, may be discharged in the open sea. However, by law, no discharges of any kind are allowed within three miles of land. Ships can potentially release pollutants and non-indigenous organisms into Cook Inlet through the discharge of ballast water. It is a recognized worldwide problem that aquatic organisms picked up in ship ballast water, transported to foreign lands, and dumped into non-native habitats, are responsible for significant ecological and economic perturbations costing billions of dollars. The National Ballast Information Clearinghouse reported that more than five million metric tons of ballast water was released from Homer to Anchorage between 1999 and 2003. Invasive species were found just off the POA in a 2004 survey by the Smithsonian Environmental Center. The effect of discharged ballast water and possible invasive species from such discharges on beluga whales and their habitat is unknown.

Subsistence Harvest

The Cook Inlet beluga whale is hunted by Alaska Natives for subsistence purposes and for traditional handicrafts. The MMPA provides an exemption from its prohibitions that allows for the harvest of marine mammals by Alaska Natives for these purposes. Alaska Natives have legally harvested Cook Inlet beluga whales prior to and after passage of the MMPA in 1972. The effect of past harvest practices on the Cook Inlet beluga whale population is significant. While a harvest occurred at unknown levels for decades, NMFS believes the subsistence harvest levels increased substantially in the 1980s and 1990s. Reported subsistence harvests between 1994 and 1998 can account for the estimated stock's decline during that interval. The observed decline during that period and the reported and estimated harvest rates (including estimates of whales which were struck and lost, and assumed to have perished) indicate these harvest levels were unsustainable.

Figure 4 summarizes subsistence harvest data from 1987 to 2010 (NMFS unpubl. data). Although information on the harvest from 1993 was originally reported as 17 beluga whales, consultation with local Native hunters estimated the annual number of beluga

whales taken during this time to be greater (DeMaster 1995). There was no systematic Cook Inlet beluga harvest survey in 1994. Instead, harvest data were compiled at the November 1994 beluga hunter meeting, including two beluga whales taken by hunters from Kotzebue. The most thorough Cook Inlet beluga subsistence harvest surveys were completed during 1995 and 1996. While some local hunters believed that the 1996 estimate of struck and lost is positively biased, the 1995 to 1996 take estimates are considered reliable (Angliss et al. 2001). Given that there was no survey during 1997 or 1998; NMFS estimated the subsistence harvest from hunter reports. The known subsistence harvest by Alaska Natives during 1995-1998 averaged 77 beluga whales annually.

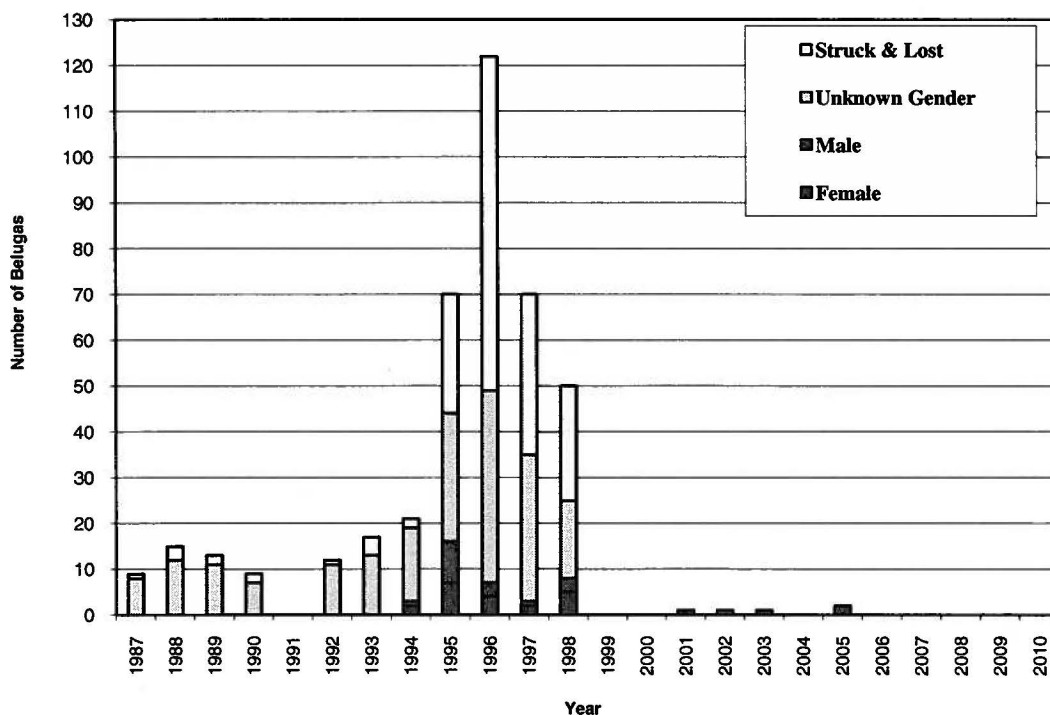


Figure 4: Summary of known Cook Inlet beluga whale subsistence harvest from 1987-2010.

The harvest, which was as high as 20 percent of the population in 1996, was sufficiently high to account for the 14 percent annual rate of decline in the population during the period from 1994 through 1998 (Hobbs et al. 2000). In 1999 there was no harvest as a result of a voluntary moratorium by the hunters that spring and a permanent moratorium in 2000 that required a cooperative agreement between NMFS and affected Alaska Native organizations for an allowable harvest. During 2000-2003 and 2005-2006 NMFS entered

into co-management agreements for the Cook Inlet beluga subsistence harvest. Between 2000 and 2007, subsistence harvests were 0, 1, 1, 1, 0, 2, 0, and 0 whales, respectively; with no cooperative agreements signed after 2007.

Sections 101(b) and 103(d) of the MMPA require that regulations prescribed to limit Alaska Native subsistence harvest be made only when the stock in question is designated as depleted pursuant to the MMPA and following an Administrative Hearing on the record. NMFS had an administrative hearing in December 2000 where interim harvest regulations for 2001-2004 were developed and another administrative hearing in August 2004 to prepare the long term harvest plan. NMFS published the Cook Inlet Beluga Whale Subsistence Harvest Draft Supplemental Environmental Impact Statement in December 2007 that provided four alternatives on the long term harvest for Cook Inlet beluga whales. The Cook Inlet Beluga Whale Subsistence Harvest Final Supplemental Environmental Impact Statement, with a set harvest plan, was published in June 2008 and, long-term harvest regulations were implemented in October 2008.

Poaching and Illegal Harassment

Due to their distribution within the most-densely populated region in Alaska and their approachable nature, the potential for poaching beluga whales in Cook Inlet still exists. Although NMFS maintains an enforcement presence in upper Cook Inlet, the area they have to cover is extensive. While poaching is a possible threat, no poaching incidents have been confirmed to date. NMFS Enforcement has investigated several incidences of reported harassment of Cook Inlet beluga whales, but to date there have been no convictions. The potential, however, for both poaching and illegal harassment exists.

Personal Use, Subsistence and Recreational Fishing

Personal use gill net fisheries occur in Cook Inlet. In the spring, fishing for eulachon (hooligan) is popular in Turnagain Arm, with no bag or possession limits. The two most significant areas where eulachon are harvested in personal use fisheries are the Twentymile River (and shore areas of Turnagain Arm near Twentymile River) and Kenai River. Other areas where eulachon are harvested include the Susitna River and Little Susitna River and their tributaries, the Placer River, and shoreline areas of Turnagain Arm and Cook Inlet north of the Ninilchik River. Annual harvests have ranged from 2.2 to 5 tons over the past decade. The personal use harvest of eulachon is possibly under-reported as some participants may confuse their harvests as being subsistence and not personal use.

Recreational fishing is a very popular sport in Alaska, as evidenced by the intensive fishing during salmon runs and the large number of charter fishing operations. In upper Cook Inlet there are numerous recreational fishing areas that primarily target salmon, including the hundreds of drainages of the Susitna River; Little Susitna River; west Cook Inlet streams; and areas around Anchorage such as Ship Creek. Recreational fishing for salmon in Ship Creek is the most popular stream fishery in the Anchorage area. In lower Cook Inlet, recreational fishing for groundfish such as halibut, rockfish and lingcod are also popular. There is a recreational fishery for littleneck clams, butter clams, and razor clams. NMFS is unaware of any beluga whales injured or killed in Cook Inlet due to

personal use, subsistence, or recreational fisheries. However, the most likely impacts from these fisheries include the operation of small watercraft in stream mouths and shallow waters, ship strikes, displacement from important feeding areas, harassment, and prey competition.

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

Incidental Take

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

NMFS placed observers in the Cook Inlet salmon drift net and upper and lower Inlet set gillnet fisheries in 1999 and 2000. During the two years of observations, only three sightings of beluga whales occurred and no beluga whale injuries or mortalities were reported. Furthermore, during the period 1990 and 2000, fishermen's voluntary self-reports indicated no beluga whale mortalities from interactions with commercial fishing. NMFS has found the current rate of direct mortality from commercial fisheries in Cook Inlet appears to be insignificant and should not delay recovery of these whales.

Reduction of Prey

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

The current salmon management plan for the State of Alaska oversees the Cook Inlet fisheries in the lower and northern (upper) districts of the Inlet. Most of these fisheries occur “upstream” of the river mouths and estuaries where beluga whales typically feed. Whether the escapement into these rivers, having passed the gauntlet of the commercial fisheries, is sufficient for the well being of Cook Inlet beluga whales is unknown. Furthermore, the amount of fish required to sustain this population is unknown.

Oil and Gas

Much of the Cook Inlet region overlies reserves of oil and natural gas. Upper Cook Inlet and the Kenai Peninsula have an association with the petroleum industry that dates back to the 1950s. There are 16 platforms in upper Cook Inlet, 12 of which are active today. Oil spills are a significant concern with regard to offshore oil and gas production, petroleum product shipment, and general vessel traffic. It is difficult to accurately predict the effects of oil on Cook Inlet beluga whales (or any cetacean) because data are lacking on the metabolism of this species. Nevertheless, some generalizations can be made regarding impacts from oil on individual whales based on present knowledge. Oil spills that occurred while Cook Inlet beluga whales were present could result in skin contact with the oil, respiratory distress from hydrocarbon vapors, contaminated food sources, and displacement from feeding areas. Actual impacts would depend on the extent and duration of contact, and the characteristics (age) of the oil. Cook Inlet beluga whales could be affected through residual oil from a spill even if they were not present during the oil spill. Also, response actions may impact whales due to intensive vessel traffic or specific technologies, such as *in situ* burning of oil.

If an oil spill were concentrated in an area that is used by large number of beluga whales, it is possible that a whale could inhale enough vapors from a fresh spill to affect its health. Contaminated food sources and displacement from feeding areas also may occur as a result of an oil spill.

Tourism and Whale Watching

Tourism is a growing component of the State and regional economies, and wildlife viewing is an important part. Visitors highly value the opportunity to view the region’s fish and wildlife, and opportunities to view the beluga whale are especially valuable due to their uniqueness. Beluga whales are very common to upper Cook Inlet and typically occur in fairly large groups. Because these waters are easily accessible from Anchorage, this presents an excellent opportunity for whale watching. Whale watching is not, in itself, harmful to whales. It presents concerns due to vessel noise, proximity to the whales (approach distance and harassment), and intrusion into important whale habitats. Concern is warranted for whale watching operations that approach beluga whales close enough to harass or that enter into confined or important habitat areas. Currently no commercial whale watching operations exist in upper Cook Inlet, and we have no information suggesting such activity might occur in the near future.

Research

Research on Cook Inlet beluga whales and their habitat within Cook Inlet can also cause disturbance. Research often requires the use of boats and/or planes to conduct surveys, adding to the vessel traffic, noise, and pollution near the action area. The following research has occurred within Cook Inlet.

Since 1993, NMFS has conducted annual aerial surveys in June and July 1995 to document the beluga whale distribution and abundance in Cook Inlet. In addition, to help establish beluga whale distribution in Cook Inlet throughout the year, aerial surveys were conducted every one to two months between June 2001 and June 2002 (Rugh et al. 2004).

The Knik Arm Bridge and Toll Authority collected baseline environmental data on beluga whale activity to be used to evaluate the potential impact of a proposed bridge crossing in Knik Arm, north of Cairn Point. Boat and land-based observations were conducted in Knik Arm from July 2004 through July 2005 (Funk et al. 2005).

Researchers using boats have collected acoustic data at and near the POA. An underwater noise survey was conducted to measure and evaluate construction noise levels incidental to a test pile driving program in October 2007. Detailed underwater sound level measurements were conducted in late September through early October 2008 during various in-water construction activities (Scientific Fishery Systems, Inc. 2009).

Since 2005, researchers from LGL Alaska Research Inc have photographed beluga whale in upper Cook Inlet as part of a photographic-identification project on Cook Inlet beluga whales, conducted for the National Fish and Wildlife Foundation, Chevron, and Conoco Phillips Alaska, Inc (McGuire et al. 2009). Photographs are taken from small boats and on land, and later analyzed and cataloged into an extensive database.

Natural Factors

Strandings

Beluga whale strandings in upper Cook Inlet are not uncommon, with most reported in Turnagain Arm. More than 700 whales stranded in upper Cook Inlet since 1988 (NMFS unpubl. data). Mass strandings (involve two or more whales) primarily occur in Turnagain Arm and Knik Arm, and often coincided with extreme tidal fluctuations (“spring tides”) and twice coincided with a killer whale sighting (NMFS unpubl. data). NMFS 2006 status review (Hobbs et al. 2006) recognized that stranding was a constant threat to the Cook Inlet beluga whale recovery. NMFS determined this declining population could not easily recover from multiple mortalities that resulted from a mass stranding event. For instance, in 2003 there were five separate live stranding events involving 115 individual beluga whales (i.e., assuming no whale stranded more than once). In 2003, more than 46 beluga whales were stranded in Turnagain Arm and were out of the water for about 10 hours waiting for the tide to return. From this one event, five beluga whales were thought to have died as a direct consequence, based upon beach cast carcasses found in the following days. Prolonged stranding events that lasts more than a few hours may result in significant mortalities. The annual abundance estimates continue to confirm a declining whale population and stranding events may represent a

significant threat to the conservation and recovery of these whales.

Predation

Although infrequent, it has been documented that killer whales prey upon beluga whales in Cook Inlet (witnessed and necropsies). The numbers of killer whales that are reported in the upper Inlet appear to be small. There may be a single pod with five or six individuals that has extended its feeding territory into Cook Inlet. However, given the small population size of the Cook Inlet beluga whales, predation may have a significant effect on the beluga whales' recovery and abundance. On average one Cook Inlet beluga whale is estimated to be killed per year by killer whales (Shelden et al. 2003). Killer whale predation effects were also addressed in status reviews conducted by NMFS in 2006 and 2008 where the models demonstrated that killer whale predation on an annual basis could significantly impact recovery. In addition to directly reducing the beluga population, killer whale presence in upper Cook Inlet may also increase live stranding events. As such, NMFS considers killer whale predation to be a potentially significant threat to the conservation and recovery of these whales.

Environmental Change

There is now widespread consensus within the scientific community that atmospheric temperatures on earth are increasing (warming) and that this will continue for at least the next several decades. There is also consensus within the scientific community that this warming trend will alter current weather patterns. Cook Inlet is a very dynamic environment which experiences continual change in its physical composition; there are extreme tidal changes, strong currents, and tremendous amounts of silt being added from glacial scouring. For example, an experienced and knowledgeable Alaska Native beluga hunter observed that the Susitna River (an area frequented by beluga whales, especially during anadromous fish runs) has filled in considerably during the past 40 – 50 years (pers. comm. P. Blatchford 1999 via B. Smith, NMFS). He told of one persistent channel in the river that was more than 40 ft deep but was filled in with sediment. Since beluga whales are still seen in the area today, they appear able to adapt to physical changes in their habitats.

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

Prior to 2004 temperatures in the Gulf of Alaska were relatively stable, but in mid 2004 temperatures warmed and stayed warm until late 2006. Sampling of oceanographic conditions (via GAK-1) just south of Seward, Alaska has revealed anomalously cold conditions in the Gulf of Alaska beginning winter of 2006 – 2007; “deep (more than

150m) temperatures are the coldest observed since the early 1970s” (Weingartner 2007). Deep water temperatures are anticipated to be even colder in winter 2007 – 2008 due to deep shelf waters remaining cold throughout the 2007 summer, and Gulf of Alaska temperatures in spring 2008 are predicted to be even colder than in spring 2007 (Weingartner 2007).

The change in water temperature may in turn affect zooplankton biomass and composition. Plankton are mostly influenced by changes in temperature, which may affect their metabolic and developmental rates, and possibly survival rates (Batten and Mackas 2007). Data collected by Batten and Mackas (2007) demonstrated that mesozooplankton (planktonic animals in the size range 0.2 – 20 mm) biomass was greater in warm conditions, and that zooplankton community composition varied between warm and cool conditions, thus potentially altering their quality as a prey resource. In Cook Inlet, mesozooplankton biomass has increased each year from 2004 to 2006; however, sampling from late 2006 to early 2007 suggests biomass values are decreasing; a change most certainly driven by changes in climate (Batten 2007). Therefore, changes in temperature effect changes in zooplankton, which in turn may influence changes in fish composition, and hence, alter the quality and types of fish available for beluga whales. While El Nino events have the potential to affect sea surface temperatures, the effects from the 1998 El Nino warming event in lower Cook Inlet were lessened by upwelling and tidal mixing at the entrance to Cook Inlet (Piatt et al. 1999). It is likely that the physical structure of the Inlet and its dominance by freshwater input acts to buffer these waters from periodic and short-term El Nino events.

Beluga whale use of Cook Inlet, and particularly, feeding habitat, has been correlated to the presence of tidal flats and related bathymetry. Their preference for shallow waters found in Knik Arm, Turnagain Arm, and the Susitna River delta undoubtedly relates to feeding strategy, as has been reported for beluga whales in Bristol Bay (Fried et al. 1979). Frost et al. (1983) theorized beluga whales’ feeding efficiencies improve in relatively shallow channels where fish are confined or concentrated. There is evidence these areas are being lost through the deposition of glacial materials. The senescence of these habitats will likely reduce the capacity of the upper Inlet to provide the needs for this population.

At this time however, the data are insufficient to assess the effects (if any exist) of environmental change on Cook Inlet beluga whale distribution, abundance, or recovery.

IV. EFFECTS of the ACTION

Here we consider the specific aspects of the KAC that may adversely affect Cook Inlet beluga whales. These effects include both direct and indirect effects (effects occurring later in time). Because the types and magnitude of expected effects will differ from construction and operation, these are described separately.

Direct Effects of the Action

A: Construction

Noise

Construction has the potential to result in takes of beluga whales by noise. Temporary disturbance or localized displacement reactions are the most likely to occur. No takes by serious injury or death are anticipated, given the planned monitoring and mitigation.

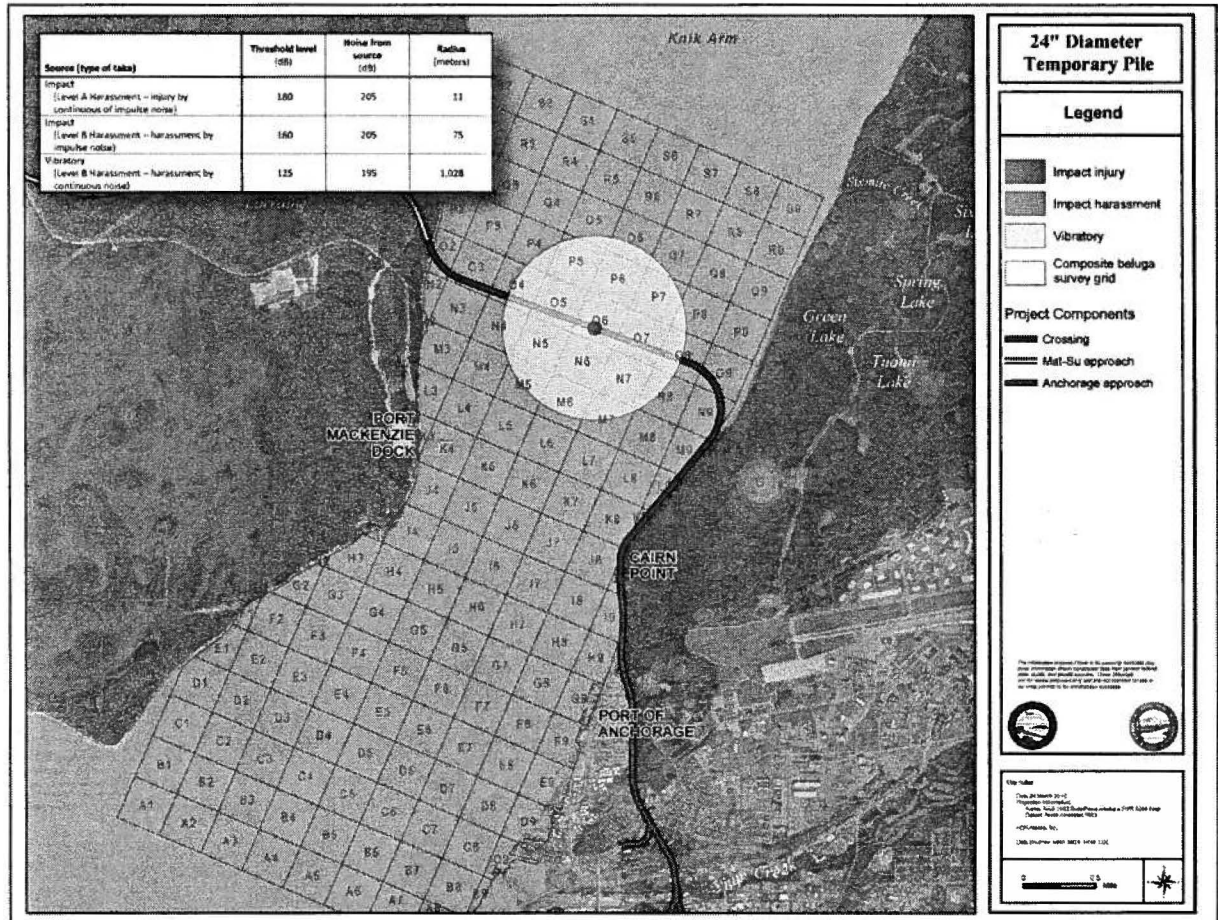


Figure 5. Noise safety zone projections for 24 inch pile driving.

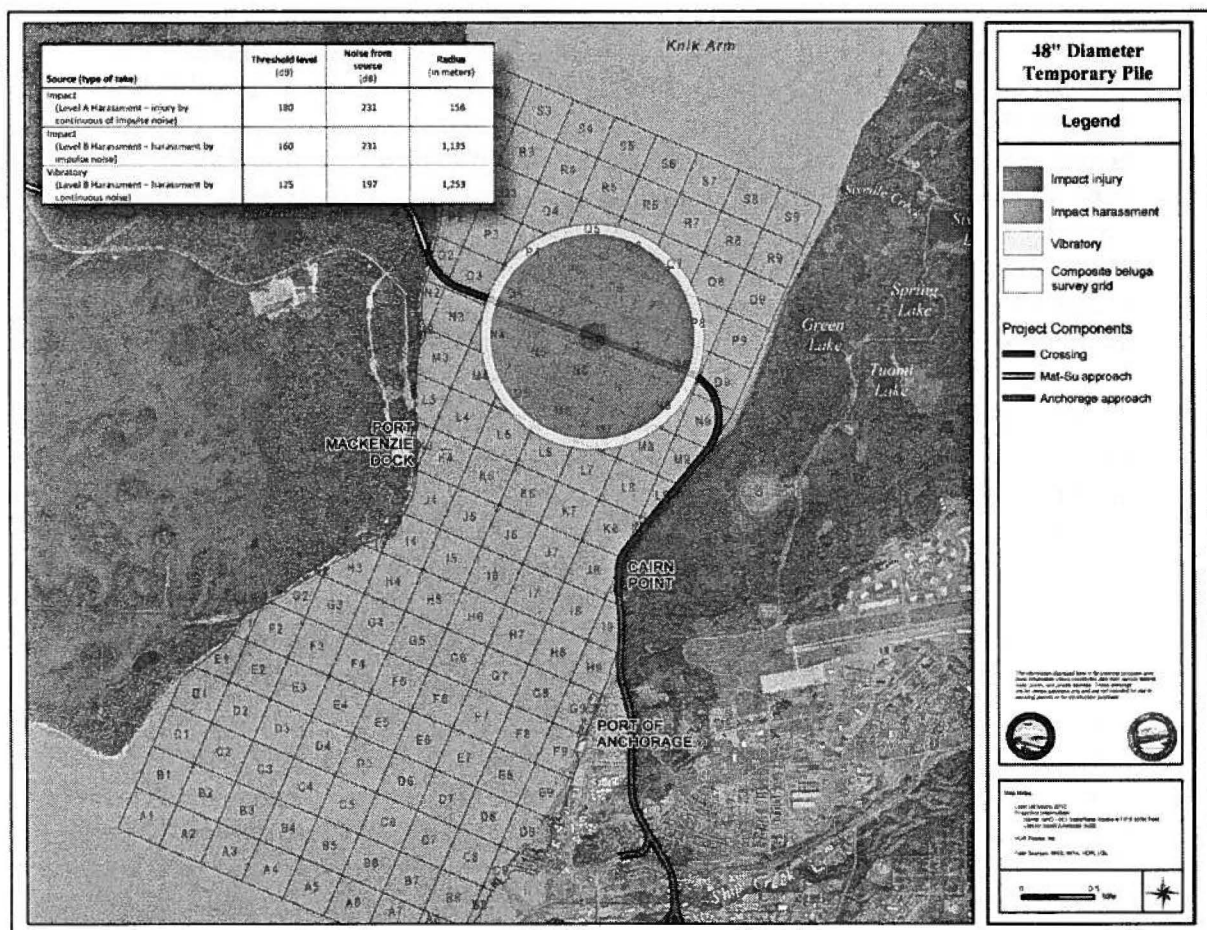


Figure 6. Noise safety zone projections for 48 inch pile driving.

In general, noise associated with coastal development has the potential to harass beluga whales that may be present around the specific action area. Beluga whales use sound for vital life functions, and introducing sound into their environment could be disrupting to those behaviors. Sound (hearing and vocalization/echolocation) serves four main functions for odontocetes (toothed whales and dolphins). These include: (1) providing information about their environment; (2) communication; (3) enabling remote detection of prey; and (4) enabling detection of predators. The distances to which sounds are audible depend on source level and frequency, ambient noise levels, physical habitat characteristics (e.g., water temperature, depth, substrate type), and sensitivity of the receptor (Richardson et al. 1995). Impacts to beluga whales exposed to loud sounds include possible mortality (either directly from the noise or indirectly based on the reaction to the noise), injury and/or disturbance ranging from severe (e.g., permanent abandonment of vital habitat) to mild (e.g., startle). Pile driving and other construction activities could cause behavioral harassment; however, neither physical injury nor mortalities (often described as Level A takes) are anticipated due to the nature of the operations and mitigation measures.

Temporary or permanent hearing impairment is a possibility when beluga whales are exposed to very loud sounds. NMFS considers the Level A in-water harassment threshold to be 180 dB re 1 μ Pa-m for cetaceans. The threshold for Level B harassment (i.e., non-injurious takes) from pulsed noise (e.g., impact pile driving) is 160 dB re 1 μ Pa-m and 125 dB re 1 μ Pa-m from non-pulsed noise (e.g., vibratory pile driving, chipping). Figures 5 and 6 depict these harassment zones for placement of 24 and 48 inch piling using impact hammering and vibratory placement. The permanent piling would be constructed using drilled shaft technology. This technology utilizes an oscillating hydraulic device that would have significantly less sound energy associated with it. No in-water noise data were found regarding drilled shafts, but the absence of a large-mass energy source such as found in impact and vibratory drivers would seem to reasonably support this assumption. It is possible, however, that different (i.e., higher) frequency noise is associated with drilled shaft placement than impact/vibratory methods. While higher frequency noise may occur with drilled shaft methods (and would be closer to the best hearing frequencies for beluga whales), the overall noise levels would still be expected to be lower and to attenuate more rapidly than low frequency noise. Several aspects of the planned monitoring and mitigation measures for the KAC project are designed to detect marine mammals occurring near pile driving and demolition activities, and to avoid exposing them to sound that could potentially cause hearing impairment (e.g., mandatory shut down zones) and minimize disturbance (e.g., shut down if allocated takes used, for large groups and groups with calves). In addition, marine mammals will be given a chance to leave the area during soft start and ramp-up procedures to avoid exposure to full energy pile driving. In those cases, the avoidance responses of the animals themselves will likely reduce or eliminate any possibility of hearing impairment. Hearing impairment is measured in two forms: temporary threshold shift and permanent threshold shift.

When permanent threshold shift (PTS) occurs, there is physical damage to the sound receptors in the ear. PTS is presumed to be likely if the hearing threshold is reduced by 40 dB (i.e., 40 dB of TTS) (Southall et al. 2007). PTS has never been measured in marine mammals despite some hearing threshold studies exposing beluga whales to pulses up to 208 dB (Finneran et al. 2002), 28 dB louder than NMFS's current Level A harassment threshold. Based on TTS studies (discussed below), proposed mitigation measures, and source levels for the KAC, NMFS does not expect that Cook Inlet beluga whales will be exposed to levels that could elicit PTS (i.e., no Level A harassment is anticipated).

To date, no studies relating TTS onset to pile driving sounds have been conducted for any cetacean species. Because noise from pile driving would not be a one-time exposure, as with most human development and exploration activities, a time component must be incorporated into any effects analysis. Experiments with marine mammals show a nearly linear relationship between sound exposure level and duration of exposure: the longer an animal is exposed, the lower the level required to produce TTS (Kastak & Schusterman 1999; Schlundt et al. 2000; Nachtigall et al. 2003). Using auditory evoked potentials (AEP) methods, Nachtigall et al. (2004) repeated his 2003 study and found TTS of approximately 4 to 8 dB following nearly 50 minutes of exposure to the same frequency

noise (center frequency 7.5 kHz) at 160 dB re 1 μ Pa-m (193-195 dB re 1 microPa2-s [SEL]). TTS recovery occurred within minutes or tens of minutes.

The noise from pile placement and removal and drilled-shaft installation and effects these activities have on ambient underwater noise will be temporary. Based on sound modeling presented in the Biological Assessment, sound associated with impact pile placement will attenuate to below acoustic harassment thresholds at a distance from the construction area ranging from 64 m to 1,135 m (210 to 3,724 feet) depending on the pile diameter. Similarly, for vibratory pile placement, the distances to these threshold isopleths range from 1,028 m to 1,253 m (3,373 to 4,111 feet). Based on data from the aforementioned studies, the fact that pile driving would occur only for a short intervals of time, and animals would not be exposed to sound levels at or above 180 dB due to proposed mitigation, NMFS anticipates that TTS, if it does occur, would not last more than a few minutes and would not likely result in impacts to vital life functions such as communication and foraging.

The most likely beluga whale response to pile-driving noise is expected to be short-term, localized avoidance. For example, beluga whales in the MacKenzie River estuary in the Beaufort Sea moved away during construction on an artificial island, but did not leave the area of construction (Richardson 1995). Cook Inlet beluga whales have continued to use habitat in Knik Arm despite heavy disturbance and underwater noise from maritime operations, maintenance dredging, aircraft operations, and pile driving for the Port of Anchorage expansion. This beluga whale behavior may, however, be taken as evidence of a possible high motivation to reach important habitat, rather than as an indication that the noise is not bothersome to the whales.

Some beluga whales repeatedly exposed to construction noise may habituate to the sounds and, upon subsequent exposures, may not change their behavior or distribution when exposed to those sounds. The proposed construction activities may not have substantial effects on these habituated individuals.

Areas in upper Knik Arm most frequented by whales at high tide are about 15 miles from the Crossing, and it is unlikely that whales in those areas will be displaced, excluded from habitat, or exposed to greater risk of stranding by pile-driving sounds. Eagle Bay is an important beluga whale habitat site about six miles from the Crossing. Beluga whales consistently occur here during the fall months, and use this bay and the lower reaches of Eagle River for foraging. The deeper waters of Eagle Bay are occupied by these whales during low tides that prevent them from reaching the more shallow mudflats of the upper Arm. This is an important consideration with respect to noise impacts. Beluga whale distribution within Knik Arm is limited by tidal height. During low tides, these whales must retreat to deeper waters between Eagle Bay, Goose Bay, and the KAC alignment. Thus, acoustic exposure to project noises may be greater during low tide periods.

High ambient noise levels in the area of the Crossing may reduce the severity of potential noise impacts to belugas, as related to pile driving and removal. Ambient noise levels are typically higher than 120 dB re 1 μ Pa in the action area. As such, 125 dB re 1 μ Pa is to be

used as the threshold for Level B harassment (NMFS 2009).

To minimize impacts of construction noise on beluga whales, all in-water impact and vibratory pile-driving activities for temporary pile installation and removal associated with docks, moorage, and pier templates will be conducted outside of the period of high beluga whale density in Knik Arm, from August 1 through November 30. This will substantially reduce the chance of exposing beluga whales to KAC project pile-driving noise. Furthermore, marine mammal observers and passive acoustics will be used during pile placement and other construction activities to reduce incidental takes. This includes a shut-down plan if beluga whales approach the safety radii.

Vessels

Vessel traffic in Knik Arm will temporarily increase to support construction of the KAC project. However, the number of motorized construction vessels will be approximately 27 percent (14 out of 52) of expected construction vessels. The increase in vessel activity will occur throughout the in-water construction phase of the project. Potential direct impacts to beluga whales from vessel traffic include increased noise, harassment of animals in the form of disturbance, and vessel collision that could result in possible serious injuries or death. Beluga whales may display avoidance reactions when approached by watercraft, particularly small, fast-moving craft that can maneuver quickly and unpredictably.

Due to their slower speed, ship strikes from construction vessels are not expected to pose a significant threat to Cook Inlet beluga whales. Larger vessels that do not alter course or motor speed around these whales seem to cause little, if any, reaction (NMFS 2008). Beluga whales are regularly sighted in and around the Port of Anchorage (Rugh et al. 2005) passing near or under vessels (Blackwell and Greene 2002), indicating that these animals may have a high tolerance of large vessel traffic. However, smaller boats that travel at high speed and change direction often present a greater threat.

Vessel traffic associated with the POA, Port MacKenzie, and other sites or activities commonly occurs in the action area. Despite the regularity of vessel movement in and out of Knik Arm, ship strikes have not been definitively confirmed as causing a Cook Inlet beluga whale death (NMFS 2008). Because of their slower speed and linear movement, large vessels, such as those to be used in constructing the KAC, are not expected to pose a substantial threat to Cook Inlet beluga whales (NMFS 2008).

Construction vessels to be used during KAC project construction will be similar to the vessels currently used at the POA and Port MacKenzie. It is estimated that construction of the KAC project will require up to 52 marine vessels during peak construction periods, 14 of which will be motorized (27 percent). Vessel noise will be transmitted through water and will vary in duration and intensity. Broadband source levels for tugs have been measured at 145 to 170 dB re 1 μ Pa (Richardson 1995). Broadband source levels for small ships and supply vessels have been measured at 170 to 180 dB re 1 μ Pa (Richardson 1995). Based on estimates, the loudest vessel noise generated during construction will be produced by ships ranging in length from 55 to 85 m (180 to

279 feet), with source levels ranging from 170 to 180 dB re 1 μ Pa. Sound from a vessel of this size will attenuate below 125 dB re 1 μ Pa between 86 m and 233 m (282 and 764 feet) from the source. The amount of noise from the small number of engine-equipped construction vessels will be minimal, given that the source levels will be approximately 156 dB re 1 μ Pa. The noise from an outboard crew vessel, in the absence of the larger and louder vessels, will attenuate to the 125 dB ambient level within 22 m (72 feet) and, therefore, be barely detectable above existing ambient noise levels at those distances.

Impacts of construction vessels on ambient noise levels will depend on the number and types of vessels employed for construction. Vessel traffic associated with bridge construction activities will be an irregularly occurring, temporary, continuous noise source (versus an impulse noise); although the noise produced by a vessel will be continuous, it will occur intermittently during the construction period.

Beluga reactions to vessels depend on whale activities and experience, habitat, boat type, and boat behavior (Richardson 1995) and may include behavioral responses, such as altered headings; fast swimming; changes in vocalizations; and changes in dive, surfacing, and respiration patterns. For example, belugas in the MacKenzie Estuary appeared to react less to a stationary dredge as opposed to a moving one, despite similar noise levels created by the vessels (Fraker 1977). Because of the frequency of marine traffic in their habitats, Cook Inlet beluga whales are familiar with the presence of large and small vessels. Belugas are frequently sighted in and around the Port of Anchorage, the Port MacKenzie dock, and the small boat launch adjacent to the outlet of Ship Creek (Blackwell and Greene 2002; NMFS 2008; Markowitz, Funk, et al., "Seasonal Patterns," 2005; Funk, Markowitz, et al. 2005). For example, Blackwell and Greene (2002) reported that Cook Inlet beluga whales did not appear to be bothered by the sounds from a passing cargo freight ship. Despite increased shipping traffic and maintenance operations (e.g., dredging) beluga whales continue to utilize waters within and surrounding the POA, interacting with tugs and cargo freight ships (Markowitz and McGuire 2007; NMFS 2008). This is in contrast to observations of beluga whales in the Saint Lawrence, where a 60 percent decline in passage rates of belugas was noted to coincide with an increase in recreational boat traffic (Caron and Sergeant 1988). During annual marine mammal monitoring studies performed at the POA, animals were found in higher densities in the nearshore area (6 km² [2.3 miles²]) around the POA where vessel presence was highest (USDOT Maritime Administration and POA 2009). Noise from increased marine vessel activity during project construction could impact beluga whales through behavioral disturbance and displacement near the Crossing location; however, background sound levels in Knik Arm are already high because of strong currents, eddies, recreational vessel traffic, and commercial and military shipping traffic entering and leaving the POA (e.g., Blackwell and Greene 2002; Blackwell 2005; URS 2007; Scientific Fishery Systems 2009; Širović and Saxon-Kendall 2009). The addition of noise due to construction and operation of the KAC would not be outside the present experience of these whales, although levels may increase locally.

Only 27 percent of the KAC construction vessels will be motorized, and routes to and

from work sites will be monitored by observers. Construction vessels will typically operate in a slow (~2–3 knots), purposeful manner transiting to and from work sites in as direct a route as possible. Marine mammal monitoring observers and passive acoustic devices will alert vessel captains as animals are detected to ensure safe and effective measures are applied to minimize beluga whale impacts.

The proposed monitoring and minimization measures incorporated into the KAC project will keep construction personnel aware of beluga presence in the construction zone, which will further reduce the possibility of a vessel strike.

Non-auditory Physiological Effects

Non-auditory physiological effects or injuries that theoretically might occur in beluga whales exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage. Due to proposed mitigation measures (e.g., mandatory shut downs) beluga whales would not be exposed to sound at or above 180 dB and likely less than that as sound studies indicate the 180/190 dB threshold is approximately 0-20 m from pile driving and NMFS is proposing a 200m shut down zone. Therefore, it is not expected that severe physiological effects from exposure to sound would be expected; however, a hormonal stress response is possible. Romano et al. (2004) demonstrated that belugas exposed to seismic water gun and (or) single pure tones (SPLs up to 201 dB) resembling sonar pings showed increased stress hormone levels of norepinephrine, epinephrine, and dopamine. While RLs would not be as strong as the ones in that study, a stress response would not be unexpected. However, in two studies, exposure of captive beluga whales to playbacks of drilling noise did not result in increased levels of (stress-related hormones) (API 1986; Thomas, Kastelein, and Awbrey 1990). Wright et. al (2007) concluded that anthropogenic noise, either by itself or in combination with other stressors, can reduce the fitness of individual marine mammals and decrease the viability of some marine mammal populations. The available literature suggests stress hormone levels may be affected by noise exposure, but that the results are highly variable and dependent (in part) upon factors such as the duration, frequency, and intensity of sound, the species of marine mammal, the individual's response, and the amount of control the individual has over the stressor. The physiological effects of any elevation in hormone levels are equally variable.

Studies have also demonstrated that reactions of animals to sounds could result in physical injury. It has recently been reported that stranded deep diving marine mammals displayed physical attributes similar to the bends (e.g., in vivo gas bubble formation) (Fernandez et al. 2004, 2005). Marine mammals may experience these symptoms if surfacing rapidly from deep dives in response to loud sounds. However, because Knik Arm is a shallow water estuary, marine mammals found there are not considered deep divers, and due to proposed mitigation measures, non-auditory physiological impacts, other than stress, are not expected.

Several aspects of the planned monitoring and mitigation measures for the KAC are designed to detect beluga whales occurring near pile driving and to avoid the chance of them being exposed to sound levels which could result in injury or mortality. Such

monitoring and mitigation at the nearby Port of Anchorage expansion project has worked well. NMFS does not expect Level A harassment to occur.

Behavioral Effects

Behavioral responses of beluga whales to noise are highly variable and depend on a suite of internal and external factors which in turn results in varying degrees of significance (Southall et al. 2007). Internal factors include: (1) individual hearing sensitivity, activity pattern, and motivational and behavioral state (e.g., feeding, traveling) at the time it receives the stimulus; (2) past exposure of the animal to the noise, which may lead to habituation or sensitization; (3) individual noise tolerance; and (4) demographic factors such as age, sex, and presence of dependent offspring. External factors include: (1) non-acoustic characteristics of the sound source (e.g., if it is moving or stationary); (2) environmental variables (e.g., substrate) which influence sound transmission; and (3) habitat characteristics and location (e.g., open ocean vs. confined area). There are no consistent observed threshold levels at which beluga whales respond to an introduced sound. Beluga whale responses to sound stimuli have been noted to be highly dependent upon behavioral state and motivation to remain or leave an area. Few field studies involving stationary industrial sounds have been conducted on beluga whales. Reactions of belugas in those studies varied. For example, in Awbrey and Stewart (1983) (as summarized in Southall et al. (2007), recordings of noise from SEDCO 708 drilling platform (non-pulse) were projected underwater at a source level of 163 dB. Beluga whales less than 1.5 km from the source usually reacted to onset of the noise by swimming away (Received Levels (RL) approximately 115.4 dB). In two instances groups of whales that were at least 3.5 km from the noise source when playback started continued to approach (RLs approximately 109.8 dB). One group approached within 300 m (RLs approximately 125.8 dB) before all or part turned back. The other group submerged and passed within 15m of the projector (RL approximately 145.3 dB). TTS experiments have also documented behavioral responses by trained belugas. These responses included reluctance to return to experimental stations when exposed to watergun pulse sounds projected 4.5m from the subject at approximately 185.3 dB (171 dB re 1 μ Pa_{2-s} [SEL]) (Finneran et al. 2002) and behavioral changes when exposed to sounds from the explosion simulator at approximately 200 dB (177 dB re 1 μ Pa_{2-s} [SEL]) (Finneran et al. 2000). In a non-pulse exposure experiment (i.e., 1 s tones), belugas displayed altered behavior when exposed to 180-196 dB (180-196 dB re 1 μ Pa_{2-s} [SEL]) (Schlundt et al. 2000).

Masking of whale calls or other sounds potentially relevant to whale vital functions may occur. Southall et al. (2007) defines auditory masking as the partial or complete reduction in the audibility of signals due to the presence of interfering noise with the degree of masking depending on the spectral, temporal, and spatial relationships between signals and masking noise as well as the respective received levels. Masking occurs when the background noise is elevated to a level which reduces an animal's ability to detect relevant sounds. Belugas are known to increase their levels of vocalization as a function of background noise by increasing call repetition and amplitude, shifting to higher frequencies, and changing structure of call content (Lesage et al. 1999; Scheifele

et al. 2005; McIwem 2006). Another adaptive method to combat masking was demonstrated in a beluga whale which reflected its sonar signal off the water surface to ensonify an object on which it was trained to echolocate (Au et al. 1985). Due to the low frequencies of construction noise, intermittent nature of pile driving, and the ability of belugas to adapt vocally to increased background noise, it is anticipated that masking, and therefore interruption of behaviors such as feeding and communication, will be minimized.

Many marine mammals, including beluga whales, perform vital functions (e.g., feeding, resting, traveling, socializing) on a diel (i.e., 24 hr) cycle. Repeated or sustained disruption of these functions is more likely to have a demonstrable impact than a single exposure (Southall et al. 2007). However, it is possible that marine mammals exposed to repetitious construction sounds from the proposed construction activities will become habituated or tolerant after initial exposure to these sounds, as demonstrated by beluga vessel tolerance (Richardson et al. 1995, Blackwell and Green 2002). Habituation is found to be common in marine mammals faced with introduced sounds in their environment. For example, bowhead whales (*Balaena mysticetus*) have continued to use pathways where drilling ships are working (RLs: 131 dB re: 1 μ Pa) so that they can continue their eastward migration (Richardson et al. 1991). In addition, harbor porpoise, dolphins, and seals have become habituated to acoustic harassment deterrent devices such as pingers and seal bombs after repeated exposure (Mate and Harvey 1987; Cox et al. 2001).

Habitat Loss and Diminished Use

The KAC will result in the direct loss and modification of beluga whale habitat. The bridge causeways will fill approximately 90 acres of intertidal and subtidal habitat. The habitat to be filled is used as migrating, rearing, and foraging habitat for fish. However, habitats with the same attributes as the area to be filled exist in many other areas of Knik Arm.

Available data do not describe the specific distribution and movements of beluga whales in these areas. Although much of this area is shallow or exposed during low tides, it is otherwise available to beluga whales and assumed to provide some habitat values. Whales are generally described to move up the east side of Knik Arm on flood tides, and return on ebb tides along the western shore. These are very generalized, however, and we believe beluga whales may be distributed throughout Knik Arm near the crossing.

As the project approaches are constructed, beluga whales continuing to use the habitat will be traversing and feeding in a deeper channel, and will be exposed to construction noise. Beluga whales have continued to use the waters off the Port of Anchorage in which past port operations and ongoing maintenance dredging occurred. This flexibility in dealing with a changing physical habitat may be the result of adaptation to the Cook Inlet environment, which is highly dynamic due to huge tides, silty substrate, and seasonal ice movements.

The effects of the KAC on beluga critical habitat are discussed later in this opinion.

Lighting

Artificial lighting will be used during project construction, including barge and crane lighting, work-area lighting, spot lights, and vehicle lights. The use and duration of these artificial light sources are not yet known. However, the Knik Arm Bridge and Toll Authority who will oversee the design of the crossing expects that most lighting will be directed toward the surfaces of project structures or toward other working surfaces and not directly on Knik Arm waters. As such, the use of lighting during construction is not expected to affect the distribution of beluga prey species at night.

B: Operation

The KAC will introduce noise into the water during operation, the majority of which would come from vehicles on the road surface. Road noise would be transmitted into the water column through the pile supports. The level of noise that may be expected is not known. While operational noise levels in water are projected by DOT to be less than 125 dB (the in-water threshold for behavioral harassment), this noise may be detected by beluga whales and could elicit more subtle reactions – most importantly by any diminished access through the crossing alignment.

Noise generated by traffic on the Crossing may enter the water through an airborne noise pathway and a structure-borne noise pathway. KABATA has estimated operational underwater sound level of approximately 94 dB re 1 μ Pa just below the water's surface. This noise may be detectable by whales, raising concern regarding the continued passage of belugas under the bridge. The BA included an analysis of passage under structures by beluga whales, both within Cook Inlet and elsewhere. That analysis found that beluga whales in Knik Arm generally follow a pattern of movement from the upper arm at high tide to Eagle Bay and the Sixmile Creek area at low tide. Belugas generally remain north of the Crossing corridor during these localized movements; occasionally, however, they transit the narrows between Cairn Point and Port MacKenzie through the Crossing corridor (Markowitz, Funk, et al., "Use of Knik Arm Crossing Corridor" 2005). The approaches and bridge associated with the KAC project will intersect a migratory path used by belugas to gain access to important habitats in mid- and upper Knik Arm.

Within the distribution range of the Cook Inlet beluga whale, no bridges spanning marine waters currently exist. Several bridges, however, span rivers within this range. All of these bridges are within the tidal reaches of rivers. Evidence indicates that Cook Inlet beluga whales are capable of traveling beneath bridges with narrower spans, lower deck heights, and shallower and more constricted water bodies than the KAC bridge (HDR 2010). Examples of Cook Inlet beluga whales passing beneath existing bridges are relevant to understanding how belugas might respond to the Crossing because they indicate that operational noise and other characteristics of these bridges are tolerated by Cook Inlet beluga whales. These provide general evidence that Cook Inlet beluga whales tolerate in-water and over-water structures, and specific evidence that at least some Cook Inlet beluga whales are willing to swim beneath and upriver of bridges.

A review in the BA (HDR 2010) considers incidents and reports of beluga whales moving

under 13 bridges spanning seven rivers in the Cook Inlet watershed:

- **Beluga River** (upriver of the bridge located near river mile [RM] 6) – Native hunters reported Cook Inlet beluga whales ascended the Beluga River as far as Beluga Lake (approximately RM 30) (Huntington 2000). Beluga whales have been observed passing under the bridge on several occasions between 2004 and 2008 to areas at least 1 mile upriver of the bridge at high tide while feeding on fish.
- **Bird Creek** (upriver of the Seward Highway Bridge and Alaska Railroad Bridge) – A satellite-tagged beluga whale was recorded upstream of the bridges in 2000 (Hobbs et al. 2005; NMML unpublished data).
- **Glacier Creek** (upriver of the Seward Highway Bridge and Alaska Railroad Bridge) – A satellite-tagged beluga whale was recorded upstream of the bridges on three occasions in 2000 (Hobbs et al. 2005; NMML unpublished data).
- **Kenai River** (upriver of the Warren Ames Bridge located at river mile [RM] 4 – During interviews conducted in 1999, Native hunters reported that beluga whales traveled up the Kenai River (Huntington 2000). Reports of Cook Inlet beluga whale sightings upriver from the Warren Ames Bridge as far as RM 11 indicate passage of beluga whales underneath the bridge. From the mid-1970s through early 1990s, small groups of belugas (one to four whales) were seen in the river from the mouth to just upriver of the bridge during salmon runs, moving upstream and often pursuing salmon.
- **Knik River** (upriver of the Glenn Highway Bridges [northbound and southbound] and the Alaska Railroad Bridge) – Cook Inlet beluga whales have been seen in the Knik River passing underneath and swimming upriver of the Glenn Highway Bridges, located at approximately RM 0. Beluga whales were also seen upriver of the Alaska Railroad Bridge over the Knik River.
- **Placer River** (upriver of the Seward Highway Bridge and Alaska Railroad Bridge) – Cook Inlet beluga whales have been seen upriver of the bridges across the Placer River (Huntington 2000; various individual sightings).
- **Twentymile River** (upriver of the Seward Highway Bridge and Alaska Railroad Bridge) – Cook Inlet beluga whales, including calves, have been seen passing underneath and swimming upriver of the bridges across the Twentymile River.

In addition to these observations, Cook Inlet beluga whale groups have also been seen adjacent to bridges in Turnagain Arm at the mouth of Indian, Peterson, and Ingram creeks (Hobbs et al. 2005; NMML unpublished data); Portage Creek (Hobbs et al. 2005; NMML unpublished data); and within 1,640 feet of the bridge spanning the Twentymile River (Hobbs et al. 2005; NMML unpublished data; Markowitz et al. 2007).

Beluga whales in populations outside of Cook Inlet have also been observed passing under bridges. In Alaska, records of beluga whale passage beneath four bridges were identified: the Dalton Highway Bridge over the Yukon River (Lowry 1994), the Tanana River and Mears Memorial bridges over the Tanana River (Joling 2006), and the bridge over the Safety Sound Estuary on Nome-Council Road. The following records of belugas passing beneath bridges outside of Alaska were also identified: a lone beluga whale

passed beneath 10 to 14 bridges in the Delaware River in 2004; a single beluga whale passed under two bridges crossing the Saguenay River at Chicoutimi, Canada (NMFS 2005; HDR 2010); and beluga whales were observed passing underneath bridges in the Dvina and Amur rivers in Russia. There are also records of additional sightings of belugas near the bridges at Chicoutimi, Canada, but it is unknown whether they crossed beneath them. In 1940, a beluga whale was seen south of the Tacoma Narrows Bridge (HDR 2010). In total, beluga whale passage upriver of several bridges worldwide has been documented, indicating that beluga whales from at least five stocks tolerate and pass beneath bridges.

Cook Inlet beluga whales are generally found to tolerate the presence of in-water structures in addition to bridges. Belugas in Cook Inlet are known to tolerate rock-armored shorelines, port facilities, and oil and gas production platforms. Because most coastal and offshore development in Alaska has occurred either in Cook Inlet or outside the distribution range of belugas, most Alaskan examples of beluga whale responses to in-water structures are from Cook Inlet. In Knik Arm, belugas are also known to transit developed areas associated with the POA and Port MacKenzie (Markowitz 2005; Prevel-Ramos et al. 2006; Cornick and Saxon Kendall 2008, 2009).

Accounts describe Cook Inlet beluga whales transiting coastal areas adjacent to rock-armored shorelines and using them as foraging areas at the POA, Port MacKenzie, and the Seward Highway along Turnagain Arm are described below (HDR 2010).

- **The POA** – Accounts of opportunistic feeding Cook Inlet beluga whales at the POA include a description of “positioning one whale along a riprap dock, while a second whale herds salmon along the structure toward the stationary beluga whale ...” (NMFS 2008a).
- **Port MacKenzie** – One account of Cook Inlet beluga whales at Port MacKenzie involves “... beluga corralling salmon into a roughly 30-foot-wide by 50-foot-long area between a silt bar and the armor rock downstream from Port MacKenzie ... larger white to grey-colored belugas pushing fish into this area and smaller belugas feeding as the larger belugas appeared to be keeping the fish corralled.”
- **The Seward Highway** – Extensive sections of the northwest Turnagain Arm shoreline have been filled in and armored with rock to widen the Seward Highway (NMFS 2008a). Cook Inlet beluga whales often travel adjacent to the rock armor when transiting these nearshore areas and, in surveys, were most often sighted immediately along the rock-armored shoreline between Bird Point and Girdwood (Markowitz et al. 2007). One-third of groups seen in September and two-thirds of groups seen in October 2006 (the months with the most sightings) were observed within 150 feet of the armored shoreline (Markowitz et al. 2007). Several Cook Inlet beluga whale groups were also seen as they traveled nearshore from Bird Point to Girdwood (McGuire et al. 2008; McGuire and Kaplan 2009). Cook Inlet beluga whales were occasionally observed feeding near rock armoring approximately 500 m (1,640 feet) east of Bird Point, as they traveled eastward and upstream in Turnagain Arm (McGuire et al. 2008).

Beluga whale sightings worldwide indicate that the whales' responses to in-water structures are variable and include avoidance, utilization of structures for prey capture, tolerance, and changes in behavior without avoidance. The variability in responses and the paucity of data make it difficult to draw definitive conclusions about potential response of belugas to in-water structures. However, documented responses of Cook Inlet beluga whales indicate they are tolerant of in-water structures.

Long-term population effects of habitat alteration from bridges—including level of tolerance and speed of habituation—are not fully understood for the Cook Inlet beluga whale population. The response of beluga whales to the KAC project is difficult to accurately predict. Examples from scientific studies and opportunistic sightings suggest that they are tolerant of bridges and will continue to swim through the crossing corridor during project operation. It is possible that some individual whales will, at least initially, not pass through the crossing; however, beluga whales' fidelity to feeding, molting, and calving areas, coupled with the exhibited tolerance of individual belugas to bridges and other in-water structures, indicates that they will likely continue traveling up Knik Arm to gain access to these sites during operation of the project. Furthermore, beluga whales have been observed transiting areas near the crossing corridor despite the presence of in-water structures associated with the POA and Port MacKenzie, implying that no diminished habitat use in or north of the crossing corridor is expected as a result of the presence of the crossing.

The approach embankments associated with the KAC project will narrow the tidal channel and increase the current through the bridge opening by approximately 4 percent (KABATA 2007). This will be most evident during spring flood tides (KABATA 2007). Analysis of actual velocity measurements across Knik Arm showed that 96 percent of the total flow within Knik Arm passes through the 8,200-foot gap that the KAC project will bridge. Belugas are known to move into the upper reaches of Cook Inlet during flood tide and depart these areas during ebb tide (Moore et al. 2000, Funk et al. 2005, Hobbs et al. 2005). They move with the tides once or twice daily in Cook Inlet, allowing access to feeding and nursery areas not accessible at lower tides (Hobbs et al. 2005). Beluga presence and direction of travel in Knik Arm are directly related to tidal stage (Funk et al. 2005). As such, an increase in current through the bridge opening is not expected to affect beluga movement.

Lighting

Bridge illumination will be with low-profile luminaires, approximately 15 to 20 feet above the approach road and bridge deck, installed in a way that will minimize incidental light scatter. Belugas are highly reliant on echolocation for navigation and feeding; any incidental light scatter is not likely to affect these behaviors. The highly turbid waters of Knik Arm will reduce light penetration through the water column, further reducing the likelihood of any impacts.

Indirect Effects of the Action

A: Construction

Construction activities may indirectly affect Cook Inlet beluga whales through impacts to prey species. In general, little is known about how noise impacts fish (Hastings and Popper 2005, DFO 2004). Some research indicates that some noises may evoke flight and avoidance response in juvenile salmon. Other studies have shown that the avoidance response is temporary. Salmon have been found to respond to low frequency sounds, but only at very short ranges (Chamberlin 1991). Carlson (1994), in a review of 40 years of studies concerning the use of underwater sound to deter salmonids from hazardous areas at hydroelectric dams and other facilities, concluded that salmonids were able to respond only to low-frequency sound and react only to sound sources within a few feet from the source. He speculated that the reason that underwater sound had no effect on salmonids at distances greater than a few feet is that they react to water particle motion/acceleration, not sound pressures as such. Detectable particle motion is only produced within very short distances of a sound source, although sound pressure waves travel farther (USDOT 2005). It is also likely that fish will avoid sound sources within ranges that may be harmful (McCauley et al. 2003).

Pollutants

The operation of marine vessels during construction of the KAC project will increase the risk of marine fuel spills from leaks or breaks in vessel fueling equipment, vessel collisions or sinking, mechanical or structural failures, or human errors such as leaving valves open. Use of heavy machinery near or in Knik Arm will also present a risk for a spill of fuel or other hazardous materials. Standard best management practices will be in place to reduce the potential for these accidents to occur.

Should an oil spill occur, the effects on beluga whales are generally unknown. Research has shown that while cetaceans are capable of detecting oil they do not seem to be able to avoid it (Geraci 1990). The potential impacts on beluga whales caught in an oil spill include: skin contact with oil; ingestion of oil; respiratory distress from hydrocarbon vapors; contaminated food sources; and displacement from feeding areas. The actual impacts would depend on the extent and duration of contact, and the characteristics (type and age) of the oil. Cook Inlet beluga whales could be affected by residual oil from a spill even if they were not present during the oil spill, due to the highly mobile nature of the spill and the drastic tidal fluctuations in the area (NMFS 2008).

Polycyclic aromatic hydrocarbons (PAHs), a group of contaminants found in petroleum products, combined with other contaminants, may cause cancer in beluga whales (Kingsley 2002) and are otherwise a concern with respect to the conservation and recovery of the Cook Inlet beluga whale. Cook Inlet belugas appear to be bioaccumulating PAHs from the environment and prey (Reynolds 2010). A spill of petroleum products during project construction might increase the release of PAHs into the environment. PAHs, however, generally do not easily dissolve in water (Agency for Toxic Substances and Disease Registry [ATSDR] 1995). Furthermore, the fast currents and assimilative capacity of Knik Arm would reduce any impacts on water quality that might result in the event of a spill. Because of the physical and chemical properties of PAHs, it is unlikely the project will result in high concentrations of these toxins in Cook Inlet or result in impacts on Cook Inlet beluga whales.

Refueling and other operations involving handling of harmful materials will be under EPA regulations prohibiting water pollution. The vessels will likely be fueled at the POA vessel fueling area, where spill containment measurements will be in place. Impacts to beluga whales resulting from a spill or release of hazardous substances during construction will be unlikely.

Stormwater runoff from ground disturbance in construction areas associated with the road corridor and the bridge approaches may be transported off site by rainfall or snowmelt and may affect water quality in receiving waters. Other potential sources of stormwater pollution will include soils tracked off site by construction traffic, hazardous materials used or stored on site, and disturbance of potentially contaminated soils.

All construction activities related to the KAC must be permitted under the guidelines of the NPDES program until construction is complete. A Construction General Permit issued by EPA under the NPDES program will be required. EPA issues the permit to the developer only after thorough review of the project-specific Stormwater Pollution Prevention Plan (SWPPP) written by the developer. The SWPPP will form the basis of stormwater pollution prevention for the KAC project during all construction phases. The SWPPP will comply with requirements of the Clean Water Act and will include an erosion control plan that details actions to be taken by construction operators to prevent stormwater contamination.

B: Operation

Changes in Availability of Beluga Whale Prey

The operation of the KAC may diminish fish habitat value, with corresponding decreases in prey numbers or availability. Beluga whales are opportunistic feeders known to prey on a wide variety of animals (NMFS 2008). Because beluga whales do not always feed at the streams with the highest runs of fish, water depth and fish density may be more important than sheer numbers of fish in the whales' feeding success (NMFS 2008). Within Knik Arm, certain bottom structure, depths, and proximity to anadromous fish streams seems to be concentrating mechanisms that characterize important feeding sites. The proposed action is not expected to diminish these physical factors that may underlie the feeding efficiency of these whales.

In 1996, the Sustainable Fisheries Act amended the Magnuson-Stevens Fishery Conservation and Management Act to require the description and identification of Essential Fish Habitat in fishery management plans, the identification of adverse impacts on essential fish habitat, and actions to conserve and enhance such habitats. Essential Fish Habitat includes those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. NMFS classifies Cook Inlet as Essential Fish Habitat for all five Pacific salmon species. Freshwater Essential Fish Habitat for the salmon fisheries in Alaska includes all streams, lakes, ponds, wetlands, and other water bodies currently or historically accessible to salmon in the state. Knik Arm is listed as essential fish habitat.

Effects on Critical Habitat

NMFS is required under Section 4(b) (2) of the ESA to designate critical habitat for the Cook Inlet beluga whale. A proposed rule to designate this critical habitat was published in the Federal Register on December 2, 2009 (74FR 63080). The in-water affected area for the proposed action is entirely within the proposed critical habitat. The proposed action has the potential to affect beluga whales through the disturbance or modification of their habitat. This section describes the essential physical and biological features of the proposed beluga whale critical habitat occurring in the action area, the mechanisms of potential direct and indirect effects of the KAC on these features, and the anticipated impact of these mechanisms to the proposed critical habitat. For each essential feature (also known as a Primary Constituent Element or PCE), we consider the baseline condition. We then assess the effect of the KAC on the quality, quantity and availability of each PCE. If there is a reduction of a PCE, then the timing, duration and magnitude of the reduction are estimated. Any mitigative measures are also considered in this evaluation. We then sum the individual effects to the PCEs to consider the project impact to critical habitat. The destruction of critical habitat and its adverse modification are evaluated by the consequences of any changes in the function, amount, or capacity of the PCE's relative to their ability to provide for the ecological needs of a recovered population of this DPS.

PCE 1 - Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) (MLLW) and within 5 miles (8.0 km) of high and medium flow accumulation anadromous fish streams

This PCE reflects the importance of shallow intertidal and subtidal areas proximate to tributary waters of Cook Inlet that contain anadromous fish populations that comprise the principle prey of Cook Inlet beluga during the spring, summer, and fall. NMFS tagging data and visual observations by various monitoring and research efforts confirm these areas are preferentially used during ice-free seasons. In addition to feeding habitat, these areas may also be important for calving and predator avoidance. This PCE occurs along the proposed crossing alignment and throughout most of the action area.

Quality

The quality of this essential feature may be altered by the project, as soft mud and sand substrates are replaced by rip rap materials. Depositional sites may have different sediment characteristics than currently exist. The functional effect of such changes to beluga whales is not considered significant because these areas would still provide structure and depths that support foraging behavior. Cook Inlet beluga whales have often been observed to utilize structure in their feeding strategy. While we are unable to identify this as beneficial to feeding behavior, we assign a neutral assessment here to any effect on the quality of this PCE.

Quantity

The bridge approach fills for the KAC would remove approximately 90 acres of intertidal and subtidal habitat. The BA (HDR 2010) estimates this represents 0.03 percent of all such habitat within Knik Arm. We were unable to verify this estimate, but acknowledge the area is small and the removal minimal when compared to the entire intertidal and subtidal acreages that exist within Knik Arm. The loss however is permanent, since the

approaches, rip rap, and fill material are to remain in place through operation. Additionally, the bridge approaches will interrupt long-shore drift patterns and can be expected to result in accretion of sediments on one side, and scouring on the other. The BA determined an additional 260 acres of intertidal and subtidal habitat would be created over time due to deposition. We were unable to validate this estimate, and believe the KAC will diminish the overall quantity of this PCE. Because several sources report that the eastern shoreline of lower Knik Arm is regularly used by beluga whales, and because this is near important beluga habitat areas such as Eagle Bay and Six Mile Creek, any reduction in the extent of habitat loss here would be beneficial. A conservation recommendation is included in this opinion to reduce this loss.

Availability

Knik Arm and Cook Inlet have habitat as defined in PCE #1 in abundance. The crossing approaches and supports include very little valuable intertidal and subtidal habitat that will be removed or altered by the project's construction and operation. The crossing structure would not obstruct access to this PCE anywhere else in Area One or Two critical habitats, nor obstruct the availability of PCE # 1. The KAC is not likely to affect the availability of PCE # 1. We believe the KAC will adversely affect proposed critical habitat because of the loss of this essential feature through filling. However, this loss would be very small and would not appear to have measurable consequence to individual whales nor this DPS.

PCE 2 - Primary prey species consisting of four (4) species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.

Cook Inlet beluga whales are highly mobile, opportunistic feeders known to prey on a wide variety of species, particularly seasonally abundant fish such as eulachon and salmon. Fish species occurring in the Arm include chum, coho, Chinook, sockeye, and pink salmon as well as Dolly Varden. In determining the effects of this action on PCE #2, we considered the loss of and alteration to fish habitat, the effects of on-land development induced by the crossing, and the effects of construction noise on these prey species. Permanent loss of 90 acres of intertidal and subtidal shoreline habitat will result from the approach fills. Construction pile driving noise will radiate throughout the water from the noise source until it dissipates to background levels. However, no standard distances from a noise source have been established for prey fish protection, and we are unable to estimate the magnitude of this effect.

Quality

The construction and operation of the KAC are not expected to have any impact on the quality of prey species. These fish are largely anadromous species whose residence time in fresh water may be two years or less, and within Knik Arm is limited to a few days to several weeks. Cod, pollock, and sole would not be expected to occur within the action area. Quality of prey may be considered to include their lipid content, body burdens of toxins or pollutants, and nutritional value to beluga whales. Land development induced by the KAC could result in increased exposure by fish to pollutants, including petroleum products and related PAHs from urban runoff. We were unable to quantify any future

levels for these pollutants or to estimate their impact on the quality of these prey species.

Quantity

Baseline studies to enumerate and identify prey fish species and how they use the habitat were conducted in lower Knik Arm around the Port of Anchorage (Pentec, 2005). These studies concluded fish species abundance and diversity is highly variable throughout the year, with overall juvenile salmon being the most prevalent around the Port. The habitat areas near the crossing alignment are similar to those near the Port, although the KAC area supports more shallow tideflats and cut channels which appear to be important micro-habitat aspects important to beluga feeding strategy.

Construction of the KAC will increase local turbidity levels which limit the ability of fish to visually feed. However, Knik Arm has extreme tides and tidally-generated currents, and high suspended sediment loads ranging into the hundreds of nephelometric turbidity units (NTU) (Pentec, 2005). Pentec concluded that, based upon their earlier work and other studies, that visual feeding by juvenile salmonids was possible in microhabitats within the surface water where short periods of quiescence allowed partial clearing. These small lenses of clearer water could occur along the shorelines as well as in the middle of the Arm. The data collected from south of Fire Island suggested that juvenile salmonids were not favoring shorelines. Therefore, the shoreline intertidal and subtidal areas were not necessarily essential to the survival of the juvenile salmonids.

The POA conducted a live caged fish study in 2008 and 2009 (URS, 2009). During this study, juvenile coho salmon were exposed to sheet pile driving noise (vibratory and impact pile driving) while acoustic measurements were made and extended behavioral observations of exposed fish were followed by necropsies to look for effects. The juvenile salmonids were exposed to pile driving at distances ranging from 0.6 meters to 50 meters from the pile driving hammers. Despite attempts to expose fish to the maximum potential noise at very close range, no acute or delayed mortality of any juvenile coho was observed as a result of the exposure to in-water pile driving (URS, 2009). Behavior in all 16 tests, including the three reference tests were recorded as normal. Slight hemorrhaging was observed in five necropsied fish, including two reference fish. However, this was attributed to handling from the hatchery, field transfers, or from the period from euthanasia to necropsy (URS, 2009). The recent fish study demonstrated that pile driving construction such as that associated with temporary pile placement at the KAC does not kill fish and the potential for noise effects on fish is low. Additionally, the seasonal restrictions on impact pile driving and adoption of alternative driving technology for placement of bridge support piling will reduce this possibility further. Pile driving noise was the primary concern for fish impact, it is reasonable to conclude that operation of the crossing would not kill nor reduce the numbers of fish.

Operationally, the crossing is projected to result in increases in wastewater generation, storm water runoff, and non-point pollution. These increases are expected to be most-pronounced within freshwater systems in the Matanuska-Susitna Borough, the majority of which are anadromous waters supporting several species of Pacific salmon, including

Chinook, pink, chum, and coho. According to the BA (HDR, 2010), potential indirect impacts of the KAC could be long-term and could affect fish populations in a large portion of the Matanuska-Susitna Borough. Such effects were not quantified.

Availability

Cook Inlet beluga whales utilize the Susitna delta area, Chikaloon Bay, and upper Knik Arm as major foraging sites, and move through lower Knik Arm at the crossing in moving between these sites. The KAC Project would not affect these primary foraging locations directly. The KAC area is not a primary feeding location for these whales. Monitoring by marine mammal observers indicates that beluga whales primarily appear to swim or travel past the KAC as they access feeding sites further up Knik Arm. We do not expect the accessibility to prey to be significantly altered by the KAC. Beluga whales foraging and anadromous fish movements at or near the crossing may experience slightly higher water velocities. The expenditure of additional energy due to increased channel currents would not be expected to be significant given 1) the relatively small increases in velocities predicted by KABATA; 2) the fact that salmon move passively with tidal movements rather than against strong tidal currents; and 3) the fact that salmon are adept swimmers capable of ascending high velocity waters such as rapids.

PCE 3 - Waters free of toxins or other agents of a type and amount harmful to Cook Inlet beluga whales.

This essential feature recognizes the importance of water quality to Cook Inlet belugas. As high-level predators, beluga whales may bio-accumulate pollutants, and populations elsewhere, such as in the St. Lawrence, have been found to carry heavy body burdens of certain chemicals. Cook Inlet belugas appear to have lower levels of many contaminants than other populations. However, the Conservation Plan (NMFS, 2008) and the Proposed Rule for critical habitat designation state that contaminants are a concern for the sustained health of Cook Inlet beluga whales. Toxicity and dose-response data are minimal for the majority of emerging chemicals, and the impact of most other contaminants to beluga whales is unknown (NMFS 2008). NMFS is presently unable to identify those pollutant agents and concentrations that are harmful to beluga whales. In a report prepared for NMFS (URS 2010), certain chemicals or substances were identified as being of potential concern to Cook Inlet beluga whales. Those found to have “probable” concern included chlorinated compounds (e.g, DDT,PCB, and Dioxins), metals such as methyl mercury, selenium, and butyltins, polycyclic aromatic hydrocarbons, while many more agents were found to be of possible concern.

Quality

At this time, the level of any toxin or substance that is harmful to beluga whales is unknown. The consequence of this uncertainty is considered minor, however, in view of the expected nature of pollutants associated with construction and operation of the KAC. Upper Cook Inlet has been identified as a Category 3 Water-body by the EPA, or water for which there is insufficient or no data to determine if any designated use is impaired. As such, there are no identified water quality concerns or total maximum daily loads for Cook Inlet (R&M, 2007, 2010). An indirect effect of the action would be increased development within the Matanuska-Susitna Borough. This would be a significant impact,

leading to projected increases in wastewater generation, storm water run-off, and non-point pollution with resultant decreases in water quality. The BA found there would be a 45 percent increase in non-point pollution with the KAC as compared to future conditions without the crossing. The BA was unable to quantify the changes in water quality, but we would expect those effects to be most pronounced within freshwater sources, as the assimilative capacity of upper Cook Inlet and Knik Arm is great, owing largely to the extent of tidal mixing and freshwater input.

Operationally, there is concern for the introduction of hydrocarbon compounds due to fuel spills from accidents as well as roadway runoff. KABATA, using roadway accident data for Alaska and a risk formula from the Transportation Research Board, estimates the odds for a fuel or HAZMAT truck accident at 0.0097 spills per year, or one every 103 years. They also point out these trucks would otherwise be crossing the upper Inlet on the existing Matanuska River and Knik River bridges (memo from L. Frazier (KABATA) to B. Smith (NMFS), October 14, 2010). Some runoff from the crossing would be expected to enter Knik Arm. We were unable to quantify this effect, but expect it to be offset to some degree by reduced traffic (and run off) over the existing bridges crossing Knik Arm.

Quantity

The BA projects the KAC would result in a forty five percent increase in non-point water pollution (without mitigation) compared with levels for the future without this project. Much of this increase would be attributable to greater housing densities and increased extent of impervious surfaces. Whether these increases would extend to waters and habitats occupied by beluga whales, or result in a reduction in waters free of toxins of a type and amount harmful to Cook Inlet beluga whales is unknown.

Availability

The availability of this PCE would essentially be the same as the quantity of waters free of toxins (above).

PCE 4 - Unrestricted passage within or between the critical habitat areas

Although many populations of beluga whales are migratory, the Cook Inlet stock has been shown to remain in Cook Inlet year round (Hobbs et al. 2005), with seasonal distribution patterns closely tied to prey availability. Annual aerial surveys and satellite tagging data from NMFS have established the distribution and abundance of beluga whales in Cook Inlet. During the spring and summer (May – July), Cook Inlet beluga whales are found in the upper Inlet, primarily concentrated in the Susitna River delta area and to a lesser extent in Knik Arm, Turnagain Arm, and Chickaloon Bay, coinciding with strong runs of eulachon and salmon. In the fall (August – October), belugas follow fish runs in Knik Arm and Turnagain Arm. As the fish runs decline in the fall, the beluga whales then disperse offshore throughout the mid Inlet during the winter (December to March) (Hobbs et al., 2005).

Within Knik Arm, Cook Inlet beluga whales move on the flooding tide, feed on salmon, then fall back with the outgoing tide to hold in waters north of the KAC. Whales moving

up Knik Arm tend to prefer the eastern shoreline, while whales moving out of Knik Arm tend to hug the western shoreline (Cornick and Saxon-Kendall 2009).

The discussion throughout this section is based on the analysis of the effects of the action on habitat use by the Cook Inlet beluga whale for movement within proposed critical habitat Area One, where the KAC is located.

Quality

Data associated with monitoring of the Port of Anchorage expansion found a high level of beluga activity within the Port area, even though in-water pile driving and the resulting noise were ongoing. The spatial distribution research over the past five years shows that the Port has not been abandoned by the Cook Inlet beluga whale. KABATA conducted research to determine how the Cook Inlet beluga whale responds to in-water structures (KABATA, 2009). Their report describes how beluga whales navigate around and past in-water structures. The report conclusions included no significant impact to beluga whale behaviors or ability to migrate around in-water structures (see also discussion under Chapter IV, Operation).

Quantity and Availability

For this PCE, we were not able to draw meaningful distinction between quantity and availability. Noise during construction is likely to degrade this PCE, as whales will detect higher in-water noise levels and react by avoiding the sound source or, possibly, abandoning their effort to navigate through and beyond the crossing alignment. This impact has been discussed in Chapter IV, Construction, Noise. While some whales may experience restrictions to passage between habitats due to construction activities, we do not believe that effect would appreciably reduce the value of critical habitat for the conservation of these whales. This is because: 1) the effect would be temporary over the construction period and not expected to persist during operation; 2) only a few whales are expected to react strongly to construction noise by abandoning this habitat; 3) any whales so-affected would have alternative habitat sites available to them; 4) belugas currently remain within upper Knik Arm for some time (e.g. days) before moving to other habitat areas, meaning some restriction in passage may not be outside of their normal experience; and 5) the scheduling of impact and vibratory pile driving to between December 1 and July 31 would avoid the periods of highest use of Knik Arm by Cook Inlet beluga whales.

Unrestricted passage is not likely to be permanently reduced by the action due to channel constriction caused by the approach fills and in-water supports, and increased mid-channel velocities that may impair movement by whales through the alignment. This is because the velocity increases are small, and the whales' movements are often with rather than against the tidal action in Knik Arm. Additionally, the tidal velocities predicted with the project would not be dissimilar to those experienced in other areas of upper Cook Inlet, notably Turnagain Arm and lower Knik Arm.

PCE # 5 - Waters with in-water noise below levels resulting in the abandonment of critical habitat areas by Cook Inlet beluga whales.

In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic

sounds. Human-induced noises within the action area include large and small vessels, aircraft, pile driving, shore based activities, dredging, filling, and other events. Much of upper Cook Inlet is characterized by its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002), thereby making it a poor acoustic environment. Despite this, Cook Inlet is a noisy environment due to both natural processes such as winds and tidal movements as well as anthropogenic causes. Recent acoustic studies have determined that background noise in lower Knik Arm (with a high level of contribution by wind and tides) exceeds 120 decibels (dB). Construction of the KAC will increase in-water noise levels due to ship and tug noise, pile driving, and general construction activity.

Quality

The KAC will increase in-water noise levels within Knik Arm and portions of upper Cook Inlet. This effect is likely the most important aspect of this project with respect to the conservation of Cook Inlet beluga whales. The quality of habitat will be affected due to noise from the planned construction activities, primarily pile driving, which will continue intermittently over a 5-6 year period. Operationally, traffic noise from the bridge may be detectable to beluga whales, but any such effect would be very localized and should not significantly detract from the quality of this feature.

Quantity and Availability

For this PCE, we were not able to draw meaningful distinction between quantity and availability. In-water pile driving using vibratory and impact hammering would occur from December through July, with significant periods of no activity during winter.

Monitoring data from the nearby POA expansion project do not indicate abandonment. Beluga whale have continued to use lower Knik Arm. Unusual behavioral changes were not observed during pile driving (ICRC 2009, 2010). Additionally, onshore observations identified no unusual responses and subsurface responses, such as changed vocalizations, were not detectable (Cornick and Saxon Kendall 2009; Kendall et al. 2009; Cornick et al. 2010). Sightings of belugas within and adjacent to areas where pile-driving and other construction activities took place at the POA indicate belugas that entered Knik Arm did not avoid the area. Anthropogenic noise is common in Knik Arm, and beluga whales may have habituated to these sound disturbances (Markowitz, Funk et al. "Use of Knik Arm" 2005).

V. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR §402.02 as: "...those effects of future State or private activities not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." Cumulative effects are defined differently under the ESA than they are under NEPA (USFWS and NMFS 1998).

Reasonably foreseeable future Federal actions and potential future Federal actions that are unrelated to the proposed action are not considered in the analysis of cumulative effects because they would require separate consultation pursuant to section 7 of the

ESA. Most structures and major activities within the range of the Cook Inlet beluga whale require Federal authorizations from one or more agencies, such as the Army Corps of Engineers (Corps), Environmental Protection Agency (EPA), and Minerals Management Service. Such projects require consultation under the ESA on their effects to the Cook Inlet beluga whale, and are therefore not addressed here as cumulative impacts.

Port MacKenzie

Port MacKenzie is the center of transportation and development plans for the west side of lower Knik Arm. It currently consists of a 500 foot bulkhead barge dock, a 1,200 foot deep-draft dock with a conveyor system, a landing ramp, and 8,000 acres of adjacent uplands available for commercial or industrial development. The Matanuska-Susitna Borough plans to provide services for bulk commodity storage and a floatplane base to serve Anchorage air taxi and private pilots. The Port MacKenzie project includes plans for the Knik Arm Crossing Bridge, a Cook Inlet ferry service, and an ARRC rail extension.

New developments at Port MacKenzie will add to the disturbance of Cook Inlet beluga whales. Noise levels will increase from construction activities. The build-up of infrastructure at Port MacKenzie will lead to greater vessel traffic on the west side of Knik Arm, with the associated increase in noise and risk of ship strikes and hazardous material releases. Usage to date of Port MacKenzie has been very low and levels of increased activity and the timeframe of any increase are uncertain.

Vessel Traffic

Small vessel activity and the use of a ferry near the mouth of Ship Creek can increase noise disturbance and the risk of ship strikes to beluga whales. The improvements made at the Ship Creek harbor may increase its use by small boats. Noise levels will increase during construction of the ferry terminal and as habitat improvements are being made. Any habitat improvements to the Ship Creek watershed will help to reduce the amount of pollution from runoff entering the Knik Arm, which will help to improve beluga whale habitat. No boat access or launches will be allowed from the KAC, and vessel traffic is not expected to increase with operation of the crossing.

Tourism/Whale Watching

There currently are no boat-based commercial whale-watching companies in upper Cook Inlet. The popularity of whale watching and the close proximity of beluga whales to Anchorage make it possible that such operations may exist in the near future. However, it is unlikely this industry will reach the levels of intensity seen elsewhere because of upper Cook Inlet's climate and navigation hazards (e.g., shallow waters, extreme tides, and currents).

Vessel-based whale-watching may cause additional stresses to the beluga population through increased noise and intrusion into beluga habitat not ordinarily accessed by boats. Avoidance reactions have often been observed in beluga whales when approached by watercraft, particularly small, fast-moving craft that are able to maneuver quickly and

unpredictably; larger vessels which do not alter course or motor speed around these whales seem to cause little, if any, reaction (NMFS 2008). The small size and low profile of beluga whales, and the poor visibility within the Cook Inlet waters, may increase the temptation for whale watchers to approach the beluga whales more closely than usually permitted for marine mammals. General marine mammal viewing guidelines would be adopted, and possibly enhanced, for any commercial beluga whale watching tours.

Pollution

There are many non-point sources of pollution within the action area; such pollution is not federally-regulated. Pollutants can pass from streets, construction and industrial areas, and airports into Ship Creek, Chester Creek, and Fish Creek and then into beluga whale habitat within the action area. The potential for pollution from all sources will increase with population growth, more development, and new commercial activities in upper Cook Inlet.

Hazardous materials can potentially be released from vessels, aircraft, the POA, Port MacKenzie, and EAFB. There is a possibility an oil spill could occur from vessels traveling within the action area, or that oil will migrate into the action area from a nearby spill.

There have been several past State oil and gas lease sales in the Inlet. Future sales are anticipated annually, including much of the submerged lands of Cook Inlet. While these sales are State matters, many or most of the subsequent actions that might impact beluga whales are likely to have some federal nexus. Location of drilling structures would require authorization from the Corps. Discharges such as muds and cuttings or produced waters require permitting through the EPA. Oil spills would be one example of an unauthorized activity. In the event an oil spill occurred on State leases in Cook Inlet, the effects on beluga whales are generally unknown; however, some generalizations can be made regarding impacts of oil on individual whales based on present knowledge.

VI. SYNTHESIS AND INTEGRATION

Pursuant to Section 7(a)(2) of the ESA, Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed endangered and threatened species or result in the destruction or adverse modification of designated critical habitat. "Jeopardize the continued existence of" is defined in regulations as to engage in any action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

In this section, we assess the effects of the KAC and integrate those effects with the environmental baseline and cumulative effects. Finally, we consider the implication of those effects on the continued existence of the species and the destruction or adverse modification of proposed critical habitat.

In particular, we examine the scientific data available to determine if an individual's probable responses to the agency action's effects are likely to have consequences for the

individual's growth, survival, annual reproductive success, and lifetime reproductive success. When individual animals exposed to an action's effects are expected to experience reductions in fitness, we would expect reductions in the abundance, reproduction rates, or growth rates (or increase the variance in these measures) of the population those individuals represent. On the other hand, when animals are not expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations.

In determining whether individual Cook Inlet beluga whales would be affected, it is necessary to analyze when, where, and how an animal would be exposed to the various activities associated with construction and operation of the crossing. During the analysis, several assumptions were made about their habitats, hearing abilities, and behaviors to reach the conclusions. The ESA does not require scientific certainty. In this opinion, NMFS has utilized the best available scientific data to evaluate the consequences of the proposed crossing on the endangered Cook Inlet beluga. Despite this fact, there exist numerous data deficiencies and uncertainties that limit our ability to accurately forecast the future with the existence of this crossing. These include biological, ecological, political, social, and economic uncertainties. When we encounter uncertainty, we have attempted to assign significance to it with respect to our analysis of impacts and its possible consequence in our determinations.

In considering uncertainty here, we are cautious not to draw upon speculation and unsupported assumptions, but rather consider uncertainty as an adjunct to a decision making process built on scientific knowns. For example, the proposed crossing is likely to result in the taking of Cook Inlet belugas by noise harassment. NMFS scientists have developed population viability models and extinction risk analyses that describe the impacts of mortalities within this DPS to their survival and recovery. Those models, however, do not include a conversion factor by which harassment takes can be assessed; how many harassments would equate to a mortality event? While science has not produced an answer to this question (uncertainty), a reasonable impact assessment can still be arrived at by considering the status of the population, current growth trends, the reactions of whales to harassment, the consequence of that reaction to individuals, and the impact of those individual reactions to the population, along with the uncertainty of the relationship between harassments and mortalities. Were we to find little likelihood of a relationship between harassment and mortality, for example, the overall impact to this DPS might be low or moderate. But by including a finding of a high likelihood that harassments are linked with some mortality, the overall impact may become very significant.

Uncertainty is also considered as we manage risk. We know the Cook Inlet beluga DPS exists at a highly precarious state; having a twenty-six percent probability of extinction within 100 years. The consequence of uncertainty to our ability to recover these whales is great. To avoid Type II errors, (i.e., concluding that the animal was not affected when in fact it was) in situations with many unknowns or uncertainties, we may assume an effect would occur, thereby providing the "benefit of the doubt" to the species. The acceptability of risk is clearly dependent on the status of the species/habitat in question,

and extremely low for populations such as the Cook Inlet beluga. The Cook Inlet beluga whale exists as a small and distinct population that is both physically and genetically isolated from other beluga whale stocks. The population may have numbered more than 1,300 prior to unsustainable levels of removals by subsistence hunting over several decades. The population is now estimated at 340 (2010) whales and has been designated as endangered under the ESA. Our best population model places the risk of extinction at 26 percent within the next 100 years. The additional annual loss of even a single whale would add significantly to this probability (NMFS 2008). The Cook Inlet DPS now may exist within the “collapsed” or “small population dynamics” phase of a population (Figure 7). Here, certain biological factors and stochastic (random) events are expected to have disproportionally larger impacts on the population. Beluga whales have a low calving rate, birthing a single calf every two to three years. Cook Inlet beluga whales have a small range and appear confined to this inlet. Because these whales occupy the most populated and developed region in the state, they must compete with various anthropogenic stressors, including habitat development, pollution, and harassment. These whales often occur in dense aggregations within small nearshore areas, where they are predisposed to adverse effects such as oil spills, poaching, pollution, ship strikes, and disease outbreaks. Live strandings are not uncommon for Cook Inlet beluga whales, and have resulted in deaths. Killer whales foray into the upper Inlet to feed on beluga whales, and this predation is an example of the disproportionate impact associated with the “small population dynamics” phase. Should a killer whale pod take ten whales annually, a population with 1,000 or more animals could easily sustain that level of removal. However, with a population of 340 Cook Inlet beluga whales, this predation rate would represent a large portion of that year’s recruitment (growth) rate. The longer a population exists within the “small population dynamics” zone, the higher the extinction risk. Unfortunately, the Cook Inlet beluga may exist at this zone for some time because of its: 1) low abundance, 2) low growth potential, and 3) lack of observed recovery, despite restriction on subsistence harvest, believed to be the principle stressor to the population. Throughout this critical zone, NMFS believes extraordinary caution is warranted for any actions that may impair the performance of individuals within this DPS.

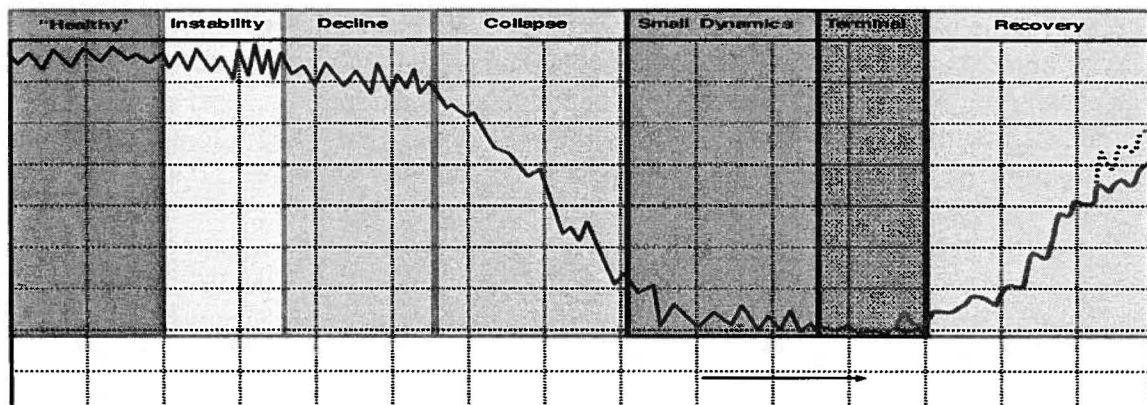


Figure 7. Population trajectory phases

Synthesis

The primary concern associated with the impacts of the proposed action on the Cook Inlet beluga whale has to do with potential impacts due to noise. Exposure to anthropogenic noise may affect these whales by impacting their hearing (temporary threshold shifts or permanent threshold shifts indicating mechanical damage to the ear structure), by masking whale communications, or affecting their behavior (harassment). Therefore, the subject of noise receives much attention in our analysis. There is still uncertainty about the potential impacts of sound on marine mammals, on the factors that determine response and effects, and on the long-term cumulative consequences of increasing noise in the world's oceans from multiple sources (e.g., NRC 2003, 2005). Beluga whales are classified as mid-frequency sensitive, and have hearing sensitivities between 40 Hz and 150 KHz.

Ketten (1998) reported that hearing loss can be caused by exposure to sound that exceeds an ear's tolerance (i.e., exhaustion or overextension of one or more ear components). Hearing loss could result in an inability to communicate effectively with other members of its species, detect approaching predators or vessels, or echolocate (in the case of the toothed whales). Some studies have shown that following exposure to a sufficiently intense sound, marine mammals may exhibit an increased hearing threshold, a threshold shift, after the sound has ceased (for example, Nachtigall et al. 2004; Kastak et al. 1999; Schlundt et al. 2000; Finneran et al. 2002). Thus, a threshold shift indicates that the sound exposure resulted in hearing loss causing decreased sensitivity. This type of hearing loss is called a temporary threshold shift if the individual recovers its pre-exposure sensitivity of hearing over time, or a permanent threshold shift if it does not.

Whether or not a temporary or permanent threshold shift occurs will be determined primarily based on the extent of inner ear damage the received sound and the received sound level causes. In general, whether a given species will tend to be damaged by a given sound depends on the frequency sensitivity of the species. Permanent threshold shifts are less species dependent and more dependent on the length of time the peak

pressure lasts and the signal rise time. Usually if exposure time is short, hearing sensitivity is recoverable. Noise can also cause modification of an animal's behavior (for example, approach or avoidance behavior, or startle).

When noise interferes with sounds used by the marine mammals (for example, interferes with their communication or echolocation), it is said to "mask" the sound (for example, a call to another whale might be masked by an icebreaker operating at a certain distance away). Noises can cause the masking of sounds that marine mammals need to hear to function (Erbe et al. 1999). In a given environment, the impact of a noise on cetacean detection of signals likely would be influenced by both the frequency and the temporal characteristics of the noise, its signal-to-noise ratio, and by the same characteristics of other sounds occurring in the same vicinity (for example, a sound could be intermittent but contribute to masking if many intermittent noises were occurring). It is not known whether (or which) marine mammals can (Erbe and Farmer 1998) and do adapt their vocalizations to background noise.

Available evidence also indicates that behavioral reaction to sound, even within a species, may depend on the listener's sex and reproductive status, possibly age and/or accumulated hearing damage, type of activity engaged in at the time or, in some cases, on group size. For example, reaction to sound may vary depending on whether females have calves accompanying them, whether individuals are feeding or migrating. Response may be influenced by whether, how often, and in what context, the individual animal has heard the sound before. All of this specificity greatly complicates our ability, in a given situation, to predict the behavioral response of a species, or on classes of individuals within a species, to a given sound. Because of this, we attempt to take a conservative approach in our analyses and base conclusions about potential impacts on potential effects on the most sensitive members of a population.

For some beluga whales that respond behaviorally or physiologically to the sounds associated with the crossing, the response could rise to the level of harassment such that an animal is "taken." The ESA does not define harassment. However, in this opinion, we define harassment as an act which creates the likelihood of injury to an individual animal by disrupting one or more behavioral patterns that are essential to an individual animal's life history or to the animal's contribution to a population, or both. This does not mean that a beluga whale that is harassed would be prevented from an essential activity. It is meant to differentiate reactions with possible biological significance from other reactions without consequence; such as slight changes in direction or a slowing of swim speed. In Cook Inlet, it is difficult to observe harassment of an animal because beluga whales dive or stay submerged. It is not known in most instances if behavioral patterns would be disrupted, if the animal is not able to complete some reproduction-related, feeding, or other activity, or if the animal is likely to be injured. Some information on whether an animal would be disrupted by certain environmental factors is available through published studies and observations. At times, information on closely related species was applied to the Cook Inlet beluga whale in this opinion.

Tertiary effects, those resulting in population-level changes including increased mortality, reduced reproductive rate, or habitat abandonment, are also not well understood. A metric for the impacts of noise exposure on critical biological parameters such as growth, survival and reproduction is needed. Unfortunately, as Wartzok et al. (2004) points out, no such metric is currently available. It is likely to take decades of research to provide the analytical framework and empirical results needed to create such a metric, if one in fact is ultimately even viable (Southall et al. 2007).

While NMFS has yet to promulgate regulations or issue guidance positing specific numerical dB thresholds under the MMPA or ESA, NMFS has been in the practice of using 160 dB re 1 μ Pa for impulsive sound and 125 dB re 1 μ Pa for continuous sound as proxies for “take” in Cook Inlet. This step function approach was a compromise intended to afford reasonable protection to a large suite of marine mammals, and may not present accurate thresholds for beluga whales. There is research to suggest that the harassment levels currently accepted by NMFS might be significantly below the levels of noise that actually harass or injure beluga whales (Southall et al. 2007). Also, an acoustic source may have radically different effects depending on operational and environmental variables, and on the physiological, sensory, and psychological characteristics of exposed animals. In many cases, specific acoustic features of the sound and contextual variables (e.g., proximity, subject experience and motivation, duration, or recurrence of exposure) may be of considerably greater relevance to the behavioral response than simple acoustic variables such as the received sound level. These factors make it difficult or impossible to justify basing broad, objective determinations of impact thresholds on received levels alone (Southall et al. 2007).

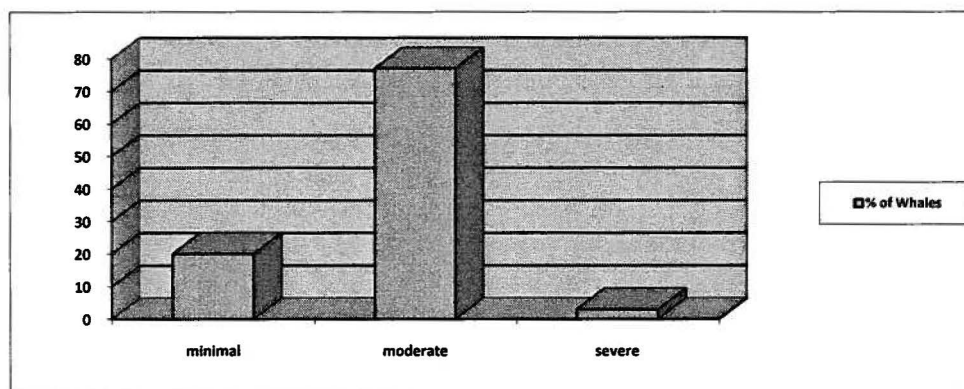


Figure 8. Behavioral Reaction of Cook Inlet Beluga Whales to Noise

Therefore it is likely the reactions of Cook Inlet belugas to in-water noise do not tightly follow the 120/160/180 dB step function NMFS currently recognizes, as the thresholds for harassment takes by continuous noise, harassment take by impulsive noise, and injurious takes, respectively. Rather, a few whales exposed to moderate to high noise levels (e.g. 120-180dB) will show little or no reaction (Figure 8). The majority will experience some level of reaction that might include behavioral changes without biological significance or more significant reactions that could cause whales to avoid the sound source, change surfacing behavior, or alter their vocalizations. Finally, a few whales could have acute reactions to these sounds. We would describe acute reactions as those presenting higher biological significance to individuals than a “take”, and might include injury through PTS or abandonment of important habitats (such as feeding, rearing, or predator-avoidance habitat) with consequence to their well being.

Underwater sound levels in the Cook Inlet are comprised of multiple sources, including physical noise, biological noise, and man-made noise. Physical noise includes wind, waves at the surface, currents, earthquakes, ice, and atmospheric noise. Biological noise includes sounds produced by marine mammals, fish, and invertebrates. Man-made noise consists of vessels (small and large), oil and gas operations, maintenance dredging, aircraft overflights, and construction noise.

Blackwell and Greene (2002) reported ambient levels, devoid of industrial sounds, at Birchwood in Knik Arm (north of the crossing alignment) at approximately 95 dB, to more than 120 dB for locations in lower Knik Arm near the Port of Anchorage. At the mouth of Eagle River, they reported ambient levels at approximately 107.2 dB re 1 μ Pa. Blackwell (2005) reported background levels, not devoid of industrial sounds, without strong currents at 115 to 118 dB. Background levels with strong currents were measured between 125 and 132 dB. URS Corporation (2007) reported ambient levels at 105 to 120 dB when no industrial sounds were identified to background levels between 120 and 140 dB when other vessels were operating. Scientific Fishery Systems, Inc. (2009) indicated background levels ranged from 120 to 155 dB, depending heavily on wind speed and tide level. All of these studies indicate measured background levels are rarely below 125 dB, except in conditions with no wind and slack tide. This means that in-water continuous noise levels at which NMFS determines whales to be “taken” by harassment are commonly exceeded by ambient conditions in Knik Arm, the whales obviously having adjusted to such levels.

This Biological Opinion has considered the effects of construction and operation of the Knik Arm Crossing on endangered Cook Inlet beluga whales. These actions are likely to adversely affect these whales due to vessel operations, noise from piledriving and other construction equipment, and from operational noise, including traffic on the elevated crossing structure. Elevated noise levels in the marine environment could alter the hearing ability of whales, causing temporary or permanent threshold shifts. However, we would not expect whales to remain within ensonified areas long enough to cause such effects, and information suggests most continuous and impulsive underwater noise levels would be at levels or durations below those expected to injure hearing mechanisms. Similarly, increased levels of in-water noise may mask communication between beluga

whales. Erbe (2000) predicted low speed vessels could mask the sounds of killer whales at a range of 1km. Any such effect would be partially mitigated by the difference in frequencies between much of the construction noise and beluga calls. Beluga whales have been found to adjust their echolocation clicks to higher frequencies in the presence of background noise (Au et al. 1985). Nonetheless, construction activities present concerns with respect to hearing, and should be closely conditioned and monitored to avoid these effects.

The DOT estimates the (maximum) total take of Cook Inlet beluga whales during construction to be 30 per year, or 150 over a five year construction period. The majority of these takes are likely to be by harassment due to acoustic exposure to construction noise. However, these estimates concern “takes” as defined by the Marine Mammal Protection Act, and are not necessarily indicative of all direct and indirect effects to beluga whales or their habitat. Cook Inlet beluga whales could be exposed to construction noise exceeding 180 dB. These levels are believed to be capable of damaging hearing in whales by creating permanent threshold shifts. The numbers of whales expected to be so-exposed is very small, and should be mitigated to a large extent by timing certain activities to avoid high-use periods of August through November and operational monitoring to stop activities when whales are within or about to enter the specified safety zones. Similar monitoring of pile driving at the Port of Anchorage has been effective in preventing whales from entering these injury zones. No lethal takes are expected. These estimates for harassment takes (30/yr) were derived through density estimates from various sources that may not reflect the actual numbers of whales in these particular areas, sound propagation figures which are derived from models that may differ from actual conditions, and an assumed “take” received sound level of 160 dB or 120 dB (for intermittent and continuous noise, respectively), which may be higher or lower than the actual levels that elicit biologically-significant response from the whales. However, the estimates appear reasonable in view of reported data for other projects in Cook Inlet.

As discussed earlier, there is concern that received levels below these thresholds are detectable by whales and may cause some behavioral reaction. The numbers of animals so-effected cannot be determined or estimated, depending on many factors including the specific sound propagation characteristics of the area and the numbers, location, age and sex of the receiving whales. There is concern for whales abandoning feeding areas when exposed to construction noise, or that the noise from the crossing may inhibit whales from passing through the alignment in order to access important habitat areas. As has been noted in several papers, the reaction of beluga whales to sound stimuli is more closely related to context (i.e., the recent experience of the whale with the sound stimulus, their current activity, and their motivation to remain or leave) than received sound levels (Wartzok et al. 2004, Southall et al. 2007). Feeding appears to be one of if not the most important habitat attribute for Knik Arm, and feeding whales are often more tolerant to noise and disturbance. Experience elsewhere in Cook Inlet supporting this finding has been described in this opinion; notably the continued occupation of the Sustina River delta by feeding whales despite being actively pursued and hunted during past subsistence harvests.

The operational impacts of the KAC are not considered to present significant direct or indirect consequences to CIB or their critical habitat, nor to significantly contribute to the existing baseline and to cumulative impacts. Spills from the crossing may occur, but would be at very low probabilities. Runoff would present a chronic source of pollution into Knik Arm, but at modest levels. Some of the runoff associated with the crossing would be generated without the project, and higher up within the Knik Arm system, as that traffic would continue to use existing bridges. Lighting of the structure may be detectable to whales, but its impact is unknown. We have few data to predict the levels of in-water noise from the crossing during operation. Noise from the structure is likely to pass into the water column, but given the source levels (road noise), should not generate noise capable of or expected to result in the injury or harassment of whales. The structure is likely to be detectable by whales, given their acute hearing and echolocation abilities, but this would not necessarily elicit a biologically-meaningful reaction by individual whales nor to the population. The effects of operational noise on beluga behavior are discussed further below.

A significant issue with regard to the crossing project's effect on beluga whales concerns their behavior when confronted with physical and acoustic disturbance during construction. Numerous studies of large mammals (Frid and Dill 2002) document the detrimental effects of human-caused disturbance on behavior, reproductive success, and parental investment. Even non-lethal anthropogenic disturbance may evoke reactions similar to those associated with the appearance of a predator. High levels of predation risk (or human disturbance) may indirectly effect survival and reproduction by causing prey (in this case, beluga whales) to divert a large proportion of time and energy away from resource acquisition, so that body condition deteriorates and survival and reproductive success are reduced (Frid and Dill 2002). Often, intense disturbance will cause animals to shift habitats, even at the cost of reduced access to resources, or to remain in preferred habitats if alternative sites are not available or of such quality that the net benefit of remaining exceeds that of adopting alternative habitats. We considered this effect in our evaluation. Such a theory is consistent with the lack of recovery by this population despite the fact that hunting has not been a significant factor since 2005. The reasons for this lack of observed recovery are unknown, but may also include predation by killer whales, strandings, habitat loss, or pollution. Also, the area most-affected by noise from the KAC would not include primary feeding habitats, but rather passage and resting habitats (albeit with some feeding behavior occurring). Any diminished use of this area may not, then, result in significant effects to individual fitness. We also note that the observations from the Port of Anchorage monitoring and TEK indicate Cook Inlet beluga whales will continue to utilize important habitats despite the presence of disturbing stimuli. Beluga hunters report that the whales do not leave the feeding areas off the Susitna River during spring even as the hunt progresses.

An uncertainty in this analysis concerns whether beluga whales' continued passage through the alignment would be impaired, diminished, or prevented during construction or operation. Observations of beluga whales passing under and next to pile supported structures and bridges have been presented earlier in this opinion (see also Appendix F of the BA). We were unable to find any published accounts of beluga whales' reaction to

overhead structure, and few reports of reaction to noise in general. There are anecdotal accounts of cetaceans reacting to bridges, and several well-documented accounts of baleen whales entering coastal tributaries in California. Efforts to drive humpback whales out of the Sacramento River were complicated by the whale's reluctance to pass under a bridge. In October 1997, nineteen killer whales entered Dye's Inlet near Bremerton, Washington and remained in these waters for a month. Responders there reported the whales were seen to be reluctant to pass under the Warren Avenue Bridge, although they eventually did so. There is considerable uncertainty regarding the reaction by whales to the bridge; specifically if whale movement through the site would be impaired or diminished. The significance of this uncertainty is important to our assessment. We consider the probability that most whales would not pass through the construction site, or under the operational bridge, to be low. However, the consequence of these whales failing to pass here could be very great, particularly if this exclusion or diminished use deprives them of important habitat areas that provide for vital life history functions, such as feeding or calving; and if alternative habitat sites cannot be utilized.

Construction noise will be significant, but largely mitigated by the construction plan that would limit the most significant sources of in-water noise, impact and vibratory pile driving, to the period December 1 to July 31, avoiding the time most beluga whales are occupying Knik Arm. Construction effects due to noise are not anticipated or projected to reach levels capable of harassment within important whale habitat farther up Knik Arm, beginning at Eagle Bay. The KAC alignment is as far south as possible while avoiding a deep canyon off Cairn Point. With this site selection, the crossing is proximate to the Port of Anchorage, Port McKenzie, the Anchorage waterfront, and the take off and approaches to JBER and the Anchorage Merrill Field airport. This acts to keep the crossing structure and its operational and construction noise footprints within an area of Knik Arm already subject to anthropogenic noise. Importantly, beluga whales presently continue to occupy and pass through this heavily-ensounded portion of Knik Arm.

Impacts of construction would be further mitigated by the employment of oscillation technology for placement of the main pile support system for the bridge. This procedure avoids the high in-water noise levels associated with impact hammering and vibratory means of pile placement and should have much less potential to harm or harass beluga whales.

In general, scientific literature describes the following reactions by beluga whales as most common with exposure to anthropogenic noise: altered headings, fast swimming, changes in dive, surfacing, respiration, feeding patterns, and changes in vocalizations. Death and injury are recorded but very rare, and associated with much higher source levels than presented by the proposed project. Though behavioral reactions are possible, monitoring reports of construction at the nearby Port of Anchorage show no apparent observable reaction of Cook Inlet beluga whales to construction noises and suggest that construction activities are not influencing beluga whale abundance or habitat use around the Port of Anchorage (USDOT 2009). There could be a number of reasons for this, including, but not limited to: 1) Cook Inlet beluga whales have demonstrated a tolerance

or adaptation to commercial vessel traffic and industrialization around the Port, or may be habituated to such noise; 2) Cook Inlet is a naturally noisy environment which raises ambient sound levels; 3) beluga responses to construction and dredging are not detectable by existing data collection methods; and 4) the need to meet certain life history requirements, such as acquiring food, overrides avoidance reactions. Research on the effects of ship noise on southern resident killer whales in the San Juan Islands (Bain et al. 2006) found whales spent more time travelling and less time foraging in the presence of boats within 400 meters. These killer whales also travelled in less direct paths and had longer average durations between breaths when vessels were present compared to when absent within 1000 meters. They found no significant difference in swim course or speed due to vessel traffic. This study concerned whale watching vessels that were approaching the killer whales at various distances. The results may not be applicable to the KAC, both due to the different species involved and the fact that construction vessels associated with the bridge should not move in relation to whales, other than to avoid them.

Opportunistic sighting reports and those from marine mammal observations describe accounts of beluga whales vocalizing around tugs and barges, swimming near and around ships, and feeding around working vessels and newly filled land. While beluga whales will be exposed to greater background noise during construction, background sound levels in Knik Arm are already higher than many marine and estuarine systems due to strong currents and eddies, wind, recreational vessel traffic, commercial shipping traffic entering and leaving the Port of Anchorage, and military, private, and commercial aircraft operating in the immediate vicinity. It appears unlikely that belugas would alter their behavior in a way that prevents them from entering and/or transiting through the crossing. This conclusion is supported by the fact that construction, particularly dredging, has been an annual event at the Port of Anchorage for decades, during which time beluga whales have been consistently seen in these waters. Beluga whales are routinely observed within the footprint of the POA expansion project, often in areas closest to the port, within 0.5 km of shore (Cornick and Kendall 2008). As mentioned earlier, it is possible and may be likely that a percentage of those whales occupying Knik Arm would react more strongly than others to construction noise and activity. We would expect this number to be small. Given that the highest numbers of whales found in Knik Arm at any one time is on the order of 100, possibly less than 10 of these may show strong avoidance reaction, and some may abandon the habitat altogether during construction.

Our assessment of possible behavioral reactions to the crossing also considered site fidelity by beluga whales. As previously stated, beluga whales in Cook Inlet appear to exhibit some fidelity to several upper-Inlet sites during the ice-free months, but few data presently exist regarding any demographic divisions within this population. Fidelity to habitat sites is strong within some other beluga populations (e.g. St. Lawrence), and less so with other populations such as the Eastern Beaufort Sea stock. Rugh, Sheldon, and Hobbs (2010) found Cook Inlet beluga distribution to have changed over the last decades, and suggest this may be due to their reduced numbers that allows the whales to select only the most productive habitat areas. This apparent redistribution indicates this characteristic is at least somewhat flexible for the Cook Inlet belugas, and that any reduction in the use of upper Knik Arm by beluga whales might be offset by their

adaptive use of other habitat areas in the Inlet. This adaptive behavior also appears probable in view of the fact that only a portion of the Cook Inlet DPS occurs in Knik Arm at any one time, while the remainder of the whales occupy other (and presumably similar) habitats elsewhere. We would not expect all beluga whales to fail to pass through the crossing alignment (during construction or operation). Because of this, and the presently lower population size, the productivity and habitat value of alternative sites should be capable of providing for the nutritional and other requirements of the small numbers of whales that may experience any reduced use of upper Knik Arm habitat. While these alternate habitat sites may be fully-utilized by a recovered Cook Inlet beluga population, this would not occur for decades; long past the construction period for the KAC.

Any reduction in the availability of, or access to, foraging habitat could have consequence to individual fitness. Williams et al. (2006) considered the impact of exposure to vessels (these were mostly fishing vessels rather than whale-watching vessels) by northern resident killer whales in British Columbia. They found these whales reduced the time spent feeding from 13 per cent to 10 per cent when boats were present, but concluded the net energetic effect of this was small; increasing by 3 per cent in the presence of vessels. However, they estimated the lost opportunity to feed resulted in a 28 per cent decrease in 12 hour energetic gain. This study found that, while northern resident killer whales may be able to balance the energetic costs of avoiding boats, such short-term behavioral responses can carry energetic costs that could have long-term population effects if the population were food-limited. At this time, NMFS is not aware of evidence to support the theory that the Cook Inlet beluga whale population is so-limited.

We would expect any diminished use of Knik Arm by beluga whales to recover after construction. Morton and Symonds (2002) describe the effects of acoustic harassment devices on killer whales in Johnstone Strait near Vancouver Island. Operation of those devices, designed to deter harbor seals, coincided with a marked decrease in the numbers of killer whales in the area. The harassment devices operated at 10kHz, a frequency that would be particularly sensitive to mid-frequency cetaceans such as killer whales and beluga whales. However, when the use of the devices ended, killer whale occurrence re-established to baseline levels.

Any possible reductions in passage through the alignment would be mitigated in part through construction timing to avoid periods of high beluga use. Also, because behavioral reactions by beluga whales are highly dependent on context; that beluga (and other) whales are often more tolerant of disturbance when feeding; that beluga presence in Knik Arm is associated with anadromous fish runs and much of their behavior here is assumed to be related to foraging; and because beluga whales have demonstrated tolerance to noise sources (Richardson 1995); we believe there is reasonable certainty that passage through the alignment will not be impaired to the point of biological significance. We note here, however, that other habitat functions of Knik Arm may exist but are presently unknown or poorly described. Functions such as breeding or calving may be particularly sensitive to noise and harassment, and elicit more pronounced reactions by these whales. If this were to occur, it is possible some reduced access to

such habitat sites may have biological consequence, possibly at population levels. Field observations (Funk et al. 2005) have noted higher percentages of calves within beluga groups in Knik Arm than in the Susitna River area. TEK has also identified upper Knik Arm as a traditional nursery site. However, calves and juvenile whales have been observed throughout sites in upper Cook Inlet, and the Funk et al. 2005 paper was not able to determine whether Knik Arm was representative of beluga whale use at other sites in the Inlet or if the area was selectively used by certain age or sex classes. Also, the fact that juveniles and calves are often observed in Knik Arm indicates the present gauntlet of noise in lower Knik Arm is not preventing them from accessing and utilizing habitats to the north.

NMFS' review of distributional data within Knik Arm found some increased use during May, possibly associated with the spring eulachon runs. To provide further insurance against construction impacts to whales, we propose a Conservation Recommendation to modify pile driving operations in May by halting work within 2 hours either side of low tide; a period when whales would be expected to be found closer to the crossing site.

Integration

We have considered the *project effects* to Cook Inlet beluga whales and their proposed critical habitat. We believe the construction of the KAC will result in the harassment of beluga whales. The majority of such harassment would be due to noise associated with pile driving and vessel operations. The most likely manifestations of this harassment would be a temporary change in the behavior of beluga whales, avoiding the sound source by navigating around it or passing through the ensonified area with fewer surfacing intervals. The most often observed beluga whale behaviors in the area of the crossing alignment have been travelling and diving, while known or suspected feeding was often seen as a secondary or third-level activity. Feeding behavior was found to be the primary activity by beluga whales within Eagle Bay, but this area is more than 4.5 miles from the crossing. Whales here are not expected to be significantly impacted by noise from the project because of the attenuation of in-water noise at this distance and the timing restrictions for impact and vibratory pile driving to occur outside the August through November period when most whales are present.

Studies have estimated one hundred or more beluga whales may occur in Knik Arm; or approximately thirty percent of the total population. Markowitz et al. 2005, in shore-based observations in 2004, found ninety percent of the annual sightings of beluga whales in Knik Arm occurred between August 1 and November 30. This is consistent with other observations and tagging data from NMFS and observations made at the POA (ICRC 2010). A small percentage of these whales may be reluctant to continue to occupy or pass through the construction site. Those whales would likely move into alternative sites with similar habitat properties. Any such effects would be significantly mitigated by the construction schedule that restricts all impact and vibratory pile driving to the period December 1 to July 31.

Impacts to beluga whales from operation of the KAC are unlikely to have significant adverse consequence to individuals or to the population.

The ***baseline condition*** experienced by the Cook Inlet DPS of beluga whales is characterized by its very low abundance, no observed recovery within the population (NMFS currently estimates a negative 1.1% growth rate), and a high (26%) probability of extinction within the next 100 years. The additional mortality of a single animal would accelerate this extinction timeframe. At the same time, this population faces continuing but unquantified threats from both anthropogenic and natural sources. Although NMFS believes past excessive harvest removals are largely responsible for the decline of this DPS, we are not able to identify the present cause(s) for their lack of recovery. While shoreline construction within lower Knik Arm has been extensive, and an important aspect of the baseline condition, we have no evidence such work has had any significant detrimental impact to individual whales, nor to this population.

Cook Inlet beluga whales are currently being legally harassed due to authorized construction at the Port of Anchorage and by certain scientific research. These takes have been determined not to be significant to the recovery of this DPS. Illegal harassment is likely occurring as a result of small vessels operations, aircraft overflights, and other actions by humans. We are unaware of any on-going lethal or injurious takes, although unobserved, unreported, and illegal harvests are possible. Therefore, a cautious and conservative approach to threats is appropriate and necessary in view of the baseline condition.

Our review of the ***cumulative impacts*** to Cook Inlet beluga whales also found some unquantified level of threats from activities without a federal nexus, and for which no consultation would occur under the ESA. Of these, we believe recreational vessel traffic may be of most concern, with the potential to harass beluga whales, displace them from important feeding habitat near the mouths of certain salmon streams entering the upper Inlet, and to injure whales due to strikes. However, it appears beluga whales continue to occupy feeding areas despite small boat traffic (indeed, beluga whales remained within feeding habitat of the Susitna Delta despite being actively pursued and hunted during past subsistence harvests). Ship strikes have not been identified as the cause of death for any stranded whales, although many stranding investigations are inconclusive.

On integrating the effects of the proposed KAC on beluga whales and their proposed critical habitat with the environmental baseline and cumulative effects, individual or groups of whales are likely to be harassed by construction noise, but we do not believe this project would have significant adverse consequences at the population/DPS level. Beluga whales are unlikely to be killed or injured by this project, and harassment would be expected to be localized and temporary. Whales will experience higher than ambient noise levels when approaching the crossing, but such noise would degrade to background levels within relatively short distances. The most pronounced increase in noise levels would occur during driving and removal of temporary piling. However, the proposed construction plans restrict these activities to the period of lowest occurrence by beluga whales in Knik Arm. While beluga whales have been and continue to be taken under the environmental baseline and through cumulative effects, we believe such takes are non-lethal and occur mostly due to harassment and disturbance by noise. It is not presently

possible to quantify the effects of this harassment on the extinction risk probabilities for this DPS. However, it is unlikely that non-injurious takes, such as unintentional harassment due to noise, nor the expected effects of the KAC on proposed critical habitat, would elicit consequences to the survival or reproductive capacity of the Cook Inlet beluga whales.

Conservation measures are included in this opinion which, along with operational conditions and mitigative measures in the proposed plans, would further reduce the likelihood for biologically significant impacts to individual whales or this DPS.

Mitigative Measures

In the BA, KABATA and FHA have identified the following mitigative measures, which are adopted here as part of the proposed action. We believe these measures will lessen the effects of the KAC on Cook Inlet beluga whales. Further, such measures may be associated with conditions necessary for authorization of this work under section 101(a)(5) of the Marine Mammal Protection Act. We note that some of the measures proposed by KABATA and FHA are not specific or do not include detailed descriptions. NMFS will coordinate on these matters as the project planning process continues to ensure the objectives will be implemented and effective.

- using drilled-shaft technology for the large-diameter, permanent bridge piers as opposed to driven piles originally proposed in the KAC EIS, significantly reducing in-water noise exposure
- increasing bridge span lengths from the 250-foot spans discussed in the KAC FEIS to 275-foot spans, reducing the number of bridge piers from 33 to 29
- scheduling temporary pile-construction activities when beluga whales are not in Knik Arm or the KAC project area in large numbers (specifically, between December 1 and July 31)
- implementing a soft-start application for initial pile-driving operations
- avoiding simultaneous installation and/or removal for moorage, dock, and template piles in different locations (*Exception:* Whenever beluga whales are not present in the project area and weather conditions are favorable, KABATA will however, coordinate with NMFS to determine whether pile driving at multiple locations would be acceptable to minimize the project's in-water duration of disturbance.)
- monitoring construction-related acoustics to determine appropriate safety zones around pile-driving activities
- implementing a multiple-observer monitoring program with mandatory shut-down procedures to avoid injury and minimize potential harassment to beluga whales
- implementing a construction contractor specification to maximize vessel-free beluga passage zones during construction
- implementing NMFS vessel operation guidelines to minimize construction vessel operation impacts
- implementing measures to protect water quality and flows in receiving waters

- focusing mitigation for fill impacts required for roadway approach construction to maximize fishery enhancements in Knik Arm
- preventing the construction of a boat launch ramp facility in association with the project so that no direct access to tidelands is provided
- developing an Adaptive Management Plan in close coordination with NMFS

VII. CONCLUSION

After reviewing the current status of the Cook Inlet beluga whale, the environmental baseline, the effects of the proposed action, and the cumulative effects, it is the opinion of NMFS that the implementation of the proposed action, as described in this opinion, is not likely to jeopardize the continued existence of the Cook Inlet beluga whale nor to destroy or adversely modify its proposed critical habitat.

VIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. KABATA should revise their crossing design to decrease the length of the eastern abutment fill by approximately 800 feet, or to Station 810+00 as depicted in the November 2009 Proof of Concept Geological Section. This action would reduce the loss of critical habitat and present fewer long-term impacts to beluga whales which utilize the near shore areas of Knik Arm along this shoreline.
2. KABATA or DOT should develop and implement a noise-reduction protocol for vessels. This plan should consider operational and engineering opportunities to reduce noise and may include such measures as using gaskets to isolate noise sources (e.g. engines, generators, winches), using moorings rather than propellers to maintain position, using non-powered barges and platforms in lieu of powered vessels, vessel speed limitations, access points, and travel corridors.
3. KABATA or DOT should halt impact and vibratory pile driving during the month of May within two (2) hours either side of low tide to reduce the exposure of beluga whales to this noise source during the spring eulachon migration.
4. KABATA or DOT should develop a vessel operator beluga whale awareness briefing and operational practices to reduce the effects of construction vessels on these whales. KABATA and/or DOT should consult with NMFS to develop this program and information.

In order for the NMFS, Alaska Region to be kept informed of actions minimizing or avoiding adverse effects or benefiting the endangered Cook Inlet beluga whales, we request notification of the implementation of any conservation recommendations.

IX. REINITIATION of CONSULTATION

This concludes formal consultation on this action. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent incidental take is exceeded; 2) new information reveals effects of this action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this opinion; 3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by the identified action.

X. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

This opinion does not include an incidental take statement at this time. Upon issuance of regulations or authorizations under Section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 Amendments, NMFS will amend this opinion to include an incidental take statement(s) for the described work.

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