NOAA's National Marine Fisheries Service
Endangered Species Act Section 7 Consultation

Biological Opinion

Agency: Permits, Conservation, and Education Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service

Activity Considered: Proposal to issue Permit No. 15750 to ABR, Inc., for research to document seasonal distribution and abundance of marine mammals in western lower Cook Inlet, Alaska.

Consultation Conducted by: Endangered Species Division of the Office of Protected Resources, NOAA's National Marine Fisheries Service

Approved by:

Date: NOV 15 2011

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 *et seq.*) requires each federal agency to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a federal agency's action "may affect" listed species or designated critical habitat, that agency is required to consult formally with either NOAA's National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the listed resources that may be affected. Federal agencies are exempt from this requirement if they have concluded that an action "may affect", but is "unlikely to adversely affect" listed species or designated critical habitat, and NMFS and/or USFWS concur with that conclusion (50 CFR 402.14[b]).

This document represents NMFS' Biological Opinion (Opinion) of the effects of the proposed research activities on threatened and endangered species and designated critical habitat in accordance with section 7 of the ESA. For the actions described in this document, the action agency is NMFS' Office of Protected Resources – Permits, Conservation, and Education Division (Permits Division). The consulting agency is NMFS' Office of Protected Resources – Endangered Species Division (Endangered Species Division). This Opinion is based on information submitted by the Permits Division as part of their initiation package, published and unpublished scientific information on the biology and ecology of the listed species affected, and other relevant sources of information.

CONSULTATION HISTORY

On April 8, 2011, the Permits Division requested consultation with the Endangered Species Division on a proposed action to issue scientific research permit No. 15750 to ABR, Inc., for research to document seasonal distribution and abundance of marine mammals in western lower Cook Inlet, Alaska. The permit would be valid for five years from the date of issuance. The initiation package included the permit applications from the respective applicants, discussion of the effects of the research on the target species, and drafts of the proposed permits.

Upon reviewing the initiation package, the Endangered Species division requested additional information regarding the level of effort expected by the survey team as well as disclosure of the Permits Division's methodology for estimating the likely "takes" associated with the proposed permit. Upon receiving the additional information, the Endangered Species Division initiated formal consultation on April 11, 2011.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The Permits Division proposes to issue a permit to ABR, Inc., Environmental Research and Services, Fairbanks, Alaska, for directed "takes"[1] of marine mammals, including listed Cook Inlet beluga whales (*Delphinapterus leucus*), humpback whales (*Megaptera novaeangliae*), fin whales (*Balaenoptera physalus*), and the Western U.S. Distinct Population Segment[2] (DPS) of Steller sea lions (*Eumetopias jubatus*), for scientific research purposes pursuant to section 104 of the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. 1361 *et seq*.), and section 10(a)(1)(A) of the ESA. The purpose of the proposed research is to document seasonal distribution and abundance of marine mammals in the western lower Cook Inlet, Alaska, through aerial surveys in order to inform future federal conservation and management actions affecting these species in the target area. Research would occur year-round (one or two surveys per month for every month of the year) and the permit would expire five years from the date of issuance. **Table 1** below provides the estimated "take" of listed species as presented in the draft permit.

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[1] The ESA defines "take" as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct.

[2] A distinct population segment, is a vertebrate population or group of populations that is discrete from other populations of the species and significant in relation to the entire species. The ESA provides for listing species, subspecies, or distinct population segments of vertebrate species.

Table 1. Proposed Takes of Listed Species Associated with Permit No. 15750

SPECIES (LIFE STAGE)	ACTIVITY	NUMBER OF ANIMALS PER SURVEY (FROM DRAFT PERMIT)	TAKES PER ANIMAL PER YEAR (FROM DRAFT PERMIT)
Steller sea lion-Western U.S. DPS (Non-Pups)	Aerial Survey; Count/Survey	110	52
Cook Inlet Beluga Whale (All)	Aerial Survey; Count/Survey	50	52
Humpback Whale (All)	Aerial Survey; Count/Survey	17	52
Fin Whale (All)	Aerial Survey; Count/Survey	6	52

The “take” numbers listed above accounted for the maximum number of animals expected to be encountered during an individual survey as well as the maximum number of surveys to be conducted each year and hence, the maximum takes per animal per year. The draft permit did not propose cumulative annual take numbers in the take table but if one were to calculate based on the information above, it is estimated that a maximum of 5,720 “takes” of Steller sea lions, 2,600 “takes” of Cook Inlet beluga whales, 884 “takes” of humpback whales, and 312 “takes” of fin whales may occur over the course of one year based on the expected survey effort. These annual take estimates were calculated by multiplying the maximum number of animals expected to be taken per survey by the maximum number of surveys to be performed each year based on the information presented in **Table 1** above. The Permits Division presented this as the “worst-case scenario” for the affected species. The following sections provide a brief summary of the survey activities to be authorized in the proposed permit.

Helicopter Surveys

Aerial surveys by helicopter would be conducted twice per month in Iniskin, Iliamna, and Chinitna bays in all months of the year except December, January, May, and June, where only one survey will be conducted. Surveys will be conducted during the day and near high tide in order to minimize disturbance to hauled out seals. Researchers will also avoid surveying during the peak pupping season for harbor seals (i.e. May 15-June 15 each year). Each survey will last a day or two and will involve two replicate passes of the study area. Hughes 500 helicopters are currently used by the researchers; however, other helicopter types may be used subject to availability at the time of the survey.

Surveys will be flown at speeds between 80-130 kilometers per hour and at altitudes between 90–150 meters (300-500 feet) above sea level. The helicopter will stay close to the shoreline on the first pass (around 250 meters from shore or within the 50 meter isobath) while the return flight will be directed more towards the centers of the bays. Researchers will generally view and record animals from the side of the aircraft rather than flying directly overhead and will maintain a minimal distance of at least 800 meters from known haulouts to minimize disturbance of resting pinnipeds. Circling of marine mammals would be avoided in most cases but may occur in order to assist researchers in counting groups of animals or to confirm the species of animals that could not be identified during the first pass.

Fixed Wing Aircraft Surveys

In addition to helicopter surveys, researchers also intend to conduct aerial surveys using a fixed wing aircraft to document abundances of sea otters and other marine mammals in Kamishak Bay. Researchers will use a twin-engine airplane (Aero Commander 680 or 690) at altitudes between 90–150 meters (300-500 feet) above sea level and at speeds of 185–205 kilometers per hour within the 50-meter isobath. Transect boundaries and distance zones will be delimited by tape marks on windows and verified with clinometers and GPS receivers. Researchers expect to conduct one survey per month during all months of the year. Each survey is expected to take about six hours to complete. Just as with helicopter surveys, researchers will maintain a minimal distance of at least 800 meters from known haulouts to minimize disturbance to pinnipeds and will suspend survey efforts during the period of peak harbor seal pupping (i.e. May 15-June 15). While sea otters are the target species, other marine mammals will be identified and recorded as they are encountered along the transect. Survey protocols will be similar to helicopter surveys in that circling of animals will be avoided except in situations where researchers are counting groups of animals or when confirming the species of animals that could not be identified during the first pass.

Mitigation Measures

The proposed action includes several mitigation measures associated with Permit No. 15750 to mitigate for effects to targeted and any non-targeted listed species during research activities. The following conditions are included in the proposed permit (refer to the permit document for a full list of conditions):

1. In the event a serious injury or mortality of a protected species occurs, the Researchers must suspend permitted activities and contact the Chief, NMFS Permits, Conservation, and Education Division by phone within two business days. Researchers must also submit a written incident report. The Permits Division may grant authorization to resume permitted activities based on review of the incident report and in consideration of the Terms and Conditions of the permit.

2. If authorized take[3] is exceeded, the Researchers must cease all permitted activities and notify the Chief, NMFS Permits, Conservation, and Education Division by phone as soon as possible but not later than two business days. Researchers must also submit a written incident report within two weeks of the incident. The incident report must include a complete description of the events and identification of steps that will be taken to reduce the potential for additional exceedance of authorized take.

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[3] The permit does not allow for unintentional serious injury and mortality caused by the presence or actions of researchers. This includes, but is not limited to; deaths of dependent young by starvation following research-related death of a lactating female; deaths resulting from infections related to sampling procedures; and deaths or injuries sustained by animals during capture or handling, or while attempting to avoid researchers or escape capture. Note that for marine mammals, a serious injury is defined by regulation as any injury that will likely result in mortality.

3. Researchers shall consider a marine mammal to have been taken during aerial surveys if the survey craft is flying below 1,000 feet and the animal is sighted below the survey craft.

4. Researchers may conduct aerial surveys (which consist of 1-2 replicate visits/site typically over a 1-2 day period) approximately twice/month during the spring and fall and once/month during May, June, December, and January; and not more than once per week at any time.

5. No surveys will be conducted between 15 May and 15 June, during peak pupping of harbor seals.

6. To the maximum extent practical without causing further disturbance of marine mammals, researchers shall monitor survey sites to determine if any marine mammals have been killed or injured or dependent pinniped pups or cetacean calves abandoned. Any observed serious injury to or death of a marine mammal is to be reported to the Chief, Permits Division within two weeks of the incident and any observed research-related abandonment of a dependent marine mammal is to be reported to the NMFS Alaska Regional Stranding Network Coordinator, Juneau, Alaska.

7. If a lactating female beluga whale dies as a result of the permitted activities and her dependent calf can be identified, researchers must immediately contact the NMFS Alaska Regional SNC and proceed as directed. If the calf cannot be identified or the SNC determines the calf is not a candidate for rehabilitation, the calf is to be counted as a permit-related mortality.

8. If a pregnant female beluga whale dies as a result of the permitted activities, both the female and the unborn calf shall be counted as permit-related mortalities.

9. Individuals conducting permitted activities must possess qualifications commensurate with their roles and responsibilities.

10. Persons who require state or Federal licenses to conduct activities authorized under the permit (e.g. veterinarians, pilots) must be duly licensed when undertaking such activities.

11. The Permit holder must submit annual reports to the Chief, NMFS Permits, Conservation, and Education Division and a final report must be submitted within 180 days after expiration of the permit, or, if the research concludes prior to permit expiration, within 180 days of completion of the research.

12. Research results must be published or otherwise made available to the scientific community in a reasonable period of time.

13. The Permit Holder must provide written notification of planned field work to the appropriate Assistant Regional Administrator(s) for Protected Resources. Such notification must be made at least two weeks prior to initiation of a field trip/season and

must include the locations of the intended field study and/or survey routes, estimated dates of research, and number and roles of participants.

14. To the maximum extent practicable, the Permit Holder must coordinate permitted activities with activities of other Permit Holders conducting the same or similar activities on the same species, in the same locations, or at the same times of year to avoid unnecessary disturbance of animals.

In addition to adhering to the permit conditions, the researchers will take proper steps to avoid flying directly over animals where possible and will maintain a minimal distance of at least 800 meters from known marine mammal haulouts and conduct survey during daylight hours and near high tide to minimize disturbance to hauled-out marine mammals.

APPROACH TO THE ASSESSMENT

NMFS approaches its section 7 analyses of agency actions through a series of steps. The first step identifies those aspects of proposed actions that are likely to have direct and indirect physical, chemical, and biotic effects on listed species or on the physical, chemical, and biotic environment of an action area. As part of this step, we identify the spatial extent of these direct and indirect effects, including changes in that spatial extent over time. The result of this step includes defining the *Action Area* for the consultation. The second step of our analyses identifies the listed resources that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *Exposure Analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent. Once we identify which listed resources are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure (these represent our *Response Analyses*).

The final step of our analyses establishes the risks those responses pose to listed resources (these represent our *Risk Analyses*). Our jeopardy determinations must be based on an action's effects on the continued existence of threatened or endangered species as those "species" have been listed, which can include true biological species, subspecies, or DPSs of species. The continued existence of these "species" depends on the fate of the populations that comprise them. Similarly, the continued existence of populations are determined by the fate of the individuals that comprise them – populations grow or decline as the individuals that comprise the population live, die, grow, mature, migrate, and reproduce (or fail to do so).

Our risk analyses reflect these relationships between listed species, the populations that comprise that species, and the individuals that comprise those populations. Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise.

We measure risks to listed individuals using the individuals' "fitness," or the individual's growth, survival, annual reproductive success, and lifetime reproductive success. In particular, we examine the scientific and commercial data available to determine if an individual's probable lethal, sub-lethal, or behavioral responses to an action's effect on the environment (which we identify during our *Response Analyses*) are likely to have consequences for the individual's fitness.

When individual listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions are likely to reduce the abundance, reproduction, or growth rates (or increase the variance in these measures) of the populations those individuals represent (*see* Stearns, 1992). Reductions in at least one of these variables (or one of the variables we derive from them) is a necessary condition for reductions in a population's viability, which is itself a necessary condition for reductions in a species' viability. As a result, when listed plants or animals exposed to an action's effects are not expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). As a result, if we conclude that listed plants or animals are not likely to experience reductions in their fitness, we would conclude our assessment.

Although reductions in fitness of individuals is a *necessary* condition for reductions in a population's viability, reducing the fitness of individuals in a population is not always *sufficient* to reduce the viability of the population(s) those individuals represent. Therefore, if we conclude that listed plants or animals are likely to experience reductions in their fitness, we determine whether those fitness reductions are likely to reduce the viability of the populations the individuals represent (measured using changes in the populations' abundance, reproduction, spatial structure and connectivity, growth rates, variance in these measures, or measures of extinction risk). In this step of our analyses, we use the population's base condition (established in the *Environmental Baseline* and *Status of the Species* sections) as our point of reference. If we conclude that reductions in the fitness of individuals are not likely to reduce the viability of the populations those individuals represent, we would conclude our assessment.

Reducing the viability of a population is not always *sufficient* to reduce the viability of the species those populations comprise. Therefore, in the final step of our analyses, we determine if reductions in a population's viability are likely to reduce the viability of the species those populations comprise using changes in a species' reproduction, numbers, distribution, estimates of extinction risk, or probability of being conserved. In this step of our analyses, we use the species' status (established in the *Status of the Species* section) as our point of reference. Our final jeopardy determinations are based on whether threatened or endangered species are likely to experience reductions in their viability and whether such reductions are likely to be appreciable.

Destruction or adverse modification[4] determinations must be based on an action's effects on the conservation value of habitat that has been designated as critical to threatened or endangered

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[4] We are aware that several courts have ruled that the definition of destruction or adverse modification that appears in the section 7 regulations at 50 CFR 402.02 is invalid and do not rely on that definition for the determinations we

species. If an area encompassed in a critical habitat designation is likely to be exposed to the direct or indirect consequences of the proposed action on the natural environment, we ask if primary or secondary constituent elements included in the designation (if there are any) or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species are likely to respond to that exposure. If primary or secondary constituent elements of designated critical habitat (or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species) are likely to respond given exposure to the direct or indirect consequences of the proposed action on the natural environment, we ask if those responses are likely to be sufficient to reduce the quantity, quality, or availability of those constituent elements or physical, chemical, or biotic phenomena.

If the quantity, quality, or availability of the primary or secondary constituent elements of the area of designated critical habitat (or physical, chemical, or biotic phenomena) are reduced, we ask if those reductions are likely to be sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area. In this step of our assessment, we combine information about the contribution of constituent elements of critical habitat (or of the physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species, particularly for older critical habitat designations that have no constituent elements) to the conservation value of those areas of critical habitat that occur in the action area, given the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area.

If the conservation value of designated critical habitat in an action area is reduced, the final step of our analyses asks if those reductions are likely to be sufficient to reduce the conservation value of the entire critical habitat designation. In this step of our assessment, we combine information about the constituent elements of critical habitat (or of the physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species) that are likely to experience changes in quantity, quality, and availability given exposure to an action with information on the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area. We use the conservation value of the entire designated critical habitat as our point of reference for this comparison. For example, if the designated critical habitat has limited current value or potential value for the conservation of listed species that limited value is our point of reference for our assessment.

To conduct these analyses, we rely on all of the evidence available to us. This evidence might consist of monitoring reports submitted by past and present permit holders, reports from NMFS Science Centers, reports prepared by State or Tribal natural resource agencies, reports from non-governmental organizations involved in marine conservation issues, the information provided by the Permits, Conservation and Education Division when it initiates formal consultation, and the general scientific literature. We supplement this evidence with reports and other documents – environmental assessments, environmental impact statements, and monitoring reports – prepared by other federal and state agencies like the Minerals Management Service, U.S. Coast Guard and U.S. Navy whose operations extend into the marine environment.

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make in this Opinion. Instead, as we explain in the text, we use the “conservation value” of critical habitat for our determinations which focuses on the designated area’s ability to contribute to the conservation or the species for which the area was designated.

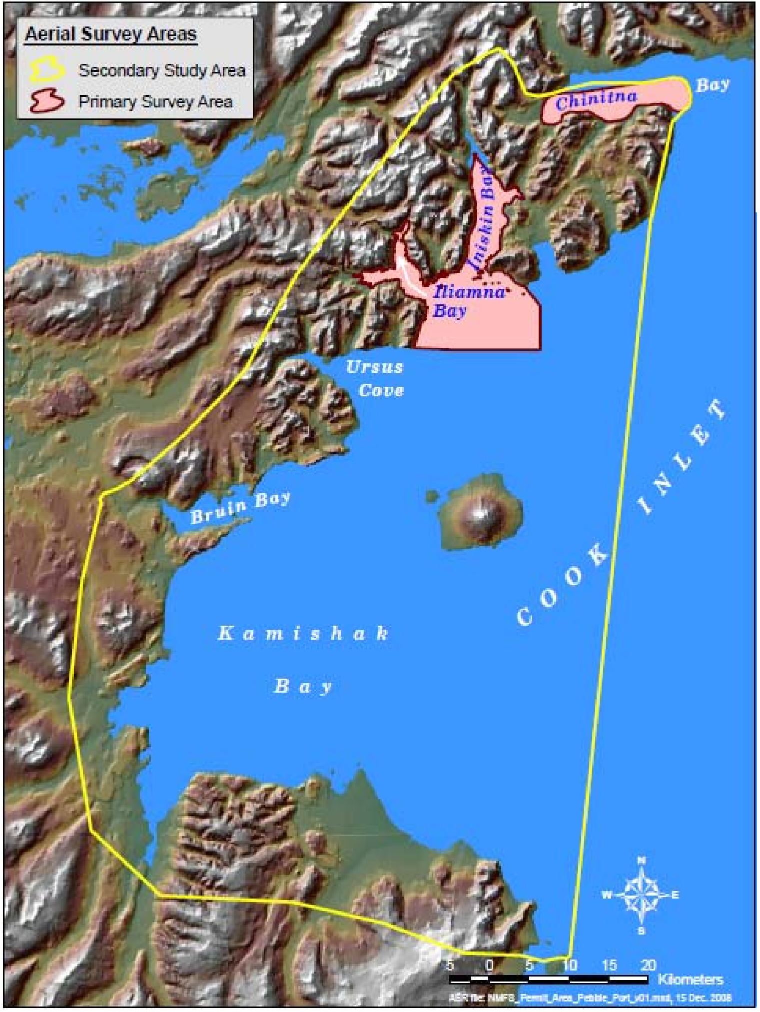
During each consultation, we conduct electronic searches of the general scientific literature using *American Fisheries Society*, *Google Scholar*, *ScienceDirect*, *BioOne*, *Conference Papers Index*, *JSTOR*, and *Aquatic Sciences and Fisheries Abstracts* search engines. We supplement these searches with electronic searches of doctoral dissertations and master's theses. These searches specifically try to identify data or other information that supports a particular conclusion as well as data that does not support that conclusion.

We rank the results of these searches based on the quality of their study design, sample sizes, level of scrutiny prior to and during publication, and study results. Carefully designed field experiments (for example, experiments that control potentially confounding variables) are rated higher than field experiments that are not designed to control those variables. Carefully designed field experiments are generally ranked higher than computer simulations. Studies that produce large sample sizes with small variances are generally ranked higher than studies with small sample sizes or large variances. Finally, in keeping with the direction from the U.S. Congress to provide the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], when data are equivocal, or in the face of substantial uncertainty, our decisions are designed to avoid the risks associated with incorrectly concluding an action has no adverse effect on a listed species when, in fact, such adverse effects are likely (i.e. avoiding Type II error).

ACTION AREA

The action area is defined in 50 CFR 402.02 as "all areas to be affected directly or indirectly by the Federal Action and not merely the immediate area involved in the action." The action area for this proposed action encompasses both the primary and secondary survey areas along the lower western shore of Cook Inlet, Alaska, where helicopter and fixed wing aircraft surveys will be conducted (see **Figure 1** below). The action area extends from the shoreline to about 250 meters from shore (or within the 50 meter isobath) within Kamishak, Iliamna, Iniskin, and Chinitna Bays.

Figure 1. Action Area for the Proposed Action Showing the Primary and Secondary Survey Areas (provided by the research applicants as part of their Permit Application)



STATUS OF THE SPECIES

The Endangered Species Division has determined that the following listed and proposed species and designated critical habitat provided protection under the ESA occur within the action area and may be affected by the proposed action:

LISTED RESOURCE (BY TAXON)	SCIENTIFIC NAME	LISTING STATUS
Cetaceans		
Blue whale	*Balaenoptera musculus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
North Pacific Right whale	*Eubalaena japonica*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered

Sperm whale	*Physeter macrocephalus*	Endangered
Cook Inlet Beluga whale	*Delphinapterus leucas*	Endangered
Pinnipeds		
Steller Sea Lion Eastern DPS	*Eumetopias jubatus*	Threatened
Steller Sea Lion Western DPS	*Eumetopias jubatus*	Endangered
Sea Turtles		
Leatherback sea turtle	*Dermochelys coriacea*	Endangered
Green sea turtle	*Chelonia mydas*	Threatened
Olive ridley sea turtle	*Olivacea kempii*	Endangered
Loggerhead sea turtle	*Caretta caretta*	Threatened
Loggerhead sea turtle North Pacific DPS	*Caretta caretta*	Proposed Endangered
Anadromous Fish		
Chinook Salmon (Lower Columbia River)	*Oncorhynchus tshawytscha*	Threatened
Chinook Salmon (Upper Colombia River Spring-Run)	*Oncorhynchus tshawytscha*	Endangered
Chinook Salmon (Puget Sound)	*Oncorhynchus tshawytscha*	Threatened
Chinook Salmon (Snake River Fall-Run)	*Oncorhynchus tshawytscha*	Threatened
Chinook Salmon (Snake River Spring-Summer Run)	*Oncorhynchus tshawytscha*	Threatened
Chinook Salmon (Upper Willamette River)	*Oncorhynchus tshawytscha*	Threatened
Coho Salmon (Lower Columbia River)	*Oncorhynchus kisutch*	Threatened
Coho Salmon (Oregon Coast)	*Oncorhynchus kisutch*	Threatened
Chum salmon (Columbia River)	*Oncorhynchus keta*	Threatened
Chum salmon (Hood Canal Summer-Run)	*Oncorhynchus keta*	Threatened
Sockeye salmon (Ozette Lake)	*Oncorhynchus nerka*	Threatened
Sockeye salmon (Snake River)	*Oncorhynchus nerka*	Endangered
Steelhead Trout (Central California Coast)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout (Lower Columbia River)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout (Middle Columbia River)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout (Northern California)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout (Puget Sound)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout (Snake River)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout (California Central Valley)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout (Upper Columbia River)	*Oncorhynchus mykiss*	Threatened
Steelhead Trout (Upper Willamette River)	*Oncorhynchus mykiss*	Threatened
Critical Habitat		
Cook Inlet Beluga Whale Critical Habitat		Designated
Steller Sea Lion Critical Habitat		Designated

Listed Resources Not Considered in this Opinion

Cetaceans

Blue whales have a cosmopolitan distribution and tend to be pelagic, only coming nearshore to feed and possibly to breed (Jefferson et al., 2008). Call types from both northeastern and northwestern Pacific blue whales were recorded from July through December in the Gulf of Alaska region suggesting that blue whales utilize the surrounding area (Stafford, 2003; Stafford et al., 2007); however, blue whales are more likely to occur in the western portion of the Gulf of Alaska, southwest of Kodiak, where their calls have been detected and would be expected to occur offshore in deeper waters than those found in the action area. Given the present rarity of these whales in region surrounding the action area and the fact that researchers have not observed a blue whale in prior surveys performed in Cook Inlet, we conclude that the potential for this species to be exposed to the proposed aerial surveys is extremely unlikely and the risks posed by the proposed action are discountable. Therefore, blue whales are not likely to be adversely affected by the proposed action and this species will not be considered further in this Opinion.

Historically, North Pacific right whales ranged across the entire North Pacific north of latitude 35ºN and occasionally occurred as far south as latitude 20ºN. However, recent population estimates for the eastern North Pacific population based on genotyping and photo-identification provide estimates of well under 100 individuals (Wade et al., 2011). Right whales have been detected in the southeastern Bering sea around the localized area of the designated critical habitat; however, right whales have not been sighted or acoustically detected outside this localized area during recent summer surveys (Moore et al., 2000; Moore et al., 2002; Friday et al., 2009; Friday et al., 2011; Zerbini et al., 2006; Zerbini et al., 2009; Zerbini et al., 2010; Clapham et al., 2009; Rone et al., 2010). Given the extremely low population size of the eastern North Pacific population, the present rarity of the whales in the surrounding region, and the fact that researchers have not observed a North Pacific right whale in prior surveys performed in Cook Inlet, we conclude that the potential for this species to be exposed to the proposed survey is extremely unlikely and the risks posed by the proposed action are discountable. Therefore, North Pacific right whales are not likely to be adversely affected by the proposed action and this species will not be considered further in this Opinion.

Sei whales migrate from temperate zones occupied in winter to higher latitudes in the summer, where most feeding takes place (Gambell, 1985a). During summer months in the North Pacific, the sei whale can be found from the northern Gulf of Alaska to the Bering sea. However, no sei whales were seen during recent surveys in the Gulf of Alaska by Wade et al. (2003), Waite (2003), Zerbini et al. (2006), or Rone et al. (2010). Given the present rarity of these whales in the surrounding region and the fact that researchers have not observed a sei whale in prior surveys performed in Cook Inlet, we conclude that the potential for this species to be exposed to the proposed aerial surveys is extremely unlikely and the risks posed by the proposed action are discountable. Therefore, sei whales are not likely to be adversely affected by the proposed action and this species will not be considered further in this Opinion.

Adult and subadult male sperm whales are thought to move north in the summer to feed in the Gulf of Alaska, Bering Sea, and waters around the Aleutian Islands (Kasuya and Miyashita, 1988). Also, surveys conducted by The National Marine Mammal Laboratory (NMML) in the summer months have found sperm whales to be the most frequently sighted large cetacean in the coastal waters around the central and western Aleutian Islands (NMML, unpublished data). However, while sperm whales are frequently sighted in the western portion of the Gulf of Alaska, they have not been sighted in Cook Inlet during surveys performed by the researchers in the past and are thought to occur in deeper waters offshore than those found in the action area. Given the present rarity of these whales in the surrounding region and the fact that researchers have not observed a sperm whale in prior surveys performed in Cook Inlet, we conclude that the potential for this species to be exposed to the proposed aerial surveys is extremely unlikely and the risks posed by the proposed action are discountable. Therefore, sperm whales are not likely to be adversely affected by the proposed action and this species will not be considered further in this Opinion.

Pinnipeds
The Western U.S. distinct population segment of Steller sea lions includes animals that reside in the central and western Gulf of Alaska and Aleutian Islands. The Eastern distinct population segment of Steller sea lions includes animals living in southeast Alaska, British Columbia, California, and Oregon. While some sea lions traverse long distances between haul out sites (Calkins and Pitcher, 1982; Raum-Suryan et al., 2002; Raum-Suryan et al., 2004) we expect that any sea lions occurring within the action area are likely to be from the Western U.S. DPS given the fact that many important haulout and rookery sites are located immediately south of the action area. As part of their research application, researchers indicated that sea lions have been observed during prior surveys in the action area and expect that their proposed helicopter and fixed wing aircraft surveys are likely to expose approximately 110 adult and/or juvenile Steller sea lions (i.e. non-pups) to harassment as a result of visual and noise disturbance with a maximum of 52 surveys to be performed each year over the life of the proposed permit (see **Table 1** above).

The Permits Division did not request consultation on these expected takes due to the fact that the takes expected from the proposed aerial surveys were determined to be consistent with the Preferred Alternative identified in the Record of Decision (ROD) for the Steller Sea Lion and Northern Fur Seal Final Programmatic Environmental Impact Statement (FPEIS) completed in 2007 (NMFS, 2007) and because of that, any takes associated with this new proposed action were assumed to have already been evaluated in a previous biological opinion that was completed in 2009 (NMFS, 2009). After conducting a review of the above documents, the Endangered Species Division concurred with the Permits Division’s determination that the proposed aerial surveys were consistent with the type of research activities that were specified in the Preferred Alternative for the 2007 FPEIS the effects of which were previously evaluated in the 2009 biological opinion. Any expected takes are expected to be in the form of harassment and would not result in sea lion mortalities; thus, they would not exceed the 10 percent biological removal for either stock (as evaluated in the 2009 biological opinion). Also, the type of research activity and methods are consistent with those specified in the 2007 FPEIS. Therefore, we will not be considering the Western U.S. DPS of Steller sea lions or the Eastern U.S. DPS of Steller sea lions further in this Opinion and we refer the reviewer to the 2009 biological opinion (*see* NMFS, 2009) for more information.

Critical Habitat

Critical habitat was designated for the Eastern and Western DPSs of Steller sea lions on August 27, 1993 (58 FR 45269). Critical habitat occurs along the Alaskan coastline and extends out 3,000 feet (0.91 kilometers) seaward in state and federally managed waters from the baseline or basepoint of each major rookery for the Eastern DPS and extends out 20 nautical miles (37 kilometers) seaward in state and federally managed waters for the Western DPS. Essential features of Steller sea lion critical habitat include the physical and biological habitat features that support reproduction, foraging, rest, and refuge, and include terrestrial, air and aquatic areas. Specific terrestrial areas include rookeries and haul-outs where breeding, pupping, refuge and resting occurs. More than 100 major haulouts are documented. The principal, essential aquatic areas are the nearshore waters around rookeries and haulouts, their forage resources and habitats, and traditional rafting sites. Air zones around terrestrial and aquatic habitats are also designated as critical habitat to reduce disturbance in these essential areas.

Critical habitat for the Western U.S. DPS for Steller sea lion runs below the lower entrance to Cook Inlet where the proposed aerial survey would occur; however, we included this listed resource in our evaluation in order to account for the possibility of researchers incidentally transiting over portions of critical habitat on their way to the survey site. As stated in the previous section above, the proposed action considered in this consultation was determined to be consistent with research activities specified in the Preferred Alternative identified in the 2007 FPEIS for Steller Sea Lion and Northern Fur Seal Research and as a result, the effects were already evaluated in the 2009 biological opinion conducted for that Preferred Alternative (see section above for more information). Therefore, critical habitat designated for Steller sea lions will not be considered further in this Opinion and we refer the reviewer to the 2009 biological opinion (*see* NMFS, 2009) for further information.

Sea Turtles

Four species of sea turtles can possibly be encountered in Alaskan waters: leatherback, green, olive ridley, and loggerhead sea turtles (including members of the proposed North Atlantic Ocean DPS) (ADF&G, 2011). Although a few sightings of green, olive ridley, and loggerhead sea turtle species have been documented in Alaska, most of these involve individuals that were either cold-stressed, likely to become cold-stressed, or already deceased (Hodge and Wing, 2000; McAlpine et al., 2002). Thus, the Gulf of Alaska region (including portions of Cook Inlet within the action area) is considered to be outside the normal range for these sea turtle species and their presence in the action area would be considered extremely rare. The leatherback sea turtle ranges farther than any other sea turtle species, exhibiting broad thermal tolerances and are widely distributed throughout the world’s oceans (NMFS and USFWS, 1992). They are uncommon in the insular Pacific Ocean, but individual leatherback turtles are sometimes encountered in deep water and prominent archipelagoes. To a large extent, the oceanic distribution of leatherback turtles may reflect the distribution and abundance of their macroplanktonic prey in temperate and boreal latitudes (NMFS and USFWS, 2007). While leatherback sea turtles have been documented in the Gulf of Alaska, they are expected to occur offshore in deeper waters than those found in the action area and researchers have not documented encounters with leatherback sea turtles (or any other sea turtles species) in monitoring reports submitted for prior surveys occurring in Cook Inlet. We conclude that the potential for these sea turtle species to be exposed to the proposed survey is extremely unlikely and the risks posed by the proposed action are discountable. Therefore, leatherback, green, olive ridley, and loggerhead sea turtles as currently listed as well as the proposed North Pacific Ocean DPS of loggerhead sea turtles are not likely to be adversely affected by the proposed action and these listed and proposed species will not be considered further in this Opinion.

Anadromous Fish
Several listed DPSs/Evolutionary Signficant Units (ESUs) of Chinook, coho, chum, and sockeye salmon as well as steelhead trout may occur within the Alaska's coastal and marine waters as these salmonids migrate from the west coast of the United States to forage before returning to their natal streams to spawn. Anadromous fish occurrence in Alaskan waters is generally fairly close to the Alaskan shoreline and around areas of pronounced coastal upwelling (Emmett et al., 1991; Salo, 1991; Stolz and Schnell, 1991; PFMC, 2000). While studies on the effect of sound on the lateral line of fish species are limited, the work of Hasting et al.(1996) documents limited sensitivity to within a few body lengths and to sounds below a few hundred Hz . Of the fish species with distributions overlapping the Gulf of Alaska region for which hearing sensitivities are known, most are hearing generalists. Fish in the hearing generalists category are limited to detection of the particle motion component of low-frequency sounds at relatively high sound intensities (Amoser and Ladich, 2005). For example, hearing studies conducted for Atlantic salmon (*Samo salar*), a hearing generalist, indicates a rather low sensitivity to sound (Hawkins and Johnstone, 1978) which is likely due to the lack of a link between the swim bladder and inner ear (Jørgensen et al., 2004). Given the the limited sensitivity of the lateral line of similar fish species to sounds occurring within a few body lengths, we would not expect anadromous fish to exhibit physical or behavioral responses to sounds generated from aerial surveys flying overhead that would cause a reduction in fitness or rise to the level of harassment, if they were to respond to the sounds at all. We conclude that the risks posed by exposing listed salmon and trout to sounds produced by the aerial surveys are discountable. Therefore, listed salmon and trout species are not likely to be adversely affected by the proposed action and these species will not be considered further in this Opinion.

<u>Listed Resources Considered in this Opinion</u>
The sections below provide information on the status of listed resources likely to be adversely affected by the proposed action. The biology and ecology of these species as well as their global status and trends are described below, and inform the effects analysis for this Opinion.

Cook Inlet Beluga Whale

Species Description, Distribution, and Population Structure
The beluga whale is a small, toothed whale reaching a maximum length of five meters (16 feet), although average adult size is often 3.6 to 4.3 meters (Nowak, 1991). Calves are born dark gray to brownish gray and become lighter with age. Adults become white to yellow-white at sexual maturity, although Burns and Seaman (1986) report females may retain some gray coloration for as long as 21 years after birth. Beluga whales lack a dorsal fin, and the "blow" they typically produce upon surfacing is only visible at short range.

The beluga whale is a northern hemisphere species, ranging primarily over the Arctic Ocean and some adjoining seas, where they inhabit fjords, estuaries, and shallow water in Arctic and subarctic oceans. Calkins (1989) described beluga whales in Cook Inlet, Prince William Sound, Yakutat Bay, and throughout the coastal waters of the Gulf of Alaska, from the northern portions of Kodiak Island to Yakutat. The range of the Cook Inlet beluga whale population listed under the ESA has been defined as the waters of the Gulf of Alaska north of latitude 58° N and freshwater tributaries to these waters, based on available scientific data in 2000 (65 FR 34590, 31 May 2000). Belugas seek out shallow coastal waters and areas near river mouths in the summer in conjunction with fish and salmon migrations while in the winter months, belugas typically remain near the ice edge with greater use of the mid-inlet and occasional movements into the portions of the upper inlet as well (O'Corry-Crowe et al., 2002; Rugh et al., 2004). While some beluga whale populations are known to make seasonal migrations (O'Corry-Crow, 2002), sightings data conducted in Cook Inlet over the past few decades show that Cook Inlet belugas are present in the inlet year round (Calkins, 1983; MMS, 1999; Rugh et al., 2004; Hobbs et al., 2005; Vate-Brattstrom et al., 2010). Based on NMFS Alaska region's online sightings database that summarized opportunistic sightings recorded over the past 35 years, belugas may occur in the action area during the late spring through early fall months before venturing out to the mid and upper portions of Cook Inlet outside of the action area during late fall and winter months (Vate-Brattstrom et al., 2010). Rugh et al. (2010) reported that area of the highest concentration of belugas based on sightings recorded from 1998-2008 appears to be in the upper portions of the Inlet (north of the action area) in an area extending from the mouth of the Susitna River into Knik Arm and toward Turnagain Arm.

Goetz et al. (2007) modeled the importance of selected environmental parameters in structuring the beluga whale habitats in Cook Inlet. The model was based on summer aerial surveys conducted from 1993 to 2004. Bathymetries, proximity to mudflats, and distance from rivers classified by water flow accumulation values were evaluated with respect to beluga whale presence or absence. The models suggest that mudflats and flow accumulation (medium and high flow rivers) are important environmental features in the distribution of this population (Goetz et al., 2007) and may be due to prey (i.e. eulachon and salmon) availability and distribution.

Alaskan waters are home to five beluga stocks distinguished by their respective summer range: the Beaufort Sea, the eastern Chukchi Sea, the eastern Bering Sea, Bristol Bay, and Cook Inlet (Angliss et al., 2005). The degree of genetic differentiation between Cook Inlet and other Alaska beluga stocks indicates the Cook Inlet belugas are the most isolated (O'Corry-Crowe et al., 1997). The lack of beluga whale sightings along the southern Alaska Peninsula suggests that the Alaska Peninsula is an effective geographic barrier to genetic exchange (Laidre et al., 2000). Murray and Fay (1979) theorized that Cook Inlet belugas have been isolated for several thousand years, a theory which is supported by analysis of genetic data (O'Corry-Crowe et al., 1997). For the purposes of this consultation, all beluga whales affected by the proposed action are expected to be from the Cook Inlet stock.

Life History Information

The life span of beluga whales is thought to be between 25-30 years with the oldest female on record living to 35 years of age (Brodie, 1971; Sergeant, 1973; Burns and Seaman, 1986; Khuzin, 1961 *as cited in* Ohsumi, 1979). The age at sexual maturity is thought to be between four and eight years (Brodie, 1971; Sergeant, 1973; Ognetov, 1981; Seaman and Burns, 1981; Braham, 1984; Burns and Seaman, 1986) and gestation is thought to last up to 23 months

(Braham, 1984). Since the lactation period is known to last longer than one year, calf survival is likely to depend on the mother's survival during the first year after birth (Sergeant, 1973). The birth interval for beluga whales is thought to be typically three to four years depending on the age of the mother, but in some cases it may be as short as two years (Sergeant, 1973; Burns and Seaman, 1986).

Beluga age is assessed by counting the number of growth layer groups (GLGs) in their teeth, much like counting rings in a tree trunk. There has been considerable debate recently among researchers about whether belugas produce one GLG per year or two. Sergeant (1959) hypothesized that two GLGs per year were deposited by belugas, which has been supported by subsequent studies (Brodie, 1969; Brodie, 1982; Sergeant, 1973; Goren et al., 1987; Brodie et al., 1990; Heide-Jørgensen et al., 1994). The deposition of two layers per year would make belugas unique among toothed whales. However, based upon re-evaluation of previous studies, analyses of two captive belugas, and new teeth-aging techniques, several recent studies hypothesize that belugas deposit only one GLG per year (Hohn and Lockyer, 1999; Stewart et al., 2006; Lockyer et al., 2007; Luque et al., 2007). Adopting a single GLG per year would result in doubling previous estimates, with associated changes to vital rate factors such as longevity, age at reproduction/adulthood, calving intervals, age at first birth, etc. NMFS has adopted a single GLG per year as representing one year of age. Given the shift in thinking regarding GLGs, beluga whales may in fact live more than 60 years. Further research will need to be done to confirm this.

Most calving in Cook Inlet is assumed to occur from mid-May to mid-July (Calkins, 1983), although Native Alaskan hunters have reported observing calving from April through August (Huntington, 2000). Alaska Natives have described calving areas occurring in the northern side of Kachemak Bay and off the mouths of the Beluga and Susitna rivers in April and May, while in the summer months, calving occurs in Chickaloon Bay and Turnagain Arm (Huntington, 2000). However, surveys conducted during 2005 to 2007 in the upper Inlet by LGL, Inc. documented neither localized calving areas nor a definitive calving season since calves were encountered in all surveyed locations and months (April-October) (McGuire et al., 2008). It must be noted that all of these areas are located west and north of the action area; therefore, we do not expect calving to occur in the areas exposed to the effects of the proposed action. The warmer waters from various freshwater sources located in these areas may be important to newborn calves during their first few days of life (Katona et al., 1983; Calkins, 1989).

Cook Inlet beluga whales are opportunistic feeders and feed on a wide variety of prey species, focusing on specific species when they are seasonally abundant. Eulachon is an important early spring food resource for beluga whales in Cook Inlet. Eulachon first enter the upper Inlet in April, with two major spawning migrations occurring in the Susitna River in May and July (Calkins, 1989). The occurrence of beluga whale concentrations and adult salmon returns throughout the spring and summer indicates these are likely important feeding opportunities (NMFS, 2008). In the fall, as anadromous fish runs begin to decline, beluga whales return to consume the fish species found in nearshore bays and estuaries. This includes cod (*Gadus spp.*) species as well as other bottom-dwellers, such as Pacific staghorn sculpin (*Leptocottus armatus*), and flatfishes such as starry flounder (*Platichthys stellatus*) and yellowfin sole (*Limanda aspera*). In the winter, Cook Inlet beluga whales concentrate in deeper waters in lower Inlet south of Kalgin Island and make deep feeding dives, likely to feed on flatfish, cod, sculpin (*Cottidea spp.),* and walleye pollock (*Theragra chalcogramma*), among others.

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

Diving, Social Behavior, and Vocalization

Beluga whales normally swim about two to six miles per hour, but when pursued, can maintain speeds of atleast 14 miles per hour. While they usually surface to breathe every 30 to 40 seconds, radio-tracking studies show that they also routinely dive for periods of 9.3 to 13.7 minutes and to depths of 66 to 1,140 feet, presumably for feeding purposes (Nowak, 2003).

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

Beluga whales have a well-developed sense of hearing and echolocation. These whales hear over a large range of frequencies, from 40-75 Hertz (Hz) to 30-100 kiloHertz (kHz) (Richardson et al., 1995), although their hearing is most acute at middle frequencies at a range of 10-100 kHz (Fay, 1988; Blackwell and Greene, 2002). Most sound reception takes place through the lower jaw which is hollow at its base and filled with fatty oil. Sounds are received and conducted through the lower jaw to the middle and inner ears, then to the brain. Complementing their excellent hearing, beluga whales also have one of the most diverse vocal repertoires of all marine mammals. They are capable of making a variety of vocalizations (e.g., whistles, buzzes, groans, roars, trills, peeps, etc.) which leads to their nickname as “sea canaries”. Belugas also appear to have acute vision both in and out of water and their retinas contain both rod and cone cells indicating the species has the ability to perceive color (Herman, 1980).

Listing Status

In 1999 and 2000, Public Laws 106-31 and 106-553 established a moratorium on Cook Inlet beluga whale harvests except for subsistence hunts conducted under cooperative management agreements between NMFS and affected Alaska Native Organizations. The species was later listed as endangered under the ESA on October 22, 2008 (73 FR 62919). The IUCN has categorized beluga whales (throughout their range) as near threatened on their Red List of Threatened Species, which means the species is close to qualifying for or is likely to qualify for a threatened category in the near future. Critical habitat was designated for Cook Inlet beluga whales on April 11, 2011 (76 FR 20180) within the upper portion of Cook Inlet as well as nearshore areas [within two nautical miles from the Mean High Water Line (MHW)] in portions of the mid to lower Cook Inlet. See the next listed resource section for more details on Cook Inlet beluga whale designated critical habitat, including select areas located within the action area for this proposed action.

Abundance and Trends

Cook Inlet belugas have probably always numbered fewer than several thousand animals, but in recent years, the Cook Inlet beluga population has declined significantly from the stock's estimated historical abundance (NMFS, 2008). It is difficult, however, to accurately determine the magnitude of decline due to the paucity of information on the beluga whale population that existed in Cook Inlet prior to development of the region, or prior to modern subsistence whaling by Alaska Natives. With no reliable abundance surveys conducted prior to the 1990s, scientists must estimate historical abundance based on what little data exist. Relying on a survey conducted in portions of Cook Inlet during 1979, Calkins (1989) estimated a population of 1,293 individuals which represents the best estimate available on historical abundance for Cook Inlet beluga whales based on the literature. As such, NMFS currently considers 1,300 beluga whales as a reasonable estimate of historical abundance of Cook Inlet belugas for management purposes (65 FR 34590; May 31, 2000).

Comprehensive, systematic aerial surveys of beluga whales in Cook Inlet began in 1994 with the goal of determining the overall abundance as well as to monitor trends in abundance for the species. A decline in abundance of around 47 percent, from an estimate of 653 whales to 347 whales, was documented between 1994 and 1998 (Hobbs et al., 2000). After measures were established in 1999 to regulate subsistence harvests, NMFS expected that the population would grow at a rate between two and six percent; however, subsequent abundance estimates determined from aerial surveys since that time (1999–2010) indicate this level of growth did not occur and that the population actually declined about one percent per year over that period. The most recent aerial surveys conducted in 2009-2010 estimated the population at 340 individuals (NMFS, 2010a). A precise comprehensive statistical assessment of population trend is not possible given differences in survey methods and analytical techniques prior to 1994. Nevertheless, a straight comparison of the 1,293 beluga estimate from 1979 to the 340 beluga whales estimated for 2010 would indicate a 75 percent decline in the population over the 32 year period, albeit at an unspecified confidence level.

The traditional ecological knowledge of Alaska Natives (Huntington, 2000) and systematic aerial survey data conducted by NMFS indicate that the Cook Inlet beluga summer range has contracted, especially since the mid 1990s. Rugh et al. (2010) documented significant changes in beluga whale distribution across three time periods: 1978–1979 (the earliest well-documented data); 1993–1997 (during the recorded decline in abundance); and 1998–2008 (when hunting was regulated and recovery was anticipated). The results of that study showed the center of the summer range of beluga whales contracted northeastward into upper Cook Inlet from the 1970's to the 1990's (38 kilometers) and continued into the 2000's (total of 53 kilometers) with a longitudinal shift east towards Anchorage (the largest city and port in Alaska) occurring between the 1990's and 2000's (17 kilometers). The result is a reduced range in all but the area with the highest degree of human disturbance (upper Cook Inlet) which was a surprising result given the fact that animals are expected to inhabit areas that minimize the ratio of risk to net energy gain

(Frid and Dill, 2002, Wirsing et al., 2008 *as cited in* Rugh et al., 2010). The authors theorized that the shrinking distribution into areas of high anthropogenic disturbance may be due to the fact that the costs of shifting into alternative habitats have not outweighed the costs of remaining in the disturbed habitat as these areas likely offer the most abundant and accessible food, the best calving areas, and the best escape from predation, among other theories (Rugh et al., 2010).

Hobbs and Shelden (2008) conducted a population viability analysis for the species and reported a 26 percent probability of extinction in 100 years (for the model assuming one predation mortality per year and a five percent annual probability of an unusual mortality event killing 20 percent of the population). It is likely the Cook Inlet beluga population will continue to decline or go extinct during the next 300 years unless factors that determine its growth and survival are altered in its favor.

Current Threats

The Cook Inlet beluga whale population continues to be threatened by a multitude of factors shaping its current status including stranding events, predation by killer whales, interaction with fishing activities, subsistence harvest, and various forms of habitat degradation.

The documented decline of the Cook Inlet beluga whale population during the mid-1990s has been attributed to subsistence harvest removals at a level that this small population could not sustain. The known subsistence harvest by Alaska Natives during 1995-1998 averaged 77 beluga whales annually (DeMaster, 1995; CIMMC 1996; CIMMC, 1997; Angliss et al. 2001; Angliss and Outlaw, 2008; NMFS, unpublished data). The harvest, which was as high as 20 percent of the population in 1996, was sufficiently high to account for the 14 percent annual rate of decline in the population during the period from 1994 through 1998 (Hobbs et al., 2000). A permanent moratorium was established in 2000 until a cooperative agreement was reached between NMFS and affected Alaska Native organizations in order to establish allowable harvest limits. During 2000-2003 and 2005-2006 NMFS entered into co-management agreements for the Cook Inlet beluga subsistence harvest. Between 2000 and 2006, subsistence harvests were 0, 1, 1, 1, 2, 0, and 0 whales, respectively. With no cooperative agreement in place, there was no harvest from 2007-2008. The Cook Inlet Beluga Whale Subsistence Harvest Final Supplemental Environmental Impact Statement, with a set harvest plan, was published on 20 June 2008 (73 FR 35133) and long-term harvest regulations were implemented on 15 October 2008 (73 FR 60976). The harvest plan sets five year harvest limits based on the estimated population abundance over the previous five–year period as well as population growth rates from abundance estimates for the most recent 10–year period. Subsistence harvest is not allowed if the five year population estimate is less than 350 individuals (73 FR 60976). Because the five–year average abundance was below 350 whales for the 2003-2007 assessment period, the allowable harvest during the subsequent five–year period, 2008–2012, was set at zero (73 FR 60976). While no subsistence takes are currently authorized for the next two seasons, we still expect that subsistence hunting will continue to have an affect on ability of Cook Inlet beluga whales to recover over the life of the proposed permit, especially if subsistence takes are authorized in the year 2013.

The extreme tidal fluctuations of upper Cook Inlet and the belugas' preferences for shallow coastal waters both predispose these animals to strandings. Mass strandings (involving two or more whales) have occurred in Cook Inlet, particularly within the upper portions of the inlet where the greatest concentration of beluga whales occur. These stranding events are known to occur in conjunction with high tidal fluctuations (“spring tides”) or killer whale sightings (Shelden et al., 2003). During a particularly severe stranding event that occurred in 2003 in Turnigain Arm, an unusually high number of live strandings occurred (five separate events involving 2-46 whales per event) with at least 20 total mortalities (Vos and Shelden, 2005). Other mass strandings have been reported in the Susitna Delta (Vos and Shelden, 2005) and Knik Arm in the upper portion of Cook Inlet (NMFS, 2008). Due to the low population numbers estimated for Cook Inlet beluga whales (i.e. 340 individuals), strandings events caused by extreme weather events, high predation, or other stochastic events can have a particularly high impact on the ability of the species to survive and recover in the wild. For instance, if all the whales that stranded during the 2003 mass stranding event had died, it would have represented about a third of the population lost in a single year.

Given the small population size of the Cook Inlet beluga whales, predation by killer whales also can have a strong effect limiting beluga whale abundance in Cook Inlet. Shelden et al., (2003) estimated that atleast one beluga whale is killed each year due to killer whale predation based on opportunistic data. In addition to directly reducing the beluga population, the presence of killer whales in Cook Inlet may also increase stranding events as mass strandings in the upper portion of Cook Inlet have been reported to occur in conjunction with killer whale sightings (Shelden et al., 2003).

Various commercial and recreational fisheries operating throughout Cook Inlet increase the probability for ship strikes, can result in entanglement in fishing gear, and also result in the removal of prey items important to beluga whale survival. Murray and Fay (1979) stated that salmon gillnet fisheries in Cook Inlet caught five beluga whales in 1979. Incidental take by commercial salmon gillnet fisheries in the Inlet were estimated at three to six beluga whales per year during the years 1981-1983 (Burns and Seaman, 1986). There have been other reports over the years of single beluga whales becoming entangled in fishing nets, however, mortalities could not be confirmed as reports are often voluntary in nature and quite sporadic (NMFS, 2008). Aside from direct mortality and injury from fishing activities, commercial fisheries may compete with beluga whales in Cook Inlet for salmon, eulachon, and other prey species. The largest fisheries in terms of participant numbers and landed biomass are the State-managed salmon drift and set gillnet fisheries concentrated in the middle and upper portions of the Inlet (NMFS, 2008). While the number of permits fished in Cook Inlet salmon gillnet fisheries has been relatively constant, the actual number of fish caught has fluctuated greatly during the past 20 years (ranging from a high of 10.6 million in 1992 to a low of 1.8 million in 2000) (NMFS, 2008). There is strong indication beluga whales are dependent on access to relatively dense concentrations of prey during the summer months. Therefore, while the degree to which commercial and recreational fisheries are affecting the energetics of individual whales is unknown, we assume for the purposes of this consultation, that commercial and recreational fisheries represent an ongoing threat to the ability of these species to survive and recover given the direct competition between beluga whales and fisherman for similar prey resources.

Organochlorines, including PCB and DDT, have been identified from beluga whale blubber samples and are a concern to the health of individuals although members of the Cook Inlet beluga population appear to have lower levels of contaminants than other beluga whale stocks

(Becker et al., 2000). Between 1984-1994, oil spills from offshore platforms in Cook Inlet totaled roughly 10,500 gallons with four natural gas blowouts occurring since 1962 (Moore et al., 2000). Currently there are 16 platforms in upper Cook Inlet, 12 of which are still active (NMFS, 2008). No platforms currently exist in the lower Cook Inlet near the action area. Other forms of habitat degradation include stormwater runoff and habitat disturbance of nearshore areas where extensive development has occurred, especially in the upper portions of Cook Inlet where the greatest densities of beluga whales are found.

Cook Inlet beluga whales must also compete acoustically with many natural and anthropogenic sounds. Man-made sources of noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging. Underwater noise generated in the marine environment has the potential to increase stress levels, alter behavior, result in temporary or permanent hearing loss, and/or, in extreme cases, result in direct injury and even even death for animals located directly near particularly strong sound sources (Richardson et al., 1995; NRC, 2003; NRC, 2005; Clark and Ellison, 2004; Nowacek et al., 2007; Southall et al., 2007; Wright et al., 2008). Continual increases in background ambient noise levels in the action area from these various sources can cause masking of marine animals' communication systems, their ability to hear mating calls, and their ability to pick up acoustic environmental cues that animals use to navigate and/or sense their surroundings, including sounds that are used to detect predators (Hatch et al, 2008; OSPAR, 2009).

In addition to the stressors described above, the viability of small populations such as Cook Inlet beluga whales is further compromised by the increased risk of inbreeding and loss of genetic variability through drift, which reduces a population's ability to cope with disease and environmental change (Lacy, 1997; O'Corry-Crowe and Lowry, 1997). Genetic variation estimates do not, at present, suggest that Cook Inlet beluga whales are highly inbred or that a critical amount of genetic variation has been lost through drift (O'Corry-Crowe et al., 1997; Lowry et al., 2006), but this population is already in a size range where eventual genetic variability loss is expected (Lowry et al., 2006).

Cook Inlet Beluga Whale Critical Habitat

Habitat Description and Designation Status

Cook Inlet is a semi-enclosed tidal estuary located in southcentral Alaska. Cook Inlet has 1,350 kilometers of linear coastline (Rugh et al., 2000), and is generally divided into upper and lower regions by the East and West Forelands. The inlet extends in a northeast/southwest orientation from Knik and Turnagain Arms in the north to the southernmost reaches of Kamishak Bay in the south.

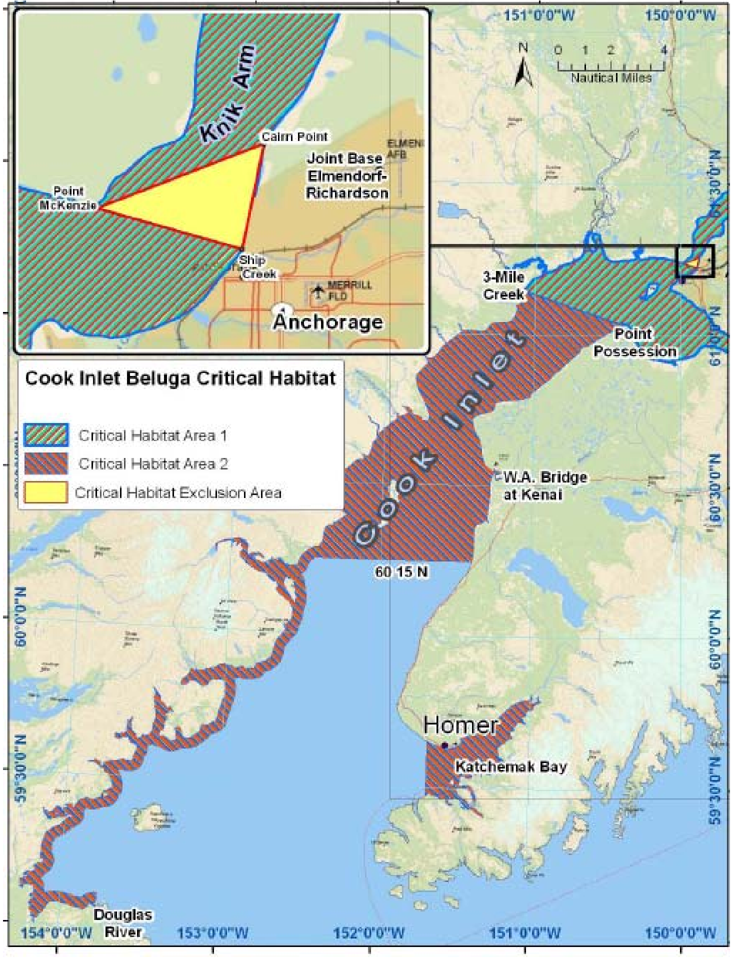
The bathymetry of Cook Inlet is varied and consists of shoals, canyons and mudflats. Cook Inlet is generally shallow, with most waters less than 73 meters (240 feet) deep. However, deeper water exists along the channels and at the entrance to the Inlet near the Barren Islands, where depths range from 183-366 meters (600-1200 feet; Mulherin et al., 2001). During low tides, mudflats constitute large areas of shoreline in Knik and Turnagain Arms, Chickaloon Bay, Redoubt Bay, Trading Bay, and the Susitna River Delta.

Cook Inlet experiences some of the greatest tidal fluctuations in the world (Mulherin et al., 2001), with differentials between high and low tides reaching as much as 12 meters (39 feet) in extreme cases. These large tidal ranges combined with broad tidal flats can result in currents reaching 6.2 meters/second, with significant changes to shoreline geomorphology occurring as a result (Moore et al., 2000). In the summer, a large volume of freshwater enters Cook Inlet from numerous major river drainages and glacial outflows, including the Knik, Matanuska, and Susitna rivers, as well as from smaller coastal streams. These sources all deposit considerable sediment into Cook Inlet. Coupled with the tidal effects and shoreline erosion, Cook Inlet waters are a highly turbid, low visibility environment.

Critical habitat was designated for Cook Inlet beluga whales on April 11, 2011 (76 FR 20180). The designation includes two geographic areas of marine habitat in Cook Inlet comprising 7,800 square kilometers (3,013 square miles) and is bounded by Mean High Water datum on the upland except for the lower reaches of four tributary rivers included in the designation. Area 1 comprises 1,918 square kilometers of marine habitat in Cook Inlet extending northeast of a line drawn from a point at the mouth of Three-mile Creek (61º 08.5 N, 151º 04.4 W) to a point at Point Possession (61º 02.1 N, 150º 24.3 W). Also included are waters of the Susitna River south of latitude 61º 20.0 N, Little Susitna River south of latitude 61º 18.0 N, and Chickaloon River north of latitude 60º 53.0 N.

Area 2 comprises 5,891 square kilometers of Cook Inlet marine waters south of a line drawn from a point at the mouth of Threemile Creek (61º 08.5 N, 151º 04.4 W) to a point at Point Possession (61º 02.1 N, 150º 24.3 W). Also included in Area 2 are waters within two nautical miles seaward of the Mean High Water line along the western shoreline of Cook Inlet between latitude 61º 25 N and the mouth of the Douglas River (59º 04 N, 153º 46.0 W), all waters of Kachemak Bay east of longitude 151 40.0 W, and the waters of the Kenai river downstream of the Warren Ames bridge in the city of Kenai. The Port of Anchorage as well as portions of military lands were excluded in the final rule in consideration of national security interests. The action area for this consultation includes areas designated in the southwestern portion of Area 2 (see **Figure 2** below).

Figure 2. Location of Critical Habitat Designated for Cook Inlet Beluga Whales



The primary constituent elements (PCEs) deemed essential to the conservation of Cook Inlet beluga whales include the following (76 FR 20180):

1. Shallow intertidal and subtidal waters of Cook Inlet (depths less than 30 feet at Mean Lower Low Water) that are within five miles of high and medium flow anadromous fish streams,
2. Fish species deemed to be the primary prey species of the Cook Inlet beluga including Chinook salmon, sockeye salmon, chum salmon, Coho salmon, Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole,
3. The absence of toxins or other agents of a type or amount harmful to Cook Inlet beluga whales,
4. Unrestricted passage within or between critical habitat, and
5. The absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales.

Usage and Movements between Critical Habitat Areas

Area 1 contains areas full of shallow tidal flats, river mouths or estuarine areas important for feeding and calving and typically exhibits the highest concentrations of belugas from spring through fall (NMFS, 2008). Belugas visit Turnagain Arm in early spring traveling up to 20-Mile River and Placer Creeks, indicating the importance of eulachon runs. Beluga use of upper Turnagain Arm decreases in the summer and then increases again in August through the fall months, coinciding with the coho salmon run. Surveys by Funk et al. (2005) noted a relatively high representation of calves in the uppermost part of Knik Arm while Cornick and Kendall (2008) observed cow/calf pairs transiting in the mouth of Knik Arm in the summer and fall months. McGuire et al. (2008) photographically identified 37 distinct beluga whales with calves in the upper Inlet during 2005–2007. However, because calves were seen in all portions of their study area, they were unable to determine distinct calving areas in the region (McGuire et al., 2008). The combination of satellite telemetry data and long term aerial survey data demonstrate that beluga whales utilize Knik Arm every month of the year, often entering and leaving the area on a daily basis (Hobbs et al., 2005; Rugh et al., 2004).

Area 2 includes areas important for feeding during the fall and winter months as well as provides transit areas for belugas traveling to and from the foraging and calving areas to the north. Area 2 includes both nearshore and offshore areas of the mid and upper inlet, and nearshore areas in the lower inlet (including the action area to the southwest). Belugas are known to feed in the fall in Tuxedni, Chinitna, and Kamishak Bays on the west coast and a portion of Kachemak Bay on the east coast (NMFS, 2008). In the fall, as anadromous fish runs begin to decline, beluga whales return to consume the fish species found in nearshore bays and estuaries before venturing out to deeper waters in the winter. Based on tracking data, Hobbs et al. (2005) documented important winter habitat concentration areas south of Kalgin Island as salmon and eulachon runs ended. The researchers noted that belugas tended to make deeper dives in these portions of Area 2 and thus, are often harder to spot and spend less time at the surface than belugas observed in the upper portions of Cook Inlet (i.e. within Area 1).

Status of Critical Habitat and Current Threats

Threats affecting the status and conservation value of Cook Inlet beluga whale critical habitat are similar to threats affecting beluga whale individuals and populations occurring within these areas. However, the sections below expand on the previous discussion to include factors shaping the status of the individual PCEs that give the habitat conservation value for the species. Threats affecting the conservation value of Cook Inlet beluga whale critical habitat include shifts in climate affecting oceanographic features and prey distribution (affecting PCE 2), commercial and recreational fisheries depleting prey resources within the critical habitat (affecting PCE 2), degradation of habitat due to pollution from land based sources (affecting PCE 3), disturbance due to vessel interactions and shoreline development influencing the movements and mobility of belugas whales between critical habitat areas (affecting PCE 4), and increasing ambient ocean noise introduced into critical habitat areas by various anthropogenic sound sources (affecting PCE 5).

As discussed earlier, traditional ecological knowledge of Alaska Natives (Huntington, 2000) and systematic aerial survey data conducted by NMFS indicate that the Cook Inlet Beluga summer range has contracted, especially since the mid 1990s. Rugh et al. (2010) showed the center of the summer range of beluga whales contracted northeastward into upper Cook Inlet (i.e. Area 1 and northern portion of Area 2) from the 1970’s to the 1990’s (38 kilometers) and continued into the 2000’s (total of 53 kilometers). The result is a reduced range in all but the area with the highest degree of human disturbance (upper Cook Inlet). Critical habitat was designated for the Cook Inlet beluga whale in response to reduced abundance and reduced range that led to the species being listed under the ESA in 2008.

The climate in Cook Inlet is driven by the Alaska Coastal Current and the Pacific Decadal Oscillation (PDO). Phase changes of the PDO have been correlated with changes in marine ecosystems in the northeast Pacific as warm phases have been accompanied by increased biological productivity in coastal waters off Alaska and decreased productivity off the west coast of Canada and the US with the opposite effect happening during cold phases. The shift in PDO to a cold phase may negatively affect zooplankton biomass and composition (Batten and Mackas, 2007), which in turn may influence changes in fish composition and alter the quality and types of fish available for beluga whales within critical habitat areas. Since the presence of primary prey resources is one of the PCEs making up critical habitat for the species (i.e. PCE 2), we assume that these types of shifts to colder PDO phases may have an adverse effect on the conservation value of critical habitat for beluga whales in Cook Inlet when they occur. The last cold phase appears to have occurred from 1950’s to the early 1980’s while the 1980’s to the late 1990’s appeared to signal a shift to a warm phase (Hopcroft et al., 2011). Recent sampling of oceanographic conditions (via GAK-1) just south of Seward, Alaska has revealed anomalously cold conditions in the Gulf of Alaska from 2006-2009 as researchers have recently documented the coldest temperatures observed since the 1970’s (i.e. temperatures observed during the last cold phase shift in the PDO) (Weingartner et al., 2010). These colder temperatures may be signaling a shift to a colder PDO phase; however, the most recent sampling season in 2010 yielded a return to near average temperatures thus running counter to these results (Hopcroft et al., 2011). More research needs to be done to determine if the region is indeed shifting to a colder PDO phase as well as the effects these phase shifts have on the dynamics of prey populations important to Cook Inlet beluga whales and the conservatioh value of its designated critical habitat.

Commercial and recreational fisheries compete with beluga whales in Cook Inlet for salmon and other prey species thus potentially impacting the conservation value of critical habitat for belugas if prey abundance, distribution, or availability are significantly altered (i.e. PCE 2). There is strong indication that belugas are dependent on access to relatively dense concentrations of high value prey throughout the summer months in Area 1 and the northern portion of Area 2 (see **Figure 2** above). Native hunters often stated that beluga whales appear thin in early spring (due to utilizing the fat stores in their blubber layer during winter), thus providing evidence of the importance of this summer feeding period to beluga survival during winter months when prey is more scarce (Huntington, 2000). Any diminishment in the ability for beluga whales to reach or utilize spring/summer feeding habitat, or any reductions in the amount of available prey, may impact the energetics of these animals as well as diminish the conservation value of its designated critical habitat. The current salmon management plan for the State of Alaska oversees the Cook Inlet fisheries in the lower and northern (upper) districts. Most fisheries occur “upstream” of the river mouths and estuaries where beluga whales typically feed. Whether the escapement into these rivers, having passed the gauntlet of commercial fishing nets, is sufficient for the well being of Cook Inlet beluga whales is unknown as is the amount of fish required to sustain the Cook Inlet population. Nevertheless, for the purposes of this consultation, we assume that commercial and recreational fisheries targeting primary prey resources (e.g., Chinook salmon, sockeye salmon, chum salmon, Coho salmon, Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole) are expected to have some effect on the conservation value of critical habitat than if they were not operating in Cook Inlet; however, the relative magnitude of this effect is uncertain.

Many cities, villages, ports, airports, treatment plants, refineries, highways, and railroads are situated on or very near to areas designated as Critical Habitat (particularly in the upper Inlet). This development has resulted in the alteration of near shore beluga habitat and changes in habitat quality due to vessel traffic, noise, and pollution. There is concern that increased development may prevent beluga whales from reaching important feeding areas in upper Knik Arm which would adversely affect PCE 4 by restricting passage within critical habitat areas as would pollution from land based sources affect PCE 3 by introducing pollutants harmful to the species within the designated critical habitat. Frequent use of shallow, near shore and estuarine habitats makes beluga whales particularly prone to regular interaction with human activities (Perrin, 1999), and are thus likely to be affected by those activities. The principal sources of pollution in Cook Inlet are: 1) discharges from industrial activities not entering municipal treatment systems; 2) discharges from municipal wastewater treatment systems; 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products (Moore et al., 2000). Extensive sections of Turnagain Arm and Anchorage area (i.e. critical habitat Area 1) shoreline have been developed (e.g., rip rap, road, and railroad construction). All these stressors are expected to diminish the conservation value of critical habitat for Cook Inlet beluga whales (particularly within Area 1).

In Cook Inlet, beluga whales are exposed to natural and anthropogenic sounds that raise background ambient noise levels and may diminish the conservation value of critical habitat if sound levels approach levels causing belugas to abandon important feeding or calving grounds (i.e. adversely affecting PCE 5). Man-made sources of noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging. Effects of noise on belugas depend on several factors including the intensity, frequency and duration of the noise, the location and behavior of the whale, and the acoustic nature of the environment (NMFS, 2008). A study conducted in 2001 by Greeneridge Sciences, Inc., made underwater and in-air recordings of various sound sources in Cook Inlet to quantify the acoustic environment that beluga whales may be subjected to in the Inlet (Blackwell and Greene, 2002). Four types of sound sources were analyzed: 1) overflights of planes landing at Anchorage International Airport and Elmendorf Air Force Base; 2) the Phillips A oil platform; 3) large and small vessels in Anchorage harbor; and 4) ambient sounds in areas removed from industrial activities. While the researchers noted that the level of noise measured in Cook Inlet did not approach levels that are expected to elicit significant effects to marine mammals according to thresholds established by NMFS, we assume that sound introduced by these sources is expected to continue in the future and thus will continue to impact the conservation value of designated critical habitat in Cook Inlet.

Fin Whale

Species Description, Distribution, and Population Structure
Fin whales are the second largest baleen whale by length, and are long-bodied and slender, with a prominent dorsal fin set about two-thirds of the way back on the body. They are dark gray dorsally and white ventrally, but the pigmentation pattern is often complex. Distinctive features of pigmentation, along with dorsal fin shapes and body scars, are useful for photo-identification (Agler et al., 1993).

Fin whales are widely distributed throughout the world's oceans; however, they tend to avoid tropical and pack ice waters with the high-latitude limit of their range set by ice and the lower-latitude limit by warmer tropical waters approximately 15° C (Sergeant, 1977). They also are less concentrated in nearshore environments while appearing to favor deeper waters. In the North Pacific in summer, fin whales are found in the Chukchi Sea, the Sea of Okhotsk, the Bering Sea and the Gulf of Alaska south to California (Gambell, 1985b). Rice (1974) suggested that Northern Pacific fin whales may winter off of southern California; however, further research is needed to confirm this (Forney et al., 2000). Fin whales have also been observed feeding in Hawaiian waters in mid-May (Shallenberger, 1981; Balcomb, 1987).

In the North Atlantic Ocean, fin whales occur in summer foraging areas from the coast of North America to the Arctic, around Greenland, Iceland, northern Norway, Jan Meyers, Spitzbergen, and the Barents Sea. In the western Atlantic, they winter from the edge of sea ice south to the Gulf of Mexico and the West Indies. In the eastern Atlantic, they winter off southern Norway, the Bay of Biscay, and Spain with some whales migrating into the Mediterranean Sea (Gambell, 1985b). In the Southern Hemisphere, fin whales are distributed broadly south of latitude 50° S in the summer while in the winter the whales migrate into the Atlantic, Indian, and Pacific Oceans along the coast of South America (as far north as Peru and Brazil), Africa, and the islands in Oceania north of Australia and New Zealand (Gambell, 1985b).

In the North Pacific Ocean, the IWC recognizes two "stocks" of fin whales for management purposes: (1) East China Sea and (2) rest of the North Pacific (Donovan, 1991). However, Mizroch et al. (1984) concluded that there were atleast five possible "stocks" of fin whales within the North Pacific based on histological analyses and tagging experiments: (1) East and West Pacific that intermingle around the Aleutian Islands; (2) East China Sea; (3) British Columbia; (4) Southern-Central California to Gulf of Alaska; and (5) Gulf of California. Based on other genetic analyses, Bérubé et al. (1998) concluded that fin whales in the Sea of Cortez represent an isolated population that has very little genetic exchange with other populations in the North Pacific Ocean (although the geographic distribution of this population and other populations can overlap seasonally). They also concluded that fin whales in the Gulf of St. Lawrence and Gulf of Maine are distinct from fin whales found off Spain and in the Mediterranean Sea. Regardless of how different authors structure the fin whale population, mark-recapture studies have demonstrated that individual fin whales migrate between management units (Mitchell, 1974; Gunnlaugsson and Sigurjónsson, 1990), which suggests that these management units are not geographically isolated populations.

NMFS currently recognizes three fin whale management stocks in U.S. Pacific waters: Alaska (Northeast Pacific), California/Oregon/Washington, and Hawaii (NMFS, 2010b). We assume that individuals from the Alaska (Northeast Pacific) stock of fin whales are the whales that would be exposed to the activities considered in this Opinion.

Life History Information

The life expectancy of fin whales is thought to be between 70 and 80 years (Kjeld et al., 2006). Fin whales become sexually mature between 5 and 15 years of age (Gambell, 1985b; COSEWIC, 2005) and have a calving interval of 2-3 years (Agler et al., 1993). Gestation lasts about 12 months and nursing occurs for 6-11 months (Perry et al., 1999). Calving and mating activities occur in late fall and winter (Mackintosh and Wheeler, 1929; Nishiwaki, 1952; Tomilin, 1957).

Fin whales feed on euphausiids and large copepods in addition to schooling fish (Nemoto, 1970; Kawamura, 1982; Watkins et al., 1984) although their diet varies seasonally and geographically (Watkins et al., 1984; Shirihai, 2002). They feed by filtering large volumes of water for the associated prey. The movements and distribution of fin whales may be based on prey availability, as Payne et al. (1990) concluded that fin whales are less stressed by fluctuations in prey availability than other species such as humpback whales due to their greater ability to exploit patchy prey aggregations.

Most fin whales in the northern hemisphere migrate seasonally from the Arctic in summer to lower latitudes in the winter to breed. However, the locations of these breeding grounds are not known and their migration patterns are less predictable than for other species (Perry et al., 1999). They are known to occur in high densities in the northern Gulf of Alaska and southeastern Bering Sea from May to October, with some movement through the Aleutian passes into and out of the Bering Sea (Reeves et al., 1985; NMFS, 2010b).

Diving, Social Behavior, and Vocalization

The percentage of time fin whales spend at the surface varies. Some authors have reported that fin whales make 5-20 shallow dives with each of these dives lasting 13-20 seconds followed by a deep dive lasting between 1.5 and 15 minutes (Gambell, 1985b). Other authors have reported that the fin whale’s most common dives last between two and six minutes, with two to eight blows between dives (Watkins, 1981; Hain et al., 1992).

Fin whales can be found singly or in pairs, but can also form larger groupings of more than three individuals, particularly while feeding. Balcomb (1987) noted that fin whales commonly travel in herds, often widely dispersed, ranging from six to more than 100 individuals. They have also been reported grouped with other balaenopterid whale species at times (e.g. blue whales) (Corkeron et al., 1999; Shirihai, 2002).

Fin whales produce a variety of low-frequency sounds in the 10-200 Hz band range (Watkins, 1981; Watkins et al., 1987; Edds, 1988; Thompson et al., 1992). The most typical signals are long, patterned sequences of short duration (0.5-2 second) infrasonic pulses in the 18-35 Hz range (Patterson and Hamilton, 1964). Estimated source levels are as high as 190 decibels (dB) in some cases (Patterson and Hamilton, 1964; Watkins et al., 1987; Thompson et al., 1992; McDonald et al., 1995). In temperate waters, intense bouts of long patterned sounds are very common from fall through spring, but also occur to a lesser extent during the summer in high latitude feeding areas (Clark and Charif, 1998).

Listing Status

Fin whales were originally listed as endangered 1970, and this status remained since the inception of the ESA in 1973. They are also listed as endangered on the IUCN Red List and are protected by the Convention on International Trade in Endangered Species of wild flora and fauna (CITES) as well as the MMPA. Critical habitat has not been designated for the species.

Abundance and Trends

Historically, fin whale populations worldwide were severely affected by commercial whaling in the 20th century in the North Atlantic, North Pacific, and Southern oceans (Cherfas, 1989 *as cited in* Perry et al., 1999). Braham (1991) compiled available regional estimates and estimated the global population of fin whales in 1991 to be about 119,000 individuals, which represented about a quarter of his estimated pre-exploitation abundance of 464,000 individuals.

Sergeant (1977) estimated that prior to commercial exploitation, there may have been as many as 30,000 to 50,000 fin whale individuals in the North Atlantic. Currently, no reliable population estimates exist for the entire North Atlantic; however, estimates do exist for portions of the North Atlantic. For the year’s 1996-2001, the IWC’s best estimate for the population of fin whales in the central and northeastern Atlantic was 30,000 individuals. Braham (1991) estimated the western North Atlantic to contain between 3,590 and 6,300 individuals while Hain et al. (1992) estimated that there were approximately 5,000 fin whales in the western North Atlantic Ocean based on a 1978-1982 survey. The most recent abundance estimate for the western North Atlantic stock was 3,985 total individuals (CV=0.24) (Waring et al., 2009).

In the North Pacific, there may have been as many as 42,000-45,000 fin whales prior to commercial exploitation; however, it is estimated that this population was reduced to between 13,620 and 18,630 by the early 1970's (Ohsumi and Wada, 1974). Moore et al. (2000) conducted surveys for whales in the central Bering Sea in 1999 and estimated the fin whale population to be approximately 4,951 individuals. Results from ship surveys performed off the coasts of Washington, Oregon, and California in the years 1996 and 2001 estimated the fin whale population at 3,279 individuals (Barlow and Taylor, 2001) while results of a 2005 ship survey in the same region estimated the fin whale population at 3,281 individuals (Forney, 2007). Based on the available information, it is feasible that the North Pacific population as a whole has failed to increase significantly over the past 30 years.

In the Southern Hemisphere, there may have been as many as 400,000 fin whales prior to exploitation by whaling vessels; however it is estimated this population may have been reduced to 85,200 fin whales by the late 1970's (IWC, 1979). A joint Conservation of Antarctic Marine Living Resources/IWC survey in the Scotia Sea and Antarctic Peninsula during the austral summer of 2000 (January-February) resulted in a more recent abundance estimate of 4,672 individuals in the Southern Hemisphere (Hedley et al., 2001; Reilly et al., 2004).

Current Threats

The main stressors affecting the ability of the species to recover include ongoing effects from prior commercial whaling, interaction with fishing gear, ship strikes, and various sources of habitat degradation. Historically, whaling represented the greatest threat to every population of fin whales and was ultimately responsible for listing fin whales as an endangered species. From

1904 to 1975, the IWC estimates that 703,693 fin whales were captured and killed in Antarctic whaling operations alone (IWC, 1990). Whaling in the Southern Ocean originally targeted humpback whales, but by 1913, those whales had become so rare that whalers shifted their focus to other species including fin and blue whales (Mizroch et al., 1984). From 1911 to 1924, it was estimated that whalers harvested between 2,000–5,000 fin whales each year. After the introduction of factory whaling ships in 1925, the number of whales killed each year increased substantially which had a major impact on global fin whale populations prior to the ban on international whaling.

As is the case with other large whale species, entanglement in commercial fishing gear and mortality from ship strikes continue to affect the species' ability to recover. There were 14 confirmed reports of fin whales being entangled in fishing gear between 2004 and 2008 off the Atlantic coast of the U.S. and Maritime Provinces of Canada, with 3 whales dying of their wounds and an additional 3 sustaining serious injuries (Glass et al., 2010). For ship strikes, there were 13 confirmed reports of fin whales being struck by vessels with 10 dying of their wounds (Glass et al., 2010).

Organochlorines, including PCB, DDT, and DDE have been identified from fin whale blubber samples with females containing lower burdens than males. This is likely due to mobilization of contaminants during pregnancy and lactation (Aguilar and Borrell, 1988; Gauthier et al., 1997). Contaminant levels increase steadily with age until sexual maturity, at which time levels begin to drop in females and continue to increase in males (Aguilar and Borrell, 1988).

Fin whales are still hunted in subsistence fisheries off West Greenland and are hunted by Japanese whalers in the Southern Ocean as part of Japan's JARPA II research program with anticipated harvests of 50 fin whales each year expected for the period 2007-2019 (Nishiwaki et al., 2006). Other current threats affecting fin whale recovery include effects of ocean noise as well as disturbance from whale watching and other scientific research activities.

Effects of current climate change trends also present potential threats to fin whales, particularly in the Mediterranean Sea, where fin whales appear to prey exclusively on northern krill. These krill species occupy the southern extent of their range and increases in water temperature could result in their decline in the Mediterranean Sea thereby potentially affecting food availability for fin whales in this region (Gambaiani et al., 2009). However, there are insufficient data to know the effects that current climate-related trends are having on fin whale populations.

Humpback Whale

Species Discription, Distribution, and Population Structure

Humpback whales are large baleen whales known for their long pectoral fins (up to 15 ft in length) and complex whale songs. Humpback whales occur throughout the world's oceans and are generally found over continental shelves, shelf breaks, and around oceanic islands (Balcomb and Nichols, 1978; Whitehead, 1987).

In the North Pacific Ocean, the summer range of humpback whales includes coastal and inland waters from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk

(Nemoto, 1957; Tomlin, 1967; Johnson and Wolman, 1984). These whales migrate to Hawai'i, southern Japan, the Mariana Islands, and Mexico during the winter months. A “population” of humpback whales winters in an area extending from the South China Sea east through the Philippines, Ryukyu Retto, Ogasawara Gunto, Mariana Islands, and Marshall Islands (Rice, 1998).

In the Atlantic Ocean, humpback whales aggregate in four feeding areas in the summer months: (1) Gulf of Maine/Eastern Canada, (2) West Greenland, (3) Iceland and (4) Norway (Katona and Beard, 1990; Smith et al., 1999). The principal breeding range for these whales lies from the Antilles and northern Venezuela to Cuba (Winn et al., 1975; Whitehead, 1987; Balcomb and Nichols, 1982). The largest contemporary breeding aggregations occur off the Greater Antilles where extensive feeding gatherings have been identified from photographs (Katona and Beard, 1990; Clapham et al., 1993; Mattila et al., 1994; Palsbøll et al., 1997; Smith et al., 1999; Stevick et al., 2003). Winter aggregations also occur at the Cape Verde Islands in the Eastern North Atlantic (Reiner et al., 1996; Reeves et al., 2002).

In the Southern Ocean, humpback whales occur in waters off Antarctica and migrate to the waters off Venezuela, Brazil, southern Africa, western and eastern Australia, New Zealand, and islands in the southwest Pacific during the austral winter (Perry et al., 1999). A separate population of humpback whales appears to reside in the Arabian Sea in the Indian Ocean off the coasts of Oman, Pakistan, and India (Mikhalev, 1997). In the Southern Hemisphere, Donovan (1991) reported four groupings of humpback whales found in IWC Areas II through IV; however, migration of the species between ocean basins is noted (e.g., between the Indian Ocean and South Atlantic, based on genetic data) (Pomilla and Rosenbaum, 2005).

In the North Pacific, NMFS recognizes three stocks of humpback whales for management purposes under the MMPA: (1) Western North Pacific, (2) Central North Pacific, and (3) Eastern North Pacific stocks. The IWC, however, considers there to be one North Pacific management stock, although no clear consensus exists on population structure for the species in this region (Calambokidis et al., 2001).

Life History Information

Sexual maturity in humpback whales is reached between 5 and 11 years of age (Clapham, 1992; Gabriele et al., 2007). Humpback whale reproductive activities occur primarily in winter and gestation takes about 11 months (Winn and Reichley, 1985), followed by a nursing period of up to 12 months (Baraff and Weinrich, 1993). Calving primarily occurs in the shallow coastal waters of continental shelves and some oceanic islands (Perry et al., 1999). The calving interval is likely 2-3 years (Clapham and Mayo, 1987), although there is some evidence of calving occurring in consecutive years (Glockner-Ferrari and Ferrari, 1985; Clapham and Mayo, 1987; Weinrich et al., 1993). During the breeding season, humpback whales form small unstable groups (Clapham, 1996), and males sing long, complex songs directed toward females and other males.

Although largely solitary, humpback whales often cooperate during feeding activities (Elena et al., 2002). They exhibit a wide range of foraging behaviors, and feed on a range of prey types including small schooling fishes, euphausiids, and other large zooplankton (Nemoto, 1957; Nemoto, 1959; Nemoto, 1970; Krieger and Wing, 1984).

Humpback whales exhibit seasonal migrations from warmer temperate and tropical waters where they give birth to calves and cooler, temperate or sub-Arctic waters in the summer months where they feed (Gendron and Urban, 1993). Despite this known migration pattern, the seasonal distributions of this species have yet to be fully understood (Reeves et al., 2004).

Diving, Social Behavior, and Vocalization

Since a majority of humpback whale prey is found above 300 meters (or 984 feet), most dives are relatively shallow (approximately 60-170 meters) (Hamilton et al., 1997). Dives usually range between 2-5 minutes, but can last as long as 20 minutes in some cases (Dolphin, 1987).

In a review of the social behavior of humpback whales, Clapham (1996) reported that they can form small, unstable social groups during the breeding season while more stable aggregate groups form in areas with high prey densities. There is also evidence that humpbacks exhibit territoriality for both feeding (Clapham, 1994; Clapham, 1996) and calving areas (Tyack, 1981).

Humpback whale vocalization is much better understood than hearing sensitivity, although like other baleen whales, evidence indicates the species can hear at least low frequency sounds (less than 1 kHz) based on the morphology of its hearing apparatus suggesting that the auditory system of the species is more sensitive to low frequency sounds than that of smaller toothed whales (Ketten, 1997). Houser et al. (2001) reported the hearing range of humpback whales to be in the range of 700 Hz to 10 kHz. In terms of vocalization, different calls by humpback whales have been associated with different functions including feeding, breeding, and other social calls. Humpback whales are reported to be less vocal when found on their high-latitude feeding grounds in summer compared with their lower-latitude winter ranges (Richardson et al, 1995). Au (2000) compiled information on humpback whale vocalizations and reported sounds to include grunts in the frequency range of 25-1,900 Hz, pulses in the frequency range of 25-89 Hz, and songs with components ranging from 30-8,000 Hz.

Listing Status

Humpback whales have been listed as endangered under the ESA since 1973. The IWC first protected humpback whales in the North Pacific in 1965, and this species is also protected by CITES and the MMPA. Humpback whales are also listed as vulnerable on the IUCN’s Red List of Threatened Species. No critical habitat is currently designated for the species.

Abundance and Trends

It is difficult to assess the current status of humpback whales for the same reasons that it is difficult to assess the status of fin whales: (1) there is no general agreement on the size of the humpback whale population prior to whaling and (2) estimates of the current size of the different humpback whale populations vary widely and produce estimates that are not always comparable to one another, although some robust estimates do exist for certain populations (i.e. western North Atlantic).

Historically, humpback whale populations worldwide were greatly affected by commercial whaling activities. Based on mitochondrial DNA analysis, Roman and Palumbi (2003) estimated pre-exploitation populations of humpback whales to be as many as 1,000,000 worldwide with 240,000 occurring in the North Atlantic alone. Between 1805 and 1909, American whalers harvested between 14,164-18,212 humpback whales in the North Atlantic while the Pacific kill was estimated to be about 28,000 (Best, 1987 *as cited in* NMFS, 1991). Records also show that from the late 1880's to the mid-1970's, whaling operations took 1,397 humpback whales off eastern Canada and 522 off West Greenland in the western North Atlantic (Kapel, 1979; Mitchell, 1974), 1,579 in the eastern North Atlantic and Arctic Oceans (Perry et al., 1999), nearly 30,000 in the Pacific Ocean (Perry et al., 1999), and over 68,000 in the Southern Ocean (Bonner, 1982).

Current estimates for the North Atlantic humpback whale population include the estimates by Palsbøll et al. (1997) of 4,894 males and 2,804 females, based on genetic tagging data. However, some authors believe this combined total of 7,698 whales to be an underestimate of the true population size in the North Atlantic (Clapham et al., 1995; Palsbøll et al., 1997). Several researchers report an increasing trend in abundance for the North Atlantic population, and an independent increase in numbers of individuals sighted within the Gulf of Maine feeding aggregation (Katona and Beard, 1990; Barlow and Clapham, 1997; Smith et al., 1999; Waring et al., 2009). Stevick et al., (2003) estimated that approximately 11,570 animals existed in 1993 with an estimated rate of increase of 3.1 percent per year. Assuming that this rate of increase has remained constant, the estimated 2010 population size for North Atlantic humpback whales would be around 19,473 individuals, a number still significantly lower than Roman and Palumbi's (2003) pre-exploitation estimate of 240,000 individuals.

In the 1980s, North Pacific humpback whale population estimates ranged from 1,407 to nearly 2,100 (Darling and Morowitz, 1986; Baker and Herman, 1987); however, by the mid-1990s, the population was estimated to have risen to around 6,000 (Calambokidis et al., 1997). Between 2004 and 2006, a comprehensive assessment of the population of humpback whales in the North Pacific identified 7,971 unique individuals from photographic records (Calambokidis et al., 2008). Based on the results of that effort, Calambokidis et al. (2008) estimated that the current population of humpback whales in the North Pacific Ocean consisted of about 18,300 adult individuals. Rice (1978) estimated pre-exploitation numbers of humpback whales in the North Pacific to be around 15,000; however, this data has been shown to be statistically unreliable.

In the Southern Hemisphere, the IWC estimated the humpback whale population at 19,851 individuals extrapolated from survey data of whales south of latitude 60°S (IWC, 1996) although this estimate has been shown to be statistically unreliable and should be taken with caution (Perry et al., 1999). Nevertheless, these estimates are far lower than the pre-exploitation abundances reported by Gambell (1976) who estimated the humpback whale numbers in the Southern Ocean to be as high as 100,000 individuals.

Current Threats

At present, there are several stressors affecting humpback whales globally, although the significance of any effects emanating from these individual stressors remains uncertain. Historically, whaling represented the greatest threat to every population of humpback whales and was ultimately responsible for listing humpback whales as an endangered species. For the Pacific Ocean, from 1900 to 1965, nearly 30,000 whales were taken in modern whaling operations which reduced humpback whales to a fraction of their estimated pre-exploitation abundance in this region alone.

Entanglement in commercial fishing gear continues to be a problem as there were 81 confirmed reports of humpback whales being entangled in fishing gear between 2004 and 2008 off the Atlantic coast of the U.S. and Maritime Provinces of Canada, with 5 whales dying of their wounds and an additional 11 sustaining serious injuries (Glass et al., 2010). Mortality from ship strikes is also a threat to recovery. Along the Pacific coast, a humpback whale is known to be killed about every other year by ship strikes (Barlow et al., 1997). Along the Atlantic coast of the U.S. and Canada between 2004 and 2008, there were 14 confirmed reports of humpback whales being struck by vessels with 8 whales dying of their wounds (Glass et al., 2010).

There are also reports of entangled humpback whales from the Hawaiian Islands. In 1995, a humpback whale in Maui waters was found trailing numerous lines (not fishery-related) and entangled in mooring lines. The whale was successfully released, but subsequently stranded and was attacked and killed by tiger sharks in the surf zone. From 2001-2007, there were five observed interactions between humpback whales and gear associated with the Hawaii-based longline fisheries (Allen and Angliss, 2011).

Organochlorines, including PCB and DDT, have been identified from humpback whale blubber samples (Gauthier et al., 1997). These contaminants are transferred to young through the placenta, leaving newborns with contaminant loads equal to that of mothers before bioaccumulating additional contaminants during life and passing the additional burden to the next generation (Metcalfe et al., 2004).

The current IWC quota for subsistence harvest of western North Atlantic humpback whales is 20 total individuals over the seasons 2008-2012, to be caught by the Bequians of St. Vincent and the Grenadines. Japan is currently conducting its scientific whaling program (i.e. JARPA II) with anticipated harvests of 50 humpback whales from two stocks each year (Nishiwaki et al., 2006). Other current threats affecting humpback whale recovery include effects of ocean noise as well as disturbance from whale watching and other scientific research activities occurring within and outside of the action area considered in this Opinion.

ENVIRONMENTAL BASELINE

By regulation, environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR §402.02).

The purpose of the *Environmental Baseline* section is to step down from the species level discussion in the *Status of the Species* section and establish the current and projected viability or fitness of individuals and populations (as well as the conservation value of critical habitat) within the action area so that the effects of the proposed research activities can be measured and assessed. The following sections summarize the natural phenomena as well as the anthropogenic activities that have affected and continue to affect listed species and critical habitat within the action area. While some stressors uniquely occur within the action area and are thus easily identified for their respective impacts, there are other stressors where the impacts are felt only in part within the action area at an unspecified magnitude (e.g. disease, effects from prior commercial exploitation etc.). In those situations, we will discuss impacts generally and make the assumption that listed species are exposed to these ongoing effects in the action area at an unspecified degree.

Natural Sources of Stress and Mortality

Predation and Strandings

Natural stressors acting on listed species in the action area include stranding events, predation, diseases and parasitic infections, and other stochastic phenomena. Cook Inlet beluga whale stranding events have been reported thoughout the Inlet since improved recordkeeping was initiated in 1994. Live strandings resulted in suspected mortalities of atleast five belugas in 1996, five in 1999, five in 2003, and one individual in 2005 (Vos and Shelden, 2005; Hobbs and Shelden, 2008). These stranding events are known to occur in conjunction with high tidal fluctuations (“spring tides”) or killer whale sightings as killer whales are the main natural predator of Cook Inlet belugas (Shelden et al., 2003). NMFS has developed an active Alaska Marine Mammal Stranding Response Network and a Turnagain Arm Response Plan describing protocols to be followed by NMFS when responding to stranded marine mammals. It is believed that these initiatives should help minimize the impact of individual stranding events occurring in the future including those occurring in the action area.

Shelden et al., (2003) estimated that atleast one beluga whale is killed each year due to killer whale predation based on opportunistic data. The effects of killer whale predation were addressed in the 2006 status review for the species (Hobbs et al., 2006); the models used in that status review demonstrated killer whale predation on an annual basis could significantly impact recovery, especially when combined with other sources of mortality (such as strandings in response to the presence of killer whales etc.). While a majority of beluga stranding events are reported north of the action area (Allen and Angliss, 2011), the fact that killer whales are more common in the lower reaches of Cook Inlet and out into coastal Gulf of Alaska waters raise the risk of predation within the action area compared to upper portions of the Inlet. Given the small size of the Cook Inlet beluga whale population [around 340 individuals (NMFS, 2010a)], direct predation by killer whales and the impact of strandings may have a significant effect on abundance of these species within the action area from year to year.

Killer whales and large sharks are also known to occasionally prey on very young or sick fin whales (Perry et al., 1999; Ford and Reeves, 2008) and humpback whales (Steiger et al., 2008) and, therefore, could represent a threat to individuals traversing in and out of the lower portions of the Inlet. No strandings of fin or humpback whales have been reported in Cook Inlet and the threat of strandings within the action area is considered to be extremely rare.

Diseases and Parasitic Infections

Bacterial pneumonia, either alone or in conjunction with a parasitic infection, is a common cause of beach stranding and death of marine mammals (Howard et al., 1983) and, therefore, may affect species targeted by the proposed research at an unspecified degree within the action area. Viruses such as morbilliviruses, influenza, and the herpes virus are also widespread in marine mammals and have become recognized as important causes of individual mortalities as well as the potential for mass mortalities if a large amount of individuals become infected. Viruses can also compromise an animal's immune system and render it susceptible to secondary invaders such as bacterial agents and parasitic protozoa. Pulmonary aspergillosis is the most common mycotic infection in marine mammals and has been isolated in a captive beluga, harbor seal, and killer whale samples collected (Reidarson et al., 2001). The occurrence of the nematode *Crassicauda boopis* appears to increase the potential for kidney failure in humpback and fin whales and may be affecting recovery of these species throughout their respective ranges (Lambertsen, 1992).

While we assume that Cook Inlet beluga, fin, and humpback whales are affected by pathogens and parasitic infections throughout their respective ranges, the exposure and risk of infection within the action area is uncertain. Reidarson et al. (2001) postulated that exposure of free-ranging belugas to fungal organisms is expected to be lower compared to captive animals. However, the fact that Cook Inlet beluga whales are generally found throughout the inlet during all months of the year, the threat of an outbreak affecting the population is expected to be higher than for species with much broader distributions. Highly migratory species such as fin and humpback whales have the ability to carry pathogens across large distances thus potentially introduce new diseases into the action area (Perry et al., 1999). For the purposes of this consultation, we expect that beluga, fin, and humpback whales are periodically exposed to parasities as well as bacterial, viral, and fungal diseases within the action area with Cook Inlet beluga whales being especially vulnerable due to their more limited distribution.

Climate Variability

As discussed in the *Status of the Species* section of this Opinion, the climate in Cook Inlet is driven by the Alaska Coastal Current and the PDO. Phase changes of the PDO have been correlated with changes in marine ecosystems in the northeast Pacific as warm phases have been accompanied by increased biological productivity in coastal waters off Alaska and decreased productivity off the west coast of Canada and the US with the opposite effect happening during cold phases. The shift in PDO to a cold phase may negatively affect zooplankton biomass and composition in the action area (Batten and Mackas, 2007), which in turn may influence changes in fish composition and alter the quality and types of fish available for Cook Inlet beluga, fin, and humpback whales occurring within the action area. Recent sampling of oceanographic conditions (via GAK-1) just south of Seward, Alaska has revealed anomalously cold conditions in the Gulf of Alaska from 2006-2009 suggesting a shift to a colder PDO phase; however, the most recent sampling season in 2010 yielded a return to near average temperatures thus running counter to these results (Hopcroft et al., 2011). More research needs to be done to determine if the region is indeed shifting to a colder PDO phase as well as the effects these phase shifts have on the dynamics of prey populations important to Cook Inlet beluga whales and the conservation value of its designated critical habitat within the action area. A shift to a colder phase would be expected to impact prey populations available within the action area over the five year duration of the proposed permit, although the magnitude of this effect is uncertain at the time of this consultation.

Variability in water temperatures also affect the amount of ice that develops in Cook Inlet during the winter. Belugas are more susceptible to entrapment during sudden freeze-ups, fast ice formation (Heide-Jørgensen et al., 2002), and when wind conditions change, driving ice into once open areas (Armstrong, 1985). Entrapments that result in mass mortalities appear to be rare, though under-reporting is possible given these incidents occur during the dark, winter months.

Anthropogenic Sources of Stress and Mortality

Subsistence Whaling

As discussed in the *Status of the Species* section of this Opinion, impacts from prior commercial and subsistence whaling continues to threaten the ability of listed whales to recover and is expected to continue to impact beluga whales occurring within the action area. The beluga whale population declined as much as 14 percent annually from 1994-1998 throughout Cook Inlet due to subsistence whaling (Hobbs et al., 2000). The current harvest plan sets five year harvest limits based on the estimated population abundance over the previous five–year period as well as population growth rates from abundance estimates for the most recent ten–year period. Because the five–year average abundance was below 350 whales for the 2003-2007 assessment period, the allowable harvest during the subsequent five–year period, 2008–2012, was set at zero (73 FR 60976). While no subsistence takes are currently authorized for the next two seasons, we still expect that subsistence hunting will continue to have an effect on the ability of Cook Inlet beluga whales to recover over the life of the proposed permit, especially if subsistence takes are authorized beginning in the year 2013. While we do not anticipate that direct subsistence whaling will have a significant effect on beluga whales over the proposed permit period, prior exploitation may have altered the population structure and social cohesion of these species such that effects on abundance and recruitment may continue for years after harvesting ceased. Also, past whaling pressure significantly lowered population numbers such that their ability to resist the effects of deleterious phenomena such as demographic stochasticity, inbreeding depression, and Allee effects, is lowered thereby greatly affecting the ability of these species to recover to pre-exploitation levels.

Commercial and Recreational Fishing Activities

Commercial and recreational fishing activities occurring within and around the action area pose multiple threats to listed whales including possible ship strikes, entanglement in fishing gear, and/or direct competition with prey resources. Given that Cook Inlet beluga whales typically congregate in the upper portions of Cook Inlet during the summer months (Rugh et al., 2010), fisheries occurring in the upper Inlet could have a higher likelihood of interacting with the species than those occurring in the action area. The state-managed fisheries operating in the middle portions of the Inlet include salmon (both set and drift gillnet), herring (gillnet), eulachon (dip net), and razor clam. Incidental take rates by commercial salmon gillnet fisheries in the Inlet were estimated at three to six beluga whales per year during the period 1981–1983 (Burns and Seaman, 1986). Neither report, however, differentiated between the set gillnet and drift gillnet fisheries. There have been two reports during the past twenty years where a single beluga whale was entangled in fishing nets (drift net and set gillnet); however, mortalities could not be confirmed. NMFS placed observers in the Cook Inlet salmon drift net and upper and lower Inlet set gillnet fisheries in 1999 and 2000. During the two years of observations, only three beluga whale sightings occurred and no beluga whale injuries or mortalities were reported. Furthermore, during the period 1990-2000, fishermen's voluntary self reports did not indicate any interactions resulting in mortalities. In lower Cook Inlet, recreational fishing for groundfish such as halibut, rockfish, and lingcod is common. There is also a recreational fishery for littleneck clams, butter clams, and razor clams. NMFS is unaware of any beluga whales injured or killed in Cook Inlet due to personal use, subsistence, or recreational fisheries. While the extent that commercial fisheries affect listed whales in the specific action area is uncertain, we would expect that commercial and recreational fishing activities result in harassment to Cook Inlet beluga whales with occasional harassment to fin and humpback whales venturing into Cook Inlet waters; however, the current literature suggests that the possibility for serious injury and/or mortality as a result of fishing activities would be considered extremely rare.

Aside from direct mortality and injury from fishing activities, commercial fisheries may also compete with listed whales for salmon and other prey species. A reduction in the quantity or availability of prey resources would also adversely affect critical habitat designated for Cook Inlet beluga whales located within the action area as well since it would affect PCE 2. There is strong indication that Cook Inlet belugas are dependent on access to relatively dense concentrations of high value prey throughout the summer months. Native hunters often stated that beluga whales appear thin in early spring (due to utilizing the fat stores in their blubber layer during winter), and tend to sink rather than float when struck. Any diminishment in the ability for beluga whales to reach or utilize spring/summer feeding habitat, or any reductions in the amount of available prey, may impact the energetics of these animals and delay recovery. The largest fisheries in terms of participant numbers and landed biomass are the State-managed salmon drift and set gillnet fisheries concentrated in the middle and upper portions of the Inlet (NMFS, 2008) with most fisheries occurring "upstream" of the river mouths and estuaries where beluga whales typically feed. While the degree to which commercial and recreational fisheries impact the energetics of individual whales is unknown, we assume for the purposes of this consultation, that commercial and recreational fisheries represent an ongoing threat to the ability of these species to survive and recover given the direct competition between beluga whales and fisherman for similar prey resources. Additional research into whale energetics as well as the impact of fishing on predator-prey dynamics should further inform the impact that commercial and recreational fishing has on both listed whales occurring throughout Cook Inlet as well as the conservation value of critical habitat located within and outside of the action area for this proposed action.

Pollution and Other Habitat Degradation

Nearshore and offshore coastal waters utilized by listed whales in the action area are degraded by a variety of sources including 1) discharges from industrial activities that do not enter municipal treatment systems; 2) discharges from municipal wastewater treatment systems; 3) runoff from urban, mining, and agricultural areas; and 4) accidental spills or discharges of petroleum and other products (Moore et al., 2000; Burkholder et al., 2007). This section includes a brief discussion on a few of the more prominent sources for Cook Inlet that have the potential to contribute pollutants and therefore degrade habitat in and around the action area utilized by Cook Inlet beluga, fin, and humpback whales.

Currently, the treated municipal wastes of ten communities are being discharged into Cook Inlet waters. Levels of treatment of these waste waters range from primary (only materials easily collected from the wastewater – oils, fats, greases, sand, gravel, rocks, human waste are removed) to secondary (further treated to substantially degrade the biological content of the discharge) to tertiary (employing additional technologies to increase quality of discharge). Wastewaters entering these plants may contain a variety of organic and inorganic pollutants, metals, nutrients, sediments, bacteria, viruses, and other emerging pollutants of concern. Little is known about emerging pollutants and their effects on whales affected by the proposed action although they include endocrine disruptors (substances that interfere with the functions of hormones), pharmaceuticals, personal care products, and prions (proteins that may cause an infection), amongst other agents that are found in wastewater and biosolids. As discussed in the *Status of the Species* section of this Opinion, Cook Inlet beluga, fin, and humpback whales are all known to carry contaminant burdens in their tissues such as Organochlorines and heavy metals (Gauthier et al., 1997). These contaminants are transferred to young through the placenta, leaving newborns with contaminant loads equal to that of mothers before bioaccumulating additional contaminants during life and passing the additional burden to the next generation (Metcalfe et al., 2004). While beluga whale samples for Cook Inlet appeared to exhibit less of a contaminant burden than samples taken from other stocks (URS Corporation, 2010), Becker et al. (2000) concluded that little is known about the role of multiple stressors in animal health and that future research should examine their interaction and effects on population recruitment for a declining population (such as the Cook Inlet beluga whale population) so that more definitive conclusions can be reached.

The Municipality of Anchorage (MOA) located north of the action area operates under a National Pollutant Discharge Elimination System stormwater permit to discharge storm water into Cook Inlet. Deicing and anti-icing operations occur from October through May at many airports in and around Cook Inlet, especially Stevens International Airport, Merril Field, Elmendorf Air Force Base, Lake Hood and Lake Spenard. Depending on the application, deicing activities utilize different chemicals. For instance, ethylene glycol and propylene glycol are used on aircraft for anti-icing and deicing purposes, whereas potassium acetate and urea are used to deice tarmacs and runways. All the deicing materials or their break down products eventually make it to the Inlet. At the time of this consultation, it is unknown what effects these chemicals have on listed whales although it is expected that exposure within the action area would be minimal since a majority of the sources are located in the upper portions of the inlet.

The offshore oil production facilities operating in Cook Inlet currently support over 200 wells with 12 currently active north of the action area. Currently there are no platforms in the lower Inlet; however spills may reach the action area depending on the extent and duration of the particular spill event. Between 1984-1994 oil spills from offshore platforms in Cook Inlet totaled roughly 10,500 gallons, with four natural gas blowouts occurring since the year 1962 (Moore et al., 2000). Oil spills can affect marine mammals through ingestion, absorption, and inhalation with impacts ranging from instant death to sub-lethal damage to mild irritation, depending on concentration and length of exposure (Geraci, 1990). Marine mammals may inhale toxic doses of petroleum vapor when at the surface in the vicinity of an oil spill (Geraci, 1990; Geraci and Williams, 1990) and may directly injest oil or feed on contaminated prey below the surface. Few studies on oil spills have focused exclusively on cetaceans; however, bottlenose dolphins (Smultea and Wursig, 1995) and gray whales (Kent et al., 1983 *as cited in* Moore and Clarke, 2002) have been observed swimming through oil slicks and sheens making it likely that listed whales would respond similarly and would not avoid the oil immediately upon exposure. The greatest potential threat to belugas from an oil spill is the inhalation of toxic vapors that concentrate above oil slicks and, in extreme cases, could result in sudden death (Geraci, 1990).

Experience gained during the *Exxon Valdez* spill indicates that large-scale spills can cause persistent negative effects on wildlife that can last for decades (Peterson et al., 2003). For instance, Matkin et al. (2008) utilized photo-identification methods to monitor two killer whale populations five years prior to and 16 years after the *Exxon Valdez* oil spill and noted that in both cases, the two populations had not recovered from pre-spill numbers. NMFS, in cooperation with numerous agencies, developed an area oil spill contingency plan (a.k.a. Unified Plan) which has been operational for over ten years. This plan is reviewed and updated as needed to ensure its applicability to ever-changing oil spill risks and to integrate experience gained from response in other regions. While it is expected that implementation of this contingency plan would be expected to reduce overall impacts from oil spills as they occur, we still expect that major oil spill events would significantly impact the Cook Inlet beluga whale population to survive and recover given their limited range and the persistent impacts that have been studied since the last major spill event in the Alaska region.

Ship Strikes and Other Vessel Interactions

Multiple classes of vessels ranging from large shipping vessels and tankers to small fishing boats and jet skis operate year round within Cook Inlet and can temporarily harass listed whales due to their physical presence within areas utilized for feeding and reproduction and also result in serious injury or death due to ship strikes. There are eight port facilities located in Cook Inlet (i.e. Anchorage, Point MacKenzie, Tyonek, Drift River, Nikiski, Kenai, Anchor Point, and Homer) and commercial shipping occurs year round. While no ship strikes have been definitively confirmed in Cook Inlet for any of the three species affected by the proposed action, in October 2007, a dead beluga whale washed ashore with “wide, blunt trauma along the right side of the thorax” (NMFS 2008) suggesting a ship strike may have caused the injury. In addition, beluga whales often concentrate near river mouths, which predispose them to strikes by high speed watercraft that have access to shallow, nearshore areas.

In addition to serious injury or direct mortality through ship strikes, listed whales have also been shown to respond to the general presence of vessels by exhibiting avoidance behaviors and signs of increased stress including tail slapping, rolling, diving, separation of mothers and young and abandonment of resting areas, among others (Kovacs and Innes, 1990; Kruse, 1991; Wells and Scott, 1997; Samuels and Gifford, 1998; Bejder et al., 1999; Colburn, 1999; Cope et al., 1999; Mann et al., 2000; Samuels et al., 2000; Boren et al., 2001; Constantine, 2001; Nowacek et al., 2007). Vessel avoidance may cause whale individuals in the action area to move away from important feeding areas or potential mates, both of which could adversely impact the population and impede recovery. Beluga whales in the Canadian Arctic have moved rapidly along ice edges away from approaching ice-breaking ships (Finley et al., 1990) while McGuire and Kaplan (2009) observed Cook Inlet beluga whales to be exceptionally vocal and playful with survey boats, which may mean they have habituated to their presence. Even though a greater concentration of vessel activity occurs north of the action area, we expect that harassment by smaller sized fishing vessels as well as other recreational vessels to remain a threat to listed whales located in and around the action area in the near future including within critical habitat designated for Cook Inlet beluga whales.

Ocean Noise

Within the action area and in the surrounding waters of Cook Inlet, beluga, fin, and humpback whales must compete acoustically with many natural and anthropogenic sounds. Man-made sources of noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging (Moore et al, 2000). While many of these sound sources occur outside of the action area, the ambient background noise can be detected throughout Cook Inlet and therefore, we considered these sound effects when evaluating this *Environmental Baseline*. The effects of man-made noise and associated increased "background" noises depend on several factors including the intensity, frequency and duration of the noise, the location and behavior of the whales upon exposure, and the acoustic nature of the environment.

Marine mammals use sound in the ocean environment to find prey, locate mates, rear young, navigate, and to avoid predators (Bradley and Stern, 2008). Underwater noise generated in the marine environment have the potential to increase stress levels, alter behavior, result in temporary or permanent hearing loss, and/or, in extreme cases, result in direct injury and even even death (Richardson et al., 1995; NRC, 2003; NRC, 2005; Clark and Ellison, 2004; Nowacek et al., 2007; Southall et al., 2007; Wright et al., 2008).

Commercial shipping traffic is a major source of low frequency anthropogenic noise in the action area. Although large vessels emit predominantly low frequency sound, studies report broadband noise from large cargo ships at levels exceeding two kHz, which may interfere with important biological functions of cetaceans (Holt, 2008). However, the primary concern of incidental shipping noise is not related to acute exposures, but rather to the general increase in continuous background ambient noise and the potential masking of marine animals' communication systems, their ability to hear mating calls, and their ability to pick up acoustic environmental cues that animals use to navigate and/or sense their surroundings, including sounds that are used to detect predators (OSPAR, 2009).

Another concern of increased sound from shipping traffic and recreational vessels is the gradual habituation of listed whales to these types of sound sources. Habituation may increase the risk of vessel strikes since the whales do not actively avoid the acoustic noise generated by an oncoming vessel. Several investigators have suggested that vessel noise may have caused humpback whales to avoid or leave feeding or nursey areas (Jurasz and Jurasz, 1979; Glockner-Ferrari and Ferrari, 1985; Salden, 1988), while others have suggested humpback whales may become habituated to vessel traffic and its associated noise (e.g. Watkins, 1986). Croll et al. (2001) examined exposure of fin whales to low frequency noise and found that whale foraging activity continued after exposure, and there were no apparent responses of whales to loud, low frequency noise sources; however, the authors acknowledged that these results do not address the cumulative impact of this noise on fin whales over larger spatial and time scales. Beluga whales may also habituate to vessel noise as evidenced by recent studies that show that belugas still inhabit areas with high disturbance and heavy boat traffic such as Port of Anchorage in the upper sections of Cook Inlet (Rugh et al., 2010). These studies show that increased vessel traffic in the action area will continue to affect the ability of cetaceans to perceive threats as well as to communicate with mates and other conspecifics in and around the action area.

Source sound pressure levels vary widely between construction activities with drilling operations being relatively low while pile-driving and the use of explosives comprising very high source levels (OSPAR, 2009). While studies documenting the effects of marine construction and industrial activities on cetaceans are limited, it’s expected that given the comparatively low source levels, injuries from either dredging or drilling operations are unlikely in marine mammals, except those located very close to the source (Southall et al., 2007). Underwater explosions, on the other hand, have the ability to permanently injure the auditory systems of marine mammals as Ketten et al. (1993) reported injury in the ears of two humpback whales stranded after underwater explosions. While noise generated from marine construction has the potential to affect individuals in the action area, it is unknown how these activities affect these listed whales at the population level.

Commercial sonar systems are used on recreational and commercial vessels and may affect listed whales in the action area. Sonar signals could affect several vocal characteristics or behaviors of cetaceans; however the degree to which these changes significantly affect cetaceans in the action area is unknown. Sonar is a lesser contributor to the overall ocean noise budget than other sources of anthropogenic sound (OSPAR, 2009). Also, the distribution of these sounds would be small because of their short durations and the fact that the high frequencies of the signals attenuate quickly in sea water (Richardson et al., 1995). Nevertheless, increased sonar emanating from multiple sources may increase effects of masking and cause short-term behavioral effects of cetaceans in the action area.

Seismic surveys using towed airguns also occur within Cook Inlet and are the primary exploration technique for oil and gas deposits and for fault structure and other geological hazards. Airguns generate intense low-frequency sound pressure waves capable of penetrating the seafloor and are fired repetitively at intervals of 10-20 seconds for extended periods (NRC, 2003). Most of the energy from the guns is directed vertically downward, but significant sound emission also extends horizontally. Peak sound pressure levels from airguns usually reach 235-240 dB at dominant frequencies of 5-300Hz (NRC, 2003). Most of the sound energy is at frequencies below 500Hz. Very little data exists on the effects of seismic surveys on cetaceans beyond short-term behavioral responses; however, where responses have been observed, it is not known whether these reactions were significant at the population level (OSPAR, 2009). In the United States, all seismic surveys for oil and gas exploration and most research activities involving the use of airguns with the potential to take marine mammals are covered by incidental harassment authorizations under the MMPA.

Cook Inlet experiences significant levels of aircraft traffic from the Ted Stevens Anchorage International Airport and several smaller runways. Lake Hood and Spenard Lake in Anchorage are heavily used by recreational seaplanes. Even though sound is attenuated by the water surface, Blackwell and Greene (2002) found aircraft noise can be loud underwater when jet aircraft are directly overhead. Richardson (1995) discovered that beluga whales in the Beaufort Sea will dive or swim away when low-flying (less than 500 meters) aircraft passed directly above them. However, beluga survey aircraft flying at approximately 244 meters (800 feet) in

Cook Inlet observed little or no change in beluga swim directions (Rugh et al., 2000). This is likely because beluga whales in Cook Inlet have habituated to routine small aircraft over flights. Beluga whales may be less sensitive to aircraft noise than vessel noise, but individual responses may be highly variable.

A study conducted by Greeneridge Sciences, Inc in 2001 made underwater and in-air recordings of various sound sources in Cook Inlet to quantify the acoustic environment (Blackwell and Greene, 2002). Sounds were analyzed with respect to their broadband and one-third octave band levels, and their spectral composition. In the study, four types of sound sources were analyzed: 1) overflights of planes landing at Anchorage International Airport and Elmendorf Air Force Base; 2) the Phillips A oil platform; 3) large and small vessels in Anchorage harbor; and 4) ambient sounds in areas removed from industrial activities. The researchers concluded that sound levels measured in Cook Inlet at the time of the study would not be expected to have more than a minor effect on Cook Inlet beluga whales based on the fact that beluga hearing is keenest (10-100 kHz) above the frequency range of most industrial noise reported in the study. Although captive beluga whales have provided some insight into beluga hearing and the noise levels that might damage their hearing capabilities, much less information is available on how noise might impact beluga whales behaviorally in the wild. In the Canadian high Arctic, beluga whales were observed to react to ice-breaking ships at distances of more than 80 kilometers, showing strong avoidance, apparent alarm calls, and displacement (Finley et al., 1990). The whales' activity patterns were apparently affected for up to two days following the event (Whitehead et al., 2000). Based on the Cook Inlet beluga whales' current range extending into areas with high anthropogenic noise and disturbance (upper Cook Inlet), we would not expect that current noise levels in the action area (lower Inlet) would be expected to be at levels that are causing whales to abandon critical habitat (i.e. adversely affecting PCE 5); however, the presence of shipping vessels traversing to and from the upper Inlet as well as coastal construction nearshore is expected to continue to harass listed whales in the action area in the near future including within portions designated as critical habitat.

In summary, listed whales occurring in the action area are regularly exposed to several sources of anthropogenic sound sources, the effects of which are not well understood. Short-term exposure to high-energy sound sources such as underwater explosions, pile driving and other marine construction have the potential to result in direct injury or even death to listed species located near the sound source while the effects of exposure to more moderate but generally increasing background sound levels from vessel traffic, seismic surveys, and sonar pings may increase the effects of masking in listed whales as well as the long term-habitat quality in the action area. The latter has the potential to lead to more population level effects such as overall distribution and rates of reproduction although more work needs to be done to confirm this.

Scientific Research Activities

Listed whales are exposed to research activities documenting their distribution and movements within Cook Inlet and the greater Alaska region as authorized by NMFS permits. Currently, there are nine active permits authorizing "takes' for the species affected by the proposed action in the greater Alaska region with one permit occurring exclusively within Cook Inlet (i.e. vessel surveys conducted by LGL, Ltd in Upper Cook Inlet). Broader based research activities include close vessel and aircraft approaches, biopsy sampling, tagging, the opportunistic collection of sloughed skin, and active acoustic experiments. All activities are non-lethal and no mortality is currently exempted for the affected species within Cook Inlet. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by the NMFS must also be reviewed for compliance with section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species. Repeated disturbances of individuals likely occur each year; however, all permits contain conditions requiring the permit holders to coordinate their activities with the Alaska regional office and other permit holders and, to the extent possible, share data to avoid unnecessary duplication of research.

There is evidence that listed whales may be either sensitized by multiple approaches (Lundquist, 2007) which can increase their stress levels, and possibly exacerbate their reactions to biopsy sampling or tagging; however, whales have also been shown to become habituated to boats as a result of multiple approaches, possibly leading to a lesser reaction from other research activities performed on the whales as a result (Whitehead et al., 1990; Weinrich et al., 1991; Weinrich et al., 1992; Clapham and Mattila, 1993; Jahoda et al., 2003; Best et al., 2005; Richter et al., 2006). If whales are already in a stressful situation with a close approach, there is a good chance that the tagging or removal of the biopsy sample increases their stress response. It is clear that the approach itself may play a role in the extent to which a whale reacts to biopsying or tagging. Whales that are biopsied following a fast approach may respond more intensely to the impact of the dart than if approached slowly (Whitehead et al., 1990; Brown et al., 1991; Weinrich et al., 1991; Weinrich et al., 1992; Jahoda et al., 2003). When approaches are conducted slowly, the whales tend to exhibit minimal responses that are short-lived (Clapham and Mattila, 1993). Researchers operating in the action area are required to approach whales slowly using a converging course technique that should minimize the stress response of the whales according to the literature.

The fact that multiple permitted “takes” of listed whales is already permitted and is expected to continue to be permitted in the future, means that short term behavioral harassment from similar research activities has the ability to contribute to or even exacerbate the non-lethal stress responses generated from other threats occurring in the action area. The point at which this leads to a measurable cumulative impact on the survival and recovery of listed whales, however, is uncertain. Our ability to detect long-term effects from research activities will depend on several factors including our ability to better detect sub-lethal effects from research actions as well as funding and prioritizing long-term studies investigating survival and reproductive abilities of listed species targeted by similar types of research in the past. This may lead to statistically significant trends showing whether or not repeated non-lethal disturbances by research activities are affecting the ability of listed whales to survive and recover in the wild to an appreciable degree.

EFFECTS OF THE PROPOSED ACTION

Pursuant to Section 7(a)(2) of the ESA, federal agencies are directed to insure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. In this section, we describe the potential physical, chemical, or biotic stressors associated with the proposed action, the probability of individuals of listed species being exposed to these stressors, and the probable responses of those individuals (given probable exposures) based on the best scientific and commercial evidence available. As described in the *Approach to the Assessment* section, for any responses that would be expected to reduce an individual's fitness (i.e., growth, survival, annual reproductive success, and lifetime reproductive success), the assessment would consider the risk posed to the viability of the population(s) those individuals comprise and to the listed species those populations represent. In the case of critical habitat, for any responses that are expected to reduce the quantity, quality, or availability of the primary or secondary constituent elements of the area of designated critical habitat (or physical, chemical, or biotic phenomena), we ask if those reductions are likely to be sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area. The purpose of this assessment is to determine if it is reasonable to expect the proposed research activities to have effects on listed whales that could appreciably reduce their likelihood of surviving and recovering in the wild or whether effects to critical habitat would be sufficient to reduce the conservation value of the entire critical habitat designation for Cook Inlet beluga whales.

In conducting the effects analysis for the proposed action, several assumptions were made due to gaps in information available at the time of this consultation. Definitive statements on the effects of sound from the proposed survey activities are complicated because detection of sounds by the affected animals depends on the acoustic properties of the source (spectral characteristics and intensity), transmission characteristics of the water, and sensitivity of hearing in each species. Furthermore, responses to sounds can be highly variable between individuals and may depend on an animal's activity at time of exposure, motivation for that activity, age, and whether an animal has developed a habituation or sensitization to a particular sound.

For this consultation, we are particularly concerned about behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level consequences. The proposed permit would authorize non-lethal "takes" by harassment of listed species during survey activities. The ESA does not define harassment nor has NMFS defined the term pursuant to the ESA through regulation. However, the MMPA defines harassment as any act of pursuit, torment, or annoyance which has the potential to injure or disturb a marine mammal or marine mammal population in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [16 U.S.C. 1362(18)(A)]. The latter portion of this definition (that is, "...causing disruption of behavioral patterns including...migration, breathing, nursing, breeding, feeding, or sheltering") is almost identical to the U.S. Fish and Wildlife Service's regulatory definition of "harass"[5] pursuant to the ESA. For this Opinion, we define harassment similarly: an intentional or unintentional human act or omission that creates the probability of injury to an individual animal by disrupting one or more behavioral patterns that are essential to the animal's life history or its contribution to the population the animal represents.

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[5] An intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3)

Some forms of harassment including helicopter and fixed wing aircraft flyovers will occur in areas designated as critical habitat for Cook Inlet beluga whales. Therefore, these activities also have the potential to reduce the conservation value of designated critical habitat for Cook Inlet beluga whales by introducing noise and other visual disturbance. Since noise at levels causing beluga whales to abandon critical habitat would adversely affect PCE 5, we are particularly concerned with noise disturbance that may cause beluga whales to abandon critical habitat located within the path of the proposed surveys.

Potential Stressors

The stressors resulting from the proposed survey activities include visual disturbance and noise emanating from survey aircraft both from Hughes 500 helicopters and twin-engine airplanes (Aero Commander 680 or 690) operating at altitudes between 90–150 meters (~300-500 feet) above sea level.

Exposure Analysis

Exposure analyses identify the co-occurrence of ESA-listed species and critical habitat with the action's effects in space and time, and identify the nature of that co-occurrence. The exposure analysis identifies, as possible, the number, age or life stage, and gender of the individuals likely to be exposed to the action's effects and the population(s) or subpopulation(s) those individuals represent. For the exposure analysis conducted for this consultation, we estimated the number of individual whales likely to be exposed to the effects of the proposed research activities using the best information available to us including recent population estimates, the maximum survey effort expected from the researchers over the life of the permits, and past take numbers reported from permits issued to the same researchers or others that have performed similar types of research in nearby areas. We also identified areas designated as critical habitat for Cook Inlet beluga whales that would be expected to be exposed to the stressors identified for the proposed action as well as the nature of that exposure.

While annual reports detailing prior "takes" are useful in estimating exposure levels, it must be noted that the threshold for reporting whether an actual "take" occurred has evolved over the years, thus possibly introducing some level of human error or bias into numbers reported in prior annual reports (e.g. some researchers may have reported a "take" only if the animal somehow reacted to an approach while other researchers may have assumed a "take" whether the animal exhibited a visible reaction or not). Thus, past annual reports introduce some level of uncertainty as to their accuracy for predicting future activities, levels of effort, and expected "takes" of listed species. Despite this uncertainty, annual reports remain one of the most valuable resources to the Endangered Species Division for estimating exposure levels of future permit actions and were thus utilized in this consultation. The Permits Division has made an effort to standardize reporting of "takes" resulting from research activities which should lead to more accurate and informative annual reports in future years and hopefully reduce the level of error and uncertainty associated with the number of "takes" reported.

Our exposure analysis identified the numbers of Cook Inlet beluga, fin, and humpback whales expected to occur along the survey track lines based on prior survey data located in and around the action area. **Table 2** below identifies the expected number of listed whales reasonably expected to be exposed to the stressors associated with permit No. 15750. Individuals may be of either sex. The Endangered Species Division reviewed the researchers past survey data, the Cook Inlet beluga whale opportunistic sightings database, and other studies involving aerial surveys conducted to the north of the action area in Turnagain and Knik Arm (*see* McGuire et al., 2011) and south of the action area within lower Cook Inlet (*see* Zerbini et al., 2006) in order to estimate the mean total exposure events expected per survey. We then factored in the maximum level of research effort that could possibly occur (52 surveys) to determine the maximum exposure over the course of each year. NMFS expects that in any given year, not all proposed "takes" would occur given the variability in research effort due to funding and weather as well as the fact that not all animals encountered would be expected to illicit reactions that would rise to the level of "take" under the ESA. However we have provided this estimate of "take" as a worse-case scenario for the affected species given the best scientific information that was available at the time of this consultation. Based on this analysis, the maximum exposure assessed did not deviate from the numbers proposed by the Permits Division as part of their initiation package (i.e. take numbers that were previously presented in **Table 1**).

Table 2. Exposure Analysis for the Proposed Action

SPECIES (LIFE STAGE)	TYPE OF STRESSOR	NUMBER OF SURVEYS (EXPOSURE EVENTS)	NUMBER OF ANIMALS EXPOSED PER SURVEY	TOTAL CUMULATIVE EXPOSURES PER YEAR
Cook Inlet Beluga Whale (All)	Noise Disturbance from Survey Aircraft	52	50	2600
Humpback Whale (All)	Noise Disturbance from Survey Aircraft	52	17	884
Fin Whale (All)	Noise Disturbance from Survey Aircraft	52	6	312

We expect that each whale counted during a survey would be exposed to noise disturbance due to the expected altitudes. The duration of this exposure could range from a few seconds from an aircraft passing overhead to a few minutes if the researchers need to accurately count individuals in large groups or in order to accurately identify the species of a particular individual. We expect individuals will be exposed multiple times throughout the course of the year (a maximum of 52 exposures per animal given the fact that 52 surveys are possible each year over the life of the permit).

A portion of critical habitat designated for Cook Inlet beluga whales would also be exposed to noise disturbance from helicopter and fixed wing aircraft. Specifically, the southwest portion of Area 2 will be exposed (*see* **Figure 2** in the *Status of the Species* section of this Opinion) which includes waters within two nautical miles seaward of the Mean High Water line along the western shoreline from Chinitna Bay to the southern shoreline of Kamishak Bay. All other portions of Area 2 as well as the entire area encompassing Area 1 of designated critical habitat will not be exposed to the effects of the proposed action.

Response Analysis

As discussed in the *Approach to the Assessment* section of this Opinion, response analyses determine how listed resources are likely to respond after being exposed to an action's effects on the environment or directly on listed animals themselves. For the purposes of consultation, our assessments try to detect potential lethal, sub-lethal, physiological, or behavioral responses that might reduce the fitness of individuals affected in the action area. For analyses of critical habitat, our assessments determine if primary or secondary constituent elements of designated critical habitat (or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species) are likely to respond given exposure to the direct or indirect consequences of the proposed action on the natural environment and if so, whether those responses are likely to be sufficient to reduce the quantity, quality, or availability of those constituent elements or physical, chemical, or biotic phenomena. Ideally, response analyses would consider and weigh evidence of adverse consequences as well as evidence suggesting the absence of such consequences.

Responses of Listed Whales to Aircraft Noise

When survey aircraft fly below certain altitudes (about 500 meters or 1600 feet), they have caused marine mammals to exhibit behavioral responses that might constitute a significant disruption of their normal behavioral patterns similar to evading a predator (Perry, 1998; Patenaude et al., 2002). For instance, about 14 percent of bowhead whales approached during aerial surveys exhibited short term avoidance of the aircraft (Patenaude et al., 2002), and gray whale cow-calf pairs have shown to react sensitively to aircraft with calves swimming beneath their mothers (Moore and Clark, 2002). Belugas in shallow summer areas are known to react to aircraft passing overhead by swimming away and/or diving for longer periods (Fraker, 1978; Fraker and Fraker, 1979; Finley, 1982; Finley et al., 1982; Gales, 1982; Caron and Smith, 1990). Belugas in offshore waters near Alaska in spring had variable reactions to a turbine helicopter or fixed wing aircraft with some individuals unresponsive while others responded by looking upwards, diving abruptly, or turning sharply in the water (Richardson et al., 1991).

Patenaude et al. (2002) studied beluga reactions to aircraft at various altitudes. They found that 70 percent of avoidance reactions occurred at altitudes of less than 600 feet. Reactions included longer dives, diving under ice pans, and temporary displacement. Other studies conducted in the St. Lawrence estuary documented that belugas dove suddenly when jet fighters and a Bell 206 helicopter flew overhead at 1,000 feet or lower (Macfarlane, 1981; Sergeant and Hoek, 1988). Bel'Kovich (1960) and Kleinenberg et al. (1964) revealed that belugas did not react to an aircraft of unspecified type flying at 1,640 feet, but when the aircraft was at 500-660 feet they dove for longer periods, had shorter surface intervals, and sometimes exhibited avoidance by abruptly swimming away. Since researchers are expected to be flying at low altitudes [i.e. 90–150 meters (300-500 feet) above sea level], we would expect similar types of avoidance reactions to aerial surveys conducted under the proposed action.

Relatively little is known about the importance of noise generated by aircraft eliciting a reaction in beluga whales compared to visual cues. Patenaude et al. (2002) conducted a study of aircraft sound disturbance and as well as reactions of beluga whales in the Alaskan Beaufort Sea. After measuring aircraft sounds underwater, the group found that the dominant low frequency sound of the aircraft may be inaudible or at most only weakly audible to beluga whales, who hear most acutely between 10-100 kHz (Fay, 1988; Blackwell and Greene, 2002). They concluded that mid-frequency sound components, visual cues, or both, are probably the factors that could elicit beluga behavioral reactions to aircraft compared to the dominant low frequency noise that occurs as the aircraft passes overhead. Since researchers are not expected to circle or closely approach individuals whales for extended periods (few seconds to a few minutes for large groups) we expect that any reactions either by whales hearing the aircraft passing overhead or by spotting the aircraft while at the surface would be very temporary and the animals would be expected to resume normal behaviors shortly after the aircraft passes similar to observations seen for vessel surveys (*see* Orr et al., 2001; Lerczak et al., 2000).

Anthropogenic noise above ambient levels and within the same frequencies used by listed whales may interfere with hearing and communication. Interference, or masking, generally occurs when the interfering noise is of a similar frequency and louder than the auditory signal received by an animal processing echolocation signals or listening for acoustic information from mates or other conspecifics. The critical ratio, or amount by which a pure-tone signal must exceed the spectrum level background noise in order to be audible, of beluga whales spans across the widest frequency range of whales measured by Johnson et al. (1989) (40 Hz to 115 kHz) with their keenest hearing estimated to be in range of 10-100 kHz (Fay, 1988; Blackwell and Greene, 2002). Comparatively, the range for humpback and fin whales is dominated by lower frequencies [i.e. under 1 kHz for humpbacks and 10-200 Hz band range for fin whales (Watkins, 1981; Watkins et al., 1987; Edds, 1988; Thompson et al., 1992)]. While some of the low to mid frequencies expected by the aerial flights may be audible to listed cetaceans in the action area, any masking of communication between individuals is expected to be minimal and would only occur during the seconds or minutes that an aircraft remains within a hearing range of the whales. The short time (seconds to a few minutes) that the aircraft will remain within audible distance of the whales is not expected to elicit any significant masking response and therefore, these effects are discountable. Beluga whales may shift the frequency of their echolocation clicks to avoid masking by anthropogenic noise similar to bottlenose dolphins, a situation that further mitigates this effect (Au, 1993; Tyack, 1999; Tyack, 2000).

Responses of Cook Inlet Beluga Whale Critical Habitat to Aircraft Noise

Aircraft surveys conducted each month throughout the year over the duration of the permit period would expose some areas of critical habitat designated for Cook Inlet beluga whales to noise generated by the helicopters and fixed wing aircrafts in the low to mid frequency ranges audible to listed whales (as discussed above). Researchers are proposing to conduct aerial surveys over a 1-2 day period approximately twice/month during the spring and fall and once/month during May, June, December, and January. Therefore, the proposed action would introduce aircraft noise over critical habitat areas every month over the five year period, although the actual localized duration of the noise at any one time would range from a few seconds to a few minutes as the aircraft passes by or temporarily circles a group of animals to get an accurate count.

As discussed in the *Status of the Species* section of this Opinion, the PCEs deemed essential to the conservation of Cook Inlet beluga whales include the following: (1) Shallow intertidal and subtidal waters of Cook Inlet (depths less than 30 feet at Mean Lower Low Water) that are within five miles of high and medium flow anadromous fish streams; (2) Fish species deemed to be the primary prey species of the Cook Inlet beluga including Chinook salmon, sockeye salmon, chum salmon, Coho salmon, Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole; (3) The absence of toxins or other agents of a type or amount harmful to Cook Inlet beluga whales; (4) Unrestricted passage within or between critical habitat; and, (5) The absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales. PCE's 1-4 are not expected to be affected by the noise generated by the aircraft as this stressor is not expected to affect oceanographic conditions, prey composition or distribution, chemical components of the habitat, or result in unrestricted passage within or between critical habitat areas. However, aircraft noise may affect PCE 5 since noise generated in the action area may cause some whales to avoid the sound thereby potentially displacing them from critical habitat as a result.

Beluga whales are expected to respond to the noise from the aircraft in a similar fashion to how they respond to predators, namely in the form of longer dives, diving under ice pans, and temporary displacement from areas by swimming away from the sound (Fraker, 1978; Fraker and Fraker, 1979; Finley, 1982; Finley et al., 1982; Gales, 1982; Caron and Smith, 1990; Richardson et al., 1991). Based on a review of the literature, there was one report suggesting permanent habitat displacement in which Inupiat hunters concluded that low-flying aircraft were preventing belugas from entering an Alaskan bay (Burns and Seaman, 1985). However our review of the literature as discussed in the *Environmental Baseline* does not suggest that beluga whales are being displaced from critical habitat by way of aircraft noise at the present time nor do we expect this response to occur as a result of the proposed action. Blackwell and Greene (2002) reported none of the sound levels measured in their study (including those measured for military jets and commercial planes flying over Cook Inlet) exceeded 149 dB re: 1 μPa mean square pressure, which is well below the 180 dB limit whereby underwater sound pressure levels are expected to harass marine mammals (NMFS, 2000).

We also draw from studies looking at how whales responded after being exposed to other forms of disturbance, such as close approach by vessels for tagging purposes. Shelden (1994) pursued beluga whales for tagging activities in the northwest corner of Cook Inlet and reported that tagged individuals as well as belugas located in the vicinity of the vessel never abandoned the study area. Animals would move 300 to 500 meters away from the vessel's tagging operation, but once the vessel stopped approaching the whales, they would return to within 100 meters of the vessel within a short period of time. These results were also reported by Lerczak et al. (2000), who also participated in the study.

In addition, Rugh et al., (2010) reported that the range of the Cook Inlet beluga whales appears to be contracting into areas with the highest anthropogenic disturbance, mostly in the Upper Inlet north of the action area. The fact that beluga whales continue to utilize and even prefer areas with high anthropogenic disturbance, including habitat surrounded by highly developed coastal areas, airports, ports, and military installations suggests that belugas have habituated to the cumulative noise or that sound levels have not yet reached a magnitude that would cause whales to permanently abandon these important habitat areas. Given the fact that this additional critical habitat located north of the action area is more disturbed than the habitat to be affected by the proposed action, we do not expect that additional exposure of aircraft noise as a result of the proposed action would cause whales to permanently abandon critical habitat.

Based on the review of the literature, we believe the noise generated by the survey activities may lead to temporary displacement whereby beluga whales may temporarily leave critical habitat for a brief period but would be expected to return and resume normal behaviors shortly after the aircraft left the area. As a result, we do not expect responses to include permanent habitat displacement that would serve to lower the conservation value of the critical habitat designated in the action area.

Risk Analysis

Our risk analyses begin by identifying the probable risks actions pose to listed individuals that are likely to be exposed to an action's effects. Our analyses then integrate those individual risks to identify consequences to the populations those individuals represent. Our analyses conclude by determining the consequences of those population-level risks to the species those populations comprise. For analyses of critical habitat, we determine if an action is expected to reduce the quality, quantity, or availability of constituent elements or essential physical, chemical, or biological features at a level sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area. In this step of our assessment, we combine information about the contribution of constituent elements (or other essential features) to the conservation value of those areas of critical habitat that occur in the action area, given the physical, chemical, biotic, and ecological processes that produce and maintain those constituent elements in the action area. If the conservation value of designated critical habitat in an action area is reduced, the final step of our analyses asks if those reductions are likely to be sufficient to reduce the conservation value of the entire critical habitat designation.

The proposed aerial surveys would result in exposure of listed Cook Inlet beluga, fin, and humpback whales to localized noise disturbance from low flying aircraft for brief periods (seconds to a few minutes) each month over the entire five year period. Surveys would be conducted no more than twice a month and would not be done consecutively within the same week. The responses we expect for listed whales to aircraft noise disturbance, such as swimming away, diving, or spending more time underneath the surface may result in interruptions of essential behavior and certain physiological processes such as feeding, mating, nursing, resting, digestion etc. (Frid and Dill, 2002; Romero, 2004; Walker et al., 2006). However, we expect these responses to be short term in nature and would not be expected to result in long-term fitness consequences for the individuals affected in the action area given the fact that whales are expected to resume normal activities shortly after the aircraft leaves the area. Therefore, based on the best scientific information available, we expect that responses to the proposed aerial surveys are not likely to cause a reduction in growth, survival, annual reproductive success, or lifetime reproductive success (i.e. fitness) and would not have an appreciable effect on the extinction risk of the population(s) these individuals represent or the species those populations comprise.

As discussed in the *Response Analysis* above, we believe the noise generated by the survey activities may lead to temporary displacement whereby beluga whales may temporarily leave critical habitat for a brief period but would be expected to return and resume normal behaviors shortly after the aircraft left the area. As a result, we do not expect responses to lead to permanent habitat displacement of critical habitat areas designated in the action area and any reduction in the quality of PCE 5 (i.e. absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales) would not be expected to sufficiently reduce the conservation value of the critical habitat in the action area nor would it reduce the conservation value of the designation as a whole based on the best available information.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this Opinion. Future Federal actions, including research authorized under ESA Section 10(a)1(A), that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Future cumulative effects from these and other types of federal actions will be investigated in future consultations, most notably in the *Status of the Species* and *Environmental Baseline* sections of Opinions which inform the effects analyses for specific federal actions. Other possible effects that may be acting in conjunction with federal actions and could possibly contribute to a cumulative impact on listed species are described below.

Killer whale predation could remain a potentially significant threat to the conservation and recovery of Cook Inlet beluga whales, although exact implications are unknown. Given the small population size of the species, predation may have a significant effect on abundance compared to other listed whales in the future. Strandings will most likely continue to occur in Cook Inlet, but stranding events are unpredictable and causes are not always apparent. Mass strandings occurring in Turnagain Arm coincide with extreme tidal fluctuations or killer whale sightings as reported by Shelden et al. (2003). It is reasonable to assume mass strandings would continue to occur in the action area, although the exact causes and implications to the population remain unknown.

The effects of climate variability are expected to continue to affect listed whales throughout their respective ranges. Cook Inlet is a dynamic environment which experiences continual change in its physical composition. Changes in water temperature might continue to have the greatest effect on listed whales in Cook Inlet since these changes affect zooplankton biomass and composition, and affect the amount of ice that develops during the winter. More research needs to be done to determine if the region is indeed shifting to a colder PDO phase as well as the effects these phase shifts have on the dynamics of prey populations important to Cook Inlet beluga whales and the conservation value of its designated critical habitat in the future.

The number of vessels and tonnage of goods shipped by the U.S. fleet are increasing (e.g. there has been nearly a 30 percent increase in volume between 1980 and 2000) (NRC, 2003) and will lead to more vessel traffic throughout the action area in the future. The primary concern of increased levels of shipping noise expected from increased vessel traffic is not related to acute exposures, but rather to the general increase in continuous background ambient noise and the potential masking of marine animals' communication systems, their ability to hear mating calls, and their ability to pick up acoustic environmental cues that animals use to navigate and/or sense their surroundings, including sounds that are used to detect predators (OSPAR, 2009). Expanded use of commercial sonars is also expected to increase, further exacerbating these effects (NRC, 2003). At louder levels, noise may result in disturbance and harassment, or cause temporary or permanent damage to the whales' hearing.

Additionally, unrelated factors may be acting together to affect listed species and the conservation value of designated critical habitat. For example, vessel effects combined with the stresses of reduced prey availability or increased contaminant loads may reduce foraging success and lead to chronic energy imbalances and poorer reproductive success which all may work to lower an animal's ability to suppress disease. The net effect of these disturbances is dependent on the size and percentage of the population affected, the ecological importance of the disturbed area to the animals, the parameters that influence an animal's sensitivity to disturbance or the accommodation time in response to prolonged disturbance (Geraci and St. Aubin, 1980). More studies need to be done to identify the long term effects to listed whales and critical habitat from current stressors as well as the potential additive effect that multiple stressors acting in conjunction over time will have on the survival and recovery of listed whales evaluated in this Opinion.

After reviewing available information, NMFS is not aware of any additional future non-federal activities in the action area that would not require federal authorization that may contribute to a cumulative impact on listed species or critical habitat evaluated in this Opinion.

INTEGRATION AND SYNTHESIS OF EFFECTS

The following text integrates and synthesizes the *Description of the Proposed Action*, *Status of the Species*, *Environmental Baseline*, *Effects of the Proposed Action*, and *Cumulative Effects* sections of this Opinion. This information was used to assess the risk the proposed research activities pose to the future survival and recovery of listed Cook Inlet beluga, fin, and humpback whales as well as the conservation value of critical habitat designated for Cook Inlet beluga whales.

As explained in the *Approach to the Assessment* section, risks to listed individuals are measured using changes to an individual's "fitness." When listed plants or animals exposed to an action's effects are not expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise (e.g., Brandon, 1978; Mills and Beatty, 1979; Stearns, 1992; Anderson, 2000). When individuals of listed plants or animals are expected to experience reductions in fitness in response to an action, those fitness reductions can reduce the abundance, reproduction, or growth rates of the populations that those individuals represent (see Stearns, 1992). If we determine that reductions in individual plants' or animals' fitness reduce a population's viability, we consider all available information to determine whether these reductions are likely to appreciably reduce the viability of the species as a whole.

Destruction or adverse modification determinations must be based on an action‘s effects on the conservation value of habitat that has been designated as critical to threatened or endangered species. If an area encompassed in a critical habitat designation is likely to be exposed to the direct or indirect consequences of the proposed action on the natural environment, we ask if primary or secondary constituent elements included in the designation (if there are any) or physical, chemical, or biotic phenomena that give the designated area value for the conservation of listed species are likely to respond to that exposure. If responses are expected, we ask if those responses are likely to be sufficient to reduce the quantity, quality, or availability of those constituent elements or physical, chemical, or biotic phenomena, and if so, whether they are likely to be sufficient to reduce the conservation value of the designated critical habitat for listed species in the action area and finally the conservation value of the entire critical habitat designation.

The Permits Division proposes to issue a permit to ABR, Inc., Environmental Research and Services, Fairbanks, Alaska, for directed "takes" of marine mammals, including listed Cook Inlet beluga whales, humpback whales, fin whales, and members of the Western U.S. Distinct Population Segment (DPS) of Steller sea lions for scientific research purposes. The purpose of the proposed research is to document seasonal distribution and abundance of marine mammals in the western lower Cook Inlet, Alaska, through aerial surveys in order to inform future federal conservation and management actions affecting these species in the target area. The Endangered Species Division did not consult on the effects to Steller sea lions since the takes associated with the proposed action were already analyzed in a prior biological opinion.

Research would occur year-round (one or two surveys per month for every month of the year) and the permit would expire five years from the date of issuance. Aerial surveys by helicopter would be conducted twice per month in Iniskin, Iliamna, and Chinitna bays in all months of the year except December, January, May, and June, where only one survey will be conducted. Each survey will last a day or two and will involve two replicate passes of the study area. Surveys will be flown at speeds between 80-130 kilometers per hour and at altitudes between 90–150 meters (300-500 feet) above sea level. In addition to helicopter surveys, researchers also intend to conduct aerial surveys using a fixed wing aircraft to document abundances of sea otters and other marine mammals in Kamishak Bay. Researchers will use a twin-engine airplane (Aero Commander 680 or 690) at altitudes between 90–150 meters (300-500 feet) above sea level and at speeds of 185–205 kilometers per hour within the 50-meter isobath. Researchers will generally view and record animals from the side. Circling of marine mammals would be avoided in most cases but may occur in order to assist researchers in counting groups of animals or to confirm the species of animals that could not be identified during the first pass. The action area extends from the shoreline to about 250 meters from shore (or within the 50 meter isobath) within Kamishak, Iliamna, Iniskin, and Chinitna Bays.

Cook Inlet beluga whales may occur in the action area during the late spring through early fall months before venturing out to the mid and upper portions of Cook Inlet outside of the action area during late fall and winter (Vate-Brattstrom et al., 2010). The most recent aerial surveys conducted in 2009-2010 estimated the population at 340 individuals (NMFS, 2010a) which would indicate a 75 percent decline in the population over the past 30 years. Rugh et al. (2010) documented the center of the summer range of beluga whales contracted northeastward into upper Cook Inlet from the 1970's to the 2000's which was a curious result given the fact that the Upper portions of the Inlet are often the most disturbed in Cook Inlet. The Cook Inlet beluga whale population continues to be threatened by a multitude of factors shaping its current status including stranding events, predation by killer whales, interaction with fishing activities, subsistence harvest, and various forms of habitat degradation.

Designated critical habitat for Cook Inlet beluga whales located in the action area includes waters within two nautical miles seaward of the Mean High Water line along the western shoreline from Chinitna Bay to the southern shoreline of Kamishak Bay. The primary constituent elements (PCEs) deemed essential to the conservation of Cook Inlet beluga whales include: (1) Shallow intertidal and subtidal waters of Cook Inlet (depths less than 30 feet at Mean Lower Low Water) that are within five miles of high and medium flow anadromous fish streams; (2) Fish species deemed to be the primary prey species of the Cook Inlet beluga including Chinook salmon, sockeye salmon, chum salmon, Coho salmon, Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole; (3) The absence of toxins or other agents of a type or amount harmful to Cook Inlet beluga whales; (4) Unrestricted passage within or between critical habitat; and, (5) The absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales. Critical habitat in the action area includes areas important for feeding during the fall and winter months as well as provides transit areas for belugas traveling to and from the foraging and calving areas to the north. Threats affecting the conservation value of Cook Inlet beluga whale critical habitat include shifts in climate affecting oceanographic features and prey distribution (affecting PCE 2), commercial and recreational fisheries depleting prey resources within the critical habitat (affecting PCE 2), degradation of habitat due to pollution from land based sources (affecting PCE 3), disturbance due to vessel interactions and shoreline development influencing the movements and mobility of belugas whales between critical habitat areas (affecting PCE 4), and increasing ambient ocean noise introduced into critical habitat areas by various anthropogenic sound sources (affecting PCE 5).

Most fin and humpback whales in the northern hemisphere migrate seasonally from the Arctic in summer to lower latitudes in the winter to breed. Historically, fin and humpback whale populations worldwide were severely affected by commercial whaling in the 20th century in the North Atlantic, North Pacific, and Southern oceans. Braham (1991) compiled available regional estimates and estimated the global population of fin whales in 1991 to be about 119,000 individuals, which represented about a quarter of his estimated pre-exploitation abundance of 464,000 individuals. Calambokidis et al. (2008) estimated that the current population of humpback whales in the North Pacific Ocean consisted of about 18,300 adult individuals and that the population appears to be increasing. The main stressors affecting the ability of fin and humpback whales to recover include ongoing effects from prior commercial whaling, interaction with fishing gear, ship strikes, and various sources of habitat degradation.

Taken together, the components of the environmental baseline for the action area include sources of natural mortality such as predation, disease, and parasites as well as influences from natural oceanographic and climatic features. Circulation and productivity patterns may influence prey distribution and habitat quality for listed whale species as well as possibly affect the conservation value of designated critical habitat for Cook Inlet beluga whales at present and in the future. The baseline also includes human activities resulting in disturbance, injury, or mortality of individuals. These activities include the direct subsistence harvest of Cook Inlet beluga whales, habitat degradation (e.g., due to contaminants and noise), vessel traffic and risk of ship strikes, entrapment or entanglement in fishing gear, and harassment from other permitted scientific research activities. Based on the Cook Inlet beluga whales' current range extending into areas with high anthropogenic noise and disturbance (upper Cook Inlet), we would not expect that current noise levels in the action area (lower Inlet) would be expected to be at levels that are causing whales to abandon critical habitat (i.e. adversely affecting PCE 5); however, the presence of shipping vessels traversing to and from the upper Inlet as well as coastal construction nearshore is expected to continue to harass listed whales in the action area in the near future.

For this consultation, we were particularly concerned about behavioral disruptions that may result in animals that fail to feed or breed successfully or fail to complete their life history because these responses are likely to have population-level consequences. The proposed permit would authorize non-lethal "takes" by harassment of listed species during aerial survey activities due to noise and visual disturbance from the aircraft. Our exposure analysis identified the numbers of Cook Inlet beluga, fin, and humpback whales expected to occur along the survey track lines based on prior survey data located in and around the action area. After reviewing the best available information, we assessed exposure at the levels proposed by the Permits Division. Therefore, we expect that for each survey, a maximum of 50 Cook Inlet beluga whales, 17 humpback whales, and 6 fin whales may be encountered. Since aerial surveys will occur each month throughout the year, we calculated that a cumulative maximum exposure of 2,600 Cook Inlet beluga whales, 884 humpback whales, and 312 fin whales may occur each year over the life of the permit. We expect individuals will be exposed multiple times throughout the course of the year (a maximum of 52 exposures per animal given the fact that 52 surveys are possible each year over the life of the permit). NMFS expects that in any given year, not all proposed "takes" would occur given the variability in research effort due to funding and weather as well as the fact that not all animals encountered would be expected to illicit reactions that would rise to the level of "take" under the ESA.

When survey aircraft fly below certain altitudes (about 500 meters or 1600 feet), they have caused marine mammals to exhibit behavioral responses that might constitute a significant disruption of their normal behavioral patterns similar to evading a predator (Perry, 1998; Patenaude et al., 2002). Belugas in shallow summer areas are known to react to aircraft passing overhead by swimming away and/or diving for longer periods (Fraker, 1978; Fraker and Fraker, 1979; Finley, 1982; Finley et al., 1982; Gales, 1982; Caron and Smith, 1990). Since researchers are expected to be flying at low altitudes [i.e. 90–150 meters (300-500 feet) above sea level], we would expect similar types of avoidance reactions to aerial surveys conducted under the proposed action. Patenaude et al. (2002) concluded that mid-frequency sound components, visual cues, or both, are probably the factors that could elicit beluga behavioral reactions to aircraft while the dominant low frequency sounds are expected to be the main sounds affecting fin and humpback whales. Since researchers are not expected to circle or closely approach individuals whales for extended periods (few seconds to a few minutes for large groups) we expect that any reactions either by whales hearing the aircraft passing overhead or by spotting the aircraft while at the surface would be very temporary and the animals would be expected to resume normal behaviors shortly after the aircraft passes similar to observations seen for vessel surveys (Orr et al., 2001; Lerczak et al., 2000). The short time (seconds to a few minutes) that the aircraft will remain within audible distance of the whales is not expected to elicit any significant masking response.

The proposed action would introduce aircraft noise over critical habitat areas every month over the five year period, although the actual localized duration of the noise at any one time would range from a few seconds to a few minutes as the aircraft passes by or temporarily circles a group of animals to get an accurate count. For critical habitat, we were particularly concerned with noise levels that may cause some whales to abandon critical habitat which would serve to lower the conservation value by impacting PCE 5 (i.e. absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales). Based on the review of the literature, we believe the noise generated by the survey activities may lead to temporary displacement whereby beluga whales may temporarily leave critical habitat for a brief period but would be expected to return and resume normal behaviors shortly after the aircraft left the area. As a result, we do not expect responses to include permanent habitat displacement that would serve to lower the conservation value of the critical habitat designated in the action area.

We analyzed the risk associated with exposing listed whales and critical habitat to noise and visual disturbance from survey aircraft. We expect that the short term behavioral responses (i.e. swimming away from the sound, diving underwater etc.) would cease a short time after exposure and would not result in any long term fitness consequences nor would they result in permanent habitat displacement from critical habitat in the action area. Therefore, based on the best scientific information available, we expect that responses to the proposed aerial surveys are not likely to cause a reduction in growth, survival, annual reproductive success, or lifetime reproductive success (i.e. fitness) for individuals that would have an appreciable effect on the respective species' risk of extinction nor would responses sufficiently reduce the conservation value of the critical habitat in the action area and the designation as a whole.

Our analysis concluded with an evaluation of cumulative effects expected for listed species and critical habitat affected by the proposed action. Killer whale predation could remain a potentially significant threat to the conservation and recovery of Cook Inlet beluga whales, although exact implications are unknown. It is reasonable to assume mass strandings would continue to occur that could significantly affect the abundance of Cook Inlet beluga whales, although the exact causes and implications to the population remain unknown. Climate variability is expected to continue to affect listed whales throughout their respective ranges by influencing zooplankton biomass and composition as well as the timing of seasonal migrations between ocean basins. Increased levels of shipping and vessel traffic will increase background ambient noise which will contribute to harassment of listed whales by affecting their ability to perceive their environment and communicate with mates and other conspecifics. More studies need to be done to identify the long term effects to listed whales and critical habitat from current stressors as well as the potential additive effect that multiple stressors acting in conjunction over time will have on the survival and recovery of listed whales evaluated in this Opinion.

CONCLUSION

After reviewing the current status of species, the environmental baseline for the action area, the anticipated effects of the proposed activities and the possible cumulative effects, it is the

Endangered Species Division's opinion that the Permits Division's proposed action of issuing permit No. 15750 to ABR, Inc. , as proposed, is not likely to jeopardize the continued existence of Cook Inlet beluga, fin, or humpback whales and is not likely to destroy or adversely modify designated critical habitat for Cook Inlet beluga whales under NMFS' authority.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulation pursuant to section 4(d) of the ESA prohibit the "take" of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the NMFS to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Sections 7(b)(4) and 7(o)(2), taking that is incidental and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement. However, as discussed in the accompanying Opinion, only the species targeted by the proposed research activities will be significantly harassed as part of the intended purpose of the proposed action. Therefore, NMFS does not expect the proposed action will incidentally take threatened or endangered species.

CONSERVATION RECOMMENDATIONS

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

We recommend the following conservation recommendations, which would provide information for future consultations involving the issuance of permits that may affect listed whales as well as reduce harassment related to the authorized activities:

1. *Estimation of Actual Levels of "Take."* For future permits authorizing activities similar to those contained in the proposed permits, the Permits Division should review all annual and final reports submitted by researchers that have conducted research on the whales affected by this action as well as any data and results that can be obtained from the permit holders. This should be used to more accurately estimate the amount of harassment that occurs given the level of research effort, and how the harassment affects the life history of listed whales occurring in the action area. The results of the study should be provided to the Endangered Species Division for use in the consultations on future research activities.

In order for NMFS' endangered Species Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, listed species or their habitats, the Permits Division should notify the endangered Species Division of any conservation recommendations they implement in their final action.

REINITIATION NOTICE

This concludes formal consultation on the proposal to issue scientific research permit No. 15750 to ABR, Inc. for research on listed whales in Cook Inlet, Alaska. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of proposed take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this Opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of authorized take is exceeded, the Permits Division must immediately request reinitiation of section 7 consultation.

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