UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

ENVIRONMENTAL ASSESSMENT

ON THE ISSUANCE OF INCIDENTAL HARASSMENT AUTHORIZATIONS TO CONOCOPHILLIPS ALASKA, INC. AND UNION OIL COMPANY OF CALIFORNIA TO TAKE MARINE MAMMALS BY HARASSMENT INCIDENTAL TO CONDUCTING SEISMIC OPERATIONS IN NORTHWESTERN COOK INLET, ALASKA

I. INTRODUCTION

On October 6 and 12, 2006, National Marine Fisheries Service (NMFS) received applications from ConocoPhillips Alaska, Inc. (CPAI) and Union Oil Company of California (UOCC), respectively, requesting Incidental Harassment Authorizations (IHAs) for the possible harassment of small numbers of Cook Inlet beluga whales (*Delphinapterus leucas*), Steller lions (*Eumetopias jubatus*), Pacific harbor seals (*Phoca vitulina richardsi*), harbor porpoises (*Phocoena phocoena*), and killer whales (*Orcinus orca*) incidental to conducting open water seismic operations in portions of northwestern Cook Inlet, Alaska (Figure 1). The seismic operations will use a 900-in^3 BOLT airgun array with two sub-arrays of 3 225-in^3 airguns and 3 75-in^3 airguns. The seismic operations will be active 24 hours per day, but the airguns will only be active for 1 – 2 hours during each of the 3 – 4 daily slack tide periods. The proposed seismic operations are planned from mid March – mid June, 2007.

This Environmental Assessment (EA) is intended to address impacts on the environment that would result from the issuance the proposed IHAs.

II. PURPOSE AND NEED

Section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA) (16 U.S.C. 1361 *et seq.*) directs the Secretary of Commerce to allow, upon request, the incidental, but not intentional taking, by harassment, of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made.

In response to CPAI and UOCC's requests for IHAs for possible harassment of marine mammals, NMFS is required under the MMPA to determine whether issuance of IHAs is warranted. In so doing, NMFS must analyze whether any incidental takings by harassment will: 1) have a negligible impact on the marine mammal species or stock; and 2) not have an unmitigable adverse impact on the availability of the species or stock for subsistence uses. In addition, NMFS must prescribe in its IHA the permissible methods of taking by harassment, other means of affecting the least practicable impact on the species or stock and their habitat, and requirements pertaining to the monitoring and reporting of such taking.

III. DESCRIPTION OF ACTIVITY COVERED BY AUTHORIZATIONS

The proposed operations would use an ocean-bottom cable (OBC) system to conduct seismic surveys. OBC seismic surveys are used in waters that are too shallow for the data to be acquired using a marine-streamer vessel and/or too deep to have static ice in the winter. This type of seismic survey requires the use of multiple vessels for cable layout/pickup, recording, shooting, and possibly one or two vessels smaller than those used in streamer operations, and the utility boats can be very small, in the range of 10 – 15 m (33 – 49 ft).

An OBC operation begins by laying cables off the back of the layout vessel. Cable length typically is 4 – 6 km (2.5 – 3.7 miles) but can be up to 12 km (7.4 miles). Groups of seismic survey receivers (usually a combination of both hydrophones and vertical-motion geophones) are attached to the cable in intervals of 25 – 70 m (82 – 246 ft). Multiple cables are laid on the seafloor parallel to each other using this layout method, with a cable spacing of less than 0.5 mile (0.8 km), depending on the geophysical objective of the survey.

The proposed seismic operations would be active 24 hours per day, but the airguns would only be active for 1 – 2 hours during each of the 3 – 4 daily slack tide periods. The source for the proposed OBC seismic surveys would be a 900-in^3 BOLT airgun array situated on the source vessel, the *Peregrine Falcon*. The contractor, Veritas, will have a second complete backup source rigged on a second A-frame, if needed. The array would be made up of 2 sub-arrays, each with 2 3-airgun clusters separated by 1.5 m (4.9 ft) deployed off the stern of the vessel. One cluster will consist of 3 225-in^3 airguns and the second cluster will have 3 75-in^3 airguns. During seismic operations, the sub-arrays will fire at a rate of every 10 – 25 seconds and focus energy in the downward direction as the vessel travels at 4 - 5 knots (4.6 – 5.8 mph). Source level of the airgun array is 249 dB *re:* 1 μPa at 1 m when measured at 0 – peak (0-p), or 246 dB *re:* 1 μPa at 1 m rms (see Richardson *et al.*, 1995). The dominant frequency is around 20 Hz.

A near-field hydrophone is mounted about 1 m (3.3 ft) above each airgun station (one phone is used per cluster), one depth transducer per position is mounted on the airgun's ultrabox, and a high pressure transducer is mounted at the aft end of the sub-array to monitor high pressure air supply. A single 200 CFM PRICE compressor would supply air for the array. The compressor would be run through a pressure regulated valve tree. Water separators and dehumidifiers are also part of the source system. The array would be located with the use of DGPS antennas located on top of the A-frames. The A-frame would be lowered and raised based on water depth before the firing of the airguns.

The geographic region for the seismic operation proposed by CPAI encompasses a 25 mi^2 (65 km^2) area in upper Cook Inlet (Figure 2), paralleling the shoreline from just offshore of the Beluga River south for about 6 km (3.7 miles). The approximate boundaries of the region of the proposed project area are 61°09.473'N, 151°11.987'W; 61°16.638'N, 151°02.198'W; 61°12.538'N, 150°49.979'W; and 61°05.443'N, 151°00.165'W. Water depths range from 0 to 24 m (80 ft). There will be a 1.6 km (1 mile) setback of operations from the mouth of the Beluga River to comply with Alaska Department of Fish and Game (ADFG) restrictions. CPAI's proposed seismic operations would occur from mid-March depending on the time of ice breakup, and last until mid-May, 2007.

The geographic region for the activity proposed by UOCC encompasses a 28.2 km^2 (10.9 mi^2) area in northwestern Cook Inlet (Figure 3), paralleling the shoreline offshore of Granite Point, and extending from shore into the inlet to an average of about 1.6 km (1 mile). The approximate boundaries of the region of the proposed project area are 61°00.827'N, 151°24.071'W; 61°02.420'N, 151°15.375'W; 61°00.862'N, 150°15.313'W; and 61°57.979'N, 151°23.946'W. There are no major rivers flowing in the open water seismic project area. Water depths range from 0 to 18 m (60 ft). UOCC's proposed seismic operations would begin as early as May 1 and end no later than June 15, 2007.

IV. ALTERNATIVES

4.1. Alternative 1 – Issuance of IHA with No Mitigation and Monitoring Measures

Under Alternative 1, NMFS will issue one-year IHAs to CPAI and UOCC allowing the incidental take of Cook Inlet beluga whales, Pacific harbor seals, Steller sea lions, harbor porpoises, and killer whales during seismic operations in northwestern Cook Inlet. No mitigation and marine mammal monitoring measures would be required under this Alternative since the proposed project would only occur in a small area of northwestern Cook Inlet for a short period of 3 – 4 months. However, since the MMPA requires any take to be reduced to the lowest level practicable, this Alternative is inconsistent with the MMPA and, therefore, is not NMFS' preferred Alternative.

4.2. Alternative 2 – No Action Alternative

Under the No Action Alternative, NMFS would not issue the IHAs. The MMPA prohibits all takings of marine mammals unless authorized by a permit or exemption under the MMPA. If authorizations to incidentally take Cook Inlet beluga whales, Pacific harbor seals, Steller sea lions, harbor porpoises, and killer whales are denied, the applicants could choose to amend the projects either to avoid harassing marine mammals or forego the two proposed projects entirely.

4.3. Alternative 3 – Issuance of Authorization with Mitigation and Monitoring Measures

Under Alternative 3, NMFS is proposing to issue IHAs to CPAI and UOCC; allowing the incidental take by Level B behavioral harassment of a small number of Cook Inlet beluga whales, Pacific harbor seals, and harbor porpoises, and also allowing level B harassment of Steller sea lions and killer whales during seismic operations in northwestern Cook Inlet, conditioned on implementing mitigation and monitoring measures. The mitigation and monitoring requirements, described in Section VII, include: (1) establishing safety zones when sound pressure levels (SPLs) could reach 180 dB *re:* 1 μPa rms or higher for cetaceans and 190 dB *re:* 1 μPa rms or higher for pinnipeds; (2) altering ship speed and direction when marine mammals are expected to enter the safety zones when practicable and safe; (3) power-down airguns when marine mammals are expected to enter the safety zone when change of ship speed and course is not practicable, and shut-down airguns when marine mammals are found within the safety zones; (4) implementing ramp-up procedure during the initiation of airguns; and (5) conducting marine mammal survey and monitoring prior to and during seismic operations. Under the Alternative 3, these mitigation and monitoring measures would be incorporated into the IHAs and required to be fully implemented.

4.4. Alternative 4 (Preferred Alternative) – Issuance of Authorization with Mitigation and Monitoring Measures with Additional Aerial Monitoring Requirement for CPAI

The Alternative 4 is the same as Alternative 3, except NMFS would require additional aerial monitoring for beluga whales for seismic operations conducted by CPAI off Beluga River between March and May, 2007. In addition, land-based monitoring would be required when aerial monitoring is not feasible during adverse weather condition. Under the Preferred Alternative, all mitigation and monitoring measures would be incorporated into both IHAs, with additional aerial monitoring requirement be incorporated into the IHA to CPAI.

V. AFFECTED ENVIRONMENT

5.1. Physical Environment of Cook Inlet

Cook Inlet is a large tidal estuary which flows into the Gulf of Alaska (Figure 1). This shallow estuary is approximately 220 miles (322 km) long and 30 miles (48 km) wide. The Inlet is surrounded by several mountain ranges (the Aleutian and Alaska Ranges, and the Kenai, Chugach, and Talkeetna Mountains). As such, Cook Inlet lies within a transition zone. The upper Inlet is characterized by a maritime climate that transitions to a continental climate in the lower reaches of Cook Inlet. The upper Inlet is also generally drier and cooler than the lower Inlet (NMFS, 2003a).

Boyd and Shively (1999) summarize the physical environment of Cook Inlet. Offshore winds average 12 – 18 knots, but channeling in valleys can produce wind speeds in excess of 100 knots in inshore areas. Water depths in Cook Inlet are typically 20 – 40 m (66 – 131 ft) in the upper reaches. A central channel descends to 75 m (246 ft) and deepens into the lower reaches to 150 m (492 ft). There is a comparatively high tidal range in Cook Inlet, with the mean diurnal range of 9 m (29.5 ft) at Anchorage. The tidal range and inlet geometries are responsible for strong currents: maximum surface currents average about 3 knots. Bottom currents of 1.5 knots are strong enough to form migrating sand waves. Currents of up to 12 knots have been recorded locally. These currents transport large amounts of glacial sediment eroded from surrounding mountains, to be deposited in tidal flats or carried offshore to Aleutian Trench. Cook Inlet contains ice from October through April.

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

The Cook Inlet region contains substantial quantities of mineral resources including coal, oil and natural gas, sand and gravels, cooper, silver, gold, zinc, lead, and other minerals. The Inlet's coal is principally lignite, the largest field being the Beluga River deposit in the vicinity of the Beluga and Yentna Rivers, containing an estimated 2.3 billion tons (USCOE, 1993). Oil and gas deposits occur throughout the region, with estimated reserves of 76.9 billion barrels of petroleum and 14.6 trillion cubic feet of natural gas (USCOE, 1993). Six fields in the Cook Inlet region are active; five of which are located offshore in the middle Inlet. These are the Granite Point, Trading Bay, McArthur River, Middle Ground Shoal, and Redoubt Shoal fields (NMFS, 2003a).

As one of the most industrialized and urbanized regions of Alaska, Cook Inlet experiences high noise levels. The common types of noises in upper Cook Inlet include sounds from vessels, aircraft, construction equipment such as diesel generators, bulldozers, and compressors, and from activities such as pile-driving (NMFS, 2003a). A recent study on acoustic measurements in Cook Inlet showed relatively high noise levels in various sampling sites (Blackwell and Greene, Jr., 2002).

No marine protected areas and critical habitat are known to exist within the proposed project area. Since the proposed projects lies within the State of Alaska waters, no essential fish habitat under NMFS' jurisdiction would be affected.

5.2. Marine Mammal Species

Several marine mammal species, including Cook Inlet beluga whale, Pacific harbor seal, Steller sea lion, harbor porpoise, and killer whale, are found in upper Cook Inlet. Among these species, only the Steller sea lion is listed as endangered under the Endangered Species Act (ESA), and it is also designated as depleted under the MMPA. The Cook Inlet beluga whale is designated as depleted under the MMPA. General information of these species can be found in Angliss and Outlaw (2006), which is available at the following URL: http://www.nmfs.noaa.gov/pr/pdfs/sars/ak2005.pdf.

Beluga whale *Delphinapterus leucas* (Pallas, 1776)
In the U.S. waters, beluga whales comprise five distinct stocks: Beaufort Sea, Eastern Chukchi Sea, Eastern Bering Sea, Bristol Bay, and Cook Inlet (Angliss and Outlaw, 2005). The only stock likely to be affected by the proposed seismic operations is the Cook Inlet stock. The Cook Inlet stock is the most isolated of the five stocks, based on the degree of genetic differentiation between this stock and the four others (O'Corry-Crowe *et al.*, 1997).

The Cook Inlet beluga whale population has declined significantly over the years (NMFS, 2005). NMFS systematic aerial surveys documented a decline in abundance of nearly 50 percent between 1994 and 1998, from an estimate of 653 whales to 347 whales (Hobbs *et al.*, 2000). The annual abundance surveys conducted each June or July from 1999 to 2006 have resulted in abundance estimates of 367, 435, 386, 313, 357, 366, 278, and 302 whales for each year, respectively (Rugh *et al.*, 2006, NMFS unpublished data). The Cook Inlet beluga whale stock is considered below its Optimum Sustainable Population and there is considerable concern regarding its small population size. In response to this significant decline, NMFS designated the Cook Inlet stock of beluga as depleted under the MMPA on May 31, 2000 (65 FR 34590). In March 2006, NMFS formally initiated a Status Review of the Cook Inlet beluga whale to determine if this stock should be listed under the ESA. On April 20, 2006, NMFS received a petition from Trustees for Alaska to list Cook Inlet belugas as endangered under the ESA. After reviewing the information contained in the petition, as well as other scientific information readily available, NMFS determined the petitioned action may be warranted (Rugh *et al.*, 2006).

Cook Inlet beluga whales demonstrate site fidelity to regular summer concentration areas (Seaman *et al.*, 1985), typically near river mouths and associated shallow, warm and low salinity waters (Moore *et al.*, 2000). While there is inter-annual variability in beluga use among areas, generally belugas occur in the Susitna and Chickaloon areas in May to July, Turnagain Arm in August, Knik Arm in September, and the mid-Cook Inlet between Point Possession and Kalgin Island in January through April (Hansen and Hubbard, 1999; Rugh *et al.*, 2000; 2004; 2005). These patterns are consistent with those recorded for 14 tagged beluga whales tracked by satellite from 2000 to 2003 (Hobbs *et al.*, 2005).

Within this distribution, NMFS has characterized the relative value of four habitats as part of the management and recovery strategy in its "Draft Conservation Plan for the Cook Inlet Beluga Whale (*Delphinapterus leucas*)" (NMFS, 2005). Type 1 habitat is termed "High Value/High Sensitivity" and includes what NMFS believes to be the most important and sensitive areas of the Inlet for beluga whales. Type 2 is termed "High Value," and includes summer feeding areas and winter habitats in waters where whales typically occur in lesser densities or in deeper waters. Type 3 habitat occurs in the offshore areas of the mid and upper Inlet and also includes wintering habitat. Type 4 habitat describes the remaining portions of the range of these whales within Cook Inlet.

Beluga whale use and distribution near the Beluga River between the Chuitna and the Susitna rivers is relatively well documented from satellite tracking of tagged whales from 1999 to 2003 (Hobbs *et al.*, 2005), and it seems that small numbers of belugas appear to temporarily frequent in the CPAI proposed project vicinity most months of the year as they seasonally move between the upper and lower Inlet. Beluga River area is in the extreme southern edge of the area classified by NMFS as Type 2 habitat (high value), which is a summer feeding area.

Beluga whale use and distribution near the Granite Point project area during the late spring to early summer can be generally inferred from broad scale surveys conducted between Trading Bay and the Beluga River (Rugh *et al.*, 2000; Hobbs *et al.*, 2005; Rugh *et al.*, 2005). The results show that relatively small numbers of belugas infrequently occur in or near the Granite Point project area during late spring and early summer when seismic operations are planned, but use is generally brief, widely scattered, and associated with transiting to the upper Inlet, where belugas concentrate in summer and fall. The Granite Point project area is within Type 3 habitat, which is a wintering area and secondary summering site, and historic sites.

Sources of Cook Inlet beluga whale mortality include strandings (Vos and Shelden, 2005), predation by killer whales (Shelden *et al.*, 2003), subsistence harvest (Mahoney and Shelden, 2000; NMFS, 2003a; 2005), and ship strike (Burek, 1999).

Steller sea lion *Eumetopias jubatus* (Schreber, 1776)
The western U.S. stock of Steller sea lion is distributed throughout the Bering Sea, the North Pacific Ocean, and the Gulf of Alaska east to 144^{o}W, which includes Cook Inlet (Loughlin, 1997). The most recent minimum estimate of this population was 38,513 animals, including pups (Angliss and Outlaw, 2005). No abundance estimate for Steller sea lions is available for upper Cook Inlet.

Steller sea lions are regularly sighted in lower Cook Inlet and are less frequent in the upper Inlet (LGL, 2006). Steller sea lion critical habitat has been established at locations in the southern portion of Lower Cook Inlet (58 FR 45269, August 27, 1993). Haulouts in the lower Inlet are located near the mouth of Cook Inlet at Gore Point, Elizabeth Island, Perl Island, Barren Islands, and Chugach Island. Steller sea lions gather on traditional rookeries from mid-May through mid-July to give birth and breed. No haulouts occur in upper Cook Inlet and Steller sea lions are rarely sighted north of Nikiski (Rugh *et al.*, 2005; LGL, 2006).

Harbor seal *Phoca vitulina* Linnaeus, 1758
Harbor seals are present in coastal waters throughout Cook Inlet. They are more abundant in lower Cook Inlet than in the upper Inlet (Rugh *et al.*, 2005). In the upper Inlet harbor seals occur in the Little Susitna River, Susitna River, Turnagain Arm, Chickaloon Bay, Knik Arm, Beluga River, and Trading Bay from May through October (Rugh *et al.*, 2005). Typically, fewer than about 100 harbor seals have been recorded in any one of these locations with the majority in the Chickaloon Bay and the Susitna River areas and very few at the Beluga River (Rugh *et al.*, 2005). One to three harbor seals have been annually reported in or near the Beluga River area (Rugh *et al.*, 2005).

Major harbor seal haulout sites in the Cook Inlet region are found in the lower portion of the Inlet. The reproductive period (pupping and breeding) occurs at most major haulouts in the Inlet from May through July (NMFS, 2003a). Harbor seals molt following the reproductive period. The peak season for molting in the Gulf of Alaska occurs from July to September (Pitcher and Calkins, 1979).

The population size of the Gulf of Alaska stock is estimated at 29,175 seals (Angliss and Outlaw, 2005). The most recent count for harbor seals within Cook Inlet is 7,330 seals (Josh London, National Marine Mammal Laboratory. Pers. Comm. February 2007). Harbor seals have declined in some areas of the northern Gulf of Alaska by 78 percent during the past two decades (Fadely *et al.*, 1997). Causes of this decline may include natural population fluctuations or cycles, reduced environmental carrying capacity and prey availability due to natural or human causes, predation, harvests, direct fisheries related mortality, entanglement in marine debris, pollution, and emigration (Hoover-Miller, 1994).

Harbor porpoise *Phocoena phocoena* (Linnaeus, 1758)
Harbor porpoise occur throughout Alaska waters (Lowry *et al.*, 1982). The Gulf of Alaska stock

of harbor porpoise, which includes Cook Inlet animals, is estimated at 41,854 animals (Angliss and Outlaw, 2006). It is recently classified as a "strategic stock" largely due to lack of information on the incidental mortality of this stock in commercial fisheries (71 FR 145, July 28, 2006). Dahlheim *et al.* (2000) estimated the average density of harbor porpoises in Cook Inlet was 7.2 animals per 1,000 km^2 (386 square miles), or 1 animal per 139 km^2 (53 square miles), which indicate densities are very low in the Inlet. Harbor porpoises occur in upper Cook Inlet throughout the year in small numbers but are more abundant in the lower Inlet (LGL, 2006).

Killer whale *Orcinus orca* (Linnaeus, 1758)
The Eastern North Pacific killer whale stocks include transient and resident killer whales in the Gulf of Alaska and Cook Inlet (Angliss and Outlaw, 2005). The minimum abundance estimate for the Alaska resident killer whale stock is 1,123 animals; and the Gulf of Alaska, Aleutian Islands, and Bering Sea transient killer whale stock is 314 animals (Angliss and Outlaw, 2005).

Killer whales in Cook Inlet have not been well documented (Shelden *et al.*, 2003). However, their occurrence in the area is sporadic and not considered common event. Most resident killer whale sightings occur in the lower Inlet (Shelden *et al.*, 2003). Small groups of killer whales, believed to be transient whales, have been seen in upper Cook Inlet (NMFS, 2003a). Rugh *et al.* (2005) reported observing no killer whales in the upper Inlet and only 23 killer whales in the lower Inlet during aerial surveys from 1993 to 2004. Similarly, two recent marine mammal studies in the upper Inlet and Knik Arm did not observe any killer whales (Funk *et al.*, 2005; Ireland *et al.*, 2005). There are no records of killer whales in the Beluga River and Granite Point project areas.

5.3. Marine Bird Species

Over 100 species of waterfowl, shorebirds, and seabirds occur in the Cook Inlet/Susitna areas (ADNR, 1999). Migratory waterfowl and shorebirds begin arriving in Cook Inlet in early Arpil. The greatest variety and numbers of birds are found on exposed mud flats, deltas, flood plains, and salt marshes. Loons (genus *Gavia*), grebes (genus *Podiceps*), cormorants (genus *Phalacrocorax*), sea ducks, and alcids are most frequencly found on bays and exposed inshore waters. Geese and dabbling ducks primarily use river flood plains and marshes, while diving ducks spend most of their time on bay waters. Shorebirds are found primarily on mud flats and gravel areas. Gulls use a variety of habitats, especially lagoons (MMS, 1995).

An ongoing waterfowl mortality study funded by the U.S. Army at Fort Richardson revealed that dabbling ducks are primary users of upper Cook Inlet salt marshes and flats (Susitna flats, Eagle River Flats, Palmer hay Flats, and Goose Bay). As many as 60,000 to 100,000 of these birds appear each spring in upper Cook Inlet. These ducks may be feeding on fingernail clams (*Macoma* spp.) or large amphipods.

5.4 Fish Species

Forage fish species

Forage fish are primarily schooling fish that serve as the nutritional basis for marine mammal and bird populations, as well as larger fish species. The dominant forage fish species in Cook Inlet include Pacific herring (*Clupea pallasi*), walleye pollock (*Theragra chalcogramma*), capelin (*Mallotus villosus*), Pacific sand lance (*Ammodytes hexapterus*), eulachon (*Thaleichthys pacificus*), longfin smelt (*Spirinchus thaleichthys*), and saffron cod (*Eleginus gracilis*) (Piatt *et al.*, 1999; LGL, 2006).

A study by Moulton (1997) showed that fish densities in upper Cook Inlet were higher in June than in July, and the greatest mean fish densities occurred along the northwest shoreline from the Susitna delta to the North Foreland and the adjacent mid-channel waters. The lowest densities occurred along the southeastern shoreline from Moose Point to Boulder Point. The most abundant forage fish were threespine stickleback (*Gasterosteus aculeatus*) and Pacific herring, which comprised 25 and 24 percent of the total catch (Moulton, 1997).

Salmonid fish species

Five Pacific salmon species (Chinook, *Oncorhynchus tshawytscha*; sockeye *O. nerka*; pink, *O. gorbushka*; chum, *O. keta*; and coho, *O. kisutch*), steelhead trout (*O. mykiss*), and Dolly Varden (*Salvelinus malma malma*) occur in Cook Inlet and its tributary waters (NMFS, 2003a; LGL, 2006). Adult salmon return from marine habitats to their natal freshwater rivers and streams to spawn in summer and fall. Eggs are laid and develop in gravel substrates. Fry emerge from the gravel in the spring and remain in freshwater for variable amounts of time. Depending on the species and the distance from the spawning area to marine waters, fry may remain in fresh water for only a few days or weeks, or may remain in fresh water for one to two years. As the fry transition to brackish and marine habitats they become smolts. Smolts may spend several years in marine habitats before returning to freshwater to spawn as adult salmon. As salmon return to freshwater they undergo physiological changes in body shape and color. All salmon die after spawning. Steelhead and Dolly Varden may spawn more than once.

Groundfish species

Groundfish is a term used to describe fish species that inhabit the seafloor during a portion of their life cycle, typically as adults. Groundfish are also referred to as demersal, benthic, or bottom dwelling fish. However, many species are pelagic, either free swimming or as planktonic larvae, during early life stages. Groundfish species commonly found in Cook Inlet are Pacific cod (*Gadus macrocephalus*), rockfish (*Sebastes* spp.), sablefish (*Anoplopama fimbria*), Pacific halibut (*Hippoglossus stenolepis*), flathead sole (*Hippoglossoides elassodon*), and yellowfin sold (*Pleuronectes asper*) (LGL, 2006).

5.4 Marine Invertebrate Species

Dominant invertebrate animal species inhabiting the intertidal and sub-tidal fringe in the Cook Inlet area include sea urchins, chitons, lipets, whelks, mussels, clams, cockles, polychaetes, bryozoans, sponges, sea stars, sea cucumbers, snails, octpi, barnacles, and crabs (Feder and Jewett, 1987). Marine invertebrates of nearshore and offshore waters include sea cucumbers, many species of sea star, nudibranches, octopi, tunicates, worms, and sea leeches (Kessler, 1985).

Shellfish begin life as planktonic eggs released into ocean currents by gravid females. Mollusks usually settle to the bottom and with the exception of snails and octopi, permanently attach themselves to a suitable substrate in the sub-tital zone. Most crustaceans sink to the bottom and spend their adult life there where they must find protection or be consumed by fish species.

Razor clams (*Siliqua* spp.) are abundant in commercial quantities in Cook Inlet. Stocks are concentrated in the Polly Creek area on the west side, and along the east side from Anchor Point to the Kasilof River, although harvest in the latter vicinity is limited to sport and personal use (Ruesch and Fox, 1995). Many species of clams such as *Axe* spp., *Mya* spp., *Tresus* spp., *Spisula* spp., *Telina* spp., and *Macoma* spp. inhabit beaches of Cook Inlet and the Gulf of Alaska (Kessler, 1985).

Historically, commercially significant populations of tanner, king, and Dungeness crab, and several species of shrimp have inhabitaed the lower Cook Inlet. However, populations of these species have been depressed since the middle 1980s (ADF&G, 1995)

VI. ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

The impact of Federal actions must be considered prior to implementation to determine whether the action will significantly affect the quality of the human environment. In this section, an analysis of the environmental impacts in issuing IHAs to CPAI and UOCC, and the alternatives to that proposed action,are presented.

6.1. Effects of Seismic Sounds on Marine Mammals

6.1.1. Characteristics of Seismic Sounds

The sound source levels associated with the OBC seismic survey can be as high as 233 – 240 dB *re:* 1 µPa at 1 m (0-p). Received levels within a few kilometers of the array could exceed 160 dB *re:* 1 µPa (Richardson *et al.*, 1995), depending on water depth, bottom type, ice cover, etc. Since airgun arrays are designed to direct most of the sound energy downward, the effective source level for horizontal propagation is generally less than that for vertical propagation. The short duration of each pulse (ranges from tens to hundreds of milliseconds, depending on distance from the source) (Greene and Richardson, 1988), and the intervals between each pulse (10 – 20 seconds) (Caldwell and Dragoset, 2000) limit the total energy being released into the water column during a given time period. Most acoustic energy from airguns used in seismic surveys is concentrated at 10 – 120 Hz, but the pulses contain some energy up to 500 – 1,000 Hz (Richardson *et al.*, 1995). The latter components are weak when compared to the low-frequency energy but strong when compared to ambient noise levels.

Sound exposure levels produced by an acoustic source can be estimated as a function of frequency and range by subtracting transmission loss (TL) from the acoustic source level. In deep water, sound transmission characteristics are determined by geometric spreading loss and absorption within the water column. While in shallow water, sound transmission is often complicated by reflection losses from the bottom and surface; refraction from sound speed gradients; absorption, reflection and refraction from sub-bottom layers; and scattering from rough surfaces (Richardson *et al.*, 1995). The large variability in temperature characteristics of coastal waters also has a significant influence on sound propagation. Such effects are more pronounced during summer months when runoff and solar heating are high and result in a relatively warm freshened layer floats on top of cooler, more saline, and denser ocean water (LGL, 2001). All these effects must be considered along with geometric spreading loss to obtain estimates of the received levels at various distances from the sound source.

6.1.2. Marine Mammal Hearing Sensitivity

One of the most important aspects to assess the effects of high intensive sounds on marine mammals is to understand their hearing sensitivity. The hearing threshold of marine mammals varies greatly from species to species, and often depending on the species sensitivity to a particular frequency range (Richardson *et al.*, 1995; Nachtigall *et al.*, 2000). Judging by the sounds they produce, cetacean hearing varies by species from extreme low frequency capability in larger whales (Thompson *et al.*, 1979; Clark, 1989; Nishimura and Conion, 1994) to very high frequency sensitivity in small odontocetes (Schevill and Lawrence, 1953; Møhl and Andersen, 1973). Studies of audiograms of several cetacean species confirm that most odontocete species have sensitive hearing between 1 – 120 kHz (see review by Richardson *et al.*, 1995; Nachtigall *et al.*, 2000).

Beluga whale peak hearing sensitivity is between 10 and 100 kHz (Richardson *et al.*, 1995), and within that range their best hearing threshold approaches 42 dB *re* 1 μPa. Above 100 kHz their sensitivity drops off very fast but the bandwidth of their hearing extends as high as 150 kHz (Au, 1993); below 8 kHz the decrease in sensitivity is more gradual, approximately 11 dB per octave (Awbrey *et al.*, 1988). Beluga whales are able to hear frequencies as low as 40 – 75 Hz (Johnson *et al.*, 1989), but at these frequencies their sensitivity is quite poor (the threshold level at 40 Hz is on the order of 140 dB *re:* 1 μPa).

Studies on small to moderate-sized odontocetes, such as harbor porpoises and killer whales, all showed similar hearing frequency sensitivities to those of beluga whales, i.e., they all have poor hearing sensitivity at frequencies below 1 kHz, but extremely good sensitivity at, and above, several kilohertz (Andersen, 1970; Szymanski *et al*. 1999; Kastelein *et al.*, 2002).

However, despite the relatively poor hearing sensitivity of small odontocetes at the low frequencies that contribute most of the energy in pulses of sound from airgun arrays, these sounds are sufficiently strong that their received levels sometimes remain above the beluga hearing thresholds at distances out to several tens of kilometers from the sound source. Results from the Beaufort Sea seismic exploration indicate that pulses from airgun arrays are theoretically audible to beluga whales at distances more than 100 km (62 miles) at certain times (Richardson and Würsig, 1997), although there is no evidence that these whales react to airgun pulses at such long distances.

Most pinniped species have essentially flat audiograms from 1 kHz to 30 – 50 kHz with thresholds between 60 and 85 dB *re:* 1 μPa (Møhl, 1968; Kastak and Schusterman, 1995; review by

Richardson *et al.*, 1995; Terhune and Turnbull, 1995; Kastelein *et al.*, 2005;). At frequencies below 1 kHz, thresholds increase with decreasing frequency (Kastak and Schusterman, 1998). For example, for a harbor seal, the 100-Hz threshold was 96 dB *re:* 1 µPa (Kastak and Schusterman, 1995), which is considerably more sensitive than for almost all odontocete species. Limited research on two Steller sea lions showed that this species has high hearing sensitivity for sound between 1 and 25 kHz (Kastelein *et al.*, 2005).

6.1.3. Effects of Intense Sounds on Marine Mammals
It has been suggested that seismic surveys using acoustic energy may have the potential to adversely impact marine mammals in the vicinity of the activities (Richardson *et al.*, 1995; LGL, 2001; Gordon *et al.*, 2004). Intense acoustic signals from seismic surveys have been known to cause behavioral alteration such as reduced vocalization rates (Goold, 1996), avoidance (Malme *et al.*, 1986, 1988; Richardson *et al.*, 1995; Harris *et al.*, 2001), and changes in blow rates (Richardson *et al.*, 1995) in several marine mammal species. However, systematic information about the reactions of odotoncetes and pinnipeds to seismic surveys is still lacking.

Seismic operators sometimes see species of toothed whales other than beluga whales near operating airgun arrays (e.g., Duncan, 1985; Arnold, 1996; Stone, 1997; 1998). When a 3,959-in^3, 18-airgun array was firing off California, observed odontocetes showed no change of behavior from when the airguns were silent (Arnold, 1996). Most, but not all, dolphins often seemed to be attracted to the seismic vessel and floats, and some rode the bow wave regardless of whether the airguns were firing (LGL, 2001). However, in Puget Sound, Dall's porpoises (*Phocoenoides dalli*) observed when a 6,000-in^3, 12 – 16 airgun array was firing tended to be heading away from the survey boat (Calambokidis and Osmek, 1998).

Observers stationed on seismic vessels operating off the United Kingdom in recent years have provided data on the occurrence and behavior of various odontocetes species exposed to seismic pulses (Stone, 1997; 1998; 2000; 2003). Results were variable among species and years. However, various species of dolphins often showed more evidence in avoidance of operating airgun arrays than has been reported previously for small odontocetes.

Goold (1996) monitored common dolphin (*Delphinus delphis*) acoustic activity before, during, and after seismic surveys off the coast of Wales. Acoustic contact with dolphins was lower during the seismic survey than before it, and was lower again during periods when the airguns were actually firing. In addition, fewer dolphins were observed bow riding during seismic surveys.

There are even fewer studies about effects of seismic surveys on pinnipeds. One controlled exposure experiment using small airguns (source level: 215 – 224 dB *re:* 1 µPa at 1 m peak-to-peak (p-p)) was conducted on harbor seals and gray seals (*Halichoerus grypus*) that had been fitted with telemetry devices showed fright responses in two harbor seals when playback started (Thompson *et al.*, 1998). Their heart rate dropped dramatically from 35 – 45 beats/min to 5 – 10 beats/min. However, these responses were short-lived and following a typical surfacing tachycardia; there were no further dramatic drops in heart rate. Harbor seals showed strong avoidance behavior, swimming rapidly away from the source. Stomach temperature tags revealed that they ceased feeding during this time. Only one seal showed no detectable response to the airguns and approached to within 300 m (984 ft) of the sound source. The behavior of harbor seals seemed to return to normal soon after the end of each trial. Similar avoidance responses were also documented in gray seals.

By contrast, sighting rates of ringed seals (*Phoca hispida*) from a seismic vessel in shallow Arctic waters showed no difference between periods with the full array, partial array, or no airguns firing (Harris *et al.*, 2001).

Besides these behavioral responses exhibited by marine mammals during seismic surveys, exposure to high intensity sound for an extended period of time may also result in auditory effects such as hearing threshold shifts (TSs). If the TS recovers after a few minutes, hours, or days it is known as a temporary threshold shift (TTS); if the TS becomes a permanent condition, it is known as a permanent threshold shift (PTS). Little research has been done on marine mammal TTS impacted by underwater noise. A masked-TTS study done by Finneran *et al.* (2002) on a captive bottlenose dolphin (*Tursiops truncatus*) and a beluga whale exposed to 0.4, 4, and 30 kHz single underwater impulses from a seismic watergun showed that no TTS was observed in the dolphins at the highest exposure condition of 228 dB *re:* 1 μPa p-p (or 219 dB *re:* 1 μPa rms). However, masked TTSs of 6 dB were observed on the beluga whale after exposure to 0.4 and 30 kHz impulses at 226 dB *re:* 1 μPa p-p (or 217 dB *re:* 1 μPa rms). When exposed to intense 1-s tones at 0.4, 3, 10, and 20 kHz sound, masked TTSs were observed at SPLs of 192 – 201 dB *re:* 1 μPa rms for captive dolphins and beluga whales (Schlundt *et al.*, 2000). Kastak *et al.* (1999) reported TTS in a California sea lion, harbor seal, and northern elephant seal (*Mirounga angustirostris*) exposed to underwater octave band noise at 65 – 75 dB sensational level (above baseline threshold, which is between approximately 78 – 90 dB *re:* 1 μPa rms on average) for 20 – 22 min. To the contrary, in another study, no masked TTS was observed when two California sea lions were exposed to single underwater impulses of approximately 178 and 183 dB *re:* 1 μPa rms (Finneran *et al.*, 2003). Therefore, it is also important to note that the effects of the different sound exposures do not depend on the sound pressure alone, but also depend on the exposure duration. The sound exposure level (SEL), which is the function of sound pressure levels and exposure time, is thus used to measure the TTS effects. Based on several recent studies (e.g., Schlundt *et al.*, 2000; Nachtigall *et al.*, 2004; Finneran *et al.*, 2005), it is suggested that a SEL of 195 dB *re:* 1 $\mu Pa^2 s$ be considered as the onset of a TTS (Finneran *et al.*, 2005).

The dominant frequencies of the airguns to be used in the proposed seismic operations are in the extreme low end of the spectra (around 20 Hz) that can be detected by the marine mammals that inhabit upper Cook Inlet. The hearing sensitivity for beluga whales, harbor porpoises, killer whales, harbor seals, and Steller sea lions is poor for the low frequency (< 1,000 Hz) impulses produced by seismic operations (Richardson *et al.*, 1995). Also, the characteristics of seismic sounds are impulses (lasts for milliseconds every 10 – 20 seconds), not continuous sounds, and therefore, the acoustic energy being released into the water column is much lower compared to continuous sounds with similar SPLs.

In addition, the source level of this array is expected to be considerably lower than the 1,200- in^3 BOLT airgun array used by the U.S. Coast Guard (USCG) vessel *Healy* (70 FR 47792, August 15, 2005). To conservatively assess the received levels from airgun pulses, the USCG's *Healy* modeled data were used to calculate the maximum distances where sound levels would be 190, 180, and 160 dB *re:* 1 μPa rms. The maximum distances where sound levels were estimated at

190, 180, and 160 dB *re:* 1 μPa rms from a single 1,200-in^3 BOLT airgun in the Beaufort Sea were 313 m (1,027 ft), 370 m (1,214 ft), and 1,527 m (5,010 ft), respectively. However, since the proposed seismic surveys would use the much smaller 900-in^3 airgun array in an area with soft mud bottom that gradually slopes outward from shore, which is a poor condition for sound transmission (Richardson *et al.*, 1995), the received levels are expected to be much lower at these distances.

6.1.4. Number of Marine Mammals Expected to Be Taken

NMFS estimates that approximately 6 - 57 Cook Inlet beluga whales (average 26 whales) out of a population of 302 whales (NMFS unpublished data) and a maximum of 30 Pacific harbor seals out of a population of 29,175 seals (Angliss and Outlaw, 2005) would be harassed incidentally by the two proposed seismic operations from March to June, 2007. These take numbers represent 2.0 – 18.9% (average 8.6%) Cook Inlet beluga whales and less than 0.1% Alaska stock of Pacific harbor seals that could be taken by Level B harassment, if no mitigation and monitoring measures are implemented. These numbers are based on the animal density, length of track planned, and the assumption that all animals will be harassed at distances where noise at received level is at and above 160 dB *re:* 1 μPa rms. Beluga whale and harbor seal densities were calculated by dividing the daily counts of whales (ranges from 11 - 99, with an average of 46) and seals (75) by the approximate area (1,248 km^2, or 482 square miles) surveyed in the Susitna Delta (Beluga River to Little Susitna River) during the most recently published survey for June 2004 (Rugh *et al.*, 2005). Although 18.9% of Cook Inlet beluga whales could be subject to take by Level B harassment, this estimate was based on an unusually high whale count on June 3, 2004 in Susitna Delta. Cook Inlet beluga aerial surveys conducted by NMFS in June, 2003 and 2004, provided median whale counts between 0 – 99, with an average count of 29 whales in the same area. This estimate is high as it assumes that all animals exposed by seismic impulses over 160 dB *re:* 1 μPa would be harassed and disturbed. As mentioned earlier, the majority acoustic energy of low frequency airgun impulses falls outside beluga whale's most sensitive hearing range (Richardson *et al.*, 1995). It is most likely that only a portion of whales within the 160 dB *re:* 1 μPa isopleth would be disturbed. In addition, it is also possible that many of the animals would be habituated to this level of acoustic disturbances. Furthermore, mitigation measures such as requiring ramp-up during the initiation of the seismic operations (see below) would eliminate most, if not all, startling behavior from animals near the proposed project area. Therefore, NMFS believes that the actual number of Level B harassment takes of Cook Inlet beluga whale would be much lower than the estimated average of 26 whales.

Although the systematic, routine surveys for belugas in Cook Inlet includes sighting records for harbor porpoises, Steller sea lions, and killer whales, these species do not have surveys that focus on their distribution and abundanc (Rugh, *et al*., 2004; 2005; 2006). However, based on an abundance survey of harbor porpoises within the entire Cook Inlet (Dahlheim *et al.*, 2000), it is estimated that the population density of harbor porpoise in the entire Inlet is 0.0072 animal per km^2. Accordingly, NMFS estimates that about six harbor porpoises out of a population of 30,506 porpoises would be harassed incidentally by the two proposed seismic operations from March to June, 2007. This number of takes represents less than 0.02% of the harbor porpoise population that could be taken by Level B harassment.

There is no density estimates available for Steller sea lions and killer whales within Cook Inlet.

However, their appearance in upper Cook Inlet is rare and neither of these species have been seen in the upper Inlet during the NMFS survey for belugas (Rugh *et al.*, 2005). Therefore, NMFS concludes that the probability of harassment of these species is likely much lower than those of beluga whales and harbor seals.

With the implementation of mitigation and monitoring measures described in Section VII and proposed in Alternative 3 (Preferred Alternative), the number of marine mammals potentially subject to harassment as a result of the proposed seismic operations could be much lower.

6.2. Effects of the Alternatives on Marine Mammals

6.2.1. Alternative 1 – Issuance of IHAs with No Mitigation and Monitoring Measures

Under Alternative 1, NMFS will issue one-year IHAs to CPAI and UOCC allowing the incidental take of Cook Inlet beluga whales, Pacific harbor seals, Steller sea lions, harbor porpoises, and killer whales during seismic operations in upper Cook Inlet. No mitigation and marine mammal monitoring measures would be required under this Alternative.

Under this Alternative, marine mammals could be potentially exposed to intense seismic sound if they happen to be at a location close to the airgun array when firing of airguns begins, and therefore, there is a potential that these animals could experience a hearing impairment due to TTS. However, such incidents are expected to be rare since marine mammal species found in the vicinity of the proposed project area all have poor hearing sensitivity to low frequency seismic sounds. In addition, most free ranging marine mammals are known to avoid high intense sounds and swim away from sound sources during seismic operations, thus minimizing the possibility that marine mammals will be exposed to sound levels causing TTS in most cases (e.g., Malme *et al.*, 1986, 1988; Richardson *et al.*, 1995; Harris *et al.*, 2001). Although some species seem to be attracted to the anthropogenic sounds such as ship noise or seismic sounds (e.g., LGL, 2001), it is safe to conclude that in these circumstances the sounds are not at a level to cause TTS, as numerous control experiences have shown that even trained animals will avoid SPLs that could cause TTS (e.g., Kastak *et al.*, 1999; Schlundt *et al.*, 2000; Finneran *et al.*, 2002; 2005). Therefore, the probability that a marine mammal receives TTS, even with no mitigation and monitoring measures, is low. However, because the MMPA requires that activities reduce impacts to the lowest level practicable; this Alternative is not NMFS' preferred alternative.

6.2.2. Alternative 2 – No Action Alternative

Under the No Action Alternative, NMFS would not issue the IHAs. The MMPA prohibits all takings of marine mammals unless authorized by a permit or exemption under the MMPA. If authorizations to incidentally take Cook Inlet beluga whales, Pacific harbor seals, Steller sea lions, harbor porpoises, and killer whales are denied, the applicants could choose to amend the projects either to avoid harassing marine mammals or forego the proposed projects entirely.

Under this Alternative, marine mammals and other marine life in the proposed project area would not be exposed to additional intensive seismic sounds for the period between mid March and mid June, but would be exposed to sounds from existing industrial activities. Therefore, no additional takes of marine mammals are expected.

6.2.3. Alternative 3 – Issuance of Authorization with Mitigation and Monitoring Measures

Under Alternative 3, NMFS proposes to issue IHAs to CPAI and UOCC allowing the incidental take by Level B behavioral harassment of a small number of Cook Inlet beluga whales, Pacific harbor seals, and harbor porpoises, and also allowing Level B harassment to Steller sea lions and killer whales during seismic operations in upper Cook Inlet, subject to the implementation of mitigation and monitoring measures.

As discussed above, seismic surveys with intense acoustic energy from airguns may have potential adverse impacts to marine mammals, including beluga whales, harbor seals, harbor porpoises, Steller sea lions, and killer whales in Cook Inlet. Although information is lacking on the exact effects of airguns on these five species, a captive beluga whale was observed to develop a masked TTS of 6 dB when exposed to 0.4 and 30 kHz seismic watergun impulses at 226 dB *re:* 1 μPa p-p (or 217 dB *re:* 1 μPa rms) (Finneran *et al.*, 2002). When exposed to intense 1-s tones at 0.4, 3, 10, and 20 Hz sound, masked TTSs were observed at SPLs of 192 – 201 dB *re:* 1 μPa rms for captive beluga whales (Schlundt *et al.*, 2000). Kastak *et al.* (1999) reported TTS in a harbor seal exposed to underwater octave band noise at 65 – 75 dB sensational level for 20 – 22 min. However, free-ranging marine mammals have the option of moving away from intense airgun noise to prevent the onset of TTS.

Observations on other marine mammal species in the vicinity of an operating seismic airgun array have shown that animals could be displaced from the project area (e.g., Calambokidis and Osmek, 1998). Noise from seismic surveys has also been noted to alter nearby marine mammal behaviors such as changing blow rates (Richardson *et al.*, 1995), reducing vocalization rates (Goold, 1996), and/or eliciting fright responses (Thompson *et al.*, 1998).

Since marine mammals subject to potential intense airgun noise exposure are free-ranging animals that could easily swim away from the proposed project vicinity, NMFS expects that only behavioral responses, such as those described above, by Cook Inlet beluga whales, Pacific harbor seals, harbor porpoises, Steller sea lions, and killer whales could occur as a result of airgun noise exposure from the proposed seismic operations. NMFS believes that these responses constitute Level B harassment only and would not cause TTS, injury, or mortalities to these marine mammals in the vicinity of the proposed project. In addition, NMFS believes that implementation of mitigation and monitoring measures would further reduce potential Level B harassment caused by the proposed project.

These mitigation and monitoring requirements include: (1) establishing safety zones when SPLs could reach 180 dB *re:* 1 μPa rms or higher for cetaceans and 190 dB *re:* 1 μPa rms or higher for pinnipeds; (2) altering ship speed and direction when marine mammals are expected to enter the safety zones when practicable and safe; (3) power-down airguns when marine mammals are expected to enter the safety zone when change of ship speed and course is not practicable, and shut-down airguns when marine mammals are found within the safety zones; (4) implementing ramp-up procedure during the initiation of airguns; and (5) conducting marine mammal survey and monitoring prior to and during seismic operations. A detailed description of these mitigation measures are provided in Section VII.

Under this Alternative, marine mammal species and stocks within the proposed project area would be protected from exposure to intense seismic sounds. Therefore, no TTS or serious injury to marine mammals is expected as a result of the proposed seismic operations. Only small numbers of beluga whales, harbor seals, and harbor porpoises, with addition of Steller sea lions and killer whales might be affected by Level B behavioral harassment due to the firing of airguns and the presence of survey vessels.

6.2.3. Alternative 3(Preferred Alternative) – Issuance of Authorization with Mitigation and Monitoring Measures with Additional Aerial Monitoring Requirement for CPAI

The Alternative 4 is the same as Alternative 3, except NMFS would require additional aerial monitoring for beluga whales for seismic operations conducted by CPAI off Beluga River between March and May, 2007. In addition, land-based monitoring would be required when aerial monitoring is not feasible during adverse weather condition.

This additional requirement, as discussed in Sections 7.2.2 and 7.2.3, would provided more monitoring coverage in an area during the time when Cook Inlet beluga whales are expected to be present in relatively large quantity.

6.3 Impacts on the Economics, Subsistence Needs, and Marine Environment of the Proposed Project Area

6.3.1. Impacts on the Economics of the Proposed Project Area

Most direct effects on social and economics of communities and municipalities within the proposed project area are likely to be temporary and localized. The most pronounced disturbance might be the slight increase of vessel traffic by seismic surveyors.

The reasonable foreseeable effects on the communities of the proposed seismic operations include providing temporary employment during the surveys, as well as increased contract work for seismic survey operators supported by the oil and gas industry.

6.3.2. Impacts on Subsistence Needs

The proposed project areas are located 4 - 15 miles (6.4 – 24.1 km) from the Native Village of Tyonek, which is predominately a Dena'ina Athabaskan community, which is the only Native community known to be subsistence users of marine mammals near the proposed project area. However, the proposed action area is not an important subsistence area for Tyonek hunters. The Tyonek Native community has been displaced from many traditional hunting (and trapping and fishing) areas north of Tyonek, including Beluga River, during the twentieth century. As more non-Natives utilized and occupied traditional subsistence areas combined with harvest regulation restrictions, changes in the abundance and distribution of subsistence resources, and other factors, Tyonek Native subsistence activities have focused closer to the village. While Tyonek Natives may harvest one beluga whale per year and occasionally harbor seals (Huntington, 2000), their primary source of red meat is moose (Foster, 1982). Therefore, NMFS believes that the proposed projects would not have an unmitigable adverse impact on the availability of these marine mammals to be taken for subsistence uses.

6.3.3. Impacts on Marine Environment

The seismic surveys would only introduce acoustic energy into the water column and no objects would be released into the environment. Although cables will be deployed on the ocean bottom during the recording sessions of the OBC seismic operations, these cables will be retrieved immediately after each transect survey and no damage to the benthic ecosystem is expected in the proposed project area. The survey vessels would travel at a speed of 4 – 5 knots and the projects would be conducted in a small area of Cook Inlet for a short period of time between March and June, 2007).

There is relative lack of knowledge about the potential impacts of seismic energy on marine fish and invertebrates. Available data suggest that there may be physical impacts on eggs and on larval, juvenile, and adult stages of fish at very close range (within meters) to seismic energy source. Considering typical source levels associated with seismic arrays, close proximity to the source would result in exposure to very high energy levels. While eggs and larval stages are not able to escape such exposures, juvenile and adult fish and invertebrates most likely would avoid them. In the cases of eggs and larvae, it is likely that the numbers adversely affected by such exposure would be very small in relation to natural mortality. Studies on fish confined in cages that were exposed under intense sound for extended period showed physical or physiological impacts (Scholik and Yan, 2001; 2002; McCauley *et al.*, 2003; Smith *et al.*, 2004) and mortality (Caltrans, 2005). While limited data on seismic surveys regarding physiological effects on fish indicate that impacts are short-term and are most apparent after exposure at very close range (McCauley *et al.*, 2000a; 2000b; Dalen *et al.*, 1996), other studies have demonstrated that seismic guns had little effect on the day-to-day behavior of marine fish and invertebrates (Knudsen *et al.*, 1992; Wardle *et al.*, 2001). It is more likely that fish will swim away upon hearing the approaching seismic impulses (Engås *et al.*, 1996). Based on the foregoing, NMFS finds that the proposed seismic surveys conducted during slack tides would not cause any permanent impact on the physical habitats and marine mammal prey species in the proposed project area. It is not likely any marine bird species will be affected as they do not have underwater hearing. It is also not likely any invertebrate marine life will be affected since most of them do not contain internal organs subject to injury by seismic sounds.

Although deployment of ocean bottom cables may disturb some bethic marine communities, such disturbance is considered insignificant since the areas affected is relatively small compare to the ecosystem in upper Cook Inlet. In addition, no dredging or drilling into the sediment is proposed, therefore, any disturbance will only be limited on the surface of the ocean bottom.

6.4. Cumulative Impacts

Cumulative effects are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions” (40 CFR §1508.7).

The Cook Inlet region is a major population center in the State of Alaska and supports a wide range of industrial, shipping, farming, fishing, and recreational activities. The proposed project would add another industrial activity in the northwestern Cook Inlet by conducting these seismic survey operations. However, the proposed seismic operations are limited to a very small area of the upper Inlet for a short period of time, and there would be no objects or material released into the water column. Therefore, NMFS has determined that the proposed action would not have a significant cumulative effect on either the human or marine environment. In addition, NMFS has determined that the proposed action would not be likely to have significant cumulative effects on Cook Inlet beluga whales, Pacific harbor seals, Steller sea lions, killer whales, and harbor porpoises. Particularly, since the latter three species are rare in the proposed project area during March through June, when the seismic operations are conducted. The following analysis of cumulative effects on these five marine mammal species found in the proposed project area supports NMFS' determination. This analysis provides a brief summary of the present human-related activities affecting these species in the proposed action area.

6.4.1. Effects of Predation

Killer whales are the only natural predators of beluga whales, harbor seals, Steller sea lions, and harbor porpoises in Cook Inlet (Angliss and Outlaw, 2005). Beluga whale stranding events have also been correlated with the presence of killer whales, and Native hunters believe that beluga whales intentionally strand themselves in order to escape killer whale predation (Huntington, 2000). It has been suggested that the potential for significant impacts on the Cook Inlet beluga whale and the Western U.S. Steller sea lion populations by killer whales cannot be ruled out (Heise *et al.*, 2003; Shelden *et al.*, 2003).

6.4.2. Effects of Disease

Bacterial infection of the respiratory tract is one of the most common diseases encountered in marine mammals. Necropsied Cook Inlet beluga whales have been found to host a variety of endoparasites, including nematodes, trematodes, cestodes, and acanthocephalans (NMFS, 2000). However, no indication exists that these organisms has had any measurable (detrimental or adverse) impact on the survival and health of beluga whale stock despite the considerable pathology that has been done on this species. The effects of parasites or disease on other marine mammal species within the proposed project area are not well documented.

6.4.3. Effects of Commercial Harvest and Intentional Killing Other Than Subsistence Harvest

Commercial whaling and sealing have occurred periodically in Cook Inlet during the last 100 years (Bower, 1921; Mahoney and Shelden, 2000; Angliss and Outlaw, 2005).

In the early to mid-1900s, small scale commercial hunting of beluga whales occurred in Cook Inlet (Bower, 1921). In the early 1900s, a few hundred beluga whales were harvested commercially over a number of years, followed by a period of 20 – 30 years without commercial harvest and small scale harvests resuming during the 1940s and 1950s. Guided sport hunting for beluga whales out of Anchorage and Kenai enjoyed some popularity during the 1960's (Anchorage Daily Times, 1965); however, no information exists on the level of this harvest.

The Bureau of Commercial Fisheries awarded a contract to a commercial fishing company to develop techniques for harvesting Steller sea lions in Alaskan waters in 1959 (NMFS, 2003b). The two-fold purpose of the contract was to 1) reduce the sea lion population (due to alleged depredation on salmon and halibut fisheries) and 2) provide an economical source of protein for fur farms, fish hatcheries, and similar purposes. In 1959, 630 sea lion bulls were killed in an experimental harvest, but the harvest proved to be uneconomical (NMFS, 2003b). Another study was contracted by the Bureau of Indian Affairs, Department of the Interior to analyze the feasibility of a commercial sea lion harvest in Alaska. A total of 45,178 sea lion pups of both sexes were killed in the eastern Aleutian Islands and Gulf of Alaska between 1963 and 1972 (NMFS, 2003b).

Currently, all marine mammals are protected under the MMPA and there is no commercial harvest of any marine mammal species in Cook Inlet. However, it is not clear whether the declines of Cook Inlet beluga whales and Western U.S. stock of Steller sea lions can be attributed to the cumulative, long term, or residual effects of the past commercial hunts. Therefore, the effect of commercial harvests, when considered with other cumulative effects of the environment on the alternatives, is considered unknown.

Illegal shooting of Steller sea lions was thought to be a potentially significant source of mortality prior to the listing of sea lions as “threatened” under the ESA in 1990 (Angliss and Outlaw, 2005). Currently, the sea lion mortality level from illegal shooting has been estimated to be at least 50 animals per year (NMFS, 2003b). Illegal intentional killing of harbor seals also occurs, but the magnitude of this mortality is unknown (Angliss and Outlaw, 2005).

6.4.4. Effects of Subsistence Harvest

Cook Inlet beluga whales, harbor seals, and Steller sea lions are known to be subjected to subsistence hunt by Alaska Natives within the proposed project area in recent years (Stanek, 1994; Angliss and Outlaw, 2005; Wolfe *et al.*, 2005). No subsistence harvest report is available for harbor porpoises and killer whales within the proposed project area.

Cook Inlet beluga whale

Beluga whales have been hunted by Alutiiq and Dena’ina Athabaskan Indians in the Cook Inlet area since prehistoric times (Mahoney and Sheldon, 2000). In the 1930s and 1940s, the Dena’ina in Tyonek harvested about 6 – 7 whales per year (Fall *et al.*, 1984). However, increasing Native populations in the Anchorage area, combined with more efficient hunting methods may have led to increased hunting pressure on the Cook Inlet beluga population beginning in the early 1990s (Mahoney and Shelden, 2000). From 1994 to 1998, NMFS estimated an average of 67 whales (range 21 – 98) were taken annually, a number sufficiently high to account for the estimated 14 percent annual decline of Cook Inlet beluga whales during this period (NMFS, 2005). Actual mortality may even be higher, given the difficulty of estimating struck but lost belugas during the hunts (DeMaster, 2000).

To address the dramatic decline a moratorium was enacted (Pub. L. No. 106-31 (May 21, 1999)) to prohibit the harvest of Cook Inlet beluga whales except through a co-management agreement between NMFS and an Alaska Native organization (ANO). This moratorium was extended indefinitely in December 2000 (Pub. L. No. 106-553). NMFS has since promulgated regulations for the taking of Cook Inlet beluga whales by Alaska Natives for the years 2001-2004 (69 FR 17973, April 6, 2004). Under these agreements, the subsistence harvest has been severely restricted (five belugas in 2000 – 2006). A long-term harvest management plan (2005 and subsequent years) is under development (NMFS, 2005a).

Western U.S. Steller sea lion
The subsistence harvest of Steller sea lions from 1960 to 1990 has been estimated at 150 animals per year, but the estimate was subjective and not based on any referenced data. This estimate is well below the levels observed in the 1990s (Wolfe *et al.*, 2005), which seems inconsistent with the fact that sea lion populations are at their lowest recorded levels. Currently, subsistence harvest of Steller sea lions in Alaska is estimated by ADFG, under contract with NMFS. More recent estimates indicate a mean annual subsistence take of 275 from the Western U.S. stock from 1992 to 2004 (Wolfe *et al.*, 2005). The majority of sea lions were taken by Aleut hunters in the Aleutian and Pribilof islands.

In the upper Cook Inlet region, Steller sea lion subsistence harvest is relatively low, with 10, 11, 1, 1, and 1 sea lions taken in the Anchorage area in years 1992, 1993, 1994, 1996, and 2001, respectively (Wolfe *et al.*, 2005). The subsistence harvest of Steller sea lions by Alaska Natives results in direct takes are expected to continue into the foreseeable future. These takes represent the highest level of known direct mortality from an anthropogenic source. The overall impact of the subsistence harvest on the Western U.S. population of Steller sea lion depends upon the number of animals taken, their sex and age class, and the location where they are taken (NMFS, 2003b). As with other sources of mortality, the significance of subsistence harvesting may increase as the western population of sea lions decreases in size unless the harvesting rate is reduced accordingly. The future subsistence harvest may contribute to localized declines of sea lions and/or impede recovery if the harvest is concentrated geographically (NMFS, 2003b).

Pacific harbor seal
Subsistence harvest of harbor seals in Alaska is estimated by ADFG, under contract with NMFS. It is estimated that an average of 2,398 harbor seals were taken annually in Alaska waters between 1992 and 2004 (Wolfe *et al.*, 2005). In the upper -Cook Inlet region, a total of 69, 74, 85, and 64 seals were taken off Anchorage, Homer, and Tyonek in years 2001, 2002, 2003, and 2004, respectively (Wolfe *et al.*, 2005).

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

Stranding events of other marine mammals (gray, minke, humpback, beaked, and fin whales; harbor porpoise) in upper Cook Inlet are documented, and presumably are rare.

6.4.6. Effects of Entrapment and Entanglement in Commercial Fishing Gear
Entrapment and entanglement in commercial fishing gear is one of the most frequently

documented sources of human-caused mortality in many marine mammal species (Read, 2005). Marine mammal injury reports or mortalities incidental to commercial fishing operations are obtained from observer programs, fisheries reporting programs, and reports in literature.

From 1979 to 1983, an estimated 3 – 6 beluga whales per year died due to salmon gillnet entanglement in Cook Inlet (Burns and Seaman, 1985; NMFS, 2000). Single beluga whales became entangled in nets near Fire Island in July 1989, near the Susitna River in July 1990, in the Kenai area in August 1996 (Moore *et al.*, 2000), and near Nikiski in July 2005 (NMFS unpublished data). Marine mammal observers were placed on drift and set gillnet salmon fisheries in Cook Inlet during 1999 and 2000 and reported no interactions between beluga whales and fishing gear (Angliss and Outlaw, 2005). A self-reported fisheries program is the method presently used in Cook Inlet to document marine mammal interactions with commercial fisheries. Reports after 1995 are considered incomplete, due to a dramatic drop in reporting (Angliss and Outlaw, 2005).

Steller sea lions have been caught incidentally in foreign commercial trawl fisheries in the Gulf of Alaska since these fisheries developed in the 1950s. From 1960 to 1990, incidental take may have accounted for the take of more than 50,000 animals (NMFS, 2003b). Currently, the estimated mortality rate incidental to commercial fisheries is 30.9 Western U.S. Steller sea lions per year, based on observer data (25.3 percent), self-reported fisheries information (5.6 percent), or stranding data (0.2 percent) where observer data were not available (Angliss and Outlaw, 2005). There were no Steller sea lion mortalities observed in the set or drift gillnet fisheries in Cook Inlet in 1999 and 2000 when an observer program was implemented in this area.

Three commercial fisheries (groundfish trawl, longline, and pot fisheries) that operated within the range of the Gulf of Alaska stock of harbor seals and Gulf of Alaska stock of harbor porpoise were monitored for incidental take by NMFS observers during 1990 – 1995 (Angliss and Outlaw, 2005). The mean annual (total) mortality rate for harbor seal was 0.4 seals/year for the Gulf of Alaska groundfish trawl fishery and 0.2 seals/year for pot fishery (Angliss and Outlaw, 2005). During the period between 1990 and 1996, fisher self-reports from five unobserved fisheries for the entire Gulf of Alaska resulted in an annual mean of 10.25 harbor seal mortalities from interactions with commercial fishing gear. However, because logbook records are most likely negatively biased (Credle *et al.*, 1994), these are considered to be minimum estimates.

No incidental mortality of harbor porpoise was observed in Gulf of Alaska groundfish trawl, longline, and pot fisheries (Angliss and Outlaw, 2005). However, one single mortality was observed in 2000 under the Cook Inlet salmon set and drift gillnet observer program implemented in 1999 and 2000 (Angliss and Outlaw, 2005). This single mortality extrapolates to an estimated mortality level of 31.2 harbor porpoise for 2000. A reliable estimate for the mortality rate incidental to commercial fisheries for the Gulf of Alaska stock of harbor porpoise to commercial fisheries is considered unavailable because of the absence of observer placements in several gillnet fisheries.

The mean annual mortality and serious injury level for killer whales was 0.5 killer whales/year for the Bering Sea/Aleutian Islands flatfish trawl fishery, 0.6 killer whales/year for the Bering Sea/Aleutian Islands Pollock trawl fishery, 0.6 killer whales/year for the Bering Sea/Aleutian

Islands turbot longline fishery, and 0.8 killer whales/year for the Bering Sea/Aleutian Islands Pacific cod longline fishery, resulting in a mean annual mortality rate of 2.34 killer whales per year from observed fisheries (Angliss and Outlaw, 2005). No information is available whether these killer whales are from a resident or transient population. No fisher self-reports are available on killer whale mortalities from any Alaska fisheries between 1994 and 1998.

6.4.7. Effects of Ship Strikes

Collisions with commercial and recreational vessels are an increasing threat to many species of whales and dolphins. The presence of beluga whales in and near river mouths entering upper Cook Inlet predisposes them to strikes by high speed watercraft associated with sport and commercial fishing, and general recreation. The Susitna and Little Susitna river mouths, in particular, are areas where such vessel traffic and whales commonly occur. Beluga whales with propeller scars are observed in the Inlet. Most propeller injuries by small boats are thought to be nonlethal. NMFS enforcement agents investigated a report of a jet skier approaching and striking beluga whales in Knik Arm in 1994 (NMFS, 2003a). A stranded beluga whale examined in 1999 had an injury consistent with an old propeller injury (Burek, 1999). However, it appears that the potential cumulative effects of mortality due to vessel interactions on Cook Inlet beluga whales do not have a significant impact on this stock (NMFS, 2003a).

6.4.8. Effects of Anthropogenic Noise

Marine mammals rely on underwater sound for communication, foraging, navigation, and predator avoidance; therefore, acoustic cues are vital to their survival and reproductive success. However, the amount of anthropogenic sound introduced into the sea by human activities has substantially increased the ambient sound level in the ocean during the last 100 years. Much of this increase is due to the increased size of ships and shipping fleets. In addition, coastal industrial activities and active sonars, such as fishfinders and echosounders, used by both fishing and recreational vessels also introduce certain amounts of anthropogenic sound into the marine environment (Hildebrand, 2005).

The impacts of these anthropogenic sounds on marine mammal populations are not fully understood at this time. However, pervasive underwater sound from commercial shipping increases levels of background noise, which may mask acoustic signals that are important for marine mammal communication, foraging, predator avoidance, and navigation (Kruse, 1991; Miller *et al.*, 2000; Croll *et al.*, 2001; Foote *et al.*, 2004). Noise may affect developmental, reproductive, or immune functions, and cause more generalized stress. Some studies show that long-term exposure to anthropogenic noise may cause marine mammals to abandon their essential habitat (e.g., Bryant *et al.*, 1984; Morton and Symonds, 2002).

Upper Cook Inlet is one of the most industrialized and urbanized regions of Alaska. As such, ambient noise levels are high (Blackwell and Greene, Jr., 2002). The common types of noises in upper Cook Inlet include sounds from vessels, aircraft, dredging, construction equipment such as diesel generators, bulldozers, and compressors, and from construction activities such as pile-driving.

Aircraft Noise

The main approaches to the Ted Stevens Anchorage International Airport, Elmendorf Air Force

Base (AFB), Hood Lake, and Merrill Field are at all partially over upper Cook Inlet. Commercial and military jet airplanes often overfly these waters at relatively low altitudes. An acoustic measurement study in Cook Inlet, conducted by Blackwell and Greene, Jr. (2002), identified peak sound levels at 2.5 dB higher at 3 m (9.8 ft) than 18 m (59.1 ft) depth. At this level, both mid-frequency sound components and visual clues could play a role in eliciting reactions by the marine mammals (Richardson *et al.*, 1995). Despite this traffic, beluga whales are common in these waters and are often observed directly under the approach corridors off the north end of International Airport and the west end of Elmendorf AFB (NMFS, 2003a).

Response of marine mammals to airplanes and helicopters vary with social context, distance from the aircraft, and aircraft altitude. Because the underwater noise generated by an aircraft is greatest within a 26-degree cone directly beneath the craft (Richardson *et al.*, 1995), marine mammals often react to an aircraft as though startled, turning or diving abruptly when the aircraft is overhead. Richardson *et al.* (1995) report beluga whales not reacting to aircraft flying at 500 m (1,640 ft), but at lower altitudes of 150 – 200 m (492 – 656 ft) these animals dove for longer periods and sometimes swam away. Feeding beluga whales were less prone to disturbance. NMFS aerial surveys are consistently flown at an altitude of 244 m (800 ft), using fixed-wing twin engine aircrafts. Beluga whales are rarely observed to react to even repeat overflights at this altitude (NMFS, 2003a), in part because aircraft are so common in this area.

Ship and Boat Noise

The proposed project area also serves as a major shipping route for ships to and from the Port of Anchorage. Ships and boats create high levels of noise both in frequency content and intensity level. Ship traffic noise can be detected at great distances. High speed diesel-driven vessels tend to be much noisier than slow speed diesel or gasoline engines. Small commercial ships are generally diesel-driven, and the highest 1/3-octave band is in the 500 to 2,000 Hz range. Tugs can emit high levels of underwater noise at low frequencies. An acoustic study by Blackwell and Greene, Jr. (2002) suggested that beluga whales may not hear sounds produced by large ships at lower frequencies (i.e., below about 300 Hz) based on data collected by Ridgway *et al.* (2001). At high frequency ranges, the sounds from ships may not be sufficiently above beluga's hearing threshold to cause Level B harassment. Proposed expansion of the Port of Anchorage and construction of a new bridge across Knik Arm in Upper Cook Inlet may result in a relatively short-term increase in noise levels due to construction, especially pile driving activities at both locations

Small outboard motor driven watercraft, such as those commonly used for recreational purposes in the upper Inlet, typically produces noise at much higher frequencies (e.g., 6,300 Hz) and may therefore, have the highest potential to interfere with beluga whales. Also, these vessels can be erratic and unpredictable, and can cause Level B harassment.

Noise from Offshore Oil and Gas Drilling and Production

Sound produced by oil and gas drilling may be a significant component to the noise in the local marine environment, but underwater noise from the drilling platforms is expected to be relatively weak because of the small surface area in contact with the water, namely the four legs (Richardson *et al.*, 1995). However, vibrations from the machinery through the columns and into the bottom may be notable, accounting in part for the high levels observed at low frequencies (<30 Hz) (Blackwell and Greene, Jr., 2002). Gales (1982) summarized noise from 11 production platforms.

The strongest tones from four production platforms were at very low frequencies, between about 4.5 and 38 Hz, at ranges of 6 – 31 m (19.7 – 101.7 ft).

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

6.4.9. Effects of Overfishing and Prey Depletion

It is difficult to identify the potential seriousness of interactions resulting indirectly from competition for resources that represent both marine mammal prey and commercial fisheries targets. Such interactions may limit foraging success through localized depletion, disaggregation of prey, or disturbance to the predator itself. Compounding the problem of identifying competitive interactions, is the fact that biological effects of fisheries may be indistinguishable from changes in community structure or prey availability that might occur naturally.

Based on the best available scientific and commercial data, the salmon fisheries may compete with Cook Inlet beluga whales for common resources (NMFS, 2003). The extent of this competition is not known and at this time, it is not known whether overlap of foraging and resources demonstrates a significant interaction for this marine mammal stock. However, fisheries and beluga whales both consume salmon in significant quantities, and other species in lesser quantities. The high degree of temporal overlap between these fisheries and the foraging needs of beluga whales points to the potential for competitive interactions.

In addition, given that beluga whales concentrate in upper Cook Inlet to forage, the continued health of these salmon runs and their natal rivers are important. Maintaining the health of the spawning rivers may be as significant to the beluga whale as is maintaining the health of the Inlet. Therefore, activities that occur in the upland drainage areas of major spawning rivers, such as the Kenai and Susitna rivers, are likely as significant to beluga whales as are activities in the estuarine and saltwater portions of Inlet.

Prey species overfishing is also suggested to have a significant impact on the Western U.S. Steller sea lion population (Trites and Donnelly, 2003).

6.4.10. Effects of Pollutants

The principal sources of pollution in the Cook Inlet marine environment are: 1) discharges from wastewater treatment systems; 2) discharges from industrial activities that do not enter wastewater treatment systems; 3) runoff from urban, mining, aviation, and agricultural areas; 4) accidental spills or discharges of petroleum and other products; and 5) three separate Superfund sites in Knik Arm. Natural and man-made pollutants entering Cook Inlet are diluted and dispersed by the currents associated with the tides, estuarine circulation, wind-driven waves, and currents (MMS, 1996).

Ten communities currently discharge treated wastes into Cook Inlet. The maximum permitted wastewater discharges for Anchorage are 44 million gallons per day, and the other communities have a range from 10 thousand to 1.6 million gallons per day. However, the impacts of discharge wastewater on the beluga whales are unknown. Given the relatively low levels of contaminants found in Cook Inlet beluga whale tissues, municipal discharge levels are not believed to be having a significant impact on the beluga whale population (NMFS, 2003a).

Steller sea lion samples from the Bering Sea and Gulf of Alaska found that blubber PCBs ranged from 5,700 – 41,000 ng/g lipid in males, and 570 – 16,000 ng/g lipid in females. PCB concentration in sea lion males was orders of magnitude higher than other Arctic and Alaskan pinnipeds. DDT levels in males ranged from 2.8 to 17 ng/g lipid and in females from 0.19 – 6.5 ng/g lipid. For males and females aged 6 and 8 years of age, DDE levels were 5.4 and 1.8 ug/g lipid wt, respectively. Females were found to decrease the contaminant burden throughout life, relative to adult males, by dumping contaminants through lactation (NMFS, 2003b).

Oil and petroleum product production, refining, and shipping in Cook Inlet present a possibility for oil and other hazardous substances to be spilled, and to impact the marine mammal species/stocks in Cook Inlet. Data do not exist which describe any behavioral observations or deleterious effect of these spills to individual marine mammals in Cook Inlet, therefore, it is difficult to accurately predict oil spill effects in this region. While much of our understanding of how an oil spill affects a marine mammal is in development, it is known that effects to the animals, their prey, and habitat or both, might be affected by such an event. Therefore the potential cumulative effects of such an event are considered conditionally adverse.

6.4.11. Effects of Scientific Research

Because many important aspects of marine mammal biology remain unknown, or are incompletely studied, and because management of these species and stocks will require knowledge of their distribution, abundance, migration, population, ecology, physiology, genetics, behavior, and health, free-ranging marine mammal species are frequently targeted for scientific research and studies. Research activities normally include close approach by vessel and aircraft for line-transect surveys; behavioral observation; photo-identification and photo-video-grammetry; passive acoustic recording; attachment of scientific instruments (tagging), both by implantable and suction cup tags; biopsy sampling, including skin and blubber biopsy and swabbing; land-based surveys ; live capture for health assessments, and blood and tissue sampling pinniped tooth extraction, and related pinniped anesthesia procedures. All researchers are required to obtain a scientific research permit from NMFS Office of Protected Resources under MMPA and/or ESA (if an ESA-listed species is involved). Currently, the four permits authorizing research on beluga whales in Cook Inlet, and numerous permits authorizing research on harbor seals, harbor porpoises, Steller sea lions, and killer whales in Alaskan waters may have cumulative impacts on these species and stocks. NMFS anticipates that scientific research on marine mammals in Cook Inlet area will continue, and possibly expand, due to the increasing need to better understand distribution and abundance relative to temporal (seasonal, diel, or tidal) and spatial (geographic or bathymetric) parameters.

VII. MITIGATION MONITORING AND REPORTING

7.1. Mitigation

Under the Preferred Alternative, the following mitigation measures would be required under the proposed IHAs to be issued to CPAI and UOCC for conducting seismic operations in northwestern Cook Inlet. The implementation of these mitigation measures would reduce impacts to marine mammals to the lowest extent practicable.

7.1.1. Establishment of Safety Zones

The applicants propose to establish a 370 m (1,214 ft) radius safety zone for cetaceans and a 313 m (1,027 ft) radius safety zone for pinnipeds on the seismic operations to ensure that no TTS would occur to marine mammal species in the project area. Seismic operations will be curtailed when marine mammals enter their respective safety zone. These safety zone radii were calculated from data derived from a 1,200-in^3 BOLT array recorded in the Beaufort Sea where the SPL attenuated to 180 dB and 190 dB *re:* 1 μPa rms, respectively at these distances. Since the data used in calculating the size of safety zones were from a much larger array, while the proposed Cook Inlet seismic operations would use smaller arrays in an area with poor conditions for sound transmission, NMFS believes that these safety zone radii are conservative. Additional data will be acquired to verify the 190, 180, and 160 dB (rms) distances for the airgun configurations during the proposed seismic operations. An independent marine acoustic firm will be used to acquire the data. A scientifically valid sampling design will be followed to collect data at the beginning of the seismic program. The data will be used to calibrate the acoustic model and adjust the safety radii to match the field values for the 190, 180, and 160 dB distances for each array, if different from the estimated values in the IHA.

Safety zones would be surveyed and monitored prior to, during, and after the airgun seismic operations. A detailed description of marine mammal monitoring is described in the Monitoring and Reporting section below.

7.1.2. Speed and Course Alteration

If a marine mammal is detected outside the safety radius and based on the animal's position and its relative course of travel is likely to enter the safety zone, the vessel's speed and/or direct course may, when practicable and safe, be changed to allow continued operation and yet, avoid the impacts of intense sound that could cause TTS to the animal. The marine mammal activities and movements relative to the seismic and support vessels would be closely monitored to ensure that animals do not approach within the safety radius. If an animal appears likely to enter the safety zone, further mitigation measures would be taken (i.e., either further course alterations or power down or shut down of the airgun(s)).

7.1.3. Power-down Procedures

A power down involves decreasing the number of airguns in use, such that the radius of the 180- or 190-dB zone is decreased to the extent that marine mammals are not in the safety zone. During a power-down, one airgun is kept operational. The continued operation of one airgun is intended to alert marine mammals to the presence of the seismic airgun activity in the area.

If a marine mammal is detected outside the safety zone but is likely to enter the safety zone, and if the vessel's course and/or speed cannot be changed to avoid having the animal enter the safety radius, the airguns must be powered down before the animal is within the safety zone.

7.1.4. Shut-down Procedures

A shut-down occurs when all airgun activity is suspended. The operating airgun(s) must be shut down if a marine mammal approaches the applicable safety zone and a power down still does not keep the animal outside the newly adjusted smaller safety zone. The operating airgun(s) must also be shut down completely if a marine mammal is found within the safety zone during the seismic operations. The shut-down procedure should be accomplished within several seconds (of a "one shot" period of time) after the determination that a marine mammal is within or about to enter the safety zone.

Following a shut-down, airgun activity would not resume until the marine mammal has cleared the safety zone. The animal would be considered to have cleared the safety zone if it is visually observed to have left the safety zone, or if it has not been seen within the safety zone for 30 minutes.

7.1.5. Ramp-up Procedures

Although marine mammals would be protected from Level A harassment by establishing a safety zone at a SPL levels of 180 and 190 dB *re:* 1 µPa rms for cetaceans and pinnipeds, respectively, mitigation may not be 100 percent effective at all times in protecting marine mammals. To provide additional protection to marine mammals near the project area, the operators would allow marine mammals to vacate the area prior to receiving a potential injury. To further reduce Level B harassment by startling marine mammals with a sudden intensive sound, CPAI and UOCC would implement "ramp-up" practice when starting up airgun arrays. Ramp-up would begin with the smallest airgun in the array that is being used for all subsets of the 6-gun array. Airguns would be added in a sequence such that the source level in the array would increase at a rate no greater than 6 dB per 5 minutes. During the ramp-up, the safety zone for the full 6-airgun system would be maintained.

7.2. Monitoring

The applicants are required to designate biologically-trained, on-site marine mammal observers (MMOs), approved in advance by NMFS, to monitor the area for marine mammals before, during, and after seismic surveys. Data to be collected by MMOs include marine mammal behavior, overall numbers of individuals observed, frequency of observation, the time corresponding to the daily tidal cycle, and any behavioral changes due to the seismic operations shall be recorded. MMOs would be equipped with binoculars and optical or digital laser range finders for monitoring. Night vision devices would be used for monitoring during low-light hours.

7.2.1. Vessel-based Monitoring

Vessel based monitoring would be conducted by at least two qualified NMFS-approved MMOs. Reticle binoculars (e.g., 7 x 50 Bushnell or equivalent) and laser range finders (Leica LRF 1200 laser range finder or equivalent) would be standard equipment for the monitors.

Vessel-based MMOs would begin marine mammal monitoring at least 30 minutes prior to the planned start of airgun ramp-up operations and during all periods of airgun operations. MMOs would survey the safety zone to ensure that no marine mammals are seen within the zone before a seismic survey begins. If marine mammals are found within the safety zone, seismic operations would be suspended until the marine mammal leaves the area. If a marine mammal is seen above the water and then dives below, the operator would wait 30 minutes, and if no marine mammals are seen by the MMOs in that time it would be assumed that the animal has moved beyond the safety zone. Observations would also be conducted during all ramp-up procedures to ensure the effectiveness of ramp-up as a mitigation measure. When feasible, observations would also be made during transits, moving cable, and other operations when airguns are inactive.

Data for each distinct marine mammal species observed in the proposed project area during the period of the seismic operations would be collected. Numbers of marine mammals observed, species identification if possible, frequency of observation, the time corresponding to the daily tidal cycle, and any behavioral changes due to the airgun operations would be recorded and entered into a custom database using a notebook computer. The accuracy of the data entry would be verified by computerized validity data checks as the data are entered and by subsequent manual checking of the database. These procedures would allow initial summaries of data to be prepared during and shortly after the field program, and would facilitate transfer of the data to statistical, graphical, or other programs for further processing and archiving.

Results from the vessel-based observations would provide: (1) Basis for real-time mitigation (airgun shut-down); (2) information needed to estimate the number of marine mammals potentially taken by harassment, which must be reported to NMFS; (3) data on the occurrence, distribution, and activities of marine mammals in the area where the seismic study is conducted; (4) information to compare the distance and distribution of marine mammals relative to the source vessel at times with and without seismic activity; and (5) data on the behavior and movement patterns of marine mammals seen at times with and without seismic activity.

7.2.2. Aerial Monitoring

As an additional mitigation measure, seismic surveys conducted off the Beluga River between mid-March and mid-May by CPAI would also be required to conduct aerial monitoring. The aerial surveys would (1) determine the presence and relative numbers of beluga whales between the west side of the Susitna River and North Foreland, (2) determine the location of belugas relative to seismic operations, and (3) record other marine mammals observed during the seismic surveys.

Aerial monitoring area would be centered on the project area plus a buffer zone (from Susitna River to North Foreland) for detecting belugas before or after they pass through the project area. The boundary for the aerial survey extends approximately 7 mi (11 km) south of the project area to the North Foreland, approximately 7 mi (11 km) north to the Susitna River, West Fork, and 0.25 mi (0.4 km) from shore. The size of the survey area provides a design for observing whales before and during exposure to seismic sounds.

Aerial monitoring would be conducted from a single engine helicopter, which would fly a single transect line paralleling the shoreline along the coast in the project area. The survey would start from the north and finish by returning to the Beluga Gas Field, which would be the base of helicopter operations. This pattern would be flown unless observation conditions (glare, etc) require flying from south to north, depending on the effect of glare on observations. The helicopter would fly at 1,500 ft (457 m), due to glide path needs, and at a ground speed of 60 knots (111 km/h). This altitude should prevent disturbance of marine mammals and birds by the helicopter noise.

Helicopter monitoring would be conducted at a frequency that reflects the monthly abundance of belugas in the project area (LGL, 2006). Helicopter flights would be flown once per week in March when few if any whales are expected in the project area. However, should belugas be observed (by helicopter or boat), the helicopter flights would be flown daily until whales are not observed for two consecutive days. Once belugas are no longer observed for two consecutive days, helicopter flights would be flown once per week during March. Aerial monitoring would be increased to twice a week from April 1st through mid-April, until such time as belugas are observed, when helicopter flights would be flown daily until whales are not observed for two consecutive days. After mid-April, aerial monitoring would be conducted daily when the number of belugas transiting through the project area to the upper Cook Inlet is anticipated to be higher.

Aerial monitoring would fly 1 - 2 transects shortly before and half of a transect during seismic operations, which corresponds to the 3 - 4, 1-2 hour slack tides each day. Half transects are flown during seismic operations to prevent noise interference on the surveys. Half transect flight direction would be determined by the relative position of activities to the helicopter landing location. Aerial monitoring would alternate over various tidal cycles when ever possible, since beluga distribution may vary during the tidal cycles (LGL, 2006).

Surveys would only be conducted under the following conditions: (1) when the pilot considers it safe to do so; (2) during daylight hours; (3) during good viewing conditions (ceiling height above 1,500 ft (457 M) and Beaufort Sea States below 4; and (4) during periods allowed by regulatory agencies. Flights would be oriented to minimize sun glare on the observer.

One NMFS-approved MMO would be on the helicopter observing and recording marine mammals, covering the 180^{o} view in front of the helicopter. Space would be made available on the helicopter for NMFS staff to participate in surveys at least twice a month.

Data from aerial monitoring would be recorded on the species, number, group size, location (latitude/longitude), time, date, direction of travel, angle from helicopter as determined by using a clinometer, ceiling height, Beaufort Sea State, glare, weather, tide, real time positions (latitude/longitude) of seismic survey vessel, shooting, and vessel activities. Marine mammal behavior data would be recorded when possible. Observation conditions would be recorded at the start and finish of each survey or whenever conditions change. All information collected during the marine mammal survey and/or reported to the vessel would be recorded on a field form.

7.2.3. Land-based Monitoring

Land-based monitoring would be conducted by the MMO during days when no aerial monitoring is practicable. Monitoring would be conducted at Ladd Landing, a site previously used for land-based observations (LGL, 2006). The MMO would use binoculars to regularly scan the area visible from the land site for marine mammals. Data recorded would include sighting, weather, sea state, glare, amount of viewable area visible, and seismic operation information. Sighting data would include species, number, group size, direction of travel, date, time, and distance from shore.

7.3. Reporting

Reports from aerial and land-based monitoring would be faxed or e-mailed to NMFS Anchorage Field Office on a daily basis.

Reports from CPAI and UOCC would be submitted to NMFS within 90 days after the end of the seismic operations. The reports would describe the operations that were conducted, the marine mammals that were detected near the operations, and provide full documentation of methods, results, and interpretation pertaining to all monitoring. The reports would also include estimates of the amount and nature of potential "take" of marine mammals by harassment or in other ways.

VIII. Compliance with Endangered Species Act (ESA)

Based on a review conducted by NMFS Alaska Regional Office biologists, it is not likely that any ESA-listed species would be taken due to the proposed seismic operations. Steller sea lions are recorded in these waters, but are considered uncommon in spring and early summer in the proposed project area. Therefore, NMFS has determined that a formal section 7 consultation is not necessary.

IX. Compliance with State Regulations

The Division of Oil and Gas of the Alaska State Department of Natural Resources has completed its coordinating the state's review of the proposed CPAI and UOCC projects for consistency with the Alaska Coastal Management Program (ACMP). Based on the reviews, the State of Alaska concurs that the proposed seismic operations in Cook Inlet are consistent with the ACMP.

X. Conclusion

NMFS has determined that small numbers of beluga whales, Pacific harbor seals, and harbor porpoises may be taken incidental to seismic surveys, by no more than Level B harassment and that such taking will result in no more than a negligible impact on such species or stocks. In addition, NMFS has determined that Steller sea lions and killer whales, while unlikely to be found in the proposed seismic area, if they are present within the vicinity of the proposed seismic activities could be taken incidentally, but no more than Level B harassment; and that such taking would result in no more than a negligible impact on such species or stocks. Although no take numbers of Steller sea lions or killer whales are estimated due to their rare occurrence within the project areas. Regardless, given the infrequent occurrence of these species (or none at all) in upper Cook Inlet, NMFS believes that any take would be significantly lower than those of beluga whales or harbor seals.

While behavioral modifications, including temporarily vacating the area during the project period, may be made by these species to avoid the resultant visual and acoustic disturbance, NMFS nonetheless finds that this action would result in no more than a negligible impact on these marine mammal species and/or stocks. NMFS also finds that the proposed seismic action will not have an unmitigable adverse impact on the availability of such species or stocks for subsistence uses, as the proposed projects are not expected to interfere with any subsistence hunting of marine mammals.

In addition, no take by Level A harassment (injury or death) is anticipated or authorized, and Level B harassment takes should be at the lowest level practicable, due to incorporation of the mitigation measures described in this document.

Therefore, NMFS has determined that the requirements of section 101(a)(5)(D) of the MMPA have been met and the authorizations can be issued.

XI. Recommendation

It is recommended that the proposed actions be determined not to have a significant impact on the quality of the human environment and that the preparation of an environmental impact statement not be required.

Prepared by: [signature] 3/30/07

Shane Guan
Fishery Biologist
Permits, Conservation and
Education Division
Office of Protected Resources

Date

Recommended by: [signature] 3/30/07

for P. Michael Payne, Chief
Permits, Conservation and
Education Division
Office of Protected Resources

Date

FIGURE 1. MAP OF COOK INLET

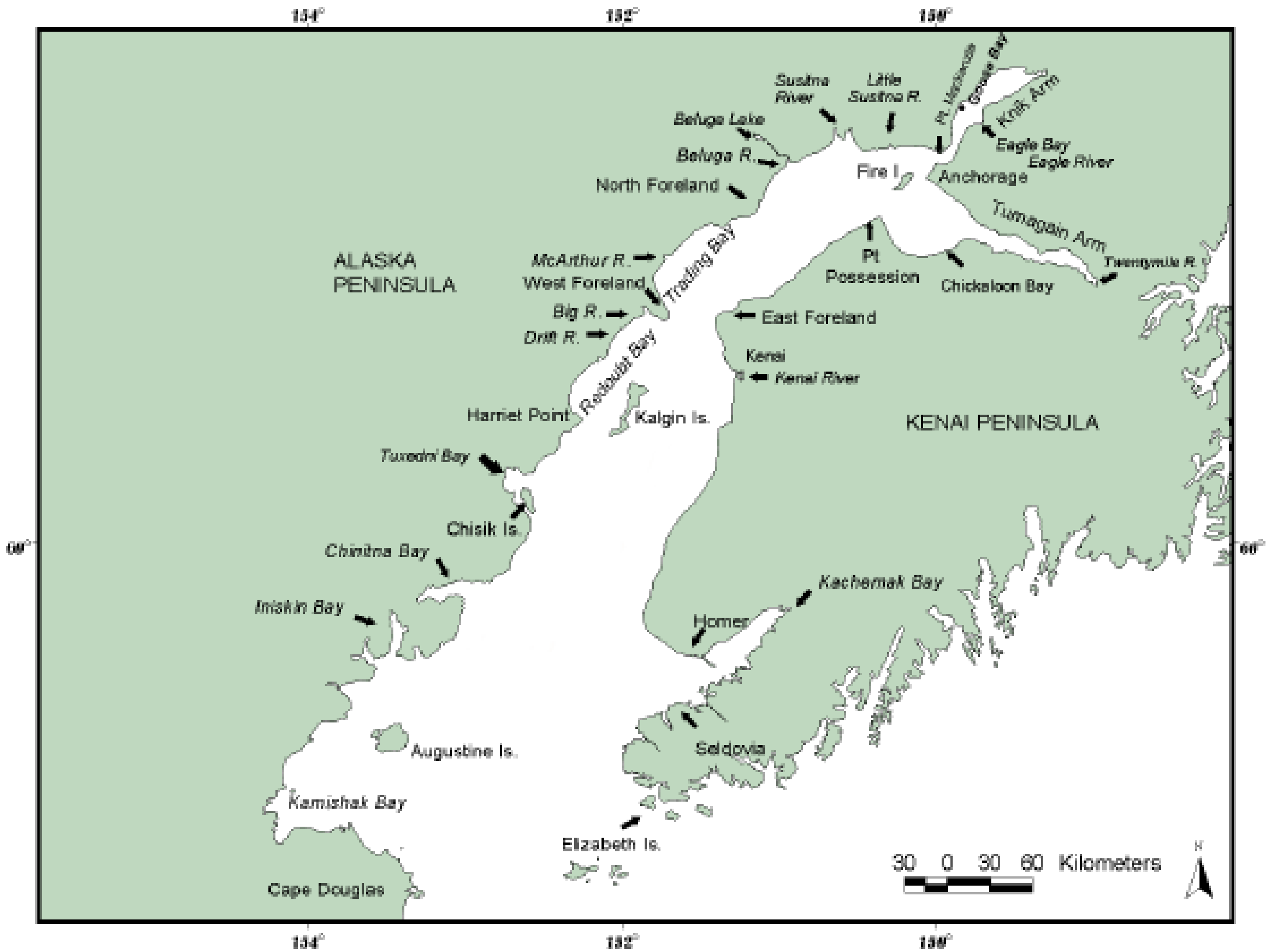


FIGURE 2. MAP OF CPAI PROPOSED ACTION AREA

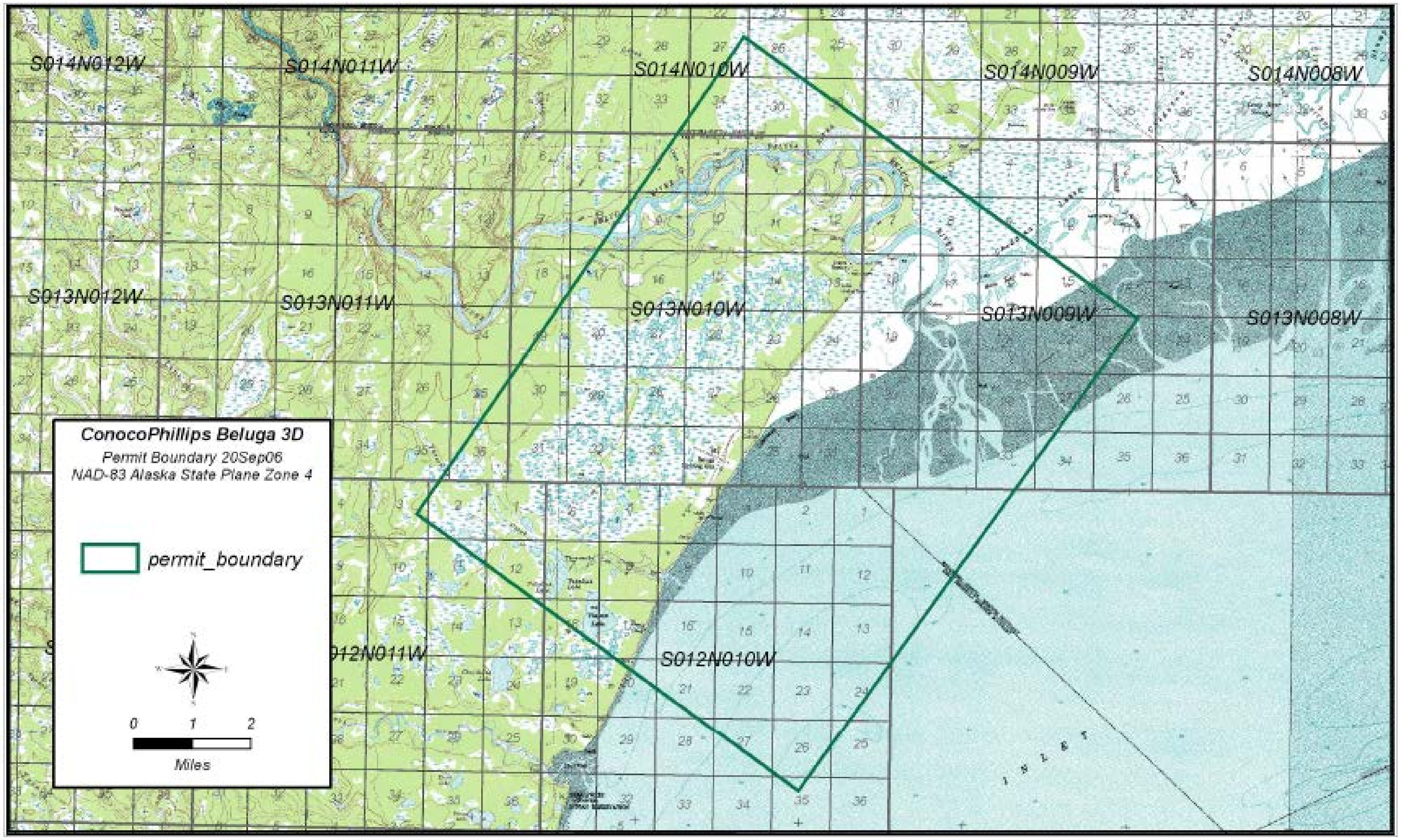
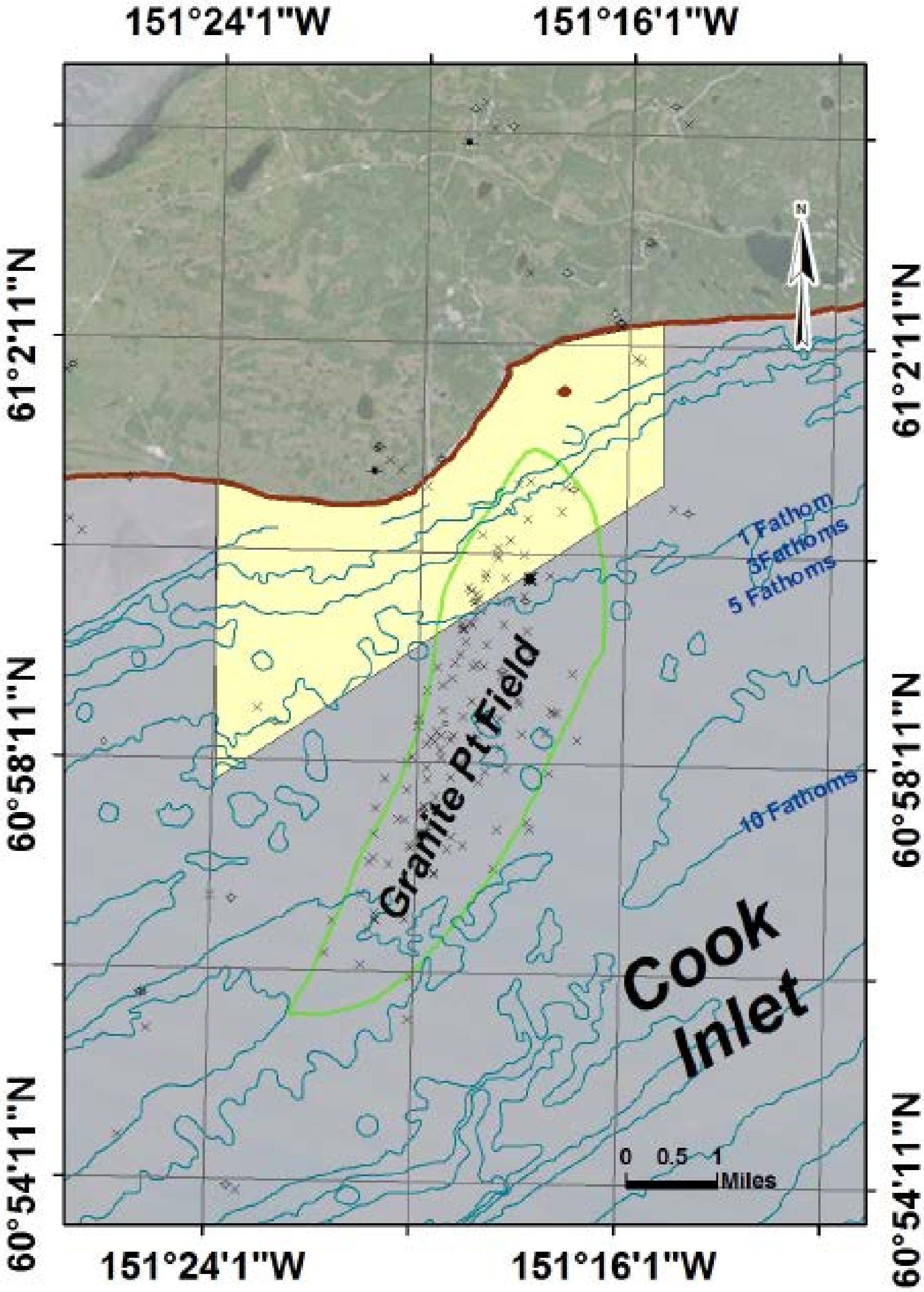


FIGURE 3. MAP OF UOCC PROPOSED ACTION AREA



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Acronyms and abbreviations

Acronym	Definition
ACMP ADFG AFB	Alaska Coastal Management Program Alaska Department of Fish and Game Air Force Base
CEQ CFR CPAI CZMA	Council on Environmental Quality Code of Federal Regulations ConocoPhillips Alaska, Inc. Coastal Zone Management Act
dB	Decibel
EA EFH EIS ESA	Environmental assessment Essential Fish Habitat Environmental impact statement Endangered Species Act
FONSI FR Ft	Finding of No Significant Impact *Federal Register* Foot (feet)
Hz	Hertz
IHA	Incidental Harassment Authorization
kHz km	Kilohertz Kilometer(s)
M min MMPA MMO MMS ms	Meter(s) Minute(s) Marine Mammal Protection Act Marine mammal observer Mineral Management Service Milisecond
NEPA NMFS NOAA	National Environmental Policy Act National Marine Fisheries Service National Oceanic and Atmospheric Administration
p-p PTS	Peak-to-peak Permanent threshold shift
rms	Root mean square
S SAR SPL	Second(s) Stock Assessment Report Sound pressure level
TS TTS	Threshold shift Temporary threshold shift
UOCC USCG	Union Oil Company of California U.S. Coast Guard
kPa µPa	Kilopascal Micropascal