Cook Inlet Belugas, *Delphinapterus leucas*: Status and Overview

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Introduction and Background

Of the five populations of beluga, *Delphinapterus leucas*, in Alaska, the most isolated is the one in Cook Inlet (Hazard, 1988; Hill and DeMaster, 1998) (Fig. 1). The geographic and genetic segregation of this stock (O'Corry-Crowe et al., 1997), combined with the beluga's tendency toward site fidelity in summer, makes this population especially vulnerable to impacts from large or persistent harvests.

Results from 8 years (1993–2000) of summer aerial surveys by NOAA's National Marine Fisheries Service (NMFS) and a review of previous studies have indicated that the beluga distribution within Cook Inlet was shrinking between the 1970's and mid 1990's (Rugh et al., 2000), and from 1994 to 1998 the abundance declined by nearly 50% (Hobbs et al., 2000a). The average reported harvest of belugas in Cook Inlet during this period, about 72 whales per year (Mahoney and Shelden, 2000), was 21% of the best estimate of abundance in 1998 (347 whales, SE = 101, CV = 0.29)(Hobbs et al., 2000a). Relative to the total number of animals that can be safely removed annually from a population of marine mammals (defined as the potential biological removal (PBR) level in the Marine Mammal Protection Act (MMPA) (16 U.S.C. 1362 § 20)), the reported harvest rate was about 5 times the calculated PBR of 14 whales (Hill and DeMaster, 1998).

The Alaska Scientific Review Group (AKSRG)[1], the Alaska Beluga Whale Committee (ABWC)[2], the Cook Inlet Marine Mammal Council (CIMMC)[3], various NMFS offices (in particular the NMFS Alaska Regional Office (AKR), NMFS Office of Protected Resources (OPR), and the NMFS National Marine Mammal Laboratory (NMML)), and several nongovernmental organizations (NGO's), have all expressed concern about the high level of harvest from this small, isolated population of belugas (NMFS, 1999, 2000). In a strongly worded statement to the NMFS and the Marine Mammal Commission, the AKSRG concluded that "the Cook Inlet beluga situation is one of the most pressing conservation issues facing Alaskan marine mammals at this time."[4]

Accordingly, NMFS, which the MMPA charges with management and protection of belugas in Alaska, initiated a formal review of the status of the Cook Inlet beluga stock on 19 Nov. 1998 (NMFS, 1998). This was through a cooperative process with ABWC and CIMMC. The objective of this review was to provide recommendations to NMFS AKR and OPR regarding the classification of this stock as endangered or threatened under the Endangered Species Act (ESA) or depleted under the MMPA.

The status review coincided with workshops held by the ABWC (16–17 Nov. 1998) and AKSRG (18–20 Nov. 1998) in Anchorage, Alaska. These workshops provided a forum for scientific presentations to interested parties, such as hunters, administrators, and researchers. To insure that the review was comprehensive and based on the best available data, NMFS subsequently solicited information and comments from any interested persons or groups/organizations on Cook Inlet beluga status. Comments were received from 19 Nov. 1998 through 19 Jan. 1999, followed by a public workshop held in Anchorage on 8–9 Mar. 1999. This provided a public review of relevant scientific information and an additional avenue for the public to comment on these issues.

The scientific portion of these reviews focused on the current status of Cook Inlet belugas: distribution, abundance, trends in abundance, habitat use, and contaminant burdens. The effects of the Alaska Native subsistence harvest and the potential effects of other anthropogenic impacts, as well as beluga natural mortality, were also examined and are summarized below.

Cook Inlet Beluga Summary

Distribution and Abundance

Beluga distribution in Cook Inlet, based on sightings made during aerial

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[1] In 1994, the MMPA was amended to require the establishment of regional scientific review groups (SRG's). These groups assist the Secretary of Commerce with drafting stock assessments for marine mammal stocks that occur in waters under U.S. jurisdiction.

[2] Founded in 1988, the ABWC is a group of beluga whale hunters, researchers, and governmental agency representatives from Alaska and northern Canada (Adams et al., 1993). Today the group comanages western Alaska beluga stocks (excluding Cook Inlet) under a cooperative agreement with NMFS.

[3] In 1994, a group of beluga hunters in Anchorage joined together to form the CIMMC. NMFS entered into an interim cooperative agreement with CIMMC to comanage the Cook Inlet beluga stock from 23 May to 31 December 2000.

[4] Letter dated 27 July 1998 from Lloyd Lowry, Chair, AKSRG, to Dan Alex, Chair, CIMMC.

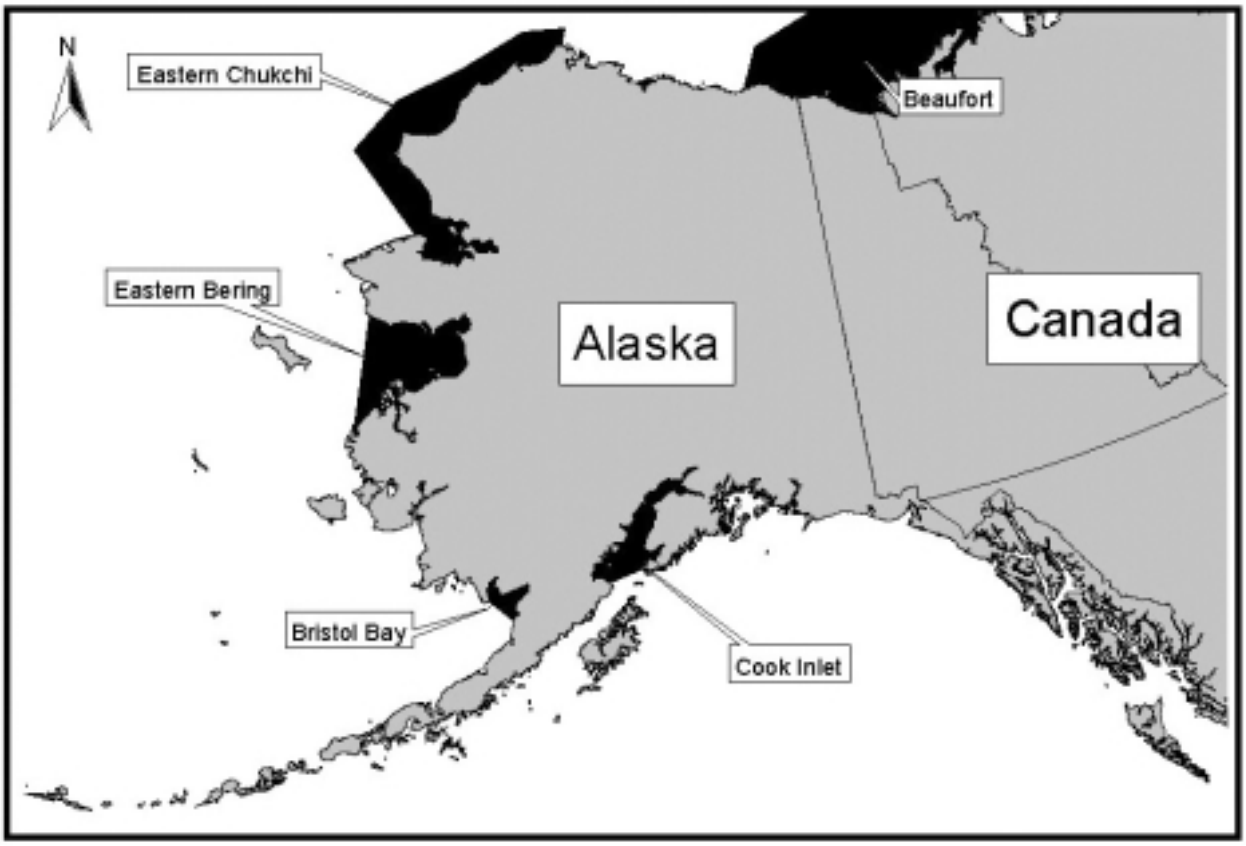

Figure 1.—Beluga stocks found in Alaska waters.

surveys flown annually during June and/or July of 1993–2000, is presented in Rugh et al. (2000). These surveys provide a thorough, annual coverage of the coastal areas of the inlet (1,350 km of shoreline) and include roughly 1,000 km of transect surveys across the central inlet.

Each year, belugas were found in a few shallow-water areas near river mouths in upper Cook Inlet. The largest concentration (151–288 whales by aerial count) was in the Susitna River Delta and/or in Knik Arm. A smaller group (17–49 whales) was consistently found between Chickaloon River and Point Possession. Smaller groups (generally <20 whales) occasionally occurred in Turnagain Arm, Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1995 but not thereafter.

Comparing the distribution of belugas in the late 1970's with that in the 1990's shows that there has been a consistent decline in sightings both in offshore areas and in lower Cook Inlet, suggesting that the range of this stock is shrinking (Rugh et al., 2000). This contention is supported by many anecdotal reports (Speckman and Piatt, 2000; Huntington, 2000; Rugh et al., 2000) and the absence of beluga sightings during dedicated at-sea surveys for marine birds and mammals conducted in lower Cook Inlet in late July and early August 1995–99 in an area where the whales used to be fairly common (Speckman and Piatt, 2000). These small boat surveys, which covered a total of 6,249 linear km in both nearshore and offshore habitats, found no belugas among 791 individual sightings representing 10 species.

Annual abundance estimates of Cook Inlet belugas were calculated for 1994–2000 (Hobbs et al., 2000a), based on counts made by aerial observers (Rugh et al., 2000) that were corrected for group sizes estimated from video recordings (Hobbs et al., 2000b). Point estimates of annual abundance ranged from a high of 653 (CV = 0.43) whales in 1994, to a low of 347 (CV = 0.29) whales in 1998; abundance in 2000 was 435 whales (CV = 0.23; 95% CI = 270–679)(Hobbs et al., 2000a). Monte Carlo simulations indicate a 47% probability that from June 1994 to June 1998, abundance of the Cook Inlet stock of belugas declined 50%, after which the decline may have stopped (Hobbs et al., 2000a).

To address concerns that summer surveys of Cook Inlet alone did not account for the full range of this stock, possible beluga distribution in the Gulf of Alaska was examined through a review of surveys conducted as far back as 1936 (Laidre et al., 2000). More than 150,000 km of dedicated survey effort in the Gulf of Alaska since 1975 resulted in sightings of over 23,000 cetaceans, only 5 of which were belugas. To date, there have been only 34 beluga sightings out-

side of Cook Inlet: 9 near Kodiak Island, 10 in or near Prince William Sound, 14 in Yakutat Bay, and 1 anomalous sighting well south of the Gulf near Tacoma, Washington. In addition, commercial whaling records for the years 1907–39 show belugas were taken only in Cook Inlet and not in the Gulf of Alaska, nor is there any conclusive evidence of beluga remains in archaeological sites outside Cook Inlet. Thus, there are no records of large, persistent groups of belugas in the Gulf of Alaska other than in Cook Inlet.

Habitat Associations and Contaminants

Habitat associations for Cook Inlet belugas were reviewed to complement population assessment surveys during 1993–2000 (Moore et al., 2000). Beluga summer distribution (Rugh et al., 2000) was used to delineate areas of high (Region 1), moderate (Region 2), and low (Region 3) whale concentrations in Cook Inlet. Subsequently, physical, ecosystem, and anthropogenic habitat factors were summarized from available literature and tabulated for each region.

In general, belugas congregate in shallow, relatively warm, low-salinity water near major river outflows in upper Cook Inlet during summer (defined as their primary habitat), where prey availability seems comparatively high and predator occurrence relatively low. In winter, belugas are seen in the central inlet, but sightings are fewer in number and whales are more dispersed compared to summer.

Although sewage effluent, discharges from industrial and military activities, and possibly natural catastrophic events such as floods negatively affect water quality in the inlet, analyses of organochlorines and heavy metal burdens indicate that Cook Inlet belugas are not assimilating contaminant loads greater than any other Alaska stocks (Becker et al., 2000). Much of the available information on Cook Inlet habitat is descriptive in nature and could be greatly improved by integration of quantifiable habitat measures associated with beluga occurrence. Recommendations in Moore et al. (2000) include: 1) obtaining seasonal data on fish run numbers for rivers used by belugas, and 2) measuring anthropogenic factors (such as fishery bycatch and underwater noise) within and outside beluga whale concentration areas.

Tissue samples from three different Alaska stocks of belugas (Beaufort Sea, eastern Chukchi Sea, and Cook Inlet) collected from subsistence harvests were analyzed for contaminants (Becker et al., 2000). Blubber of animals from these stocks contained polychlorinated biphenyl (PCB) congeners, DDT, chlordane compounds, hexachlorobenzene (HCB), dieldrin, mirex, toxaphene, and hexachlorocyclohexame (HCH). Cook Inlet belugas had the lowest concentrations of DDT (1.35 ± 0.73 and 0.59 ± 0.45 mg/kg in males and females, respectively) and PCB (1.49 ± 0.70 and 0.79 ± 0.56 mg/kg wet mass in males and females, respectively) of all three stocks. DDT and PCB concentrations in the blubber of male belugas in Cook Inlet was half that found in males in the Alaska Arctic and an order of magnitude lower than in animals from the St. Lawrence Estuary, Canada. Liver concentrations of cadmium and mercury (<1 mg/kg and 0.704–11.42 mg/kg wet mass, respectively) were also lower in the Cook Inlet stock, but copper levels (3.97–123.8 mg/kg wet mass) were substantially higher in Cook Inlet animals, compared to Alaska Arctic animals, and were similar to those reported for Hudson Bay, Canada, belugas. Although total mercury levels were lowest in the Cook Inlet stock, methyl mercury concentrations were similar among all three stocks (0.34–2.11 mg/kg wet weight).

VHF Radio and Satellite Tagging

VHF radio transmitters were attached to Cook Inlet belugas with suction cups in 1994 and 1995 to characterize beluga surfacing behavior (Lerczak et al., 2000). Video recordings were also made to document behavior of undisturbed whales and whales actively pursued for tagging. Eight whales were successfully tagged, and five tags remained attached for over 1 h each. Mean dive interval was 24.1 sec (SD = 6.4 sec). Videotaped behaviors were categorized as "head-lifts" or "slow-rolls." In undisturbed beluga groups, surfacing intervals were significantly different between head-lifting ($\bar{x}$ = 1.02 sec, SD = 0.38 sec, n = 28) and slow-rolling whales ($\bar{x}$ = 2.45 sec, SD = 0.37 sec, n = 106). Undisturbed juveniles exhibited shorter slow-roll surfacing intervals ($\bar{x}$ = 2.25 sec, SD = 0.32 sec, n = 36) than adults ($\bar{x}$ = 2.55 sec, SD = 0.36 sec, n = 70). Belugas did not exhibit strong reactions to suction-cup tags. This tagging method shows promise for obtaining surfacing data on individual belugas over periods of several days.

Attempts to capture and place satellite tags on belugas in Cook Inlet were conducted during late spring and summer of 1995, 1997, and 1999 (Ferrero et al., 2000). In 1995, efforts to capture belugas with a hoop net proved impractical in Cook Inlet because the waters were too turbid to see a whale underwater. In 1997, capture efforts focused on driving belugas into nets. Although this method had been successful in the Canadian High Arctic, it failed in Cook Inlet due to the ability of belugas to detect and avoid nets in shallow water. In 1999, belugas were successfully captured using a net encirclement technique. A satellite tag was attached to a juvenile male and provided first-ever documentation of beluga movements within Cook Inlet. This animal remained in the northern region of Cook Inlet throughout the period (31 May–17 Sept.) that it was tracked via satellite (Ferrero et al., 2000).

Harvest History and Traditional Knowledge

Archeological studies show that prehistoric Alutiiq Eskimos and Dena'ina Athabaskan Indians used many marine resources in Cook Inlet, including belugas (Mahoney and Shelden, 2000). Commercial whaling and sport hunting occurred periodically in Cook Inlet during the 1900's before such activities were banned by the MMPA in 1972. The decline of the Cook Inlet stock, and its subsequent designation as depleted under the MMPA has, in part, been attributed to harvesting by Alaska Native subsistence hunters. It is difficult to obtain accurate estimates for Alaska

Native beluga harvests in Cook Inlet due to the inability to identify all of the hunters and, in turn, the size of the harvest. So, while definitive harvest statistics are unavailable, it does appear that 21–147 belugas were taken annually by Alaska Native hunters between 1994 and 1998 (Mahoney and Shelden, 2000). Similar removals may also have occurred in earlier years.

Concerns about the decline of the Cook Inlet stock and its continued exploitation led to the voluntary suspension of the subsistence hunt by Alaska Natives in 1999, and the MMPA was subsequently amended (P.L. 106–554) to require a cooperative agreement between NMFS and Alaska Native organizations before hunting could be resumed. In October 1999, NMFS established marking and reporting regulations to improve harvest monitoring.

From October 1998 to March 1999, beluga hunters in Cook Inlet took part in a traditional ecological knowledge (TEK) survey (Huntington, 2000). Traditional knowledge about belugas has been documented for other Alaska beluga stocks (Huntington and Mymrin, 1996; Huntington, 1998), and the same interview-based methods were used to gather information systematically concerning the natural history of belugas in Cook Inlet. The hunters' knowledge is largely consistent with that described from scientific research, and it extends and augments published descriptions of the ecology of this isolated stock. Publication of this information and involving the Native hunters to a greater extent in research and management are important contributions to the conservation of Cook Inlet belugas.

Acknowledgments

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Aerial surveys were piloted by T. Blaesing of Commander NW, Ltd., each year during 1993–96, and by D. Weintraub during 1998–2000. In 1997, the pilots were J. Hagan and J. Longenecker from NOAA's Aircraft Operations Center. Primary aerial observers from NMFS were R. Angliss (1994–95), D. DeMaster (1994–95), R. Hobbs (parts of 1993 and 1996–99), L. Litzky (1998–2000), B. Mahoney (1993–96, 1998–2000), D. Rugh (1993 and project leader 1994–2000), K. Shelden (1993, 1995–2000), J. Waite (1996–97), and D. Withrow (project leader in 1993). Other NOAA/ADFG observers were J. Hanson (1993), J. Lewis (1993), B. Smith (1993 and 1999), and S. Thumm (1993).

Representatives of CIMMC joined the aerial team on one or more survey days in 1995 (K. Andrews, J. Dizon, D. Calcote, and R. Cassidy), 1996 (M. Lamoreaux), 1997 (J. Blatchford), 1998 (E. Paniptchuk, G. Paniptchuk, C. Eben, and F. Anawrok), 1999 (D. Alex, P. Blatchford [Alaska Native Marine Mammal Hunters Committee, ANMMHC], P. Merryman [Native Village of Tyonek], and J. Blatchford [ANMMHC]), and 2000 (L. Green, P. Dimmick, D. Alex, F. Kakaruk, and G. Paniptchuk). The ABWC and NMFS AKR provided partial support for some of the CIMMC observers. Analysis of the video tapes collected during the aerial surveys was done by L. Baraff, R. Bush, S. Harkness, L. Litzky, M. Muto, S. Norman, K. Shelden, and J. Waite (leader). Aerial surveys were conducted under NMFS Scientific Research Permits No. 791 (P771#63) and No. 782-1360.

Participants in the tagging projects included representatives from NMFS, USFWS, CIMMC, and scientific consultants: R. Hobbs (project director), A. Andriolo, J. Cesarone, D. DeMaster, G. Dimmick, R. Dimmick, L. Dugan, M. Eagleton, C. Eben, R. Ferrero (leader in 1999), B. Hanson, S. Hill, M. Lamoreaux, J. Lerczak, L. Litzky, B. Mahoney, P. Nader, A. Nuglene, G. O'Corry-Crowe, D. Owens, D. Rugh, D. Seagars, M. Saccheus, K. Shelden, T. Smith, S. Thumm, R. Tocktoo, D. Vos, J. Waite, and W. Walker. Special thanks go to R. Morris for providing advice, personnel, and equipment. Additional support and equipment for oceanographic sampling was provided by B. Reilly and O. Smith (U.S. Army Corps of Engineers-Anchorage) and K. Krogflund (Univ. of Washington-School of Oceanography). J. Lerczak and J. Waite reviewed the audio tapes of surfacing interval data from suction cup tagged whales. The suction cup tagging project was conducted under NMFS Permit No. 897, and the satellite tagging project was conducted under NMFS Permit No. 957.

The vessel-based study of lower Cook Inlet was directed by the Interior Department's U.S. Geological Survey (USGS). Additional funding for the project was provided by the Exxon Valdez Oil Spill Trustee Council (Restoration Project 00163M) and the Minerals Management Service (MMS). Observers during the study included: J. Figurski, B. Keitt, G. Drew, G. Snedgen, T. van Pelt, M. Robards, M. Arimitsu, B. Congdon, S. Zador, A. Harding, A. Kitaysky, C. Lascink, V. Lodha, D. Ruthrauff, R. Seymour, K. Hobson, A. Abookire, R. Suydam, and S. Wright. Thanks go to the captains and crews of the R/V *Pandalus*, P. Desjardins, and M. Hottman, Captain K. Bell of the R/V *Tiglax*, and G. Snedgen of the R/V *David Grey*.

Participants in the TEK study included P. Blatchford, H. Dimmick, R. Dimmick, C. Eben, C. Jack, F. Mamaloff, L. Saccheus, R. Schaeffer Sr., and two hunters who wished to remain anonymous. Funding and support was provided by ABWC, funds were administered by North Slope Borough, CIMMC helped set up interviews, and NMFS helped with all aspects of the project. In particular, help was provided by: D. Alex, D. Carr, M. Adams Carroll, K. Frost, C. Jack, J. James, B. Mahoney, S. Rudolph, C. Saccheus, R. Schaeffer, Lee Stephan, Leo Stephan, and B. Takes Horse.

The contaminants study received funding and support from USGS, MMS, NMFS, and ABWC. Samples from Cook Inlet were collected by NMFS, AKR, and ages were determined by B. Mahoney and R. Suydam. Tissue samples are maintained in the Alaska Marine Mammal Tissue Archival Project (AMMTAP), a collaboration between

USGS, NMFS, and the National Institute of Standards and Technology.

Life history data on harvested whales were collected by NMFS AKR in cooperation with Alaska Native hunters. Ages of animals were determined by B. Mahoney. Harvest statistics were provided by CIMMC, ABWC, ADFG, and Native hunters of Cook Inlet.

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