

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

David J. Rugh¹, Kimberly T. Goetz¹, Christy L. Sims¹, Kim W. Shelden¹,
Olga V. Shpak², Barbara A. Mahoney³, and Brad K. Smith³

¹National Marine Mammal Laboratory
Alaska Fisheries Science Center
National Marine Fisheries Service, NOAA
7600 Sand Point Way NE
Seattle, Washington 98115

²Severtsov Institute of Ecology and Evolution
of the Russian Academy of Science
33 Lenynsky Prospect
119071 Moscow, Russia

³Alaska Regional Office
National Marine Fisheries Service, NOAA
222 W 7th Ave., Box 43
Anchorage, Alaska 99513

Abstract

The National Marine Fisheries Service (NMFS) conducted an aerial survey of the beluga population in Cook Inlet, Alaska, 6-15 June 2006. The survey (58.4 flight hours) was flown in a twin-engine, high-wing aircraft at an altitude of 244 m (800 ft) and speed of 185 km/hr (100 kt), consistent with NMFS' surveys conducted each year since 1993. The flights in June 2006 included one or more surveys of coastal areas (flown 1.4 km offshore) around the entire Inlet and 1552 km of transects across the Inlet, effectively searching 32% of Cook Inlet but nearly 100% of the coastal areas. Paired, independent observers searched on the coastal (left) side of the plane, where virtually all beluga sightings occur, while a single observer was on the right side. A computer operator/data recorder was also on the left side. After finding beluga groups, a series of aerial passes was made with two pairs of observers each making four or more independent counts of each group. Daily median counts made on seven different days ranged from 64 to 126 belugas in the Susitna delta (between the Beluga and Little Susitna Rivers), 0 to 9 belugas in Knik Arm, and 8 to 60 belugas in Chickaloon Bay (including whales seen north of Point Possession). Belugas were not seen in the central or lower Inlet. Beluga sighting locations in 2006 were typical of locations documented during annual surveys in previous years. The highest of the daily median estimates (a rough but quick index of relative abundance, not corrected for effort nor for estimates of whales missed) for June 2006 is 153 belugas. This is well below index counts for years prior to 1998 (305 in 1993, 281 in 1994, 324 in 1995, 307 in 1996, and 264 in 1997), but it is similar albeit lower than other counts made during the past seven years (193 in 1998, 217 in 1999, 184 in 2000, 211 in 2001, 192 in 2002, 174 in 2003, 187 in 2004, and 192 in 2005).

Introduction

The National Marine Fisheries Service (NMFS) conducts annual 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. 2005). This project is in cooperation with the Cook Inlet Marine Mammal Council (CIMMC) and the Alaska Beluga Whale Committee (ABWC). The objectives for the 2006 annual June survey are to document the location of sightings for distributional analysis and to count and video belugas in Cook Inlet for abundance estimates. This survey maintains continuity with preceding NMFS surveys to allow for inter-year trend analyses.

The small population size (approximately 300-400 whales; Hobbs et al. 2000a) and isolation of the Cook Inlet beluga stock (O’Corry-Crowe et al. 1997; Laidre et al. 2000; Rugh et al. 2000) has focused management concerns on these whales. Until 1999, Cook Inlet belugas were subjected to an unregulated harvest (Mahoney and Sheldon 2000). On 31 May 2000, this stock was designated as depleted under the Marine Mammal Protection Act (65 FR 34590) and is now managed with a small, regulated subsistence harvest.

Methods

Aircraft and data

The survey aircraft, an Aero Commander 680 FL (*N98UP*), has twin-engines, high-wings, and 10-hour flying capability. Large bubble windows were at four observer positions, maximizing the search area. An opening window in the right rear position allowed for photography. The intercom system provided communication among the observers, data recorder, and pilots, but a selective listening device was used to aurally isolate each observer position. A laptop computer¹ 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 a transect leg was recorded. Observer seating positions were noted each time they were changed, generally every 1-2 hours to minimize fatigue.

Tracklines

Coastal surveys were conducted approximately 1.4 km offshore. 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). This coastal survey included searches up rivers until the water appeared to be very shallow based on the appearance of rapids or riffles or as recommended by Native hunters who have flown with us.

¹ Starting in 2006, data were entered using a new software program specifically developed for the Cook Inlet beluga aerial survey by Niel and Kimberly Goetz.

In addition to the coastal surveys, systematic transects were flown across the Inlet (Fig. 1). Offshore tracklines were designed to run the length of Cook Inlet or cross it, minimizing overlap (Fig. 2).

Tides

Due to broad geographical range of these surveys, in conjunction with rapidly changing tide heights, we were unable to survey at specific tidal conditions throughout Cook Inlet. There was an attempt to synchronize flight timings with low tides in the Susitna delta and Knik Arm, primarily to minimize the effective survey area – at low tide, large areas of mudflats were exposed that would otherwise have to be surveyed. It has proved best to survey Knik Arm during a rising tide because whale groups were relatively more concentrated as they moved up flooding channels. Also, when the whales followed the tide north, they moved away from the intense air traffic experienced near Anchorage (Elmendorf Air Base, Merrill Field, Lake Hood, and the Anchorage International Airport) where whales could not be circled for the standard counting protocol. Because the change of tides in Turnagain Arm can be so rapid that tide rips compromise visibility, attempts were made to survey there on a slack tide. At high tide, belugas in Chickaloon Bay tend to group close to shore or in Chickaloon River, where they were relatively easy to video and count. The timing of aerial surveys of areas south of Point Possession and North Foreland were a function of weather, not tides.

Although there are many hours of daylight in this area during early June (just prior to the summer solstice), light levels were low enough at night to limit our survey to hours between 07:30 and 19:00, local time. The flight schedule for every survey day was designed to take advantage of tidal patterns, as described above, relative to workable daylight hours.

Counting protocol

Immediately upon seeing a beluga group, each observer independently reported the sighting to the data recorder. As the aircraft passed abeam of the whales, the observer informed the recorder of the inclinometer angle and notable behaviors but not group size. With each sighting, the observer's initials were recorded by touching the respective computer key. An important component of the survey protocol was the independence of the paired observers (i.e., that they not cue each other to their sightings). This was done by having a visual barrier between the observers and shutting off their headsets but not their mikes. After a beluga group was reported, the trackline was maintained until the group was well behind the aircraft. This allowed each observer full opportunity to independently sight and report whale groups, making it clear when a group was missed. The pilot and data recorder did not cue the observers to the presence of a whale group until it was out of sight. After the whales were passed, the systematic search effort was stopped, and all headsets were activated so that everyone on board was able to interact. The crew then changed positions such that two were ready to do counts and one was ready with paired video cameras on the right side of the aircraft, while the data recorder was on the left side of the aircraft.

Location of whale groups was established at the onset of the aerial counting passes by flying directly over the group and marking the group perimeters with GPS positions. 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 right 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. The paired observers made independent counts and wrote down their results along with date, time, pass number, and quality of the count. The quality of a count was a function of how well the observers saw the location of a group, not how many whales were at the surface on the respective pass. 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. Count records were not shared within the aerial team until all surveys were completed. This was done to maximize the independence of each observer's counts.

The daily aerial counts are represented by medians of each of the observers' median counts on multiple passes (typically 4 to 8 passes) 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. However, when establishing the standard annual index, the procedure has been to use the highest of the daily medians instead of a median of the daily medians to avoid days when important areas were not sampled due to weather.

Cameras

Paired High Definition (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). For many years, abundance surveys have relied on a "standard" mini digital video camera with resolution of 720 x 480 pixels (a Sony DVCAM, DSR-PDX10 Model L10A), but the new HD cameras provide better resolution offering 1280 x 720 pixels. 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. These counts can be assessed for the amount of time the area was in view, and then a correction can be applied for whales under the surface and not visible in the video (Hobbs et al. 2000b). These counts of belugas in video footage will be used to determine an abundance estimate (Hobbs et al. 2000a).

Results

Survey effort

A total of 58.4 hours were flown around Cook Inlet 6-15 June 2006. All flights (16 take-offs and landings ranging from 2.1 to 5.4 hours) were based out of Anchorage, sometimes with refueling stops in Homer or Kenai. Of the 58.4 flight hours, 31.2 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 1.7 hours (5.3% of the effective search time) when the left-front observer considered the visibility poor or useless. Three of the observers participated in this project every season or almost every season since it began in 1993, other observers participated in several previous surveys, and one observer was new to this project but participated in similar surveys in Russia.

Coverage

The composite of the aerial surveys in June 2006 provided a thorough coverage (100%) of the Cook Inlet coastline (1,810 km) for most waters within approximately 3 km of shore (Figs. 1 and 2). In addition, there were 1,552 km of systematic transects flown across the Inlet. Assuming a 2.0 km transect swath (1.4 km on the left side plus 1.4 km on the right side, less the 0.8 km blind zone beneath the aircraft), the cumulative survey tracklines covered 6,723 km², which is 32% of the Cook Inlet surface area (20,943 km²). This coverage was typical of past beluga surveys (Rugh et al. 2000). Most of upper Cook Inlet was surveyed seven times, especially areas where beluga groups have consistently been found in the past – such as Susitna delta, Knik Arm, and Chickaloon Bay. Even when ignoring the repetition of coastal surveys in the upper Inlet, the sum of all of the offshore transects and the coastline (550 km) relative to the surface area of upper Cook Inlet shows that 69% of the waters were surveyed. In lower Cook Inlet, coverage was 24% based on 1,260 km of coastline plus the offshore transects relative to a surface area of 17,130 km².

Daily reports

June 6

This seasons' project began with a survey of upper Cook Inlet. After circling Fire Island, the trackline went to Point Possession. Group 1 (a small group of belugas, Table 1) was seen going east into Chickaloon Bay very near Point Possession. Just south of Point Possession, the trackline was directed across Cook Inlet to the Native village of Tyonek and then north along the coast of the Susitna delta. The rivers in this area were not surveyed because the water was very shallow at low tide. Group 2 was found in the mouth of the Susitna River. While counting Group 2, a boat approached from the east. The whale disturbance was sufficient that the beluga count was abandoned (the belugas stayed below the surface longer and were harder to find due to the disturbance).

In the Little Susitna River, a small group of belugas (Group 3) was found swimming up the river. Across the mouth of this river, there was a larger group (Group 4), and a short distance to the east was Group 5, a large group in a thin line perpendicular to shore. Group 5

moved north during the counting passes and eventually consolidated close to shore moving slowly westward.

Although conditions were excellent in Knik Arm, and the survey went to the Knik River Bridge, no belugas were seen. After surveying Knik Arm (1-2 hours after low tide), a break was taken in Anchorage to wait for a high, slack tide in Turnagain Arm. Although it turned out that Turnagain Arm was too windy to be adequately surveyed, Chickaloon Bay had relatively calm waters in coastal areas, and many beluga groups (Groups 6-11) were found (Table 1).

June 7

Upper Cook Inlet was surveyed a second time. Although the entry to Turnagain Arm was windy and difficult to search, Turnagain Arm itself had relatively placid water with good to excellent viewing conditions. Chickaloon Bay had good conditions in coastal areas. Two beluga groups were found along the south shore of Chickaloon Bay: Group 1 was near a mudflat, and Group 2 was close to shore along a steep bluff (Fig. 1).

The coastal survey continued south from Point Possession to Kenai River. From there, the survey crossed the Inlet to West Foreland and to the north, including searches up McArthur and Beluga Rivers. In general, conditions were good to excellent; however, with a break in Kenai, the survey was no longer synchronized with low tide, and instead the area was surveyed 2-3 hours after low tide. Belugas were found in several groups south of the Susitna River mouth (Groups 3, 4, 5), and some whales (Group 6) were in the Little Susitna River. No belugas were seen in Knik Arm, in spite of excellent viewing conditions.

June 8

Upper Cook Inlet was surveyed a third time. Turnagain Arm was again windy and rough from Fire Island to about Beluga Point, but further east the conditions were good to excellent. Chickaloon Bay had a range of conditions due to winds, but whales were found (Groups 1 and 2) along the coast and at the mouth of Chickaloon River. From Chickaloon Bay, the survey continued around Point Possession to Moose Point, across the Inlet to North Foreland, along the coast to the Susitna delta, and then around Knik Arm. Group 3 was near the Beluga River. Groups 4 and 5 were at the Susitna River. Group 6 was in the Little Susitna River. Group 7 was at Windy Point in central Knik Arm.

June 9

Weather conditions deteriorated, so no surveys were flown on this day.

June 10

Wind forecasts for upper Cook Inlet were worse than for the lower Inlet; therefore, a survey was made along the east shore of the Inlet from Point Possession south to Elizabeth Island, including Kachemak Bay. The return flight was over open water and included a survey around Kalgin Island. Belugas were found near Point Possession both on the outbound and inbound flights, but no belugas were seen south of there. Instead, large numbers of sea otters (*Enhydra lutris*: almost 900) and harbor seals (*Phoca vitulina*: more

than 900) were in Kachemak Bay; more than 10 humpback whales (*Megaptera novaeangliae*) were near Elizabeth Island; west of Kachemak Bay there was a group of 20 Steller sea lions (*Eumetopias jubatus*) and one minke whale (*Balaenoptera acutorostrata*).

June 11

The fourth survey of upper Cook Inlet was generally in good to excellent conditions; only a relatively small area in the western portion of Turnagain Arm had poor viewing conditions. Beluga groups were found near Chickaloon River (Group 1), close to shore on the south perimeter of Chickaloon Bay (Group 2), between Point Possession and Fire Island (Groups 3 and 4), at Beluga River (Group 5), near the Susitna River (Group 6), and at Eagle Bay, in central Knik Arm (Group 7).

June 12

The fifth survey of upper Cook Inlet involved a change in the usual routine. Instead of starting with a survey of Turnagain Arm and then surveying the Susitna delta and Knik Arm at low tide, the survey track went around Fire Island, then south past Point Possession almost to Boulder Point before crossing the Inlet to McArthur River (Trading Bay) and north around the Susitna delta and Knik Arm. The change in route was to avoid low overcast, fog, and rain in Turnagain Arm in the morning. However, this meant the Susitna and Knik areas were surveyed at high tide. Although conditions were generally good, only one group of belugas was found in the Susitna delta. The whales (Group 1) were well away from shore but near the shelf break where they are often found at low tide. Along the shore between the Little Susitna River and Point MacKenzie, 14 small boats were seen with set nets running perpendicular to shore. This level of fishing activity has not been observed in the past and may partially explain the lack of beluga sightings in this area on this day. No whales were seen in Knik Arm. The survey of Turnagain Arm was done at low tide in somewhat marginal weather conditions because of high winds and whitecaps. However, the observers were able to see across most of the channels in Turnagain Arm. In Chickaloon Bay, viewing conditions were good. Three groups (Groups 2, 3, and 4) were found near the mudflats and bluffs along the south shore of Chickaloon Bay.

June 13

The west side of lower Cook Inlet was surveyed with good viewing conditions along all coastal areas (100% coverage) from Cape Douglas to West Foreland. Although fog compromised the search effort on portions of the offshore transects, the coastal effort was ideal with heavy overcast, no wind, and flat seas. Many sea otters and harbor seals were seen. Steller sea lions were seen on rocks near Cape Douglas, and three humpback whales were found in the Inlet midway between Kamishak and Kachemak Bays. Unlike most years, no killer whales (*Orcinus orca*), gray whales (*Eschrichtius robustus*), or harbor porpoise (*Phocoena phocoena*) were seen in lower Cook Inlet.

June 14

The sixth survey of upper Cook Inlet was a standard flight covering Fire Island, Turnagain Arm, and Chickaloon Bay at high tide, and the Susitna delta and Knik Arm at low tide. Heavy overcast and almost no wind made for ideal survey conditions. Belugas were found in Chickaloon Bay (Groups 1, 2, 3, and 4; when Groups 2 and 4 merged, the new group was identified as Group 5), near Point Possession (Group 6), near Beluga River (Group 7), near Susitna River (Group 8), and at the Little Susitna River (Group 9). No belugas were found in Knik Arm in spite of excellent viewing conditions.

June 15

The seventh and final survey of upper Cook Inlet concentrated on coastal and offshore areas where belugas had been seen across the past 10 days. The survey was conducted at high tide. The flight path included coastal areas of Fire Island, Turnagain Arm (as far as Bird Point), Chickaloon Bay, and Point Possession to the Native village of Tyonek, the Susitna delta, and Knik Arm (to the Knik River bridge). Survey conditions were ideal with almost no wind and a heavy overcast; however, insect densities were high enough to compromise visibility on the forward side of bubble windows. Belugas were found in the usual places: near Chickaloon River (Group 1); along the south shore of Chickaloon Bay (Group 2); near Beluga River (Group 3); and south of Susitna River (Groups 4 and 5). No whales were found at the Little Susitna River and in Knik Arm.

Summary counts of belugas

Medians of beluga counts are shown in Table 1, and beluga sighting locations are shown in Figure 3. The daily medians ranged from 81 to 153 whales (Fig. 5), varying little from day to day. Following the standard procedure, the highest daily median is used as the annual index count; therefore, in June 2006 the index count was 153 belugas. This summary count does not reflect any correction for missed whales. Calculations for whales missed during these aerial counts and abundance estimates were described in Hobbs et al. (2000a, b). The median count in 2006 (153 belugas) is lower than similar counts from 1998-2005 (174-217 belugas; Table 2).

Other marine mammals

Besides belugas, the only other marine mammal found in upper Cook Inlet (north of 60°43'N) were harbor seals. There were 36 sightings ranging 1-120 seals in a group (total 887; median group size 4). Harbor seals were seen every day, primarily between the Theodore and Ivan Rivers (Susitna delta) and near the Chickaloon River.

Although belugas were not seen in lower Cook Inlet (south of 60°43'N), many other marine mammals were recorded (Fig. 4). Harbor seals were common (34 sightings ranging 1-650 seals; total 911; median group size 2). Sea otters were seen in or near Kachemak Bay (53 sightings for a total of 895 otters; median group size 5) and Kamishak Bay (104 sightings of 755 otters; median group size 2). Steller sea lions were near Cape Douglas (sightings of one group of 10 and another group of 53 sea lions on rocks) and west of Homer (20 sea lions swimming together). Whale sightings in lower Cook Inlet included seven sightings of 14

humpback whales in groups of 1 to 7 individuals and one sighting of 1 minke whale. No harbor porpoise were seen this year, although in the past they were commonly seen in the lower Inlet.

Discussion

The June 2006 survey of Cook Inlet was similar to previous surveys in terms of research protocol and area covered. The type of aircraft, window configuration, altitude, air speed, and coastal search patterns were kept as constant as possible between years, and all observers were well experienced in belugas surveys. This consistency has the benefit of minimizing variables. In addition to the many years this project has been underway (1993-2006), each of these annual beluga surveys has involved several replicate flights around upper Cook Inlet. The number of flights and consistency in effort has helped detect patterns of whale distribution. In 2006, as in most years, belugas were found in small groups near river mouths along the shores of upper Cook Inlet, in particular near the Susitna River, Little Susitna River, Knik Arm, and Chickaloon Bay. Also, typical of most surveys in recent years, belugas were not found south of the Forelands in lower Cook Inlet (Fig. 3; Table 1). Prior to 1996 it was not uncommon to see groups of belugas south of North Foreland (Rugh et al. 2000), but since then only one or two beluga groups have been found in lower Cook Inlet, if any (Table 2). Sighting conditions have generally been ideal during the coastal and offshore surveys; however, belugas were regularly observed only in upper Cook Inlet. Because many other marine mammals were seen in the lower Inlet, the lack of beluga sightings was not due to visibility.

The median estimate from the best survey day (153 belugas) is similar to but lower than index counts made each year since 1998, generally near 200 whales (Table 2). Index counts made prior to 1998 were higher, generally near 300 whales. These median counts must be treated as merely a rough index that provides a quick assessment of the raw counts made during the aerial surveys. Calculated abundances include corrections for whales missed within the viewing range of observers and whales missed because they were beneath the surface. These corrected abundance estimates are shown in Table 2 (estimates from 1994-2000, Hobbs et al. [2000a]; estimates from 2001-05, NMFS unpublished data). The abundance estimates, with their associated coefficients of variance, are the appropriate values to be used in interyear trend analyses.

Acknowledgments

Rod Hobbs, Task Leader for the Cook Inlet beluga studies, helped coordinate funding for this project. Dave Weintraub (Commander NW, Ltd., Wenatchee, WA) helped provide the aircraft and flew on many of the surveys; his investment in this project is greatly appreciated. Our primary pilots in 2006, Jeremy Weintraub and Andy Harcombe, 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.

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Table 1. June 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	6/6	6/7	6/8	6/10	6/11	6/12	6/13	6/14	6/15
Turnagain Arm	---	0*	0	---	0*	0*	---	0	0
Chickaloon Bay/ Point Possession	40	17	8	---	18	60	---	28	15
Point Possession to East Foreland	---	0	---	15 ²	---	0*	---	---	---
Mid-inlet east of Trading Bay	---	---	---	0	---	0	0	---	---
East Foreland to Homer	---	---	---	0	---	---	---	---	---
Kachemak Bay	---	---	---	0	---	---	---	---	---
West side of lower Cook Inlet	---	---	---	---	---	---	0	---	---
Redoubt Bay	---	---	---	---	---	---	0	---	---
Trading Bay	---	0	---	---	---	0	---	---	---
Susitna delta ³	97	55	70	---	126	73	---	110	89
Knik Arm	0	0	4	---	9	0	---	0	0
Fire Island	0	0	0	---	0	0	---	0	0
Totals	136	72	81		153	133		138	104

*Viewing conditions compromised by high winds in some areas.

²This group of whales was seen near Point Possession on both the outbound and inbound legs of the survey of lower Cook Inlet.

³ For purposes of dividing Cook Inlet into coverage areas, this table includes all coastline between North Foreland and Point MacKenzie as a part of the Susitna delta, although belugas were only found between the Beluga and Little Susitna Rivers.

Table 2. Index counts of Cook Inlet belugas made during aerial surveys in June or July 1993-2006 showing abundance estimates with respective CVs (Hobbs et al. 2000a; NMFS unpublished data). Sighting percentages are indicated in three generalized zones.

Year	Dates	Index counts	Abundance estimates	CV	Lower Cook Inlet	Susitna delta ¹	Elsewhere in upper Cook Inlet
1993	June 2-5	305	---	---	0%	56%	44%
1994	June 1-5	281	653	0.43	4%	91%	5%
1995	July 18-24	324	491	0.44	4%	89%	7%
1996	June 11-17	307	594	0.28	0%	81%	19%
1997	June 8-10	264	440	0.14	0%	28%	72%
1998	June 9-15	193	347	0.29	0%	56%	44%
1999	June 8-14	217	367	0.14	0%	74%	26%
2000	June 6-13	184	435	0.23	0%	62%	38%
2001	June 5-12	211	386	0.09	1%	35%	64%
2002	June 4-11	192	313	0.12	0%	48%	52%
2003	June 3-12	174	357	0.11	0%	9%	91%
2004	June 2-9	187	366	0.2	0%	6%	94%
2005	May 31-June 9	192	278	0.18	0%	60%	40%
2006	June 5-15	153	---	---	0%	76%	24%

¹ Susitna delta is defined here as between the Beluga River and Little Susitna River, where most belugas have been observed.

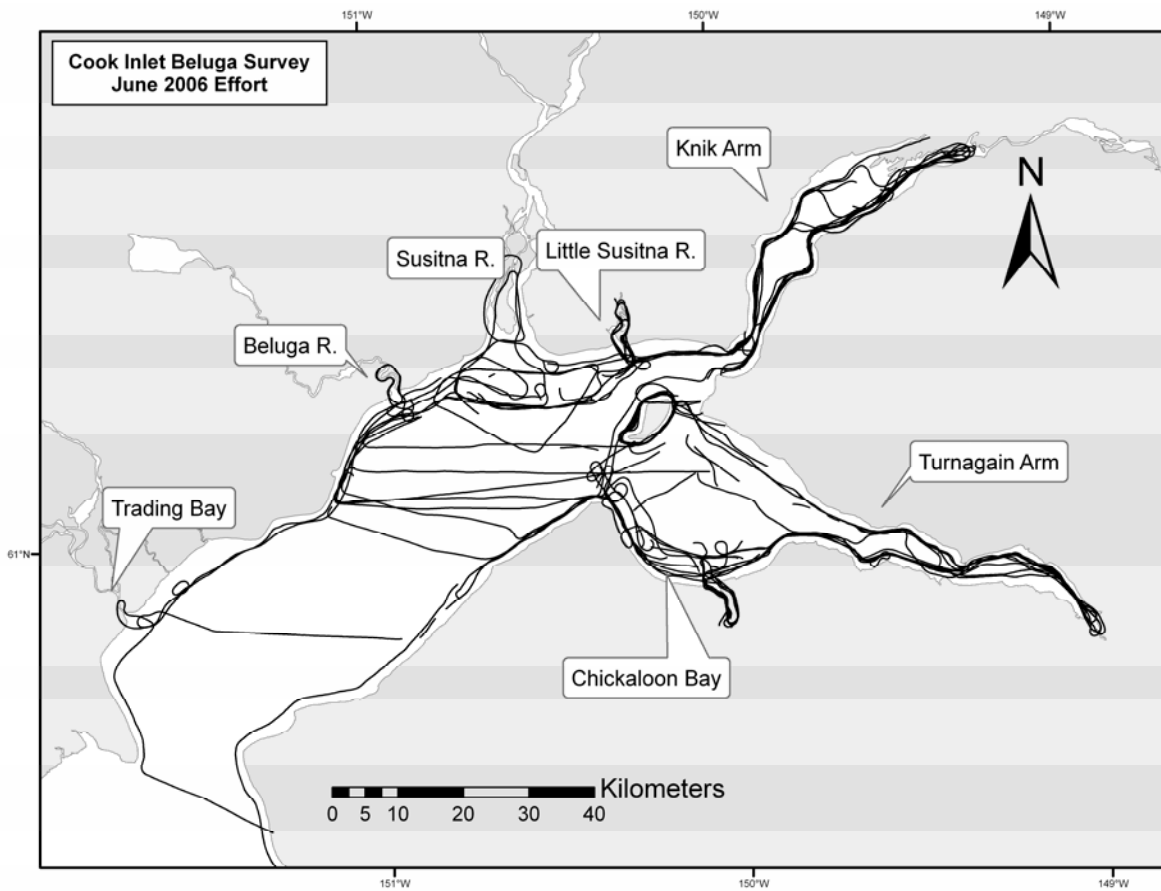


Figure 1. June 2006 on-effort tracklines for upper Cook Inlet.

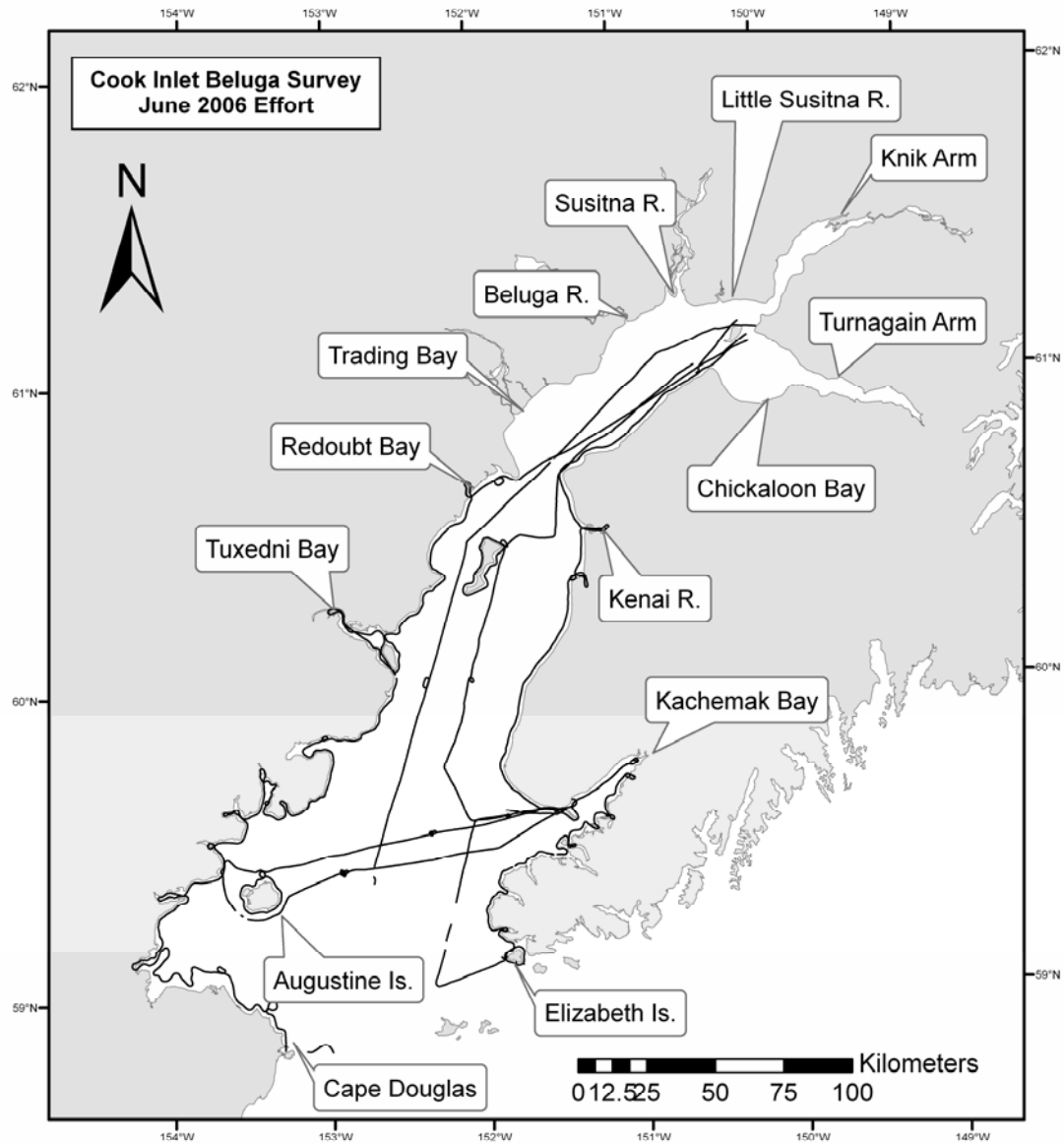


Figure 2. June 2006 on-effort tracklines for lower Cook Inlet.

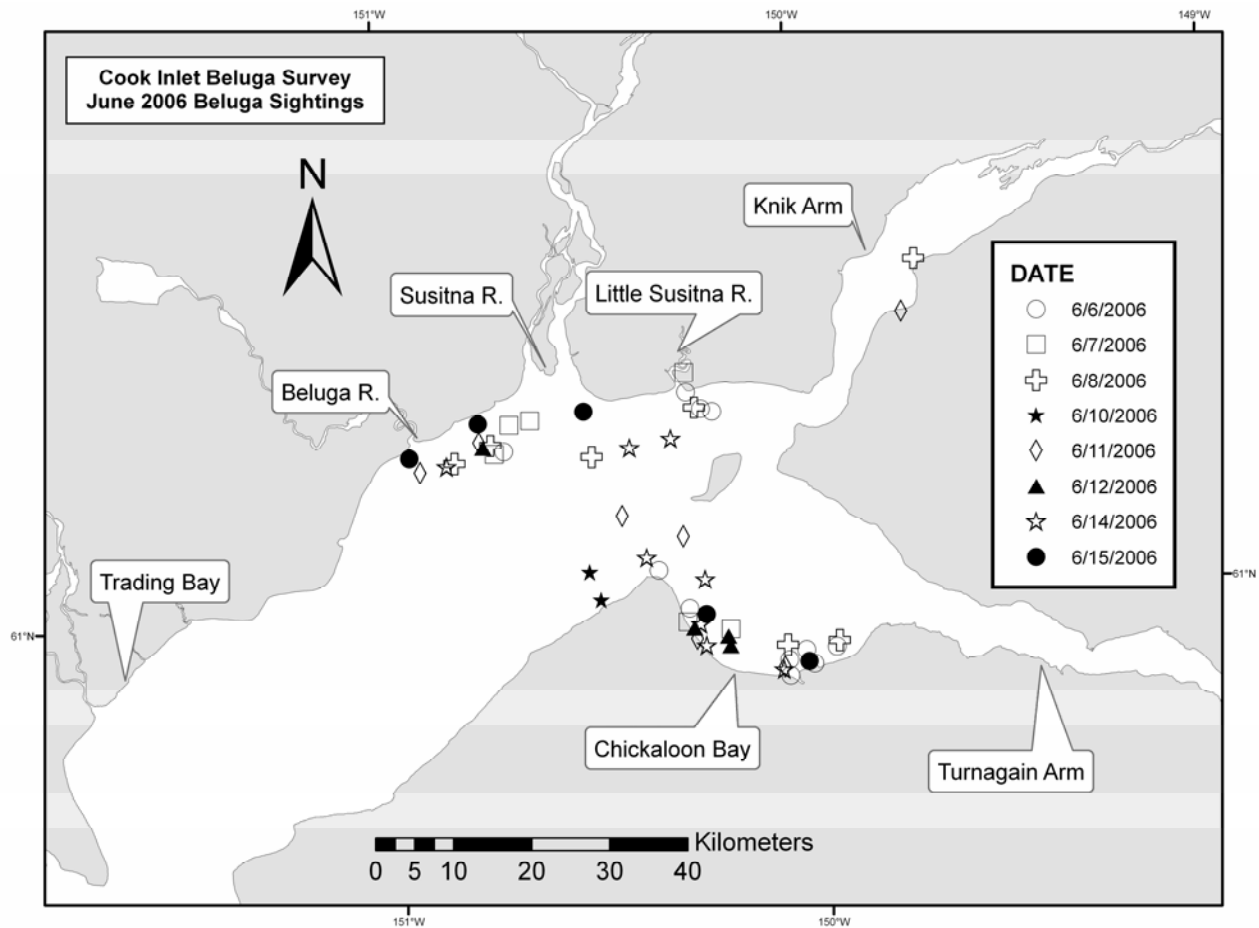


Figure 3. June 2006 beluga sightings in Cook Inlet.

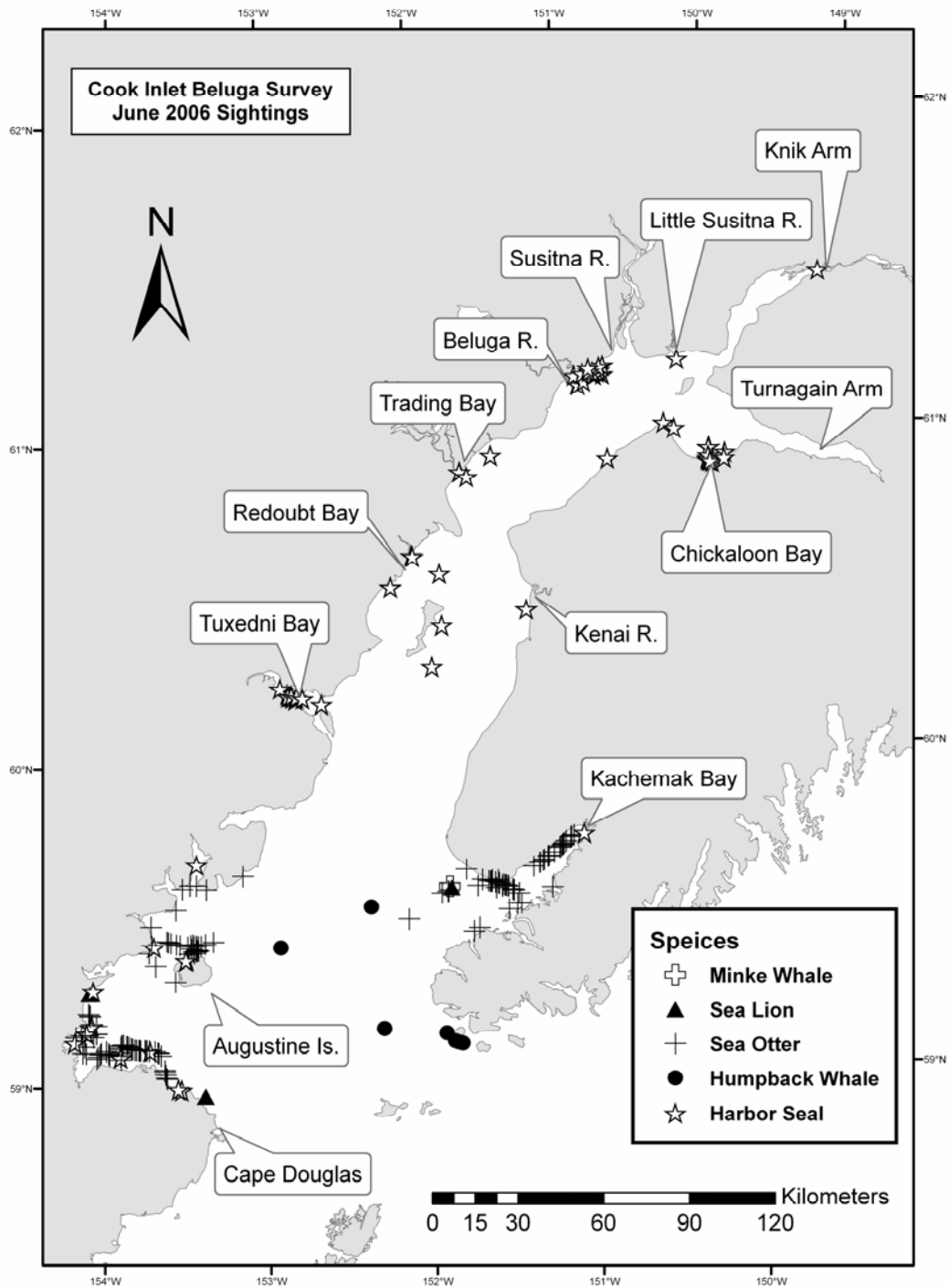


Figure 4. June 2006 sightings of marine mammals other than belugas in Cook Inlet.

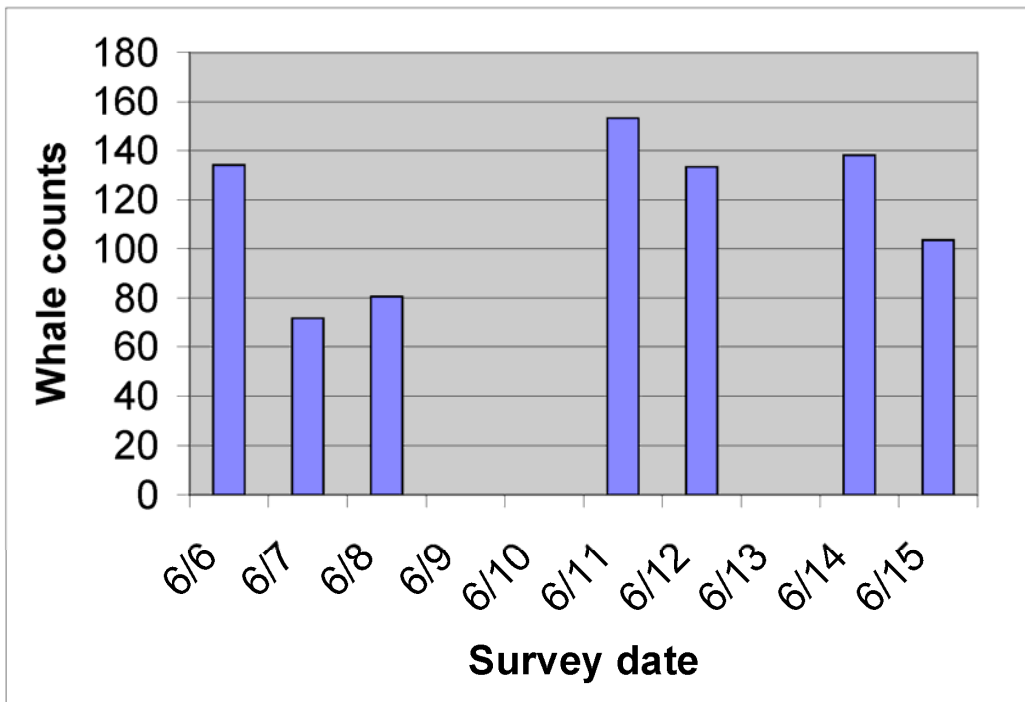


Figure 5. June 2006 daily median counts of belugas in Cook Inlet.