



Alaska
Fisheries Science
Center

National Marine
Fisheries Service

U.S. DEPARTMENT OF COMMERCE

AFSC PROCESSED REPORT 2016-02

doi:10.7289/V5/AFSC-PR-2016-02

Aerial Surveys of Beluga Whales in Cook Inlet, Alaska, June 1991

February 2016

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This document should be cited as follows:

Shelden, K. E. W., and B. A. Mahoney. 2016. Aerial surveys of beluga whales in Cook Inlet, Alaska, June 1991. AFSC Processed Rep. 2016-02, 22 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115. doi:10.7289/V5/AFSC-PR-2016-02.

Available at <http://www.afsc.noaa.gov/Publications/ProcRpt/PR2016-02.pdf>

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**AERIAL SURVEYS OF BELUGA WHALES
IN COOK INLET, ALASKA,
JUNE 1991**

by
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February 2016

ABSTRACT

During 18-21 June 1991, aerial surveys were flown to document the distribution and group sizes of beluga whales, *Delphinapterus leucas*, in Cook Inlet, Alaska. The original data from these surveys were thought to be lost. The only description of these surveys, a short summary and single map (NMFS 1992:7-9), exists within an unpublished document (titled: “Status Report on Cook Inlet Belugas (*Delphinapterus leucas*)”) prepared by the National Marine Fisheries Service, Alaska Region. In February 2013, a floppy disk containing the original survey flight file data was discovered. Once extracted and analyzed, the recovered data were compared to the information presented in the NMFS (1992) status report (Shelden and Mahoney 2013). These results and additional information from survey participants are presented here.

Overall, the beluga sighting locations and tracklines in the recovered data mirrored those in Figure 2 in NMFS (1992:8). The number of nautical miles (nmi) surveyed, reported as 1,600 in NMFS (1992:7) was slightly less than the 1,640 nmi in the recovered data. However, errors were found in the computation of the highest daily count, the correction factor applied to the count, and the resulting abundance estimate. NMFS (1992) reported the highest daily count as 242 belugas, which was also recorded in the recovered data. However, this represented a high count for whale groups observed between the Beluga and Susitna rivers, where two counting passes were conducted. Combining this count with the other areas surveyed that day (Little Susitna to Point MacKenzie and Chickaloon Bay/Turnagain Arm) resulted in a count of 370 whales for 20 June 1991. NMFS (1992:9) also applied a correction factor of 2.72 (attributed to Frost (1987)) to produce an abundance estimate of 653 whales (*sic.* 658 whales). We could not find the source for this correction factor but note that Frost et al. (1983, 1984, 1985) report a correction factor of 2.75 (for whales missed during aerial surveys because they are submerged below turbid waters). Applying the 2.75 correction to the highest daily count of 370 whales results in an abundance estimate of almost 1,018 beluga whales in Cook Inlet for June 1991.

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INTRODUCTION

In 1992, the National Marine Fisheries Service (NMFS), Alaska Regional Office (AKR), prepared a report¹ titled “Status Report on Cook Inlet Belugas (*Delphinapterus leucas*)” (cf., NMFS 1992). The document provides a review of beluga whale life history and results from an aerial survey conducted during 18-21 June 1991 in Cook Inlet. The results presented include only a short summary with a map (NMFS 1992:7-9) and the original data from these surveys were thought lost. In February 2013, a floppy disk containing the original flight file data from the 1991 survey was discovered. Once extracted and analyzed, the recovered data were compared to the information presented in the NMFS (1992) status report (Shelden and Mahoney 2013). These results and additional information from survey participants (Brad Smith, Jeanne Hanson, and Barbara Mahoney) are presented here.

METHODS

Aircraft and Data Entry

Aerial surveys along Cook Inlet’s coastal and offshore waters were conducted by NMFS AKR in June 1991. The survey aircraft was a NOAA Twin Otter that was equipped with bubble windows at the forward observer positions on the left and right side. These windows allowed observers to view ahead of and beneath the aircraft. The survey altitude range was 152-305 m (500 -1,000 ft.). A computer operator collected survey data using an acquisition program designed for marine mammal surveys. Available data fields included: observer position (LEFT or RIGHT SIDE); date (month-day-year); time (in hours:minutes:seconds); latitude (LAT: degrees, minutes, seconds); longitude (LON: degrees, minutes, seconds); altitude (ALT: in feet); weather (WEA: coded as CL [clear], LR [light rain], HF [heavy fog], OV [overcast]); Beaufort sea state (B); visibility from left and right observer positions (VISL/VISR: noted as EX [excellent], GO [good], FA [fair], PO [poor], or UA [unacceptable]); transect number (TRAN);

¹ Although the cover page of the report says “Prepared by the Alaska Region,” B. Mahoney recalled the survey data were analyzed and a report was prepared *for* AKR via a contract with EBASCO Environmental, EBASCO Services Inc.

number of animals seen (N#); species (SP); inclinometer angle to the sighting (ANGLE); and comment entries. Although the program allowed for identifying which observer reported a sighting (SIDE: 1 for left, 2 for right), this information was not entered; instead the observer for a particular beluga sighting was sometimes noted in a comment entry.

Data Analysis

Files for each survey transect were saved as text files with varying names such as “KNIK PT. MACKENZIE TO PT. CARIN” (*sic* CAIRN) and UPNCOAST PT. MAKENZIE TO WEST FORELANDS” (*sic* MACKENZIE). These files were compiled for each survey day into edited files (i.e., DL061891.EDT; DL061991.EDT; DL062091.EDT; and DL062191.EDT) found on the recovered floppy disk. Another file on the disk (i.e., TOTAL.LEG) appeared to combine all files into one text file without the comment entries. The actual seconds recorded for time, latitude, and longitude were converted to decimal minutes in this combined file.

In February 2013, the recovered files were copied into an Excel file (i.e., “1991 Cook Inlet Beluga Aerial Surveys Summary.xlsx” and reviewed line by line. Each text line was parsed into columns and labeled with appropriate headers (i.e., Date, Time, SP, etc.) in an Excel spreadsheet. This spreadsheet also included metadata that described all edits and notes made by the data editor (i.e., K. Sheldon). Daily tracklines and sightings were extracted from this file and mapped in ArcView (ver. 10.1); and later compared to Figure 2 in NMFS (1992). Maps for each survey day are provided in the results section, along with a daily summary of the survey area covered, viewing conditions, and beluga sightings (and resightings).

RESULTS

Survey Effort

The NMFS AKR survey of Cook Inlet covered 1,640 nmi (3,037 km or 1,887 statute miles [mi]) of trackline and took 18.5 hours. Beluga whale observers appeared to occupy the same positions each day for the entire flight (Brad Smith: Left Side, Steve Treacy: Right Side) with additional participants (Barbara Mahoney and Ron Morris) recorded only on 20 June. The file from the last survey day (DL062191.EDT) omitted the file name headers and observer/computer operator information, as provided in the previous EDT files. Comment entries during this final survey day suggest beluga whale observers remained in the same positions, but it is unknown if Jeanne Hanson continued as Computer Operator.

Summary Counts

Overall, sighting locations and tracklines (Fig. 1) mirrored those presented in Figure 2 in the NMFS (1992) report (see Appendix 1). Beluga counts for each day and area surveyed are summarized in Table 1 (for detailed sighting records see Appendix 2).

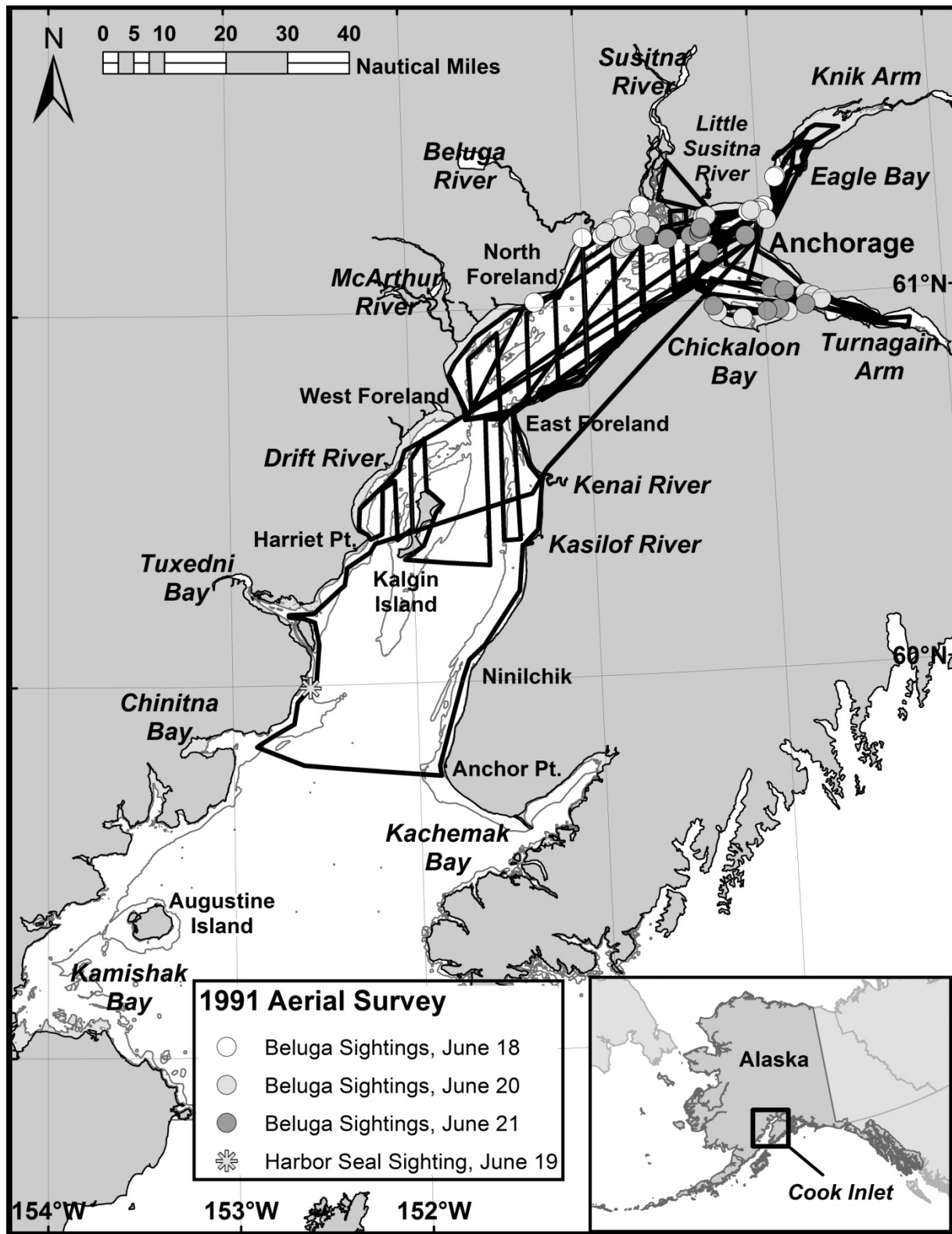


Figure 1.--Tracklines and sighting locations from aerial surveys conducted in Cook Inlet, Alaska, 18-21 June 1991.

Table 1.--Beluga counts during aerial surveys of Cook Inlet, Alaska, in June 1991. Counts in bold are the highest count for an area unless noted otherwise (beluga groups and counting passes are provided in Appendix 2). Counts in italics are areas that were surveyed a second time during the same day. A dash indicates that the area was not surveyed and zeros indicate that the area was surveyed, but whales were not seen. Sites are listed in a clockwise order around Cook Inlet, starting with Chickaloon Bay. Lower inlet regions are shaded.

Location	6/18	6/19	6/20	6/21
North shore Chickaloon Bay	0	---	20	12
Turnagain Arm	0	---	0	5
South shore Chickaloon Bay	0	---	55	57
Point Possession to East Foreland	0	---	0	0
Mid-inlet tracklines, upper inlet	167 ^a	---	0	0
East Foreland to Anchor Point	---	0	---	---
West side of lower Cook Inlet	---	0	---	---
Redoubt Bay	---	0	---	---
Mid-inlet tracklines, lower inlet	---	0	---	---
Trading Bay	1	---	0	---
Beluga River - Susitna River	95 ^a	---	242	129
Little Susitna River – Point MacKenzie	68, 88 ^b		52	73, 100^d
Knik Arm	5	---	1	0
Fire Island	---	---	0	4 ^e
Totals	169 – 261 ^c	0	370	280

^a Mid-inlet tracklines on 6/18 ran all the way to shore encountering beluga groups between the Beluga River and Susitna River presumably counted earlier in the day, the count of 167 is therefore a resampling of this area.

^b After surveying Knik Arm, the Point MacKenzie area was surveyed a second time yielding a count of 88 whales.

^c The low count (169 belugas) does not include the resampling counts (shown in italics), the high count (261 belugas) uses the resampling counts, replacing the original counts made in Beluga River-Susitna River (95 belugas) and Little Susitna River-Point MacKenzie (68 belugas).

^d The resampling of the Little Susitna area at the end of the day (100 belugas) is not included in the total count for that day (280 belugas).

^e A group of 3 whales observed between Fire Island and Point Campbell at the end of the day was not included in the table because this was probably the same group seen off the west side of Fire Island (4 belugas).

Daily Reports

18 June 1991

Survey effort began at Point MacKenzie (0831 hours) and followed a coastal transect to West Foreland. Along the transect, belugas were seen 1) near Point MacKenzie; 2) off the west tributary to the Susitna River; 3) between the Ivan and Lewis rivers; 4) between the Theodore and Beluga rivers; and 5) off Granite Point, in Trading Bay (Fig. 2, Table 1). The survey continued across the inlet to East Foreland where the coastal survey resumed, heading north to

Point Possession. From Point Possession, the track crossed to the north shore of Fire Island, then to Point Woronzof, before continuing along the east coast into Knik Arm. The coastal survey continued into Eagle Bay and north to Birchwood where it crossed Knik Arm and resumed the coastal survey along the western shore, toward Point MacKenzie. Belugas were encountered on the west side, south of Goose Bay and by Point MacKenzie (Fig. 2, Table 1). The Point MacKenzie sightings, at 1025 hours, were in the same location as whales first observed at 0838 hours (Fig. 2). Observers noted the whales were headed south, out of Knik Arm.

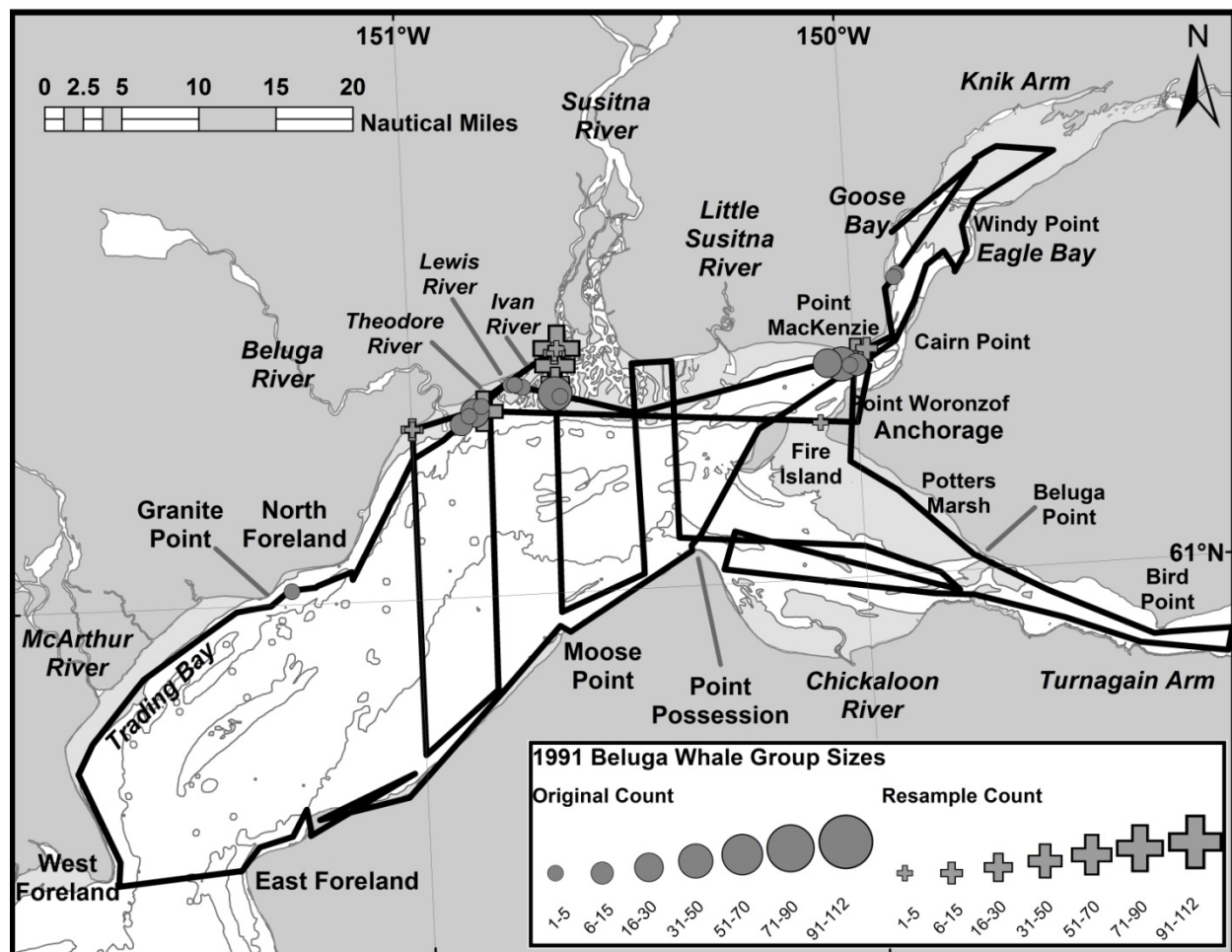


Figure 2.--Tracklines and sighting locations from aerial surveys conducted in Cook Inlet, Alaska, 18 June 1991. Group sizes are shown for original observations (circles) and for areas that were resampled (crosses) that same day.

The survey track crossed to Point Woronzof to resume the coastal survey into Turnagain Arm. After a complete survey of Turnagain Arm and Chickaloon Bay, the team flew offshore tracklines from Point Possession to east Chickaloon Bay (near Burnt Island) returning to Point Possession. Additional offshore tracklines were spaced at 8 km (5 mi) increments crossing the inlet north and south starting from Point Possession. After a southbound line from Susitna River, the space between tracklines was increased to 16 km (10 mi) increments. The survey ended at Beluga River during high tide. Belugas were again encountered along the north-south (N-S) trackline entering the west tributary of the Susitna River, on the line ending south of Beluga River, and off the Theodore River as the survey ended and the plane returned to Anchorage (4.7 flight hours; 452 nmi [837 km, 520 mi]). Sighting conditions were identified as good, with overcast skies, and Beaufort sea states at 1-2; except in Turnagain Arm where Beaufort sea states were 3-5. Because beluga groups were sampled more than once during the day, a range is given for the total count (169 to 261 belugas; Table 1).

19 June 1991

The second survey day focused on lower Cook Inlet waters. The team departed Anchorage at 0852 hours and flew directly to Redoubt Bay (Fig. 3) to begin a coastal survey from Big River ending at Harriet Point. A series of offshore transects were flown north to south around Kalgin Island, including a survey along the east coastline of the island. Offshore transects ended at East Foreland where a coastal survey resumed south to Anchor Point. The aircraft crossed Cook Inlet to Chinitna Bay, and flew north along the west shore to Harriet Point. An attempt to enter Chinitna Bay was aborted due to poor visibility and precipitation. After crossing the inlet from Harriet Point to refuel in Kenai, the aircraft returned directly to Anchorage (5.8 flight hours; 460 nmi [852 km, 529 mi]). Sighting conditions were identified as good to fair, with light rain, and Beaufort sea states at 2-4. Belugas were not seen; however, 10 harbor seals, *Phoca vitulina*, were observed hauled out on a spit between Chinitna and Tuxedni bays (Fig. 3).

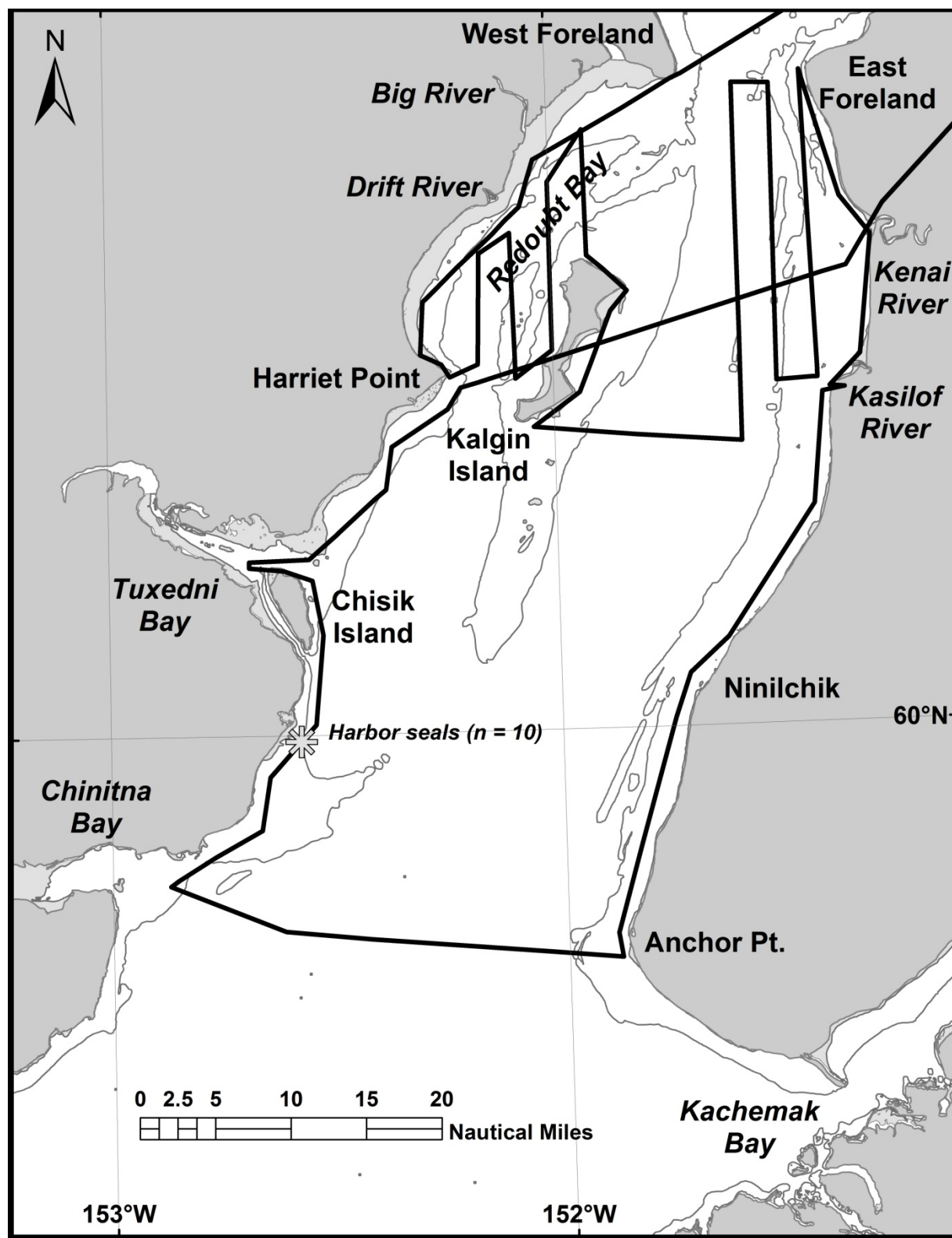


Figure 3.--Tracklines and sighting locations from aerial surveys conducted in Cook Inlet, Alaska, 19 June 1991.

20 June 1991

Day 3 surveyed upper Cook Inlet, north of the Forelands (Fig. 4). The team departed Anchorage at 0850 hours and started the survey along the east coast of Knik Arm (with low tide at 0803 hours). A single beluga was observed swimming toward Anchorage immediately after takeoff. Just beyond Windy Point, the aircraft circled west over exposed shoals. After completing the eastern shoreline of Knik Arm to Point Woronzof, the aircraft surveyed the north and west coast of Fire Island before crossing the island to begin a transect into Turnagain Arm. Belugas were seen near Beluga Point in a line formation (long surfacing intervals were noted). The track continued along the north coast, before reaching Bird Point where it turned to survey the south coast. Belugas were observed as the plane entered Chickaloon Bay, near Burnt Island (Fig. 4). Two additional beluga groups were observed: 1) at Chickaloon River, and 2) near the bluffs. Multiple counting passes were flown on the three Chickaloon Bay beluga groups (see Appendix 2). The survey continued along the coast from Chickaloon Bay, to Point Possession, to East Foreland, then crossed the inlet to West Foreland (Fig. 4).

From West Foreland, the plane crossed Trading Bay to Granite Point. The survey continued to North Foreland, then crossed to the Susitna River. Large numbers of belugas were counted between the Beluga and Susitna rivers (Fig. 4). The survey crew made two additional passes to count belugas between the two rivers before flying to Point MacKenzie (Table 1). Two additional beluga groups were found by the Little Susitna River, at which time the team surveyed upriver. From here they flew west over land to the power lines and surveyed the east tributary before resuming the coastal survey to Point MacKenzie. At Point MacKenzie, the plane turned to fly a mid-inlet trackline to West Foreland. A beluga group was found between Point MacKenzie and Point Woronzof before the offshore effort began (Fig. 4, Table 1).

At West Foreland, N-S tracklines (spaced at 16 km [10 mi] intervals) were flown to Anchorage (Fig. 4). Tracklines ended 2.4 km (1.5 mi) from shore (*editor note*: presumably to reduce the likelihood of encountering whale groups already counted in the Susitna and Little Susitna rivers as occurred on 18 June). These offshore tracklines ended south and west of Point Possession. Belugas were not seen during this survey effort. During the 5.3 hour flight (495 nmi [917 km, 570 mi]), sighting conditions were identified as good, with clear skies and Beaufort sea states at 1. A high count of 370 belugas was calculated using the highest counts when multiple passes were made (Table 1).

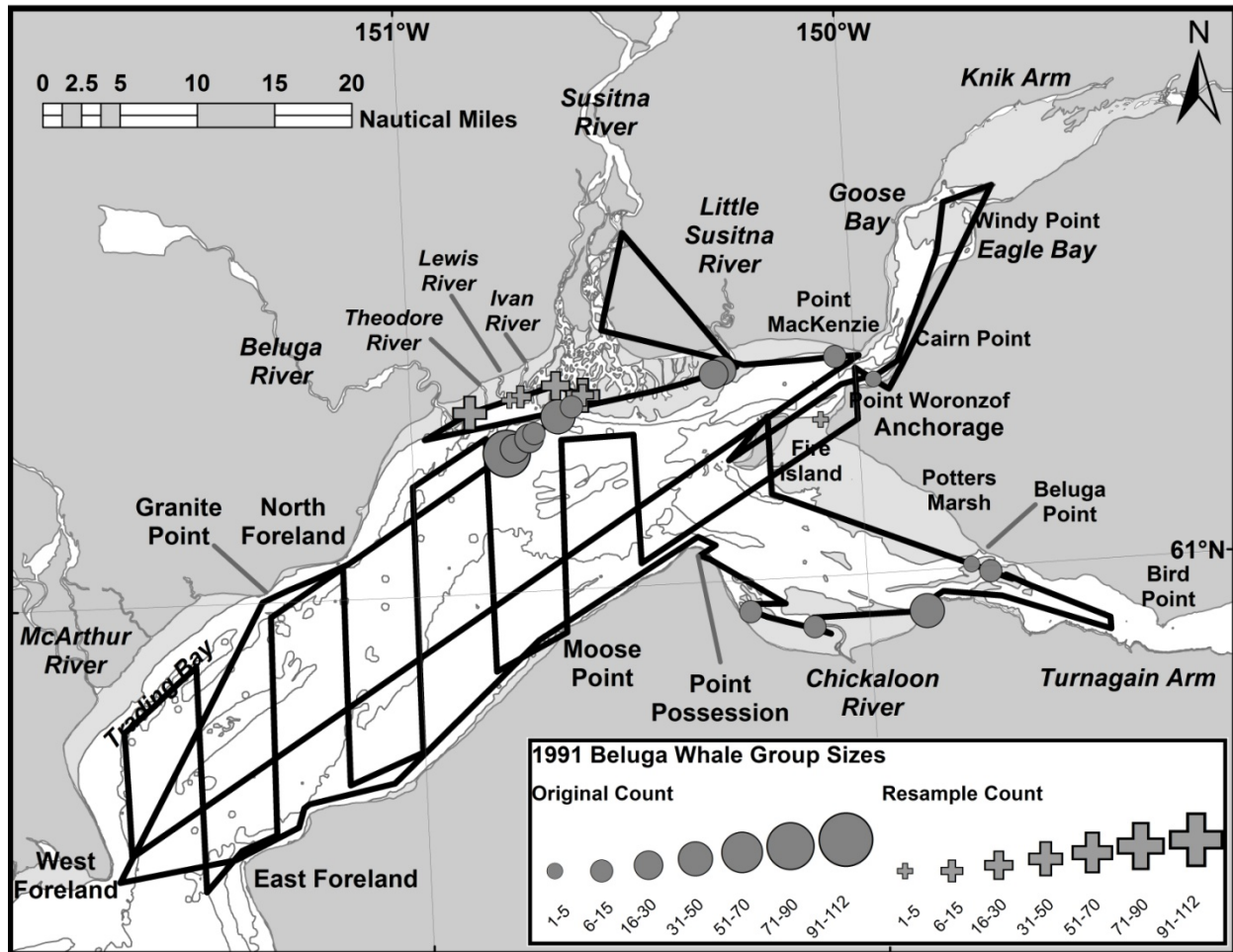


Figure 4.--Tracklines and sighting locations from aerial surveys conducted in Cook Inlet, Alaska, 20 June 1991. Group sizes are shown for original observations (circles) and for areas that were resampled (crosses) that same day.

21 June 1991

The final survey began at 0855 hours intending to focus on upper Cook Inlet. The survey started at Chickaloon Bay, along the north shore, and headed east into Turnagain Arm (Fig. 5). Two beluga groups were seen and counted near Potters Marsh, as the aircraft first entered Turnagain Arm (Fig. 5). The survey continued to beyond Bird Point and then turned west towards Chickaloon Bay. Another beluga group was found east of Chickaloon Bay. Three separate beluga groups were counted in Chickaloon Bay: 1) near Burnt Island, 2) east of Chickaloon River, and 3) near the bluffs (Fig. 5, Table 1). The flight continued to Point Possession, traveled north along western Fire Island, toward Knik Arm. Air traffic controllers

required the plane to divert to shore east of the Little Susitna River, where the team began a coastal survey to West Foreland (Fig. 5). The survey crew encountered beluga groups by the Little Susitna River, and at the east and west tributaries of the Susitna River. Beluga counts along the Susitna River ended because of poor visibility due to low lying fog in the area.

The survey continued south finally breaking out of the fog when abeam of North Foreland. With the west coast covered in fog, the plane continued to East Foreland and turned north to resume the coastal survey along the east side to Point Possession. A fog bank obscured the survey area near Moose Point. From Point Possession, the survey continued to Fire Island and into Knik Arm. A small group of belugas was seen off the west side of the Fire Island. Belugas were not found in Knik Arm. The survey team made another attempt to survey the coastline from Point MacKenzie to West Foreland. A beluga group was found at the Little Susitna River and four passes and counts were made (Table 1) before the survey effort ended. A small group was encountered between Fire Island and the airport as the plane arrived at the Anchorage airport. This beluga group could be the same group encountered at Fire Island earlier that day. During the 2.7 hour flight (233 nmi [432 km, 268 mi]) sighting conditions were identified as good to unacceptable, with clear skies and low lying fog, and Beaufort sea states at 0-2. The total count of 280 belugas (Table 1) did not include the Little Susitna group counted at the end of the survey (100 belugas) or the small group (3 belugas) seen prior to landing in Anchorage.

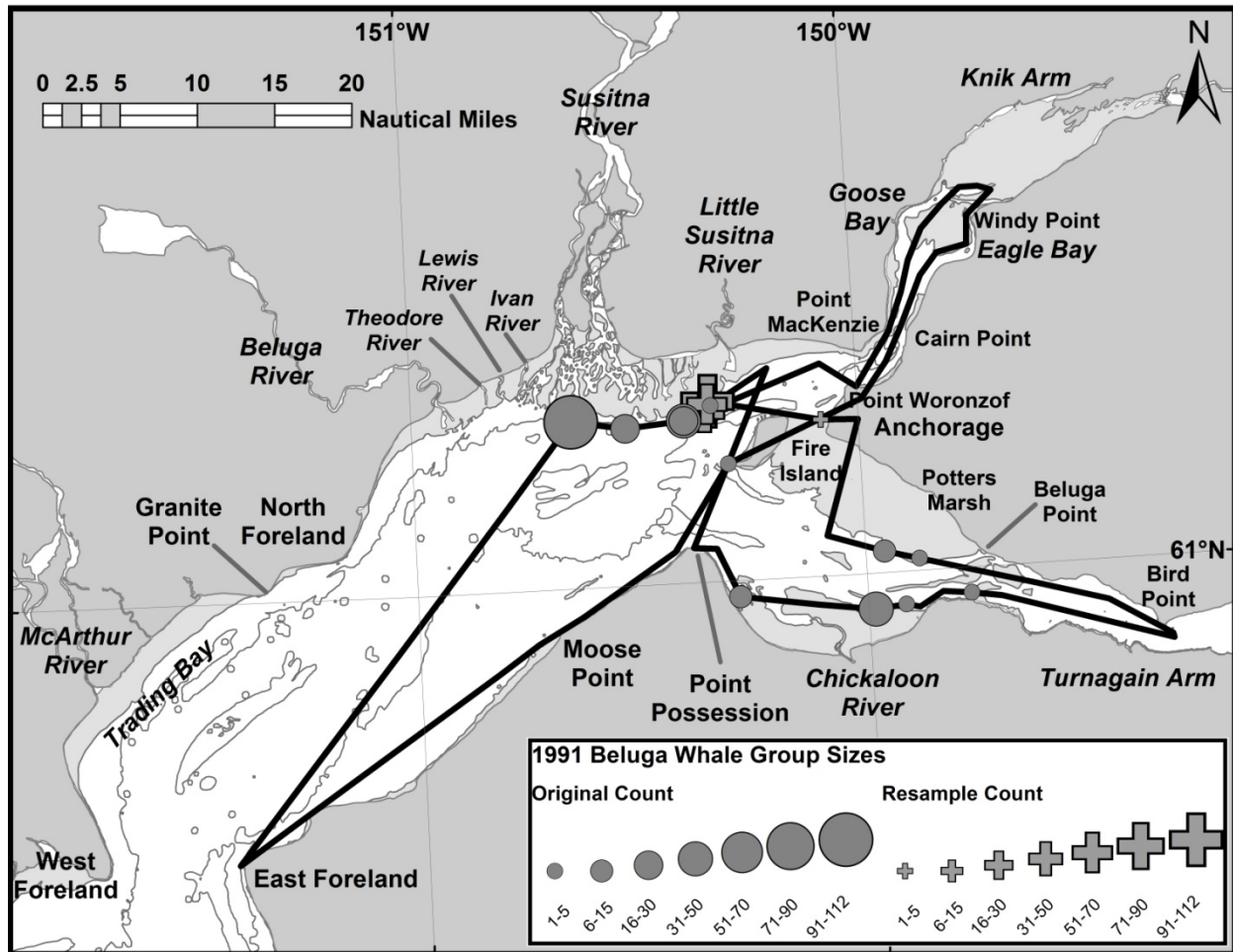


Figure 5.--Tracklines and sighting locations from aerial surveys conducted in Cook Inlet, Alaska, 21 June 1991. Group sizes are shown for original observations (circles) and for areas that were resampled (crosses) that same day.

DISCUSSION

Overall, the sighting locations and tracklines found in the recovered data mirrored those in NMFS (1992). After comparing each daily flight file (i.e., *.EDT) to the data in the combined file (i.e., Total.Leg), and adding information missing from the Total.Leg file (in particular, comments entries that provided additional location data [latitudes/longitudes]), the new trackline now followed the shoreline of Cook Inlet and the mudflats more closely than the track shown in NMFS (1992) (see Appendix 1). Beluga sighting locations changed only slightly after this review (see Appendix 1). Also, repeat passes and counts over beluga groups (and summary counts included as sightings rather than comments) were removed from the maps presented in

the text, unless noted otherwise. The recovered files include 1,640 nmi of trackline, which is slightly more than the 1,600 nmi reported in NMFS (1992:7).

The highest count for one day was 242 beluga whales in NMFS (1992:7), which does not match information provided in the recovered data files (Table 1). For example, this count does appear in comments made during the flight on 20 June, but 242 belugas was the highest count after three counting passes were made on whales found between the Beluga and Susitna rivers. After counting three more groups between the Little Susitna River and Point MacKenzie, a comment stated “end of line – high total count of animals seen is 308...”. However, the count of 308 does not appear to include beluga groups reported in other areas such as Chickaloon Bay that same day (Table 1). NMFS (1992) concluded, based on the high count of 242 belugas, that an estimated 653 belugas were in upper Cook Inlet (using a correction factor for unseen animals of 2.72 (attributed to Frost (1987)²). This estimate of 653 in itself also includes a multiplication error and should be 658 whales. Applying the Bristol Bay correction of 2.75 (Frost et al. 1983, 1984, 1985) to the counts presented in this report (i.e., highest daily count of 370 belugas) yields an estimated population size of almost 1,018 belugas in Cook Inlet in 1991.

² This citation is missing from the references cited section in NMFS (1992) and we were unable to find a Frost (1987) document. The correction factor based on Bristol Bay beluga radio-tagging studies used by Frost et al. (1983, 1984, 1985) is 2.75.

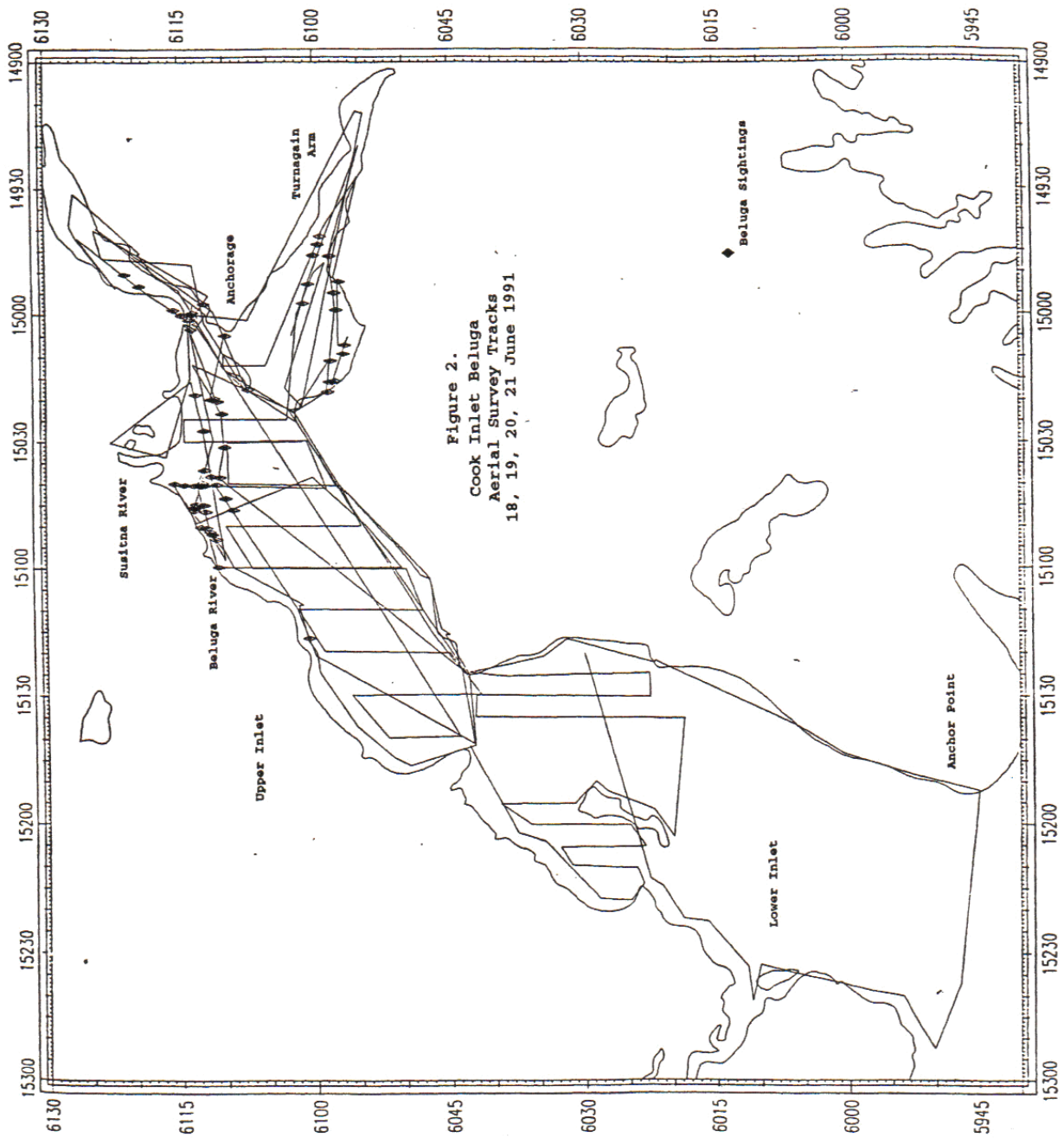
Acknowledgments

Data were collected 18-21 June 1991 by Brad Smith (left side observer); Steve Treacy (right side observer); Jeanne Hanson (computer operator); Barbara Mahoney, and Ron Morris. Survey aircraft and pilots were provided by NOAA, Office of Aircraft Operations. Original data were edited and provided to the Alaska Regional Office in 1992 by Rich Grotefendt (EBASCO Environmental, EBASCO Services Inc.). Edited files were recovered in February 2013 by Kevin Savetz (Savetz Publishing, Portland OR) via (www.floppyrecovery.net). A field report based on recovered data was prepared March 2013 by Kim Shelden and Barbara Mahoney. This unpublished report was originally made available as Shelden and Mahoney (2013).

CITATIONS

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- Shelden, K.E.W., and B.A. Mahoney. 2013. Aerial survey of beluga whales in Cook Inlet, Alaska, June 1991. NMFS unpublished field report based upon data recovered in February 2013. 16 p.

Appendix 1.--Figure 2 from NMFS (1992).



Appendix 2.--Beluga whale sightings and group counts during aerial surveys of Cook Inlet, Alaska, 18-21 June 1991.

Day	N#	Angle	Side	Mode	Recount	Altitude	Time	Latitude	Longitude	B	VisL	VisR	WX	Location	Notes
18	6	35		T	N	1000	8.6386	61.2283	-149.9950	2	GO	GO	OV	POINT MACKENZIE	.
18	3	35		T	N	1000	8.6442	61.2283	-150.0100	2	GO	GO	OV	POINT MACKENZIE	.
18	35	35		T	N	1000	8.6503	61.2300	-150.0283	2	GO	GO	OV	POINT MACKENZIE	.
18	24	30		T	N	1000	8.6614	61.2317	-150.0600	2	GO	GO	OV	POINT MACKENZIE	.
18	2	70		T	N	1000	8.8294	61.2117	-150.6633	2	GO	GO	LR	WEST TRIBUTARY OF SUSITNA RIVER	.
18	45			T	N	1000	8.8497	61.2150	-150.6750	2	GO	GO	LR	WEST TRIBUTARY OF SUSITNA RIVER	.
18	2	70		T	N	1000	8.8528	61.2233	-150.7467	2	GO	GO	LR	BETWEEN IVAN AND LEWIS RIVERS	.
18	3	45		T	N	1000	8.8556	61.2250	-150.7583	2	GO	GO	LR	BETWEEN IVAN AND LEWIS RIVERS	.
18	1	20		T	N	1000	8.8575	61.2267	-150.7650	2	GO	GO	LR	BETWEEN IVAN AND LEWIS RIVERS	.
18	2	15		T	N	1000	8.8597	61.2267	-150.7733	2	GO	GO	LR	BETWEEN IVAN AND LEWIS RIVERS	.
18	2	65		T	N	1000	8.8861	61.2050	-150.8417	2	GO	GO	LR	BETWEEN THEODORE AND BELUGA RIVERS	.
18	30	4		T	N	1000	8.8892	61.1983	-150.8567	2	GO	GO	LR	BETWEEN THEODORE AND BELUGA RIVERS	.
18	1	75		T	N	1000	8.8919	61.1950	-150.8700	2	GO	GO	LR	BETWEEN THEODORE AND BELUGA RIVERS	.
18	7	75		T	N	1000	8.8958	61.1867	-150.8883	2	GO	GO	LR	BETWEEN THEODORE AND BELUGA RIVERS	.
18	1	38		T	N	1000	9.0539	61.0150	-151.2833	2	GO	GO	LR	GRANITE POINT, TRADING BAY	.
18	4	17		T	N	500	10.3417	61.3233	-149.8933	1	GO	GO	OV	KNIK ARM, SOUTH OF GOOSE BAY	.
18	1	18		T	N	500	10.3450	61.3200	-149.9000	1	GO	GO	OV	KNIK ARM, SOUTH OF GOOSE BAY	.
18	12	15		T	Y	500	10.4028	61.2450	-149.9700	1	GO	GO	OV	POINT MACKENZIE	Resampled the area surveyed earlier in the day
18	40	40		T	Y	500	10.4122	61.2383	-149.9967	1	GO	GO	OV	POINT MACKENZIE	Resampled the area surveyed earlier in the day
18	8	35		T	Y	500	10.4206	61.2333	-150.0217	1	GO	GO	OV	POINT MACKENZIE	Resampled the area surveyed earlier in the day
18	14	50	1	T	Y	500	10.5606	61.2317	-150.0000	1	GO	GO	OV	POINT MACKENZIE	Resampled the area surveyed earlier in the day
18	10	60	1	T	Y	500	10.5606	61.2317	-150.0000	1	GO	GO	OV	POINT MACKENZIE	Resampled the area surveyed earlier in the day
18	1	30	2	T	Y	500	10.5606	61.2317	-150.0000	1	GO	GO	OV	POINT MACKENZIE	Resampled the area surveyed earlier in the day
18	3	80	2	T	Y	500	10.5606	61.2317	-150.0000	1	GO	GO	OV	POINT MACKENZIE	Resampled the area surveyed earlier in the day
18	3	20	2	T	Y	1000	12.3000	61.2083	-150.6733	2	GO	GO	OV	WEST TRIBUTARY OF SUSITNA RIVER	At end of mid inlet trackline, resampled groups
18	20			T	Y	1000	12.3033	61.2117	-150.6733	2	GO	GO	OV	WEST TRIBUTARY OF SUSITNA RIVER	At end of mid inlet trackline, resampled groups
18	26	20		T	Y	1000	12.3153	61.2283	-150.6733	2	GO	GO	OV	WEST TRIBUTARY OF SUSITNA RIVER	At end of mid inlet trackline, resampled groups
18	52	9	1	P	Y	1000	12.3294	61.2450	-150.6717	2	GO	GO	OV	WEST TRIBUTARY OF SUSITNA RIVER	Circled back for a second pass - total count 68
18	4		2	P	Y	1000	12.3525	61.2583	-150.6717	2	GO	GO	OV	WEST TRIBUTARY OF SUSITNA RIVER	Circled back for a second pass - total count 68
18	12		2	P	Y	1000	12.3525	61.2583	-150.6717	2	GO	GO	OV	WEST TRIBUTARY OF SUSITNA RIVER	Circled back for a second pass - total count 68
18	3		2	P	Y	1000	12.3881	61.2633	-150.6667	2	GO	GO	OV	WEST TRIBUTARY OF SUSITNA RIVER	Circled back for a third pass - total count 87
18	84		1	P	Y	1000	12.3881	61.2633	-150.6667	2	GO	GO	OV	WEST TRIBUTARY OF SUSITNA RIVER	Circled back for a third pass - total count 87
18	10		1	T	Y	1000	12.9303	61.1833	-150.9983	3	GO	GO	OV	BELUGA RIVER	At end of mid inlet trackline, resampled groups
18	4		2	T	Y	1000	12.9303	61.1833	-150.9983	3	GO	GO	OV	BELUGA RIVER	At end of mid inlet trackline, resampled groups
18	66		1	T	Y	1000	13.0139	61.2000	-150.8383	3	GO	GO	OV	OFF THE THEODORE RIVER	May include whales seen when circling Susitna
20	1	35		T	N	500	8.9042	61.2083	-149.9600	1	GO	GO	CL	HEADED TOWARDS ANCHORAGE	.
20	2			T	N	1000	9.5347	61.0033	-149.7667	1	GO	GO	CL	BELUGA POINT, TURNAGAIN ARM	.
20	10			T	N	1000	9.5475	60.9950	-149.7250	1	GO	GO	CL	BELUGA POINT, TURNAGAIN ARM	.
20	8			T	N?	1000	9.5611	60.9850	-149.6783	1	GO	GO	CL	BELUGA POINT, TURNAGAIN ARM	Not clear in record if this is a second pass on group of 10
20	40			T	N	1000	9.8414	60.9567	-149.8717	1	GO	GO	CL	CHICKALOON BAY NEAR BURNT ISLAND	Three counting passes: 34, 30, 40
20	6			T	N	700	9.9861	60.9467	-150.1233	1	GO	GO	CL	CHICKALOON RIVER	Three counting passes: 5, 6, 5
20	9	30	1	T	N	1000	10.0617	60.9667	-150.2633	1	GO	GO	CL	CHICKALOON BAY BLUFFS	1st pass Side 1=3 Side 2=8;
20	88		1	T	N	1000	11.0983	61.1500	-150.7883	1	GO	GO	CL	BELUGA RIVER TO SUSITNA RIVER	2ndpass Side 2=8; consensus 9 whales present
															Pass 1: total count = 182;
															total count provided for Pass 3 (no locations) of 242 whales
															(Side 1 = 196, Side 2 = 56)

Day	N#	Angle	Side	Mode	Recount	Altitude	Time	Latitude	Longitude	B	VisL	VisR	WX	Location	Notes
20	20	80	2	T	N	1000	11.1053	61.1550	-150.7700	1	GO	GO	CL	BELUGA RIVER TO SUSITNA RIVER	Pass 1: total count = 182; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	20		1	T	N	1000	11.1181	61.1650	-150.7367	1	GO	GO	CL	BELUGA RIVER TO SUSITNA RIVER	Pass 1: total count = 182; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	10		2	T	N	1000	11.1228	61.1700	-150.7250	1	GO	GO	CL	BELUGA RIVER TO SUSITNA RIVER	Pass 1: total count = 182; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	34		1	T	N	1000	11.1439	61.1867	-150.6700	1	GO	GO	CL	BELUGA RIVER TO SUSITNA RIVER	Pass 1: total count = 182; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	10		1	T	N	1000	11.1558	61.1967	-150.6383	1	GO	GO	CL	BELUGA RIVER TO SUSITNA RIVER	Pass 1: total count = 182; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	32		1	T	Y	1000	11.1822	61.2083	-150.6117	1	GO	GO	CL	SUSITNA RIVER TO BELUGA RIVER	Pass 1: total count = 182; Pass 2: total count = 154; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	13		2	T	Y	1000	11.1822	61.2083	-150.6117	1	GO	GO	CL	SUSITNA RIVER TO BELUGA RIVER	Pass 2: total count = 154; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	30		1	T	Y	1000	11.2028	61.2200	-150.6717	1	GO	GO	CL	SUSITNA RIVER TO BELUGA RIVER	Pass 2: total count = 154; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	26		2	T	Y	1000	11.2028	61.2200	-150.6717	1	GO	GO	CL	SUSITNA RIVER TO BELUGA RIVER	Pass 2: total count = 154; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	9		2	T	Y	1000	11.2269	61.2100	-150.7517	1	GO	GO	CL	SUSITNA RIVER TO BELUGA RIVER	Pass 2: total count = 154; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	4		2	T	Y	1000	11.2344	61.2067	-150.7767	1	GO	GO	CL	SUSITNA RIVER TO BELUGA RIVER	Pass 2: total count = 154; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	40		?	T	Y	1000	11.2614	61.1950	-150.8667	1	GO	GO	CL	SUSITNA RIVER TO BELUGA RIVER	Pass 2: total count = 154; total count provided for Pass 3 (no locations) of 242 whales (Side 1 = 196, Side 2 = 56)
20	20		2	T	N	1000	11.5536	61.2233	-150.3167	1	GO	GO	CL	LITTLE SUSITNA RIVER	.
20	22		1	T	N	1000	11.5608	61.2267	-150.2983	1	GO	GO	CL	LITTLE SUSITNA RIVER	.
20	10	40	2	T	N	1000	11.9083	61.2350	-150.0433	1	GO	GO	CL	END OF SURVEY LINE OFF POINT MACKENZIE	.
21	7		1	T	N	1000	9.0500	61.0233	-149.9583	1	GO	GO	CL	CHICKALOON BAY OFF POTTERS MARSH	.
21	5		2	T	N	1000	9.0733	61.0133	-149.8817	1	GO	GO	CL	CHICKALOON BAY OFF POTTERS MARSH	.
21	5		1	T	N	1000	9.3775	60.9733	-149.7700	0	GO	GO	CL	TURNAGAIN ARM NEAR GULL ROCK	.
21	3		1	T	N	1000	9.4194	60.9650	-149.9167	0	GO	GO	CL	CHICKALOON BAY NEAR BURNT ISLAND	.
21	40			T	N	1000	9.4406	60.9617	-149.9850	0	GO	GO	CL	OFF TRIBUTARY OF THE CHICKALOON RIVER	.
21	14			T	N	1000	9.5550	60.9833	-150.2833	0	GO	GO	CL	CHICKALOON BAY BLUFFS	At least two juveniles in group
21	2		2	T	N	1000	9.8264	61.1900	-150.3283	2	GO	GO	CL	LITTLE SUSITNA RIVER	.
21	43		1	T	N	1000	9.8478	61.1750	-150.3900	2	GO	GO	CL	BETWEEN LITTLE SUSITNA & SUSITNA RIVERS	.
21	28		2	T	N	1000	9.8478	61.1750	-150.3900	2	GO	GO	CL	BETWEEN LITTLE SUSITNA & SUSITNA RIVERS	.
21	17		2	T	N	1000	9.8875	61.1700	-150.5217	2	GO	GO	CL	EAST TRIBUTARY OF SUSITNA RIVER	.

Day	N#	Angle	Side	Mode	Recount	Altitude	Time	Latitude	Longitude	B	VisL	VisR	WX	Location	Notes
21	112			T	N	1000	9.9222	61.1800	-150.6417	2	GO	GO	CL	WEST TRIBUTARY OF SUSITNA RIVER	.
21	4			T	N	500	10.6533	61.1267	-150.2950	2	GO	GO	CL	WEST SIDE OF FIRE ISLAND	.
21	65			P	Y	1000	11.1897	61.1833	-150.3417	2	GO	GO	CL	RECOUNTS AT LITTLE SUSITNA RIVER - PASS 1	.
21	62		1	P	Y	1000	11.3469	61.1917	-150.3350	2	GO	GO	CL	RECOUNTS AT LITTLE SUSITNA RIVER - PASS 2	.
21	55		2	P	Y	1000	11.3561	61.1917	-150.3350	2	GO	GO	CL	RECOUNTS AT LITTLE SUSITNA RIVER - PASS 3	.
21	100			P	Y	500	11.4150	61.1950	-150.3333	2	GO	GO	CL	RECOUNTS AT LITTLE SUSITNA RIVER - PASS 4	.
21	3			T	Y?	500	11.4997	61.1683	-150.0833	2	GO	GO	CL	BETWEEN FIRE ISLAND AND PT. CAMPBELL	Possible resighting of group seen off west side of Fire Island