

AERIAL SURVEYS OF BELUGAS IN COOK INLET, ALASKA, AUGUST 2006

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Abstract

The National Marine Fisheries Service (NMFS) conducted an aerial survey of the beluga population in upper Cook Inlet, Alaska, 16-17 August 2006. The survey (10.1 flight hours) provided thorough coverage of coastal areas around the upper Inlet north of East and West Forelands. Consistent with NMFS surveys conducted since 1993, the August 2006 survey was flown at an altitude of 244 m (800 ft) and a speed of 185 km/hr (100 kt). Tracklines were flown both parallel to the coast (1.4 km offshore) and across the Inlet. When beluga groups were encountered, a series of aerial passes was made with two observers each making four or more independent counts. The survey in August 2006 was different from most previous surveys in that it was done in a Twin Otter aircraft instead of an Aero Commander, and paired, independent searches were not conducted. The primary intent of the survey was to document whale groups in video camera for an analysis of age structure (white adults relative to dark juveniles).

Belugas were found near the mouth of the Susitna River (median counts of 116 whales on one day and 47 on the second day), near Eklutna (10 belugas on the first day and 95 on the second), and in Turnagain Arm near Bird Point (2 belugas seen on the second day). These sighting locations were fairly typical of the distribution seen each June except that it was unusual to find no whales in Chickaloon Bay. The density of the whale group seen near the Susitna River on 17 August was one of the highest ever observed, but on the next day, belugas were in small, somewhat dispersed groups in this area. Meanwhile there was nearly a tenfold increase in whales at the far end of Knik Arm indicating that many whales had moved from the Susitna to Knik Arm. The daily median estimates (a quick index of relative abundance not corrected for missed whales) were 126 for 16 August and 143 for 17 August. The latter count compares favorably with the index count for June 2006 (153 belugas) but is below the similar count done in August 2005 (236 belugas on 11 August and 277 on 12 August).

Introduction

The National Marine Fisheries Service (NMFS) conducts aerial surveys to study the distribution and abundance of belugas (*Delphinapterus leucas*) in Cook Inlet, Alaska. These surveys typically occur in June and have been repeated each year since 1993 (Rugh et al. 2000, 2005a). This project is in cooperation with the Cook Inlet Marine Mammal Council (CIMMC) and the Alaska Beluga Whale Committee (ABWC). Management concerns have focused on belugas in Cook Inlet because of the small population size (less than 300 whales; Hobbs et al. 2000a; NMFS unpublished data) and isolation of this stock (O’Corry-Crowe et al. 1997; Laidre et al. 2000; Rugh et al. 2000). This stock has been designated as depleted under the Marine Mammal Protection Act (65 FR 34590) and is now managed with a small, regulated subsistence harvest.

The objectives for the aerial survey in August 2006 were to continue documenting the presence of beluga groups for studying seasonal distribution relative to temporal habitat features (e.g. fish runs) and to use paired High Definition (HD) video cameras to document beluga groups for continued analysis of age structure (white adults relative to dark juveniles), especially at a time (August) when most beluga calves are born.

Methods

The survey aircraft, a Twin Otter (*N48RF*), has twin-engines, high-wings, and 5-hour flying capability (with an internal fuel tank). Large bubble windows were at the left and right forward observer positions. However, since there were not two comparable bubble windows on the left side, there was not an option for paired, independent searches. Video cameras were operated in the left rear position where an opening window provided an unobstructed field of view. An intercom system provided communication among the observers, data recorder, and pilots. A new aerial survey program recorded sighting data as well as location data from a portable Global Positioning System (GPS). Data entries included routine updates of time, locations, percent cloud cover, sea state (Beaufort scale), glare (on the left and right), and visibility (on the left and right). Visibility was documented in five subjective categories from excellent to useless; conditions rated poor or useless were considered unsurveyed. Each start and stop of survey effort was recorded.

Most of the search effort was directed at coastal surveys conducted approximately 1.4 km offshore in upper Cook Inlet (north of East and West Forelands). The objective was to search all nearshore, shallow waters where belugas are typically seen in summer (Rugh et al. 2000). The trackline distance from shore was monitored with an inclinometer such that the waterline was generally 10° below horizontal while the aircraft was at the standard altitude of 244 m (800 ft). Ground speed was approximately 185 km/hr (100 knots). The survey included searches up rivers until the water appeared to be very shallow or as far as was recommended by Native hunters who have flown with us in the past (Rugh et al. 2000). Due to weather conditions in the mornings of each survey day, we were unable to survey at low tide when the search area is greatly reduced.

Location of each whale group was established by flying directly over the group and marking it with a GPS position. The flight pattern used to count a whale group involved an extended oval around the longitudinal axis of the group with turns made well beyond the ends of the group. Whale counts were made on each pass down the long axis of the oval with the observers and cameras on the left side of the aircraft. Counts began and ended on a cue from the front observer, starting when the leading edge of the group was close enough to be counted and ending when the trailing edge went behind the wing line. This provided a precise record of the duration of each counting effort. Quality of each counting pass was a function of how well the observers saw the location of a group, not how many whales were at the surface. Ratings were A (if no glare, whitecaps, or distance compromised the counting effort) through F (if it was not practical to count whales on that pass). Only quality A and B estimates were used in the analysis. Although whale tracks were often seen in muddy water, only whales that were at the surface during a counting pass were included in the counts. The daily aerial counts are represented by medians of each of the observers' median counts on multiple passes (typically 4) over each whale group (Table 1). The process of using medians instead of maximums or means reduces the effect of outliers (extremes in high or low counts) and makes the results more comparable to others' surveys which lack multiple passes over whale groups. Medians are also more appropriate than maximums when counts are corrected for missed whales because correction factors should be applied to the most representative counts, not the most extreme.

Paired HD video cameras were used to document beluga groups; one camera had a lens set at wide angle to capture a view of the entire beluga group, and the second camera lens was zoomed to magnify individual whales in the group. The zoomed video is used to determine correction factors for missed animals (see Hobbs et al. 2000b) and to examine color ratios of white adults relative to dark juveniles (Litzky 2001; Sims et al. 2003). The paired cameras were operated on most counting passes. Video footage from the cameras will be studied in the laboratory to obtain precise counts of belugas and the relative proportions of white (adult) vs gray (juvenile) vs dark (calf) belugas.

Results

A total of 10.1 hours were flown around upper Cook Inlet 16 and 17 August 2006. All flights (3 take-offs and landings ranging from 2.3 to 4.8 hours) were based out of Anchorage. Of the 10.1 flight hours, 6.2 hours were spent on effort (i.e., not including time spent taxiing on the runway, deadheading without a search effort, circling whale groups to conduct counts, or periods with poor or useless visibility). Visibility conditions interfered with the survey effort during 0.04 hours (0.7% of the effective search time) when the left-front observer considered the visibility poor or useless. All four of the observers (authors of this report) have participated in this project during several or many of the previous surveys.

The aerial surveys in August 2006 provided thorough coverage (100%) of the coastline of upper Cook Inlet for most waters within 3 km of shore as well as some tracklines away from the coast (Fig. 1). The original intent was to start the surveys each morning at about 09:00 in order to follow the rising tide through Knik Arm (whales concentrate on low

tides and are easier to count, and the amount of area to be surveyed is greatly reduced when the tide is low). However, on both 16 and 17 August, fog and light rain delayed the flights until near noon. This meant the surveys were conducted at high tide. On 16 August, the route started in Knik Arm, continued around Fire Island to Turnagain Arm and Chickaloon Bay, then south to East Foreland, across the Inlet to West Foreland, and north along the shore around the Susitna Delta and back to Anchorage. The only belugas that were seen were in a disperse group near Eklutna in Knik Arm (total of 10 whales, Table 1) and a very dense, large group (116 whales) in shallow water near the Ivan and Susitna Rivers. No boats were seen in coastal areas on this day.

On 17 August, the flight path went from Anchorage (near Campbell Creek) around Turnagain Arm and Chickaloon Bay, south to Moose Point and across the Inlet to Tyonek, then north around the Susitna Delta and Knik Arm. Viewing conditions were ideal throughout the coastal areas of this survey in that there was a thick overcast (minimizing glare) and no wind. Only while crossing the Inlet did conditions deteriorate because of winds and whitecapping. Two belugas were seen in Turnagain Arm (near Bird Point), scattered groups were seen in the Susitna area (total of 75 whales), and many whales (144) were in Knik Arm again near Eklutna. It does appear that many of the belugas seen about 17:30 on 16 August near the Susitna River had moved to the upper reaches of Knik Arm by 16:00 on 17 August. Between Little Susitna River and Point MacKenzie, four small boats were seen, apparently because the commercial set net fishery was open on this day (Alaska Department of Fish and Game, pers. commun.); no sports fishing was seen in the Little Susitna River when belugas were seen there.

Discussion

The aerial survey of Cook Inlet in August 2006 helped continue documenting beluga distribution in months other than June, supplementing information gathered in 2000/01 (Rugh et al. 2005a). Although the survey area in August 2006 was limited to upper Cook Inlet, this coverage is considered sufficient for examining beluga distribution because there was little incentive to survey south of the Forelands (lower Cook Inlet) where there has been consistently low sighting rates for over a decade (Rugh et al. 2000; 2005a). Beluga locations in August 2006 were similar to sighting locations during almost all June surveys in that concentrations of whales were seen near the Susitna River and in Knik Arm. Unlike most previous surveys, no belugas were found in Chickaloon Bay in spite of good viewing conditions; this lack of belugas was also noted in the survey conducted August 2005 (Rugh et al. 2005b). The apparent shift of many belugas from the Susitna River on 16 August to Knik Arm on 17 August is not unexpected, since similar shifts have been seen in the past (Rugh et al. 2005a). Further evidence that there was not a major change in beluga distribution in August relative to June is that the median counts of whales were almost the same (153 in June and 143 in August). The June 2006 index count (153; Rugh et al. 2006) is the lowest yet recorded during annual surveys conducted by NMFS since 1993. Our survey in August provided a check to see if there was some irregularity in the June effort that made for an anomalously low count. Instead, the consistency in counts between August and June

indicates that either some whales left Cook Inlet since 2005 or the abundance declined. Although medians of aerial counts are a crude index of abundance uncorrected for missed whales, they do provide an indication of trends that generally parallel trends in corrected abundance estimates (Rugh et al. 2005a).

The primary objective in August 2006 was to use paired HD video cameras to document beluga groups for analysis of age structure (white adults relative to dark juveniles) at a time when it is likely all belugas of the year are born. This is the same objective applied to the survey conducted in August 2005 (Rugh et al. 2005b). Lab analysis will determine if the ratio of calves (small, dark whales) to adults (large, white whales) significantly changes between June and August. This ratio will be important in assessing the reproductive potential of this depleted stock of belugas.

Acknowledgments

Rod Hobbs, Task Leader for the Cook Inlet beluga studies, helped coordinate funding for this project. Our pilots in August 2006 were Wally Pierce and Kristie Twining of NOAA; they filled a critical role in keeping the aircraft at the preferred altitude and distance from shore while flying intricate patterns over moving whales and watching for aircraft in an exceptionally busy airspace. Two HD video cameras were loaned to our project by Chris Rooper of the Alaska Fisheries Science Center, NOAA. Data entries were made on a program developed specifically for this project by Niel and Kim Goetz. This study was conducted under MMPA Scientific Research Permit No. 782-1719.

Citations

- Hobbs, R.C., D.J. Rugh, and D.P. DeMaster. 2000a. Abundance of beluga whales, *Delphinapterus leucas*, in Cook Inlet, Alaska, 1994-2000. *Marine Fisheries Review*. 62(3):37-45.
- Hobbs, R.C., J.M. Waite, and D.J. Rugh. 2000b. Beluga, *Delphinapterus leucas*, group sizes in Cook Inlet, Alaska, based on observer counts and aerial video. *Marine Fisheries Review*. 62(3):46-59.
- Laidre, K. L., K. E. W. Shelden, D. J. Rugh, and B. A. Mahoney. 2000. Beluga, *Delphinapterus leucas*, distribution and survey effort in the Gulf of Alaska. *Mar. Fish. Rev.* 62(3):27-36.
- Litzky, L.K. 2001. Monitoring recovery status and age structure of Cook Inlet, Alaska belugas by skin color determination. Thesis (M.S.) Univ. Wash. 76 p.
- O’Corry-Crowe, G.M., R.S. Suydam, A. Rosenberg, K.J. Frost, and A.E. Dizon. 1997. Phylogeography, population structure and dispersal patterns of the beluga whale *Delphinapterus leucas* in the western Nearctic revealed by mitochondrial DNA. *Mol. Ecol.* 6:955-970.
- Rugh, D.J., K.E.W. Shelden, and B.A. Mahoney. 2000. Distribution of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska, during June/July 1993-2000. *Mar. Fish. Rev.* 63(3):6-21.

- Rugh, D.J., K.E.W. Sheldon, C.L. Sims, B.A. Mahoney, B.K. Smith, L.K. Litzky, and R.C. Hobbs. 2005a. Aerial surveys of belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. NOAA Tech Memo. NMFS-AFSC-149. 71p.
- Rugh, D.J., K.T. Goetz, and B.A. Mahoney. 2005b. Aerial survey of belugas in Cook Inlet, Alaska, August 2005. Unpubl. NMFS report. 8 pp.
- Sims, C.L., R.C. Hobbs, and D.J. Rugh. 2003. Developing a calving rate index for beluga in Cook Inlet, Alaska using aerial videography and photography. Abstract (poster) in the Fifteenth Biennial Conference on the Biology of Marine Mammals. Greensboro, North Carolina. 14-19 Dec. 2003.

Table 1. August 2006 beluga counts made during aerial surveys of Cook Inlet. Counts are medians from observers doing multiple counts of each whale group. Dashes indicate no survey effort, and zeros indicate that the area was surveyed, but no whales were seen. Sites are listed in a clockwise order around Cook Inlet starting with Turnagain Arm.

Location	8/16	8/17
Turnagain Arm	0	2
Chickaloon Bay/ Point Possession	0	0
Point Possession to East Foreland	0	---
Trading Bay	0	---
Susitna delta	116	47
Knik Arm	10	95
Fire Island	0	0
Totals	126	143

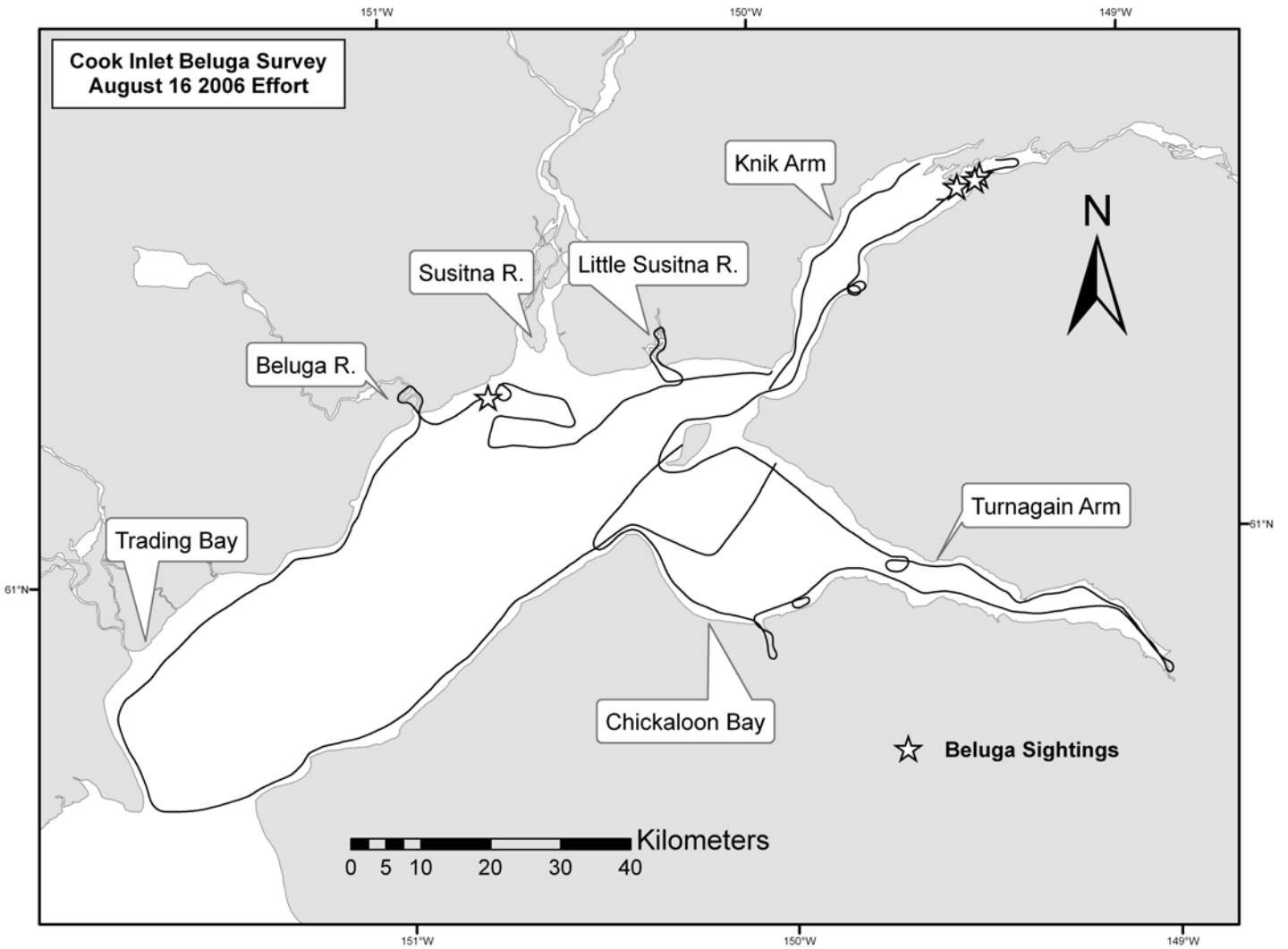


Figure 1. On-effort tracklines and beluga sightings for upper Cook Inlet on 16 August 2006.

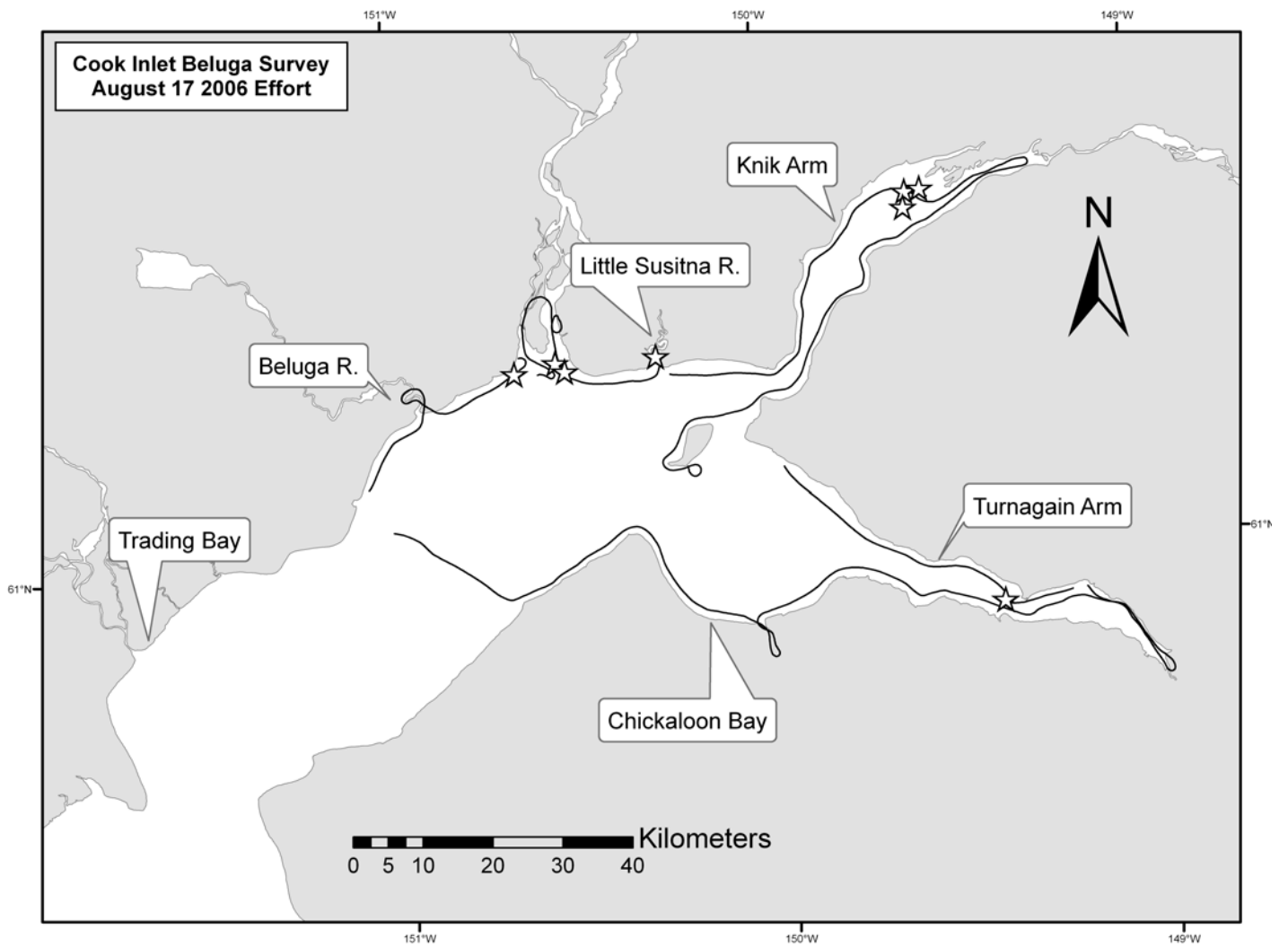


Figure 2. On-effort tracklines and sightings for upper Cook Inlet on 17 August 2006.