

AERIAL SURVEYS OF BELUGAS IN COOK INLET, ALASKA, JUNE 2009

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ABSTRACT--The National Marine Fisheries Service (NMFS) conducted surveys of the beluga population in Cook Inlet, Alaska, 2-9 June 2009. The aerial surveys (39.4 flight hours) were flown in a twin-engine, high-wing Aero Commander aircraft at an altitude of 244 m (800 ft) and speed of 185 km/hr (100 kt), consistent with NMFS' surveys of Cook Inlet conducted each year since 1993. The study in June 2009 included surveys of coastal areas (flown 1.4 km offshore) around most of the Inlet and 1074 km of transects across the Inlet, effectively searching 28% of Cook Inlet's total area. Paired, independent observers searched on the coastal (left) side of the plane where virtually all beluga sightings occur, while a single observer and computer operator/data recorder were on the right side of the plane. After finding belugas, multiple aerial passes were made with paired observers completing four or more independent counts of each group. Daily median counts made on seven different days ranged from 116 to 290 belugas in the Susitna delta (between the Beluga and Little Susitna rivers), and 13 to 40 belugas in Chickaloon Bay. Belugas were not observed in lower Cook Inlet, which is typical of annual surveys in most of the recent years. In June 2009, the highest daily median estimate, used here as an index for relative abundance (not corrected for effort nor for estimates of missed whales), was 303 belugas. This is within the range of index counts from previous survey years (305 belugas in 1993, 281 in 1994, 324 in 1995, 307 in 1996, and 264 in 1997, 193 in 1998, 217 in 1999, 184 in 2000, 211 in 2001, 192 in 2002, 174 in 2003, 187 in 2004, 192 in 2005, 153 in 2006, 224 in 2007, and 126 in 2008).

Introduction

The National Marine Fisheries Service (NMFS) conducts annual aerial surveys to study beluga (*Delphinapterus leucas*) distribution and abundance 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 annual June surveys are to document beluga sightings for distributional analysis and to count and video belugas in Cook Inlet for abundance estimates. The intent of the 2009 survey was to maintain 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 subsistence harvest (Mahoney and Shelden 2000). Following abundance estimates that indicated this stock had declined nearly 50% between 1994 and 1998, NMFS designated the stock as depleted under the Marine Mammal Protection Act (65 FR 34590) on 31 May 2000. As of October 2008 (73 FR 62919), this population has been listed as *endangered* under the Endangered Species Act. Cook Inlet belugas are now managed with a small, regulated subsistence harvest.

Methods

Aircraft and data

The survey aircraft used in June 2009, an Aero Commander 680 (*N98UP*), has twin-engines, high-wings, and more than 8-hour flying capability. Bubble windows were at the right forward, left forward, and left rear observer positions, maximizing the search area. A window behind the left rear observer position was opened during counting passes to provide unobstructed video recordings of the beluga groups. An intercom system provided communication among the observers, data recorder, and pilots, and a selective listening device was used to aurally isolate the left observer positions. The data recorder used a laptop computer¹ to record sighting data and download 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 sides of the aircraft), and visibility (on the left and right sides). 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.

Tracklines

Coastal surveys were conducted approximately 1.4 km offshore from the apparent waterline. The objective was to search all nearshore, shallow waters where belugas are typically seen in late spring/early 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 too shallow for belugas (as indicated by Native hunters who participated on surveys in the past).

In addition to the coastal surveys, systematic transects were flown across the Inlet. Offshore tracklines were designed to run the length of Cook Inlet or cross it, minimizing overlap within the 2009 survey effort and between previous survey years (Fig. 1).

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

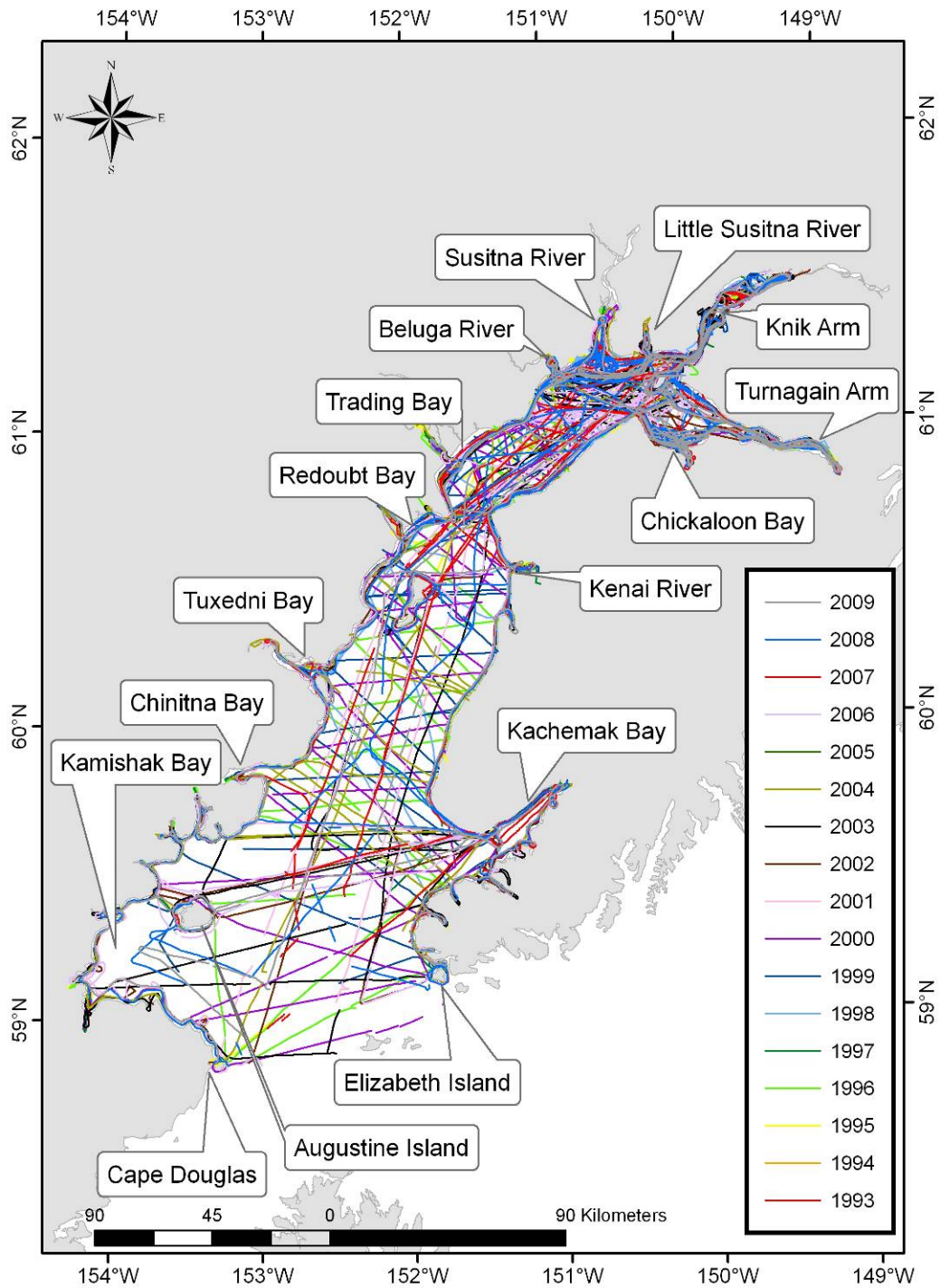


Figure 1. On-effort tracklines for June aerial surveys of belugas in Cook Inlet, 1993-2009.

Tides

Due to the broad geographical range of these surveys, in conjunction with rapidly changing tide heights, surveys were not flown at specific tidal conditions throughout Cook Inlet. There generally was an attempt to synchronize flights with low tides in the Susitna delta because: 1) the effective survey area was minimized at low tide when large areas of mudflats were exposed; and 2) beluga groups tend to concentrate along the edges of the mudflats at low tide, making them easier to find and count. Because tide changes in Turnagain Arm can be so rapid that tide rips and white caps compromise visibility, attempts were made to survey Turnagain Arm at slack tide. In Chickaloon Bay, belugas tend to be close to shore or in Chickaloon River at high tide, where they were relatively easy to video and count. Aerial surveys south of East and West Foreland were scheduled as a function of weather, not tides.

Although there are many daylight hours in June, light levels in Anchorage were low enough at night so that no surveying was done prior to 07:30 or after 19:30, 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 whale group, the observer(s) informed the recorder of the inclinometer angle and notable group behaviors but not group size. An important component to the survey protocols was the independence of the paired observers (i.e., that they not cue each other to sightings). This was done by having a visual barrier between the two left observers and audio shutoffs at each observer position. After a beluga group was reported, the trackline was maintained until the group was well behind the aircraft. This allowed each observer an opportunity to independently sight and report whale groups, and helped identify which beluga groups were missed by an observer. The pilot and data recorder did not call out beluga sightings until the whales were past the wing and likely missed by observers on that side of the aircraft. After passing the whales, the systematic search effort was stopped, and all headsets were activated so that everyone was able to communicate during counting passes.

Whale group locations were established at the onset of the 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 belugas. 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 cue from one counter, starting when the leading edge of the beluga group was close enough to be counted and ending when the trailing edge went behind the wing line. This provided a precise record for the duration of each counting effort. The paired observers made independent counts and recorded their results along with date, time, pass number, and quality of the count. The pass quality was a function of how well the observers saw the group location – it was not a function of how many whales were at the surface on the respective pass. Ratings were A (the counting effort was uncompromised by glare, whitecaps, distance, etc.) through F (when it was not practical to count whales). Only quality A and B estimates were used in the abundance analysis. Although whale tracks can be seen in muddy water, only whales at the

surface during a pass were included in the counts. Daily count records were not shared within the aerial team until the survey effort was completed to maximize the independence of each observer's counts.

The daily aerial counts are represented by medians of each observer's median counts on multiple passes (typically 4 to 8 passes) over each whale group (Table 1). Using median counts instead of maximum or mean counts reduces the effect of outliers (extreme high or low counts) and makes the NMFS surveys more comparable to other surveys that lack multiple counting passes over whale groups.

Median counts are also more appropriate than maximums when these counts are corrected for missed whales because correction factors should be applied to representative counts, not extremes. However, when establishing the annual index, the procedure has been to use the highest of the daily medians instead of a median of all daily medians; this avoids including counts from days with only partial surveys.

Table 1. Beluga counts made during aerial surveys of Cook Inlet in June 2009. Counts are medians from 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	6/2	6/3	6/4	6/5	6/7	6/8	6/9
Turnagain Arm	0	0	0	0	---	---	0
Chickaloon Bay/ Point Possession	21	40	23	30	---	---	13
Point Possession to Moose Point/East Foreland	0	0	---	---	---	---	---
Mid-inlet east of Trading Bay	0	---	---	---	0	0	---
East Foreland to Homer	---	---	0*	---	---	0	---
Kachemak Bay to Elizabeth Island	---	---	---	---	---	0	---
West side of lower Cook Inlet	---	---	---	---	0	---	---
Redoubt Bay	---	---	0*	---	---	---	---
Trading Bay	---	0	0	---	0**	---	---
Susitna delta***	116	130	150	174	---	****	290
Knik Arm	0	0	0	0	---	---	0
Fire Island	0	0	0	0	---	---	0
Totals	136	170	173	204			303

* Surveyed to Kenai River (upriver to shallows) before crossing inlet to Drift River and surveying north to West Foreland.

** Surveyed Harriet Point to Drift River.

*** The coast between North Foreland and Point Mackenzie is defined as the Susitna delta, however, beluga groups (1-2/day) were found only between the western tributary of the Susitna River and Point Mackenzie in 2009.

****Two groups of belugas were observed from offshore trackline Waypoint 5 but were not counted or video taped.

Cameras

Paired High Definition (HD) video cameras were used to document beluga groups; one camera had a lens set at wide angle to view 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, 2006). For many years, Cook Inlet beluga abundance surveys 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 all counting passes when group size appeared to be more than 20 belugas. Video clips from the two cameras will be studied in the laboratory to obtain precise beluga counts. These beluga counts will 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). The beluga counts in the video images will be used to determine the 2009 Cook Inlet beluga abundance estimate (e.g., Hobbs et al. 2000a).

Results

Survey effort

A total of 39.4 hours were flown around Cook Inlet 2-9 June 2009. All flights (14 take-offs and landings ranging from 1.8 to 3.7 hours) were based out of Anchorage, sometimes with refueling stops in Homer. Of the 39.4 flight hours, 21 hours were spent on survey effort (i.e., not including time on the runway, deadheading without a search effort, circling whale groups to conduct counts, or periods with poor or useless visibility). Due to poor or useless visibility as determined by the left-front observer, 1.6 hours of search effort (7% of the possible search time) was lost.

Two observers (KWS & DJR) have participated in the Cook Inlet beluga surveys in most or all seasons since the project began in 1993. One observer (CLS) had participated in 2003, 2004, 2006, and 2008. The remaining two observers (KTG & LWB) have participated since 2005 and 2008, respectively.

Coverage

The June 2009 aerial surveys provided a thorough coverage (100%) of the Cook Inlet coastline (1,810 km) for waters within approximately 3 km of shore (Figs. 2 and 3). In addition, 1074 km of systematic transects were 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 5766 km², which is 28% of the Cook Inlet surface area (20,943 km²). This coverage was similar to past beluga surveys in Cook Inlet (Rugh et al. 2000). Upper Cook Inlet was surveyed on five days in 2009, concentrating in areas where beluga groups have consistently been found in the past, such as the Susitna delta, Knik Arm, Turnagain Arm, and Chickaloon Bay. Excluding repetitions of the upper inlet, the area covered by all offshore transects (936 km²) and coastline survey (1100 km²) was

approximately 53% of upper Cook Inlet's total area. In lower Cook Inlet, surveys covered 22% of the area (2519 km² of coastline plus 1211 km² of offshore transects relative to a surface area of 17,130 km²).

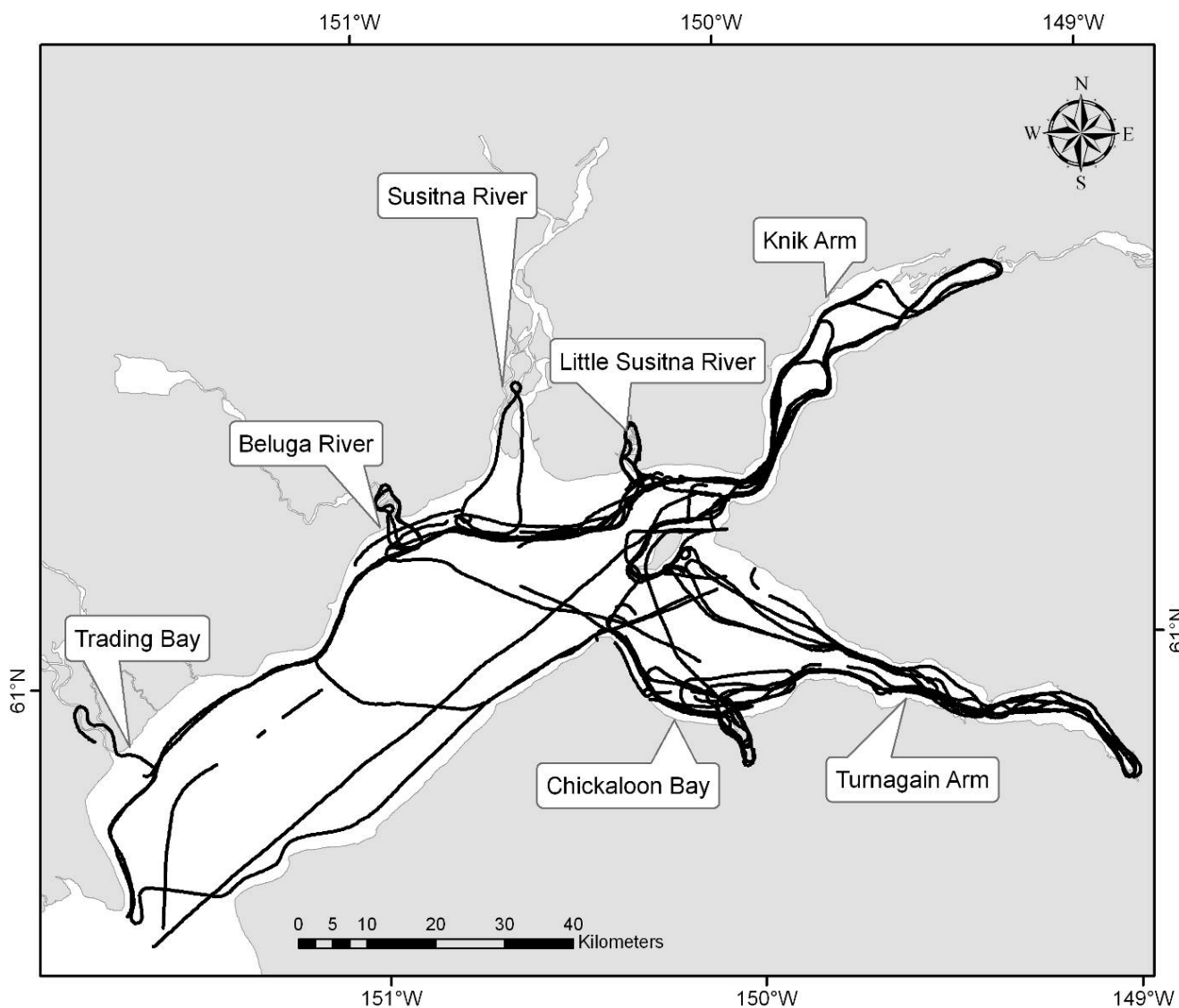


Figure 2. On-effort tracklines for aerial surveys of belugas, upper Cook Inlet, June 2009.

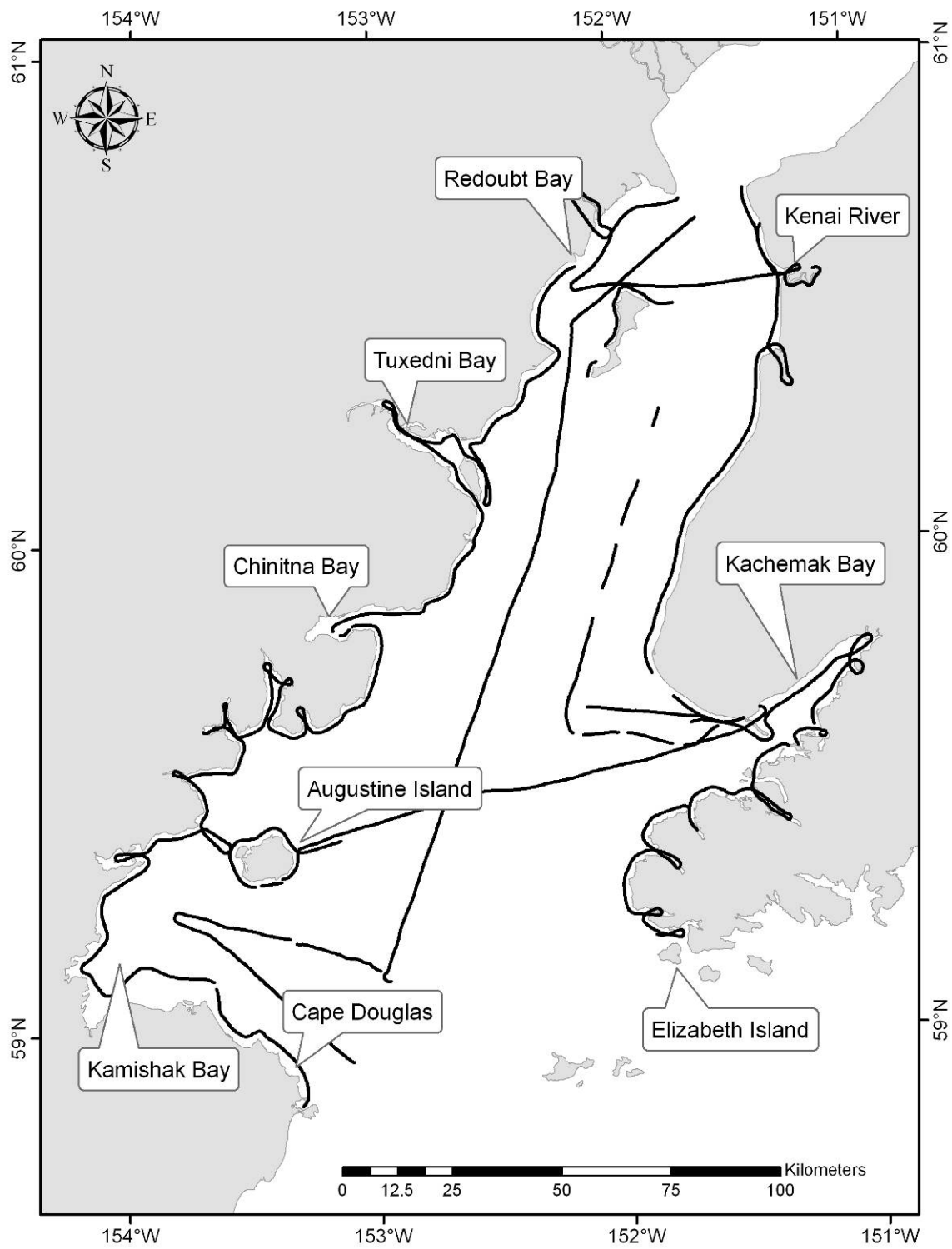


Figure 3. On-effort tracklines for aerial surveys of belugas, lower Cook Inlet, June 2009.

2009 daily reports

June 2

The season began with a survey of upper Cook Inlet. We departed Anchorage 2 hours before low tide (Anchorage, Knik Arm station) and flew across Chickaloon Bay to Point Possession then followed the coast to Moose Point where we turned and crossed the inlet to North Foreland. Here the coastal survey resumed including flying up river to the power lines on the Beluga, Susitna and Little Susitna Rivers, Knik Arm to the bridge, and ended the survey after circling Fire Island. Belugas (Group 1) were first encountered at the west tributary of the Susitna River at low tide (Fig. 4). We completed video and counting passes (12) as the group continued to travel west along the mudflat edge toward the Ivan River. Group 2 was observed along the mudflats of the east tributary of the Susitna River, also traveling west (Fig. 4). We completed 9 video and counting passes on the group. A brief break was taken in Anchorage to refuel after which Turnagain Arm and Chickaloon Bay were surveyed. Belugas (Group 3) were found east of the Chickaloon River in a line running from shore to about 2 miles offshore. We completed 9 video and counting passes as the whales continued to travel east toward Turnagain Arm. Sighting conditions were fair to excellent during the survey with intermittent patches of glare. Sea states ranged from Beaufort 1 to 3 with a few small areas in Turnagain Arm at Beaufort 4. Other marine mammal sightings included: 54 harbor seals (*Phoca vitulina*) on the Susitna River mudflats, 5 harbor seals at the Little Susitna River, and 12 harbor seals hauled out west of Chickaloon River.

June 3

We followed a similar pattern to the June 2 surveys with the exception of extending the coastal survey south to the Forelands on the first flight of the day. We encountered one large group of belugas (Group 1, Fig. 4) at the mouth of the Little Susitna River (9 video and counting passes). Two beluga groups were observed in Chickaloon Bay. Group 2 was west and offshore of Chickaloon River (9 video and counting passes), and Group 3 was in the notch of Chickaloon Bay where the bluffs meet the mudflats (5 video and counting passes). Other marine mammal sightings included: 152 harbor seals hauled out at the McArthur River. Sighting conditions were similar to the previous day with calm sea states and fair to excellent visibility.

June 4

We began the first flight of the day at East Foreland following the coast to the Kenai River. We surveyed up the river then crossed the inlet to Drift River where we resumed the coastal survey heading north to Point Mackenzie. Two large groups of belugas were found: one west of the Little Susitna River (Group 1: 9 video and counting passes) and the other along the coast and in the mouth of the Little Susitna River (Group 2: 11 video and counting passes) (Fig. 4). The second flight of the day coincided with low tide in Knik and Turnagain Arms. We began the survey at Point Mackenzie, surveyed Knik Arm (Goose and Eagle Bay), rounded Fire Island, up Turnagain Arm (as far as Bird Point), and completed coastal and offshore tracklines in Chickaloon Bay. Two groups of belugas were found after extensive off-effort searching in Chickaloon Bay. Group 3, a group of 2 belugas, was seen by the pilot just west of the Chickaloon River while Group 4 (7 video and counting passes) was seen once again where the mudflats meet the bluffs (Fig. 4). Other marine mammal sightings included: 3 groups of

harbor seals hauled out near Big River (70 animals) and another harbor seal group near Kenai River (40 animals). Winds increased during the day with heavy overcast and light rain. This affected sighting conditions in Turnagain Arm and Chickaloon Bay, particularly during the negative low tide when whitecaps were scattered across the mudflats.

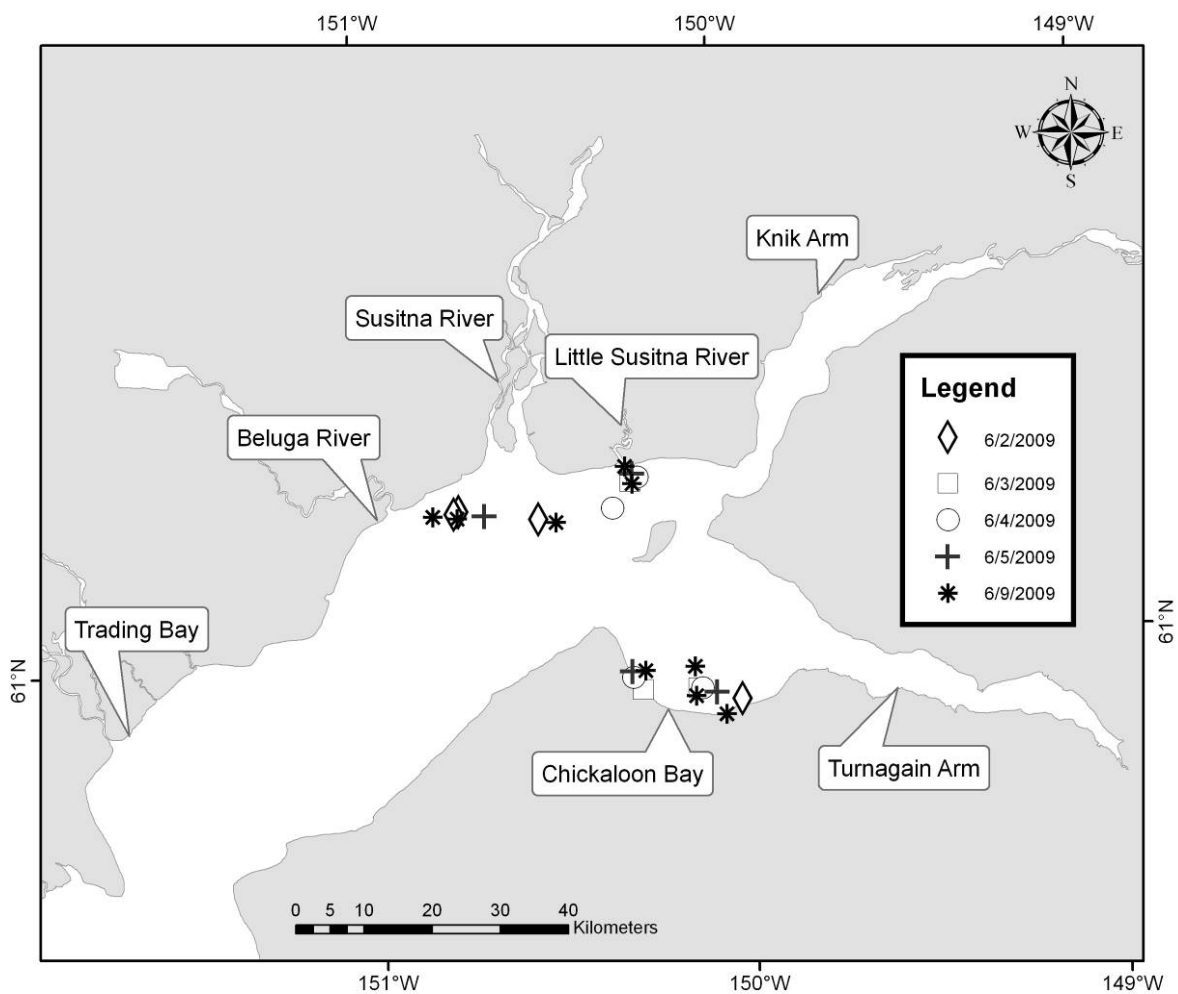


Figure 4. Beluga sightings in Cook Inlet, June 2009.

June 5

We completed a full survey of the upper inlet north of Point Possession and the Beluga River. The morning flight coincided with the falling tide in Turnagain Arm and low tide in the Susitna delta. Belugas were in two groups: Group 1 at the Chickaloon River (12 video and counting passes) and Group 2 where the bluffs meet the mudflats in Chickaloon Bay (5 video and counting passes). Although we planned to survey the Susitna delta and Knik Arm after completing Chickaloon Bay, a low fog bank covered the entire region from Fire Island across the Susitna delta. After landing for an hour to allow the fog to move out of the area, the second flight covered the coast from the Beluga River to Point Woronzof. Belugas were found traveling rapidly east along the mudflat edge on the west tributary of the Susitna River (Group 3: 9 video and counting passes) and in the mouth of the Little Susitna River (Group 4: 8 video and counting passes) (Fig. 4). This was the fourth consecutive day that belugas were found in the same regions in Cook Inlet. Other marine mammal sightings included: an unidentified pinniped swimming near Beluga Point in Turnagain Arm and harbor seals hauled out and in the water at Chickaloon River (22 animals). Sighting conditions were fair to excellent with calm winds in the morning and sea states of Beaufort 1 to 3 in the afternoon.

June 6

Took a day off to repair/evaluate broken video equipment. Observer (LWB) arrived to replace exiting observer (CLS).

June 7

After completing 4 circuits of upper Cook Inlet, surveys of the lower inlet began on June 7. The survey began with offshore tracklines heading south to Cape Douglas and then the coastal survey from Cape Douglas to Ursus Cove. A trackline along the south coast of Augustine Island was completed before surveying across the inlet to Homer. After departing Homer, the survey effort resumed on the north coast of Augustine crossing to Ursus Cove and continuing along the west coast to Drift River. Species sighted included harbor porpoise (*Phocoena phocoena*), sea otters (*Enhydra lutris*), Steller Sea Lions (*Eumetopias jubatus*), harbor seals, humpback whales (*Megaptera novaeangliae*), gray whales (*Eschrichtius robustus*), and an unidentified pinniped. Harbor porpoise (18 sightings for a total of 21 animals) were seen on an offshore trackline (20 to 30 km from the western shore) between Chinitna Point and Redoubt Point. Sea otters were seen in Kachemack Bay (76 animals), and along the west side of the inlet from Cape Douglas to Chinitna Bay (371 animals). In addition, 20 sea lions were sighted near Cape Douglas and 19 on the eastern shore of Augustine Island, a gray whale was seen just north of Douglas River, and 3 humpback whales were sighted approximately 35 kilometers southeast of Augustine Island. Finally, a total of 284 harbor seals were seen along the western side of Cook Inlet from Kamishak Bay to Redoubt Bay (7 sightings). Viewing conditions were excellent for much of the survey except for brief periods where fog or glare reduced conditions to poor or useless (Fig. 3).

June 8

Lower inlet surveys continued for a second day, covering the coastline from the Kenai River to Elizabeth Island, and an offshore trackline (20-30 kilometers offshore) from Elizabeth Island back to Anchorage. During the coastline survey sightings included: 568 sea otters (36 sightings) in Kachemak

Bay, 670 harbor seals hauled out at Fox River, 1 harbor porpoise on the north coast of Kachemak, and 2 humpback whales offshore of English Bay. Low fog and high sea states prevented a survey of the coastline of Elizabeth Island and truncated the offshore transect. After a break in Homer, the second flight continued the offshore trackline survey from Homer to Anchorage with a break to circle Kalgin Island. Sightings included 1 sea otter approximately 45 kilometers south of Kalgin Island and two beluga whale groups in the Susitna delta. In general, viewing conditions were fair to excellent for the coastal survey but deteriorated during the offshore trackline survey because of fog, glare and high winds (Fig. 3).

June 9

Although 4 circuits of upper Cook Inlet had been completed we decided to survey the entire upper inlet north of Point Possession and Beluga River to check the distribution of beluga groups after our three day absence. The morning flight coincided with the high tide in Turnagain Arm. Beluga whale groups were found in Chickaloon Bay (a lone beluga in the Chickaloon River (Group 1), and a group scattered from the mouth to about 2 miles offshore (Group 2) and the Susitna delta (one group scattered from the Theodore River to the western tributary of the Susitna River (Group 3) and a second group in the mouth of the Little Susitna River (Group 4). Because animals were too dispersed to count or video tape, we landed to wait for the low tide. For the low tide flight, we surveyed a reverse route to catch the low at the Susitna delta and then at Chickaloon Bay. Beluga whales were found at the mouth of the Little Susitna River (renamed Group 5: 6 video and counting passes), in the channel along the mudflat edge of the eastern tributary of the Susitna River (Group 6: 4 video and counting passes), lined up traveling westbound in the mudflat channel from the Theodore River to the western tributary of the Susitna River (Group 7: 5 video and counting passes), and scattered from Point Possession to the Chickaloon Bay mudflats (Group 8: 6 counting passes, but too dispersed to video tape). Because one of the HD cameras was damaged, only standard video was obtained on Groups 5-7. Sighting conditions were mostly fair to excellent.

Summary counts of belugas

The daily medians ranged from 136 to 303 whales (Table 1). Following the protocol from previous surveys, the highest daily median is used as the annual index count; therefore, in June 2009 the index count was 303 belugas. This annual index does not reflect any correction for missed whales. Calculations for whales missed during these aerial counts and abundance estimates are described in Hobbs et al. (2000a, b). The median count in 2009 falls within the range of counts from 1993-2008 (Table 2).

Table 2. Cook Inlet beluga index counts (i.e., highest daily median count) made during aerial surveys in June or July 1993-2009 showing abundance estimates with respective CVs (Hobbs et al. 2000a; NMFS unpublished data).

Year	Dates	Index counts	Abundance estimates	CV	Nmin	Upper CL	Lower CL
1993	June 2-5	305	---	---			
1994	June 1-5	281	653	0.43	462	1464	291
1995	July 18-24	324	491	0.44	345	1120	215
1996	June 11-17	307	594	0.28	471	1018	347
1997	June 8-10	264	440	0.14	391	578	335
1998	June 9-15	193	347	0.29	273	606	199
1999	June 8-14	217	367	0.14	326	482	279
2000	June 6-13	184	435	0.23	359	679	279
2001	June 5-12	211	386	0.09	359	458	326
2002	June 4-11	192	313	0.12	283	396	248
2003	June 3-12	174	357	0.11	326	440	290
2004	June 2-9	187	366	0.2	310	540	248
2005	May 31-June 9	192	278	0.18	239	395	196
2006	June 5-15	153	302	0.16	264	412	221
2007	June 7-15	224	375	0.14	333	493	285
2008	June 3-12	126	375	0.23	310	585	240
2009	June 2-9	303	321	0.18	276	456	226

Other marine mammals

Besides belugas, the only other marine mammals found in upper Cook Inlet (north of 60°43'N) were harbor seals. There were 21 harbor seal sightings ranging from 1 to 152 seals per group (387 harbor seals total; mean group size of 18). Harbor seals were seen on every survey day in lower and upper Cook Inlet. Although belugas were not seen in lower Cook Inlet (south of 60°43'N), many other marine mammals were recorded (Fig. 5). Harbor seals were common in the lower inlet (20 sightings ranging from 1 to 300 seals; 1028 harbor seals total; mean group size of 51). Sea otters were seen in or near Kachemak Bay (40 sightings for a total of 644 otters; mean group size of 16), along the east side of the inlet, including Augustine Island (45 sightings for a total of 271 otters, mean group size of 8), and mid inlet (1 otter). Steller sea lions were only seen near Cape Douglas (1 sighting of 20 animals) and on the southeast side of Augustine Island (2 sightings for a total of 19 animals). Cetacean sightings in lower Cook Inlet included two humpback whale sightings (five individuals), one gray whale, and 32 sightings of harbor porpoise (86 individuals).

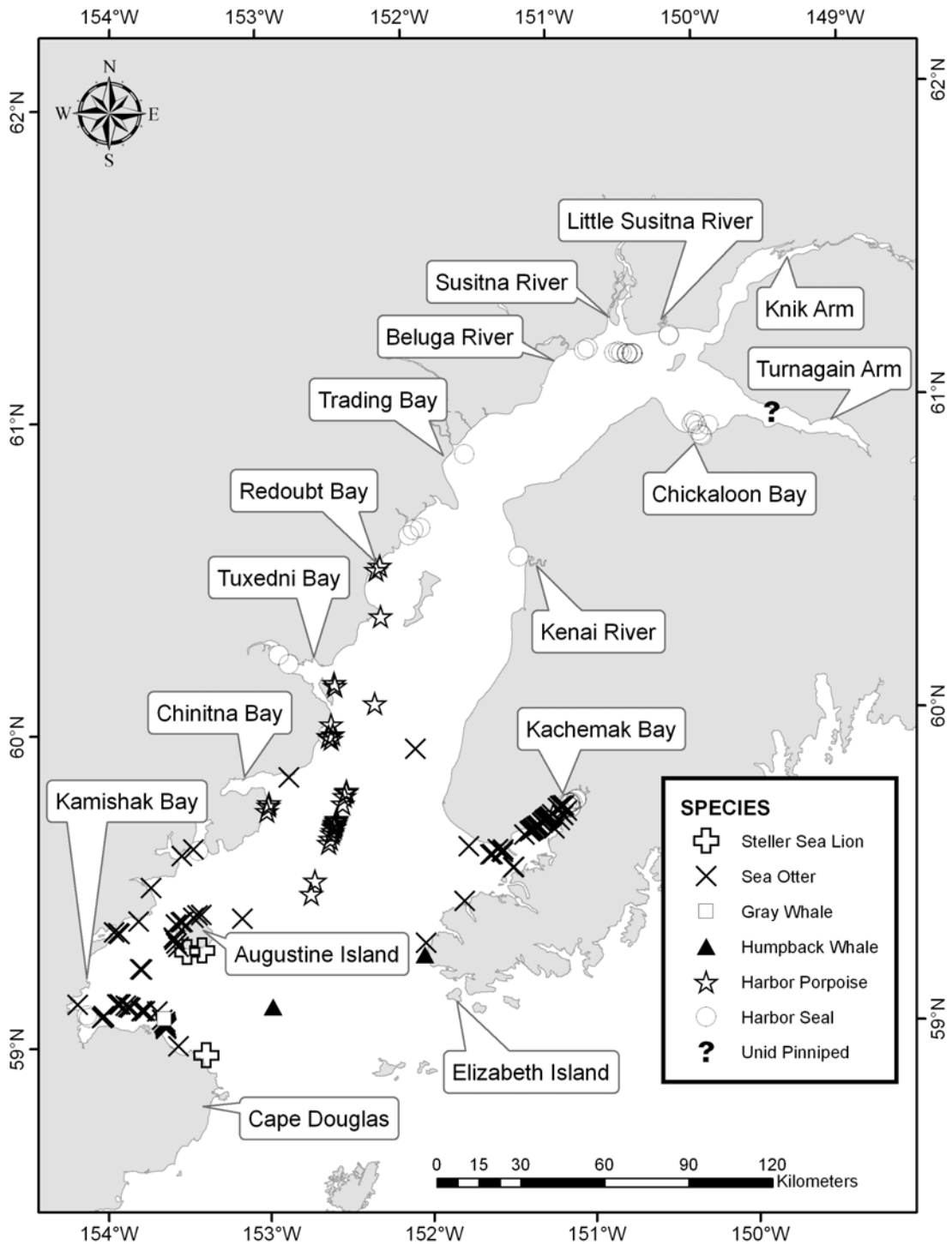


Figure 5. Marine mammal sightings, other than belugas, in Cook Inlet, June 2009.

Discussion

The June 2009 Cook Inlet survey was similar to previous surveys in terms of research protocol and survey area. In addition to the many years this project has been underway (1993-2008), each of these beluga surveys has involved several replicate flights around upper Cook Inlet. The large number of flights and consistency in effort has helped detect whale distribution patterns. In 2009, belugas were found in three or four groups on most days in the Susitna delta and Chickaloon Bay, similar to groups observed in 2008. Typical of most surveys in recent years, belugas were not found south of the Forelands. Prior to 1996 it was not uncommon to see beluga groups south of North Foreland (Rugh et al. 2000), but since the mid-1990s, only one or two beluga groups have been found in lower Cook Inlet (Table 2). In spite of good sighting conditions during most of these annual surveys in June, 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 2009 index count, that is, the median count from the best survey day (303 belugas) is within the range of index counts made annually since 1993 (Table 2). These median counts are uncorrected for missing whales, but they do provide a quick assessment of the aerial survey effort. The annual calculated abundance includes corrections for whales missed within the viewing range of observers, whales missed because they were beneath the surface. These corrected abundance estimates are shown in Table 2 and Figure 6 (estimates from 1994-2000, Hobbs et al. 2000a; estimates from 2001 to 2009, Rugh et al. 2005, 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. Northern Commanders, LLC provided the aircraft and crew. Our pilots in 2009, Roger Weber, Jon Hall, Andy Harcombe and Will Vacendak, 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.

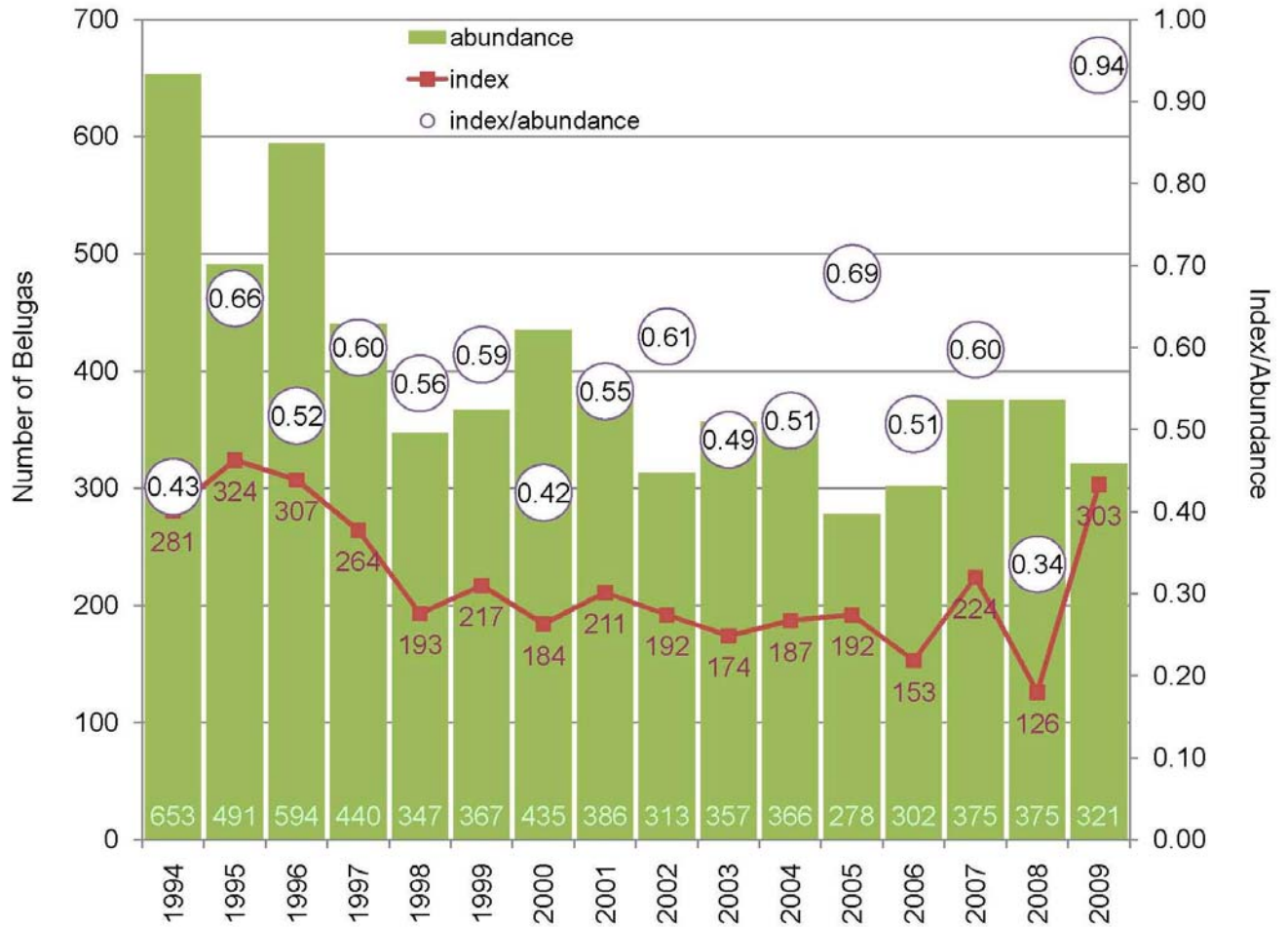


Figure 6. Annual abundance estimates (green bars) and median index counts (red line) for beluga aerial surveys, Cook Inlet, Alaska, 1994-2009. Circles show index counts divided by abundance estimates (note: in most years the index count is between 50% - 70% of the total abundance estimate).

Citations

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