

## AERIAL SURVEYS OF BELUGAS IN COOK INLET, ALASKA, AUGUST 2008

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**Abstract--**The National Marine Fisheries Service (NMFS) conducted an aerial survey of the beluga population in northern Cook Inlet, Alaska, 12-14 August 2008. The survey (16 hours total) covered the coastal areas north of Moose Point and the Native Village of Tyonek. Consistent with previous surveys by NMFS made each year since 1993, the August 2008 survey was flown in a high-wing, twin-engine aircraft (AeroCommander 680FL *N98UP*) at an altitude of 244 m (800 ft) and a speed of 185 km/hr (100 kt). The survey track paralleled the coast (1.4 km offshore) and crossed Cook Inlet on 12 August from just north of Moose Point to North Foreland, and on 13 and 14 August from Point Possession to North Foreland. Each flight coincided with the afternoon low tide. The goal of the surveys was to obtain high-resolution video of each group of belugas to determine age structure (white relative to gray individuals and dark gray calves) and number of calves. We found belugas in Turnagain Arm, the Susitna delta, and Knik Arm. On 12 August, we video-taped and counted belugas in Turnagain Arm near Sunrise (median count = 29 whales), at the Little Susitna River (median count = 55 whales), at the north end of Eagle Bay in Knik Arm (median count = 2 whales), and near Eagle River in Knik Arm (median counts = 23 whales) for a total median count of 109 whales. On 13 August, we video-taped and counted belugas near Bird Point in Turnagain Arm (median count = 21 whales), along the mudflats of the Susitna River (median count = 69 whales), in the Little Susitna River (median count = 26 whales), and in Eagle Bay, Knik Arm (median count = 61 whales) for a total median count of 177 belugas. On 14 August, we found belugas in the same locations as on 13 August: near Sunrise in Turnagain Arm (median count = 26 belugas), Susitna mudflats (median count = 80 belugas), Little Susitna River (median count = 38 belugas) and Eagle Bay, Knik Arm (median count = 50 belugas) for a total median count of 194 whales. We saw no belugas in Chickaloon Bay during this survey. The median estimates of belugas seen each day in August 2008 (a quick index of relative abundance not corrected for missed whales) were similar to those documented in August 2007 (181 belugas on 1 August, 141 belugas on 2 August) and in August 2006 (126 belugas on 16 August, 143

belugas on 17 August) but smaller than those in August 2005 (236 belugas on 11 August, 277 belugas on 12 August).

## Introduction

The National Marine Fisheries Service (NMFS) conducts aerial surveys of belugas (*Delphinapterus leucas*) in Cook Inlet, Alaska, each year to document their local distribution and abundance (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 the population of belugas in Cook Inlet because of its isolation from other beluga populations (O’Corry-Crowe et al. 1997; Laidre et al. 2000; Rugh et al. 2000) and its small size (<400 whales; Hobbs et al. 2000a; Hobbs and Shelden 2008). The population in Cook Inlet has been designated as *depleted* under the Marine Mammal Protection Act (MMPA, 65 FR 34590) and is proposed for listing as *endangered* under the Endangered Species Act (72 FR 19854). The subsistence hunt by Alaska Natives has been managed under MMPA Section 119 (Cooperative Agreements with NMFS) since 2000 (65 FR 59164, Mahoney and Shelden 2000).

The goals of the aerial survey in August 2008 were a) to document seasonal distribution relative to temporal habitat features (e.g. fish runs) and, b) to use paired high-definition (HD) video cameras to document the age structure of groups of belugas (white relative to gray individuals and dark gray calves) in Cook Inlet at a time when most calves have been born. This is the fourth year for this project which began in August 2005 (Rugh et al. 2005a, 2006; Shelden et al. 2007).

## Methods

The survey aircraft (AeroCommander, *N98UP*), was equipped with large bubble windows at the left and right forward observer positions. Video camera footage was obtained through an open window on the left. An intercom system allowed communication among the observers, data recorder, and pilots. A computer program recorded sighting and location data from a portable Global Positioning System (GPS). Data entries included routine updates of time, location, percent cloud cover, sea state (Beaufort scale), glare (on the left and right), visibility (on the left and right), and start and stop of survey effort. Visibility was documented using five subjective categories from *excellent* to *useless*. Survey segments that were rated as *poor* or *useless* on the left (coastal) side of the aircraft were considered un-surveyed.

Most of the search effort was 1.4 km offshore along the coast of northern Cook Inlet (north of Point Possession and North Foreland). The goal 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, keeping the waterline 10° below horizontal when 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

seemed to be very shallow or a distance recommended by Alaska Native beluga hunters who surveyed with us in the past (Rugh et al. 2000). Surveys were conducted daily during low tide.

The location of each whale group was established by recording a GPS position while flying directly over the group. The flight pattern used to count a whale group was an extended oval around the longitudinal axis of the group with turns made beyond the ends of the group. Whales were counted during each pass down the long axis of the oval with 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 aircraft wing. This method gives an accurate record of the duration of each counting pass. 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 ratings were used in the analysis. Although whale tracks were sometimes seen at the surface in muddy water, only whales at the surface during a counting pass were included in the counts. The daily aerial counts are represented by medians of each observer's median counts on multiple passes over each whale group (Table 1). The process of using medians instead of maxima or means reduces the effect of outliers (extremes in high or low counts) and makes the results more comparable to aerial surveys that do not include repeated passes over whale groups. Medians are also more appropriate than maxima when counts are corrected for missed whales because correction factors should be applied to the most representative counts, not the most extreme.

We used paired HD video cameras used to film each group of belugas. One camera was set at wide angle to capture a view of the entire group, and the other camera was zoomed to magnify individual whales in the group. The zoomed video is used to determine correction factors for missed whales (see Hobbs et al. 2000b) and to examine color ratios of white relative to gray belugas (Litzky 2001; Sims et al. 2003). The paired cameras were operated on all counting passes. Video footage from the cameras will be analyzed in the laboratory to obtain more accurate counts of belugas and the relative proportions of white versus gray versus dark gray (calf) whales.

## Results

The surveys (16 hours total) covered all coastal areas north of Point Possession and North Foreland (Figs. 1-3). All flights on 12, 13, and 14 August 2008 (3 take-offs and landings, flight time ranged from 5.02 to 5.55 hours) were based out of Anchorage International Airport. Of the 16 flight hours, 6.5 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). Viewing conditions were ideal during most of the surveys. *Poor* or *useless* visibility conditions (determined by the primary front observer) only interfered with the survey effort during 0.01 hours (0% of the effective search time). Four observers (authors of this report: KEWS, KTG,

LVB, BAM) have participated in this project on previous surveys, two observers (MMK & BSS) were first time participants.

The aerial surveys in August 2008 covered the entire coastline in northern Cook Inlet for most waters within 3 km of shore during low tide (Fig. 1). On 12 August, the survey began by circling Fire Island, following the coast along Chickaloon Bay into Turnagain Arm as far as Twentymile River, back to Chickaloon Bay, entering Chickaloon River, rounding Point Possession to Moose Point then crossing the inlet to North Foreland where the coastal survey continued to Beluga River (surveying about 5 miles upriver), Susitna River, Little Susitna River (surveying about 7.5 miles upriver), and Knik Arm, before returning to Anchorage (Fig. 1). One group of belugas was found near Sunrise in Turnagain Arm, one large group was dispersed into the mouth of the Little Susitna River and along the coast toward Point Mackenzie, and two groups were found in Knik Arm, a small group at the north end of Eagle Bay and another group near Eagle River. Overflights were made to count and video-tape each group: 11 passes, median count = 29 whales in Turnagain Arm; 9 passes, median count = 55 whales at Little Susitna River; 5 passes, median count = 2 whales in Eagle Bay; and 9 passes, median count = 23 whales near Eagle River.

On 13 August, we flew the same pattern excluding the portion between Point Possession and Moose Point (Fig. 2). One group of belugas was found near Bird Point in Turnagain Arm, one large group along the mudflats of the Susitna River, one group in the mouth of the Little Susitna River, and one group in Eagle Bay, Knik Arm. Overflights were made to count and video-tape each group: 10 passes, median count = 21 whales in Turnagain Arm; 11 passes, median count = 69 whales at the Susitna River; 10 passes, median count = 26 whales in the Little Susitna River; and 12 passes, median count = 61 whales in Knik Arm.

On 14 August, we flew the same pattern as on 13 August (Fig. 3). Belugas were found at the same locations as on 13 August: one group near Sunrise in Turnagain Arm, a large group in the exact same location along the Susitna mudflats, a group (broken into 2 sub-groups) near the mouth of the Little Susitna River, and a large dispersed group in Eagle Bay, Knik Arm. Overflights were made to count and video-tape each group: 9 passes, median count = 26 whales in Turnagain Arm; 10 passes, median count = 80 whales at the Susitna River; 8 passes, median count = 38 whales near the Little Susitna River; and 12 passes, median count = 50 whales in Knik Arm.

The median estimates (an index of relative abundance not corrected for missed whales) for each day of 109, 177, and 194 belugas were similar to those documented in August 2007 (181 on 1 August, 141 belugas on 2 August) and August 2006 (126 belugas on 16 August, 143 on 17 August) but were smaller than those in August 2005 (236 belugas on 11 August, 277 on 12 August). In June 2008, the median estimates for each day ranged from 58 to 126 belugas (Shelden et al. 2008).

Other marine mammal sightings included harbor seals (*Phoca vitulina*) hauled out on mudflats offshore of the mouth of the Chickaloon River (1 group, n = 55 harbor seals), and along the Ivan River (2 groups, n = 50 harbor seals) on 12 August; at mudflats at the mouth of the Susitna River (1 group, n = 25 harbor seals) and along the shore of the Little Susitna River (1 group, n = 5 harbor seals) on 13 August; and along the shore near Sunrise in Turnagain

Arm (1 group, n = 15 harbor seals) and on the Susitna mudflats (1 group, n = 28 harbor seals) on 14 August.

### **Discussion**

The primary goal of the surveys in August 2008 was to use paired HD video cameras to document beluga groups for analysis of age structure (white relative to gray individuals and dark gray calves) at a time when most calves have been born. This was consistent with the goals of surveys made in August of 2005, 2006, and 2007 (Rugh et al. 2005b, 2006, Sheldon et al. 2007). Further analyses of the data will determine if there are any differences between the ratios of calves (small, dark whales) to adults (large, white whales) in June versus August. This ratio will be important in assessing the reproductive potential of this proposed *endangered* beluga stock.

The August 2008 aerial survey of Cook Inlet continued the time series documenting the distribution of belugas in months other than June, and supplemented information gathered in 2000 and 2001 (Rugh et al. 2005a). Although the survey area in August 2008 was limited to northern Cook Inlet, this coverage is considered sufficient for examining beluga distribution for calf ratios because there have been consistently low sighting rates south of the Forelands (lower Cook Inlet) for more than a decade (Rugh et al. 2000; 2005a). Groups of belugas were seen in Turnagain Arm, near the Susitna and Little Susitna Rivers, and in Knik Arm. No belugas were found in Chickaloon Bay though survey conditions were excellent. This absence was consistent with results from surveys in 2005, 2006, and 2007 (Rugh et al. 2005b, 2006, Sheldon et al. 2007). Median counts of whales in August 2008 were greater than median counts in June 2008 (194 versus 126 belugas, respectively), also similar to the results in 2005 (277 in August versus 192 belugas in June), but not in 2006 (143 versus 153 belugas) or 2007 (181 versus 224 belugas) when the June count was higher than the August count. There was no substantial difference in the distribution of belugas in upper Cook Inlet between June and August.

### **Acknowledgments**

Rod Hobbs, Task Leader for the Cook Inlet beluga studies, helped coordinate funding for this project. Our pilots in August 2008 were Roger Weber and Jon Hall of Northern Commanders LLC; they filled a critical role in keeping the aircraft at the preferred altitude and distance from shore when 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 Goetz and Kimberly Goetz. This study was conducted under MMPA Scientific Research Permit No. 782-1719.

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Table 1. Estimates of beluga whale abundance made during aerial surveys of Cook Inlet in August 2008. Counts are medians from observers doing multiple counts of each whale group. Zeros indicate the area was surveyed, but no whales were seen. Sites are listed in a clockwise order around Cook Inlet starting with Turnagain Arm.

Location	8/12	8/13	8/14
Turnagain Arm	29	21	26
Chickaloon Bay/ Point Possession	0	0	0
Point Possession to Beluga River	0	0	0
Beluga River	0	0	0
Ivan River	0	0	0
Susitna River	0	69	80
Little Susitna River	55	26	38
Knik Arm	25	61	50
Fire Island	0	0	0
<b>Totals</b>	<b>109</b>	<b>177</b>	<b>194</b>

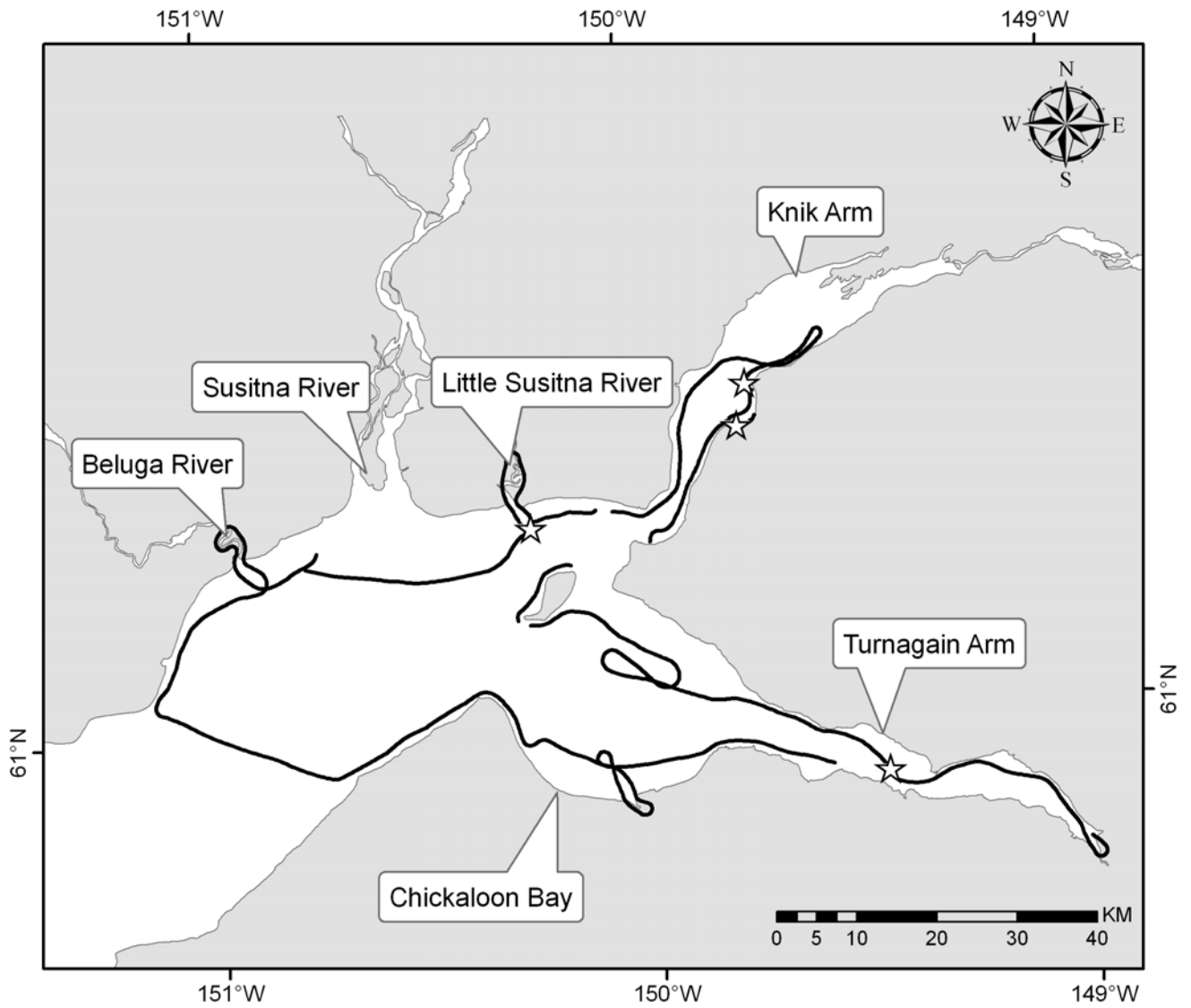


Figure 1. On-effort tracklines and beluga sightings for upper Cook Inlet survey on 12 August 2008.



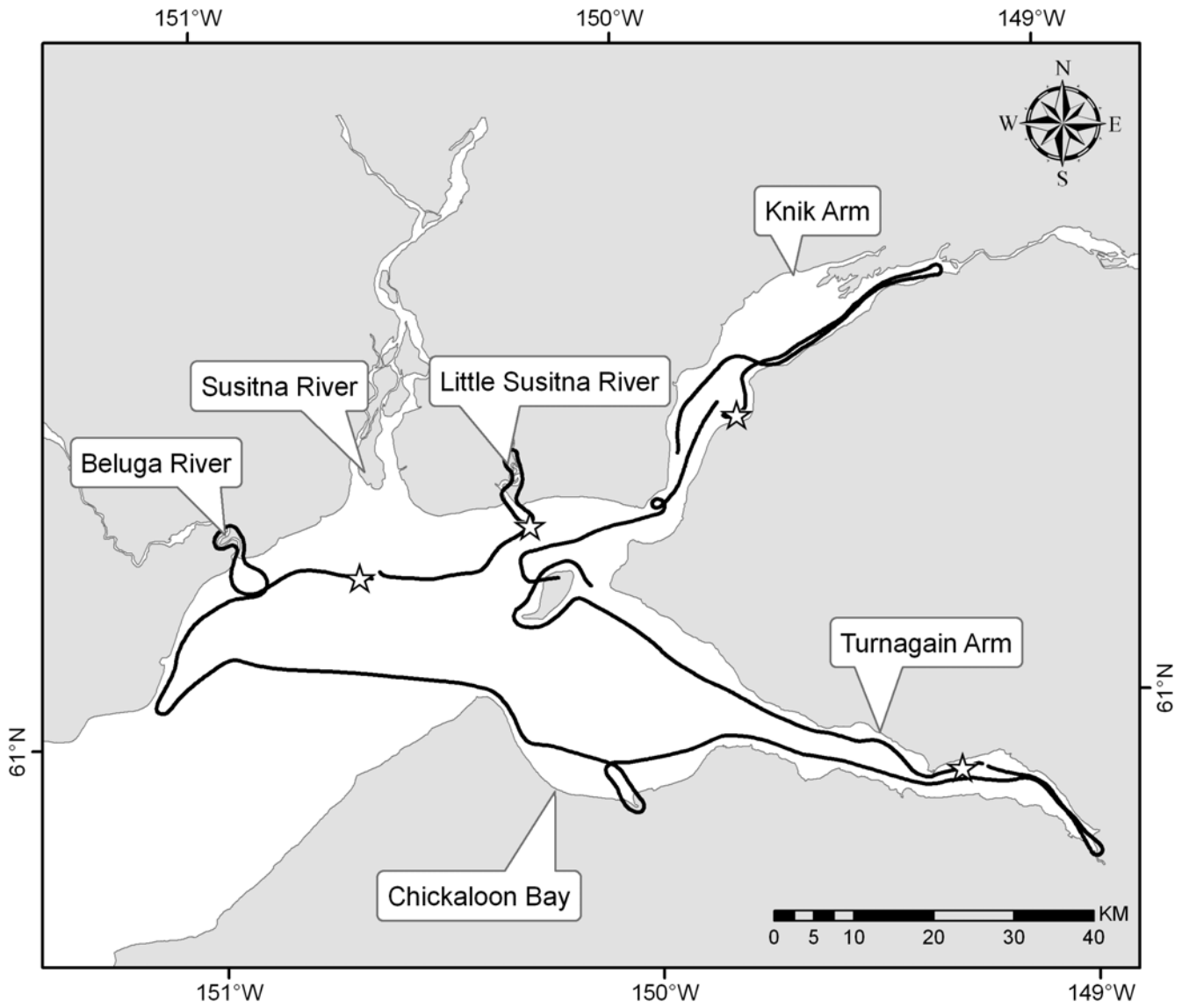


Figure 2. On-effort tracklines and beluga sightings for upper Cook Inlet survey on 13 August 2008.

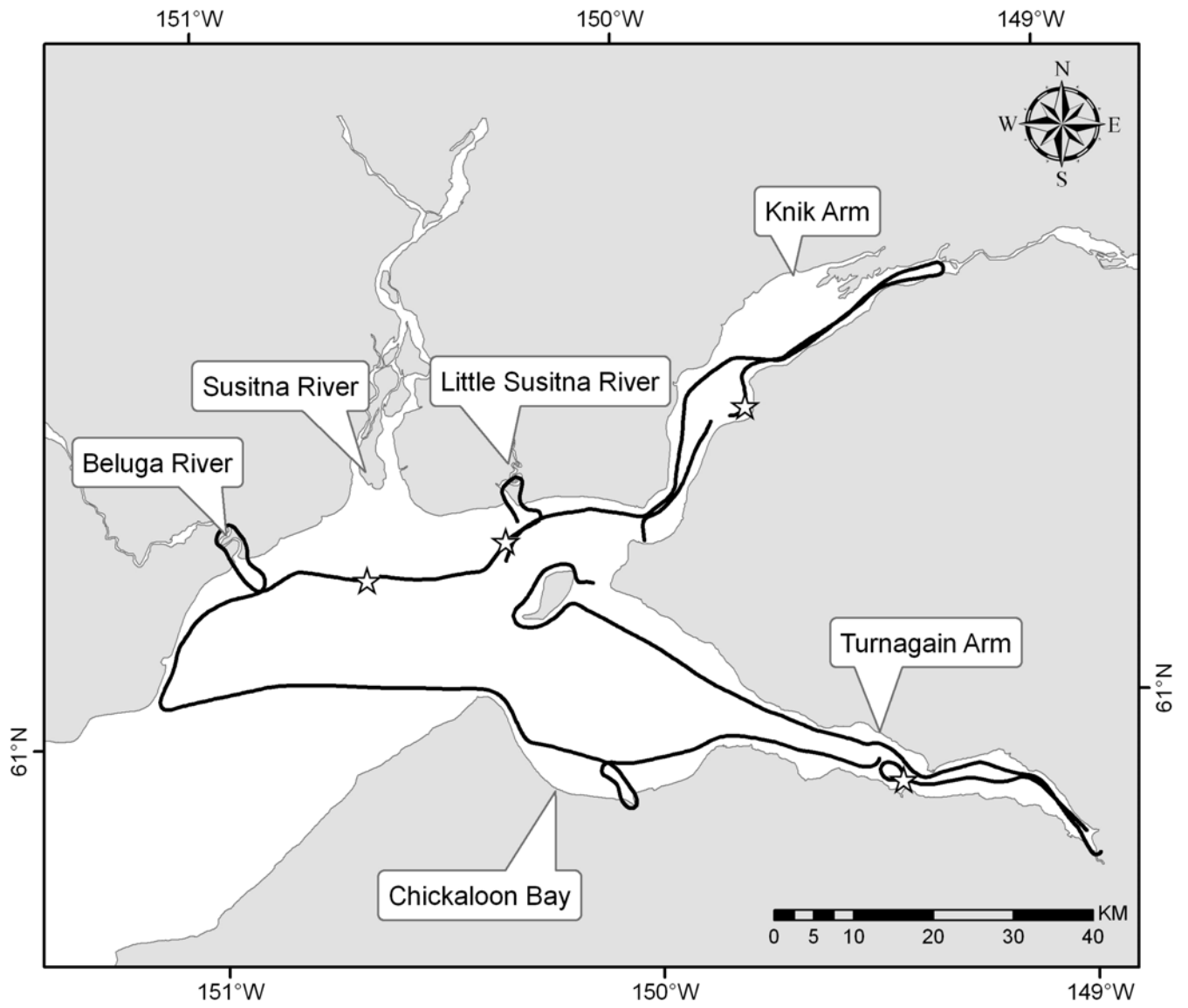


Figure 3. On-effort tracklines and beluga sightings for upper Cook Inlet survey on 14 August 2008.

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