ENDANGERED SPECIES ACT: SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Action Agency:	US Army Alaska and National Marine Fisheries Service
Activity:	The Resumption of Year-Round Firing Opportunities at Fort Richardson, Alaska
Consulting Agency:	National Marine Fisheries Service, Alaska Region
Approved By:	
Date Issued:	MAY 27, 2011

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 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 biological 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 to its designated critical habitat. If jeopardy is not likely, the biological 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.

The US Army Alaska (Army) has requested formal consultation on the Resumption of Year-Round Firing in Eagle River Flats (ERF) Impact Area Fort Richardson, Alaska. This document constitutes NMFS' biological opinion on the effects of that action on the endangered species in accordance with section 7 of the ESA. Specifically, this biological opinion analyzes the effects of the Resumption of Year-Round Firing in ERF Impact Area Fort Richardson, Alaska on the endangered Cook Inlet beluga whale (*Delphinapterus leucas*) (73 FR 62919, October 22, 2008).

In formulating this biological opinion, NMFS used information presented in the following information sources:

- 2009 Biological Assessment of the Cook Inlet Beluga Whale *Delphinapterus leucas* for the Resumption of Year-Round Firing in ERF Impact Area Fort Richardson, Alaska
- 2010 U.S. Army Draft Environmental Impact Statement for Resumption of Year-Round Firing Opportunities at Fort Richardson, Alaska
- 2008 Conservation Plan for the Cook Inlet Beluga Whale
- 2008 Status Review and Extinction Risk Assessment of Cook Inlet Beluga Whales (*Delphinapterus leucas*)
- 2008 Final Supplemental Environmental Impact Statement for the Cook Inlet Beluga Whale Subsistence Harvest
- Published scientific studies
- Unpublished data
    - NMFS, National Marine Mammal Laboratory
    - State of Alaska
    - Alaska Native communities

Consultation History

By email dated 7 April 2010, the Army requested formal consultation with NMFS on the Resumption of Year-Round Firing in ERF Impact Area Fort Richardson, Alaska with the submission of a Biological Assessment (BA) in support of its request. Year-round firing at ERF Impact Area may affect the endangered Cook Inlet beluga whale. Given that this operation would also harass several marine mammal species, the Army will apply to NMFS Permits, Conservation, and Education Division (PR1) for an incidental take authorization under the MMPA. PR1 will later enter into formal consultation with NMFS, Alaska Region.

Term of this Biological Opinion

This biological 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.

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.

Since 1997, NMFS has been using generic sound exposure thresholds to determine when an activity produces sound sufficient to affect marine mammals (70 FR 1871). For impulsive noises such as those generated by the detonation of high explosive (HE) munitions, the current numerical threshold indicative of harassment take under the ESA is 160 decibels referenced to 1 microPascal (notated as 160 dB re 1 μPa RMS SPL). The action area thus encompasses all areas that may be affected by underwater sounds equal to or greater than 160 dB re 1 μPa RMS SPL as a result of the proposed action.

While underwater noise may be the furthest reaching effect, other land-based effects associated with the proposed action, such as sedimentation or deposition of energetic compounds, has potential to impact marine mammals. For purposes of this biological opinion, the action area is defined as the ERF Impact Area (to include the section of Eagle River from the Route Bravo Bridge downstream to the mouth where it meets Eagle Bay), artillery and mortar firing points surrounding ERF Impact Area, as well as areas of Eagle Bay and Knik Arm where marine mammals may be subjected to underwater sound pressures of 160 dB re 1 μPa RMS SPL or greater as a consequence of training. Eagle Bay is roughly defined as those waters extending inland (South and East) from a straight line drawn on a magnetic bearing of approximately 192° between a point on the northernmost aspect of the bay (61° 22.33' N, 149° 43.24' W) to a point on the southwestern most aspect of the bay (61° 19.61' N, 149° 46.71 W). Using this definition, the bay possesses an approximate surface area of 2,150 acres at mean high tide.

The direct and indirect effects of this action on the endangered Cook Inlet beluga whale are expected to be confined to the action area (Figure 1).

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Presentation of the Analysis in this Biological 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 on the other sections in this biological opinion and the analyses that can be found in each section. Every step of the analytical approach described above will be presented in this biological 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 biological 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 ensure 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.

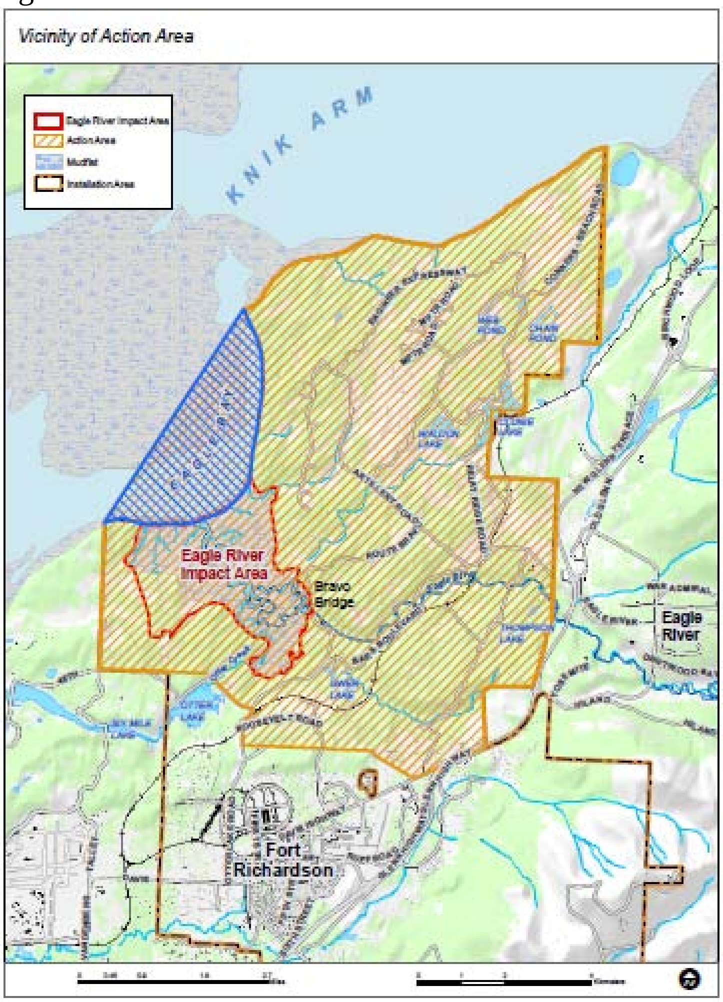
Additional requirements on the analysis of the effects of an action are described in regulation (50 CFR 402) and our conclusions related to "jeopardy" and "destruction or adverse modification" generally require an expansive evaluation of the direct and indirect consequences of the proposed action, related 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. In addition, the Courts have directed that our risk assessments consider the effects of climate change on the species and critical habitat and our prediction of the impacts of a proposed action.

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.

I. DESCRIPTION OF THE PROPOSED ACTION

The Army has requested formal consultation on the Resumption of Year-Round Firing Opportunities on Fort Richardson, Alaska. Under Alternative 2 of the Draft Environmental Impact Statement for Resumption of Year-Round Firing Opportunities at Fort Richardson, AK, year-round use of ERF Impact Area would be re-instated to provide live-fire training capabilities at former Fort Richardson (now Joint Base Elmendorf Richardson).

Figure 1. Action Area



a. Overview

The purpose of the proposed action is to remove the winter-only firing restrictions and provide year-round weapons training opportunities at ERF Impact Area in order to fulfill current military training needs at former Fort Richardson (now Joint Base Elmendorf Richardson).

i. Creation of Joint Base Elmendorf Richardson (JBER)

A 2005 decision under the Base Realignment and Closure initiative created a new managing entity called Joint Base Elmendorf-Richardson (JBER), which combined certain functions of the former Elmendorf Air Force Base (AFB) and Fort Richardson. Joint basing created a single installation and the newly formed JBER includes all real property controlled by both Elmendorf AFB and Fort Richardson, totaling more than 75,000 acres. With supporting duties subsumed by JBER, Fort Richardson and Elmendorf AFB have ceased to exist. JBER management falls under the purview of the Air Force. JBER reached full operational capability on 1 October 2010 and as a combined installation, JBER supports Alaskan Command, 11th Air Force, U.S. Army Alaska (USARAK), and more than 90 supported and tenant organizations. Although the action will be engaged by USARAK, both JBER and USARAK staff will be responsible for mitigation commitments stemming from this action. For the purpose of this biological opinion, historic activities conducted by the Army or actions specific to the Army operational mission will be referenced as Army actions, while current conservation activities will be referenced as JBER actions.

ii. Historic Use of ERF Impact Area

The ERF Impact Area at Fort Richardson, Alaska has been used for weapons training since the 1940s. A wide range of live-fire weapons has been used at this site, including mortars, howitzers, missiles, rockets, grenades, illumination flares, smoke rounds and small arms (20-mm caliber and smaller). This impact area supported heavy year-round use until February 1990 when USARAK voluntarily implemented a temporary firing suspension. In 1991, the Army resumed winter-only firing which allows use between November 1 and March 31.

Figure 2 shows the historic use of ERF Impact Area as depicted by percent crater cover. Historically, the most heavily used areas within ERF Impact Area have been in the center part of the impact area on the east and west sides of Eagle River. Analyses of aerial photographs show heavily used target areas in the center of the impact area and show distinct impact craters in those areas from over 60 years of live-fire training.

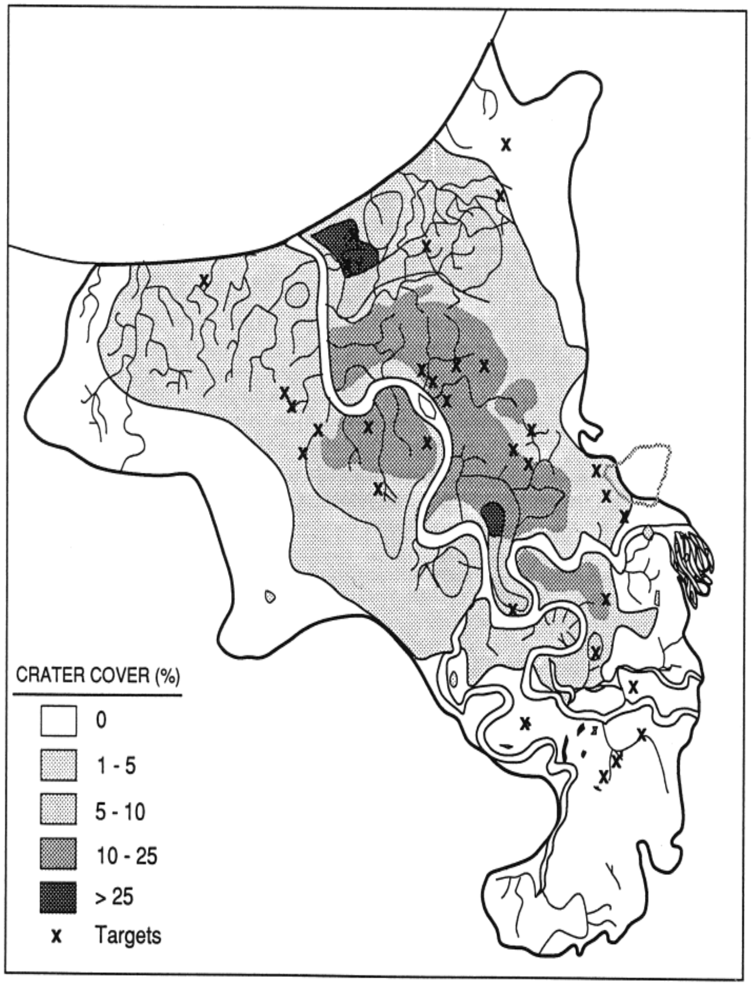
Description of Action

Currently, the Army conducts many types of required live-fire weapons training at the ERF Impact Area. Due to existing environmental restrictions, however, the Army must limit its weapons training at ERF Impact Area to the winter months when waterfowl are not present and when ice is at sufficient thickness. If Alternative 2 is selected, the proposed action would remove seasonal restrictions to allow the Army to conduct required live-fire weapons training on a year-round basis. Overall, this action would entail firing approximately 25 – 50 percent more rounds over the current baseline, subject to continuing and newly developed restrictions and conservation measures.

The Resumption of Year-Round Firing in ERF Impact Area is driven by compliance with current Army policy and regulation, which create the objectives summarized below:

- Provide year-round opportunities (within certain constraints) for live-fire weapons training at Fort Richardson

- Train units to a common standard, including use of a full array of indirect- and direct-fire weapons at Fort Richardson



- Accommodate current and future training needs of newly stationed personnel at Fort Richardson
- Limit the need for travel to other installations for small-unit training (company and below)
- Ensure long-term realistic combat training at Fort Richardson
- Reduce overall training costs

iii. Live-fire Weapon Systems

Weapons proficiency is a critical component of combat. Each unit on Fort Richardson must meet proficiency standards established in DA PAM 350-38 (U.S. Army 2008). Units must be proficient in the safe use, maintenance, and employment of specifically assigned weapons and weapon systems. Individuals and crews must meet weapons qualification standards for their weapons within munitions resourcing levels authorized by DA PAM 350-38 (U.S. Army 2008). Units stationed at Fort Richardson conduct both direct- and indirect-fire weapons training. Training standards for the 4th Brigade Combat

Team (Airborne), 25th Infantry Division (4/25 ABCT) stationed at Fort Richardson include proficiency training at ERF Impact Area using the weapons systems listed in Table 1.

Table 1. Indirect Live-fire Weapon Systems and Munitions Used at ERF Impact Area

WEAPON TYPE	WEAPON SYSTEM	MUNITIONS
Mortars	60-mm mortar (14 mortar tubes)	HE, full range training rounds, illumination rounds
	81-mm mortar (8 mortar tubes)	HE, full range training rounds, illumination rounds
	120-mm mortar (12 mortar tubes)	HE, full range training rounds, illumination rounds
Artillery	105-mm howitzer (16 guns)	HE, blank round (shotgun shell), illumination rounds, smoke (non-WP*) rounds

*White phosphorus

In addition to the indirect live-fire weapon systems listed in Table 1, all of the units on Fort Richardson are required to conduct training on individually assigned direct-fire weapons such as the M-16 rifle and the .50-caliber rifle. While these small arms may not be fired directly into ERF Impact Area, they may be fired at other ranges where the surface danger zone (SDZ) for these weapons could overlap the ERF Impact Area. A SDZ is the ground and airspace designated to contain all hazards (projectiles, fragments and other objects) resulting from weapons firing. The entire SDZ must be contained within the boundaries of the installation. Other direct-fire weapons whose SDZ could overlap ERF Impact Area include the AT4, the MK 19, and the M203 grenade launcher. These weapons systems could be fired at the 40-mm/AT4 range where the SDZ would overlap the western upland portion of ERF Impact Area. Weapons fired at the 40-mm/AT4 range would not directly impact in the ERF wetland area nor in or near Eagle River or Eagle Bay. Training with individually assigned direct-fire weapons is not part of this proposed action. Training with these direct-fire weapons would continue at JBER on existing ranges designed specifically for direct-fire weapons. The impacts from such training have been analyzed in existing National Environmental Policy Act (NEPA) documentation. The Environmental Impact Statement (EIS) and this biological opinion will assess the potential impacts from large caliber mortar and artillery training, which require a permanent explosive munitions impact area.

1. Munitions

DA PAM 350-38 (U.S. Army 2008) also contains standardization requirements for training with different types of rounds for each weapon system. To meet standardized training requirements, units must train with their weapon system and demonstrate combat ready proficiency using different types of munitions. Each type of munitions has a different purpose and soldiers must understand how and when to employ each kind. For instance, soldiers need to demonstrate proficiency with the 105-mm howitzer by firing shotgun shell rounds (blank training round), HE rounds, obscurant or smoke rounds, and illumination rounds (ILLUM). Thus, units cannot train to standard using only one type of round such as inert training rounds.

2. Inert Training Rounds

Shotgun shell rounds are inert rounds used with the 105-mm howitzer weapon system. They are blank rounds, meaning they do not have a projectile component that leaves the muzzle of the gun and travels down range. They consist simply of a shell casing fitted with a primer.

Full range training rounds (FRTR) are inert practice rounds used with the 60-, 81-, and 120-mm mortar weapon systems. A complete round consists of the projectile body, the fin assembly, a practice fuze, an ignition cartridge, and propelling charges. The projectile body is made up primarily of metal and metal alloys, such as iron, steel, copper, and brass, and inert filler consisting of waxes or other material that produces a final weight similar to an HE round. The fin assembly is typically made of aluminum or other metal. The practice fuze is made up of metals or metal alloys and contains a small amount of pyrotechnic compound that produces a flash, bang and smoke upon impact in the impact area. The ignition cartridge is fitted inside the fin assembly and contains a pyrotechnic compound, which is consumed at the moment of firing and ignites the propellant charges. A propellant charge consists of a cloth bag or container filled with a pyrotechnic compound. The first four components, including the expired ignition cartridge, comprise the projectile that travels down range and lands in the impact area. The rounds contain no HE.

3. HE Rounds

HE rounds for the 105-mm howitzer consist of the projectile body, fuze, propelling charges, and shell casing fitted with an ignition cartridge and primer. The projectile body is typically made of metal and metal alloys such as iron and steel. It is filled with HE filler and fitted with the fuze. The fuze is made up of metals or metal alloys and contains a pyrotechnic charge used to detonate the HE filler. The propellant charges consist of organic based bags or containers filled with a pyrotechnic compound and are contained in the shell casing. The shell casing is typically made of metal or a metal alloy. The ignition cartridge is fitted inside the shell casing and contains a pyrotechnic compound used to ignite the propelling charges. The primer is fitted into the end of the shell casing and typically consists of a metal cup filled with a small amount of pyrotechnic compound used to ignite the ignition charge. The projectile body and fuze are the only components that travel down range and land in the impact area.

HE rounds for the 60-, 81-, and 120-mm mortar weapon systems are similar in configuration and make-up to the FRTR; the primary difference being the filler contained in the projectile body. As with FRTR, the projectile body, fin assembly, fuze, and spent ignition cartridge travel down range as one unit and land in the impact area.

4. Smoke Rounds

At the current time, the 105-mm howitzer is the only weapon system with non-phosphorus smoke rounds in production that can be fired into wetland environments. The

105-mm smoke round is similar in configuration and make-up to the HE round except that smoke canisters and a pyrotechnic expelling charge are contained within the projectile body instead of HE filler. The smoke canisters are typically made of metal of metal alloy and contain a smoke producing compound.

5. **ILLUM Rounds**

ILLUM rounds for the 105-mm howitzer are similar in configuration and make-up to smoke rounds except that an illuminant compound is contained within the canisters instead of a smoke compound. In addition, a parachute assembly is attached to the illumination canister.

ILLUM rounds for the 60-, 81-, and 120-mm mortars are similar in configuration and make-up to HE rounds except that the projectile body contains an illumination candle assembly and parachute assembly instead of HE filler. The illumination candle assembly contains an illuminant compound. As with the other mortar rounds, the projectile body, fin assembly, fuze, and spent ignition cartridge travel down range and land in the impact area.

The information provided in Table 2 presents the type of weapon, type of round, maximum number of rounds that could be fired under the proposed action during unfrozen conditions, and the maximum number of rounds that could be fired at ERF Impact Area annually. The maximum number of rounds used annually is updated each year and sets limits on the number of rounds that can be fired to meet requirements (DA PAM 350-38 (U.S. Army 2008). The maximum number of rounds fired during unfrozen times is based on requirements for howitzer and mortar units to meet qualification standards semi-annually. In general, up to about half of a unit's training exercises could be conducted at ERF Impact Area during times when ice thickness requirements are not met. It is estimated that the maximum number of HE rounds (including all weapon systems) that could be fired at ERF Impact Area during unfrozen times would be about 3,100 (**bold** entries in the table indicate HE rounds). The Army depends heavily on practice rounds and simulators, and approximately 3,800 FRTR could be used as a component of training during unfrozen conditions (these rounds are in *italics* in the table). The actual number of rounds fired when existing ice thickness requirements are not met will be dependent upon the time of year units begin their annual training cycles.

Table 2. Indirect-fire Weapons and Live-fire Munitions to Be Used Annually at Fort Richardson

Weapon System	Type of Round	Potential Number of Rounds Fired during Unfrozen Conditions	Maximum Number of Rounds Fired Annually*^
105-mm Howitzer	**HE**	**1530**	**2998**
	Smoke	88	176
	ILLUM	224	464
	Blank round (shotgun shell)	*384*	*768*

120-mm Mortar	**HE**	**456**	**720**
	ILLUM	240	384
	FRTR	*1248*	*2256*
81-mm Mortar	**HE**	**392**	**592**
	ILLUM	152	280
	FRTR	*800*	*1600*
60-mm Mortar	**HE**	**686**	**1036**
	ILLUM	266	490
	FRTR	*1400*	*2800*

* Total number of rounds for all guns and tubes
^ Based on 2008 data from DA Pam 350-38 (U.S. Army 2008)

There are circumstances where small arms training conducted at other ranges generate SDZs that overlap with ERF Impact Area. Rounds used in such training include 5.56-mm, 7.62-mm, and .50-cal standard BALL and tracer ammunition. While the probability of an errant round reaching ERF Impact Area is difficult to quantify due to intervening topography and vegetation, the potential for adverse impacts to Cook Inlet Beluga whales within the Eagle River is considered negligible. Again, these activities are not part of the proposed action analyzed in this biological opinion and will be covered in a separate discussion with NMFS.

iv. Live-fire Training Frequency

Each howitzer and mortar unit must conduct semi-annual qualification training to maintain weapon system proficiency and battle readiness as required by Army training regulations. Frequent training is critical to ensure that all soldiers, especially those rotating into new units, are sufficiently trained and ready for combat. In accordance with Department of the Army (DA) Pamphlet 350-38, Training, Standards in Weapons Training, As Amended through October 2008 (DA PAM 350-38, U.S. Army 2008), individuals and units (collective training) are required to complete qualification and other live-fire training for assigned weapon systems.

v. Targets

Realistic training is facilitated by using realistic targets. Aiming at a realistic, visible target helps train forward observers to call in fire adjustments to the fire crew, and helps teach soldiers how to properly employ a weapon system to its maximum efficacy. Targets on ERF Impact Area generally consist of derelict vehicles placed either singly or in a line to simulate a convoy. New targets may be placed as needed and will be located outside of habitat protection buffers to comply with herein proposed and existing conservation measures as described in the most current Integrated Natural Resource Management Plan (INRMP).

vi. Restrictions

1. Restrictions on Munitions used for Live-fire Weapons Training

USAG FRA will continue permanent restrictions on the use of any munitions containing white phosphorus (WP) at ERF Impact Area. Based on the studies conducted at ERF in the early 1990s, the Army imposed a ban on firing munitions containing WP into wetlands on any of its lands anywhere in the United States. Recently, the Army has extended this ban to include all munitions with phosphorus as the primary constituent. As of early 2010, active remediation of WP contaminated areas in ERF will be complete and the Army has no plans to reinstate its use or the use of any white phosphorus munitions in ERF Impact Area or in any wetlands.

2. Restrictions on Live-Fire Weapons Training

Under current conditions, firing of artillery and mortars at ERF Impact Area is permitted during the period from 1 November through 31 March, only when ice thickness is sufficient to protect underlying WP-contaminated sediments from disturbance. The required ice cover will also inherently protect natural resources. Unless otherwise noted, the following spatial and temporal restrictions offered as part of the proposed action will thus apply only to times of the year when ice conditions are not met. Restrictions during times when ice-conditions are met will remain unchanged, unless otherwise stated.

3. Spatial Restrictions on Live-fire Weapons Training

The Army will impose spatial restrictions or habitat protection buffers within the ERF Impact Area. The term "habitat protection buffer" is defined as an area within which no targets can be placed, in order to protect natural resources. A munitions-specific habitat protection buffer is an area within which no targets can be used for specified munitions fired with a specified weapon system, in order to protect beluga whales from noise levels that could potentially exceed the defined harassment level and cause take. These spatial restrictions are designed to 1) protect marine mammal, avian, and fish habitat, 2) protect beluga whales and other marine mammals from noise, and 3) protect WP remediated areas from direct and indirect disturbance.

4. Spatial Restrictions on All Weapon Systems and Munitions

The Army/JBER has developed a number of habitat protection buffers, applicable to all weapon systems and munitions, which prohibit the targeting of and thereby protect sensitive areas and habitats within ERF Impact Area. These buffers would apply during times of insufficient ice thickness, unless otherwise noted.

1) The Eagle River habitat protection buffer prohibits intentional firing directly into the Eagle River channel from its mouth upriver to the Route Bravo Bridge. This habitat protection buffer is documented in the most current INRMP, to protect marine mammals, fish, and their habitat. This is a year-round restriction, regardless of ice conditions.

2) The proposed action would establish a 130-m habitat protection buffer on either side of Eagle River from its mouth to 100 m upstream of the Otter Creek confluence at which point the zone is reduced to 50 m on either side of the river and continues upstream to the Route Bravo Bridge. This habitat protection buffer is documented in the most current INRMP and the professional knowledge of the JBER conservation staff, and would further protect marine mammal and fish habitat.

3) The Otter Creek habitat protection buffer prohibits intentional firing directly into the Otter Creek channel and a 50 meter zone on either side of its banks from the Otter Creek and Eagle River confluence to the boundary of ERF Impact Area. It is based on JBER conservation staff professional knowledge, and is established to further protect fish habitat.

4) The Eagle Bay habitat protection buffer prohibits firing into a 500-m zone along Eagle Bay. This habitat protection buffer is based on the professional knowledge of JBER conservation staff, and is established to address habitat as well as noise concerns. It should be noted that Eagle Bay lies fully outside of the installation boundary and as such would never be intentionally targeted. The SDZs of all live-fire exercises must be contained within the Fort Richardson installation bounds per USARAK Regulation 350-2. This is a year-round restriction, regardless of ice conditions.

5) The ERF East and West Pond habitat protection buffers prohibit firing into freshwater or tidal ponds. Included in these habitat protection buffers is a 75-m buffer around the hot ponds identified during the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) remediation. These habitat protection buffers are based on the recommendations of scientists from the Cold Regions Research and Engineering Laboratory (CRREL) familiar with the CERCLA cleanup and incorporate the largest blast radius from all HE munitions that are currently used at ERF Impact Area. They are established to protect waterfowl habitat as well as those areas that were capped with gravel as part of the WP remediation effort.

6) The Racine Island habitat protection buffer prohibits firing into an area in the southeast portion of ERF, commonly referred to as Racine Island, between the Eagle River main channel and a well developed secondary channel to the south. This habitat protection buffer is based on the recommendations of scientists from CRREL familiar with the CERCLA cleanup, and protects areas of potential residual WP from direct disturbance.

5. Weapon System and Munitions Specific Spatial Restrictions

Under the proposed action, Army/JBER would supplement the aforementioned habitat protection buffers with additional restrictions tailored to prevent impacts of individual weapon systems, based on the unique blast and sound signature of each weapon system. These “weapon-specific” habitat protection buffers would restrict the targetable areas of the weapon systems to which they apply, thereby further reducing beluga noise exposure as well as the potential for direct injury from a blast.

A consideration critical in determining the spatial extent of the proposed restrictions was the Cook Inlet beluga whales’ tolerance to noise. While there is much to learn regarding the effect from various types and noise levels on beluga behavior, we have provided guidance on these issues. In regulating take under the MMPA, we currently use 180 dB and 160 dB re 1μPa thresholds to identify Level A and Level B harassment, respectively.

Although these thresholds are pursuant to a regulatory regime distinct from the ESA and section 7 concerns, we told the Army that the 180 dB and the 160dB should be used to guide their present analysis.

It is important to note that the peak sound energy emitted during live-fire training detonations occurs at a frequency of about 20 Hertz (Hz). The Cook Inlet Beluga Whale Conservation Plan reports that the lowest frequency a beluga can hear is about 40 Hz. Thus, while it is very likely that beluga whales can hear blast noise, much of the energy emitted from live-fire training at ERF Impact Area is in a range of frequencies that beluga whales cannot hear or to which they have limited sensitivity.

- In light of the above, the weapon-specific restrictions were designed and shaped so as to avoid subjecting Cook Inlet beluga whales to noise over 160 dB RMS. Table 3 presents the distances at which 180 dB RMS and 160 dB RMS re 1 μPa noise occurs for each weapon system firing HE rounds. This table was created using data collected in 2007. Researchers conducted simulations and field measurements near the mouth of the Eagle River to help predict underwater noise levels that could be produced by weapons training during non-winter months when beluga whales could be present (Anderson et al. 2007). Researchers collected acoustic time series data produced by the detonation of 6.8-kg (15 lb) C4 plastic explosive charges on land approximately**)** 500 m (1,640 ft) from the water's edge.

Table 3. 180 dB and 160 dB Thresholds for HE Rounds by Weapon System

Weapon System	**Distance from Detonation (m)**	
	180 dB RMS re 1 μPa	160 dB RMS re 1 μPa
060-mm Mortar	<1	24
081-mm Mortar	<1	69
105-mm Howitzer	4	416
120-mm Mortar	10	976

Based on the current knowledge as given above, the Eagle River habitat protection buffer is itself sufficient to protect beluga whales from excess noise exposure during live-fire training exercises with 60-mm mortar HE rounds. Thus an additional buffer specific to the 60-mm mortar is not necessary.

Army will not conduct live-fire training exercises with 120-mm mortar and 105-mm howitzer HE rounds while belugas are in the river. Thus, no additional weapons or munitions specific buffers have been developed at this time.

In conducting comprehensive analysis of all potential causes for impact, Army also considered the potential for shrapnel from a munitions detonation to affect beluga whales. However, because the shrapnel-related impacts of a detonation are confined to a relatively small space as compared to concurrent noise-related impacts, additional protections based on blast radii were not deemed necessary.

To further ensure the accuracy of its noise impacts analyses, JBER will continue to study the effects of live-fire weapons noise on the Cook Inlet beluga whale. As more data are gathered, it may be possible to fine-tune the buffers discussed above, pending further consultation with NMFS.

6. Temporal Restrictions on Live-Fire Weapons Training

The following sections detail existing and proposed temporal restrictions on live-fire weapons training at ERF Impact Area. Temporal restrictions are effective when whales are in Eagle River as well as during waterfowl migration periods.

7. Restrictions When Whales are in Eagle River

Under the proposed action, firing of HE munitions with 105-mm howitzers and 120-mm mortars will be temporarily suspended in the event beluga whales are detected in Eagle River by JBER marine mammals observers (from a boat at the river's mouth), as will firing of HE munitions with 81-mm and 60-mm mortars at all targets on the bay side of the target area demarcation line running roughly southwest to northeast through the confluence of Otter Creek and Eagle River, as shown in Figure3. Target areas on the inland side of this demarcation line could be used for firing of HE munitions with 81-mm and 60-mm mortars even while whales are in Eagle River, as the distance of available targets from the river, combined with the limited range of these munitions, would prevent adverse effects on beluga whales. All firing may resume once the whales leave the river. Live-fire training exercises with all weapon systems using non-HE rounds (FRTR, smoke, ILLUM) may be conducted when beluga whales are present in Eagle River. These restrictions will limit the potential noise exposure for beluga whales.

8. Restrictions during Waterfowl Migration Periods

Under the proposed action, the Army/JBER will apply restrictions on the use of ERF Impact Area during waterfowl migration periods. Presently, all firing is prohibited during fall migration periods, and the firing of HE munitions using proximity fuzes is prohibited during spring migration periods. The proposed action would modify these restriction by permitting only the firing of non-HE rounds during both spring and fall migration periods. Live-fire training with HE munitions will not be conducted during either of the waterfowl migration periods, training with other munitions would be allowed during these times. The exact beginning and ending of the waterfowl migration periods will be determined by JBER wildlife biologists (using USFWS approved protocols) in coordination with the USFWS each year. Spring migration is generally mid-April to mid-May and fall migration is generally August to late October.

While these restrictions were originally created to protect migratory waterfowl, the peak migratory waterfowl period during the fall corresponds with the heaviest use of Eagle River by beluga whales. Figure 4 shows the monthly average number of beluga whales observed in Eagle River and Eagle Bay during the 2007 and 2008 field seasons compared to the monthly average number of waterfowl (ducks, geese and swans) on ERF for the same years. It is apparent that continuing to prohibit live-firing with HE munitions during the fall waterfowl migration will help minimize potential impacts to beluga whales. Data was not available for beluga whales in April or waterfowl in November.

Figure 3. ERF Impact Area Habitat Protection Buffers

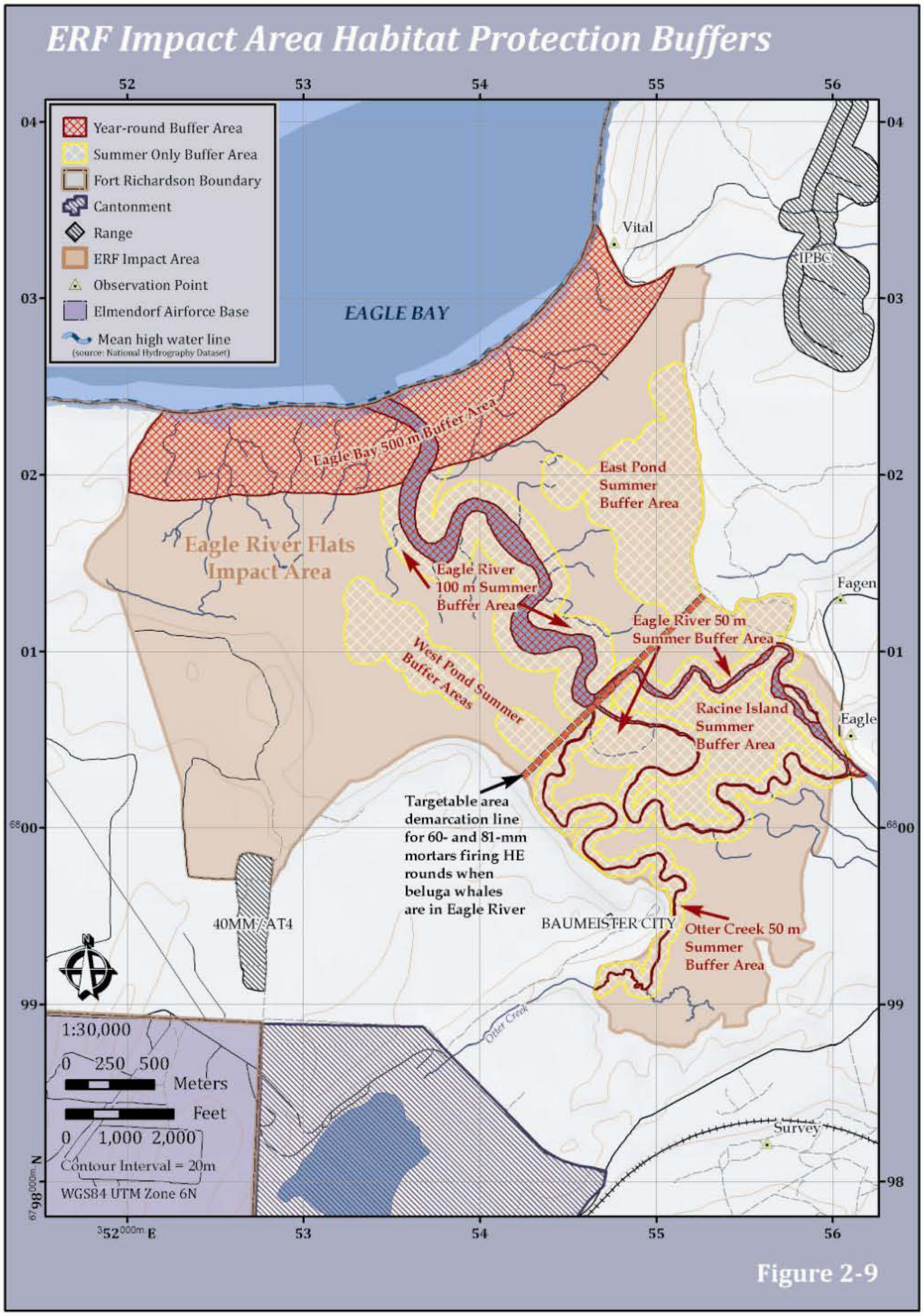


Figure 4. 2007 and 2008 Timing of Beluga Sightings vs. Waterfowl Migration in ERF

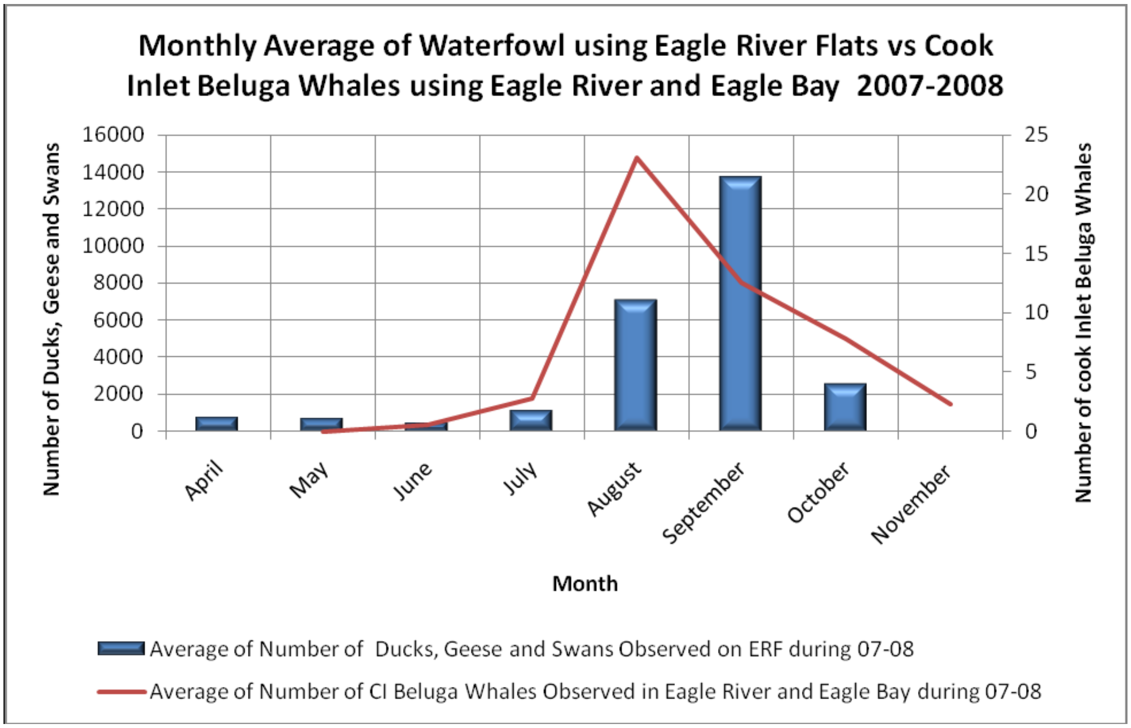


Table 4 summarizes the weapons systems that can be fired under different conditions into ERF Impact Area.

Table 4. Weapon Systems that can be fired under a Variety of Conditions

Weapons System	Type of Round	Beluga Whales Present in Eagle Bay	Beluga Whales Present in Eagle River	During Waterfowl Migration
60-mm Mortar	HE	Permitted	Firing at select targets / target areas* permitted	No firing
	Other	Permitted	Permitted	Permitted
81-mm Mortar	HE	Permitted	Firing at select targets / target areas* permitted	No firing
	Other	Permitted	Permitted	Permitted
105-mm Howitzer	HE	Could be permitted pursuant to take authorizations	No firing	No firing
	Other	Permitted	Permitted	Permitted
120-mm Mortar	HE	Could be permitted pursuant to take	No firing	No firing

		authorizations		
	Other	Permitted	Permitted	Permitted

*Target areas available for use while beluga whales are in Eagle River are shown in Figure 3

II. STATUS OF THE SPECIES

NMFS has determined the Cook Inlet beluga whale is the only threatened or endangered species under NMFS's jurisdiction 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 biological 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 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, as neither NMFS nor the Army was aware of Steller sea lions in the Knik Arm. During informal consultation, NMFS and the Army agreed that 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 biological opinion.

a. Cook Inlet beluga whales

i. Range wide

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 Cook Inlet 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).

ii. 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.

iii. 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).

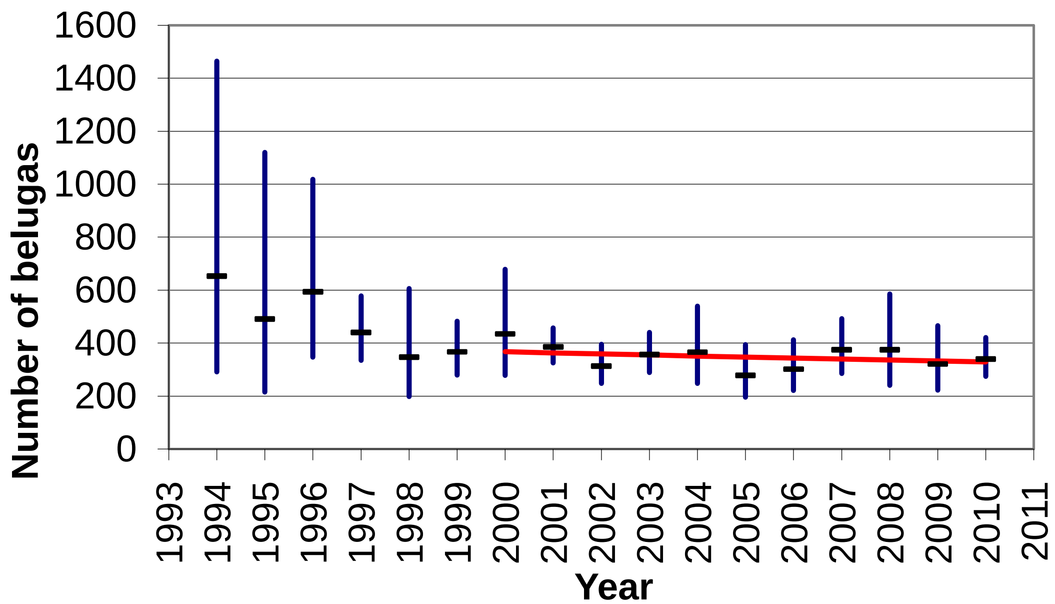
iv. Population Abundance and Trend

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 (Figure 5). 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 – 2010) indicate this level of growth did not occur. Looking at the population estimates since the regulation of subsistence harvests (1999 – 2010) NMFS has documented a population decline of 1 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 340 beluga whales estimated for 2010 would indicate a 75 percent decline in 32 years, but with unspecified confidence. NMFS has committed to conducting systematic abundance surveys which monitor population status and growth over time such that a significant change in abundance and trend would be detected over a ten years.

Figure 5. 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 (1999-2010), the rate of decline (red trend line) has been -1.1 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). Daily surveys conducted by boat only in Knik Arm during 2004 reported variable abundance counts for August through October: 5 – 130 whales in August, 0 – 70 whales in September, and 0 – 105 whales in October (Funk et al. 2005).

v. Population Viability Analysis and Extinction Risk Assessment

The National Marine Mammal Laboratory published the 2008 Supplemental Status Review and Extinction Risk Assessment of Cook Inlet Beluga Whales (*Delphinapterus leucas*) (Hobbs et al. 2008). That Review included an update from the November 2006 and April 2008 Status Reviews and responded to issues raised by a panel of independent experts regarding the earlier Status Review. The conclusions from the October 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 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.

vi. Distribution and Movements

Beluga whales are circumpolar in distribution and occur in seasonally ice covered arctic and subarctic waters where they inhabit fjords, estuaries, and shallow waters.

Five distinct beluga whale stocks are currently recognized in Alaska: Beaufort Sea, eastern Chukchi Sea, eastern Bering Sea, Bristol Bay, and Cook Inlet. Of these, the Cook Inlet stock is 1) the most isolated in Alaska, based on the degree of genetic differentiation between this stock and the other four Alaska stocks; 2) the only one of the five Alaskan stocks occurring south of the Alaska Peninsula in waters of the Gulf of Alaska; and 3) is numerically the smallest population.

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.

In addition to frequenting the Susitna delta and corresponding flats throughout the summer, beluga whales may remain in the upper Inlet into the fall, and appear to use the smaller streams along the west side of the Inlet, following the Coho salmon runs. Data from 14 satellite tagged beluga whales and anecdotal reports, in conjunction with Traditional Ecological Knowledge (TEK), indicate that during late summer and fall beluga whales use the streams on the west side of Cook Inlet from the Susitna delta south to Chinitna Bay. Native hunters and others report that beluga whales are often seen well upstream in the Kenai and Little Susitna rivers, presumably following the fish migrations (Huntington 2000).

During winter months, these whales concentrate in deeper waters in lower Inlet south of 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.

TEK from 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 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 lower 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 in Eagle Bay and sometimes in Goose Bay (about four miles from ERF Impact Area) 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 that 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).

vii. 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. However, it is apparent the movements and feeding distribution of beluga whales are not simply explained by when and where the most fish are located. 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 fish runs, water depth and fish density may be more important than sheer fish numbers 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 at the river mouths and their shallow waters act to funnel salmon as they move past waiting beluga whales. Dense concentrations of prey may be essential to beluga whale foraging success. 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 (*Oncorhynchus*) species: Chinook (*O. tshawytscha*), chum (*O. keta*), Coho (*O. kisutch*), pink (*O. gorbuscha*), and sockeye (*O. nerka*) 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 from harvested and stranded beluga whales have shown consistent summer blubber thicknesses (NMFS unpublished 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 Chinook salmon in its stomach (Huntington 2000). In July 2005, NMFS (unpublished 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 (*Limanda aspera*). 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 south of Kalgin Island and make deep feeding dives, likely to feed on such prey species as flatfish, cod, sculpin (*Cottidea spp.),* and walleye pollock (*Theragra chalcogramma*). 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, Pacific eulachon (*Thaleichthys pacificus*), and smelt (*Osmeridae spp*.), 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 (*Eleginus gracilis*) migrate inshore during winter for spawning (Cohen et al. 1990). Pacific cod (*G. macrocephalus*) 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.

Army personnel sampling the tidally influenced portions of Eagle River and its tributaries within ERF, in 2007 and 2008 collected 3-spine stickleback (*Gasterosteus aculeatus*), 9-spine stickleback (*Pungitius pungitius*), saffron cod, starry flounder, snailfish (*Liparidae spp*.), rainbow smelt (*O. mordax*), eulachon, Dolly Varden (*Salvelinus malma malma*), adult salmon (all five species), and sand shrimp (*Crangon crangon*).

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.

viii. 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 Shelden 2000; Vos and Shelden 2005, NMFS unpublished 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 used extensively in the summer and fall by cow/calf pairs. Surveys by LGL (Funk et al. 2005) noted a relatively high representation of calves in the uppermost part of Knik Arm. The mouth of Knik Arm has been reported to be transited in the summer and fall by cow/calf pairs (Cornick and Kendall 2008), presumably moving into the upper reaches of Knik Arm. McGuire et al. (2008) photographically identified 37 distinct beluga whales with calves in the upper Inlet during 2005 – 2007. However, because calves were seen in all areas of their study (Susitna delta, Knik Arm, Chickaloon Bay/Southeast Fire Island, and Turnagain Arm), they were unable to determine distinct calving areas (McGuire et al. 2008).

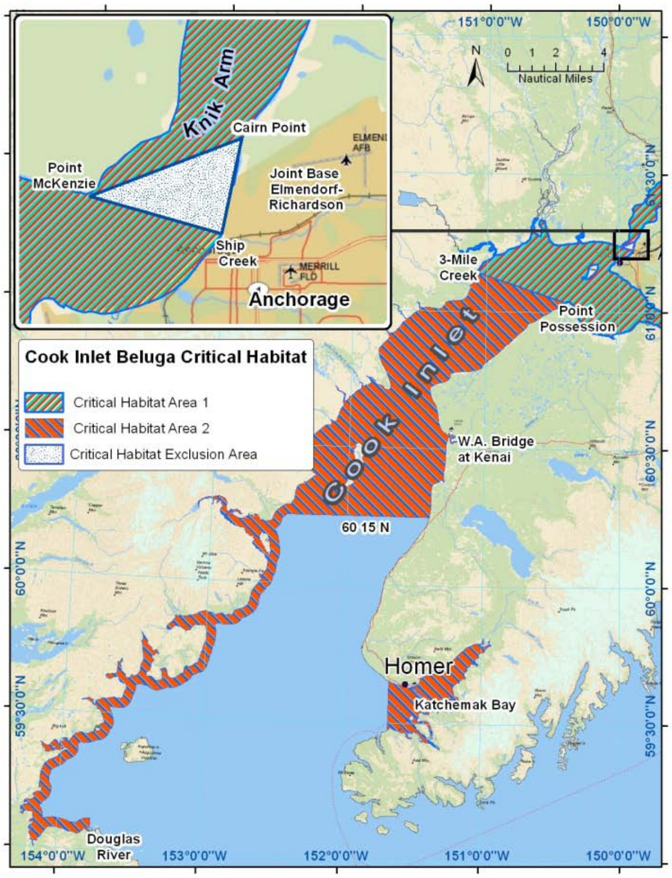
ix. Critical Habitat Designation

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.

Critical habitat has been designated for the Cook Inlet beluga whales (76 FR 20180, April 11, 2011). The critical habitat includes two geographic areas of marine habitat in Cook Inlet comprising 7,800 square kilometers (3,013 square miles) and is bounded by Mean Higher High Water (MHHW) datum on the upland. The Port of Anchorage was excluded in the final rule in consideration of national security interests. Additionally, consistent with the proposed rule (74 FR 63080, December 2, 2009), portions of military lands were determined to be ineligible for designation as critical habitat. 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.

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 (61º 08.5 N, 151º 04.4 W) to a point at Point Possession (61º 02.1 N, 150º 24.3 W). Also included are waters of the Susitna River south of latitude 61º 20.0 N, Little Susitna River south of latitude 61º 18.0 N, and Chickaloon River north of latitude 60º 53.0 N.

Figure 6. Critical habitat for the Cook Inlet beluga whale



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 (61º 08.5 N, 151º 04.4 W) to a point at Point Possession (61º 02.1 N, 150º 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 61º 25 N and the mouth of the Douglas River (59º 04 N, 153º 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.

Included in the ruling is an exclusion from critical habitat designation under ESA 4(a)(3)(B)(i) for the ERF, including the lower reaches of Eagle River, based on an analysis of the Army’s INRMP. NMFS concluded that the INRMP provides benefit for the Cook Inlet beluga whale consistent with section 4(a)(3)(B)(i) of the ESA, and therefore, ERF is excluded from the critical habitat designation.

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, sockeye salmon, chum salmon, Coho salmon, Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole
- 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

b. Action Area

i. Army Beluga Whale Monitoring in Eagle Bay and Eagle River

The Army has historically taken an interest in the beluga whale and has recorded sightings during the past two decades. In recent years more intensive field surveys for beluga whales have been conducted from June through October of each year. In 2005, the Army developed standard operating procedures and protocols for monitoring beluga whales in and around ERF Impact Area. In 2008 the survey methodology was modified to include more statistically rigorous data.

ii. Results of Beluga Whale Monitoring Efforts on Fort Richardson, 1988 – 2009

Limited information is available on beluga whale monitoring efforts by the Army staff from 1988 (one report) and 1991 (13 reports). Army biologists conducted beluga whale monitoring surveys in and around ERF Impact Area on 10 occasions during the 2005 field season, from June through October, but they did not observe whales during this time. Four additional aerial surveys conducted in August, September, and October of the same year resulted in four beluga whale groups observed adjacent to ERF Impact Area (Clevenger 2006).

During 2006, Army biologists conducted surveys on 19 days, from May through October. Beluga whales were observed during three surveys, during late August and early September. A maximum of eight beluga whales were sighted at one time in the river itself while a maximum of 15 to 20 beluga whales were sighted in Eagle Bay. The majority of beluga whale activity in Eagle River occurred within the first 0.3 river miles upstream from Eagle Bay, although two whales were observed traveling up to 0.75 river miles upstream (Garner 2007). Observed beluga whale activity in Eagle River included traveling (58 percent), milling (32 percent), feeding or suspected feeding (7 percent), and other activities including one incident of spy hopping and one interaction with a harbor seal (2 percent). Observed beluga whale activity in Eagle Bay was predominantly traveling (86 percent) and milling (14 percent). However, feeding behavior in either Eagle River or Eagle Bay is most likely underrepresented in the dataset because the definition of feeding requires visual confirmation of prey capture.

During October 2007, the Army conducted beluga surveys in Eagle River and Eagle Bay from May through October. Beluga whales were observed 21 days (43 percent of all observation days) and the mean number of whales counted was 7.5 (1 – 35 whales) individual beluga whales.

In 2008, the Army conducted beluga whale surveys in Eagle River and Eagle Bay from June through November. Beluga whales were observed on 32 days (38 percent of all observation days) and the mean number of whales counted was 13.6 (2 – 68 whales) individual beluga whales.

iii. Observations within the Action Area

Knik Arm is regularly used by Cook Inlet beluga whales (Funk et al 2005; Cornick and Saxon-Kendall 2009; Shelden et al. 2010). The most common activities documented by the Army/JBER are traveling and milling, with some active feeding. The beluga whales exhibit distinctive seasonal and tidal patterns in visiting Eagle Bay (Funk et al. 2005).

Although few beluga whales have been observed in the project area during the months of June and July, in August they appear to use the action area primarily for transit and milling, with some foraging, as they follow prey north into upper Knik Arm. Beluga whales remain visible in the Eagle Bay until ice cover in November. However, satellite tag data showed that during winter, when beluga whales are in the upper inlet, they made rapid movements between distinct bays and river mouths (Hobbs et al. 2005), including Eagle Bay. Often they remained stationary in one area for many weeks and then moved abruptly to another area (within a day).

Beluga whales enter Knik Arm on flood tides and travel to lower Knik Arm on ebb tides. Beluga whales can be found in Eagle Bay and Eagle River as the whales tend to stay close to shore, following the tide through the narrows within 1 km of either shoreline. Whales ascend to upper Knik Arm on the flooding tide, feed on salmon, and although they can be found in the Eagle Bay area during all tides, beluga whales hold in the waters by Eagle River during incoming and outgoing mid tides. Whales moving up Knik Arm tend to prefer the eastern shoreline, following the channel along Eagle Bay (Cornick and Saxon-Kendall 2009).

iv. Knik Arm Bridge and Toll Authority (KABATA) 2004-2005 Baseline Study

To assist in the evaluation of the potential impact of a proposed bridge crossing of Knik Arm north of Cairn Point, KABATA initiated a study to collect baseline environmental data on beluga whale activity and the ecology of Knik Arm (Funk et al. 2005). Boat and land-based observations were conducted in Knik Arm from July 2004 through July 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 suggests 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.

III. ENVIRONMENTAL BASELINE

By regulation, the environmental baseline for biological 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 biological 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 trend 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 with subsistence harvest regulations.

a. Cook Inlet Beluga Whales and Habitat within the Action Area

Knik Arm and the action area are regularly used by Cook Inlet beluga whales. Knik Arm is an important feeding area for beluga whales during much of the summer and fall, especially upper Knik Arm. Beluga whales appear to use the action area for traveling and milling, with some suspected foraging, as they follow prey into Eagle River and upper Knik Arm, primarily in August and September. 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 percent 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 in 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 (Cornick and Saxon-Kendall 2009). 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 (Cornick and Saxon-Kendall 2009). Funk et al. (2005) observed that beluga whales preferred Knik Arm temporally (high tide) and seasonally (August through November.

The most commonly observed behaviors by beluga whales in Knik Arm include traveling, feeding (often suspected feeding behavior), diving, and resting (Markowitz and McGuire 2007). Much of the mid to upper portions in 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 is an area where belugas concentrate near the mouth of Eagle River, an important salmon stream that provides a deep channel used by these whales.

Boat and land-based observations were conducted from multiple points in Eagle Bay, but primarily at the mouth of Eagle River. These observations were collected opportunistically during 2005-2007 and systematically from May through October 2006 (21 days) and June through November 2008 (32 days). Beluga whales were observed in Eagle Bay during July, August, September, October, and November 2008. Primarily these beluga whales were milling and traveling through Eagle Bay, with some diving and prey pursuit activities.

i. Human Induced Factors

The upper Cook Inlet region is the major population center of Alaska, with the 2009 Municipality of Anchorage population at 286,174, Matanuska-Susitna Borough at 88,379, and Kenai Peninsula Borough at 54,665 (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.

1. 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. 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, road, and railroad construction), as have the shorelines in the Anchorage area.

2. Port Facilities

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. 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 phased POA Intermodal Expansion Project will add 135 acres of useable land to the current 129 acre POA (total area of 264 acres). 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 POA. 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 by harassment associated with the proposed action of 34 whales. During 2009 construction work at the POA, a total of 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 behavioral criteria.

POA maintenance dredging has occurred annually since 1965. The current operations and maintenance plan at the POA authorizes the Army Corps of Engineers (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 to maintain the POA 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 containing re-suspended contaminants into the water column and seriously impact 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.

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 more than 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 shore side 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). 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.

3. Joint Base Elmendorf-Richardson

This military installation at Anchorage is home to both Army and Air Force, which began air force operations in 1940. The Joint Base Elmendorf-Richardson (JBER) maintains and operates a runway near Knik Arm 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.

4. 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), which suggested 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 containerships 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, Port MacKenzie, and 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. Other launches are near the Knik River Bridge and 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, which predispose 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). 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.

5. 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, used 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 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 over flights. 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 noise characteristics.

The ERF Impact Area at Fort Richardson has been used for weapons training since the 1940s, and supported heavy year-round use until February 1990 when the Army voluntarily implemented a temporary firing suspension. In fact, training often occurred at far heavier levels than those proposed here. Training has not occurred during the times of the year when beluga whales are observed in the affected area since 1990. In December 1991, live-fire weapons training within ERF Impact Area was resumed, restricted to winter months only, when specified ice conditions are met.

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

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

Several notable studies may offer insight on the effect of ship and aircraft noise on Cook Inlet beluga whales. A 2001 acoustic research program within upper Cook Inlet identified underwater noise levels (broadband) as high as 149 dB re: 1 μPa (Blackwell and Greene 2002). That noise was associated with a tug boat that was docking a barge. Ship and tug noise have been present at the POA for several decades and are expected to continue into the future.

6. 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 in 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 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 methyl-mercury levels 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 PCBs concentrations and chlorinated pesticides on animal health may be less significant for 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 (ARRC). The POA transfers and stores petroleum oils, as well as other hazardous materials; and since 1992, all significant spills and leaks 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 ARRC rail yard. In 1986, petroleum seeped into Ship Creek from the nearby rail yard and several oil spills occurred in 2001 (U.S. Army 2010). Freight handling activities have historically caused numerous surface stains and spills at the rail yard.

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 use 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 that enter 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 (NMSF 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 with only limited studies conducted 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 hormones and their functions), 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 in Cook Inlet, 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.

Sediment and surface water samples have been collected from various locations within ERF Impact Area since 1989. Samples have been analyzed for volatile organic, semi-volatile organic, PCBs, and inorganic compounds (metals and other). Trace amounts of several organic compounds have been detected in sediment but not at concentrations that are deemed harmful to humans or wildlife. Water samples have not contained elevated levels of any contaminants, including munitions constituents. The wetland environment of the ERF Impact Area functions as a uniquely effective mechanism for water treatment, and repeated testing indicates that munitions constituents are neither accumulating in nor migrating off the wetlands.

7. Subsistence Harvest

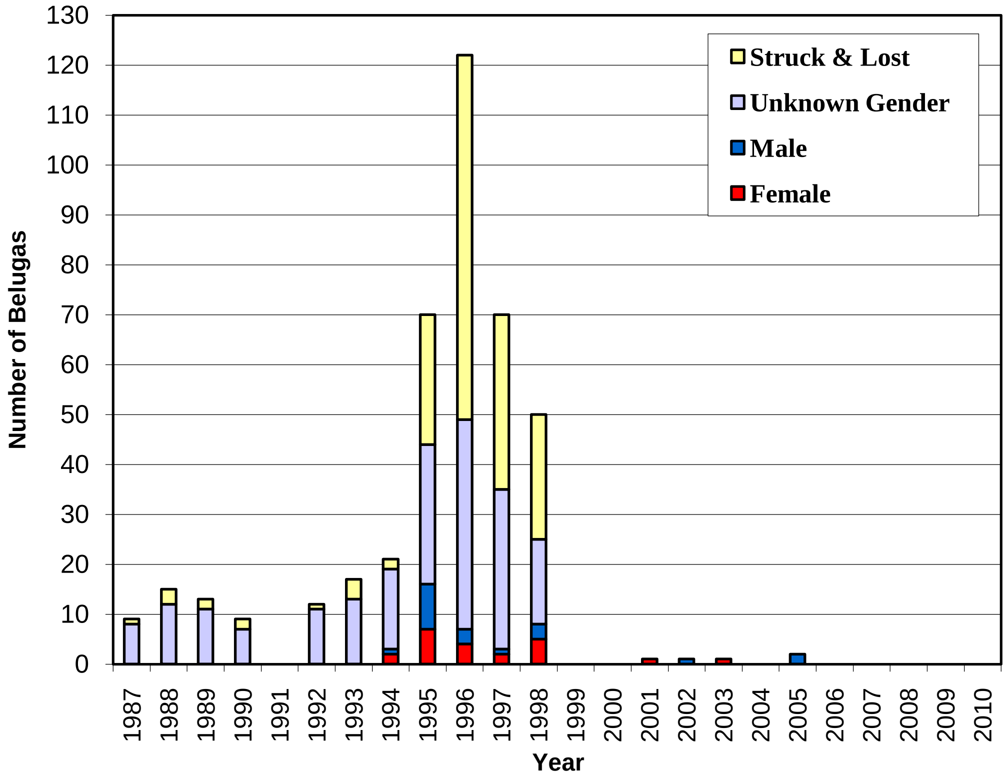
The Cook Inlet beluga whale is hunted by Alaska Natives for subsistence purposes and for traditional handicrafts. The MMPA provides an exemption from its prohibitions that allows for the harvest of marine mammals by Alaska Natives for these purposes. Alaska Natives have legally harvested Cook Inlet beluga 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 that were struck and lost, and assumed to have perished) indicate these harvest levels were unsustainable.

Figure 7 summarizes subsistence harvest data from 1987 to 2010 (Angliss and Outlaw 2008; NMFS unpublished 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 (CIMMC 1996, 1997). Although some local hunters believed that the 1996 estimate for struck and lost is positively biased, the 1995 to 1996 take estimates are considered reliable (Angliss et al. 2001). Given that there was no official harvest 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.

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 2006, subsistence harvests were 0, 1, 1, 1, 2, 0, and 0 whales, respectively; with no cooperative agreement, and therefore, no harvest, in 2004 and 2007 to the present.

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

Figure 7: Summary of known Cook Inlet beluga whale subsistence harvest from 1987-2010.



beluga whales. The Cook Inlet Beluga Whale Subsistence Harvest Final Supplemental Environmental Impact Statement, with a set harvest plan, was published on 20 June 2008 (73 FR 35133) and, long-term harvest regulations were implemented on 15 October 2008 (73 FR 60976)

8. 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 reported incidences on 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.

9. 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 Twenty Mile River (and shore areas of Turnagain Arm near Twenty Mile 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 – 5 tons during the past decade. The personal use eulachon harvest is possibly under-reported, as some participants may confuse their harvests as being subsistence and not personal use.

Recreational fishing is very popular 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 to 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 very 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 to belugas 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.

10. 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. 2010), fisheries that occur in those waters during spring and summer could have a higher likelihood of interacting with beluga whales.

11. Incidental Take

The term incidental take in regards to commercial fishing refers to the catch or entanglement of marine mammals 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 two reports during the past twenty years where a single beluga whale was entangled in fishing nets (drift net and set gillnet); 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 beluga whale sightings occurred and no beluga whale injuries or mortalities were reported. Furthermore, during the period 1990 through 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.

12. 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 stores 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. Most 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 commercial fishing nets, 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.

13. 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 these 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 from oil on Cook Inlet beluga whales (or any cetacean) because data is 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 numbers 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 immediately as a result of an oil spill.

14. 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.

15. 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 (only in 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.
- Researchers using boats have collected acoustic data at and near Eagle Bay, Cairn Point (POA), Fire Island, Beluga River, Trading Bay, Kenai River, Tuxedni Bay, and Kachemak Bay. At 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.
- In the summer of 2007, researchers conducted simulations and field measurements near the mouth of the Eagle River to help predict underwater noise levels that could be produced by weapons training during non-winter months when beluga whales could be present (Anderson et al. 2007). Researchers collected acoustic time series data produced by the detonation of 6.8-kg (15 lb) C4 plastic explosive charges on land approximately**)** 500 m (1,640 ft) from the

water’s edge

16. Potential Projects

Other potential development projects in Cook Inlet include: 1) Seward Highway improvements along Turnagain Arm; 2) south coastal trail extension in Anchorage; 3) Chuitna Coal project with a marine terminal; 3) Pebble Mine with a marine terminal in Iniskin Bay; 4) Diamond Point granite rock quarry near Iliamna and Cottonwood Bays; and 5) placement of a submarine fiber optic cable by ACS from Nikiski to Anchorage.

ii. Natural Factors

1. Stranding

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 unpublished 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 unpublished 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. Prolonged stranding events that lasts more than a few hours may result in significant mortalities. In the past 12 years (1999 – 2010) the average confirmed stranded dead beluga whale was 11 whales per year (4 whales (2009) to 20 whales (2003)); and 267 – 285 beluga whales were confirmed to live strand (4 – 9 whales (2003) to 58 whales (1999)). Another concern is the fact that in 2009, four beluga whales stranded, all female and two were pregnant. The annual abundance estimates continue to confirm a declining whale population trend and stranding events may represent a significant threat to the conservation and recovery of these whales.

2. Predation

Although infrequent, it has been documented that killer whales prey upon beluga whales in Cook Inlet (witnessed and necropsies). The number of killer whales reported in the upper Inlet appears to be small. There may be a single pod with five or six individuals that has extended its feeding territory into upper 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, 2008, 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. In fact, witnesses reported killer whales in Turnagain Arm during the live stranding events in August 1999 (58 – 70 whales) and September 2000 (15 – 20 whales). As such, NMFS considers killer whale predation to be a potentially significant threat to the conservation and recovery of these whales.

3. 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). This hunter 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 must be 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 is 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 and Mackas 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 Cook Inlet and its dominance by freshwater input act 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 effects (if any exist) from environmental change on Cook Inlet beluga whale distribution, abundance, or recovery.

IV. EFFECTS of the ACTION

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 any action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

Components of the resumption of year-round firing in ERF impact area on Fort Richardson would result in environmental impacts that would co-occur in space and time with beluga whales. In this section, we describe the probable risks of the resumption of year-round firing in ERF impact area on individual beluga whales and then integrate those individual risks to identify consequences to the population. We examined the best scientific and commercial data available to determine whether and how these individuals and this population are likely to respond given the adverse impacts associated with year-round firing. We measure risks to individuals using their "fitness," the ability to survive and reproduce. 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 year round firing. Many biological aspects of Cook Inlet beluga whales are not well known or understood. During the analysis, several assumptions were made about their habitats, hearing abilities, and behaviors to reach the conclusions. For most situations, there is some information to apply to Cook Inlet beluga whales, but for those with little to no data, we erred on the side of species. 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 assumed an effect would occur, thereby giving the "benefit of the doubt" to the species.

For some beluga whales that respond behaviorally or physiologically to the sounds associated with the resumption of year-round firing, the response could rise to the level of harassment such that an animal is "taken." The ESA does not define harassment. However, in this biological 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. 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 it is not able to complete some reproduction-related, feeding, or other activity, or if the animal is likely to be injured. In order to avoid committing a Type II error, we assume that animals are harassed when their behavior appears to be disrupted, such as ceasing to feed or exhibiting avoidance reactions upon exposure to human-made sounds. 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 biological opinion.

NMFS has considered the specific aspects that may adversely affect Cook Inlet beluga whales. The remaining issues to be considered include the effects of noise on beluga whales, as well as pollution, vessel traffic and ship strikes, and cumulative effects.

a. Direct Effects

For the purpose of this biological opinion, the term "munitions" means all ammunition products and components used by the Army. The term includes solid propellants, explosives, pyrotechnics, smokes, incendiaries, bulk explosives, rockets, guided missiles, mortar rounds, artillery ammunition, small arms ammunition, grenades, demolition charges, and components of any item thereof. Training at ERF Impact Area under the proposed action would include the utilization of four basic types of munitions: FRTR; HE rounds; smoke rounds (non-phosphorus); and ILLUM rounds. HE rounds are the only munitions type that can create explosions having the potential to harm beluga whales, their habitat, and/or their prey.

Munitions can produce both direct and indirect effects. Potential direct effects include the physical disturbance of natural resources, including whales themselves, their habitat, and their prey. Potential indirect effects include the degradation of water quality due to munitions residues, which could potentially lead to toxicity in whales and their prey, as well as the possibility of increased sediment loads due to habitat disturbance. Each of these potential effects is discussed in detail in the following sections.

i. Direct Effects that are Likely/Quantifiable

1. Noise

The year round firing 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 monitoring and mitigation planned by the military.

The noise source of concern with regard to beluga whales is the low frequency, impulsive noise resulting from year-round live-fire training as contemplated by this proposed action. Munitions types other than high-explosives, such as ILLUM rounds, smoke rounds, and training practice rounds, all of which do not contain large amounts of high-explosive filler, are not expected to produce significant noise levels in Eagle Bay or Eagle River. While training practice rounds may contain spotting charges that produce a flash and a bang, and in some cases smoke, the amount of explosives used for the charge is several times less than that contained in high-explosive service ammunition (e.g., the 60 mm mortar FRTR contains a 12 gram spotting charge). It is expected that the use of these types of munitions will not impact marine mammals in any way and therefore training with these munitions would not need to be suspended or cancelled when marine mammals are in Eagle River. The 105 mm howitzer and 120 mm mortar are the two weapon systems that would be used at ERF Impact Area that, with the use of HE munitions, create noise with the potential to impact beluga whales.

Research on Noise at ERF

The Army has studied potential impacts from live-fire training on marine mammals in the ERF vicinity. In the summer of 2007, researchers conducted simulations and field measurements near the mouth of the Eagle River to help predict underwater noise levels that could be produced by weapons training during non-winter months when beluga whales could be present (Anderson et al. 2007). The study employed C4 explosive charges to simulate the noise from 155 mm artillery rounds. It should be noted that 155 mm rounds are not included within the proposed action, but enable the Army to model the impacts associated with less powerful weapons systems. The noise level that munitions produce upon detonation is largely a function of the type and weight from the munitions' explosive filler. Where the noise impacts associated with the detonation of particular munitions are known, it is possible to deduce the noise impacts from other munitions that use the same type of explosive by conducting a relative comparison of their explosive weights.

As outlined in Anderson et al. (2007), researchers collected acoustic time series data produced by the detonation of 6.8 kg (15 lb) C4 plastic explosive charges on land approximately 500 m (1,640 ft) from the water's edge. Nine separate charges were detonated during high tide and again during low tide. Data were collected by two hydrophones deployed by boat, at depths of 3 m and 1.5 m (10 ft and 5 ft respectively). The water depth during high tide was 7.8 m (26 ft) and during low tide was 6 m (20 ft). The lower and upper frequency cut-offs were 30 Hz and 10 kHz on the pre-amplifier. The highest energy or noise level at the hydrophones in the recorded spectrum was at the 20 Hz frequency, which is below the hearing threshold of a beluga whale. The recorded sound levels progressively decreased as the frequency increased.

During the study, researchers encountered very high ambient (background) noise levels within area water, as high as 160 dB. Researchers indicated that this ambient noise could have been due to strong currents interacting with the research vessel. In a previous study conducted at the mouth of Eagle River, Blackwell and Greene (2002) recorded low frequency (less than 200 Hz) ambient noise at much lower levels, around 120 dB. The apparent disparity in ambient noise levels between the Blackwell and Greene (2002) study and the Anderson (2007) study could be due to differences in environmental conditions, equipment, instrument calibration, or post processor calculations of the noise energy. This information suggests that actual noise levels produced during the 2007 testing could have been much lower than calculated.

The results from simulations of 155 mm rounds were used to estimate the underwater acoustic energy produced by smaller rounds, specifically 120 mm and 60 mm mortars, which are included in the proposed action (Anderson 2008). Calculations demonstrate that a 120 mm mortar round would result in a reduction of 7 decibels when compared to the larger 155 mm artillery round, and a 60 mm mortar round would result in a reduction of 23 decibels. The results of this study are the best available, however, further research would be beneficial in developing a greater understanding of the noise environment surrounding ERF. It is expected that the results of this analysis represent a worst-case scenario.

Analysts scaled the estimated noise impacts from the 120 mm and 60 mm mortars discussed above to project noise impacts for the 105 mm and 81 mm munitions in accordance with the relative differences in their explosive weights. It is estimated that a 105 mm Howitzer would result in a reduction of 10.7 dB compared to the 155 mm round, and an 81 mm mortar would result in a reduction of 18.5 dB. It should be noted that these values are approximations and are based on several assumptions. They are, however, the best assessments available given the current restrictions on summer firing at ERF. Moreover, these figures likely overestimate the potential noise impacts of those munitions which would be used under the proposed action.

Janssen (1980) describes three levels of noise impacts on wildlife. Primary effects result in damage to hearing organs and a temporary or permanent hearing loss. Secondary effects result in behavior alteration (including startle response or movement away from the noise) or inducement of the physiological stress response. Tertiary effects result in population-level changes including increased mortality, reduced reproductive rate, or habitat abandonment. The potential for these effects is extremely hard to quantify since there are many variables affecting the actual exposure of whales at any given time, and whale sensitivity to specific sounds at specific frequencies is not well understood. While some observers have noted that beluga whales are very sensitive to noise, in more heavily trafficked areas there is evidence of habituation to anthropogenic noise. Because the potential effects of noise are not well understood, are extremely variable among individuals, and can be context-specific, direct and indirect effects are addressed as a continuum.

The primary means to assess environmental noise on humans is through the use of computer simulations. But every species has a unique auditory sensitivity, and any attempt to extrapolate these results to animal species would prove problematic. Moreover, the noise generated contours are based primarily on noise transmission through the air, where as noise reaching beluga whales and their prey travels primarily through water and land. Thus, the analysis presented here relies on observational data during training and simulated training events, as well as a review of the published literature.

Marine mammals use hearing and sound transmission to perform vital life functions and introducing sound into their environment could disrupt those behaviors. Sound (hearing and vocalization/echolocation) serves four primary functions for odontocetes (toothed whales and dolphins). These include: 1) providing information about their environment; 2) communication; 3) enabling remote prey detection; and 4) enabling predator detection.

Actual exposure and the potential for disturbance or injury are dependent upon many variables: the intensity and frequency spectrum of the sound source, the duration of the sound, the ambient noise levels, the location and sensitivity of the receptor (in this case, the whale), and the sound attenuation in the media through which it travels (land, air and/or water). Available data on these variables and the coinciding potential for disturbance and/or injury are very limited.

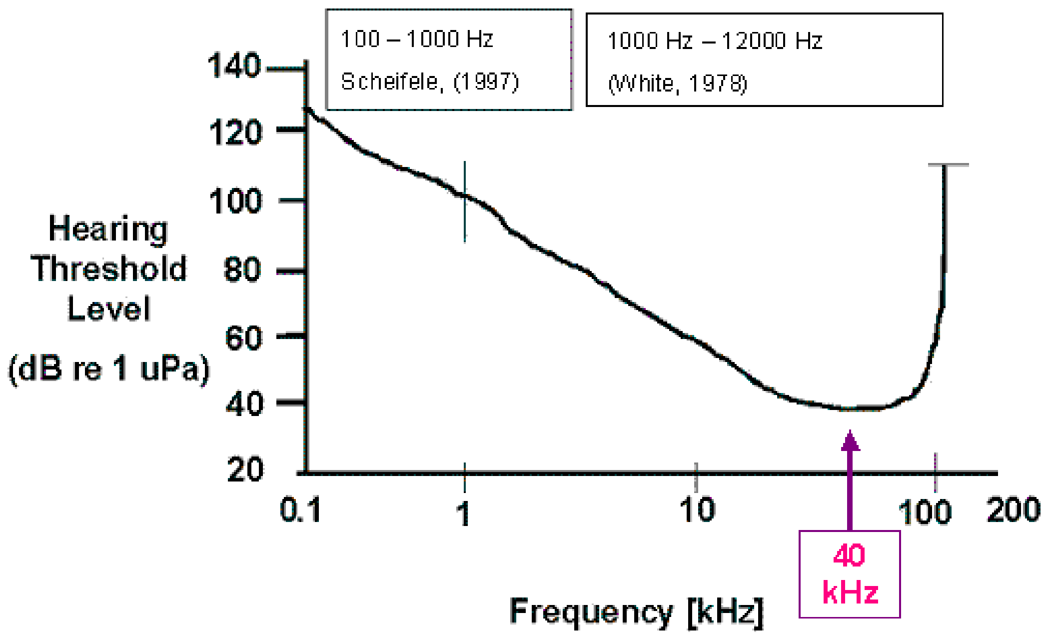
Noise Criteria

Since 1997, NMFS has been using generic sound exposure thresholds to determine when an activity in the ocean produces sound potentially resulting in impacts to a marine mammal and causing take by harassment (70 FR 1871). NMFS has used 160 db re 1 μPa RMS SPL @ 1 m and 180 dB re 1 μPa RMS SPL @ 1 m as proxies for prohibited "take" under the MMPA. New science-based thresholds to improve and replace the current generic exposure level thresholds are in the works, but the criteria have not yet been finalized (Southall et al. 2007). The current Level A (injury) threshold for impulse noise (e.g., impact pile driving) is 180 dB root mean square (RMS) for cetaceans (whales, dolphins, and porpoises) and 190 dB RMS for pinnipeds (seals, sea lions). The current Level B (disturbance) threshold for impulse noise is 160 dB RMS for cetaceans and pinnipeds. The current Level B threshold for non-pulsed noise (e.g., vibratory pile driving) is 120 dB RMS.

Noise and Beluga Whales

The beluga whales' hearing range is from approximately 40 Hz to 150 kHz, although the frequency for best hearing is approximately 40 kHz (Au 1993; Johnson 1967; Johnson et al. 1989; Scheifele 1987; White et al. 1978). Figure 8, adapted from Anderson et al. 2007, shows the estimated hearing threshold (the level when the beluga starts to hear sound) curve for a beluga whale. At lower frequencies around 40 Hz, the whale's hearing threshold is about 140 dB re 1 µPa. In the range of best hearing, at about 40 kHz, the threshold is 40 dB re 1 µPa.

Figure 8. Hearing Range and Threshold for the Beluga Whale



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. Echolocation is presumably used to avoid obstacles and to search for prey (Nowak 2003). 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.

Primary Effects

According to Southall et al. (2007), no data exist on exposures that would cause permanent auditory injury of odontocetes (primary effects). Limited data on captive marine mammals exposed to various kinds of noise suggest that auditory fatigue (an increased hearing threshold, i.e., poorer sensitivity temporarily for some period of time following exposure) onset occurs at levels which may be below those required for direct non-auditory physiological trauma. Southall et al. (2007) estimate that beluga whales subjected to single pulse or multiple pulse events would theoretically not be injured until sound pressure levels reach 230 dB re: 1 µPa or greater.

Secondary Effects

Secondary effects (those resulting in behavior alteration or inducement of the physiological stress response) are generally more variable, context-dependent, less predictable than effects from noise exposure on hearing or physiology, and dependent on a suite of internal and external factors which may result in varying degrees of significance (NRC 2005; 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, gender, and presence of dependent offspring. External factors include: (1) non-acoustic characteristics from 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). Thus, behavioral responses to sound are highly variable and context-specific. It has proven to be exceedingly challenging to establish a generally accepted definition of biologically meaningful behavioral disturbance (NRC 2005). Peak sound pressure values of 224 dB re: 1 µPa are recommended as "behavioral" disturbance criteria for beluga whales by Southall et al. (2007).

Tertiary Effects
Tertiary effects, defined earlier as 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 from 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, and 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).

Potential Noise Impacts from the Proposed Action on Beluga Whales
Based on determinations derived using the above methodologies, the Army/JBER has developed ERF Impact Area-specific noise contours that spatially depict potential noise impacts of 160 dB that may result from firing into designated target areas. Within these contours there is the potential for the exposure of marine mammals to noise at or above 160 dB (but below 180 dB) within detectable frequencies.

Figure 9 shows the 160 dB noise contours that are estimated as a result of firing120 mm mortars, 105 mm howitzers, 81 mm mortars, and 60 mm mortars using HE munitions at a target 500 m from Eagle Bay. The 120 mm mortar and the 105 mm howitzer HE rounds could generate peak noise levels in water greater than 160 dB, thus potentially exposing marine mammals present within the designated contours at the time of detonation to possible harassment or take. The noise generated by a 120 mm mortar would drop below the 160 dB threshold within a distance of about 1,000 m from the detonation point or about 500 m out into Eagle Bay. The 160 dB noise contour for the 105 mm howitzer HE rounds would not extend into Eagle Bay. Neither the 60 mm nor the 81 mm mortars would generate noise in Eagle Bay at levels greater than 160 dB at frequencies within the hearing range of a beluga whale (40 Hz or higher). Due to the layout of targets and the buffer along Eagle Bay, there is no potential for 60 mm and 81 mm mortars to exceed 160 dB into neighboring waters.

Under the proposed action, the 105 mm Howitzer and 120 mm mortar are the two HE weapons systems used at the ERF Impact Area that create noise with the potential to negatively impact beluga whales. Detonation of 120-mm mortar HE rounds has the potential to create noise levels that may exceed 160 dB in Eagle Bay, but they are not anticipated to exceed 180 dB.

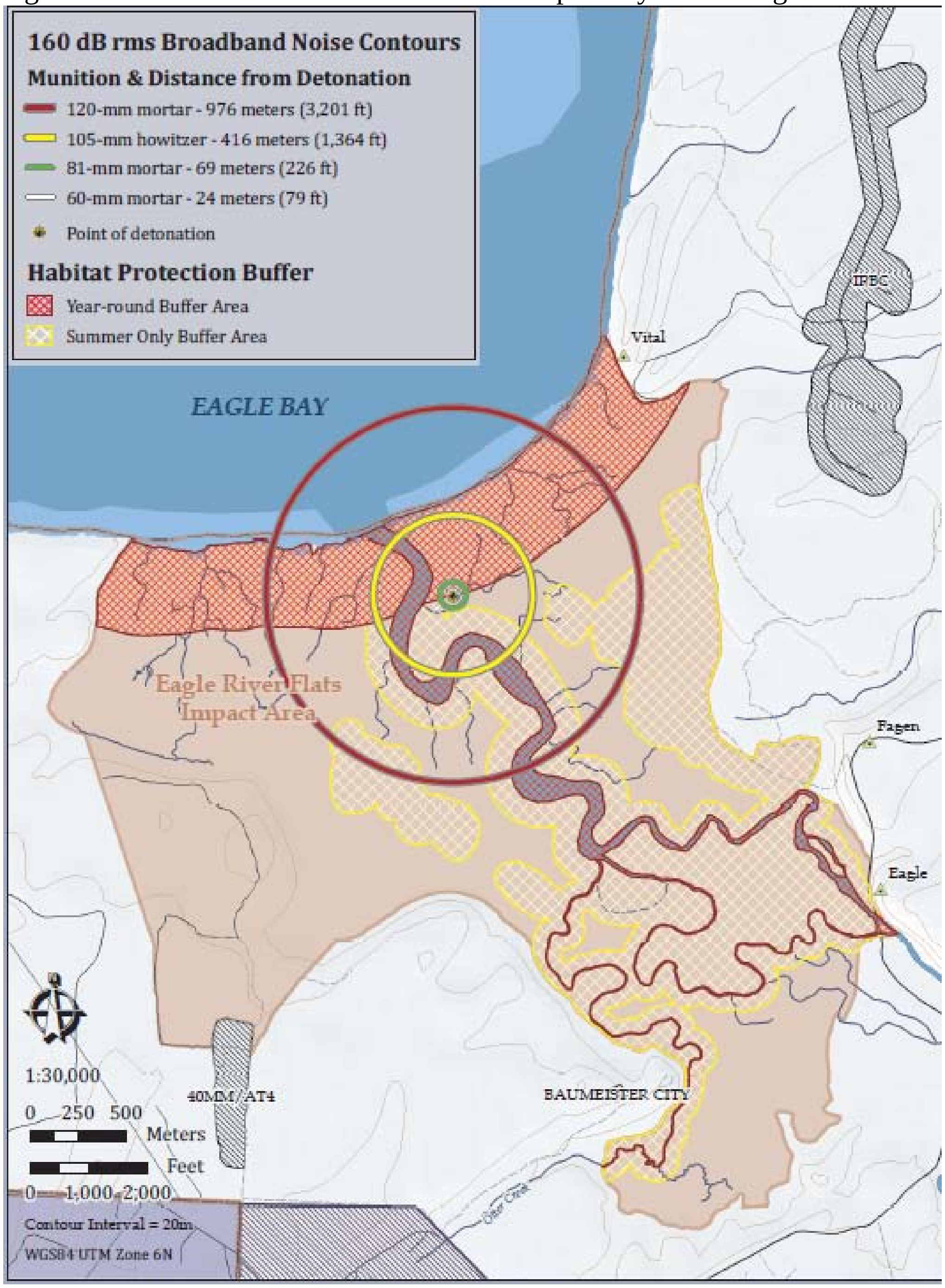
Southall et al. (2007) recently drafted acoustic guidelines for 126 species of marine mammals, divided into five functional hearing groups, for three categories of anthropogenic noise: single pulse, , multiple pulse, and non-pulse. According to this study, referred to earlier as well, the relevance of the 160 dB disturbance criterion is not well established. Animals exposed to either natural or anthropogenic sound may experience physical and psychological effects, ranging in magnitude from none to severe, depending upon spatial relationships between the sound source and the animal receiver, sensitivity of the receiver, received exposure level, duration, and many other factors (Southall et al. 2007; Richardson 1995). The same 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 to base broad, objective determinations of impact thresholds on received levels alone (Southall et al. 2007).

There is new research to suggest that the 160 dB and 180 dB harassment levels currently accepted by NMFS might be significantly below the noise levels that actually harass or injure beluga whales. Southall et al. (2007) estimated that beluga whales subjected to single pulse or multiple pulse events would theoretically not be injured until sound pressure levels reach 230 dB re: 1 μPa or greater. Southall et al. (2007) recommends peak sound pressure values of 224 dB re: 1 μPa as “behavioral” disturbance criteria for beluga whales.

A. Determination of Noise Effect from Training, Smoke and Illumination Munitions in All Weapons Systems

Munitions types other than high-explosives to be utilized under the proposed action, namely ILLUM rounds, smoke rounds, and training practice rounds, do not contain large amounts of high-explosive filler, and do not produce significant noise levels in Eagle Bay or Eagle River. It is expected that the use of these types of munitions will not impact marine mammals in any way. FRTR are inert practice rounds used with the 60-, 81-, and 120 mm mortar weapon systems. The practice fuze contains a small amount of pyrotechnic compound that produces a flash, bang, and smoke upon impact, for observation reasons only. The amount of explosives used for the charge is several times less than that contained in HE service ammunition. Smoke rounds contain smoke

Figure 9. 160dB Noise Contours for Each Weapons System Firing HE Rounds



canisters and a pyrotechnic expelling charge, and are used to provide cover for soldiers operating in the field. At the current time, the 105 mm howitzer is the only weapon system with smoke rounds in production that can be fired into wetland environments. ILLUM rounds are used with the 60-, 81-, and 120 mm mortars as well as the 105 mm howitzer weapons systems, and contain an illuminant compound that allows soldiers to confirm or deny the presence of the enemy without revealing the location of friendly

Soldiers and/or weapons. For these reasons, and through use of the best available science, NMFS has agreed with the Army's determination that noise resulting from the use of training, smoke and ILLUM rounds in all weapons systems under the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

B. Determination of Noise Effect from High-Explosive Munitions Use in 60 mm and 81 mm Mortar Weapons Systems

The Army, through careful design of its proposed action and mitigation techniques, has eliminated any serious risk of exposing beluga whales to direct impacts or noise more than 180 dB. To protect beluga whales from potential for exposure to 160 dB noise as a result of training with HE munitions, the Army/JBER-will: 1) not fire munitions outside military reservation boundaries; 2) not intentionally fire into Eagle River at any time or within specified habitat protection buffers around Eagle River when beluga whales are present in the river; 3) not fire into specified habitat protection buffers along Eagle Bay shoreline in the ERF Impact Area; 4) place all new targets outside the defined habitat protection buffers and will cease using old targets within those areas; 5) not fire HE munitions into ERF Impact Area during the peak waterfowl migration periods in the spring and fall, that also coincide with peak beluga activities in Eagle River during the fall; and 6) have observers present prior to and during training exercises to ensure that beluga whales are not present where they could be harassed or harmed. In light of the above, NMFS agrees with the Army's determination, using the best science available, that noise resulting from the use of HE munitions in the 60 mm, and 81 mm mortar weapons systems as part of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

C. Determination of Noise Effect from High-Explosive Munitions Use in 105 mm Howitzer and 120 mm Mortar Weapons Systems

The Army established a 500 m habitat protection buffer along Eagle Bay to minimize the possibility of acoustic exposure (to sound pressure levels equal to or greater than180 dB RMS SPL) into Eagle Bay as a result of these HE munitions. The 120-mm mortar HE rounds have the potential to generate noise levels in Eagle Bay and lower Eagle River greater than 160 dB RMS SPL, but less than 180 dB RMS SPL. However, the 160 dB threshold would extend about 500 m out into Eagle Bay. The 105-mm Howitzer HE round has the potential to produce noise levels greater than 160 dB RMS SPL, but less than 180 dB RMS SPL in lower Eagle River. The 500 m buffer along Eagle Bay ensures that noise levels greater than 160dB will not extend into the waters of Eagle Bay. As such, NMFS agrees with the Army's determination using the best science available that the 120 mm mortar and 105 mm Howitzer are the two HE weapons systems used at the ERF Impact Area that create noise with the potential to negatively impact beluga whales in Eagle Bay and lower Eagle River and therefore **is likely to adversely affect** the Cook Inlet beluga whale population.

Summary of Direct Effects from Noise that are Likely/Quantifiable

NMFS has been in the practice of using 180 db re 1 μPa SPL @ 1 m and 160 dB re 1 μPa RMS SPL @ 1 m as proxies for prohibited "take" under the MMPA. The Army has eliminated any serious risk of exposing beluga whales to direct impacts or noise more than 180 dB. There is significant risk inherent in the proposed action, however, of exposing beluga whales to noise more than 160 dB.

The proposed action entails year round live indirect fire weapons training using four weapons systems: 60-, 81-, and 120 mm mortars, and 105 mm howitzers. Each of these weapons systems can fire a variety of munitions. The categories of munitions to be used with these systems under the proposed action include FRTR, smoke rounds, ILLUM rounds, and HE rounds. As discussed above, the only one of these categories of munitions that could create the potential for “take” of beluga whales is HE rounds.

In the summer of 2007, researchers conducted simulations and field measurements near the mouth of the Eagle River to help predict underwater noise levels that could be produced by weapons training with high-explosive rounds. From the results of this research, 160 dB noise contours (at frequencies above 40 Hz, the lowest frequency audible by beluga whales) were developed to determine potential noise levels in Eagle Bay as a result of training. Habitat protection buffers and observation procedures to watch for whales were then developed as part of the proposed action, and along with existing conservation measures, will virtually eliminate any potential to adversely affect beluga whales with the use of 60- and 81 mm mortars. There does, however, remain a possibility that undetected beluga whales within Eagle Bay or Eagle River could be exposed to noise greater than or equal to 160 dB from firing of 105- or 120 mm HE munitions.

Although in general little is known about how noise impacts beluga prey, salmon have been found to respond to low frequency sounds such as those created by the proposed action, but only at very short ranges, within distances of a few feet from the sound source.

Due strictly to the potential for exposure of undetected whales in Eagle Bay or Eagle River to noise above 160 dB as a result of training with HE munitions using 105 mm howitzers or 120 mm mortars, NMFS agrees with the Army’s determination that noise from training as part of the proposed action **may affect, and is likely to adversely affect** the Cook Inlet beluga whale population.

ii. Direct Effects that are Unlikely/Unquantifiable

Potential direct effects of the proposed action on beluga whales that are unlikely /unquantifiable include the physical disturbance of natural resources during training missions, including: 1) injury or mortality as a result of a direct hit on a beluga whale; 2) the disturbance and modification of beluga whale habitat as a result of training activities; and 3) changes in the prey availability for beluga whales due to either a direct hit on beluga whale prey or the disturbance or modification of prey habitat. Although these are all possibilities inherent in weapons training with HE munitions, some are unquantifiable. The Army has many effective policies and regulations already in place, and is offering, as part of the proposed action, additional measures that minimize the true potential of occurrence from these effects.

This document identifies direct effects in two categories: 1) unlikely/unquantifiable (ex., direct hit and prey availability) and 2) likely/quantifiable (ex., noise). The direct effects from munitions shall be summarized separately for each category.

1. Potential for Injury or Mortality Due to a Direct Hit

Both Eagle River, running directly through the ERF Impact Area, and critical habitat in Eagle Bay, adjacent to the northern border of the ERF Impact Area, constitute known Cook Inlet beluga whale habitat. Given the inherent dangers from weapons training, there exists some small, unquantifiable, potential for a direct hit on a beluga whale in either of these two water bodies. Numerous regulatory and conservation policies are in place, however, to protect beluga whales from the possibility of injury or mortality due to direct contact by munitions or any objects resulting from training activities. Additional protective measures are offered as part of this proposed action (Conservation Measures).

The possibility of error due to equipment variability is built into the protections provided by the Army's training regulations, in the definition of target areas and SDZs. Even with the best protections in place, however, there is a non-quantifiable risk of soldier error in a training exercise. The Army provides a series of protocols, procedures, regulatory requirements, and supervisory responsibilities, which interact to ensure compliance with policies and regulations to the greatest extent possible. Soldiers go through a sequence of intensive training including classroom; simulation; training munitions; and finally training with HE-munitions. In preparation for deployment to the field, soldiers are required to complete a series of exams and certification drills that verify their proficiency with the standard operating procedures for operating the weapon system. Military forward observation teams also go through similar training prior to an exercise. Additionally, key leaders are formally trained at Army schools on all procedures involved in firing the weapon. When a unit deploys to the field it must review these procedures prior to the start of any live-fire exercise. During all aspects of the firing sequence (observation, firing data calculation, and weapons control) there are double checks in place to verify that the information being transmitted or set on the weapon is correct.

A. Determination of Effect for the Potential for Injury or Mortality Due to a Direct Hit

Although there is always an element of risk associated with live-fire training exercises, the Army has built in all reasonable measures to prevent a direct hit from impacting beluga whales, including rigorous training, use of SDZs and protective redundancies in firing protocol, beluga observation and cease-fire protocols. As such, NMFS agrees with the Army's determination using the best science available that the potential for injury or mortality due to a direct hit as a result of the proposed action is extremely unlikely to occur, is discountable, and therefore **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

2. Potential for Beluga Whale Habitat Disturbance or Modification

The proposed action has the potential to affect beluga whales through the disturbance or modification of their habitat within Eagle River and Eagle Bay. This section describes the beluga whale habitat types occurring in the action area, the mechanisms for potential direct effect of the proposed action on beluga whale habitat, and the anticipated impact of these mechanisms. Habitat for beluga whales found within or near ERF Impact Area is not expected to be significantly altered by year-round training activities at ERF Impact Area because, again, the Army has many effective policies and regulations in place to protect habitat, and conservation measures are offered as part of the proposed action. To protect beluga whale habitat from disturbance or modification the Army/JBER will: 1) not intentionally fire direct or indirect – fire weapons into Eagle River at any time; 2) not fire across or into navigable waters not listed in the Federal Register as a 'Restricted Area'; 3) not fire munitions that contain WP; 4) continue to monitor water quality in Eagle Bay and Eagle River; and 5) not cause any impedance to either ingress or egress of beluga whales along the stretch of Eagle River from Bravo Bridge to the mouth at Eagle Bay. Additionally, local natural processes are effective in repairing damaged areas.

In the Knik Arm of Cook Inlet, beluga whales generally are observed arriving in May and often use the area all summer, feeding during various salmon runs and moving with the tides. There is more intensive use of Knik Arm in August through the fall, coinciding with the Coho run. Beluga whales are opportunistic feeders known to prey on a wide variety of animals (NMFS 2008) including many species found in Eagle River. The Eagle River drainage supports small runs of Chinook, Coho, sockeye, pink, and chum salmon, as well as resident grayling, Dolly Varden, and rainbow trout (Miller and Bosch 2004). Beluga whales often gather in Eagle Bay between the months of May and November (Huntington 2000) and have been observed in Eagle River from June to October 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, about 4 miles from ERF Impact Area. They often retreat to the lower portion of Knik Arm during low tides (NMFS 2008).

While it is difficult to quantify the importance of various habitats in terms of Cook Inlet beluga whale health, survival, and recovery, 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). According to 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).

The training activities described in the proposed action occur on land and in the ERF Impact Area. No training activities occur directly in water, in beluga habitat. Since Eagle River runs through the middle of ERF Impact Area, and Eagle Bay constitutes the northern border of the ERF Impact Area, the potential for a direct hit on beluga whale habitat in either of these two water bodies does exist. The topography and water depth in river mouths is believed to be very important to beluga feeding. Beluga whales use the shallow water and river channel to aid in chasing and trapping fish. The Army has numerous regulatory and conservation policies in place to protect beluga habitat making it extremely unlikely that a direct impact on the river bank would occur thereby modifying the river channel and making it harder for beluga whales to trap fish. Moreover, since Eagle River is a dynamic and ever changing river system, damage from the extremely unlikely occurrence of a direct impact would be temporary, as the continuous process of natural bank erosion would re-carve the river bank.

The physical effects of direct impacts in the ERF Impact Area wetland as a result of the proposed action will be obvious due to crater formation from explosives. This wetland area does not constitute habitat for Cook Inlet beluga whales or their prey. The Army has a policy; however, to locate targets away from surface water bodies to minimize all munitions impacts on water resources and associated wildlife. On-the-ground inspection has shown that the craters fill in with sediment and that the vegetative mat recovers. Thus, craters in ERF do not appear to affect the overall hydrological or ecological function of the wetland.

A. Determination of Effect for the Disturbance or Modification of Beluga Whale Habitat

As described above, the proposed action poses very little potential for direct physical effects on beluga whale habitat. The only foreseeable scenario in which effects may occur regards a detonation in shallow water or near a stream bank. The careful design of the proposed action, and in particular the multiple habitat protection buffers, render this scenario quite unlikely. Moreover, because the ERF system as a whole is a dynamic and largely self-repairing system, adverse impacts to beluga habitat are not anticipated even in the unlikely event of an errant round. For these reasons, and through use of the best available science, the NMFS agrees with the Army’s determination that the disturbance or modification of whale habitat as a result of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

3. Potential to Change Availability of Beluga Whale Prey

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 fish runs, water depth and fish density may be more important than sheer numbers of fish in the whales’ feeding success (NMFS 2008). Eagle River, Otter Creek, ponds on ERF, and Eagle Bay are the water bodies that contain fish within the region of influence. The proposed action is not expected to result in reduced prey availability for beluga whales, once again due to the numerous policies and regulations in place and proposed to protect these water bodies and the life within.

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 substrates 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. Eagle River and Otter Creek are listed as Essential Fish Habitat.

The Alaska Department of Fish and Game (ADFG) considers Eagle River to be relatively unproductive, but it does support small runs of Chinook, Coho, sockeye), pink, and chum salmon, as well as resident grayling (*Thymallus arcticus arcticus*), Dolly Varden, and rainbow trout (*O. mykiss*) (Miller and Bosch 2004).

The real potential for a direct hit on beluga prey species is minimal due to the policies and regulations to protect beluga whales and beluga habitat. To protect beluga whales and their habitat, and therefore, their prey species found in Eagle Bay and Eagle River, the Army will: 1) not intentionally fire into Eagle River at any time or within specified habitat protection buffers around Eagle River during unfrozen conditions; 2) not fire into specified habitat protection buffers along Eagle Bay shoreline in the ERF Impact Area; 3) not intentionally fire direct or indirect – fire weapons into Eagle River at any time; and 4) not fire across or into navigable waters not listed in the Federal Register as a 'Restricted Area'.

The only freshwater salmon rearing and spawning areas within the action area occur in Otter Creek. The Army is proposing several additional conservation measures as part of this proposed action, including a 50 m habitat protection buffer along the banks of Otter Creek, to supplement those already in place and augment the protection of Eagle River, and ponds in the region of ERF, as well as the natural resources within them. The potential does exist, however, for increased erosion and sedimentation in waterways due to training activities during summer months. Any additional erosion or sedimentation occurring under the proposed action would, however, only affect waterways that are already characterized by high natural turbidity, and would not significantly alter the quality of this habitat. After considering these potential impacts, the Army has determined that the proposed action would not adversely affect Essential Fish Habitat or the availability of beluga whale prey.

A. Determination of Effect for Changes in Availability of Beluga Whale Prey

The proposed action poses very little potential for changes in availability of beluga whale prey, primarily due to the many conservation and protection measures proposed and already in place. Because the proposed action has very little chance to affect fish populations or conditions in Otter Creek, Eagle River, or any other fish habitat, NMFS agrees with the Army's determination under the best available science that the potential for changes in availability of beluga whale prey as a result of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

Summary of Direct Effects of Munitions that are Unlikely/Unquantifiable

The potential direct effects of munitions use in year-round live-fire weapons training include 1) injury or mortality as a result from a direct hit; 2) the disturbance or modification of beluga whale habitat; and 3) changes in the prey availability. Although these effects are all possibilities inherent in weapons training with HE munitions, numerous policies are included in the proposed action and others are already in existence to minimize the potential. Munitions should not be directly introduced into beluga whale habitat or prey habitat as a result of the proposed action. Firing into Eagle River, Eagle Bay, Otter Creek, and protected ponds as depicted in Figure 3, as well as the habitat protection buffers along their shorelines shall be strictly forbidden; and educational and training programs will be implemented to ensure compliance. Thus, NMFS agrees with the Army's determination, as described above, that direct effects of munitions as a result of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

b. Indirect Effects

1. Munitions Indirect Effects that are Unlikely/Unquantifiable

The potential indirect effects of the proposed action on beluga whales, their habitat and prey as a result of munitions use that are unlikely/unquantifiable include: 1) degradation of water quality due to the munitions residue accumulation; 2) the degradation of water quality due to increased erosion and sediment runoff; 3) contamination of fisheries (bioaccumulation in fish); and 4) effects of noise on prey fisheries

Degradation of Water Quality Due to the Deposition of Munitions Constituents

The potential for the degradation of water quality, affecting beluga habitat as well as beluga prey, arises from the introduction of munitions constituents into the environment as a result of firing munitions into the ERF Impact Area. The following analysis examines the likelihood of the proposed action causing such impacts.

The term "munitions constituents" refers to any material originating from fired munitions, unexploded ordnance, discarded military munitions, or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (10 USC 2710(e)(3)). The primary components (more than 97 percent by weight) of mortar and howitzer munitions are explosives, iron (steel), copper, and aluminum. The projectile body is the only part of the munitions that lands in the impact area and it is typically made of steel or iron. Many of the rounds have copper alloy rotating bands, and the fuzes and fins are made of aluminum.

Munitions also contain trace amounts of other metals such as zinc, manganese, nickel, chromium, and cadmium that are generally components of steel or iron alloys. For instance, chromium and nickel are common additives to stainless steel that enhance corrosion resistance. Other compounds, such as waxes and silicon, represent just a few grams of the overall weight of munitions. During a detonation, the metals are discharged as shrapnel and essentially everything else is consumed. The remaining 2 – 3 percent of the munitions' weight characterized by other compounds represents 43 grams (0.095 lbs) for the 81-mm mortar and 143 grams (0.31 lbs) for 105-mm howitzer.

Generally, munitions constituents have the potential to impact health and the environment. Many of these constituents are energetic compounds such as propellants. These compounds have been detected at firing points (generally propellants) and in impact areas (generally explosives and white phosphorus (WP)).

Testing has repeatedly shown that firing into the ERF Impact Area is not causing contamination of water or fisheries. JBER has ongoing comprehensive monitoring programs in place and will continue to implement these programs in addition to implementing supplemental monitoring programs as a part of this proposed action, as described below, to ensure that the proposed action does not result in the degradation of water quality in the action area.

Munitions Use and Fate

The proposed action would include the firing of approximately 5,346 HE rounds into the ERF Impact Area annually. This is substantially fewer than the estimated 9,000 HE artillery and mortar rounds typically fired on an annual basis prior to 1991. The maximum number of all munitions that could be fired annually into ERF Impact Area under the proposed action would be about 14,560. Munitions that are fired during military training will experience one of several fates. Most rounds detonate as intended. Some, however, undergo a low-order or partial detonation, or become duds (also referred to as unexploded ordnance).

Environmental Effects of Munitions Constituents

A substantial body of water quality data has been collected at ERF during the past 26 years. The Army investigated munitions constituents at the ERF Impact Area due to a suspected correlation between munitions and high levels of waterfowl mortality. As part of the initial investigations, sediment and surface water samples were collected from various locations within ERF Impact Area during 1989, 1990, and 1993. None of these initial studies detected munitions residues, except WP, at concentrations deemed to be harmful to human health or the environment. A total of 258 sediment samples were collected in 1989, 1990, and 1993 as part of the initial assessments. These samples were collected from areas where the highest rates of mortality were observed. In general, the concentration levels of residues were only a few parts per million. The concentrations of detected organic analytes in surface water were only a few parts per billion (CH2M Hill 1997). The studies that CRREL conducted in 1990 showed that the only detectable levels of munitions residues at ERF Impact Area were propellant grains found on the open burn/open detonation (OB/OD) pad and in the salt marsh along the edge of the pad. Researchers suspected that the propellant grains found near the OB/OD pad had either been dumped there or had been dispersed during a demolition exercise, and was not the result of firing mortars or artillery at ERF Impact Area. Additional studies were conducted in 1993 to test surface and sediment samples. The samples were analyzed for metals, explosives, organics, and pesticides. None of the samples contained detectable explosives, organics or pesticides, and the metals concentrations were within background parameters for a glacially-fed tidal wetland system (USAEHA 1993).

Following the initial investigations at ERF and the determination that WP was the cause of waterfowl mortality at the ERF Impact Area, the Army continued to fund and conduct research to quantify the levels of residues that remain after weapons training. The presence of munitions-related compounds has been studied at 31 military ranges in the U.S. and in Canada, including ERF Impact Area and many other artillery ranges (Jenkins et al. 2007). Researchers from CRREL have studied the presence of residues from artillery and mortar live-fire exercises at ERF Impact Area and associated upland firing points. White phosphorous, due to its devastating impacts on waterfowl, has been studied most extensively, but other munitions are known to be harmful at high levels and have been studied as well. The CERCLA Record of Decision (ROD) involves extensive study not only of WP, but of these other munitions residues as well. Summarizing these studies, munitions residues were not found extensively on ERF. Additionally, soil and groundwater samples were analyzed for an extensive list of volatile and semi-volatile organic chemicals and metals. Very few chemicals were detected in either the soil or groundwater.

Studies conducted since 1993 have confirmed these results and reiterate that the only contaminant of concern ever to be identified at ERF Impact Area is WP. The Army has focused considerable efforts on the remediation of WP from the ERF wetland and has reduced waterfowl mortality to levels easily satisfying the remedial action objectives outlined in the CERCLA ROD. While approximately 1,000 ducks died in 1996, estimated waterfowl mortalities due to WP in 2007 were less than 40. JBER plans to continue monitoring and sampling efforts to ensure long-term success of the implemented CERCLA remedy.

Historic and recent research suggests that munitions constituents, while present in the impact area, are not migrating off ERF. In addition, explosive residues are not persistent in the wetland. As previously mentioned, scientific data suggest that high-order detonations do not present an environmental hazard with regard to the release of munitions constituents.

In contrast, low-order detonations represent the greater potential for deposition of munitions residues. Samples collected near a low-order detonation crater during a 2007 field study contained measurable amounts of energetic compounds. Residues were present, ranging from tens to thousands of parts per million in the soil samples. These residues were generally un-reacted particles of explosives that may be 1 – 2 cm in diameter. Additional testing at the site showed that the concentrations decrease with time.

CRREL researchers also conducted water and sediment sampling near two low-order sites that had been detected at the ERF Impact Area. Water and sediment samples were collected during a series of flooding tides from a gully that was in the drainage path of the low-order detonations, in the end of August 2007. Energetic residues were not detected in sediment samples collected from the gully down-gradient from the low-order detonations. Water samples collected from the head of the gully adjacent to the low-order detonations contained detectable munitions residue concentrations; however, concentrations decreased significantly downstream within the gully and the constituents were undetectable about 80 ft from the source (Walsh 2008).

Subsequent water quality testing conducted as part of the NPDES application process produced similar results. Water quality samples were collected annually from ERF and Goose Bay (comparable ecosystem to ERF and Eagle Bay, and is used as the background natural state against which the ERF samples are compared) for six years, between 2002 and 2008. Samples were analyzed for energetic or explosive residues and metals. None of the munitions constituents of interest were detected at levels above background, and results showed that there were no differences in water quality parameters for metals between ERF and Goose Bay. Results of these water quality monitoring events have been submitted to EPA for review.

In 2007, in connection with the preparation of an EIS to re-instate year-round indirect live-fire training at Fort Richardson, water quality samples were collected during three separate sampling events from areas along Eagle River, including areas up river from ERF and at the river's mouth. Samples were analyzed for the presence of metals, explosives, and PCB. None of the samples contained metals in excess of drinking water Maximum Contaminant Levels. In addition, no explosive compounds or PCB compounds were detected.

A. Determination of Effect on Water Quality Due to Munitions Constituents Deposition

Testing has consistently shown that munitions constituents are not accumulating in or migrating off ERF. Studies conducted since 1993 reiterate that the only contaminant of concern ever to be identified at ERF Impact Area is WP. WP contamination has been remediated on ERF and WP is no longer used in wetlands. The number of HE rounds to be fired annually at ERF Impact Area under the proposed action is less than were fired historically when the range was used year-round. Moreover, the anaerobic environment at ERF has great capacity to chemically reduce munitions constituents. For these reasons, and through use of the best available science, NMFS agrees with the Army's determination that degradation of water quality due to deposition of munitions constituents as a result of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

2. Water Quality Degradation Due to Erosion and Sedimentation

The potential for the degradation of water quality, affecting beluga habitat as well as beluga prey, arises from not only the introduction of munitions constituents into the environment, but also from increased sediment runoff as a result of firing munitions into the ERF Impact Area. Weapons training can alter wetland and aquatic habitat through cratering, soil compaction, soil erosion, and vegetation removal, creating the potential for increased sediment runoff. Habitat protection buffers included as part of the proposed action will minimize or prevent such impacts from occurring near any clear water tributaries or other salmon spawning or rearing habitat within the ERF Impact Area. Moreover, Eagle River and other large rivers draining into Knik Arm are fed by glacial melt and carry massive quantities of naturally occurring silt and clay-sized particles. Thus, any increase in sediment load in Eagle River associated with the proposed action would not discernibly impact fish or beluga whales or their habitat. Sediments that settle out of floodwaters and are deposited in ponds and mudflats are important to the maintenance of the ERF ecosystem. Researchers estimate that there is a net influx of sediment into ERF that counteracts the effects of gully and river channel erosion (Racine et al. 1995).

Erosion and sedimentation are a constant within the ERF Impact Area and significant changes have occurred within the last 40 years. Erosion associated with channel changes mobilizes significant amounts of bank sediments that are eventually transported downstream towards the mouth of the river. Some sediment, however, is deposited into the ponds, mudflats and wetland areas during flooding tides. Various factors determine the amount of new sediment that is transported within Eagle River and the wetland. The amount and frequency of tidal inundation, currents (both wind and water), topographic slope, and ice all interact to determine the flux of sediment and water within the flats. Although tides higher than 32 ft often inundate ERF, lower tides that are supplemented by river surge or high winds may also cause inundation of the wetland. Ice damming can also cause flooding in ERF. Researchers (Racine et al. 1994) found that the hydrology of the landward third of ERF is controlled or dominated by the dynamics of Eagle River, and that the seaward two-thirds of ERF are dominated by tidal inundation and ebb. They also noted that the drop in water level during the ebb tide is slower than the rise during flooding. The difference indicates a temporary storage of tidal waters that allows sedimentation to occur within ERF. Existing data indicate that there is a net transfer of sediment into ERF.

Significant sedimentation of ponds and mudflats can occur during flooding tides, and the major source of sediment is the Knik Arm waters that contain extremely high levels of total suspended solids or sediment. Total suspended solids levels measured in ERF can be as high as 2,000 milligrams of sediment per liter of water. Total suspended solids levels in Knik Arm can be five times higher than levels found in Eagle River during fall months (Racine et al. 1994). Sedimentation, however, can occur throughout the year and 60 or more flood events can occur each year. Sedimentation rates vary dramatically within ERF and are dependent upon vegetative cover, distance from the sediment source (e.g., Knik Arm), and elevation. Sedimentation rates can vary from about 2 to 35 mm (0.08 to 1.38 in) per year depending upon location in the flats, and data suggest that the largest net accumulation of sediment is occurring in ponds. The rate of sedimentation tends to increase eastward from the Eagle River levees, across the mudflats and into the ponds. Sedimentation in un-vegetated mudflats that would typify conditions after detonation of HE munitions would be expected to average about 7 to 15 mm (0.28 to 0.59 in) per year. Each successive flooding tide deposits new material, which eventually fills the ponds, marshes, and craters. The process of sedimentation is evident from observations of old impact craters that have been completely filled with sediment during the last 18 years. Based on the length of time since munitions have been fired at ERF Impact Area during summer months (18 years) and the depth of a crater created by a 105-mm howitzer round (about 70 cm or 27.6 in), the sedimentation rate could be as high as 40 mm (1.57 in) per year in certain areas. Further monitoring may be warranted, however, to fully understand the dynamics of how cratering will affect the sedimentation process.

Habitat protection buffers are proposed along Eagle River and Otter Creek to minimize the impacts of erosion and sedimentation, among other reasons. Due to the massive sediment loads and high natural turbidity in the affected waterways, the Army has determined that any sedimentation resulting from the proposed action would not significantly alter the quality of this habitat and would not adversely affect Essential Fish Habitat.

A. Determination of Effects on Water Quality Due to Erosion and Sedimentation

As explained above, weapons training can alter wetland and aquatic habitat through cratering, soil compaction, soil erosion, and vegetation removal, creating the potential for increased sediment runoff. Habitat protection buffers included as part of the proposed action will minimize or prevent such impacts from occurring. Moreover, Eagle River and other large rivers draining into Knik Arm are fed by glacial melt and carry massive quantities of naturally occurring silt and clay-sized particles. Thus, any increase in sediment load in Eagle River associated with the proposed action would not discernibly impact fish or beluga whales or their habitat. Researchers estimate that there is a net influx of sediment into ERF that makes the impact area basically self-repairing. For these reasons, and through use of the best available science, NMFS agrees with the Army's determination that the degradation of water quality due to erosion and sedimentation as a result of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

3. Fisheries Contamination

Beluga whales are opportunistic feeders known to prey on a wide variety of animals (NMFS 2008) including many species found in the Eagle River. The potential exists for the bioaccumulation of munitions constituents in beluga prey as a result of the proposed action; however, studies have repeatedly shown that contamination of beluga prey is not, in fact, occurring. Since munitions deposition levels under the proposed action will be lower than historically documented prior to 1990, contamination of prey as a result of the proposed action is not anticipated. Fish tissue sampling will be conducted in conjunction with regulatory agencies until absence of munitions constituents in prey species is validated by both regulatory agencies and JBER.

During the 2007 field season, the Army conducted a study to identify fish species in Eagle River that could be a food source for humans and beluga whales (Garner et al. 2008). Gill nets and minnow traps were used to capture 703 fish that represented nine different species and three developmental stages (juvenile, juvenile/adult and adult). The primary species captured during the sampling were 1) chum, Coho, pink, and sockeye salmon, 2) three-spine stickleback, 3) slimy sculpin (*Cottus cognatus*), and 4) starry flounder. Fish tissue samples were collected and sent to the U.S. Army Center for Health Promotion and Preventative Medicine (USACHPPM) for analysis. Fish samples were also collected for NMFS for their catalog of fatty acid profiles of potential Cook Inlet beluga prey items. The munitions concentration residues tested during the analysis did not exceed the detection limit in any of the fish tissue samples. In other words, no munitions residues were detected. The results of this study indicate that munitions residues are not entering the food chain via ERF. These findings are consistent with other data showing that neither munitions related residues nor PCBs that could be associated with Army activities are entering Eagle River. In 2008, samples of bottomfish and smelt (saffron cod, starry flounder, snailfish, eulachon and rainbow smelt) were sent to

USACHPPM for analysis of the same analytes. Results from these analyses were negative as well.

CH2MHill (1998) found no significant accumulations of WP in fish during sampling conducted as part of the initial CERCLA investigations at ERF.

Both fish tissue sampling (Garner et al. 2008) and water quality sampling from Eagle River indicate that munitions constituents are not polluting the river or entering the food chain. Additionally, past studies have shown that WP did not affect aquatic species (USARAK 1997). Since WP is no longer being used in ERF Impact Area and successful cleanup efforts are almost complete, the potential for any future impact of WP contamination is not likely. Thus, based on the low bioaccumulation potential for most munitions residues, the highly reducing conditions present in ERF, as well as the results of Eagle River fish tissue contamination studies that have provided strong evidence that munitions residues are not entering the food chain, it is expected that the proposed action will not have significant impacts on the fisheries that serve as beluga whale prey.

A. Determination of Effects on Fisheries Contamination

The potential exists for the bioaccumulation of munitions constituents in beluga prey as a result of the proposed action. Most munitions residues, however, have a low bioaccumulation potential. Both fish tissue sampling and water quality sampling from Eagle River indicate that munitions constituents are not polluting the river or entering the food chain. Since munitions deposition levels under the proposed action will be lower than historically documented prior to 1990, contamination of beluga prey as a result of the proposed action is not anticipated. For these reasons, and through use of the best available science, NMFS has agreed with the Army's determination that the contamination of fisheries due to the bioaccumulation of munitions constituents as a result of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

4. Potential Effects from Noise on Prey Fisheries

In general, little is known about how noise impacts fish. 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, within distances of 2 ft or less from the sound source, even though the sounds were at levels up to 156 dB. 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 only able to respond to low-frequency sound and only able to react 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).

Sadler and Woodbury (2009) were unable to demonstrate adverse effects to juvenile fish exposed to pile driving. However, this fish study did not measure sub-lethal effects to fish, such as temporary threshold shifts in hearing sensitivity. Temporary threshold shifts is not injury in the strict sense of the word, but is rather a temporary numbing of the auditory system. The functional effect of impaired sensory ability could potentially reduce survival, growth, and reproduction, increase predation, and alter foraging and reproductive behaviors.

A. Determination of Effects from Noise on Prey Fisheries

As discussed above, in general little is known about how noise impacts fish. Salmon have been found to respond to low frequency sounds, but only at very short ranges, within distances of a few feet from the sound source. In light of this information, and given the habitat protection buffers to be implemented in the proposed action, NMFS agreed with the Army's determination, using the best science available, that the effects of noise on prey fisheries as a result of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

Summary of Indirect Effects

Munitions constituents are undoubtedly deposited into the ERF Impact Area due to unexploded ordnance and low-order detonations, however, water quality data collected during the past 25 years indicate that these munitions related compounds are not accumulating nor are they migrating into local water bodies. Only small amounts of explosives in unexploded ordnance are exposed to the environment as the unexploded ordnance corrodes over time. According to modeling conducted by CRREL researchers, corroding unexploded ordnance contribute only a small proportion to the net change in overall dissolved high-explosives residues within an impact area. At the calculated deposition rate of about 3 kilograms per year, residues from low-order rounds would not significantly impact the environment at ERF Impact Area. Degradation processes in ERF continually breakdown explosives and prevent a net buildup in the wetland.

Even after 60 years of munitions training at ERF Impact Area, only low levels of munitions residues have been detected in ERF, and only in the immediate vicinity of low-order rounds or burn sites (Racine et al. 1992; USAEHA 1993; Walsh et al. 2008). The ROD signed following the CERCLA investigations concluded that WP was the only munitions constituent that posed a risk to the ecological health at ERF (CH2MHill 1998), and the Army has effectively met the requirements to clean up WP at ERF with the small remaining areas to be capped.

The basic reason that munitions residues are not detected at ERF Impact Area is the reducing environment found in the wetland. In general, wetlands are particularly good water filters and are effective at removing both organic and inorganic contaminants (USEPA 1993). Processes of sedimentation, microbial degradation, precipitation, and plant uptake remove most contaminants (USEPA 2000). Heavy metals in a wetland system may be sorbed to wetland soil or sediment, or may be chelated or complexed with organic matter (USARAK 2010). Metals can precipitate out as sulfides and carbonates, or get taken up by plants (USARAK 2010). Compounds in sediment, such as iron oxides, show preference for certain metals (USARAK 2010). Sulfate-reducing bacteria oxidize organic matter and reduce sulfate to form hydrogen sulfide (USARAK 2010). Hydrogen sulfide reacts with metals to form metal sulfides, which precipitate (USARAK 2010). Organic compounds can be broken down for consumption by microorganisms in a wetland system. This biodegradation removes the organic compounds from the water as they provide energy for the organisms (USARAK 2010). Organics can also be degraded when taken up by plants.

It is suspected that several processes working in conjunction contribute to the degradation of explosives (USARAK 2010). Wastewaters contaminated with munitions compounds have been successfully treated using constructed wetlands (Lorion 2001). The ERF wetlands must have an incredible capacity to chemically reduce munitions-related constituents.

Organic compounds do not persist and are degraded quickly in the ERF environment. This is the same reason that man-made wetlands are commonly constructed to treat runoff from contaminated sites. If this were not the case, large quantities of residues would have been detected in ERF Impact Area during the extensive sampling that has been conducted since the early 1980s. The exception to this rule is WP, which is not broken down in the wetland environment.

A general summary of findings from studies that have been conducted at ERF follows:

- There has been no net loading of explosives or metals at ERF. Munitions inputs have not and are not expected to exceed the carrying capacity of the wetland or its ability to effectively biodegrade explosives.
- Explosives have not been detected in water samples collected from Eagle River and Eagle Bay, indicating that these constituents are not abundant and are not migrating off the range.
- Munitions related compounds were not detected in fish tissue samples and are not entering the food chain via ERF.
- Metals concentrations in water, sediment, and soils are consistent with background levels and are less than naturally occurring metals levels found in groundwater in some areas on Fort Richardson.
- Anaerobic biodegradation is the primary mechanism at work degrading explosives and metals deposited into ERF.

The number of HE rounds to be fired annually at ERF Impact Area under the proposed action is still about 3,600 less than were fired prior to 1990 when the range was used year-round. Munitions compounds were not widely detected during extensive testing conducted at the height of year-round munitions use and those compounds are not widely detected today. Scientific testing conducted during the past 25 years indicates it is unlikely that year-round training using explosive munitions will result in contaminant loading within ERF. On the contrary, the evidence indicates that ERF may be a particularly effective location for an impact area given the ability of the highly reducing environment in the wetland to effectively treat and buffer munitions inputs. Thus, NMFS agrees with the Army's decision, as described above, that indirect effects of munitions as a result of the proposed action **may affect, but is not likely to adversely affect** the Cook Inlet beluga whale population.

c. Mitigation Measures

The mitigation measures are currently in place through existing natural resource management plans (INRMP), Army Regulations, or NEPA documentation (Table 5).

The current INRMP put into place policies, programs, procedures, and projects that will provide a benefit to marine mammal species occurring on or directly adjacent to JBER waters and lands. The current INRMP also states explicitly or incorporates by reference controls on military training in USARAK Regulation 350-2 (Regulation 350-2, Training, United States Army Alaska Range Regulation; USARAK 2002). USARAK Regulation 350-2 provides procedures for planning, requesting, and operating ranges and training areas within Army lands. It mandates specific safety policies for conducting live-fire as required by DA regulations. This regulation applies to all military units, organizations, and authorized individuals and agencies that use ranges and training areas at Fort Richardson. Both of these documents will be updated to include any additional mitigation measures developed during ESA consultation or the EIS process related to the resumption of year-round live-fire training on Fort Richardson.

Table 5. Marine Mammal Mitigation Measures

Goal	Mitigation Measures	Authority
Minimize impacts to marine mammal species from military training	Live-fire activities may never intentionally target wildlife	Federal and State Law reflected in USARAK Regulation 350-2
	Harassment of fish and wildlife is prohibited. Any action that disturbs fish and wildlife is considered harassment by Federal and Alaska State law. Harassment includes such things as pursuit with vehicles or aircraft, feeding, and shooting wildlife. Vehicles, watercraft, and aircraft, including helicopters, may not be used to herd/chase wildlife off the ranges or training areas. Individuals who harass fish and wildlife are subject to prosecution.	Federal and State Law reflected in USARAK Regulation 350-2
	Army units will not fire munitions outside military reservation boundaries. Surface danger zones (SDZs) may not extend beyond military reservation boundaries.	USARAK Regulation 350-2
	Dedicated impact areas (i.e., ERF Impact Area) are permanently off limits to maneuver training and all recreation.	USARAK Regulation 350-2
	Army units will not intentionally fire into Eagle River at	INRMP

	any time or within specified habitat protection buffers around Eagle River during unfrozen conditions[1]. The habitat protection buffers are defined for each weapon system and munitions type.	
	Army units will not fire into specified habitat protection buffer along Eagle Bay shoreline in ERF Impact Area, the size of which is base on habitat protection goals.	INRMP
	Army will place all new targets outside of the defined habitat protection buffers and will cease using any old targets within those areas.	INRMP
	Army units will not fire HE munitions into ERF Impact Area during the peak waterfowl migration periods in the spring and fall as determined by JBER biologists. While this prohibition is enacted to protect migratory waterfowl, the timing of the migratory period coincides with peak beluga activity in Eagle River.	INRMP
	JBER marine mammal observers will be present prior to, during and after training exercises to ensure that marine mammals are not present where they could be harassed or harmed due to training activities.	INRMP
	Army will design its proposed action to avoid take to the extent practicable, and will not engage in activities likely to cause take without authorization under the MMPA and ESA.	INRMP
Minimize impacts to marine mammals from recreational use	Explosive munitions impact areas (i.e., ERF Impact Area) are permanently off limits to recreational users.	USARAK Regulation 350-2
	JBER will not provide recreational access to Knik and Eagle Bay from Fort Richardson.	INRMP
	JBER prohibits rafting access to ERF Impact Area. The take out point for Eagle River rafters is 4 km upstream from the mouth of the river approximately 100 m upstream of Route Bravo Bridge. The Army is also currently proposing restrictions to access through a portion of Eagle Bay and Eagle River.	USARAK Regulation 350-2
Minimize impacts to marine mammal habitat	Army units will not intentionally fire direct or indirect-fire weapons into Eagle River at any time.	USARAK Regulation 350-2
	There will be no firing across or into navigable waters not listed in the Federal Register as a ‘Restricted Area’.	USARAK Regulation 350-2
	Munitions containing phosphorous as the primary	USARAK

[1] The term unfrozen conditions is used to refer to times when the following ice conditions are not met: 1) two inches of ice cover or frozen sediment to enable firing of 60-mm and 81-mmmortars; and 2) five inches of ice cover or frozen sediment to enable firing of 105-mm howitzers and 120-mm mortars (USARAK 2005)

	constituent will not be fired into wetlands.	Regulation 350-2
	Water quality sampling will be conducted in conjunction with regulatory agencies until absence of constituents in Eagle Bay and Eagle River is jointly validated	INRMP
	Eagle River will remain unobstructed to normal passage for beluga whales through the entirety of ERF. Army/ JBER activities will not cause any impedance to either ingress or egress of beluga whales along the stretch of Eagle River from Route Bravo Bridge downstream to the mouth at Eagle Bay.	INRMP
Protect and Enhance Marine Mammal Food Sources and Associated Habitat	No tracked or wheeled maneuvering is permitted within a 50 m buffer around all streams, lakes, and any open, flowing water located on JBER lands during the summer unless crossing at a 90 degree angle to the stream. Fish spawning streams will not be crossed during summer. All appropriate state and federal permits will be obtained prior to any in-water activities occurring in anadromous waterways.	USARAK Regulation 350-2
	Stream bank restoration and erosion control projects will be conducted on JBER.	INRMP
Monitor occurrence or marine mammals on JBER controlled waters and lands	Continue to work cooperatively with NMFS to monitor beluga whales in Eagle Bay and Knik Arm. Monitoring will continue to be refined to improve the ability to detect beluga whales.	INRMP
	Conduct weekly monitoring (contingent on the presence of live training) during the summer/fall to identify the presence and abundance of beluga whales in Eagle River.	INRMP
	JBER marine mammal observers will verify the presence or absence of beluga whales in Eagle River (from a boat at the river mouth) prior to firing to determine applicable firing restrictions.	INRMP

i. Existing Mitigation Measures

Mitigation measures that are in place to protect Cook Inlet beluga whales, their habitat, and their prey from noise include:

- Army will not fire munitions outside military reservation boundaries.
- Army will not intentionally fire into Eagle River or any open body of water at any time.
- JBER will continue to work cooperatively with NMFS to monitor beluga whales in Eagle Bay and Knik Arm. Monitoring will continue to be refined to improve the ability to detect beluga whales.
- JBER will conduct weekly monitoring during the summer and fall to identify the presence and beluga whale abundance in Eagle River.
- JBER will map the bathymetry of Eagle River and Eagle Bay using multi-beam sonar. This map will be compared to areas of observed prey pursuit and feeding

by beluga whales. It should also provide data that could aid in future noise attenuation studies.

II. Mitigation Measures

NMFS recommends these specific conservation measures be added to further protect beluga whales, their habitat, and their prey from noise include:

- JBER marine mammal observers will verify the beluga whale presence or absence in Eagle River (from a boat at the river mouth) prior to commencing training exercises and will call for a cease fire for training exercises employing HE munitions as specified (specific weapons and targets) herein when beluga whales are spotted.
    - JBER personnel shall verify beluga whale presence at the surface.
    - JBER personnel shall verify beluga whale presence on those whales below the surface, with the best technology available that would work in the environmental conditions found in ERF.
- During unfrozen conditions, the Army will not fire into a specified 130 m habitat protection buffer along Eagle River and 50 m habitat protection buffer along Otter Creek.
- Army will not fire into a specified 500 m habitat protection buffer along the Eagle Bay shoreline in ERF at any time.
- JBER will inform NMFS of firing closure dates due to waterfowl migratory periods in ERF.

d. Occurrence of and Reported Take in Eagle Bay and Eagle River

There has been no reported take (as defined by either the MMPA or the ESA) of Cook Inlet beluga whales in Eagle Bay or Eagle River as a result of Army activities in ERF. However, in 2008, observers at the mouth of Eagle River noticed several incidences (four airplanes, two Zodiac rafts, and one unidentified) of possible take by non-Army entities.

e. 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 final rule to designate this critical habitat was published in the Federal Register on 11 April 2011 (76 FR 20180). The Eagle Bay affected area for the proposed action is within the 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 beluga whale critical habitat occurring in the action area, the mechanisms of potential direct and indirect effects from the year round firing, and the anticipated impact of these mechanisms to the critical habitat. For each essential feature (also known as a Primary Constituent Element (PCE)), we consider the baseline condition. We then assess the potential effect of the proposal 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 is estimated. Any mitigation 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 PCEs relative to their ability to provide for the ecological needs of a recovered population.

PCE 1 - Intertidal and subtidal waters of Cook Inlet with depths <30 feet (9.1 m) (MLLW) and within five 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 for Cook Inlet beluga whales 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 for the critical habitat occurs in the waters of Eagle Bay.

Quality

The quality of this essential feature is not expected to be altered by the project. Therefore, the functional effect of the PCE will not change and would still provide the water depths and channels that support foraging behavior. Cook Inlet beluga whales have often been observed at the mouth of Eagle River using the shallow channels and banks in their feeding strategy.

Quantity

None.

Availability

Knik Arm, including Eagle Bay, and Cook Inlet has habitat as defined in PCE 1 in abundance. The year round firing would not affect the availability of PCE 1, and therefore, would not have measurable consequence to individual whales or 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 Knik Arm and Eagle Bay include Chinook, chum, Coho, pink, and sockeye salmon. In determining the effects of this action on PCE 2, we considered the loss of and alteration to fish habitat, and the effects from year round firing with munitions in ERF on these prey species. The Army will refrain from firing directly into Eagle River at any time and will continue to monitor water quality in Eagle Bay and Eagle River. Water quality sampling will be conducted in conjunction with regulatory agencies until absence of constituents in Eagle Bay and Eagle River is jointly validated. Eagle River will also remain unobstructed to normal passage of beluga whales through the entirety of ERF. Although these benefits are for Cook Inlet beluga whales, prey species, which share the same habitat will also benefit.

Quality

The quality of this essential feature is not expected to be altered by this project, and therefore, PCE 2, primary prey species, will not. These fish are largely anadromous species whose residence time in fresh water may be two years or less, and within Eagle Bay are limited to a few days to several weeks. Pollock and sole are not expected to occur within Eagle Bay. Quality of prey may be considered to include their lipid content, body burdens of toxins or pollutants, and nutritional value to beluga whales. Additional firing in ERF Impact Area could result in an increased exposure by fish to pollutants; however, we were unable to quantify any future pollutant levels or estimate their impact on the quality of these prey species.

Quantity
None.

Availability
The availability of this essential feature is not expected to be altered by this project, and therefore, PCE 2, primary prey species, will not change. Beluga whales successfully feed at the mouth of Eagle River and in Eagle Bay, and this project would not affect these foraging areas.

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 Saint Lawrence, have been found to carry heavy body burdens of certain chemicals. Cook Inlet beluga whales appear to have lower levels of many contaminants than other populations. However, the Conservation Plan (NMFS 2008) and the Final Rule for critical habitat designation stated that toxins 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 from 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 a potential concern to Cook Inlet beluga whales. Those found to have "probable" concern included: chlorinated compounds (e.g., DDT, PCB, Dioxins), metals (e.g., methyl mercury, selenium, 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 fact that munitions deposition levels under the proposed action will be lower than historically documented prior to 1990. Beluga prey contamination, as a result of the proposed action, is not anticipated.

Quantity
None.

Availability
The availability of this essential feature is not expected to be altered by this project, and therefore, PCE 3, water free of toxins, will not change.

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 (June) and satellite tagging data (June – May) 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 primarily 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 sometime wait in Eagle Bay. Whales moving up Knik Arm tend to prefer the eastern shoreline (Cornick and Saxon-Kendall 2009).

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

Quality

Data associated with monitoring the ERF Impact Area found a high level of beluga activity during August and September, and early parts of October. The quality of this essential feature is not expected to be altered by this project, and therefore, PCE 4, unrestricted passage within critical habitat areas, will not change.

Quantity
None.

Availability
The availability of this essential feature is not expected to be altered by this project, and therefore, PCE 4, unrestricted passage within or between the critical habitat areas will not change. Beluga whales successfully migrate in and around Eagle River and Eagle Bay, and this project would not affect these areas.

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 noise in Eagle River and Eagle Bay consists primarily of three

types of noise: transportation noise from vehicles and aircraft, noise from small arms fire, and low frequency impulsive noise from artillery fire and demolition operations. 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.

In general, Cook Inlet is a noisy environment. 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). Noise from Army activity, especially the low frequency, impulsive noise from the detonation of HE munitions, will increase in-water noise levels during operations.

Quality
The year round firing in ERF Impact Area will increase in-water noise levels in Eagle River and Eagle Bay. This effect is likely the most important aspect of this project with respect to Cook Inlet beluga whale conservation. The quality of habitat will be affected primarily from the low frequency, impulsive noise from the detonation of HE munitions.

Quantity
In-water noise from this project (transportation noise from vehicles and aircraft, noise from small arms fire, and low frequency impulsive noise from artillery fire and demolition operations) would occur year round during live fire training.

Monitoring data from the POA port operations and their expansion project do not indicate abandonment. Beluga whales have continued to use lower Knik Arm. Unusual behavioral changes were not observed during pile driving (ICRC 2010). Additionally, onshore observations identified no unusual responses and subsurface responses, such as changed vocalizations, were not detectable (Cornick and Saxon Kendall 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 et al. 2005). These results imply no diminished habitat use is expected in the Eagle Bay and Eagle River area.

Availability
The availability of this essential feature is expected to be altered by this project, and therefore, PCE 5, in-water noise, will increase during intermittent operations.

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 Corps, Environmental Protection Agency (EPA), and Bureau of Ocean Energy Management, Regulation and Enforcement. 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.

i. 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.

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ii. Vessel Traffic

Small vessel activity and a ferry used 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.

iii. 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.

iv. 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 JBER. 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.

POA and its tenants have pollution prevention plans in place to help identify potential sources of pollution, and to minimize the risk of spills and releases of contaminants. The POA has plans to improve water quality by treating the storm water discharges that pass from the POA expansion into the Knik Arm.

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.

NMFS recognizes that not enough is known about the effects of each specific threat, and they do not definitively understand the level of impact each threat has on Cook Inlet beluga whales. Cook Inlet beluga whales may be affected by multiple threats at any given time, compounding the impacts of the threats. Without an understanding of how individual threats impact beluga whales, the cumulative effects of all the threats on Cook Inlet beluga whales remain unknown and this uncertainty is incorporated into our analysis below.

VI. SYNTHEIS 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 any action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

In this section, we assess the effects from the year-round firing in ERF Impact Area 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 to 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, and/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 population’s viability.

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 the year-round firing in ERF Impact Area. Cook Inlet beluga whales are not well known or understood. 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 biological opinion, NMFS has utilized the best available scientific data to evaluate the consequences from the year-round firing in ERF Impact Area 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 this activity. 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 impacts analysis and its possible consequence in our determinations.

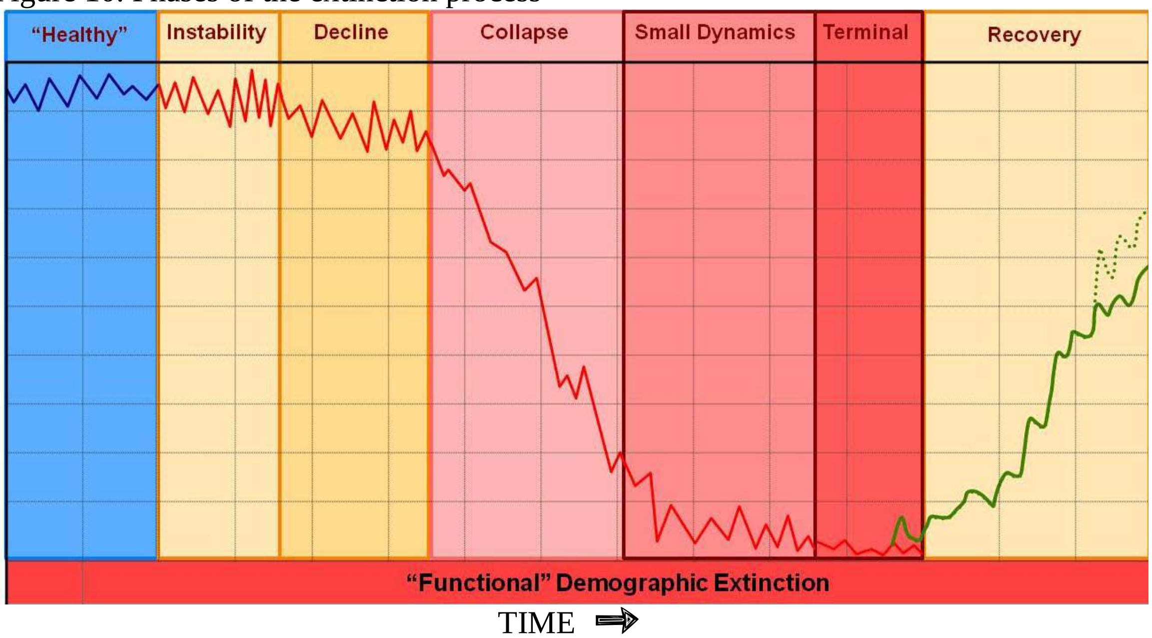
In considering uncertainty here, we are cautious not to draw upon speculation and unsupported assumptions, but rather consider uncertainty as an adjunct to a decision making process built on scientific understandings. For example, the year-round firing in

ERF Impact Area is likely to result in the taking of beluga whales by noise harassment. NMFS scientists have developed population viability models and extinction risk analyses that describe the population impacts from 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 population status, current growth trends, the whales' reactions to harassment, the consequence of that reaction to individual whales, 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 significant.

Uncertainty is also considered as we manage risk. Here, 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 species/habitat status in question, and the acceptability of risk is 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 during the past several decades. The 2010 population is estimated at 340 whales (NMFS unpublished data) 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 can be considered to have collapsed and now lies within the "small population dynamics" phase (Figure 10). Certain biological factors and stochastic (random) events are expected to have disproportionally larger impacts on this population. Beluga whales have a low calving rate, birth a single calf every two to three years. Cook Inlet beluga whales have a small range and appears confined to Cook 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 near shore areas, where they are predisposed to adverse effects such as oil spills, noise, poaching, pollution, ship strikes, and disease outbreaks. Live strandings are not uncommon for Cook Inlet beluga whales, and have resulted in deaths due to prolonged exposure. 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 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 restrictions on subsistence harvest, believed to be the principle stressor to the population. Throughout this critical zone (collapse), NMFS believes extraordinary caution is warranted for any actions that may impair the performance of individuals within this DPS.

Figure 10. Phases of the extinction process[2]



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 especially, on the long-term cumulative consequences from increasing noise in the world's oceans from multiple sources (e.g., NRC 2005). Beluga whales are classified as mid-frequency sensitive, and have hearing sensitivities between 40 Hz and 150 KHz.

Ketten (1997) reported that hearing loss can be caused by exposure to sound that exceeds

[1]C. Johnson, NMFS, unpublished data.

an ear's tolerance (i.e., exhaustion or overextension of one or more ear components). Hearing loss could result in an inability to 1) communicate effectively with other members of its species, 2) detect approaching predators or vessels, or 3) echolocate (in 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 (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.

Ketten (1997) reported that whether a temporary threshold shift or a permanent threshold shift occurs will be determined primarily based on the extent of inner ear damage the received sound and the received sound level caused. In general, whether a given species will tend to be damaged by a given sound depends on the frequency sensitivity of that 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 to an animal's behavior (e.g., approach or avoidance behavior, or startle response).

When noise interferes with sounds used by marine mammals (e.g., interferes with their communication or echolocation), it is said to "mask" the sound (e.g., a call to another whale might be masked by an icebreaker operating a certain distance away). Noises can mask the sounds that marine mammals need to hear to function (Erbe et al. 1999). In a given environment, the noise impact on cetacean detection of signals would likely be influenced by both the noise frequency and the temporal characteristics, its signal-to-noise ratio, and by the same characteristics of other sounds occurring in the same vicinity (e.g., 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 gender and reproductive status, possibly age and/or accumulated hearing damage, type of activity engaged in at the time or, in some cases, group size. For example, reaction to sound may vary depending on whether females have calves accompanying them, and/or 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 by a species, or on classes of individuals within a species, to a given sound. Therefore, we attempt to take a conservative approach in our analyses and base conclusions about potential impacts or potential effects on the most sensitive members in a population.

For some beluga whales that respond behaviorally or physiologically to the sounds associated with the year round firing at ERF Impact Area, the response could rise to the level of harassment such that an animal is "taken." The ESA does not define harassment.

However, in this biological 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. 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 it is not able to complete some reproduction-related, feeding, or other activity; or if the animal is likely to be injured. In order to avoid committing a Type II error, we assume that animals are harassed when their behavior appears to be disrupted, such as ceasing to feed or exhibiting avoidance reactions upon exposure to human-made sounds. 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 biological 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, and 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 used 160 db re 1 μPa for impulsive sound and 125 dB re 1 μPa for continuous sound as proxies for "take" in Cook Inlet. This step function approach was a compromise threshold intended to afford reasonable protection to a large suite of marine mammals, and may not be 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).

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 harassments take by continuous noise, harassment take by impulsive noise, and injurious takes, respectively. Most whales exposed to moderate to high noise levels (e.g. 120-180 dB) 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 having biological significance to individuals, and might include injury through permanent threshold shifts or abandonment of important habitats (e.g., 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, dredging, construction noise, and aircraft over flights.

Blackwell and Greene (2002) reported ambient levels, devoid of industrial sounds, at Birchwood in Knik Arm (north of ERF Impact Area) at approximately 95 dB, to more than 120 dB for locations in lower Knik Arm near the POA. At the mouth of Eagle River they reported ambient levels at approximately 107.2 dB re 1 μPa (Blackwell and Greene 2002). 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 (2007) reported ambient levels at 105 to 120 dB when no industrial sounds were identified to background levels between 120 and 140 dB when 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, with the whales obviously having adjusted to such levels.

This biological opinion has considered the effects from year round firing in ERF Impact Area on endangered Cook Inlet beluga whales. These actions are likely to adversely affect these whales due to the low frequency, impulsive noise from the detonation of HE munitions. Elevated noise levels in Eagle Bay (Figure 11) could alter the whale’s hearing ability, causing temporary or permanent threshold shifts. However, we would not expect whales to remain within ensonified areas capable of causing such effects. Similarly, increased levels of in-water noise may mask communication between beluga whales. Erbe (2000) predicted low speed vessels could mask killer whale sounds at a range of 1km. Any such effect would be partially mitigated by the difference in frequencies between the much of the HE munitions 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, year round firing activities present concerns with respect to hearing, and should be closely conditioned and monitored to avoid these effects.

The Army has not yet estimated the expected total take (maximum) of Cook Inlet beluga whales during the resumption of year round firing. However, it is expected that the requested takes will likely be by harassment due to acoustic exposure to HE munitions noise. These “takes” as defined by the MMPA would be direct and indirect effects to beluga whales and/or their habitat, between 160 – 180dB. These levels are believed to not damage hearing in whales (i.e., permanent threshold shifts).

The numbers of whales expected to be so-exposed is not many and should be mitigated to a large extent by timing certain activities to avoid high-use periods from mid August through October and operational monitoring to stop activities when whales are within or about to enter the specified safety zones. Similar beluga whale monitoring at the POA during pile driving has been effective in preventing whales from entering these impact areas. No lethal takes are expected.

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 in the area and the numbers, location, age and gender of the receiving whales. There is concern that whales would abandon feeding areas when exposed to loud noises or that noise from the year round firing in ERF Impact Area will prevent whales from milling, feeding, and traveling in Eagle River and Eagle Bay. As has been noted in several papers, beluga whale reactions 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.

The resumption of year round firing at the ERF Impact Area is not considered to present significant direct or indirect consequences to Cook Inlet beluga whales or their critical habitat, nor significantly contribute to the existing baseline and cumulative impacts.

A significant issue with regard to the year round firing at the ERF Impact Area effect on beluga whale concerns changes in their behavior which may not rise to the level of take, such as when confronted with acoustic disturbance during firing. Numerous studies on 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 remain in preferred habitats if alternative sites are not available or of such quality that the net benefit to remain exceeds that of adopted 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 1999. The reasons for this lack of observed recovery are unknown, but may include killer whale predation, strandings, habitat loss, or pollution. Also, the area most-affected by noise from the year round firing would include primary feeding habitats during the fall, and passage and resting habitats. Any diminished use of this area may not, then, result in significant effects to individual fitness. We also note that the observations from the POA 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 did not leave the feeding areas off the Susitna River during their spring hunt.

An uncertainty in this analysis concerns whether beluga whales' continued use of Eagle Bay and Eagle River would be impaired, diminished, or prevented during firing operations. Impulsive noise from the detonation of HE munitions will increase in-water noise levels during operations and could be significant, but largely mitigated by the beluga monitoring plan that would limit the most significant sources of in-water noise when beluga whales are observed in the area. Firing effects due to noise in Eagle Bay and Eagle River are not anticipated or projected to reach levels capable of harassment within important whale habitat further up Knik Arm.

Long-term beluga whale observations in Knik Arm suggest that construction activity noises are not influencing beluga whale abundance or habitat use around the POA (POA et al. 2009). In general, scientific literature describes the following reactions 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 in-water than presented by the proposed project. Though behavioral reactions are possible, monitoring reports of construction at the POA show no apparent observable reaction by Cook Inlet beluga whales to construction noises. There could be many 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 POA, 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.

Opportunistic sighting reports and those from marine mammal observations describe beluga whales vocalizing around tugs and barges; swimming near and around ships; and feeding around working vessels and newly filled land. While beluga whales may be exposed to greater noise levels during firing, 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 POA; 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 Eagle Bay and Eagle River. This conclusion is supported by the fact that noise from construction, particularly dredging, has been an annual event at the POA for decades, during which time NMFS has consistently recorded beluga whale presence 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 2008a). 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 anthropogenic 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 animals. However, it is not expected that the interim firing by HE munitions would cause the beluga whales to abandon their habitat altogether during the military activities. Any small numbers of whales, which may be temporarily displaced from the action area due to range operations, are likely to select alternative habitat sites that provide the same function elsewhere in Cook Inlet. This adaptive behavior 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 similar) habitats elsewhere. The capacity of these other habitats to support any displaced whales should be adequate, given the presently lower population size. However, because we would not expect all beluga whales to ignore (during firing activities) Eagle Bay and Eagle River, the productivity and habitat value of alternative sites should provide the small number of belugas their nutritional and other requirements if they experience any reduced use of Eagle Bay, Eagle River, and upper Knik Arm habitats.

Our assessment of possible behavioral reactions to the resumption of year round firing into ERF Impact Area also considered site fidelity by beluga whales. Site fidelity is likely within the Cook Inlet belugas, 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 beluga whale stock. Rugh et.al (2010) found CI beluga distribution to have changed during the last decades and suggest this may be due to their reduced numbers that allow 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.

Any possible reductions in use of Eagle Bay and Eagle River would be mitigated in part through specific restrictions on the use of HE rounds during major waterfowl migration periods (spring migration and fall migration that is generally August to late October) that, in addition, would avoid periods of high beluga use. Also, behavioral reactions by beluga whales are highly dependent on the situation and beluga (and other) whales are often more tolerant to disturbance(s) when feeding (Richardson 1995). Beluga whale presence in Eagle Bay, Eagle River, and upper Knik Arm is associated with anadromous fish runs and much of their behavior here is assumed to be related to foraging. Therefore, beluga whales are expected to tolerate some noise in the Eagle Bay area. We believe there is reasonable certainty that Eagle Bay and Eagle River will not be impaired to the point of biological significance.

However, other habitat functions may occur in the Eagle Bay area, such as breeding or calving, which may be particularly sensitive to noise and harassment, and could 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) 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 gender classes. Also, the fact that juveniles and calves are often observed in Knik Arm indicates the present gauntlet from noise in lower Knik Arm does not prevent the beluga whales from accessing and utilizing habitats in Eagle Bay, Eagle River, and upper Knik Arm.

Integration
We have considered the ***project effects*** to Cook Inlet beluga whales and their critical habitat. We believe the resumption of year round firing in ERF Impact area will result in the harassment of beluga whales. The majority of such harassment would be due to noise associated with the impulsive noise from the detonation of HE munitions. The most likely manifestations from this harassment would be a temporary change in behavior, avoiding the sound source by navigating around it, or passing through the ensonified area with fewer surfacing intervals. The most often observed behaviors in the ERF Impact Area travelling, milling and feeding. Whales here are not expected to be significantly impacted by noise from the project because of 1) timing restrictions during spring migration and fall migration, generally August to late October, when most whales are present; 2) monitoring requirements where observers will be present prior to and during training exercises to ensure that marine mammals are not present where they could be harassed or harmed due to training activities; and 3) buffer areas around Eagle Bay and Eagle River.

Studies have estimated one hundred or more beluga whales may occur in Knik Arm during one observation; or approximately twenty five 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). Although unlikely, it is possible that a small percentage of these whales may be reluctant to continue to occupy or pass through the ERF Impact Area. Those whales would likely move into alternative sites with similar habitat properties. Any such effects would be significantly mitigated by the firing schedule that restricts firing HE munitions into ERF Impact Area during the peak waterfowl migration periods in the spring and fall; monitoring requirements to make sure beluga whales were not present prior to and during training exercises; and buffer areas around the ERF Impact Area.

Impacts to beluga whales from the resumption of year round firing in ERF Impact Area are unlikely to have significant adverse consequence to individuals or to the population.

The ***baseline condition*** experienced by the Cook Inlet beluga whale DPS is characterized by its very low abundance, no observed recovery within the population (NMFS currently estimates an annual decline of 1.1 percent), and a high (26 percent) probability of extinction within the next 100 years. The additional annual 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 harassed due to authorized construction at the POA and by certain scientific research. These takes have been determined not to be significant to the recovery of this DPS. Lethal or injurious takes are not known to be on-going, 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 at 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 from the proposed resumption of year round firing at ERF Impact Area on beluga whales and their critical habitat with the environmental baseline and cumulative effects, individual or groups of whales are likely to be harassed by impulsive noise from the detonation of HE munitions, 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. Whales will experience higher than ambient noise levels should they be undetected before and during actual firing, but such noise would degrade to background levels within relatively short distances. The most pronounced increase in noise levels would occur during the actual explosion. However, the firing activity would not occur during the peak fall waterfowl migration period (generally August to late October), which coincides with the peak beluga activity in Eagle Bay and Eagle River. While beluga whales are being taken under the environmental baseline and through cumulative effects, we believe such takes are non-lethal and are mostly due to harassment and disturbance by noise. It is not presently possible to quantify the effects of this harassment to the extinction risk probabilities for this DPS. However, it is difficult to demonstrate, and we believe unlikely, that non-injurious takes, such as unintentional harassment due to noise, would elicit consequences to the survival or reproductive capacity of the Cook Inlet beluga whales.

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

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 biological opinion of NMFS that the implementation of a the proposed action, as described in this biological opinion, is not likely to jeopardize the continued existence of the Cook Inlet beluga whales nor to destroy or adversely modify its 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.

In the BA, the Army has identified most of the following conservation measures, which are adopted here as conservation recommendations. While adopting these conservation measures is not a condition of the findings in this biological opinion (other than those that are considered part of the proposed action), these measures will lessen the effects from the project on Cook Inlet beluga whales. Further, such measures may be associated with conditions necessary to authorize this work under section 101(a)(5) of the MMPA. We note that some of the measures proposed by the Army 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.

The following conservation recommendations would minimize adverse effects to Cook Inlet beluga whales from in-water noise generated by 120 mm mortar and 105 mm Howitzer HE rounds.

1. JBER will coordinate with NMFS to determine specific dates to cease firing all HE munitions that could cause take in the Eagle River into ERF Impact Area during the peak fall waterfowl migration periods.
2. JBER will continue to develop methods that better identifies beluga whale presence in Eagle Bay, especially when whales are not at the surface.

NMSF recommends these additional conservation measures be put in place to further protect beluga whales, their habitat, and their prey include:

- JBER will coordinate with NMFS to determine specific dates to cease firing all HE munitions that could cause take in the Eagle River into ERF Impact Area during the peak fall waterfowl migration period. While this prohibition is primarily enacted to protect migratory birds, the timing of the fall migratory period coincides with peak beluga activity in Eagle Bay and Eagle River.

- JBER will continue to monitor for marine mammals with the following additional provisions:
  - Improve beluga whale monitoring through use of a common ethological sampling method with restraints, such as all-occurrences sampling. This will allow for analysis of frequencies, rates, and durations of various behaviors and seasonal presence/absence information.
  - Place additional personnel in the field during the upcoming summer field seasons for beluga whale monitoring.
  - Continue photo-identification of individual beluga whales in coordination with NMFS.
  - Use a hand-held high-definition video camera to compile a catalog of whale behaviors to help further refine quantitative analysis, coordinate data collection among various research entities, and for educational purposes.
  - JBER will continue to explore the technological feasibility of installing an automated monitoring system at the mouth of Eagle River to detect beluga whale presence.

Additional conservation measures that could be put in place to further protect beluga whales, their habitat, and their prey include:

- JBER will monitor suspended sediment loads in waterways as an indicator of increased erosion and possibly develop specific erosion monitoring programs.
- JBER will expand monitoring to further investigate sedimentation changes at ERF due to detonation of munitions within the impact area.
- JBER will develop a long-term trend monitoring program at ERF, to establish ecosystem baselines, define critical metrics and evaluate ecosystem changes over time.

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, re-initiation 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 of incidental take is exceeded; 2) new information reveals effects from this action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this biological 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 biological 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 prohibits the take of endangered species 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. Harm is further defined by NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. 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 Act provided that such taking is in compliance with the terms and conditions of an ITS.

Cook Inlet beluga whales may be exposed to explosions, at less than 180dB but more than 160 dB, in Eagle Bay and possibly Eagle River. An ITS for Cook Inlet beluga whales is not included at this time because the incidental take of marine mammals has not been authorized under section 101(a)(5) of the MMPA. Following issuance of such authorization, we intend to grant an ITS for Cook Inlet beluga whales, as appropriate.

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