NOAA Technical Memorandum NMFS-AFSC-369
doi:10.7289/V5/TM-AFSC-369

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U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Alaska Fisheries Science Center

February 2018

NOAA Technical Memorandum NMFS

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This document should be cited as follows:

Shelden, K. E. W., K. T. Goetz, R. C. Hobbs, L. K. Hoberecht, K. L. Laidre, B. A. Mahoney, T. L. McGuire, S. A. Norman, G. O'Corry-Crowe, D. J. Vos, G. M. Ylitalo, S. A. Mizroch, S. Atkinson, K. A. Burek-Huntington, and C. Garner. 2018. Beluga whale, *Delphinapterus leucas*, satellite-tagging and health assessments in Cook Inlet, Alaska, 1999 to 2002. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-369, 227 p.

Document available: http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-369.pdf

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Beluga Whale, *Delphinapterus leucas*, Satellite-Tagging and Health Assessments in Cook Inlet, Alaska, 1999 to 2002

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ABSTRACT

Cook Inlet beluga whales, *Delphinapterus leucas*, are currently listed as 'Endangered' under the U.S. Endangered Species Act (ESA). The National Marine Fisheries Service (NMFS) began monitoring this population during the 1990s after it was added to the ESA Candidate Species list in 1988. Monitoring efforts included aerial surveys, and in 1995, the first attempts to capture and satellite-tag whales. Working with Canadian scientists and Alaska Native subsistence hunters in 1995 and 1997, tagging methods were adapted to conditions in Cook Inlet (muddy water, extreme tides, and extensive mudflats), culminating in successful capture and tracking of a whale during the summer of 1999. This was followed by three more years of capture and tagging studies during late summer. Tags were attached to 18 whales between 1999 and 2002.

We do not have detailed accounts of these later tagging seasons (e.g., similar to the Appendix chronicling events from the 1997 and 1999 seasons in Ferrero et al. (2000)). Litzky et al. (2001) summarized field operations for the 2000 tagging season, but no reports exist for 2001 and 2002. A reanalysis of the tag dataset (Goetz et al. 2012) led to questions about the captures and how tags were programmed during this time period. Given the Cook Inlet population has continued to decline (Hobbs et al. 2015, Shelden et al. 2017), and was listed as an Endangered Distinct Population Segment under the ESA in October 2008 (NOAA 2008), future recommendations for tagging will depend on lessons learned from these past projects. Lacking detailed field reports, we consolidated information from multiple sources.

Herein, we bring these varied sources together to provide a thorough documentation of the tagging operations undertaken in Cook Inlet each summer in 2000, 2001, and 2002. We include revised tag transmission timelines, monthly movement maps, dive behavior data, and ice-association graphs and maps for all whales (where applicable) tagged in 1999, 2000, 2001, and 2002. Whale locations were compared to sighting records (opportunistic and systematic) to determine how many whales were likely proximate to tagged whales. Animations of whale movements are available at http://www.afsc.noaa.gov/News/Cook_Inlet_Beluga_Range_Contracted.htm (accessed 17 Aug. 2016).

Beginning with the 2000 season, each whale underwent a health assessment at the time of tagging. Results from laboratory analyses of the blood, blubber, skin, and mucus samples are presented. These include results obtained for hematology and serum chemistry values, hormones, DNA extractions, blubber lipid composition, fatty acid profiles, stable isotope ratios, and persistent organic pollutant profiles. We also provide a follow-up to the tagging study, describing captured and tagged whales that have been photo-documented since 2005 by the Cook Inlet Beluga Whale Photo-identification Project (https://www.cookinletbelugas.com/).

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INTRODUCTION

Beluga whales, *Delphinapterus leucas*, live year-round in arctic and subarctic seas of the Northern Hemisphere (Hazard 1988). In Alaska waters, belugas spend summer in different regions of Alaska (Frost and Lowry 1990) to the extent that genetic differentiation has occurred within the species (O'Corry-Crow et al. 1997). These summering populations are found in Cook Inlet, Bristol Bay, the eastern Bering Sea, the eastern Chukchi Sea, and the eastern Beaufort Sea (Fig. 1). For Cook Inlet, both geographic and genetic isolation from the other beluga populations in Alaska has resulted in evident genetic drift (O'Corry-Crowe et al. 1997, 2010). While some of these Alaska populations are migratory, covering 1,000s of kilometers between summering and wintering regions, most Cook Inlet belugas remain year-round within the boundaries of the inlet.

The National Marine Fisheries Service (NMFS) began monitoring the Cook Inlet population in the 1990s, following consideration for listing (assigning Candidate Species status) under the U.S. Endangered Species Act (ESA) in 1988 (Shelden et al. 2015). Prior to this, the State of Alaska and Alaska Department of Fish and Game had conducted aerial surveys in the 1960s, late 1970s, and early 1980s (Shelden et al. 2015). The surveys in the late 1970s were the first attempt to document seasonal distribution of the Cook Inlet population. While informative, aerial studies were limited by range of the aircraft and inclement weather, particularly during the winter months. By the early 1990s, Canadian scientists were successfully attaching satellite-linked transmitters to the dorsal ridges of belugas (Martin and Smith 1992). These devices allowed scientists to track the daily movements of the whales. NMFS scientists worked with the Canadian scientists and Cook Inlet native subsistence hunters to develop a tagging program for Cook Inlet (Ferrero et al. 2000).

Capture and satellite-tagging of Cook Inlet belugas was first attempted in July 1995 (Ferrero et al. 2000). After two seasons of experimenting with capture techniques (1995 and 1997), successful attachment of a satellite-linked transmitter to a juvenile male beluga occurred in late May 1999 (Ferrero et al. 2000). This whale's movements were followed through the summer months until the last satellite uplink was received on September 17, 1999 (Ferrero et al. 2000, Shelden et al. 2015). With this success, future tagging efforts were planned for late summer to attempt to document autumn and winter movements of Cook Inlet belugas.

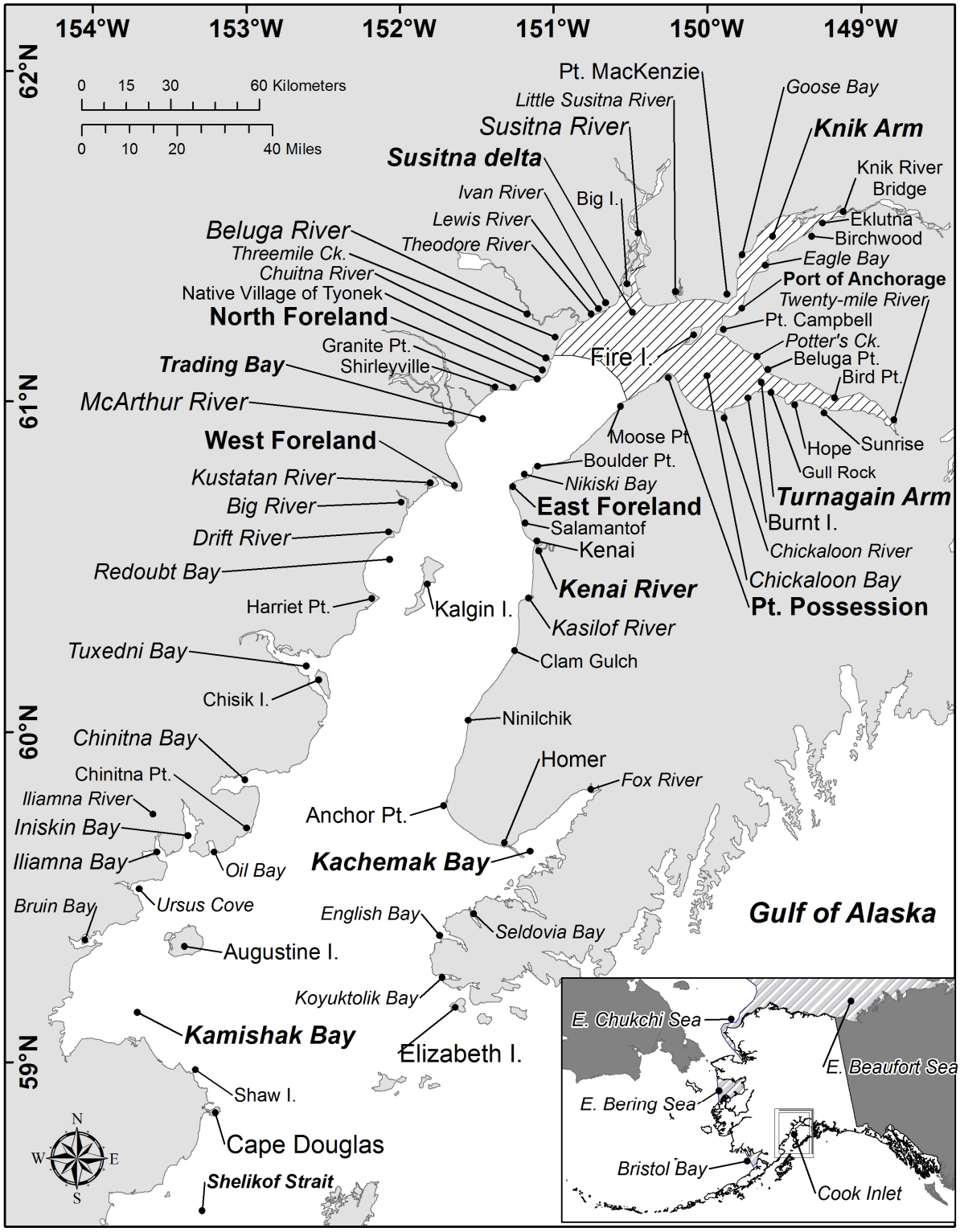


Figure 1. -- Cook Inlet study area and place names mentioned in the text (beluga summer range shown as striped shading). Inset shows summering locations of the other beluga whale stocks that occur in Alaska waters (striped shading).

From 1994 to 1998 the Cook Inlet population experienced a significant decline (over 50%: from 653 (CV = 0.24) to 347 (CV = 0.17) belugas) during a period of unregulated hunting by Alaska Natives (Mahoney and Shelden 2000). This led to a designation of 'depleted' under the U.S. Marine Mammal Protection Act in 2000 (NOAA 2000a) after a moratorium had been placed on the hunt in 1999. It also led to recognition of these whales as a Distinct Population Segment (DPS) as defined under the ESA. With hunting regulations established under a Harvest Management Plan (NOAA 2000b), the population was expected to show signs of recovery. NMFS increased monitoring efforts and, in combination with aerial surveys monitoring seasonal (Rugh et al. 2004) and early summer distribution and abundance (Rugh et al. 2005), tagging studies were conducted on Cook Inlet belugas the next 3 years (2000-2002).

We do not have detailed accounts of these tagging seasons (e.g., similar to the Appendix chronicling events during the 1997 and 1999 seasons in Ferrero et al. (2000)). Litzky et al. (2001) summarized field operations for the 2000 tagging season, but no reports exist for 2001 and 2002. A reanalysis of the tag dataset (Goetz et al. 2012) led to questions about the captures and how tags were programmed during this time period. Given the ongoing population decline (Hobbs et al. 2015, Shelden et al. 2017), and Endangered status of the Cook Inlet DPS (NOAA 2008), future recommendations for tagging will depend on lessons learned from past projects. Lacking detailed field reports, we consolidated information from sources that included the following:

- The field report for the 2000 season (Litzky et al. 2001),
- Tagging webpages on the NMFS Marine Mammal Laboratory's (NMML) website,
- Archived spreadsheets and data files at MML and AKR,
- Personal field journals and log books from 2000 and 2001 (L. Litzky and R. Hobbs),
- Level A stranding forms from 2001 and 2002 (B. Mahoney),
- Beluga Capture forms from 2002 (B. Mahoney),
- Memorandums re. whales CI-0202, CI-0204, and CI-0207,
- Photographs and video footage taken during tagging operations, and
- Recollections from individuals involved in the field work.

During this process, an unpublished document detailing movements and diving behavior of the whales tagged in 1999 and 2000 was discovered. We subsequently published these preliminary findings as an AFSC Processed Report (see Laidre et al. 2017).

Herein, we bring these varied sources together to provide a thorough documentation of the tagging operations undertaken in Cook Inlet each summer in 2000, 2001, and 2002. We include revised tag transmission timelines, monthly movement maps, dive behavior data, and ice-association graphs and maps for all whales (where applicable) tagged in 1999, 2000, 2001, and 2002. Beginning with the 2000 season, each whale underwent a health assessment at the time of tagging. Results from laboratory analyses of the blood, blubber, skin, and mucus samples are presented. These include results obtained for hematology and serum chemistry values, hormones, DNA extractions, blubber lipid composition, fatty acid profiles, stable isotope ratios, and persistent organic pollutant profiles. We also provide a follow-up to the tagging study, describing some of the captured whales that have been "recaptured" in photographs taken by the Cook Inlet Beluga Whale Photo-identification Project (https://www.cookinletbelugas.com/), which began in 2005.

METHODS

Study Area

In September 2000, the capture and tagging of Cook Inlet belugas occurred in Knik Arm (Fig. 2) based on the tagging results from the 1995, 1997, and 1999 seasons (Ferrero et al. 2000). An emphasis was placed on Eagle Bay, about 25 km (15.5 mi) north of Anchorage, for three reasons (Litzky et al. 2001). First, results from the 1999 satellite tagging study indicated the whale (tagged near the Little Susitna River in late May) frequented this part of the inlet during early to mid-September (Ferrero et al. 2000). Second, Eagle Bay provided an environment conducive to operations used for whale capture (described in the Capture Protocol section): a deep channel follows the shoreline around the bay, whereas the center of the bay is shallower with sandbars and mud flats that are exposed during low tides, an area referred to as Eagle Flats. Knik Arm is also protected from the strong winds generated in Turnagain Arm, which can make crossing the inlet to the Susitna River mudflats hazardous. Third, the proximity to Anchorage facilitated crew transport to and from the area. All operations were based out of Anchorage with daily trips made to the study site rather than establishing field camps near the Little Susitna River as in past capture projects (see Ferrero et al. 2000).

In early to mid-August 2001, capture operations were again based out of Anchorage. Unlike the 2000 field season, capture operations began at the Little Susitna River (Fig. 2). Reasons for this change from the previous year were not documented. B. Mahoney (pers. comm.) noted that the team did not find whales in the Susitna River delta following the successful tagging of a whale in the Little Susitna River (CI-0101) on the first day of tagging operations (Fig. 2). It appeared that most of the whales had moved into Knik Arm where the tagging team focused efforts for the remainder of the 2001 season. Plans for the next year included arriving in late July with hopes of capturing more whales in the Susitna River delta.

In late July 2002, tagging operations were staged from Anchorage and began in the Susitna River delta. Two days were spent tagging near the Little Susitna River (Fig. 2). It was noted on the Beluga Capture Datasheet for whale CI2002-03 (alternate ID CI-0203) that the team was unable to capture any more whales in the Susitna-Little Susitna area and decided to head to Knik Arm on 31 July. The reason for this inability to capture whales was not documented. In an attempt to increase sampling of whales in the Susitna River delta, the team decided to return there the next day and tagged one more whale (CI-0204) near the Little Susitna River. The remainder of the season was spent in Knik Arm.

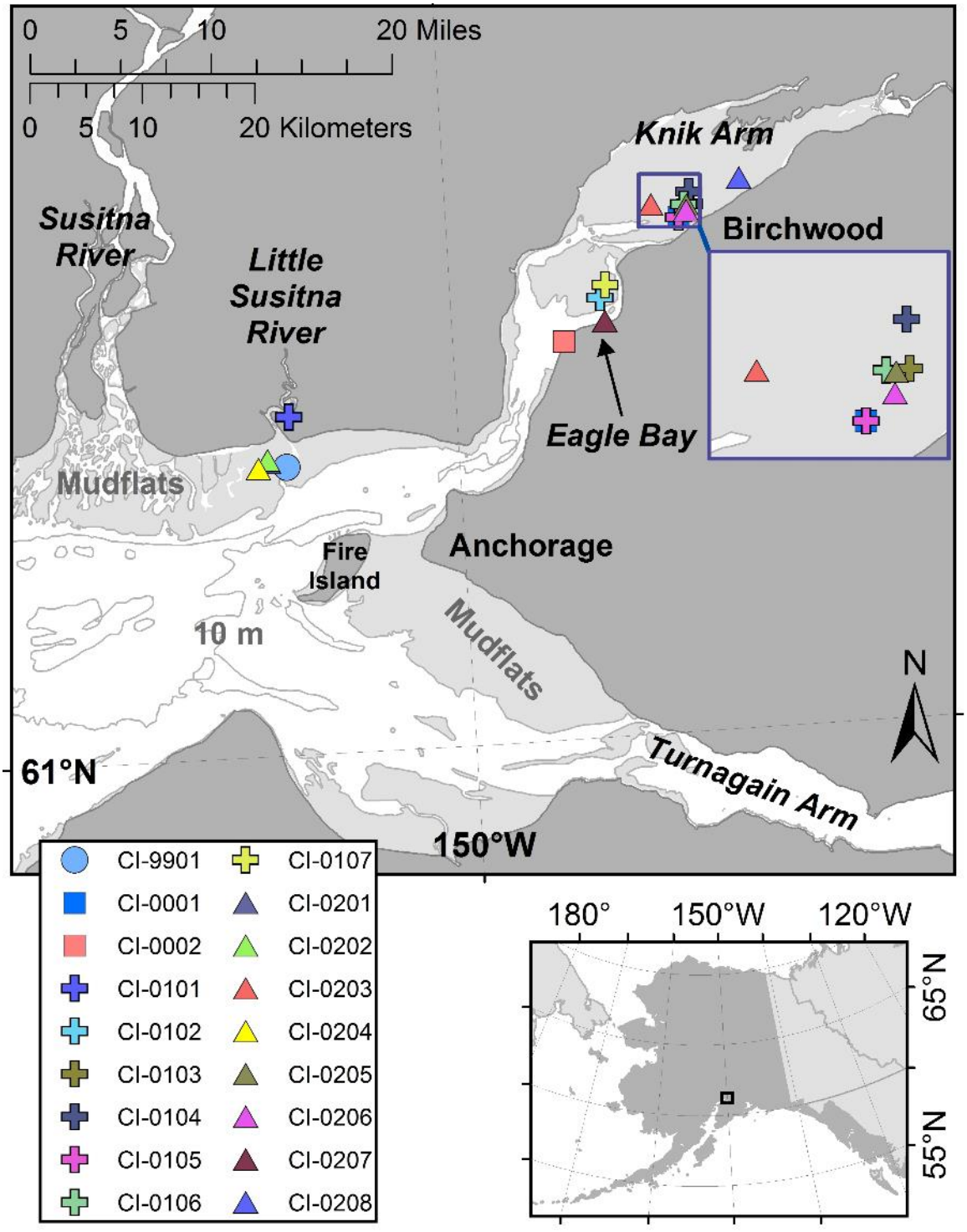


Figure 2. -- Capture locations for beluga whales tagged with satellite-linked transmitters in 1999 (circle), 2000 (squares), 2001 (crosses), and 2002 (triangles) in Cook Inlet, Alaska (from Shelden et al. 2015). Study area shown as black box on map of Alaska (dark gray region).

Capture Protocol

After unsuccessful attempts to capture whales using a hoop net in 1995 and driving whales into a mesh gillnet in 1997 (Ferrero et al. 2000), a herding/encirclement technique was developed in 1999 that proved effective in the shallow, turbid waters of Cook Inlet (Fig. 3). This method (described in detail in Ferrero et al. 2000) was used during the 2000-2002 tagging seasons.

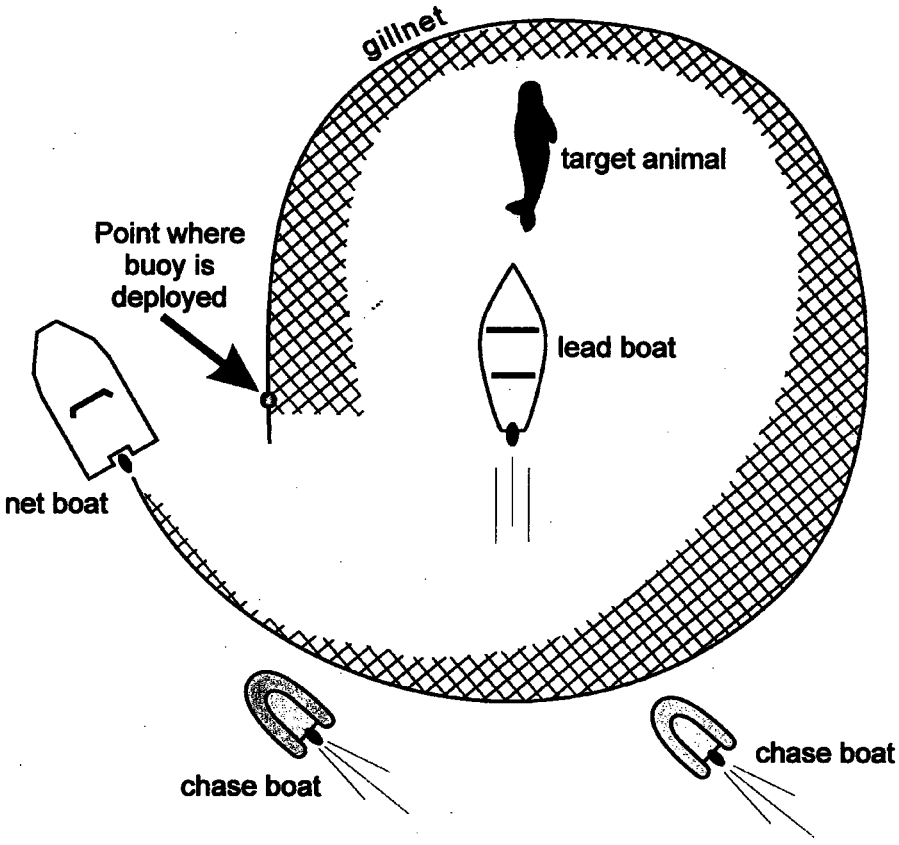


Figure 3. -- Schematic of the herding/encirclement approach developed in June 1999 (from Ferrero et al. (2000):116).

In 2000, the tagging team conducted capture operations from four vessels (Litzky et al. 2001). One team deployed a mesh gillnet from a 6.4 m (21 ft.) Boston Whaler ("net boat"). Another team located and isolated whales using a 5 m (17 ft.) rigid-hulled inflatable (RHIB "NOAA-08"). Two smaller vessels, a 3.9 m (13 ft.) RHIB ("NOAA-13") and a 3.7 m (12 ft.) inflatable Zodiac, were used to herd whales into the deployed net and to carry additional support

crew. In 2001 and 2002, the smaller vessels were replaced with a 5.4 m (18 ft.) RHIB ("NOAA 5-4") and a 3 m (10 ft.) RHIB ("Beluga"). Boats were on the water from sun up to sun down as permitted by tides and weather (see Capture Effort in the Results and Discussion section).

Net deployment techniques were similar to those developed in 1999 (Ferrero et al. 2000), although a longer net of larger mesh size was used. In 2000, the net included 16 panels each 15 m (50 ft.) in length by 4.6 m (15 ft.) in depth for a total net length of 240 m (800 ft.). The net was composed of a 0.64 cm (0.25 in.) lead line, 3.8 cm (1.5 in.) cork line, and 53 cm (21 in.) stretch mesh of size 30 twine. Construction of a ramp that led the net out of a storage box and over the net boat engine made for more efficient deployment (Fig. 4). Similar nets were used during the 2001-2002 seasons, ranging from about 274 to 308 m (900-1,000 ft.) in length.

Figure 4. -- Ramp system used to deploy the capture net during the 2000-2002 Cook Inlet beluga tagging project.

Capture procedures in 2000 were as follows: After spotting belugas, the whales were approached slowly by NOAA-08, with the net boat close behind on the port side. The intent was to identify and isolate mature individuals (white adults) and not to capture juveniles (gray-colored belugas) or cows with calves. Once separated from the group, the crew on NOAA-08 continued to follow the selected animal and attempted to herd it into shallow water (i.e.,

beginning the ‘chase’). Once the whale was in position, the crew on NOAA-08 gave a signal to the net boat team who then rapidly deployed the net, encircling both NOAA-08 and the whale. At the same time, the two small boats would speed to the location of the set to prevent the whale from leaving the net before the circle was closed (as shown in Fig. 3). The net was then systematically checked for any additional whales that may have been captured.

Captured belugas were measured and assessed to determine suitability for tagging. Initially, suitability was defined as a length > 8 ft. 4 in. (254 cm) and not accompanied by a calf; however, this length criterion was not consistently applied (see Capture Effort sections). If not considered suitable for tagging, a biopsy of the skin was taken and the animal(s) were released. Belugas suitable for tagging were towed slowly toward shore where the water was shallow enough to expose the back and allow the whale to rest comfortably on the mudflat. A hoop net was placed over the head and the flukes were held with a rope lasso to immobilize the whale (Fig. 5).

Figure 5. -- Hoop net and rope lasso used to immobilize belugas during tagging operations in Cook Inlet, Alaska, in 2000. A satellite-linked time/depth recording tag was attached via three nylon rods inserted through the blubber layer of the dorsal ridge. A four-battery version is shown on whale CI-0002.

Similar methods were used in 2001, although a sling system was introduced during this field season. The sling, consisting of five straps, was covered in tarp and suspended the whale

between two of the capture boats (Fig. 6) allowing the team to work without towing and grounding the whale and boats as the tide fell and rose. In 2002, the sling system was employed for the entire season and was modified to include a manual cinching mechanism. The cinching mechanism allowed the tagging crew to tighten the straps so that the whale could not roll or move freely, unlike non-cinching straps. Whales were never lifted out of the water, their eyes and pectoral flippers were kept beneath the water line. The two boats were also cinched closer together, leaving enough lateral space for the whale's pectoral flippers. Limiting the movement of the captured belugas allowed the tagging and handling process to be quicker and the blood collection to be more successful than in 2001.

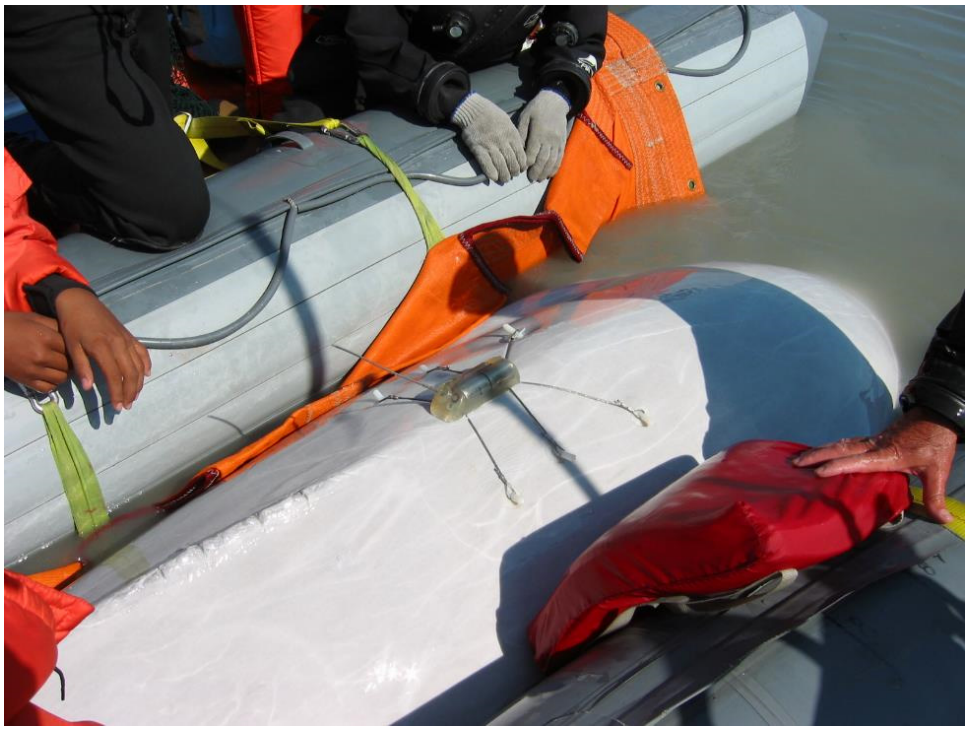


Figure 6. -- Sling system used to immobilize belugas during tagging operations in Cook Inlet, Alaska, in 2001-2002. Satellite-linked time/depth recording tags were attached via three nylon rods inserted through the blubber layer of the dorsal ridge. A two-battery version is shown on whale CI-0205.

Chase times ranged from roughly 5 to 15 minutes and capture times from 50 to 86 minutes. After tagging and releasing each whale, the field team detected signals using a whip antenna or two-element YAGI antenna attached to a VHF radio receiver (Advanced Telemetry Systems, Inc., Isanti, MN). In 2000, in addition to vessel operations, whale group locations and (after tag attachment) tag signals were monitored from a Cessna 182 aircraft during daily

reconnaissance flights over the northern portion of Cook Inlet. An aerial observer used a two-element strut-mount radio antenna (Telonics) with a VHF radio receiver (Advanced Telemetry Systems, Inc., Isanti, MN) to detect signals. The pilot and observer communicated with the vessel crew via cell phone. Some aerial reconnaissance occurred the first day of tagging in 2001, but daily surveys were not conducted, and there is no mention of aerial reconnaissance occurring in 2002.

Tag Design and Attachment

In 2000, the tag-mounting design for bolt attachment was modified from a saddle-style with flexible material straps (sometimes referred to as a 'backpack' tag on the Level A stranding forms: see Fig. 7) to wire cables (Fig. 8). The wire cables required only three bolts versus the four needed for 'backpack' tags. These satellite-linked, time-depth recording (SLTDR) tags, known as 'spider' tags, were constructed by Wildlife Computers (Redmond, WA). They were composed of C-cell batteries (two or four), an on-board processor, a platform transmitter terminal (PTT) (ST16 UHF transmitter by Telonics, Mesa, AZ), a pressure sensor, and a conductivity sensor all encased in a rigid polyurethane block.

A time-depth recorder (TDR MK-6 by Wildlife Computers) encased in floatation with a VHF radio transmitter (built by Robin Baird, NOAA) and a suction-cup attachment was also deployed on one whale in 2000. This short-term tag had to be recovered to download the dive data. The TDR consisted of a 3.5 V battery and sensors for velocity, light levels, temperature, and depth, which were sampled every second.

In 2001, some whales were instrumented with a smart position or temperature transmitting tag (SPOT2, Wildlife Computers) in lieu of or in addition to a spider tag or backpack tag (Fig. 8). The SPOT2 tag was programmed to transmit locations every 6-10 days for a 24-hour period versus the SLTDR which was not duty-cycled (Table 1).

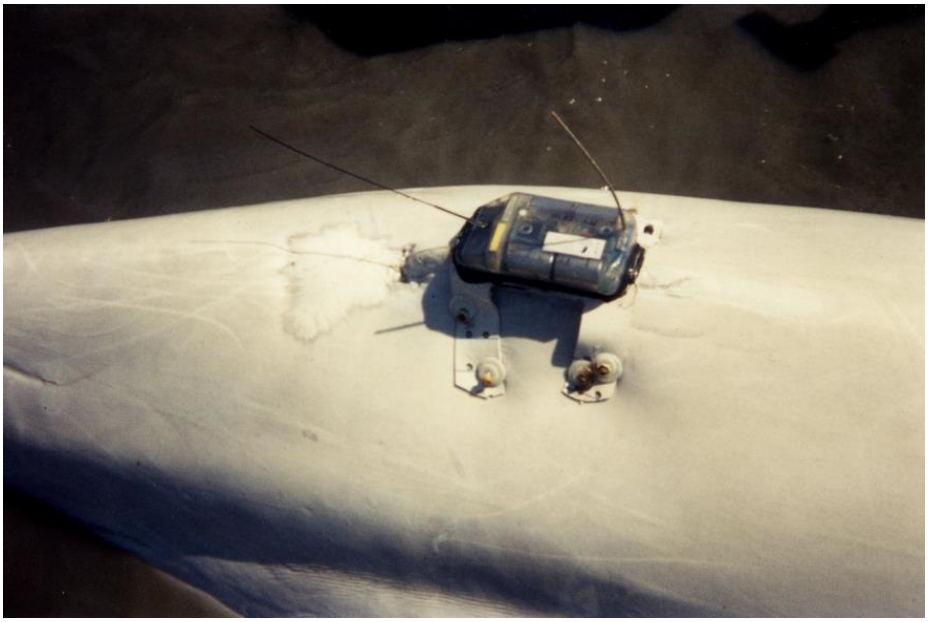


Figure 7. -- Beluga (RCF-400, alternate ID CI-9901) outfitted with a satellite-linked transmitter mounted on a 'backpack' tag (Cook Inlet, Alaska, May 1999: from Ferrero et al. 2000). Flexible material straps were attached via four nylon rods inserted through the blubber layer of the dorsal ridge. Although replaced by the wire-cable attachment system in 2000, two whales were tagged with this model in 2001, in addition to a smart position or temperature transmitting tag (SPOT2, Wildlife Computers).

Figure 8. -- Beluga (CI-0107) outfitted with a smart position or temperature transmitting tag (SPOT2) and ST16 'spider' tag (4-battery version) during tagging operations in Cook Inlet, Alaska, in 2001.

Table 1. -- Examples of satellite tag programming used during beluga whale capture and tagging operations in Cook Inlet, Alaska, 2000-2002.

Model	Parameters	Units used
ST16	Software version 3.15a	
	Time (GMT):	E8:24:07.92
	Date (GMT):	0C August 1900
	Shallowest depth considered a "dive":	1 m
	Deepest depth for accumulating surface-timelines (0=dry only):	0 m
	SLTDR uses 1-sec/ ¼-sec wakeups when shallower than:	20 / 6 m
	Local time [0-23 hours] corresponding to 00h UT (GMT):	14
	Transmission intervals (at-sea/ on-land) min:sec:	00:46.00 / 01:31.00
	SLTDR will use on-land interval after:	50 consecutive dry transmissions
	SLTDR will suspend transmissions after:	4 hours "hauled-out"
	"Haul-out" ends after SLTDR is "wet" for:	4 successive at-sea transmission intervals
	Transmissions will duty cycle with	1 day on and 0 days off
	Daily allowance (2-message transmissions; unused xmits don't accumulate):	800 (sometimes this was set to 500)
	STATUS will be transmitted every:	15 messages
	Blocks of Time-Lines will be transmitted every :	48 messages
	Hours when SLTDR transmits:	00-23
	Upper limits of maximum-depth histogram bins are (meters):	1,2,3,4,5,10,25,50,75,100,150,200,245
	Upper limits of dive-duration histogram bins are (minutes):	1,2,3,4,5,6,8,10,12,15,18,21,25
	Upper limits at time-at-depth histogram bins are (meters):	1,2,3,4,5,10,25,50,75,100,150,200,245
	Discrete-layer seawater option enabled with the fresh water resistance:	100
SPOT2		
	Time (local):	AKDT
	Daily allowance (standard is 500 per day):	200, 240, 300, or 400
	Duty cycle (3 days or 6 days):	9,19,29 or 1,6,11,16,21,26
	Temperature (on / off), If "on":	1,2,4,6,8,10,12,15,18,21,25
	6-hour time bins	03:00, 09:00, 15:00, 21:00

In 2002, flipper bands similar to those placed around both pectorals of the whale captured in 1999 (Orr and Hiatt-Saif 1992, Ferrero et al. 2000) were placed on either the left or right flipper of each whale (Fig. 9). The flipper bands used in Cook Inlet were given to NMFS in 1997 by the Department of Fisheries and Oceans (DFO, Canada) for use in beluga tagging projects in Alaska.

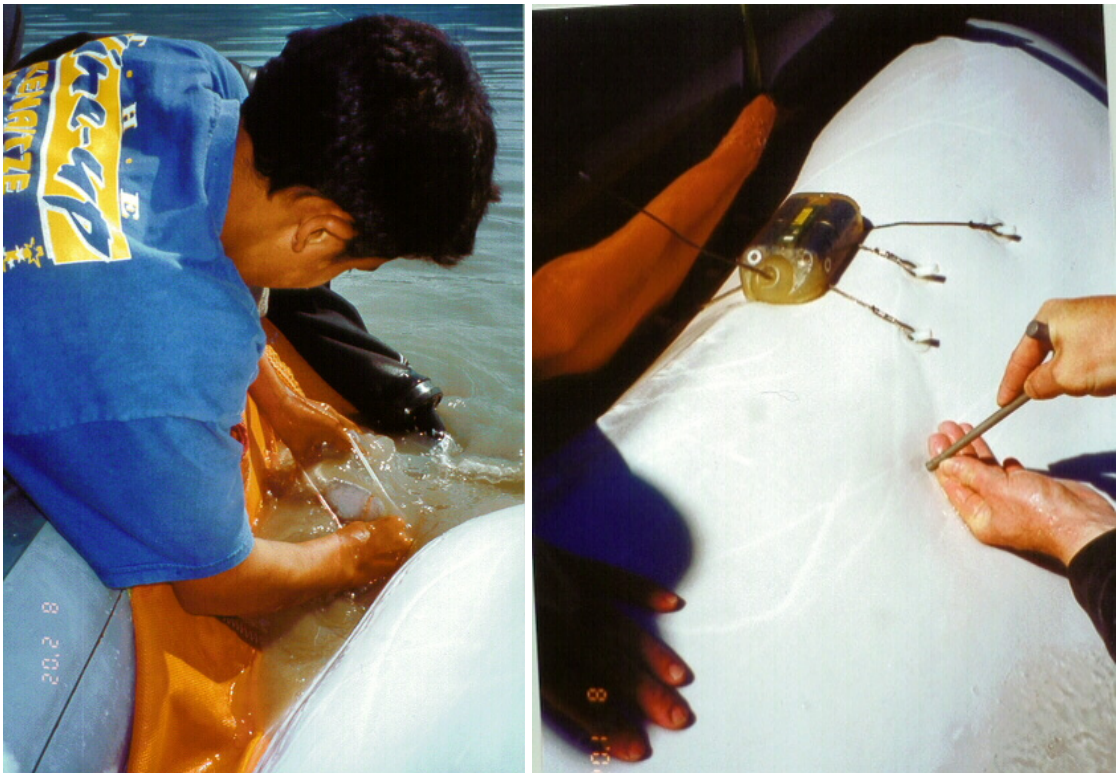


Figure 9. -- Belugas outfitted with a flipper band (left panel: whale CI-0205) and undergoing biopsy sampling with the coring tool (right panel: whale CI-0204) in Cook Inlet, Alaska, in August 2002.

Holes were bored through the blubber layer of the dorsal ridge (or forward of the ridge) using a coring device (referred to as a trocar) that was 1 cm (0.4 in.) in diameter (Fig. 9). A sander was used to sharpen the trocars into a beveled point, determined in 2001 as the sharpest design. Flexible nylon rods (sometimes called "pins" in the field notes) with threaded ends were then pushed through the blubber holes by inserting the sharpened end of the rod into the opening of the trocar and pushing against the trocar as it was removed. Wire cables were attached through a hole drilled in each end of the nylon rod, and secured with nylon nuts threaded and melted onto the ends of each rod using a torch lighter. The wire cables allowed the tag to be cinched against the back of the animal to minimize tag movement and drag. No analgesics were used during these operations.

The rods and trocars were soaked overnight in Topical Antiseptic Microbicide (Rite Aid, Antiseptic Solution), using about one bottle (8 fluid oz.) with 1.5 gallons of water. The antiseptic ingredients were: active 10% povidone iodine; inactive citric acid, glycerin, and other

ingredients. Generally, only one trocar was used per animal, though sometimes multiple trocars were used to expedite tagging.

Kits were created using large plastic bags containing one trocar, three rods, and a whirlpack with six washers and 12 crimpers. Typically one large bag was used for each captured beluga. A few times extra crimps, washers, and rods were needed. These bags, with the satellite tags (three tags were available per day), were stored in two coolers with the other necessary gear (crimpers, wooden blocks, measuring tape, blood sampling kits, extra supplies, etc.). One cooler was kept on each of the RHIBs that held the sling. Biopsy samples of skin and blubber were kept in the trocar, wrapped in tin foil, and kept cold on ice until frozen at the end of the day.

Satellite-linked tags transmit signals to ARGOS receivers on NOAA's polar-orbiting weather satellites, and position data were downloaded by the researcher. Assuming satellites are overhead when the tag is turned on and the whale is at the surface, several signals may be received during a satellite overpass. When tag transmissions are received, positions calculated via Doppler Effect are sent to a ground station which sends the entire transmitter ID and frequency information to Service Argos headquarters in France for processing. Location and dive data were subsequently analyzed in the laboratory (e.g., Hobbs et al. 2005, Goetz et al. 2012). Land avoidance algorithms and modelled locations (based on whale swim speed and data gaps > 1 day) were applied to the raw Argos data to create movement profiles for each whale (Goetz et al. 2012).

Health Assessment Sampling

In 2000, morphometric measurements as well as mucus and blood samples were taken while the satellite tag was being attached. Mucus samples from the blowhole were collected using sterile cotton tipped swabs. When the whale lifted its head for a breath, a swab was quickly inserted into the blowhole before it was shut and gently swiped around inside. When the animal opened its blowhole for the next breath the swab was removed. The swab was wrapped in tin foil, placed in a labeled sealed plastic bag and stored with ice. Blood samples were taken from the flukes using 18- or 19¾-gauge needles with a syringe or a vacutainer equipped with a "butterfly" catheter. Two types of collection tubes were used: 'purple tops' containing ethylene-diamine-tetra-acetic acid (EDTA) for complete blood counts (CBCs), and 'red tops' with serum

separators for blood chemistry. Purple-topped tubes were rocked gently for 2-3 minutes after blood collection and all tubes were then stored with ice. The red tops were later centrifuged (no details were provided about elapsed time between collection and spinning, centrifuge speed, and sample storage).

Tissue (i.e., blood, skin, and blubber) sampling occurred in 2001 and 2002 after the tag(s) were attached (B. Mahoney, pers. comm.). Mucus samples were not obtained during these two seasons. Information about needle size and sample storage was not provided on the Level A stranding form or Beluga Capture form. Level A forms sometimes noted where samples were distributed/submitted (e.g., skin to the Southwest Fisheries Science Center (SWFSC) in La Jolla, CA, blood to Dynacare Laboratories Consumer's Medical Lab (CML) in Anchorage, SeaWorld San Antonio, TX, and/or the Alaska SeaLife Center (ASLC) in Seward, AK, and skin and blubber biopsy for stable isotope, fatty acid, and contaminant analyses to the Northwest Fisheries Science Center (NWFSC) in Seattle, WA). Bloodwork results from CML and SeaWorld were also attached to some of the Level A stranding forms.

RESULTS and DISCUSSION

The capture effort and tagging results from the 1995, 1997, and 1999 field seasons are chronicled in Ferrero et al. (2000). Summaries of daily effort for the 2000 field season presented herein were extracted from the Litzky et al. (2001) field report and associated log book entries. We do not have field reports for the 2001 and 2002 tagging seasons. In 2001, capture and tagging efforts were documented in a personal field journal (L. Litzky), in Level A stranding forms by NMFS-AKR personnel (B. Mahoney), and in two Excel files. Additional notes on how each tag was programmed were included in the log book used during the 2000 tagging season (R. Hobbs). In 2002, a Beluga Capture Datasheet was also included with each Level A stranding form but tagging effort and weather conditions were not provided. A field journal/log book for this season was not found. Identification (ID) numbers were assigned to each whale in the field, however, we found that these ID numbers were often modified in subsequent publications or that laboratories used their own labelling system. We provide all ID numbers assigned to these whales in the field, for lab analyses, necropsies, photo-identification studies, and publications (see Appendix 1).

Results from analyses of the blood, blubber, skin, and mucus samples are presented in the Laboratory Analyses section. Goetz et al. (2012) reanalyzed tag data presented in Ferrero et al. (2000) and Hobbs et al. (2005), applying a land avoidance algorithm and creating new segments when gaps in data of longer than 1 day occurred in the modelled whale movement track. Therefore, we present revised monthly movement maps for each whale including the whale tagged in 1999. Goetz et al. (2012) also compiled dive depth and dive duration data from the whales tagged with ST16s from which we created plots showing these behaviors by month and general location. Examples of ice associations are also presented for whales with tags that continued to transmit into winter.

Capture Effort 2000

Capture operations occurred from 6 to 15 September 2000 resulting in 77 hours spent on the water. The capture net was deployed 16 times including 2 sets for practice and 14 sets on belugas. Seven sets failed to encircle whales. During four of the sets, whales were encircled in the net, but due to tangles formed during net deployment, and one instance where the animal apparently broke through the net, no belugas were captured. Of the 14 sets, only 3 were successful in capturing belugas that were then evaluated for tagging. Daily accounts from the log book are summarized below:

6 September 2000

The team spent the day testing gear and practicing net deployment. The capture net was deployed two times from the Boston Whaler (net boat) while coordinating with the chase boats (NOAA-08 and NOAA-13).

7 September 2000

Weather was sunny with scattered clouds. Aircraft reconnaissance reported three groups of whales: ~30 belugas north of Birchwood in Knik Arm, two whales across from the boat ramp, and ~10 whales near Indian Creek in Turnagain Arm. The group of about 30-40 whales was milling and spread out when the tagging team arrived near Birchwood on the rising tide around 12:30 h. NOAA-08 isolated one whale, following it as the whale surfaced twice. While waiting

for the third surfacing, the team saw a "footprint" (circular pattern on the surface of the water formed when the flukes move up and down beneath the surface) and alerted the net boat. As the net deployed, the Zodiac moved in and was encircled. Immediately after the set, the whale was observed swimming away. It was suspected that either a section of the net had tangled or the water was too deep (> 15 ft.) allowing the whale to escape under the net. The capture operations focused on moving the whales into shallower water.

On the second attempt, the isolated whale created a clear wake formed by its head and multiple footprints visible during pursuit. Both chase boats were encircled but the whale escaped because the net had twisted in multiple areas during deployment. On the third attempt, the set was late and the whale turned and swam straight at the chase boats, going under both. Engines were turned off before the whale bumped the bottom of NOAA-08. The whale then surfaced a number of times and was observed to have a cut about 40 cm (16 in.) long on the left side of its body, just forward of the peduncle. The cut appeared to be superficial with minimal bleeding. The animal was followed at a distance and observed to return to the group At this point the tide was beginning to fall, so the vessels headed south into Eagle Bay. The net boat proceeded into Eagle River looking for whales but none were found. The vessels returned to the boat ramp at 18:00 h.

8 September 2000

Weather included partly cloudy skies. The boats departed Anchorage on the falling tide around 07:00 h and encountered a group of ~30 belugas swimming north toward Eagle Bay. The capture team passed the group before entering Eagle Bay to wait for their arrival. A small group was chased briefly near Eagle River but appeared to be composed of smaller, gray-colored belugas. The vessels continued north, rounding the N. Point but did not find any whales. Engines were turned off and the vessels were allowed to drift south toward Eagle River. The wakes and footprints of the whales were clearly visible on the surface of the turbid water as they approached the drifting boats that were now over shallow water. With engines back on, NOAA-08 isolated one whale as the net boat slowly churned through the ~4 ft. deep water eventually encircling the whale. This first successful net deployment occurred around 11:00 h at low tide. The length of the beluga, identified as CI-01-2000 (alternate ID = CI-DL-01-00 in the field report), was measured in the water at 274 cm (9 ft.). The skin was light gray in color and very smooth with no

visible scarring. Because the focus of the study was to tag mature whales, this apparently young animal, caught early on in the study, was not tagged. A small skin biopsy was taken (sent to SWFSC for genetic analysis, Appendix 1) and the whale was released at 11:15 h (video footage of capture taken by B. Gossweiler). Aerial reconnaissance reported four white belugas in Eagle River around 11:00 h.

Two large holes in the net required repair. At 12:15 h, the team resumed searching for whales. Belugas were present on the east and west sides of Knik Arm but disappeared each time the boats approached. Other species observed included two minke whales (*Balaenoptera acutorostrata*) in the middle of Knik Arm at 14:20 h. With the tide rising and winds picking up, capture operations were suspended at 15:30 h. Boats returned to the ramp by 17:00 h after running a series of tag location tests.

9 September 2000

Weather was sunny with clear skies. Capture teams departed the boat ramp at 08:15 h heading north to Eagle River. At the river mouth the teams encountered a group of belugas and attempted to herd them to the shallows. Most of the whales appeared to be gray-colored. Aerial reconnaissance reported whales north of point heading south on the falling tide. The team continued to herd whales near Eagle River but most appeared to be cows with calves. No sets were attempted. The chase boats drifted near the bluffs along Eagle Bay as the tide reached low while the net boat rounded point heading north to search for whales.

At 13:00 h, whales were seen approaching from the south on the rising tide. NOAA-08 isolated a whale but the first set was too early and the whale escaped. The second set was on a whale with distinct notches along its peduncle. The whale was seen within the confines of the net but then disappeared. A large hole was found in the net upon retrieval suggesting the whale broke through the net. By 14:00 h, the small, scattered group was gone and another small group was spotted south of Eagle River close to shore. For the third set, one of the team members remained on shore with one end of the net while the boat deployed like a beach seine. Chase boats attempted to herd whales toward the net. The third set was aborted when the whales appeared to be a cow with calf. Attempts to herd other whales were not successful and eventually this small group left the area. Between 16:00 and 17:00 h, the team began heading south to return to the boat ramp when a group of ~50 belugas were encountered. Whales were spread along the

shore south of point headed toward Eagle River (aerial reconnaissance observed this group earlier in the day in Turnagain Arm). A fourth set was attempted using the beach seine technique but now at high tide the whales evaded the boats and disappeared. Boats returned to the ramp at 20:00 h.

10 September 2000

Weather was overcast and rainy. The boats launched at 08:00 h on the falling tide and headed north to Eagle River. A group of belugas was found near the flats. An attempt to isolate one resulted in the group turning and heading south. Capture teams continued to Eagle River where another group was found. By 10:00 h the belugas were spread out along the coast from the river mouth to the point. Winds began to pick up as attempts were made to herd the whales toward the mudflats. Large juveniles and cows with calves were among the whales in the group. The net boat isolated one large, gray beluga and began to set the net. The whale was able to evade the net but continued to swim beside the net. Chase boats attempted to herd the whale into the net but were unsuccessful. At 11:00 h low tide grounded all the boats and the crew waited on shore until 14:30 h. Weather continued to deteriorate, so after refloating and one last look for whales (none were found after low tide) the teams returned to the boat ramp at 16:00 h.

11 September 2000

New tactics were discussed prior to departure from the boat launch. Recommendations included slower approaches, setting the net across a passage area and waiting for whales to arrive, and not setting nets on cows with calves. The teams headed north at 08:00 h and immediately encountered a group of belugas. The boats, in an echelon formation, approached the group of about five whales but the water was too deep for a set and the whales disappeared. At 09:30 h more whales were seen mid-inlet. The teams spent time trying to herd the whales toward the western shoreline but the belugas were able to evade the boats. At 10:30 h the boats continued north and encountered another group of whales just south of Eagle Bay. With boats in echelon formation, the team slowly herded the whales toward the mudflats for about an hour. The boats began closing on the group when two cows with calves crossed the boat bows heading south causing the team to abort the attempt. The team then planned to set on three other whales but they disappeared. Boats continued to the mudflats to wait out the low tide.

At 14:00 h, the Zodiac made a reconnaissance run up to N. Point in Eagle Bay. A large group of whales was spotted heading south. The net boat moved toward the group causing the whales to turn and head into shallow water. Three whales were separated out by NOAA-08 but before the set could occur, the Zodiac unintentionally blocked NOAA-08 and a calf was seen among the whales. Two more whales were isolated by NOAA-08 but when the net boat approached, the whales disappeared once again. At 17:00 h the boats headed north to N. Point using a deeper channel and began herding a group back toward shallow water. A set was made on a large, gray beluga but it was able to escape the net. Winds picked up and heavy rain forced the team to abandon tagging and return to the boat ramp by 19:30 h.

12 September 2000

The weather was overcast with wind and rain. The teams departed the boat ramp at 08:30 h heading north to Eagle River. Whales were observed near N. Point but water was choppy and it was difficult to track the whales. The boats headed to the beach to wait out the low tide (negative tide at 14:00 h). At 15:30 h, whales were seen moving north through the mudflats. Boats followed the whales north toward Birchwood. A set was made in the shallows off Birchwood. A whale was captured but the ends of the net drifted apart allowing it to escape. More whales were seen close to shore but disappeared after boats rapidly approached. Many whales were seen south of N. Point but it was too late in the day to make any more sets. Boats returned to the ramp at 20:30 h.

13 September 2000

Boats departed at 08:30 h and headed to Eagle River. The first set occurred at 12:15 h with NOAA-08 isolating a whale at 12:00 h. Capture occurred at 12:20 h. The beluga, identified as CI-DL-02-00 (aka “Paul” then “Paula” after determining via genetics this was a small female; alternate ID = CI-0002 in subsequent publications), was slightly darker gray than the whale captured on 8 September, but still considered light gray. There were some light scars visible on the animal’s back. Measurements taken in the water (9 ft. 4 in.) found this beluga suitable for tagging and it was slowly towed, fluke first, to shore just north of Sixmile Creek with the aid of a hoop net and tail rope. On shore measurement of whale length was 272 cm (8 ft. 11 in.). Tagging began at 13:30 h (tag PTT #30719). Due to the falling tide, the whale was continually moved

down shore during the tagging process to keep it in shallow water. A total of four holes were made through the blubber of the dorsal ridge. Nylon rods were put through three of these holes for tag attachment. The first hole made was not used because it was too high on the dorsal ridge. During tag attachment, two mucus samples were taken from the whale's blowhole. Blood samples were also taken from the left side of the dorsal surface of the beluga's fluke using an 18-gauge needle. About 25 ml of blood were taken filling two purple capped tubes and four red caps. Lastly, a TDR was attached to the left dorsal side of the whale with a suction cup (Fig. 10). The animal was released at 14:15 h and the crew on NOAA-13 followed to monitor the TDR transmissions. The rest of the team headed north to Birchwood.

Figure 10. -- Whale CI-DL-02-00 (aka "Paul/Paula", alternate ID: CI-0002) equipped with satellite-linked time/depth recording (SL-TDR) tags attached via three nylon rods inserted through the blubber layer of the dorsal ridge and a suction-cup attached TDR with flotation (yellow tag: right panel). L to R (left panel): K. Laidre and R. Hobbs monitoring the whale, restraining the fluke and assisting with the blood draw are L. Hoberecht, M. Eagleton, W. Walker, G. O'Corry-Crowe, D. Vos, and B. Mahoney (standing). Photographer: D. Seagars, NMFS-AKR.

The second set of the day occurred near Birchwood but was unsuccessful as the whale bolted ahead of the net. The third set was successful, capturing a large, white beluga identified as CI-DL-03-00 (aka "Ringo"; alternate ID = CI-0001 in subsequent publications) at 17:45 h. It was towed to shore head first, again using a hoop net and two tail ropes. Shore was reached around 18:10 h, where the animal was sexed (male) and measured (length 413 cm (13 ft. 7 in.)). A deep, old scar was evident on the forward portion of the dorsal ridge. Attachment of satellite tag (PTT #25850) occurred just behind this scar and required the boring of three holes through the dorsal ridge (Fig. 11). Again, two mucus samples were taken from the blowhole. About 16 ml of blood

were taken from the dorsal surface of the fluke using a 19¾-gauge needle and filling 2 purple tops and 2½ red tops. During tagging, the beluga was continually moved up shore with the rising tide to keep it at the water's edge. The whale was released at 19:00 h and the teams returned to the boat ramp.

Figure 11. -- Whale CI-DL-03-00 (aka "Ringo", alternate ID: CI-0001) outfitted with a satellite-linked time/depth recording (SL-TDR) tag attached via three nylon rods inserted through the blubber layer of the dorsal ridge.

14 September 2000

The weather was clear and sunny, but cold. At 08:00 h the team met at the ramp and repaired the net that was damaged during yesterday's capture. The boat finally departed at 09:30 h and headed to Eagle Bay where much of the day was spent waiting for whales. At 16:30 h, a large group of belugas was seen, the most concentrated yet during the project. Many whales were isolated and chased but all ended up being cows with calves. Finally, one large whale was isolated and a set was started in shallow water but the boat ran aground and could not close the net. The boats returned to the boat ramp and the day ended at 20:00 h.

15 September 2000

Today was the final day of the project. NOAA-08 launches to search for TDR on "Paula" (CI-0002). A weak signal was heard near the Port of Anchorage (POA) and whales were seen. Then whales disappear and the signal was lost. NOAA-08 searched in Eagle Bay (no signal), Birchwood (no signal), back at POA (no signal), then south to Fire Island (no signal). The team returned to the POA at 14:30 h to refuel and a weak signal was heard. They returned to Eagle Bay and on approach the signal got stronger. Whales were seen near N. Point, so the team headed to shore and monitored the signal until it was gone. A juvenile harbor porpoise (*Phocoena phocoena*) was observed on the second trip to Eagle Bay. The team returned to the boat ramp at 20:00 h.

16 September 2000

A stranded harbor porpoise was reported at the POA so the team headed out to rescue it.

17 September 2000

Aircraft and boats searched for the TDR. The plane detected a constant strong signal directly across from the POA near Point MacKenzie. A yellow object was spotted on shore. NOAA-08 was launched to investigate but the object was not the TDR. NOAA-08 detected a weak signal but could not get a direction. The team searched until last light.

Other team members went to Anchor Point (at the entrance of Kachemak Bay in lower Cook Inlet, Fig. 1) to retrieve a dead beluga calf (a female: Field ID AKDL000917.01, SWFSC Lab ID 17859).

18 September 2000

A necropsy on the dead beluga calf was performed. The team on NOAA-08 was able to locate and retrieve the floating TDR in Knik Arm.

Lessons Learned in 2000

Whales appeared to ignore vessels that were greater than 46 m (150 ft.) away. When approached slowly, they would consistently move in a direction away from the boats. When approached rapidly, whales tended to surface in quick succession and then disappear by

submerging for extended periods of time. When in shallow water, their underwater movements could be tracked by the appearance of a surface wake. Upon deployment of the capture net, which coincided with a burst of speed and engine noise from the net boat, whale behavior became erratic. Usually, the isolated whale would race away from the vessels in a straight line but there was one instance of an animal turning and swimming toward the chase boats.

Capture Effort 2001

Capture operations began 10 August and ended on 20 August 2001. In total 77.5 hours were spent on the water. The capture net (1,000 ft. (21 in. mesh)) was deployed 21 times, of which nine sets were successful in capturing whales. From those nine sets, seven belugas were deemed suitable for tagging (two cows with calves were released). Daily accounts presented below were created using information provided in L. (Litzky) Hoberecht's personal field journal, notes on tag programming found in the 2000 field log book (R. Hobbs), and data found in two Excel files (B. Mahoney). Level A stranding forms provided additional information but were not always complete (i.e., some were missing PTT numbers, capture release times, and did not identify where biopsy, skin/blubber, and blood samples were sent).

10 August 2001

Weather was overcast with mild temperatures (~55°F-62°F). At 08:30 h the boats (NOAA-08, NOAA 5-4, 'Beluga', and the Boston Whaler aka 'Net Boat') departed the dock and headed to the Little Susitna River. At the mouth of the river, the team encountered 50-60 whales in shallow water. The first set was deployed on a lone, white beluga but failed to capture the whale which was observed outside the net after deployment. At this point the whales disappeared. NOAA-08 and 'Beluga' searched for the whales but failed to find any. After waiting until noon, the aerial reconnaissance plane reported whales near Birchwood in Knik Arm and 2-3 miles upriver in the Little Susitna River. The boats entered the river, and after encountering the whales, attempted to move them toward the shallows. The second set occurred as the whales were swimming down river toward the inlet.

The boats gathered on the north side of the river to force the whales into the shallows. A cow with calf was allowed to pass, then the second set was made on a single whale. The beluga

(CI-01-01) was successfully captured “about 2 turns up river from the cut” at 13:30 h. The whale was described as “a subadult, gray-colored beluga” and measured at 8 ft. 5 in. (257 cm) with a fluke width of 63 cm (~2 ft. 1 in.). Given its size, the decision was to only tag with a SPOT2 tag (PTT #13934) using 3 quarter-inch rods (Fig. 12). The tag was programmed to transmit 3 days per month (on 9, 19, and 29) and collect temperatures. A biopsy was collected for fatty acid analysis, skin/blubber for genetics, and a blood draw was attempted from the flukes but failed as the dorsal surface of the flukes was heavily scarred and thick. The whale was released at 14:30 h. The boats returned to the docks at 15:30 h to unload and repair the net.

Figure 12. -- Whale CI-01-01 outfitted with a smart position or temperature transmitting tag (SPOT2) via three nylon rods inserted through the blubber layer of the dorsal ridge.

11 August 2001

Weather was partly cloudy with lots of sun and warm temperatures (~55°F-66°F). The boats departed at 10:00 h headed into Knik Arm to Birchwood (where whales had been seen the previous day by the aerial reconnaissance crew). The first set captured what appeared to be a cow with a large calf about mid-day near Eagle River in Knik Arm. The “calf” was about 8 ft. in

length. A skin/blubber biopsy was taken from the adult whale (Field ID DL010811.01, SWFSC Lab ID 24858 genetics confirmed this was a female). Both were released without tagging. The second set resulted in an empty net. On the third set, the target whale was able to swim ahead of the net boat and escape. On the fourth set, the target whale was able to escape before the net could be closed. On the fifth set, although the set initially failed, the chase boat 'NOAA-08' was able to maneuver the whale into the net.

The whale (CI-01-02) was captured at 15:45 h on Eagle Flats (Fig. 13). The adult, white beluga measured 10 ft. 7 in (323 cm) with a fluke width of 90 cm (2 ft. 11.4 in.). The whale was tagged with both a SPOT2 (PTT #13937) and ST16 'spider' tag (PTT #30720, note: Level A has a typo '3072' missing the last zero). The SPOT2 was programmed to transmit 6 days per month (on 1, 6, 11, 16, 21, and 26) and collect temperatures. A biopsy was collected for fatty acid analysis, skin/blubber for genetics, and a blood draw was attempted from the flukes. The whale was released at 17:45 h (the field journal listed the capture period from ~15:30-17:30 h).

Figure 13. -- Whale CI-01-02 outfitted with a smart position or temperature transmitting tag (SPOT2) and ST16 'spider' tag via nylon rods (2 and 3, respectively) inserted through the blubber layer of the dorsal ridge.

12 August 2001

Weather was sunny and hot (~53°F-69°F). The boats departed at 10:00 h headed into Knik Arm. After two sets, the third set was successful following a long, 'squirrely' chase. The net boat went into deep water before setting. Whale (CI-01-03) was caught near Birchwood at 13:35 h (Fig. 14). The adult, white beluga measured 10 ft. 3 in (312 cm) with a fluke width of 78 cm (~2 ft. 7 in.). The whale was tagged with both a SPOT2 (PTT #13933) and ST16 'backpack' tag (PTT #25847, note: Level A was incomplete listing SPOT with no PTT number and does not mention the backpack tag, this information was provided in the Excel file). The SPOT2 was programmed to transmit 3 days per month (on the 9th, 19th, and 29th) and collect temperatures. A biopsy was collected for fatty acid and genetic analyses, and a blood draw was attempted from the flukes. A release time was not provided. At 17:00 h, the team left the boat dock after unloading gear.

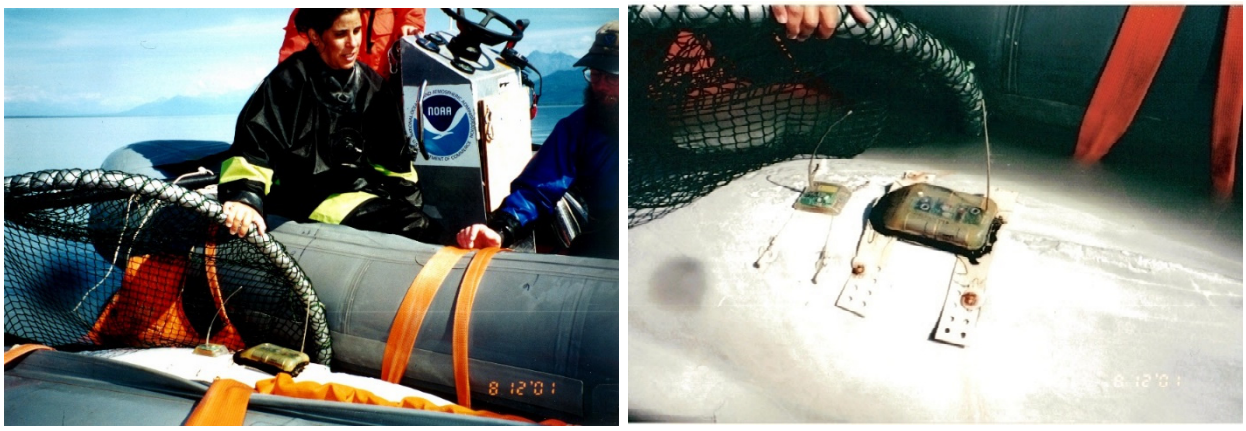


Figure 14. -- Whale CI-01-03 outfitted with a smart position or temperature transmitting tag (SPOT2) and ST16 'backpack' tag via nylon rods (2 per tag) inserted through the blubber layer of the dorsal ridge.

13 August 2001

Weather was sunny and hot (~53°F-73°F). The team arrived at boat dock at 08:00 h to mend the net and prepare the boats. The crew departed at 11:00 h headed into Knik Arm. Both sets were successful near Birchwood. Whale (CI-01-04) was captured at 12:15 h. Notes in the Excel file state "this beluga rolled once" in the sling. This was not uncommon during the 2001 season because the un-cinched straps left the sling low in the water and the boats farther apart

which allowed the whales to move. The adult, white beluga measured 11 ft. 2 in (340 cm) with a fluke width of 88 cm (2 ft. 10.6 in.). The whale was tagged with both a SPOT2 (PTT #13945) and ST16 'backpack' tag (PTT #25849) using two rods per tag (note: Level A was incomplete, mentioning the backpack tag but not listing the PTT number, this information was provided in the Excel file, also the field journal misidentified this whale as CI-01-06). The SPOT2 was programmed to transmit 6 days per month and to collect temperatures. A biopsy was collected for fatty acid and genetic analyses, and a blood draw was attempted from the flukes. A release time was not provided. No photographs of this whale were found among the images provided for the 2001 season.

Whale (CI-01-05) an adult, white beluga measured 11 ft. 8.5 in (357 cm [note: Level A incorrectly converted to 362 cm]) with a fluke width of 2 ft. 8 in (81 cm [note: Level A rounded to 82 cm], field journal misidentified this whale as CI-01-07) was captured at 14:52 h. The whale was tagged with a SPOT2 (PTT #13938, using two rods) programmed to transmit 6 days per month but not to collect temperatures (to compare longevity results to the SPOT2 on CI-01-04). The whale was described as "extremely calm in the sling" (Fig. 15). A biopsy was collected for fatty acid, contaminant, and genetic analyses and blood was collected from the flukes. The whale was released at 15:36 h. The team returned to the dock at 17:00 h.

Figure 15. -- Whale CI-01-05 outfitted with a smart position or temperature transmitting tag (SPOT2) via two nylon rods inserted through the blubber layer of the dorsal ridge.

14 August 2001

The weather was rainy and windy (~57°F-66°F). The team arrived at the dock to repair the net and service the Boston Whaler but did not attempt to go out on the water.

15 August 2001

The weather was overcast and cool (~57°F-64°F) and the crew departed the dock at 07:30 h. Field notes stated subsistence whalers were leaving Knik Arm so the team waited for the tide to change. Three sets were attempted. The first set failed to capture a whale in the net. During the second set, a whale was seen in the net but somehow escaped (water may have been too deep). The third set was successful after a long drive herding the whales to the north. Whale (CI-01-06) was captured near Birchwood (Fig. 16). Capture and release times were not provided on the Level A stranding form or in the field notes.

The adult, white beluga measured 13 ft. 2 in. (401 cm) with a fluke width of 3 ft. 6 in. (107 cm). The whale was tagged with both a SPOT2 (PTT #13942) and ST16 'spider' tag (PTT #13947, note: Level A form was incomplete listing SPOT2 with no PTT number and does not mention the spider tag, this information was provided in the Excel file). The SPOT2 was programmed to transmit 6 days a month but not to collect temperatures. A biopsy was collected for fatty acid, contaminant, and genetic analyses, and a blood draw was attempted from the flukes but failed. Boats returned to the dock at 21:00 h.

Figure 16. -- Whale CI-01-06 outfitted with a smart position or temperature transmitting tag (SPOT2) and ST16 'spider' tag via nylon rods (2 and 3, respectively) inserted through the blubber layer of the dorsal ridge.

16 August 2001

Weather was cloudy, rainy, and cold (~55°F-63°F). The crew met at the dock at 10:00 h to repair nets but did not attempt to go out in the morning. At 14:00 h the crew returned to load the boats and departed for the Susitna area at 15:00 h. No whales were found so the boats returned to Knik Arm and arrived near Birchwood around 17:00 h. There was an attempt to chase one whale but the tide was high and water was too deep. The boats departed area at 20:00 h and returned to the dock at 21:00 h.

17 August 2001

The weather was overcast and rainy, causing a late departure from the dock at 16:00 h. Field notes state "tide was so high today that the flats had >15 ft. of water over them." The first set was made in 7 ft. of water but the late deployment caused the boat to loop back to prevent the whale from escaping. Once encircled, a calf appeared next to the adult so both whales were immediately released. Additional chases were attempted but waters were too deep and it was getting dark. Effort was ended at 20:15 h.

18 August 2001

The crew arrived at the dock at 12:30 h to transport the boat and net to the warehouse where the net was repaired. At 15:30 h, the crew returned the boat to dock and met with a documentary team from Discovery Program from 15:30-16:30 h.

19 August 2001

The weather was overcast and cool (~53°F-60°F). The team departed dock at 08:30 h heading into Knik Arm. There were two unsuccessful sets: the first against a sand bar near the channel in Eagle Bay, and the second made without chase boats. The boats returned to the dock at 21:00 h.

20 August 2001

Weather was partly cloudy and warm (~51°F-66°F). The crew arrived at the dock at 10:00 h. Three sets were attempted, but only the second one was successful. Whale (CI-01-07) was out of the water through the tide cycle on Eagle Flats from 12:50 to 18:00 h (Fig. 17). The adult, white beluga measured 14 ft. 6 in (442 cm) with a fluke width of 189 cm (6 ft. 2.4 in.). The whale was tagged with both a SPOT2 (PTT #13943) and a ST16 'spider' tag (PTT #13948, note the Level A mentions the spider tag but does not list the PTT number, this information was provided in the Excel file). The SPOT2 tag was programmed to transmit positions 6 days per month and not to collect temperature data. A biopsy was collected for fatty acid and genetic analyses, and blood was collected from the flukes.

Figure 17. -- Whale CI-01-07 outfitted with a smart position or temperature transmitting tag (SPOT2) and ST16 'spider' tag via nylon rods (2 and 3, respectively) inserted through the blubber layer of the dorsal ridge.

21 August 2001

Today was the last day of the project and the team arrived at the dock at 10:00 h to clean boats and unload gear.

Capture Effort 2002

Capture operations began 29 July and ended on 4 August 2002. Comments about tagging events were recorded on a Beluga Capture Datasheet. Level A stranding forms were also filled out for each whale (B. Mahoney). Daily accounts presented below were based on information extracted from these two forms (note: effort details, such as departure and return times to the boat ramp, searches for whales, and numbers of unsuccessful sets, were not documented in 2002). Additional information about tagging events on 1 August 2002 were provided in a series of memorandums between B. Mahoney and S. Moore/P.M. Payne (Mahoney 2002a,b).

29 July 2002

The first whale of the 2002 season was captured at 10:00 h at the mouth of the Little Susitna River (61°14.085'N, 150°19.046'W). During the set, the whale escaped when the net boat became entangled but then swam back into the net, wrapping the float and lead line around his body. The team had to remove about 100 ft. (30.5 m) of damaged netting and the prop screw

was lost when removing net from the Boston Whaler (which had to be towed back to Anchorage).

The white beluga (CI2002-01, alternate ID: CI-0201) was measured at 13 ft. 6 in. (412 cm) with a fluke width of 99 cm (3 ft. 3 in.) (Fig. 18). Tagging began at 10:30 h and the whale was released at 11:23 h. A four-battery tag (PTT #25850) was attached with three rods and a flipper band (DL00126) was put around the right pectoral flipper. A 9 cm (3.5 in.) biopsy sample was collected from the flank about 25 cm (10 in.) below the dorsal ridge. Skin and blood (~5 ml before the needle was dislodged) were also collected.

Figure 18. -- Whale CI2002-01 (alternate ID: CI-0201) outfitted with a four-battery ST16 'spider' tag via nylon rods inserted through the blubber layer of the dorsal ridge. The net boat (Boston Whaler) is shown in the background. The whale was suspended in a sling between NOAA-08 and the Zodiac.

30 July 2002

Successful capture took place west of the Little Susitna River (61°14.204'N, 150 19.160'W). After setting the net at 09:48 h, the whale avoided entangling for about 30 minutes until the team tightened the circle of the net to about 15 ft. (4.6 m) in diameter. The light gray beluga (CI2002-02) was measured at 11 ft. 2 in. (340 cm) with a fluke width of 88 cm (2 ft. 10.6 in.) (Fig. 19). Tagging began at 10:55 h and the whale was released at 11:50 h. A four-

battery tag (PTT #30719) was attached with three rods and a flipper band (DL00129) was put around the left pectoral flipper. An 8 cm (3 in.) biopsy sample was collected along the flank about 25 cm (10 in.) below the dorsal ridge. Skin and blood were also collected.

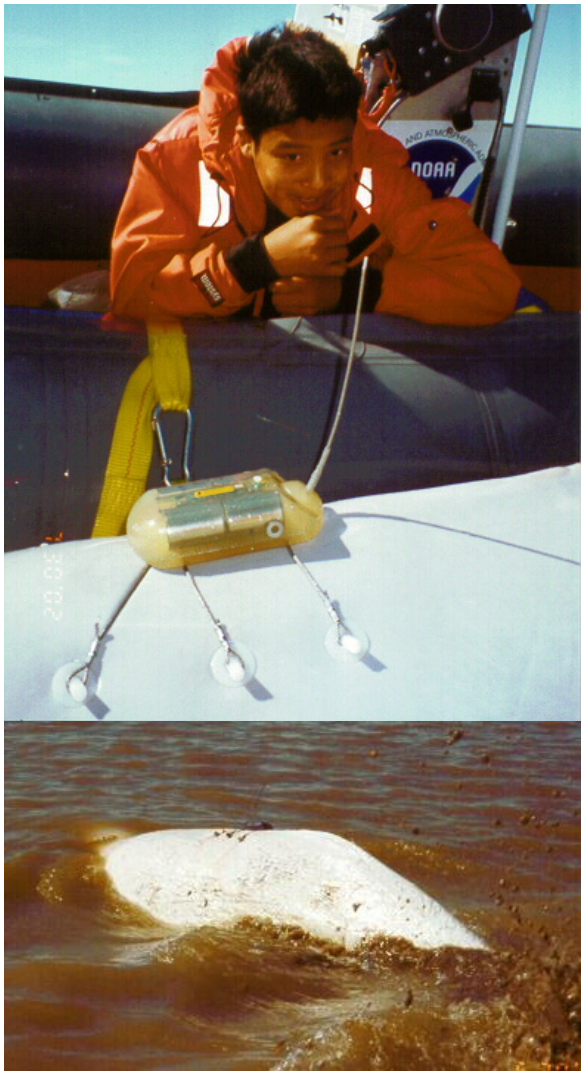


Figure 19. -- Whale CI2002-02 (alternate ID: CI-0202) outfitted with a four-battery ST16 'spider' tag via nylon rods inserted through the blubber layer of the dorsal ridge.

31 July 2002

The field team did not find belugas at the Susitna delta so the teams headed to Knik Arm. A beluga was successfully captured west of Birchwood (61°25.3'N, 149°39.3'W). The whale was by itself at the time of capture (13:35 h) though a large group was observed closer to shore.

The white beluga (CI2002-03) was measured at 12 ft. (366 cm [note: Level A rounded to 367 cm]) with a fluke width of 81 cm (2 ft. 8 in.) (Fig. 20). Tagging began at 13:50 h and the whale was released at 14:35 h. A two-battery tag (PTT #13943) was attached with three rods and a flipper band (DL00202) was put around the left pectoral flipper. An 8 cm (3 in.) biopsy sample was collected along the flank about 25 cm (10 in.) below the dorsal ridge. Skin and blood were also collected.

Figure 20. -- Whale CI2002-03 (alternate ID: CI-0203) outfitted with a two-battery ST16 'spider' tag via nylon rods inserted through the blubber layer of the dorsal ridge.

1 August 2002

On 1 August the crew met at 09:45 h. The four boats were launched between 10:15 and 10:30 h, and departed Anchorage at 10:40 h. At 11:11 h, approximately 75 belugas were

observed on the west side of the Little Susitna River (61°13.658'N, 150°17.885'W) swimming east and west along the shore. The 5.4 RHIB motored around the beluga pod to separate a single whale in the shallow waters. At 11:35 h, a 900 ft., 21 inch mesh net was set around one beluga in the shallow waters west of the Little Susitna River (61°13.8'N, 150°20.10'W). The whale swam into it immediately, as did almost all of the other tagged belugas this year (except CI2002- 02, which took more than 30 minutes to be entangled). CI2002-04 was entangled relatively simply, with the float line floating and the lead line beneath (unlike CI2002-01 who wrapped the float and lead line around his body). Only the head and a bit of the tail were caught in the 21 in. mesh. The net was not submerged. People on the 5.4 m RHIB and NOAA-08 attended to the beluga immediately, securing its tail with two ropes and its head with the head net. Unlike more entangled belugas, this whale was quickly released from the net with minimal cutting. It was not necessary to move the whale out of shallow water, as the beluga was captured just before high tide and later released as the tide was going out on the west side. By 12:05 h, the beluga was disentangled from the net and secured in a sling between the 5.4 m RHIB and 16 ft. RHIB at which time the tagging process was started.

The white beluga (CI2002-04) was measured at 12 ft. 5 in. (379 cm) with a fluke width of 89 cm (2 ft. 11 in.) (Fig. 21). A four-battery tag (PTT #25849) was attached with three rods and a flipper band (DL00196) was put around the right pectoral flipper. A 9 cm (3.5 in.) biopsy sample was collected along the right flank about 25 cm (10 in.) below the dorsal ridge. Skin was collected and placed in a vial with dimethyl sulfoxide solution (DMSO) for genetic analysis. Blood was collected (less than 20 cc) from under the whale's fluke. After pictures were taken, the whale was released at 12:50 h (note the Level A lists an incorrect release time of 14:35 – this was the release time for CI2002-03). This beluga was not seen again by the tagging team.

After the net was mended, the boats continued to follow the same beluga pod. At 14:40 h, another set was made around a single white beluga near the Little Susitna River (61°14'N, 150°18'W), without success. The boats departed for Anchorage at 15:00 h and arrived at 15:45 h.

Figure 21. -- Whale CI2002-04 (alternate ID: CI-0204) outfitted with a four-battery ST16 'spider' tag via nylon rods inserted through the blubber layer of the dorsal ridge. A 9 cm (3.5 in.) biopsy was collected along the right flank (right panel).

2 August 2002

A beluga was successfully captured in Knik Arm, south of Birchwood (61°25.175'N, 149°35.752'W) at 13:10 h. The white-gray beluga (CI2002-05) was measured at 12 ft. 8 in. (386 cm [note: Level A converted length incorrectly to 390 cm]) with a fluke width of 90 cm (2 ft. 11.4 in.) (Fig. 22). Tagging began at 13:30 h and the whale was released at 14:00 h. A two-battery tag (PTT #13947) was attached with three rods and a flipper band (DL00200, size 15.5 cm (6 in.)) was put around the left pectoral flipper. A 10 cm (4 in.) biopsy was collected along the flank about 25 cm (10 in.) below the dorsal ridge (no muscle in the sample). Skin and blood were also collected.

Figure 22. -- Whale CI2002-05 (alternate ID: CI-0205) outfitted with a four-battery ST16 'spider' tag via nylon rods inserted through the blubber layer of the dorsal ridge. A flipper band was placed around the left pectoral (right panel).

3 August 2002

Two whales were captured in Knik Arm. The first capture occurred south of Birchwood (61°24.915'N, 149°35.820'W) at 13:40 h using a 900 ft. (21 in. mesh) net. The "whitish-gray" beluga (CI2002-06) was measured at 11 ft. 7 in. (353 cm [note: Level A incorrectly converted to 355 cm]) with a fluke width of 2 ft. 9 in. (84 cm) (Fig. 23). Tagging began at 14:15 h and the whale was released at 14:50 h. A two-battery tag (PTT #13948) was attached with three rods and a flipper band (DL00078, size 16 cm (6.3 in.)) was put around the right pectoral. A 13 cm (5 in.) biopsy sample was collected along the flank about 25 cm (10 in.) below the dorsal ridge (no muscle in the sample). Skin and blood were also collected.

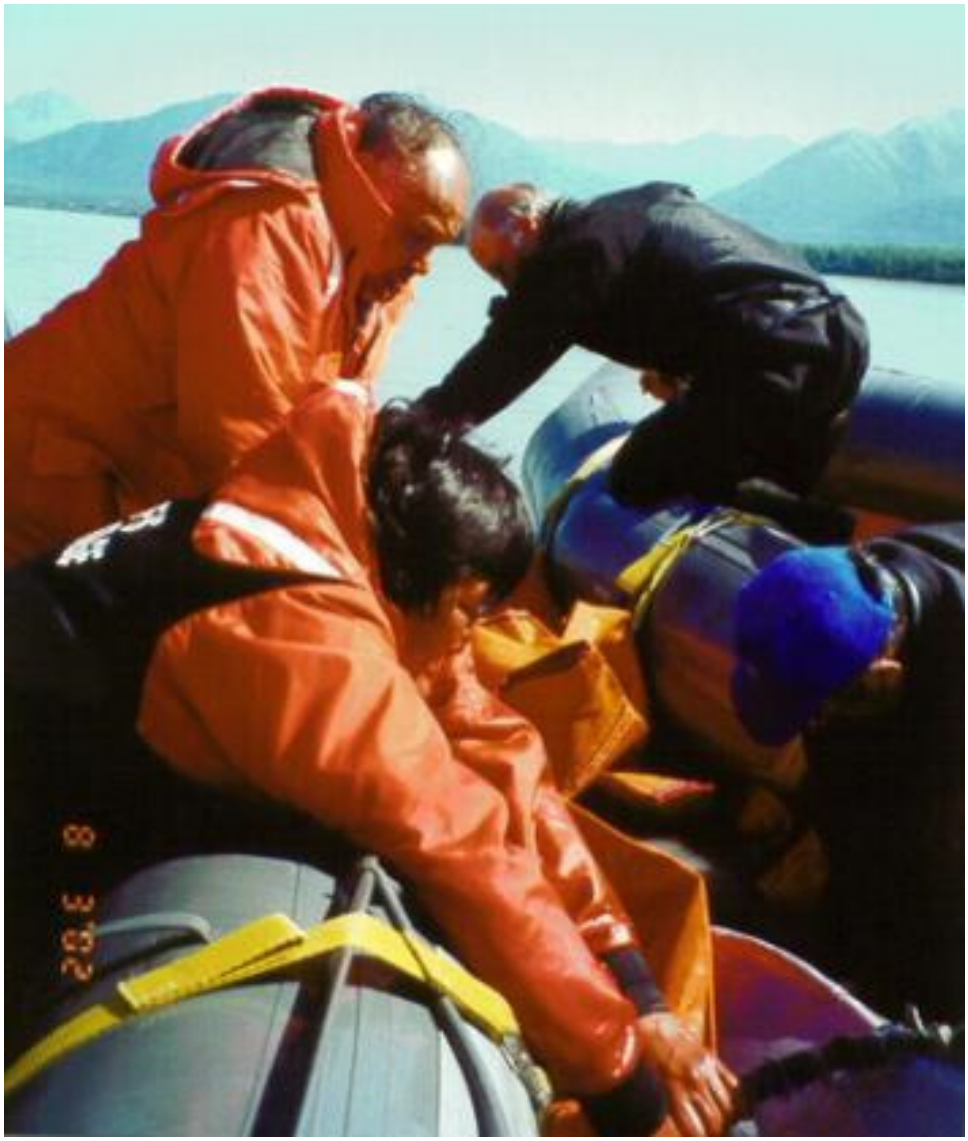


Figure 23. -- Whale CI2002-06 (alternate ID: CI-0206) restrained in the sling and hoop net.

The second beluga was captured southwest of Windy Point in Eagle Bay (61°19.890'N, 149°44.653'W) at 18:49 h. According to Mahoney (2002a, b), this was the second of two whales that were well entangled this year, wrapping the float and lead line around their bodies, which required an extended period of time to cut away the net before tagging could begin. The white beluga (CI2002-07) was measured at 12 ft. 3 in. (374 cm) with a fluke width of 2 ft. 9 in. (84 cm [note: Level A incorrectly converted to 85 cm]) (Fig. 24). Tagging began at 19:40 h after towing the whale from the mudflats to a channel along the shore of Eagle Bay as the tide was falling. The whale was released at 20:15 h. A four-battery tag (PTT #30720) was attached with three

rods and a flipper band (DL00133) was put around the right pectoral flipper. A 12 cm (4.7 in.) biopsy sample was collected along the flank about 25 cm (10 in.) below the dorsal ridge (no muscle in the sample). Skin and blood were also collected.

Figure 24. -- Whale CI2002-07 (alternate ID: CI-0207) with nylon rods inserted through the blubber layer of the dorsal ridge for ST16 tag attachment.

4 August 2002

The final beluga captured during the 2002 field season occurred north of Birchwood on the east side of Knik Arm (61°26.3'N, 149°30.3'W) at 15:15 h (note the Level A form incorrectly lists the observation and examination date as 3 August instead of 4 August). The "white-gray" beluga (CI2002-08) was measured at 12 ft. 4 in. (376 cm [note: on Level A rounded down to 375 cm]) with a fluke width of 3 ft. 1 in. (94 cm [note: on Level A rounded down to 93 cm]) (Fig. 25). Tagging began at 15:40 h and the whale was released at 16:26 h. A two-battery tag (PTT #25847) was attached with three rods and a flipper band (DL00219) was put around the left pectoral flipper. A 15 cm (6 in.) biopsy sample was collected along the flank

about 25 cm (10 in.) below the dorsal ridge (no muscle in the sample). Skin and blood were also collected.

Figure 25. -- Whale CI2002-08 (alternate ID: CI-0208) outfitted with a two-battery ST16 'spider' tag via nylon rods inserted through the blubber layer of the dorsal ridge (right panel).

Laboratory Analyses

Mucus Swabs and Blood Samples

2000 field season

Swabs were used to collect mucus samples from the blowhole of the two belugas captured in September 2000. However, the swabs were highly saturated with water and could not be processed. Litzky et al. (2001) state "Although it would be useful to have whales completely out of the water to prevent saturation of swabs during blowhole sampling, the resulting stress to the animal, and difficulty in then returning the animal to the water, prevent the recommendation of such a technique. Due to improper storage of blood samples, it is unclear if analyses for CBCs and blood chemistry will yield results. A disease screening [was] planned [but apparently did not occur as no records were found]. In the future it is recommended to use needles of size 18-gauge or lower for blood collection as the 19 ¾-gauge needles were too thin and tended to clog."

2001 field season

Scientific collection notes on the Level A forms for five of the whales (CI-0101, CI-0102, CI-0103, CI-0104, and CI-0106) state "blood collection was attempted @ fluke" but apparently was not successful as blood draw results were not attached to the respective forms. Results were attached to the Level A forms for CI-0105 and CI-0107 on which "blood collected from fluke" was noted.

CML provided serum chemistry results for both of these whales, but hematology tests were run only for CI-0107, suggesting only one tube was collected for CI-0105. It was also noted for CI-0105 that the sample was refrigerated overnight and spun at 10:30 am the next day. The serum chemistry specimen from CI-0105 was slightly hemolyzed compared to the specimen from CI-0107 which was moderately hemolyzed. Hemolysis (i.e., breakage of a red blood cell's (RBC) membrane causing the release of the hemoglobin and other internal components into the surrounding fluid) could potentially increase values for phosphorus (which might otherwise suggest dehydration, bone disease, or massive cell lysis due to stranding) and aspartate amino-transferase (AST, used to detect liver damage), or lower values for creatinine (used to assess kidney function). Some hematology results for whale CI-0107 were also affected by hemolysis and subsequent lipemia (presence of a high concentration of lipids (or fats) in the blood) causing the sample to appear cloudy. In particular, this affected the test for hemoglobin (Hgb), which at low levels might indicate anemia.

We compared the Cook Inlet beluga results obtained for hematology (Appendix 2) and serum chemistry values (Appendix 3) to those obtained from belugas in Bristol Bay, Alaska (Norman et al. 2012). Bristol Bay belugas inhabit an area similar to Cook Inlet during the summer months (river estuaries hosting anadromous fish runs) and health assessments of this healthy and growing population provide a means to access the health of declining populations such as Cook Inlet. Most of the Cook Inlet values fell within the range observed in Bristol Bay or were slightly above or below. Exceptions included albumin, globulin, and the albumin/globulin ratio which were extremely low (Appendix 2). However, these values may be the result of calibration differences between labs. When we compared SeaWorld results to CML results for these three serum chemistry values using samples collected in 2002 (Appendix 2), the SeaWorld results fell within the Bristol Bay value ranges (which were analyzed at the Animal Health

Diagnostic Center at Cornell University, Ithaca, New York), whereas CML results continued to be extremely low. It is important to note that we can only compare bloodwork results with caution as equipment calibrations often differ from lab to lab.

2002 field season

CML received blood samples from all eight whales though hematology results were not available for CI-0201 (only a small sample of whole blood was obtained before the needle was dislodged) and CI-0202 (noted as pending on the testing document). CML had incorrect sexes assigned for whales CI-0201, CI-0202, CI-0203, CI-0205, and CI-0206 (Appendix 3). Unfortunately this meant that pregnancy tests were applied to the three males and only two of the females: CI-0204 and CI-0207. SeaWorld also received samples from whales CI-0203 through CI-0208 though no tube was provided for hematology tests for CI-0203 and serum chemistry test for CI-0206 (Appendices 2 and 3). SeaWorld did not run pregnancy tests on any of the blood samples. Norman (2002a,b) originally reviewed blood draw results for three of these whales: CI-0202 (processed at CML), CI-0204 (processed at SeaWorld), and CI-0207 (processed at SeaWorld) and noted:

"Blood results were obtained from Dynacare Laboratories (human laboratory; aka CML). This presents problems when interpreting blood test results due to variability amongst laboratories (mechanics, laboratory technician technique, and normal value ranges for that lab). The serum was noted to be hemolyzed which can produce artifacts in the final blood parameter results. Hemolysis may affect serum iron, LDH, potassium and creatinine values, as well as ALT, calcium, proteins, GGT, and bilirubin. Many of the values for this animal were considered abnormal by the laboratory (high or low compared to their normal values). After reviewing this animal's results, only results that were then considered out-of-range, compared to captive and free-ranging belugas, are discussed below." Norman (2002a,b) also noted the samples tested by SeaWorld were slightly hemolyzed as well.

Although a few values appeared to be high or low when compared to captive and free-ranging beluga blood chemistry ranges available in 2002 (e.g., RBC, hematocrit, HgB, blood urea nitrogen, glucose, phosphorus, creatinine kinase), subsequent comparison to the ranges obtained from Bristol Bay belugas show Cook Inlet values fall within or just slightly outside

these ranges. Overall, the SeaWorld values were similar to those obtained from CML, with the exception of the albumin and globulin tests.

Blood samples from six whales (three females: CI-0202, CI-0203, CI-0207, and three males: CI-0205, CI-0206, CI-0208) were screened for three reproductive hormones: progesterone, testosterone and total estrogens, and three metabolic hormones: cortisol, total thyroxine (TT4) and total triiodothyronine (TT3) (S. Atkinson, UAF). Results were compared to values for whales held in aquaria and free-ranging Bristol Bay whales (Appendix 3).

Progesterone concentrations of female whales were significantly greater than those of the males (Appendix 3). When compared to females from Bristol Bay and aquaria, the female Cook Inlet beluga whales also had significantly higher progesterone concentrations. These elevated progesterone concentrations were likely indicative of pregnancy given the time of year these whales were sampled. This contradicted the test results from CML that CI-0207 was not pregnant. Mahoney (2002b) had also concluded that CI-0204 was not pregnant or lactating based on pregnancy tests run by CML, but we are no longer confident that these results are valid given their results for CI-0207. Total estrogen concentrations in the serum were similar between female Cook Inlet beluga whales and the Bristol Bay and aquaria whales.

The circulating testosterone concentrations were similar between the male Cook Inlet beluga whales and the Bristol Bay and aquaria whales. Cortisol concentrations in the serum of the Cook Inlet beluga whales were significantly higher than the aquaria whales; however, they were not different from the Bristol Bay whales. TT4 concentrations in the Cook Inlet beluga whales were significantly lower than the Bristol Bay whales. Concentrations of TT3 were higher in Cook Inlet beluga whales than in aquaria whales but similar to those measured in Bristol Bay whales.

Biopsy Samples

The NOAA Fisheries Service's SWFSC oversaw extraction of DNA and ran an assay on each sample to determine/confirm sex for each whale captured and/or tagged during the study (Appendix 1). Trocar biopsy samples collected from tagged whales in 2001 and 2002 were analyzed for their lipid and chemical tracers including fatty acids (FA), stable isotopes (SI), and

persistent organic pollutants (POP) at the NOAA Fisheries Service's NWFSC (Appendix 4). The following sections include results from these studies.

Lipid composition

Krahn et al. (2004) analyzed blubber and skin samples from two of the whales tagged in 2001: CI-0105 and CI-0106. Both females were captured on different days in mid-August near Birchwood in Knik Arm. Although trocar biopsy samples were collected from all of the whales tagged in 2001, only these two had blubber of sufficient length and mass to allow division into two parts representing near-skin and near-muscle layers. At the time of this study, samples from the 2002 whales had not been analyzed (see data in Appendix 4).

CI-0105 and CI-0106 were compared to subsistence-hunted belugas necropsied in July 2001 (a lactating female: 692-BLKA-073) and July 2002 (an adult male: 692-BLKA-076) in Cook Inlet, and a juvenile male Bristol Bay beluga that was sampled in May 2002 (692-BLKA-075). The blubber samples collected from the satellite-tagged whales had lower lipid content and an uneven distribution of lipid between halves (inner and outer layers) compared to the necropsied whales. These differences were attributed to a probable sampling bias as lipid likely leached out from the biopsy trocar prior to freezing the samples taken from the tagged whales (given other factors such as animal ages and time/location of sampling were similar for the four Cook Inlet whales). Trocar samples collected in 2002 fared better and included not only the inner layers but also skin for stable isotope analyses (see data in Appendix 4). Further analyses of these samples collected in 2002 are needed.

For CI-0105 and CI-0106, the blubber lipid was largely comprised of triglycerides, regardless of depth, which was expected given results from studies of other cetaceans (e.g., Kawai et al. 1988, Tilbury et al. 1997, Krahn et al. 2001). The two satellite-tagged whales also showed the same profile of lipid classes found in the necropsy samples (Krahn et al. 2004).

Stable isotopes

Nitrogen ($^{15}N/^{14}N$) and carbon ($^{13}C/^{12}C$) stable isotope ratios were measured using skin samples collected from whales tagged in 2002 (Appendix 4). These ratios can be compared to ratios found within their potential prey to estimate beluga diet. Preliminary findings suggest differences in diet between male and female belugas (Fig. 26). Note that three of the females

may have been pregnant at the time they were biopsied (CI-0202, CI-0203, and CI-0207). Further analyses of these samples are needed.

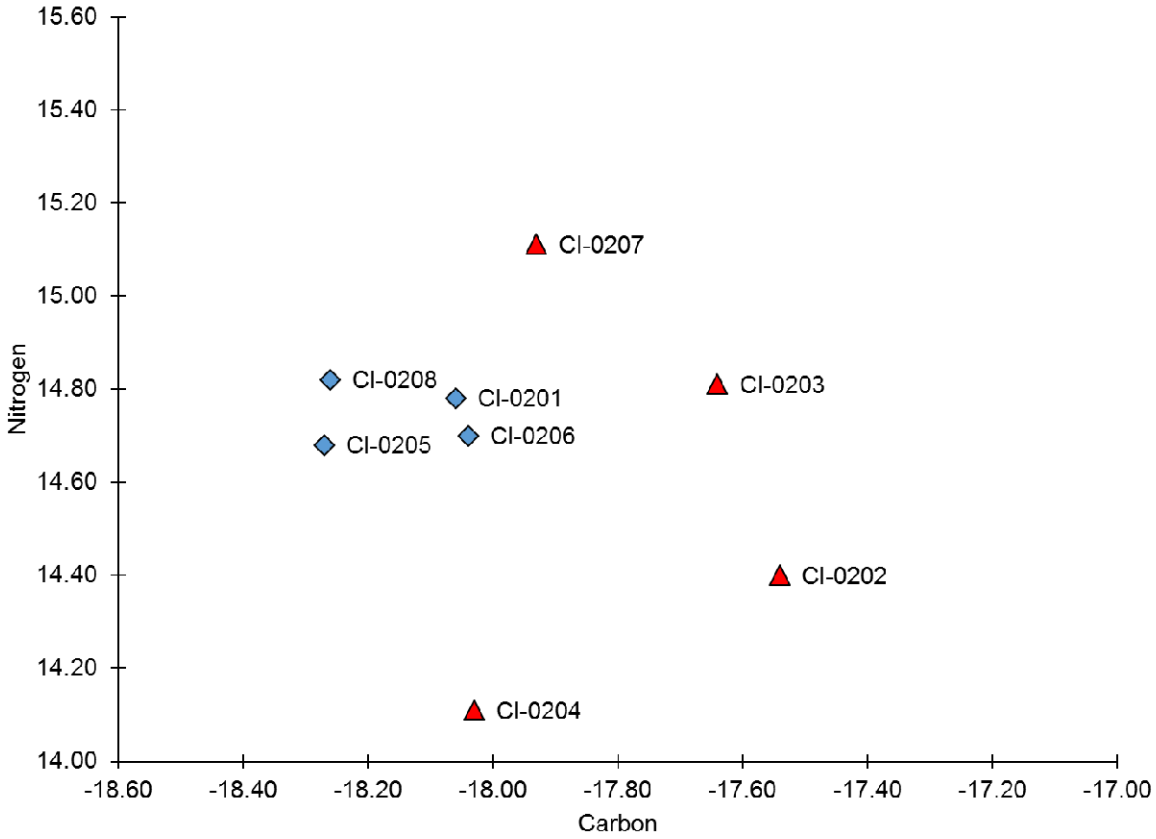


Figure 26. -- Stable isotope ratio values for Cook Inlet belugas satellite-tagged in 2002 (diamonds = males, triangles = females). Each individual is identified by a CI number. Progesterone levels for CI-0202, CI-0203, and CI-0207 suggest these whales may have been pregnant when biopsied. See Appendix 4 for values.

Fatty acids

Krahn et al. (2004) analyzed 83 FAs (as methyl esters, i.e., FAMEs) found in the blubber of most marine mammals (see Table 2 in their publications for a list of systematic names and abbreviations). Samples collected in 2002 were not available for the Krahn et al. (2004) study, but show similar patterning to their Figure 3 (on p. 183 in their publication). Results from all 83 FAs are presented in Appendix 4, and for the 2002 tagged whales, patterns are shown in Figure 27. Further analyses of these samples are needed.

Of these 83 FAs, Krahn et al. (2004) limited their final Principal Components Analyses (PCA) to eight FAs that appeared to contribute the most to beluga diet. When comparing Bristol Bay to Cook Inlet, they found they could distinguish between the two populations by their fatty acid profiles. The FA profiles differed between the Bristol Bay whale and the Cook Inlet whales at all blubber depths (Krahn et al. 2004). Additional blubber samples have been collected from Bristol Bay (beach-cast and subsistence hunted), beach-cast Cook Inlet, and subsistence-hunted Point Lay whales. Preliminary analyses conducted at the NWFSC suggest distinguishable differences among these populations as well (G. Ylitalo, pers. comm.). Similar to the stable isotope analyses, preliminary analyses of FA profiles conducted at the NWFSC suggest differences in diet between Cook Inlet males and females. Further analyses of these samples are needed.

Krahn et al. (2004) also determined that the FA profiles in the inner and outer blubber layers were not similar. They cautioned that a biopsy sample of only the outer blubber layer would, therefore, "not accurately represent the metabolically active inner layer and thus would likely fail to correlate well with the fatty acid signatures of their primary prey species." Part of the FA/SI study conducted at NWFSC included analyzing potential prey items from Bristol Bay and Cook Inlet. We do not present the preliminary results from those unpublished studies here but note that further analyses may be undertaken at a later date.

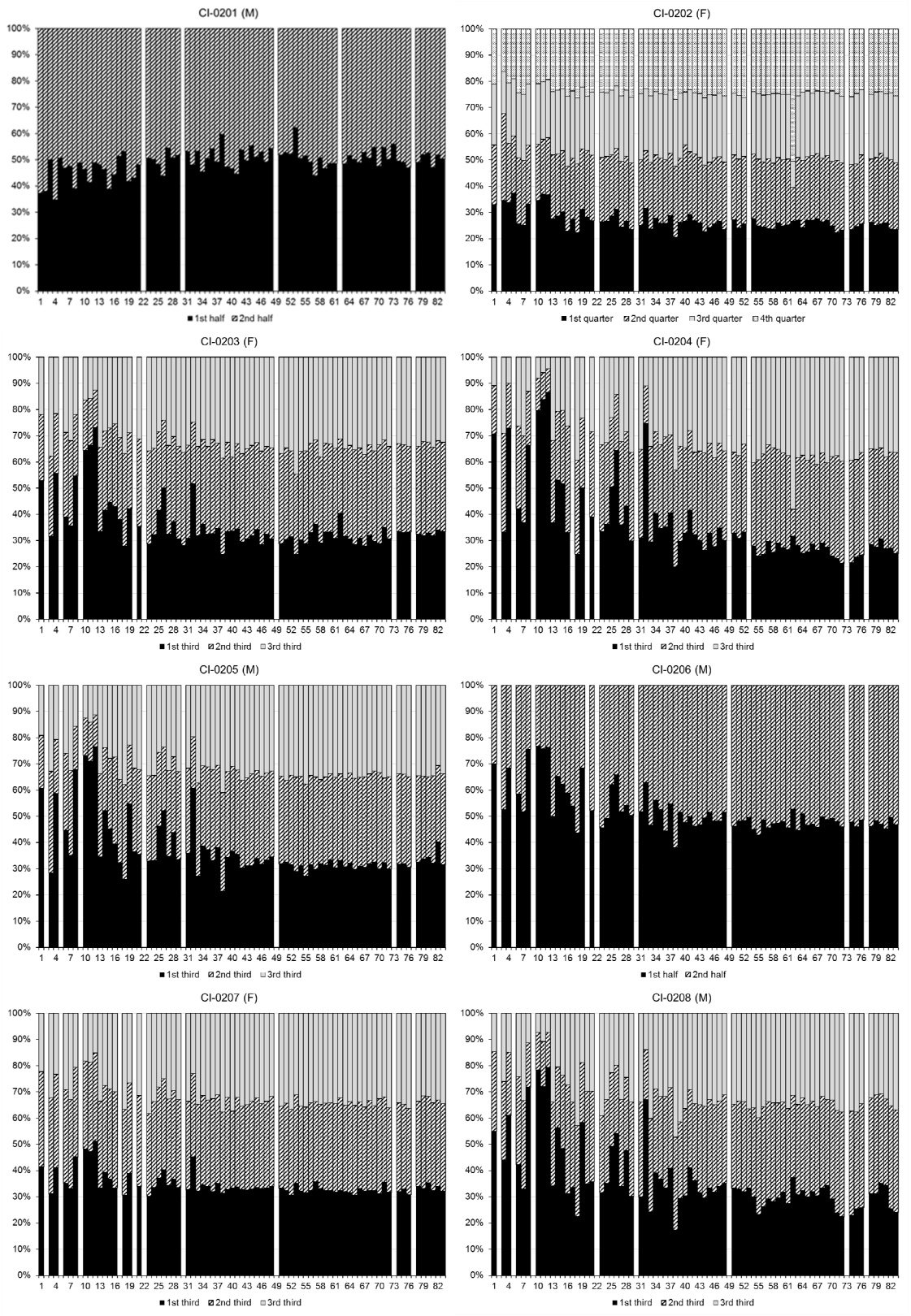


Figure 27. -- Proportions of 83 fatty acids in the blubber layer of belugas tagged in 2002 (methods in Krahn et al. 2004). Outer-most layer (black) with subsequent layers closer to muscle.

Contaminants

Krahn et al. (2004) found that the adult female belugas had lower concentrations of ∑PCBs and ∑DDTs than the adult male, suggesting possible maternal transfer of contaminant burdens to offspring during gestation and lactation (e.g., Muir et al. 1992, Aguilar and Borrell 1994, Norstrom and Muir 1994, Ridgway and Reddy 1995, Krahn et al. 1997, 1999, Aguilar et al. 1999). The concentration of POPs determined in the blubber of the necropsied Cook Inlet whales were in the same range as same-sex whales previously sampled in the Cook Inlet population (Krahn et al. 1999). However, lipid loss affected the POP results for the satellite-tagged whales: CI-0105 and CI-0106. POPs were not distributed through the blubber uniformly, with higher contaminant levels found in the outer layer for most whales, with the exception of the Bristol Bay whale (i.e., inner layer = higher concentrations), emphasizing the need for full-thickness blubber sampling for this particular study.

POP contaminant level values for all Cook Inlet whales tagged in 2001 and 2002 are presented in Appendix 4. CI-0101 appeared to be very young at the time of her tagging and this may explain her high contaminant burden compared to other females tagged that same year (Fig. 28). CI-0202, CI-0203, and CI-0207 were likely pregnant at the time of tagging (based on progesterone levels) but it is unknown if this was a first pregnancy for these whales, which may explain some of the differences in contaminant burden. Similar to the findings by Krahn et al. (2004), mature females (with the exception of CI-0202) had lower burdens than the males (Fig. 28).

Similar to the fatty acid analysis, POP profiles were unique to each individual animal and Krahn et al. (2004) found that the contaminant patterns for the single whale from Bristol Bay differed from the Cook Inlet whales. Krahn et al. (2004) emphasized that defining stock structure based on contaminant patterns alone, however, would require obtaining a larger sample size.

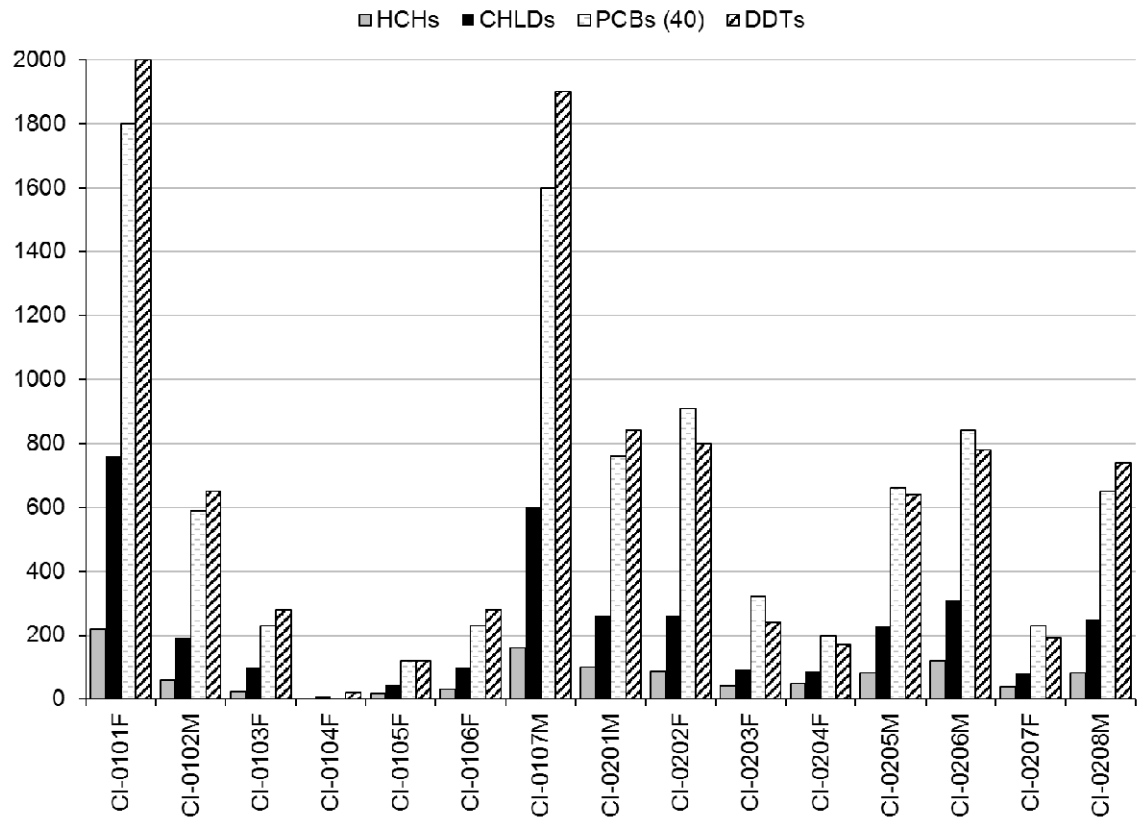


Figure 28. -- Concentrations of ∑HCHs, ∑CHLDs, ∑PCBs, and ∑DDTs (ng/g, wet weight) determined by gas chromatography/mass spectrometry for belugas tagged in 2001 and 2002 (methods in Krahn et al. 2004). See Appendix 4 for values.

Whale Movement and Dive Behavior

Goetz et al. (2012) reanalyzed the satellite tag movement and dive data previously published in Ferrero et al. (2000) and Hobbs et al. (2005). This included filtering the data to remove erroneous locations based on the average swimming speed for belugas, applying a land avoidance algorithm to move locations from land to nearby water, and modelling hourly predicted locations using the 'CRAWL' package in R (Johnson 2011, R Core Team 2012) which allows the inclusion of poorer quality ARGOS locations. Here we provide graphs and maps showing the transmission period for each tag, monthly movements (tracks), kernel densities (the number of modelled locations per square mile using the geodesic method in ArcGIS spatial analyst for whales with ST16 tags), ice association examples for tags that continued to transmit into November, and dive data for whales tagged with SLTDRs. Whale locations were compared

to sighting records (opportunistic and systematic) to determine how many whales were potentially with tagged whales (Appendix 5). Kernel densities created for each season and month (Appendix 6) include all modelled locations from whales tagged from 1999 to 2002. Animations of whale movements are available at http://www.afsc.noaa.gov/News/Cook_Inlet_Beluga_Range_Contracted.htm (accessed Aug. 2016). Tagging results from each field season are presented below.

1999 Tagging Results

Whale CI-9901 provided the first documentation of summer movement patterns of a Cook Inlet beluga (Fig. 29). The tag on this adult male transmitted almost continuously from 31 May to 17 September 1999 (109 days with 103 days usable for analysis). Descriptions of CI-9901's movements during this 3.5-month period are based on review of the database and animations of daily tag transmissions created by K. Goetz (http://www.afsc.noaa.gov/News/Cook_Inlet_Beluga_Range_Contracted.htm).

After tagging on 31 May, CI-9901 remained near the Little Susitna River, and according to tag transmissions, may have been among a group of 36 belugas seen there on 6 June (Appendix 5), and the largest number of whales (average group size = 248, range 178-314) seen in the Susitna River delta (between Beluga River and the Little Susitna River) that year during the NMFS abundance survey 8-14 June (Shelden et al. 2015). On 17 June, CI-9901 ventured across the inlet to Point Possession before circling back to Fire Island and returning to the Susitna River delta that same day (Fig. 30). CI-9901 remained in the Susitna River delta until 29 July when he crossed the inlet to Turnagain Arm, spending a few days there before returning to the Susitna River delta on 1 August.

Figure 29. -- Satellite-linked modelled tracks from beluga CI-9901 tagged in Cook Inlet, Alaska. Transmissions were received from 31 May to 17 September 1999 (109 days with 103 days usable for analysis).

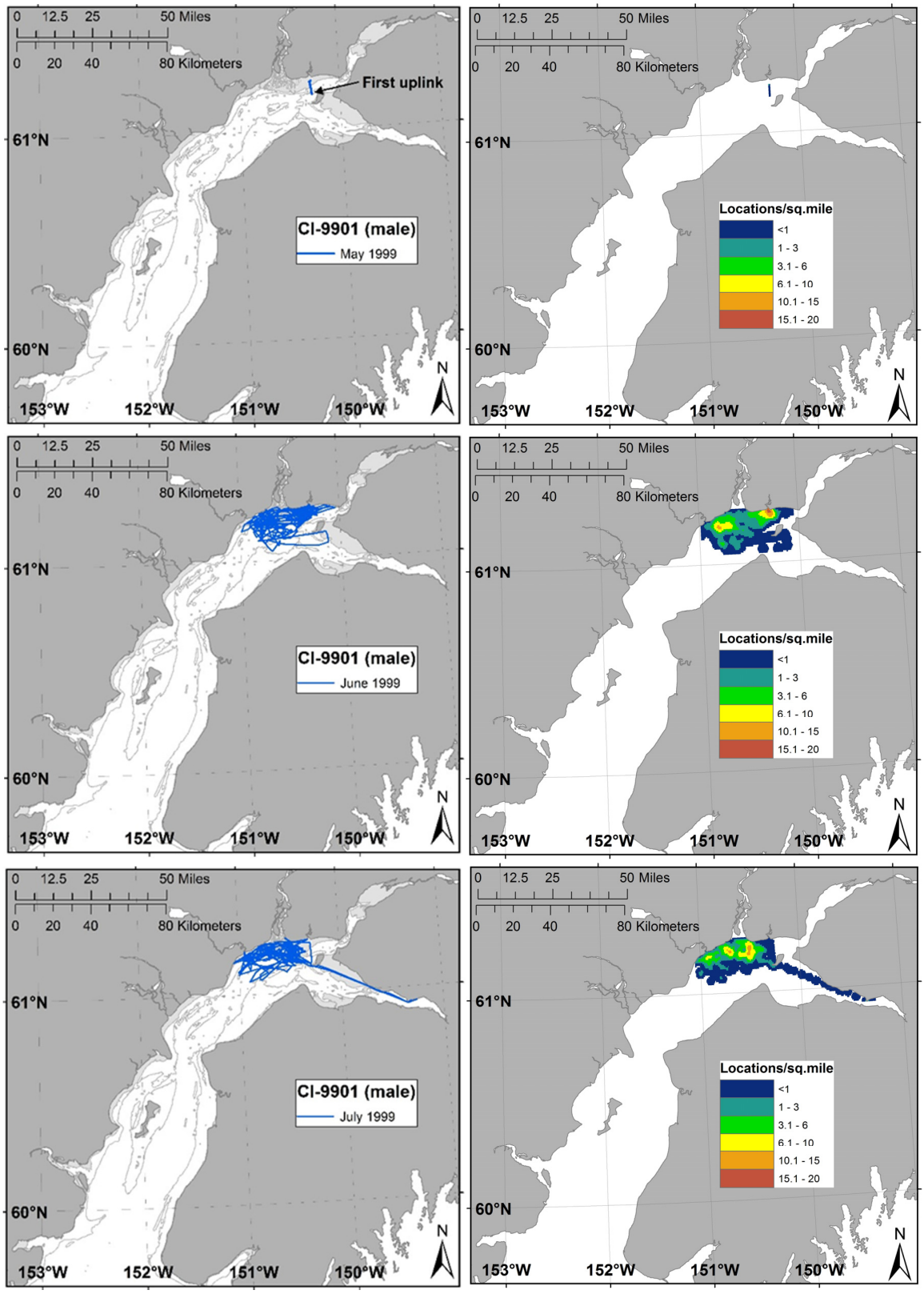


Figure 30. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of beluga CI-9901 tagged in Cook Inlet, Alaska.

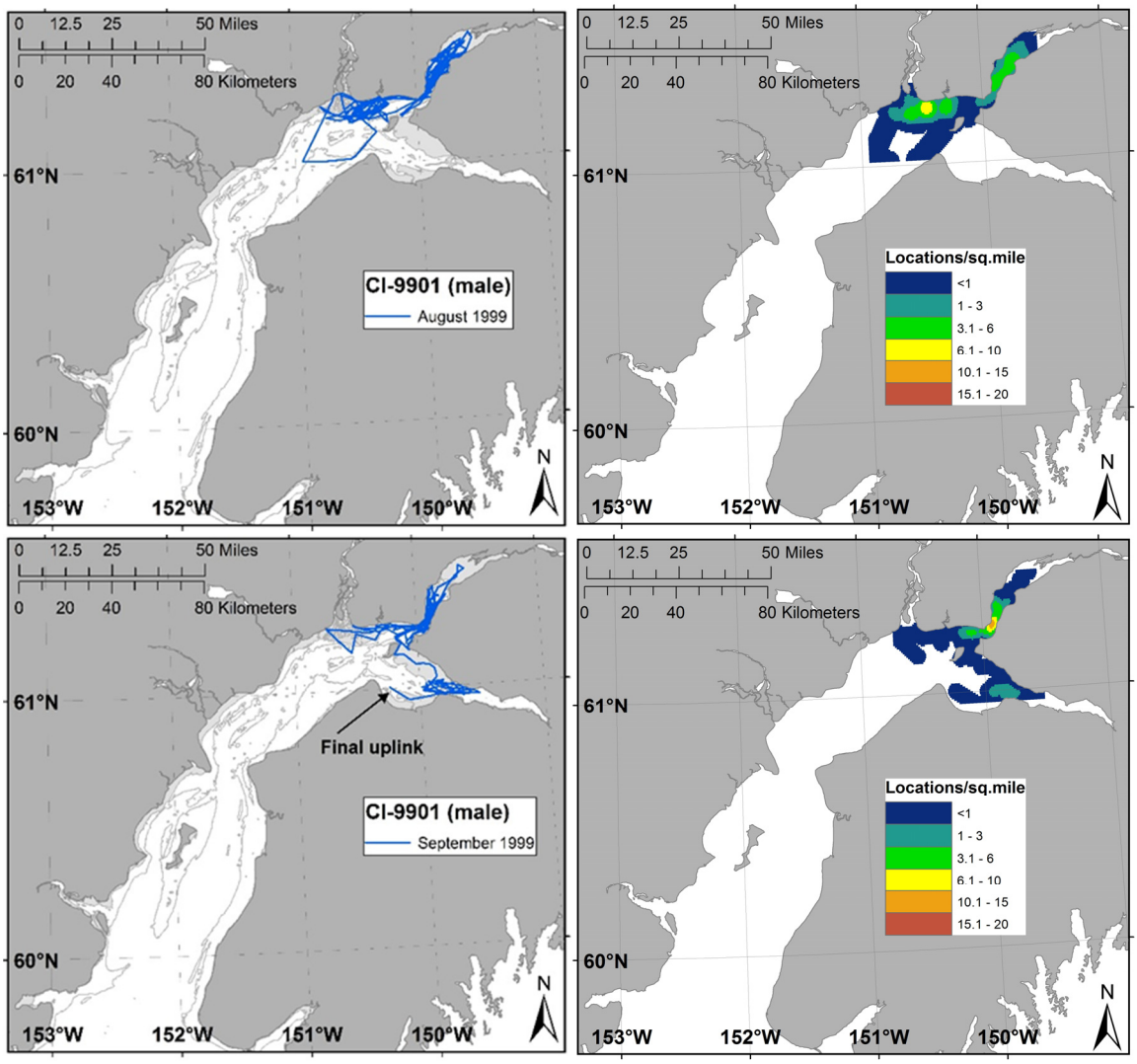


Figure 30. --Cont.

On 16 August, CI-9901 swam offshore then circled counterclockwise toward Point Possession then back to the Little Susitna River before entering Knik Arm on 17 August. He remained in Knik Arm until 23 August when he briefly returned to the Little Susitna River before circling back to Knik Arm on 25 August, remaining there until 28 August. Six opportunistic beluga sightings in Knik Arm in August occurred when CI-9901 was in Knik Arm (Shelden et al. 2015), though upon closer inspection of the modelled tag locations, CI-9901 appeared at times to be north of the area where a particular sighting occurred (Appendix 5). The back-and-forth behavior continued from 28 August to 13 September with nine brief trips between Knik Arm and the Little Susitna River or north of Fire Island. On 13 September, he left

Knik Arm, rounded Point Woronzof, and swam into Turnagain Arm. On 16 September, CI-9901 departed Turnagain Arm and was crossing Chickaloon Bay and heading toward Point Possession when tag transmissions ended (Fig. 30). CI-9901's tag locations in September coincided with all opportunistic sightings in Knik Arm (n = 19) but nowhere else, with groups ranging in number from one to 25 whales, or described as "two large groups" (Shelden et al. 2015). Closer inspection of the tag locations suggests CI-9901 was likely present during 12 of these observations (Appendix 5). Transmissions ended well before ice first began to appear in the inlet on 5 November 1999 (Fig. 31).

CI-9901's diving behavior (duration and depth) is shown for each month and each area (Fig. 32). Average dive depth and duration tended to be shallower and shorter, respectively, during June, July, and August in all areas. In particular in Chickaloon Bay, Turnagain Arm, and near North Foreland where he spent only brief amounts of time before returning to the Susitna delta. In September, deeper and longer dives occurred within all areas visited by CI-9901. Laidre et al. (2017) provide further details on diving behaviors of CI-9901. With the exception of mid-July to mid-August when 98% of his time diving was within the 0-1 m depth bin, he generally spent over half his time (61-65%) diving to this depth during the other time periods. His deepest dives were 60-64 m, but most dive activity occurred between 0-2 m and 5-10 m (Laidre et al. 2017). Overall, his dives were significantly deeper at night (t-test, $P < 0.001$). Dive duration averaged about three minutes overall, but this behavior did change from mid-July to mid-August, when average duration was less than 2 minutes, and the end of September, when duration averaged 6.4 minutes. It was rare for CI-9901 to dive for longer than 24 minutes (0.25% of dives). It was only during the period from mid-June to mid-July that CI-9901's diving behaviors (depth, duration, and time at depth) were significantly different during the tide cycle, with longer, deeper dives occurring on the falling tide (Laidre et al. 2017).

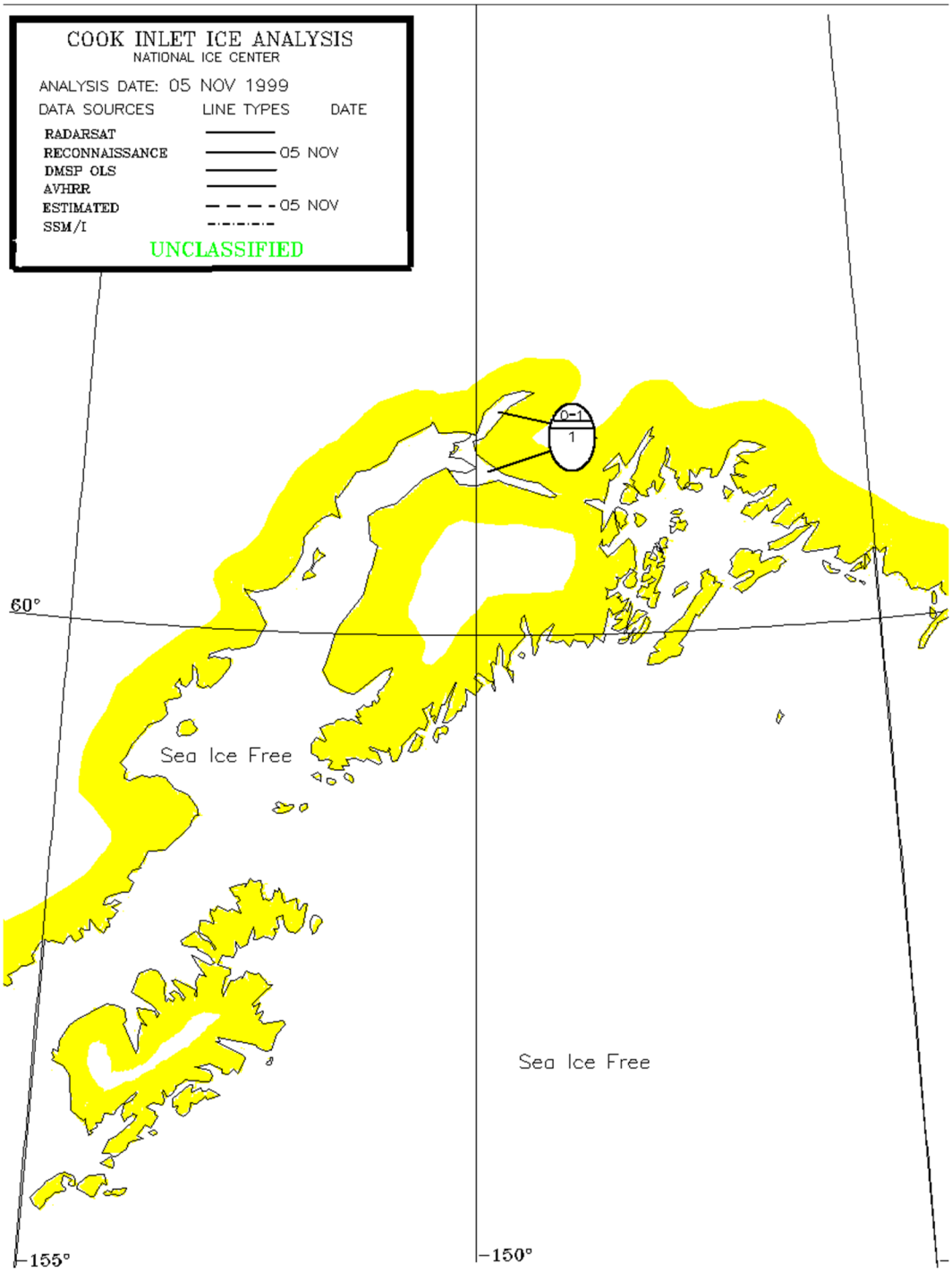


Figure 31. -- First appearance of ice in Cook Inlet, Alaska, in 1999 (image from the U.S. National Ice Center/Naval Ice Center http://www.natice.noaa.gov/products/weekly_products.html accessed 3 Oct. 2016). The "egg code" shows the total concentration in tenths (0-1) and the stage of development (1 = new ice) in Knik Arm and Turnagain Arm. (http://www.natice.noaa.gov/products/egg_code.html)

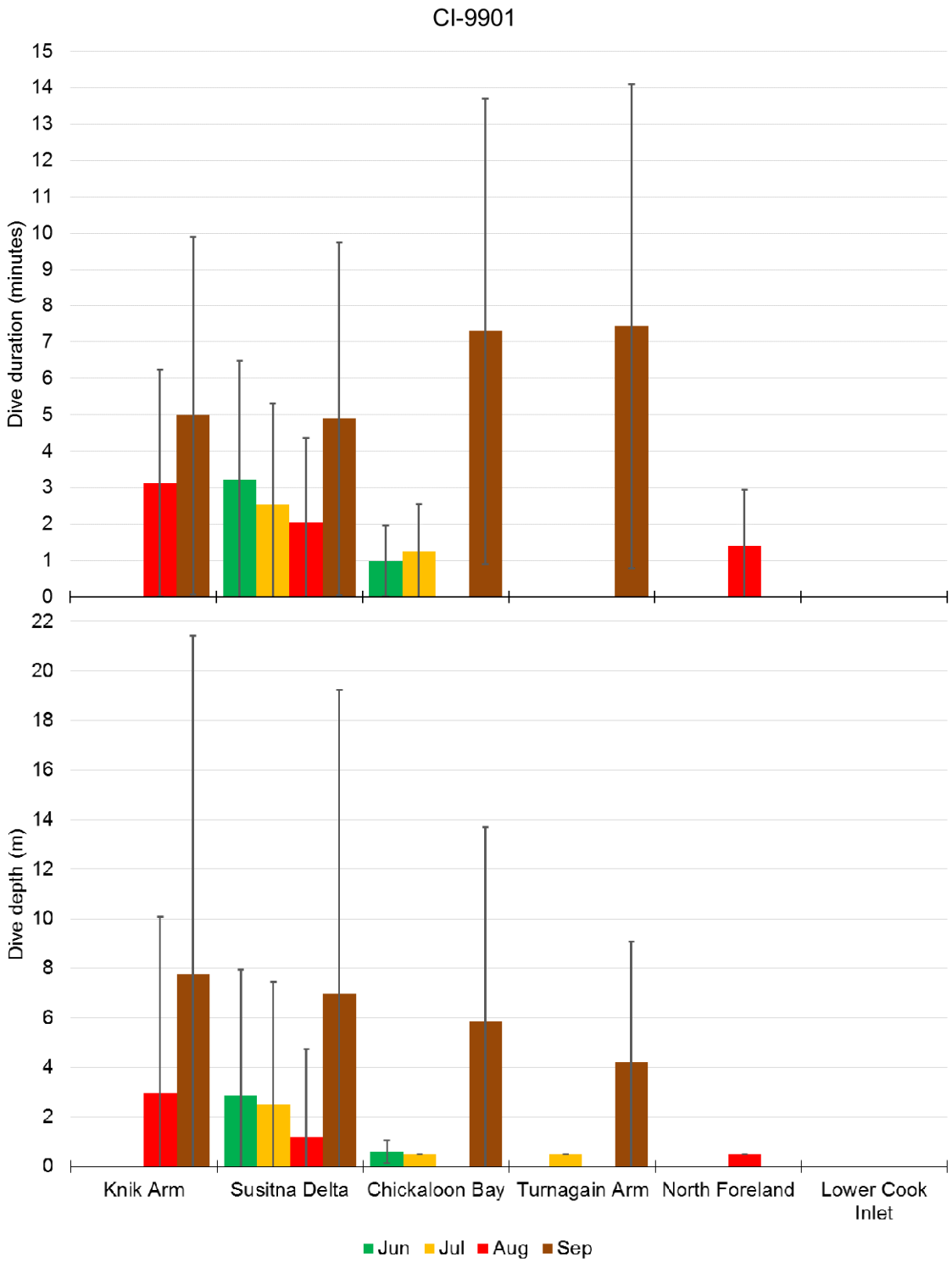


Figure 32. -- Monthly dive behavior of beluga CI-9901 tagged in Cook Inlet, Alaska, 31 May 1999. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

2000 Tagging Results

Whales CI-0001 (an adult male) and CI-0002 (a small female) provided the first documentation of autumn (September-November) and winter (December-January) movements for the Cook Inlet population. Transmissions from the two satellite tags began immediately after the whales were released on 13 September. CI-0001's tag stopped transmitting on 6 January, 115 days after attachment, while CI-0002's tag continued for another 12 days with the final transmission occurring on 18 January (Fig. 33). Descriptions of CI-0001's and CI-0002's movements during this 4-month period are based on review of the tagging database and animations of daily tag transmissions (http://www.afsc.noaa.gov/News/Cook_Inlet_Beluga_Range_Contracted.htm: orange line in animation = CI-0001, red line = CI-0002).

Unlike CI-9901, CI-0001 and CI-0002 had active transmitters when ice began to form in Cook Inlet, by 1 December in 2000 (Fig. 34). Goetz et al. (2012) examined the spatial distribution of sea ice concentration in Cook Inlet, computed twice a month between 1999 and 2003, to investigate beluga movements relative to average ice conditions. These data were delivered as polygons representing discrete ice concentration values: 0, 1, 13, 24, 35, 46, 57, 68, 79, 81, 91, and 92%. Ice data were re-categorized using definitions presented in the NOAA Observers Guide to Sea Ice (available at http://response.restoration.noaa.gov/book_shelf/695_seaice.pdf). Zero ice concentration was classified as 'open water', concentrations of 1, 13, and 24 were considered 'very open pack', concentrations of 35, 46, 57, and 68 were considered 'open pack', concentrations of 79 and 81 were considered 'close pack', and ice concentrations of 91 and 92 were considered 'compact' ice. Charts and maps presented herein were created using these datasets (see Goetz et al. (2012) for methods used to combine whale locations with ice data).

Figure 33. -- Satellite-linked modelled tracks from belugas CI-0001 (light gray) and CI-0002 (dark gray) tagged in Cook Inlet, Alaska. Transmissions were received from mid-September 2000 into January 2001 (CI-0001: 115 days with 111.5 days usable for analysis, CI-0002: 127 days with 126.3 days for analysis).

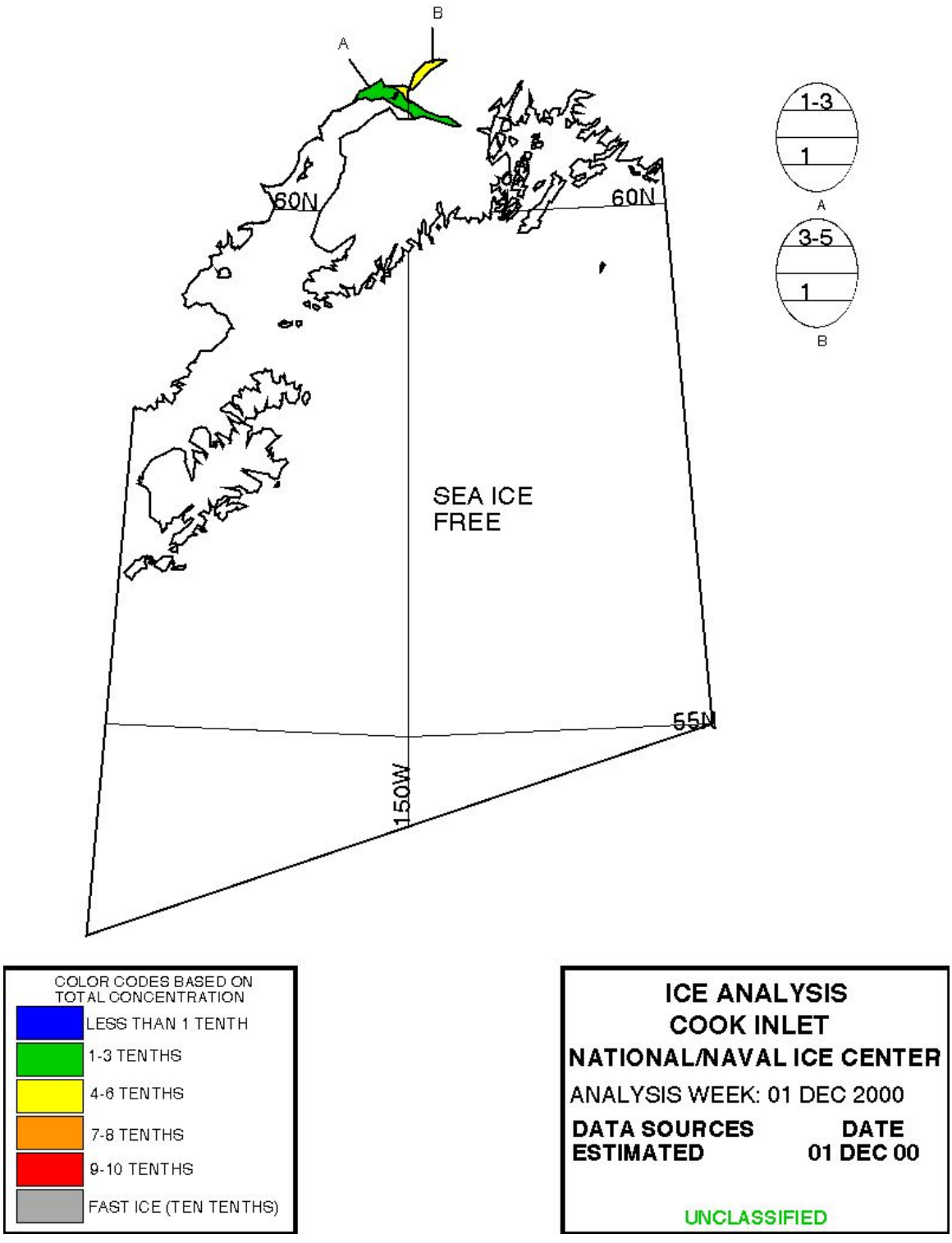


Figure 34. -- First appearance of ice in Cook Inlet, Alaska, in 2000 (image from the U.S. National Ice Center/Naval Ice Center http://www.natice.noaa.gov/products/weekly_products.html accessed 3 Oct. 2016). The “egg code” shows the total concentration in tenths for each area (1-3 and 3-5) and the stage of development (1 = new ice). (http://www.natice.noaa.gov/products/egg_code.html)

Between mid-September and mid-January, the two whales remained in upper Cook Inlet, although they rarely spent time together despite both being tagged in Knik Arm. After tagging, CI-0002 swam north toward the location where CI-0001 was tagged. One boat followed her, recording each time the VHF was detected. It appeared as though the two groups of whales joined during the early morning hours of 14 September. The aerial reconnaissance team detected CI-0002's VHF signal among a group of 4-5 belugas north of Birchwood (61°24.7'N, 149°35.4'W) between 08:35-08:55 h. Her signal was detected multiple times during the afternoon survey flights within a large group of whales (30+) south of Eagle Bay (61°19.3'N, 149°49.7'W) at 15:38 h, and in Eagle Bay (61°22.3'N, 149°44.7'W) at 18:32 h. The whales remained together until 15 September when CI-0001 departed Knik Arm, rounded Point Campbell, and entered Turnagain Arm while CI-0002 remained in Knik Arm (Fig. 35). They would not come within proximity to one another again until November.

On 15 September, the aerial team located CI-0002 among 12 whales north of Birchwood (61°28.6'N, 149°32.2'W) at 08:47 h. The boat crew searched for her from 11:00 to 16:00 h before finally detecting a faint signal from the VHF suction-cup TDR near the Port of Anchorage. During two flights conducted on 16 September, CI-0002 was located among 20 whales at 08:11 h (61°27.2'N, 149°34.4'W) and 30 whales south of Eagle Bay at 16:10 h. During the latter sighting, the whales were resting at the surface for long intervals creating mud plumes while their backs remained exposed. The last reconnaissance flight on 17 September detected CI-0002 at 08:38 h near the Port of Anchorage. Groups of 6-8 belugas were seen near CI-0002's location during 17-18 September (Shelden et al. 2015), though upon closer inspection of the transmission locations she was north of the port at the time of the sightings (Appendix 5).

On 25 September, 10 days after entering Turnagain Arm, CI-0001 exited the Arm and swam south into Chickaloon Bay. During the period he was in Turnagain Arm, opportunistic sightings of belugas (in groups of four to 20+) were reported on 18 and 24 September (Shelden et al. 2015, Appendix 5). On 24 September at 15:45 h, a NMFS Enforcement Officer reported a small pod of killer whales (3-4 animals) preying upon a beluga near Bird Point that appeared to have been separated from its group (Shelden et al. 2003). Transmissions from CI-0001's tag at 14:30 h and 16:30 h show he was about 5-10 miles east of Bird Point, between Twenty-mile River and Girdwood. There were unconfirmed reports of a killer whale stranding near Twenty-mile River later that day.

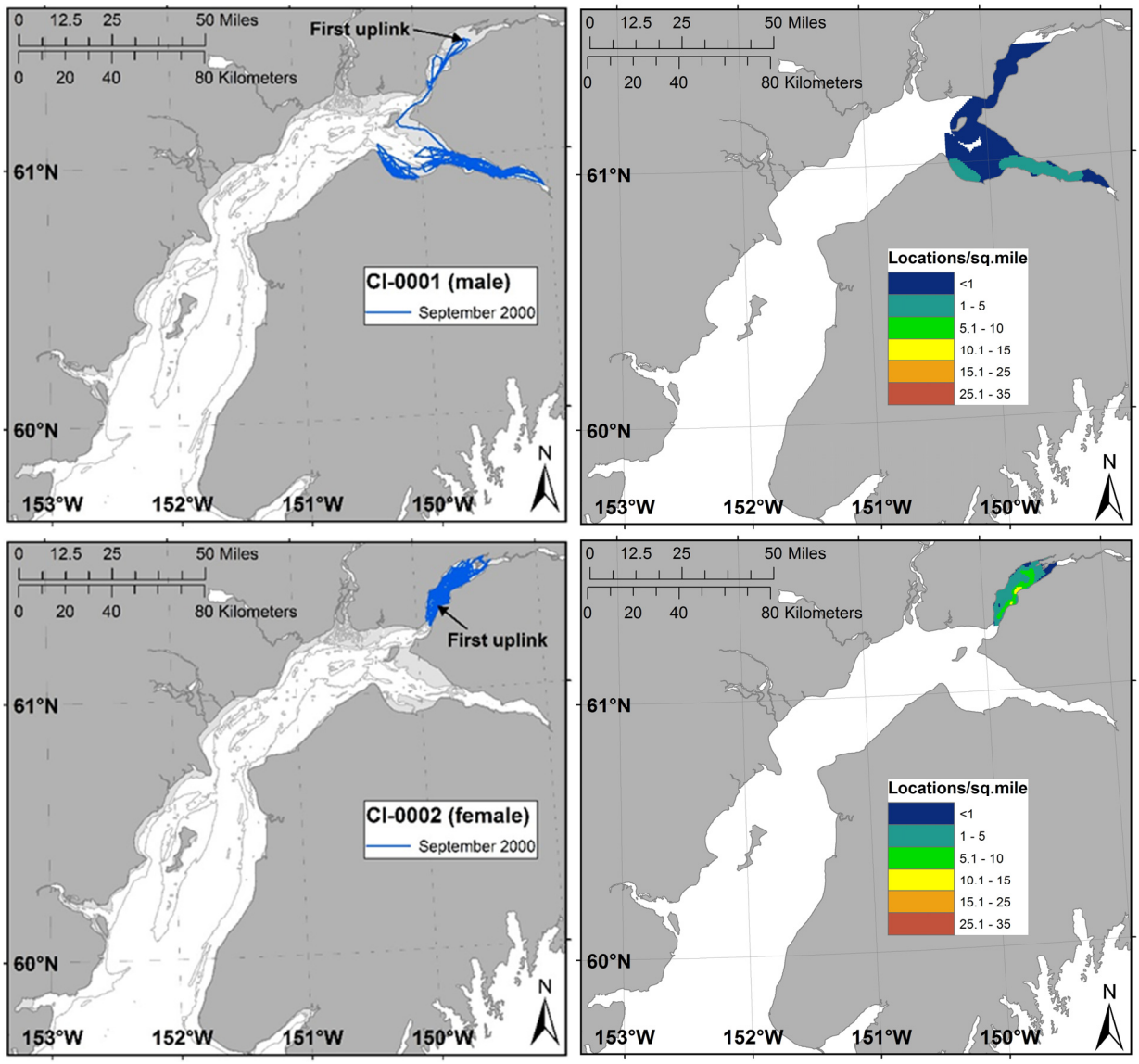


Figure 35. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of belugas CI-0001 and CI-0002 in Cook Inlet, Alaska, in September 2000.

On 1 October, CI-0002 briefly departed Knik Arm, rounded Point MacKenzie and headed toward the Little Susitna River before she circled back to Knik Arm that same day. CI-0001 swam back into Turnagain Arm on 3 October then returned to Chickaloon Bay on 4 October. On 9 October, CI-0002 departed Knik Arm and spent a few days in the Susitna River delta before heading south to Trading Bay on 11 October where she stayed until 14 October. That day she swam south of West Foreland and entered Redoubt Bay. CI-0001 swam back into Turnagain Arm on 12 October, and remained there until 14 October when he departed Chickaloon Bay, rounded Point Possession, and swam southwest along the eastern shoreline halfway to East

Foreland before he turned and returned to Chickaloon Bay on 15 October (Fig. 36). CI-0002 remained in Redoubt Bay until 19 October when she returned to the upper inlet. She circled Trading Bay until 22 October then swam south back to Redoubt Bay. She returned to Trading Bay on 27 October and continued north to the Susitna River delta where she remained until 31 October when she returned to Knik Arm. CI-0001 briefly entered Turnagain Arm from 28–29 October, overlapping with an opportunistic sighting of a group of 20 belugas (Shelden et al. 2015, Appendix 5). He took another short trip around the tip of Point Possession on 31 October, returning to Chickaloon Bay that same day.

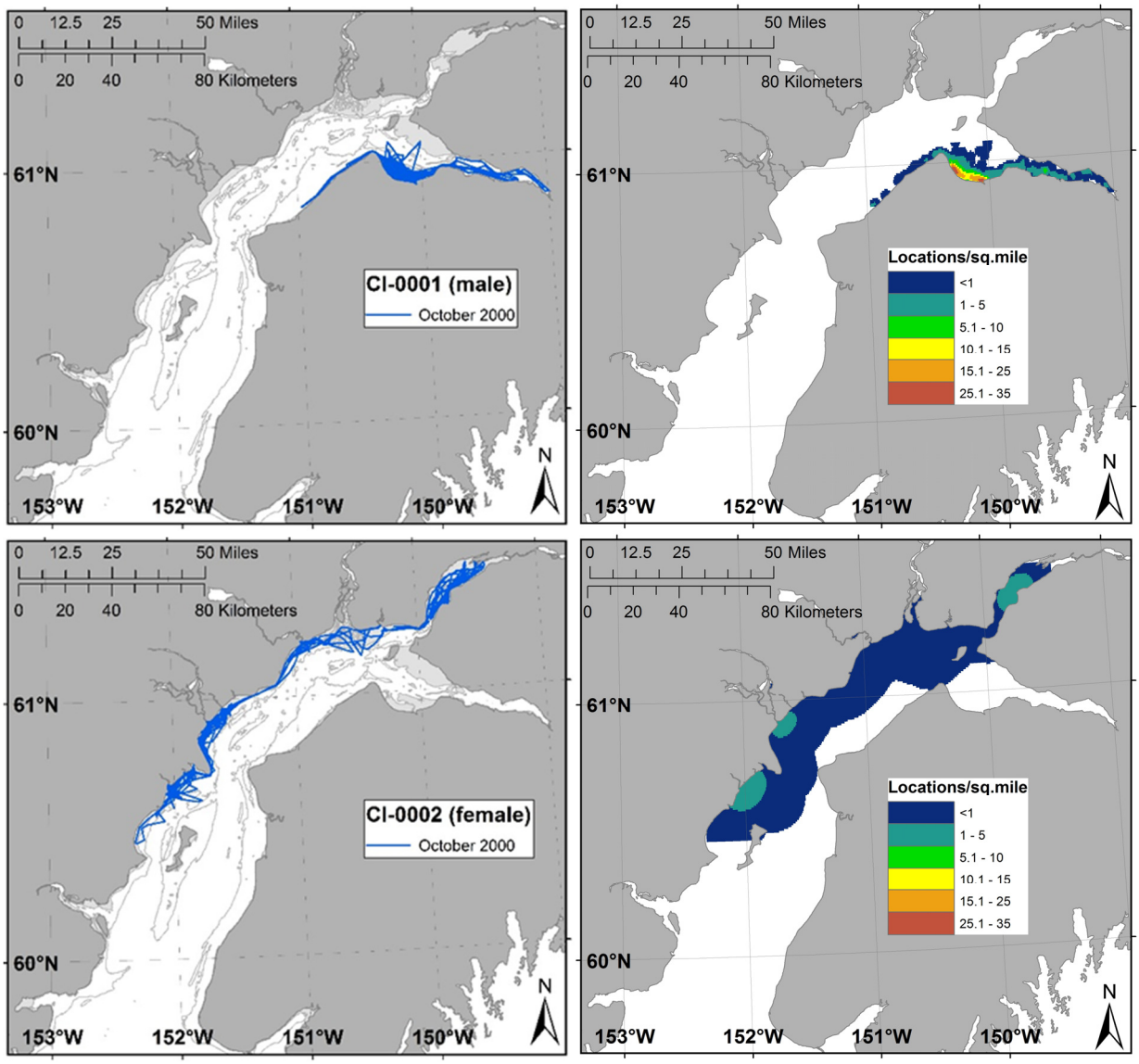


Figure 36. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of belugas CI-0001 and CI-0002 in Cook Inlet, Alaska, in October 2000.

On 3 November, CI-0001 entered Turnagain Arm then swam back to Knik Arm through the channel between Fire Island and Point Campbell where he rejoined CI-0002. The whales remained in Knik Arm until 9 November when CI-0002 swam to Chickaloon Bay and CI-0001 swam to the Susitna River delta (Fig. 37). CI-0002 joined CI-0001 in the Susitna River delta on 11 November where they remained together for three days. Both departed the Susitna River delta and entered Knik Arm on 14 November remaining together until 17 November. CI-0002 then departed Knik Arm and began a series of offshore loops as she swam south toward East Foreland. On 20 November, CI-0001 departed Knik Arm and swam to Turnagain Arm. CI-0002 returned north on 21 November and swam into Chickaloon Bay on 22 November as CI-0001 was entering the Bay after departing Turnagain Arm. The whales would approach one another then circle back in opposite directions until CI-0002 departed the Bay on 23 November. CI-0002 briefly returned to Knik Arm, then began another series of offshore loops in the middle of the upper inlet before returning to the Susitna River delta on 29 November. CI-0001 remained in Chickaloon Bay and Turnagain Arm through the end of the month in an area of open water (Figs. 34, 37, and 38). Opportunistic sightings that occurred in Knik Arm in November overlapped with tag locations from both whales (Shelden et al. 2015), but not when they were together (Appendix 5). Group sizes during these encounters ranged from 6 to 35 whales.

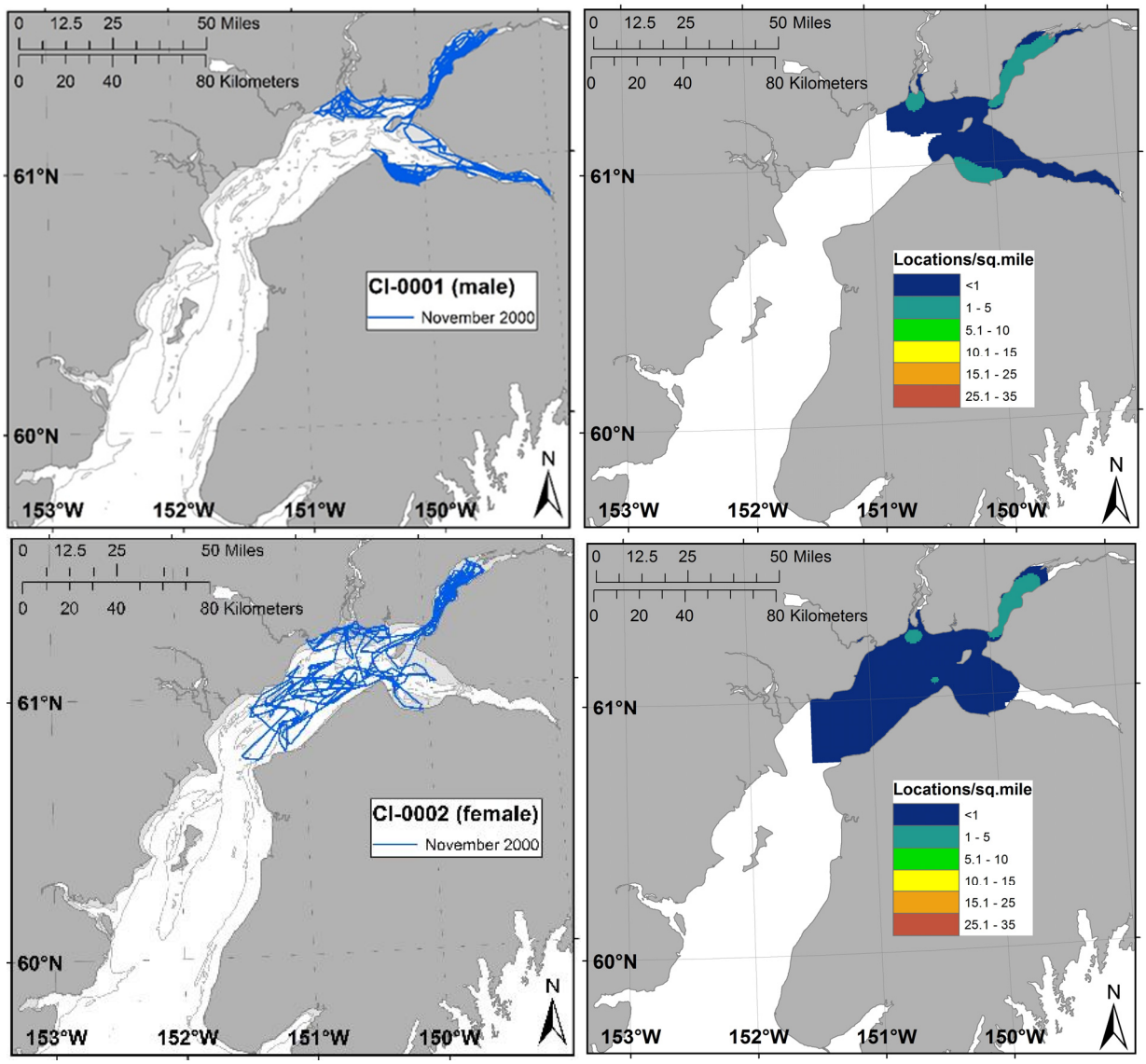


Figure 37. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of beluga CI-0001 and CI-0002 in Cook Inlet, Alaska, in November 2000.

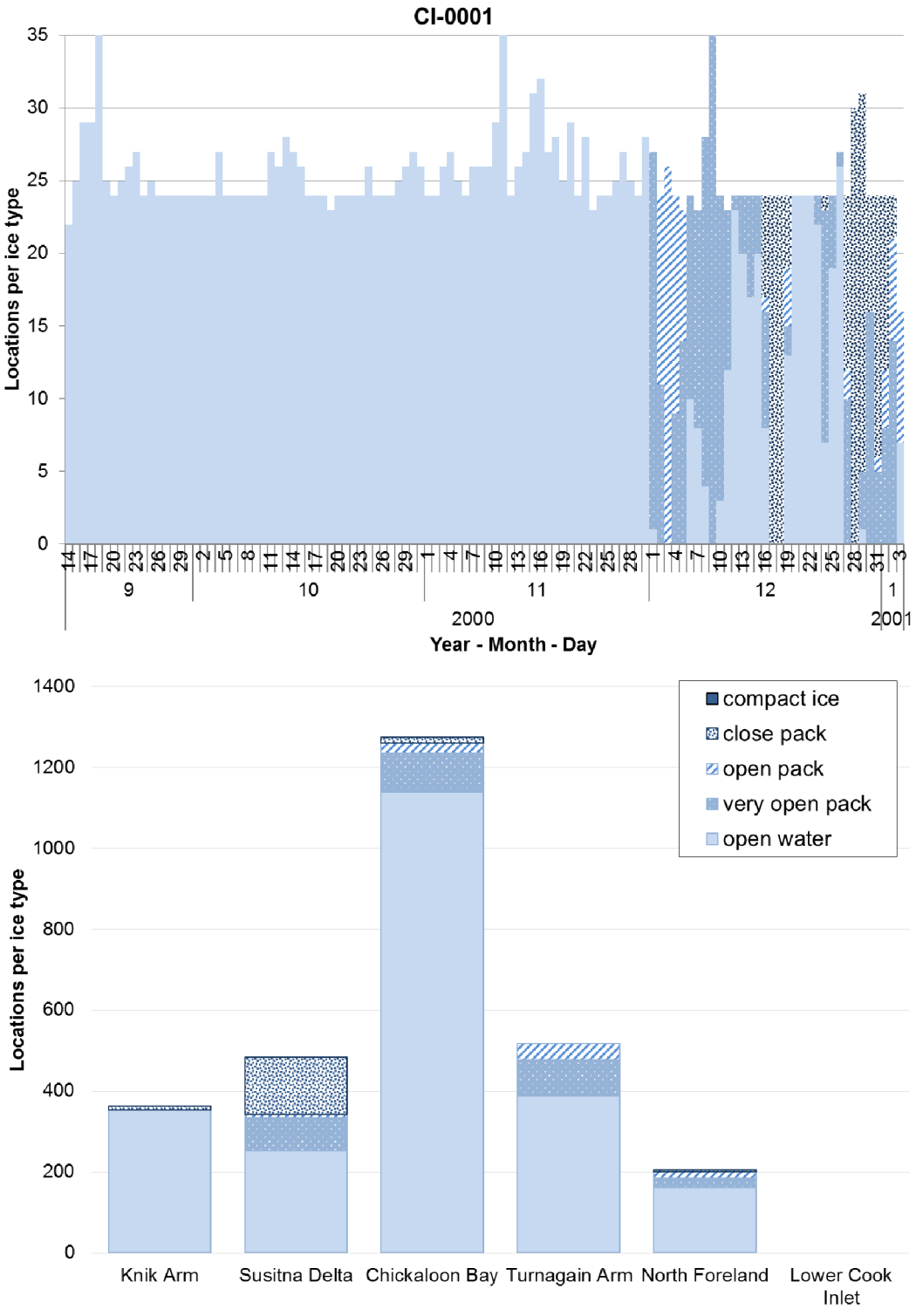


Figure 38. -- Ice associations for beluga CI-0001 tagged in Cook Inlet, Alaska, 13 September 2000. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) in each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

During the winter period, CI-0002 swam from the Susitna River delta into Trading Bay, circled back to the Susitna River delta, then entered Knik Arm from 1–3 December, encountering the first ice of the season (Figs. 34, 39, and 40). She left Knik Arm, rounded the west coast of Fire Island, and entered Chickaloon Bay where she joined CI-0001 (Fig. 40). They remained near one another until 6 December when CI-0002 began a series of loops back-and-forth between the Susitna River delta and Chickaloon Bay – approaching CI-0001, but not swimming in tandem. On 11 December, the two whales began swimming in tandem mid-inlet south of Fire Island. This continued until 14 December when CI-0002 swam south toward East Foreland before looping back to Point Possession. Here she rejoined CI-0001 on 15 December where he had continued to circle in mid-inlet waters north of the point. Both belugas swam in tandem and followed one another back-and-forth across the upper inlet until 26 December. CI-0001 then swam north to the Susitna River delta approaching Anchorage while CI-0002 swam to Trading Bay before crossing the inlet to Point Possession. On 28 December, both whales were in the Susitna River delta shortly before midnight. CI-0001 departed and swam into Knik Arm, returning to the Susitna River delta on 29 December. The whales were proximate to each other until 30 December, after which CI-0001 circled near Fire Island and CI-0002 circled near East and West Foreland.

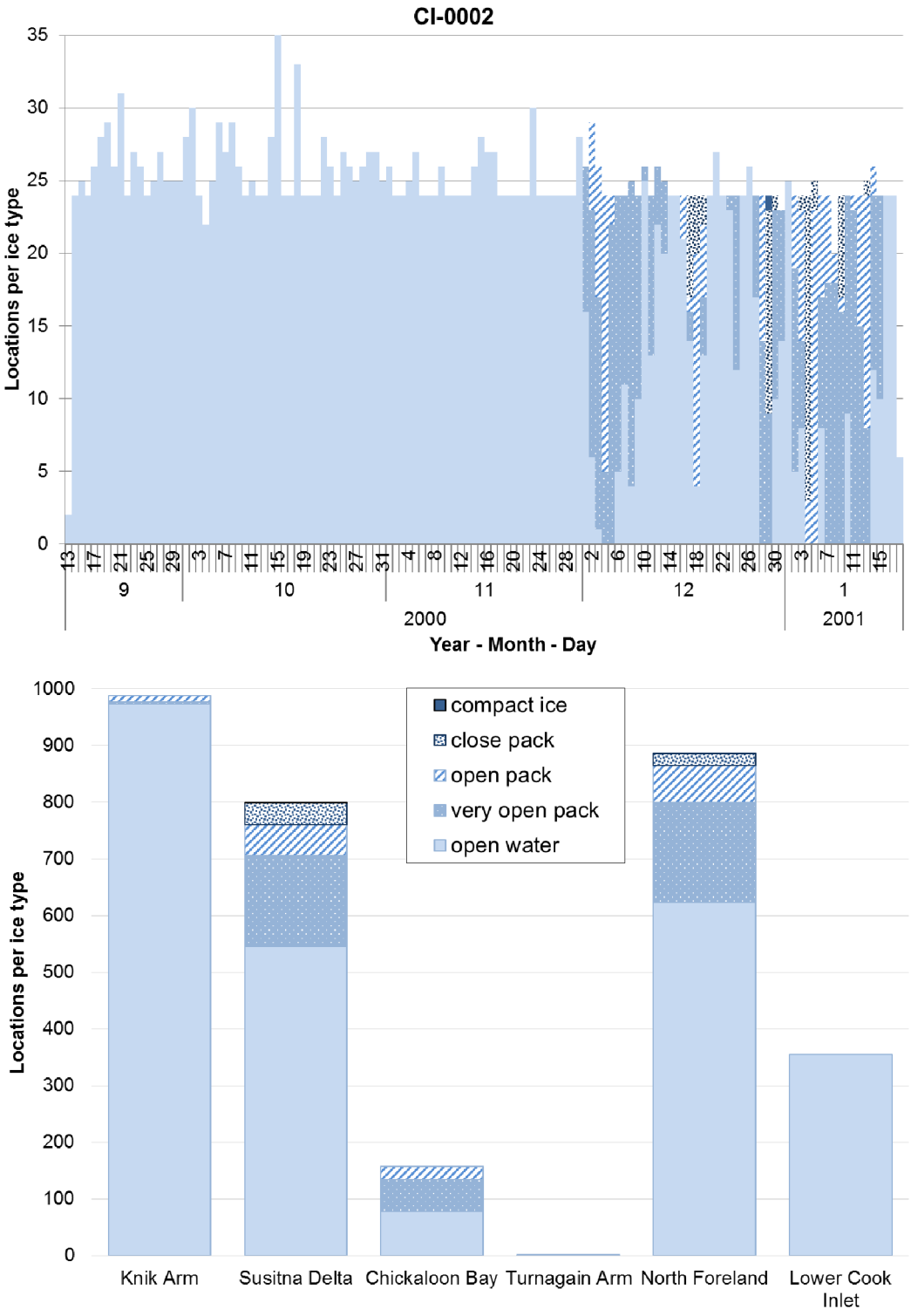


Figure 39. -- Ice associations for beluga CI-0002 tagged in Cook Inlet, Alaska, 13 September 2000. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) in each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

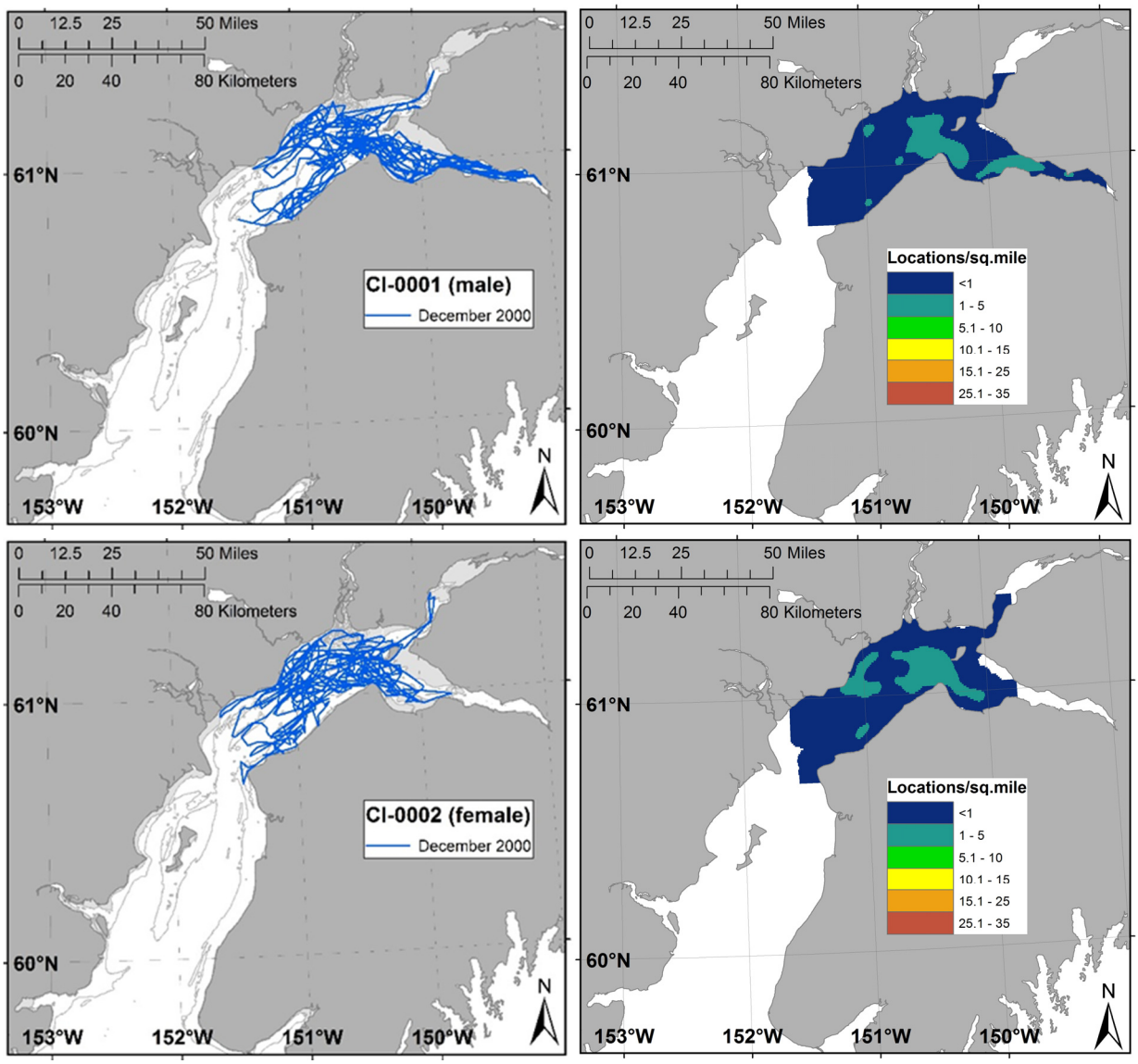


Figure 40. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of belugas CI-0001 and CI-0002 in Cook Inlet, Alaska, in December 2000.

On 2 January, the whales began swimming in tandem mid-inlet off Trading Bay when transmissions from CI-0001 stopped (Fig. 41). CI-0002 continued to cross back-and-forth from the Susitna to East and West Foreland exploring the shoreline and mid-inlet waters before entering the lower inlet on 15 January. She continued south, briefly circling mid-inlet between Kalgin Island and Kasilof River on 16 January. She swam south of Kalgin Island toward Tuxedni Bay before circling back and entering Redoubt Bay on 17 January. Transmissions stopped as she passed the north tip of Kalgin Island headed toward the Forelands (Fig. 41). Both tags appeared

to be losing power prior to the end of transmissions (Appendix 7). No opportunistic sightings were reported during the winter period (Shelden et al. 2015).

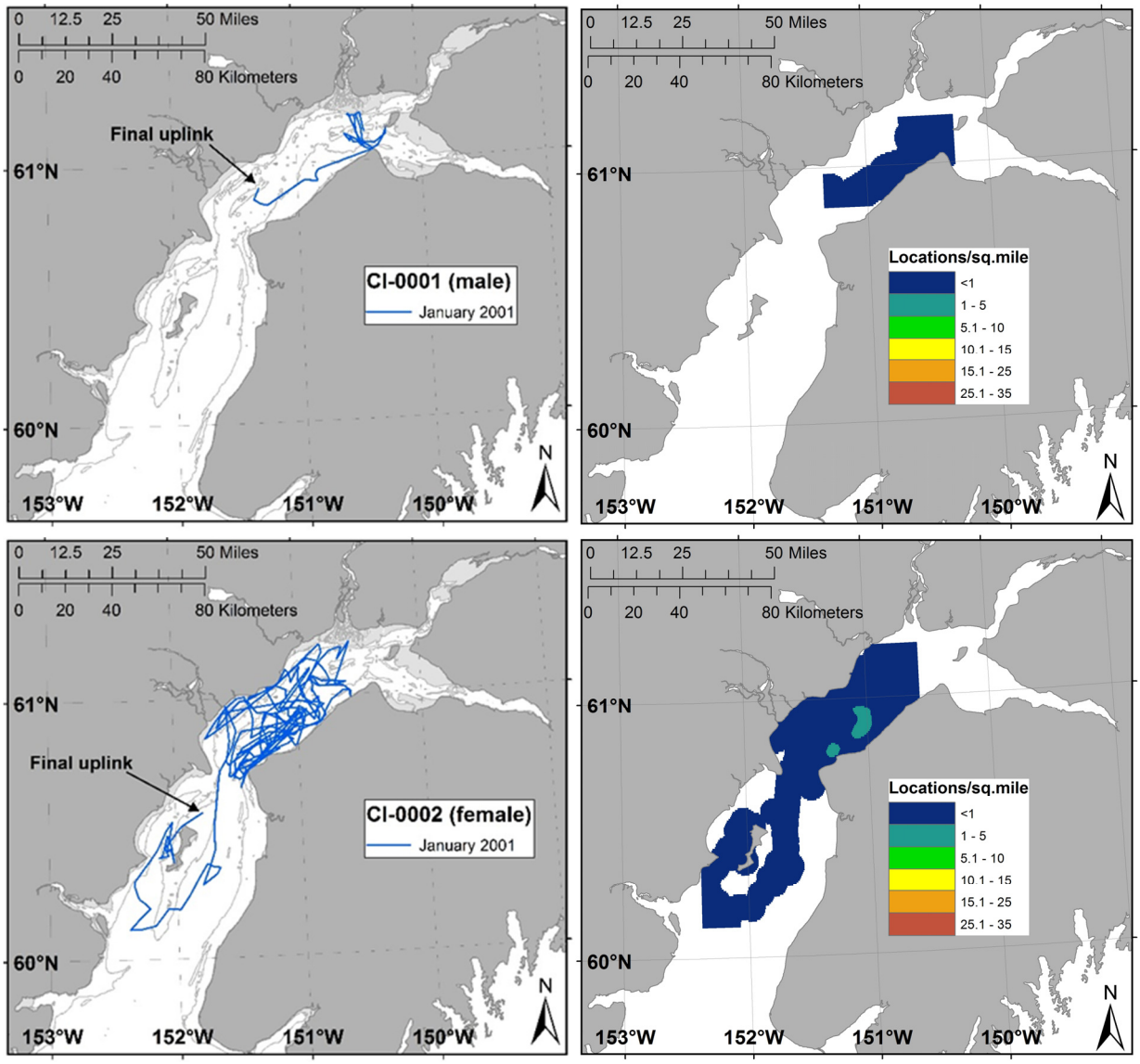


Figure 41. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of belugas CI-0001 and CI-0002 in Cook Inlet, Alaska, in January 2001.

Based on these results, we found that some belugas remain in the upper inlet through autumn and into early winter. CI-0001 (Fig. 38) and CI-0002 (Fig. 39) began to encounter ice in early December. Ice formation in the inlet was first recorded the week of 1 December (Fig. 34), but ice did not cover the entire upper inlet until mid-January (Appendix 8). During the period of

ice formation, CI-0001 was in open water and very open pack ice (concentrations of 13 and 24) for 34.7% and 34.4% of the modelled locations (n = 844), respectively (Fig. 38). He encountered open pack ice (concentrations of 35 and 57) in all areas but Knik Arm (10.8% of modelled locations) and close pack ice (concentration 79) in all but Turnagain Arm (20.1% of modelled locations).

After 1 December, 48% of the modelled locations (n = 1,178) from CI-0002's tag occurred in open water (Fig. 39). She entered close pack ice (5.1% of modelled locations, concentration 79) and compact ice (0.1%, concentration 92) in the Susitna River delta, but was usually associated with very open pack ice, in particular concentration 13 (19.7% of the 33.7% of modelled locations in this ice category). Similarly, when in open pack ice (13.2% of modelled locations), she tended to be in the lower concentrations (35 = 5.3%, 57 = 7.0%) (e.g., Fig. 42). Laidre et al. (2017) also found that CI-0002, when compared to CI-0001, was located in areas of low ice concentration during three time periods: 1-15 December, 16-31 December, and 1-16 January; however, this was significant ($P = 0.007$) only during the middle time period.

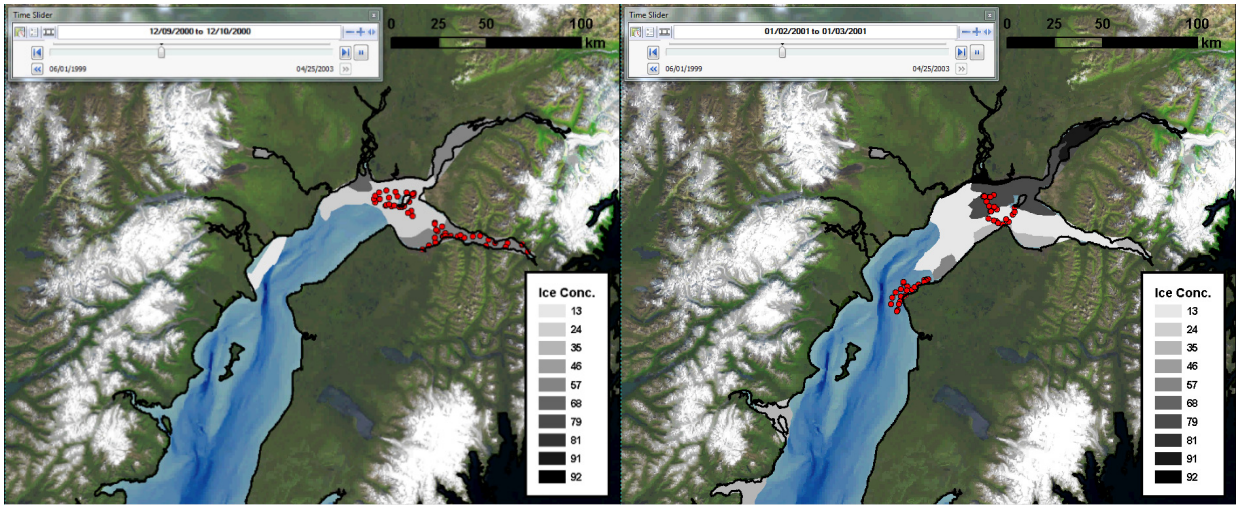


Figure 42. -- Examples of ice associations in December (left panel) and January (right panel) for whales CI-0001 and CI-0002 tagged in Cook Inlet, Alaska, 13 Sept. 2000 (maps extracted from animations created by K. Goetz). Panels show when CI-0002 appeared to avoid heavy ice (i.e., clusters of locations in open water and lower ice concentrations). Ice did not cover the entire upper inlet until mid-January in 2001 (Appendix 8).

Dive behavior for the two whales tagged in mid-September 2000 included shallower (Fig. 43: roughly < 2 m) and shorter duration (Fig. 44: < 3 minutes) dives that lasted until December when depth and duration increased (> 6 m, > 3 minutes). This behavior was unlike whale CI-9901, who began a longer and deeper diving pattern (> 4 m, > 4 minutes) before transmissions ended in mid-September of 1999 (see Fig. 32). On average, the small female (CI-0002) spent much more time submerged (Fig. 44) and at greater depths (Fig. 43) compared to the adult male (CI-0001), particularly when in mid-inlet waters off North Foreland and in the lower inlet. Laidre et al. (2017) noted that for both whales, maximum dive depth and dive duration increased significantly from autumn to winter. CI-0002's deepest dive was 112 m, whereas CI-0001 did not dive deeper than 64 m. Unlike CI-9901, their day and night diving depths were not significantly different (Laidre et al. 2017). Tide cycle appeared to influence diving behavior of CI-0002, but only during the November-January period, at which time longer and deeper dives occurred on the rising tide (Laidre et al. 2017). By mid- to late November, both whales were spending less time at the surface (0-6 m depth), dropping to 10-20% from 30-50% (Laidre et al. 2017). By November, more time was spent above 2 m or below 5-6 m than at depths between 2 and 5 m.

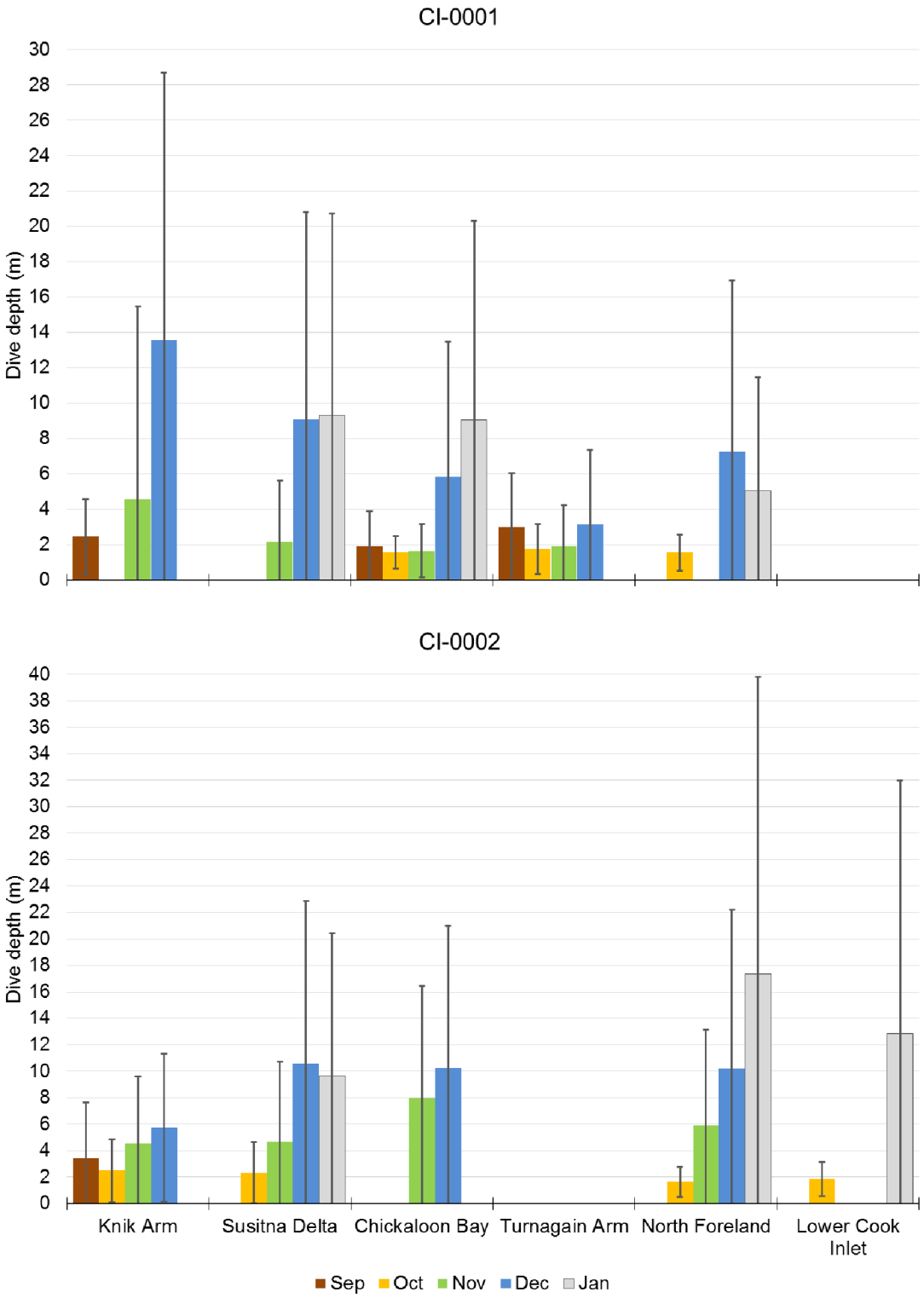


Figure 43. -- Monthly dive behavior of belugas CI-0001 (top panel) and CI-0002 (bottom panel) tagged in Cook Inlet, Alaska, 13 September 2000. Histograms show average dive depth in meters for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

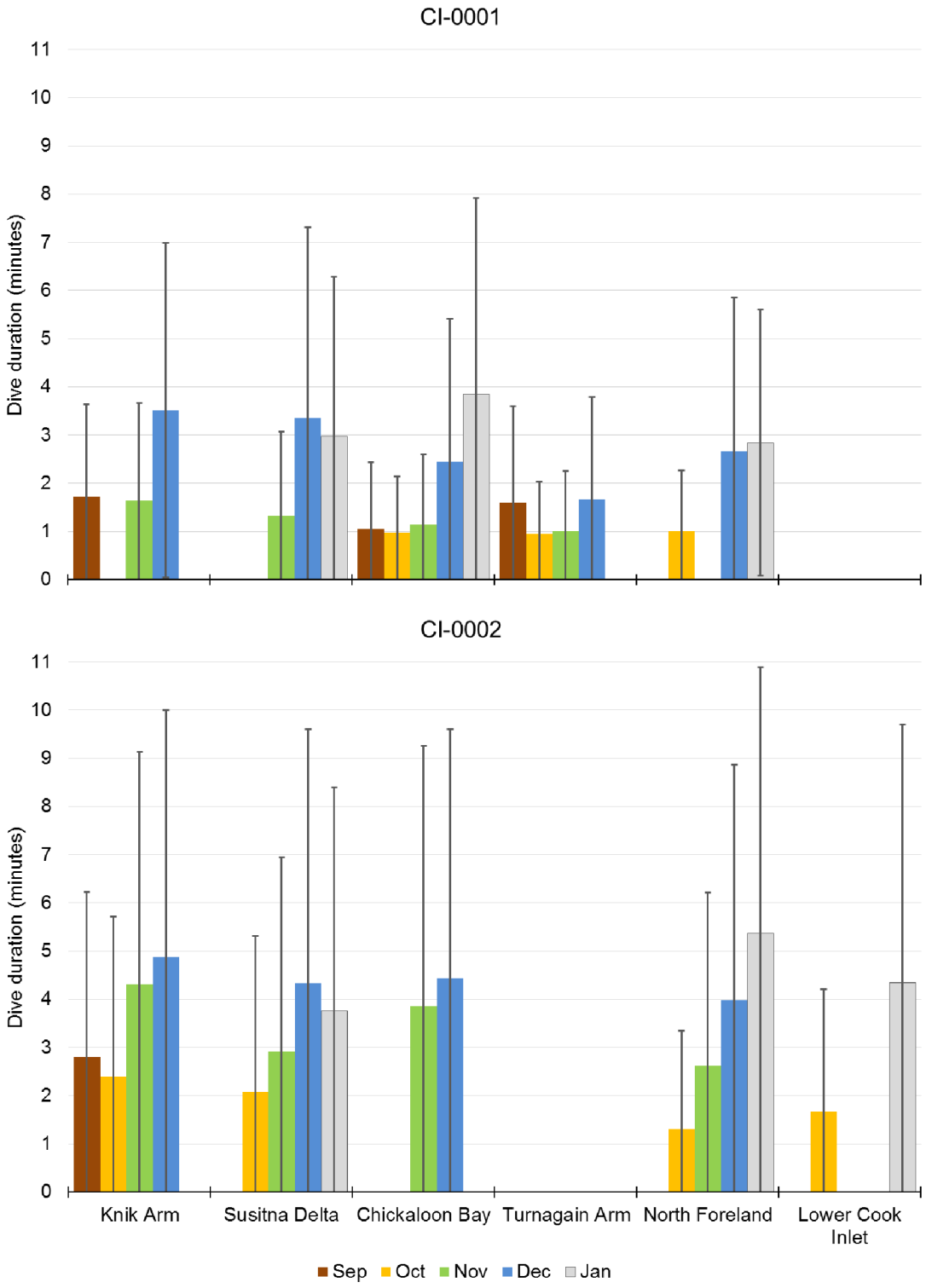


Figure 44. -- Monthly dive behavior of belugas CI-0001 (top panel) and CI-0002 (bottom panel) tagged in Cook Inlet, Alaska, 13 September 2000. Histograms show average dive duration in minutes for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

In addition to the ST16 satellite-linked time-depth recording tag, CI-0002 also had a short-term suction cup attached TDR. After 4 days of monitoring the VHF on CI-0002 from boat and aircraft, the suction-cup released the tag from the whale and it was retrieved by the boat crew. The tag had remained on CI-0002 for at least 90 hours and collected 55 hours of data before the memory limit was exceeded (Appendix 9). While attempts were made to document each surfacing during the monitoring bouts on 13 and 15 September, the boat team noted that it was likely that some of the times the whale was at the surface were missed (Fig. 45).

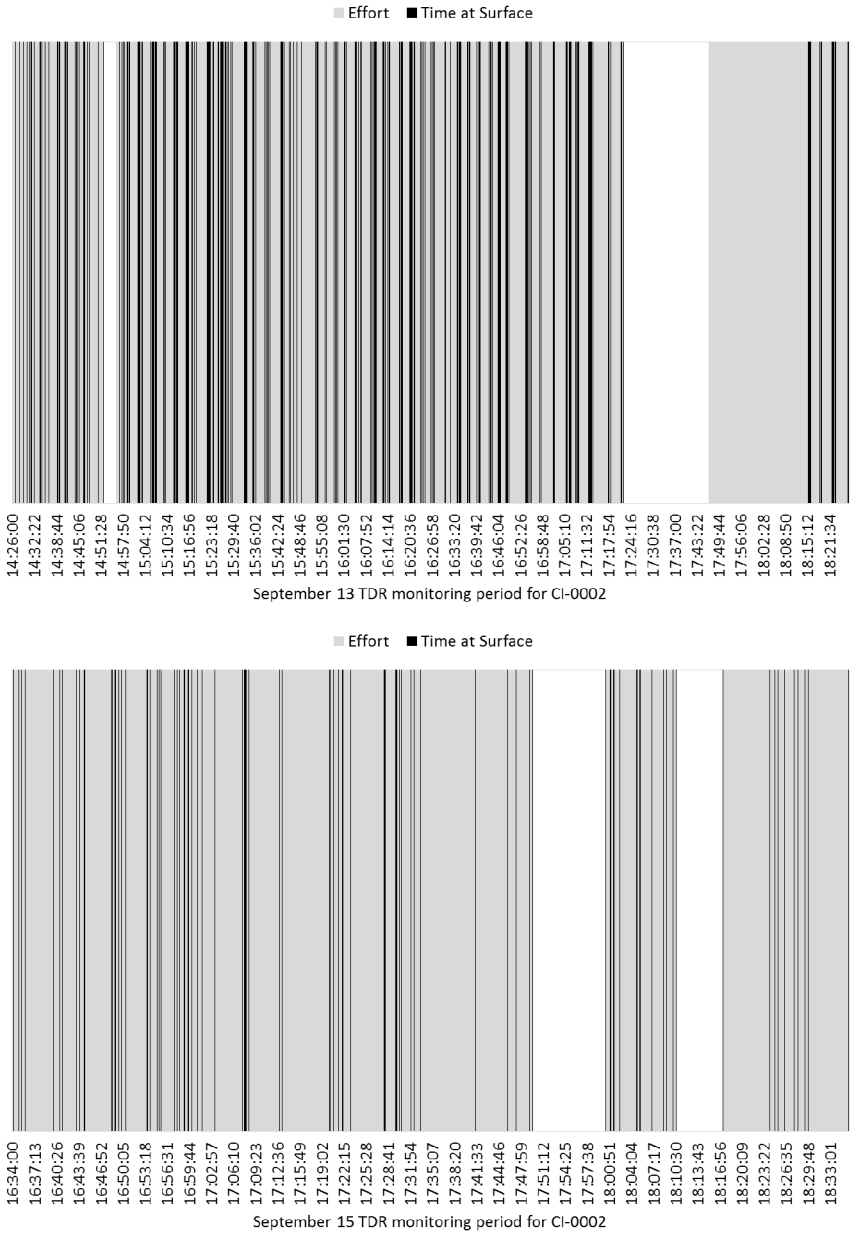


Figure 45. --Time-at-surface VHF signals manually tracked for beluga CI-0002.

2001 Tagging Results

Whales tagged during the 2001 season provided further documentation of late summer (August), autumn (September-November), and winter (December-February) movements for the Cook Inlet population, and the first documentation of early spring movements (March). Whales remained in Cook Inlet during this entire period, one (CI-0105) travelling south as far as Chinitna Bay before returning to the upper inlet (Fig. 46). Whales began encountering ice in the upper inlet the week of 5-9 November (Fig. 47) and by 8 December much of the upper inlet was ice covered (Appendix 10). During the 2001 tagging season, the field team placed two types of tags on five of the whales, in part to test longevity of the SPOT2 tags, which were duty cycled to transmit 3 or 6 days per month (Table 2). SPOT2 tags programmed to collect temperature worked fairly well alone or when the ST16 tag failed (Appendix 11). All SPOT2 tags that did not collect temperatures behaved as programmed, but failed to transmit status updates when associated with an ST16 tag (Appendix 7). Monthly location density plots were created for individual whales with tags that transmitted daily (CI-0106 and CI-0107).

Table 2. -- Satellite tags deployed on belugas in Cook Inlet, Alaska, during the 2001 capture and tagging season. * = Temperature data have not been analyzed (see Appendix 11).

	Tag type				
	ST16	SPOT2			
Whale ID	PTT#	PTT#	Duty cycle (days per month)	Programmed to collect temperature?	Comments
CI-0101	NA	13934	3	Yes*	Transmissions appear normal after 19 Sept.
CI-0102	30720	13937	6	Yes*	ST16 never transmitted in 2001 (no test transmissions in Seattle, see text notes) SPOT transmissions appear normal after 16 Sept.
CI-0103	25847	13933	3	Yes	SPOT began transmitting consistently only after ST16 failed and did not collect any temperature data.
CI-0104	25849	13945	6	Yes	Neither tag transmitted (test transmissions occurred in Seattle in July 2001 and for the SPOT on 12 Aug. in Anchorage, see text notes).
CI-0105	NA	13938	6	No	Transmissions appear normal.
CI-0106	13947	13942	6	No	Transmissions appear normal but status/voltage updates from SPOT only occurred after ST16 stopped transmitting (see Appendix 7).
CI-0107	13948	13943	6	No	Transmissions appear normal but no status/voltage updates from SPOT.

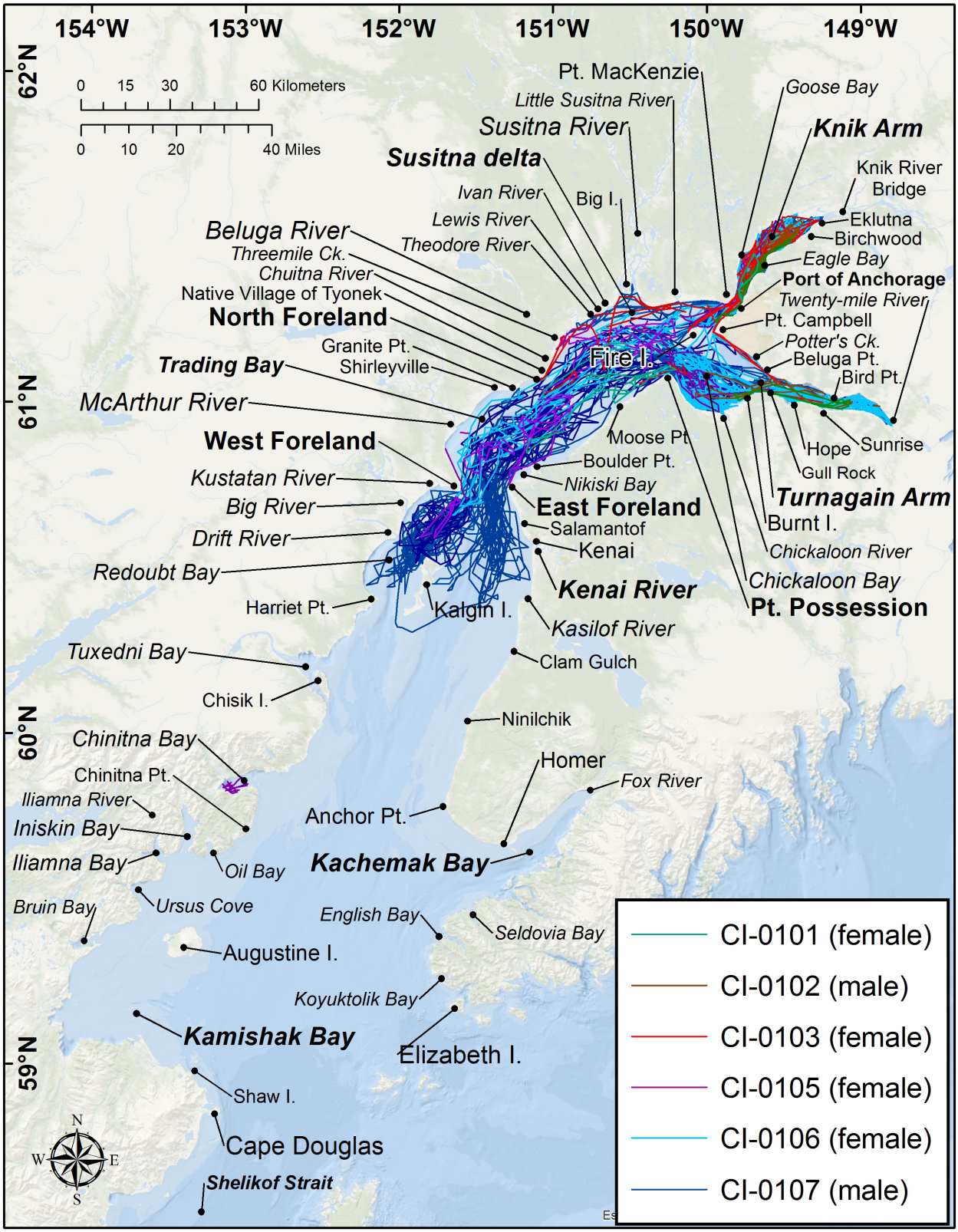


Figure 46. -- Satellite-linked modelled tracks from belugas tagged in Cook Inlet, Alaska, in August 2001. Tags attached to CI-0104 (female) failed to transmit (see text).

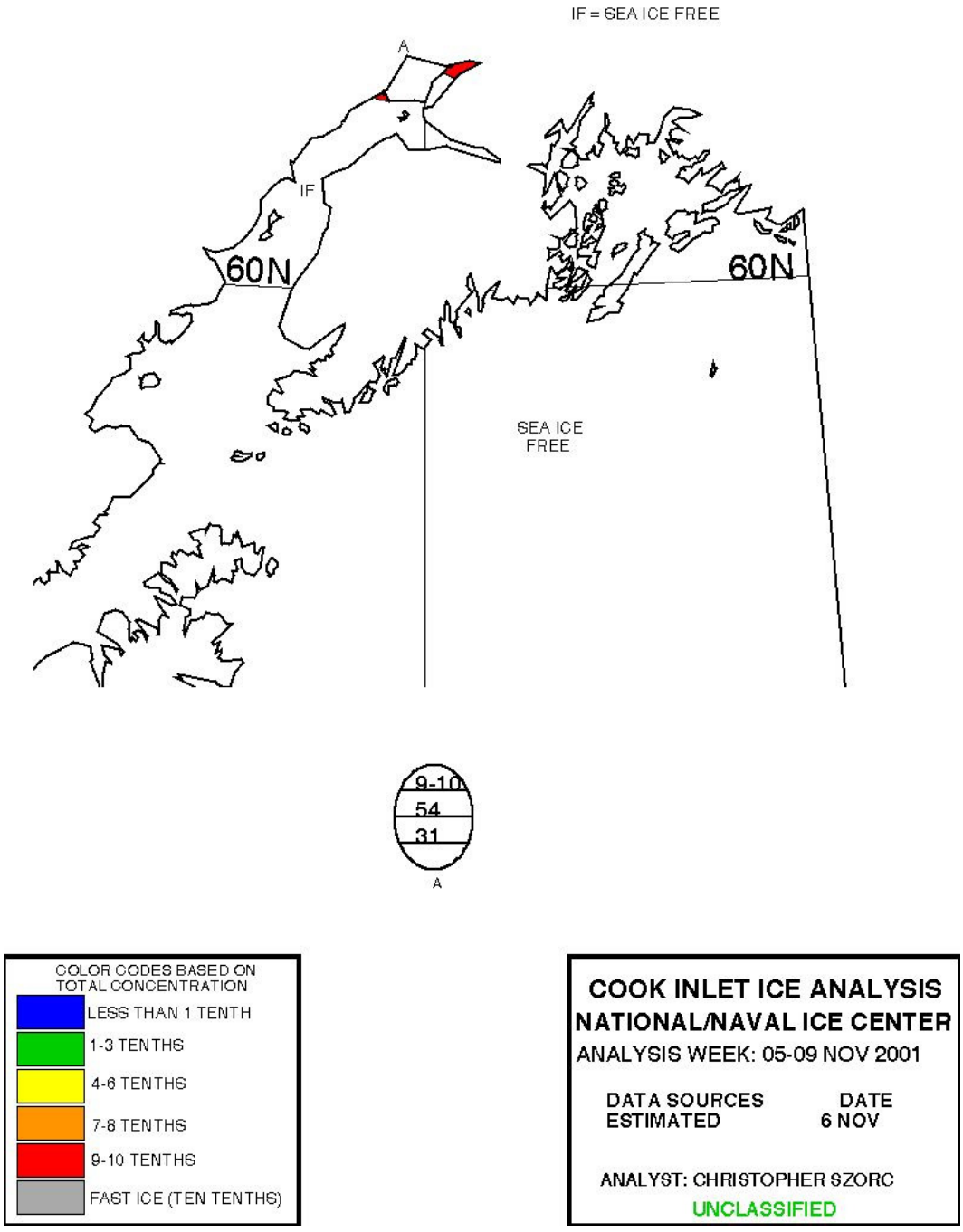


Figure 47. -- First appearance of ice in Cook Inlet, Alaska, in 2001 (image from the U.S. National Ice Center/Naval Ice Center http://www.natice.noaa.gov/products/weekly_products.html accessed 3 Oct. 2016). The "egg code" shows the total concentration in tenths for area A (9-10), the partial concentration in tenths by descending thickness (5, 4) and the stage of development in descending order (3 = young ice, 1 = new ice) . (http://www.natice.noaa.gov/products/egg_code.html)

CI-0101

Because of her small size, CI-0101 was tagged with a SPOT2 only, therefore, no dive data were collected. The tag was programmed to transmit 3 days per month (on the 9th, 19th, and 29th) and collect temperatures (per Table 1). Although CI-0101 was captured and tagged in the Little Susitna River on 10 August, her SPOT2 did not transmit a location until 19 September (Fig. 48), at which time she had moved to Knik Arm near Birchwood (Fig. 49). The tag did not transmit on 29 September. Although transmissions were at times sporadic, temperature data were collected during the programmed periods (see Appendix 11). Transmissions in October placed her in Knik Arm on 9–10 October and 19–20 October, when she started to head out of Knik Arm toward Fire Island. The 29–30 October transmissions were in Turnagain Arm and Chickaloon Bay (Fig. 49). On 9-10 November, she had returned to Knik Arm during the transmissions where she encountered close pack (concentration of 79) and compact ice (concentration of 91) (Fig. 50). At some point after this she traveled south of Fire Island, as the remaining transmissions in November show her between Moose Point and Point Possession (Fig. 49) where she moved from open water to close pack ice (Fig. 50). The 9–10 December transmissions show her moving in offshore waters of the upper inlet before transmissions ended near North Foreland (Fig. 49). Tag transmissions did not coincide with opportunistic sightings reported during this time period (Appendix 5), though CI-0101 may have been among whales observed in Knik Arm by the NMFS aerial team on 9 November (Rugh et al. 2004; Shelden et al. 2015).

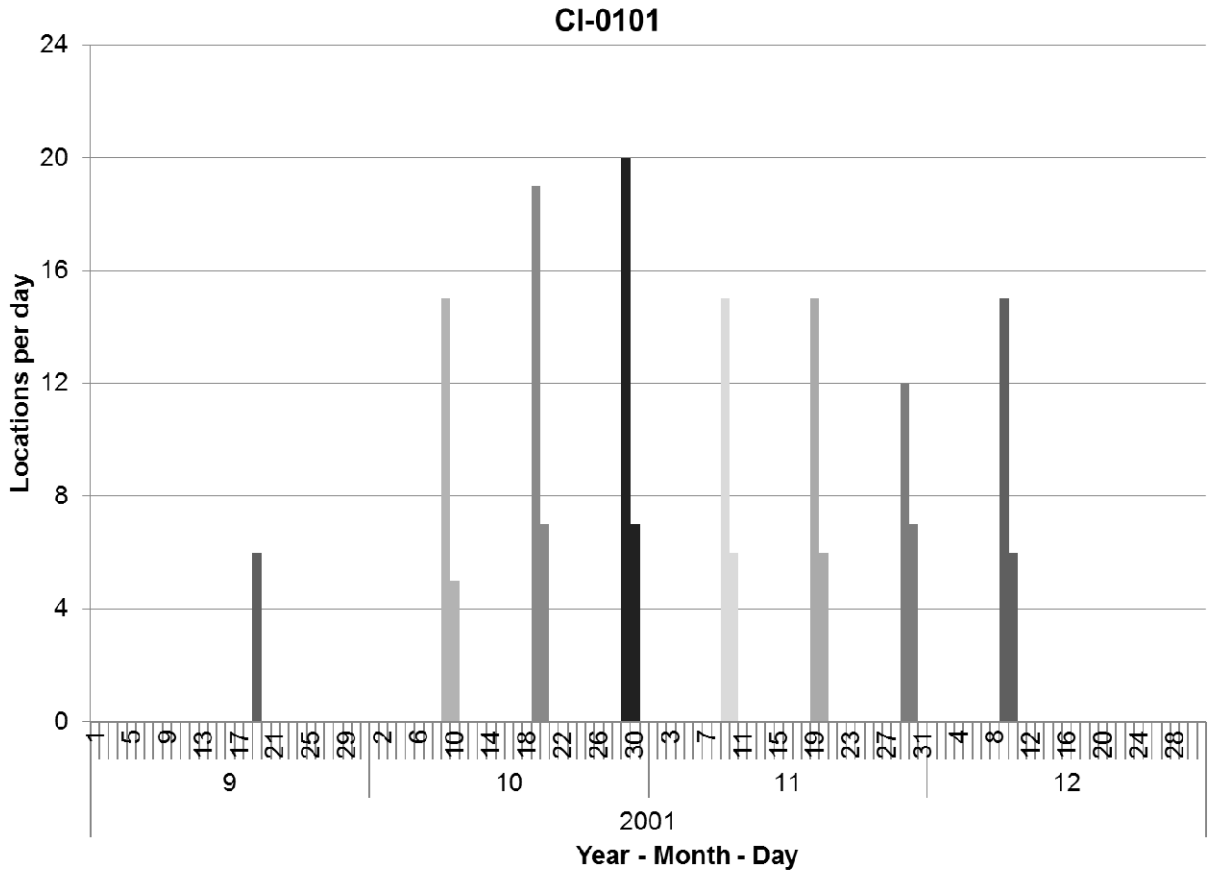


Figure 48. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0101 tagged in Cook Inlet, Alaska, 10 August 2001. Transmissions were programmed to occur 3 days per month (9th, 19th, and 29th) for 24 hours, and to collect temperature (Appendix 11). A change in column color denotes transmission gaps > 1 day. Transmissions were received from mid-September 2001 into December 2001 (covering a 122-day period with 5.6 days of data usable for analysis).

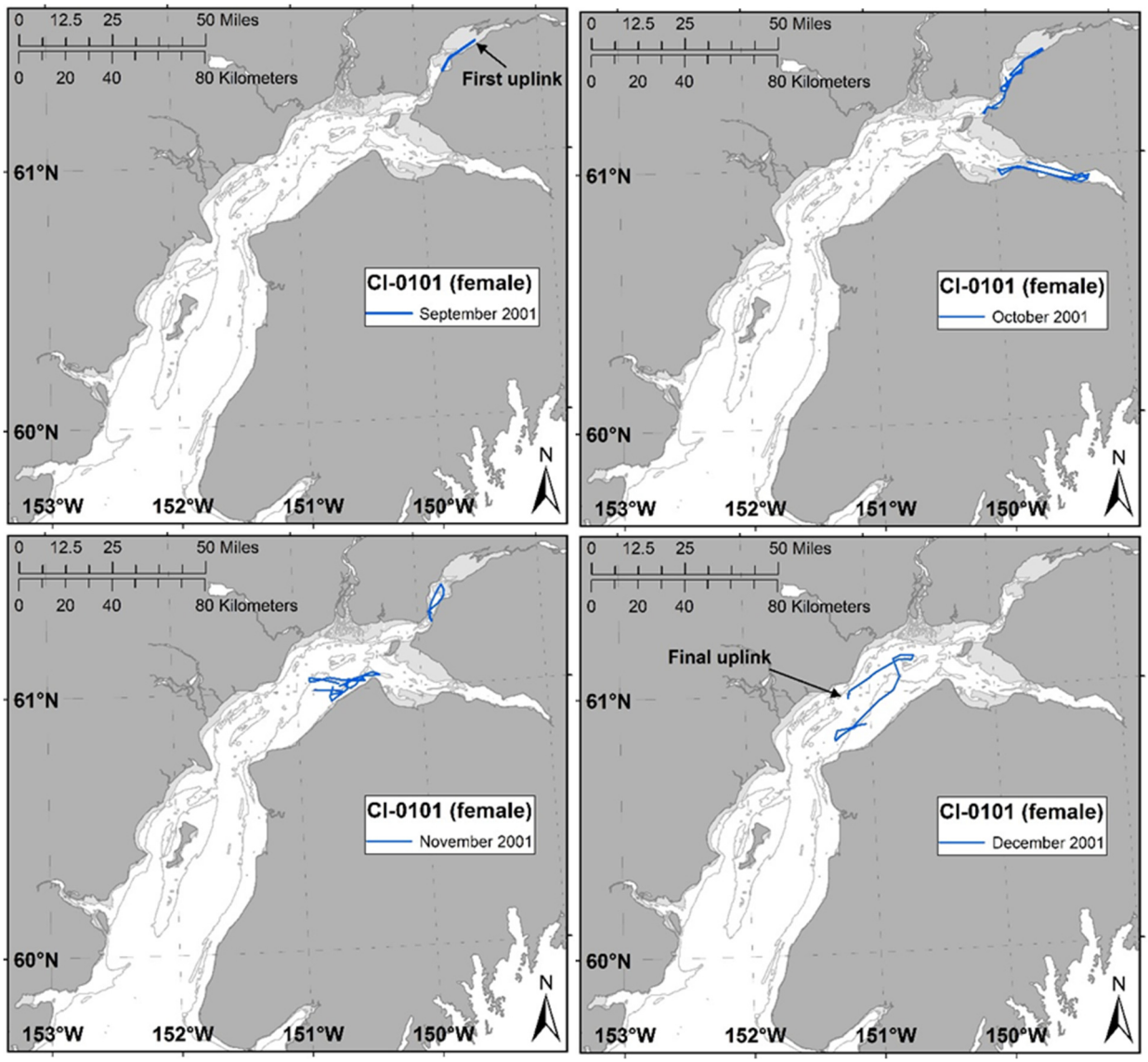


Figure 49. -- Monthly movement tracks (blue) of beluga CI-0101 tagged in Cook Inlet, Alaska, 10 August 2001. Note: SPOT2 tag was duty cycled to transmit only 3 days per month.

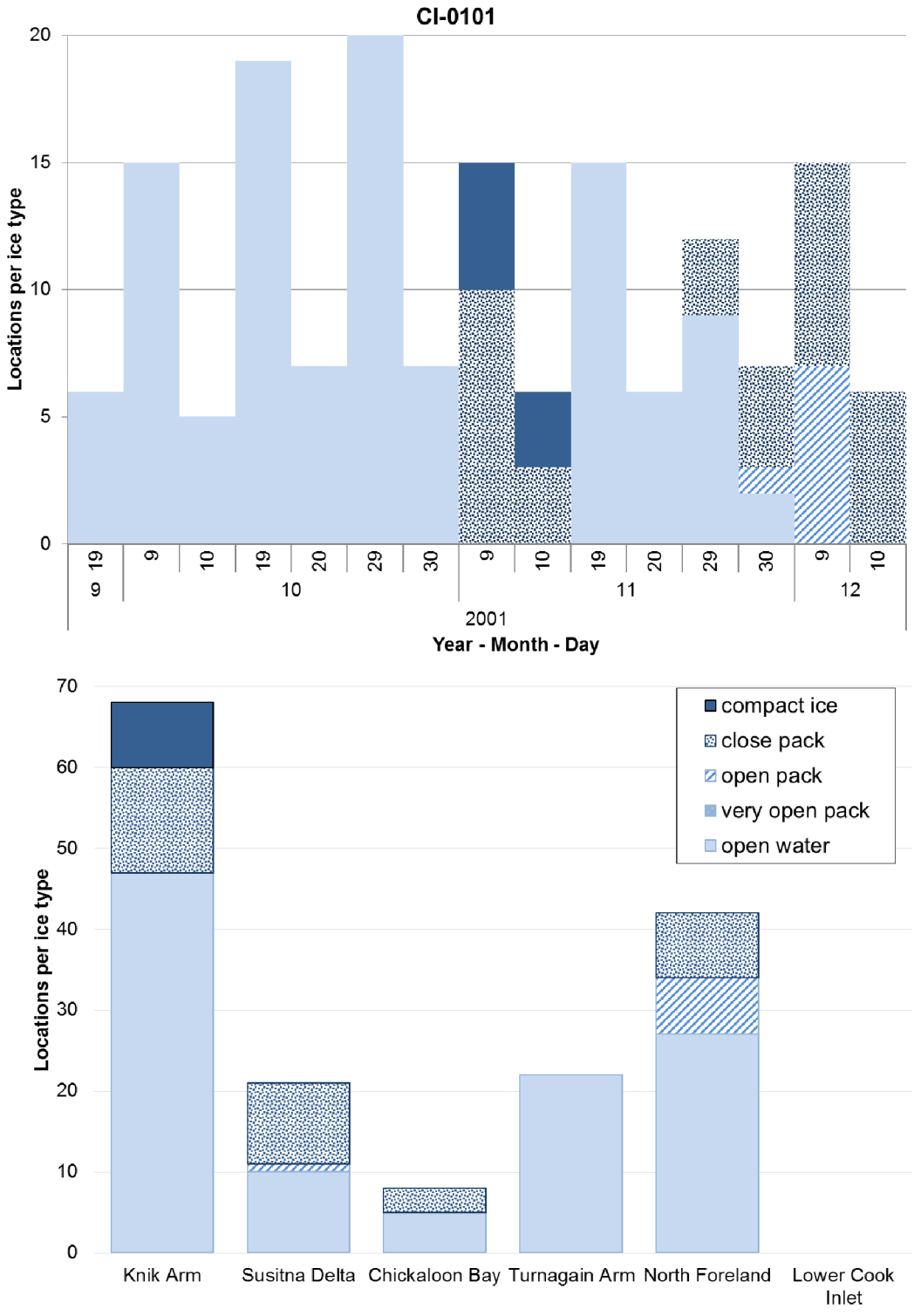


Figure 50. -- Ice associations for beluga CI-0101 tagged in Cook Inlet, Alaska, 10 August 2001. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) in each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0102

CI-0102 was double-tagged in Knik Arm on 11 August 2001. The ST16 tag failed to transmit a single location in 2001 (no test locations for PTT# 30720 were documented). It appears that due to an oversight this tag was put on a whale although it had not been tested or programmed, therefore, no dive data for this male beluga are available. The SPOT2 tag, programmed to transmit 6 days per month (1st, 6th, 11th, 16th, 21st, and 26th) and collect temperatures (per Table 1, see Appendix 11), first transmitted on 16 September (Fig. 51) from Knik Arm. Transmissions continued to place the whale in Knik Arm (though the tag did not transmit on the 26th) until the 6 October transmission (Fig. 52). At that time, CI-0102 was in Chickaloon Bay and then entered Turnagain Arm. The 11 October transmissions placed him back in Knik Arm, where he appeared to remain until the 21 October transmissions, which show he had returned to Chickaloon Bay. The tag did not transmit again until a month later on 21 November, during which time CI-0102 remained in Turnagain Arm near Twenty-mile River (Fig. 52) in close pack ice (concentration of 79) (Fig. 53). Modelled locations did not overlap with opportunistic sighting locations (Appendix 5), but CI-0102 may have been among the whales present in Knik Arm during NMFS aerial surveys conducted on 12 and 15 October (Rugh et al. 2004, Shelden et al. 2015).

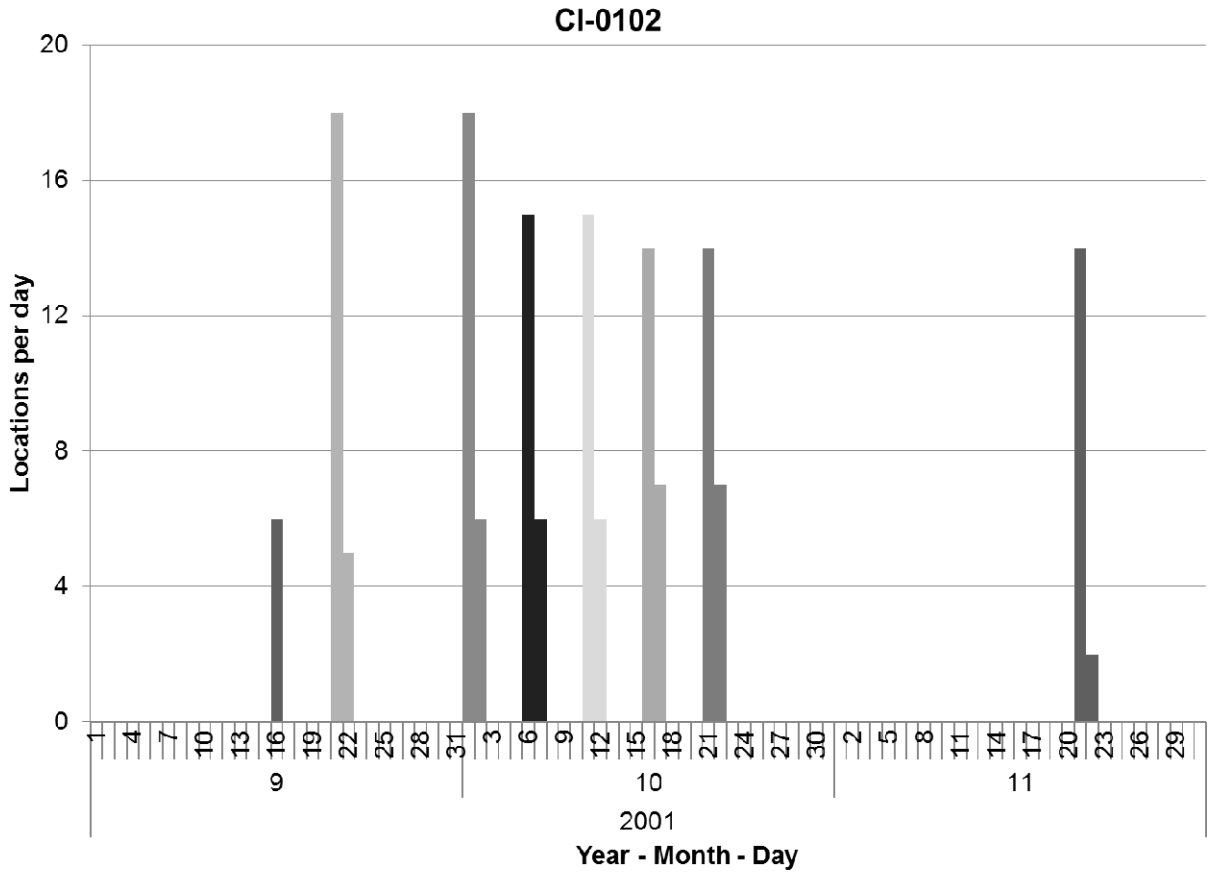


Figure 51. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0102 tagged in Cook Inlet, Alaska, 11 August 2001. Transmissions were programmed to occur 6 days per month (1st, 6th, 11th, 16th, 21st, and 26th) for 24 hours, and to collect temperature (Appendix 11). A change in column color denotes transmission gaps > 1 day. Transmissions were received from mid-September 2001 into November 2001 (covering a 107-day period with 5.6 days of data usable for analysis).

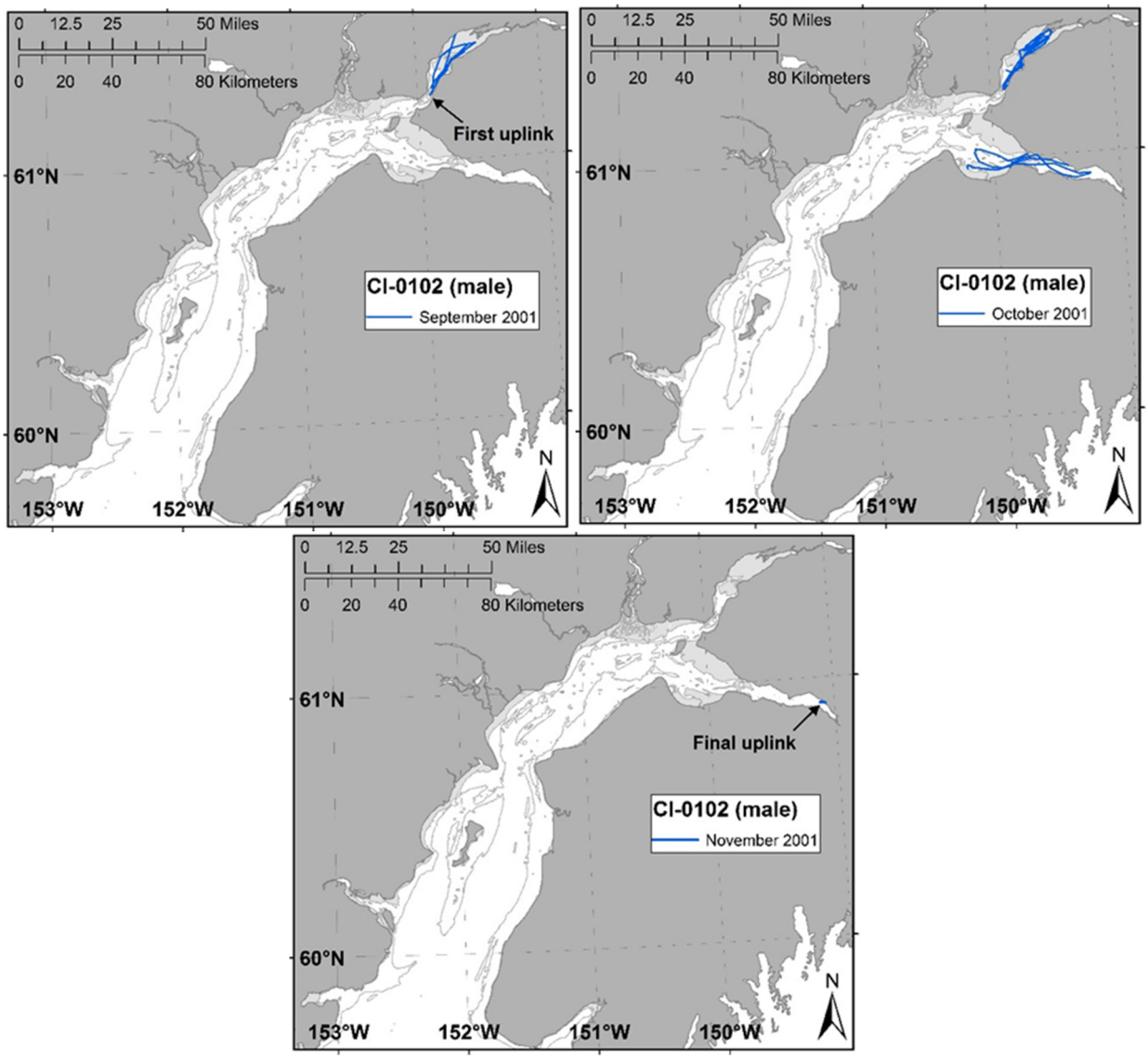


Figure 52. -- Monthly movement tracks (blue) of beluga CI-0102 tagged in Cook Inlet, Alaska, 11 August 2001. Note: SPOT2 tag was duty cycled to transmit only 6 days per month.

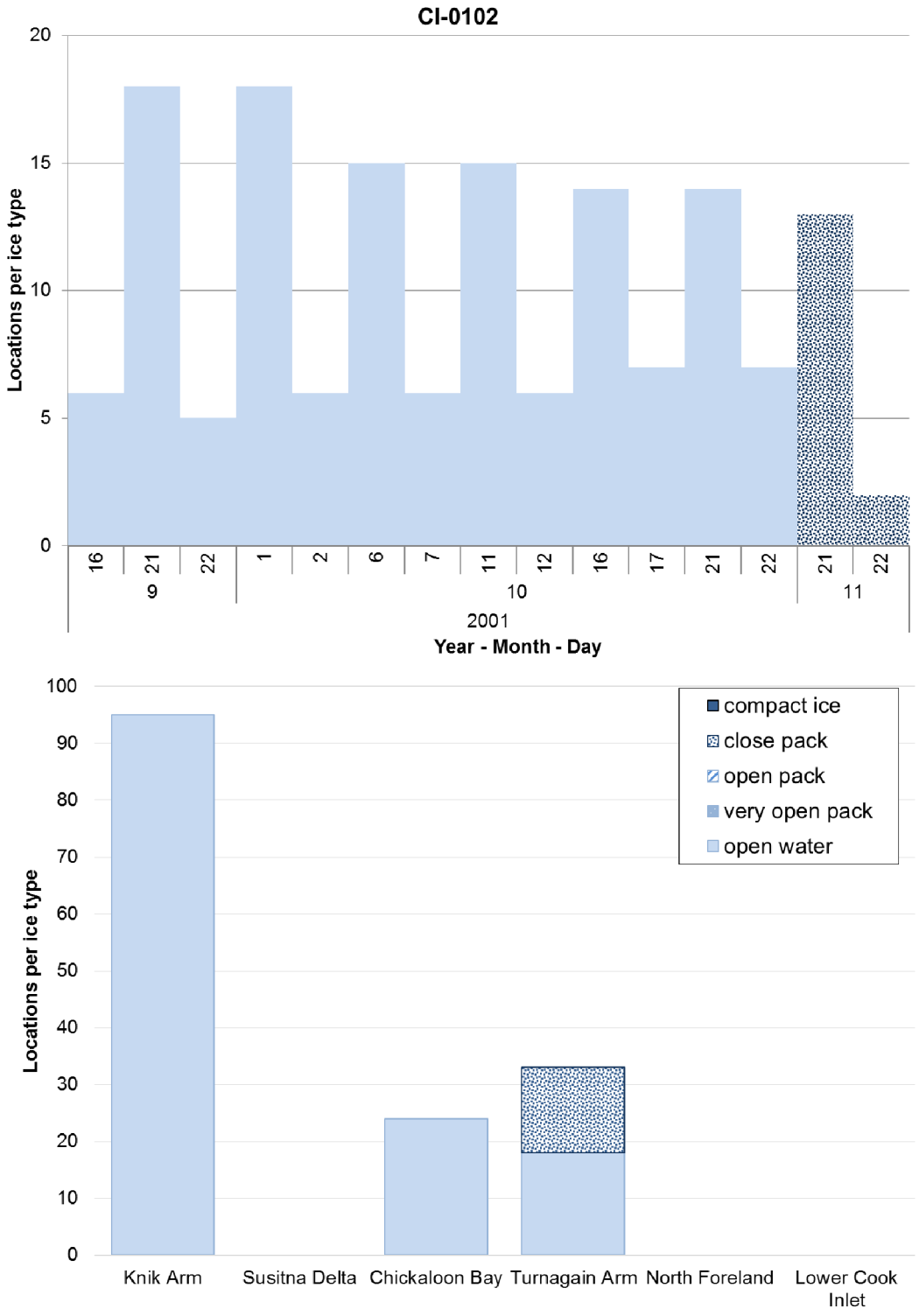


Figure 53. -- Ice associations for beluga CI-0102 tagged in Cook Inlet, Alaska, 11 August 2001. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) in each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0103

CI-0103 was double-tagged the following day (12 August 2001) in Knik Arm. The SPOT2 programming was the same as the tag placed on CI-0101. While CI-0101's tag began transmitting on 19 September, the first transmission from the SPOT2 tag on CI-0103 did not occur until 29 September and the tag failed to collect any temperatures. The ST16 tag began transmitting immediately after tagging (Fig. 54). CI-0103 spent most of August in Knik Arm, with a brief trip to Chickaloon Bay and waters near Fire Island on 25-26 August (Fig. 55), before returning to Knik Arm and possibly remaining there until late September. Gaps in transmissions from the ST16 began on 23 August, followed by longer gaps from 27–29 August and 1–6, 9–12, 15–19 September. On the evening of 24 September, CI-0103 left Knik Arm and headed west into the Susitna River delta. She was still there when the last usable transmissions from the ST16 occurred on 30 September (Fig. 54). On 10 October, the SPOT2 tag transmitted her location in Knik Arm. She was also in Knik Arm when the SPOT2 transmitted on 20 and 30 October (Fig. 55). When transmissions resumed in November, CI-0103 was in Turnagain Arm on the 9th in open pack ice (concentration of 57) and near Point Possession moving between open water and very open pack (concentration of 13) and open pack ice (concentration of 57) on the 19th and open water and close pack ice (concentration of 79) on the 29th (Fig. 56). During the final transmissions from the SPOT2 on 10 December, CI-0103 was off North Foreland headed into Trading Bay in close pack ice.

Transmissions were received from CI-0103 in the vicinity of opportunistic sightings on 13, 24, and 25 August, (Appendix 5). She may have been in Knik Arm during opportunistic sightings and NMFS aerial surveys on 12 and 15 October (Shelden et al. 2015). The NMFS aerial team also observed whales in Turnagain Arm on 9 November (Shelden et al. 2015) when CI-0103 was in the area.

Dive data were available only for the period August-September when the ST16 tag was functioning. Average dive duration was similar for the two regions visited by CI-0103 during that time (Fig. 57), though dive depth was a bit deeper in the Susitna River delta during August when she was near the north tip of Fire Island (Fig. 55).

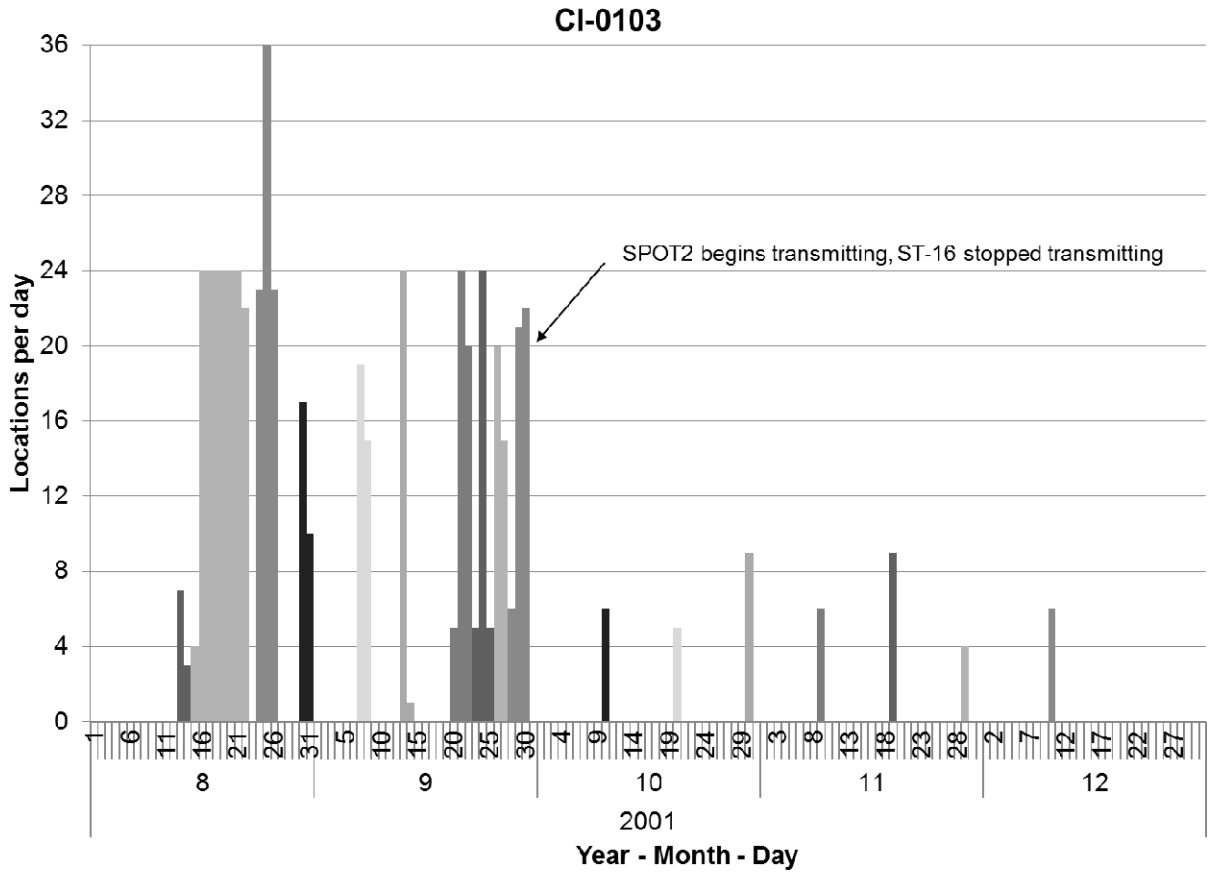


Figure 54. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0103 tagged in Cook Inlet, Alaska, 12 August 2001. The ST16 was programmed to transmit daily but gaps in transmissions began occurring during August and no status updates were received from this tag. Transmissions and temperature readings from the SPOT2 were expected to occur 3 days per month (9th, 19th, and 29th) for 24 hours, but no TAT data were transmitted (Appendix 11). A change in column color denotes transmission gaps > 1 day. Transmissions were received from mid-August 2001 into December 2001 (covering a 130-day period with 21.8 days of data usable for analysis).

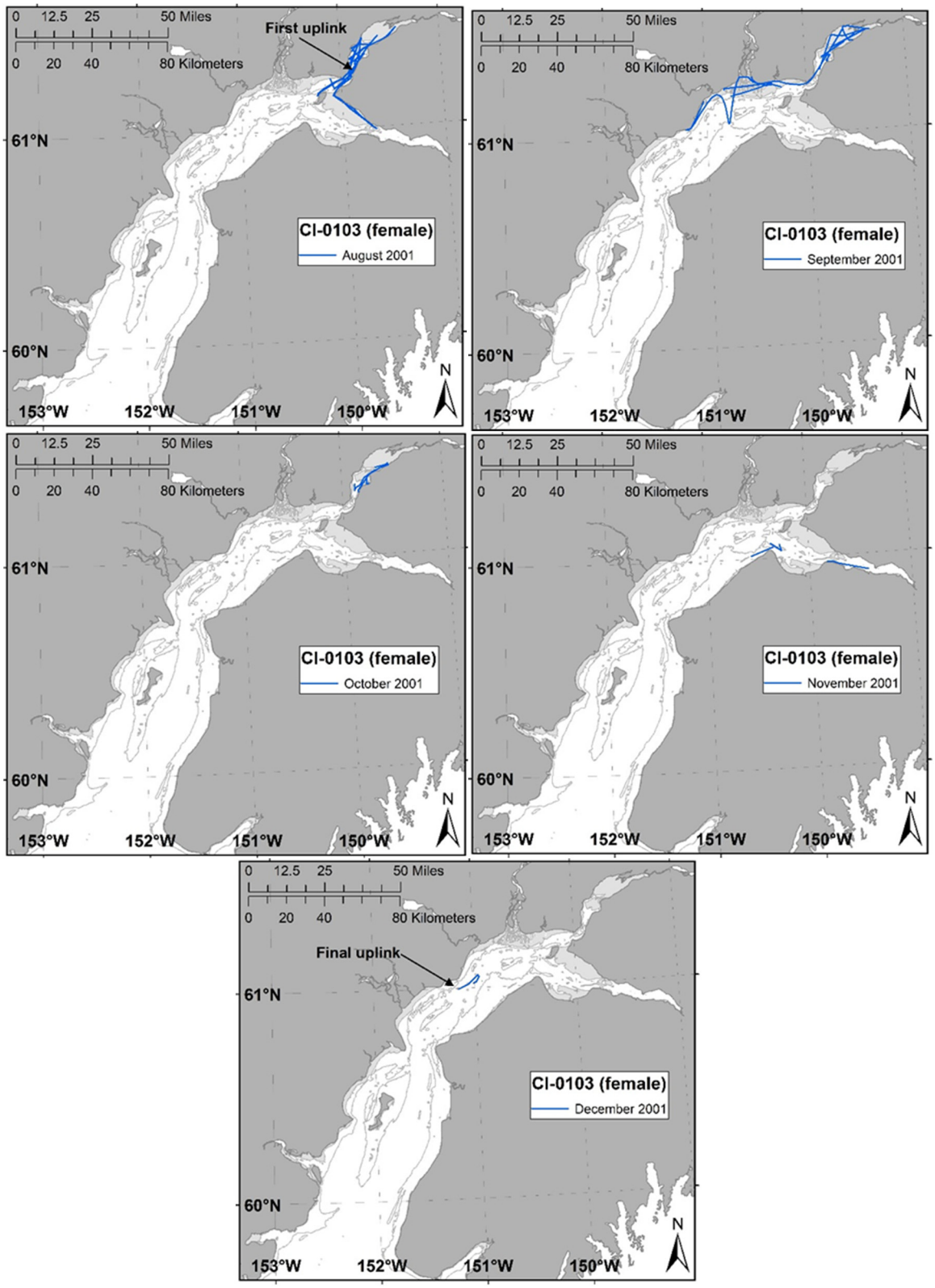


Figure 55. -- Monthly movement tracks (blue) of beluga CI-0103 tagged in Cook Inlet, Alaska, 12 August 2001. Note: the ST16 tag ceased transmitting on 30 Sept., the first transmission from the SPOT2 occurred on 29 September.

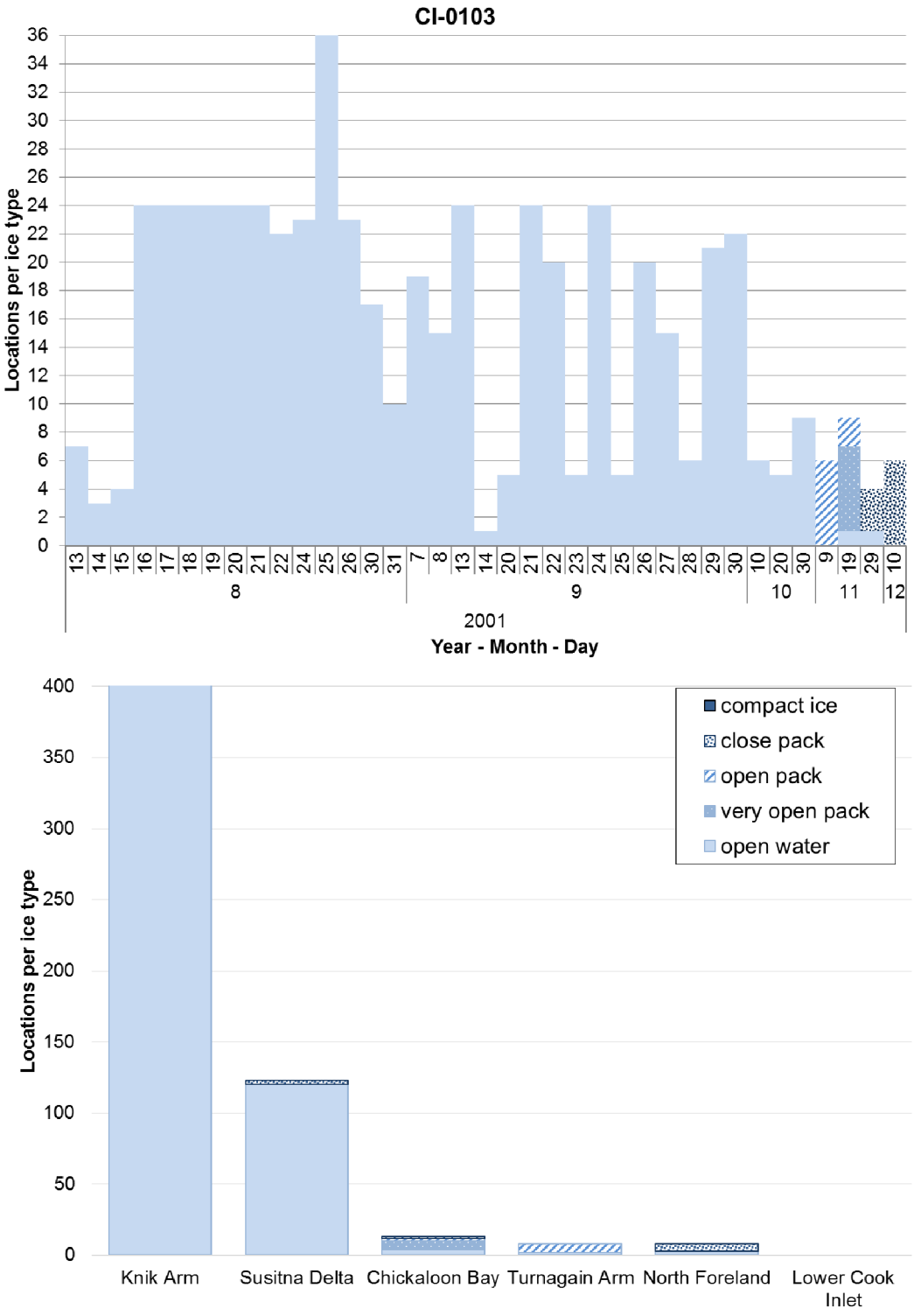


Figure 56. -- Ice associations for beluga CI-0103 tagged in Cook Inlet, Alaska, 12 August 2001. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) in each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

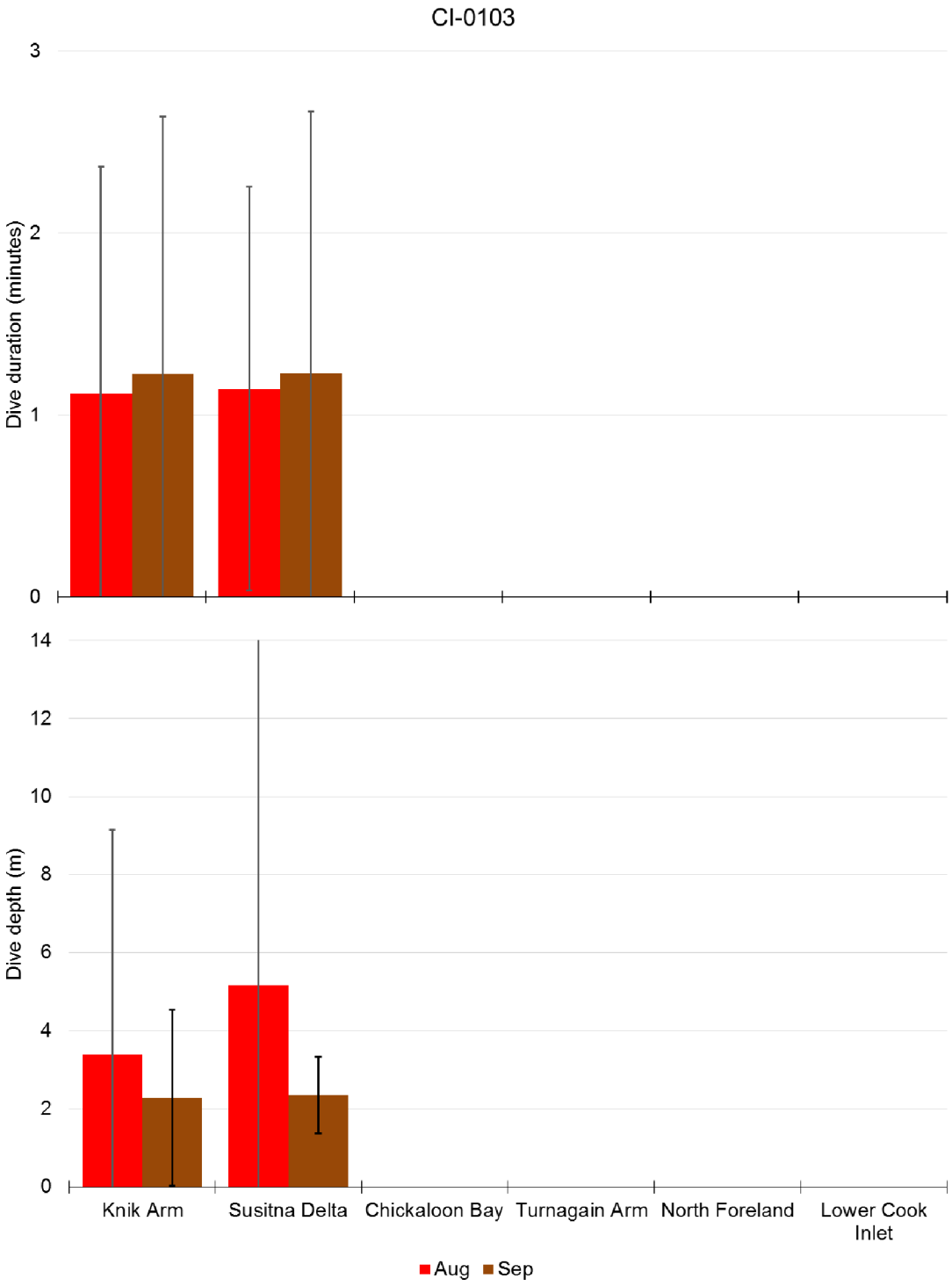


Figure 57. -- Monthly dive behavior of beluga CI-0103 tagged in Cook Inlet, Alaska, 12 August 2001. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0104 and CI-0105

Two female whales were tagged in Knik Arm on 13 August 2001. CI-0104 was double-tagged, whereas CI-0105 was tagged with only a SPOT2 (Table 2). The SPOT2 tags were set to transmit the same number of days, but temperature collection was not activated on CI-0105's tag to test longevity. Unfortunately, neither tag on CI-0104 transmitted normally. The ST16 (PTT# 25849) did not transmit any data though test transmissions were recorded in Seattle from 15-21 July. Similarly, the SPOT2 showed test transmissions in Seattle on 30-31 July, prior to the field season, and on 12 August in Anchorage, the day before tagging. The first transmission from the SPOT2 on CI-0105 occurred on 16 August (Fig. 58), by which time she had traveled to the Susitna River delta (Fig. 59). She circled near the mouth of Beluga River on 21–22 August, and on 26–27 August, she remained near the mouth of the McArthur River in Trading Bay (Fig. 59). Although the NMFS aerial survey included this area on 27 August, no belugas were observed by the scientific team (Shelden et al. 2015).

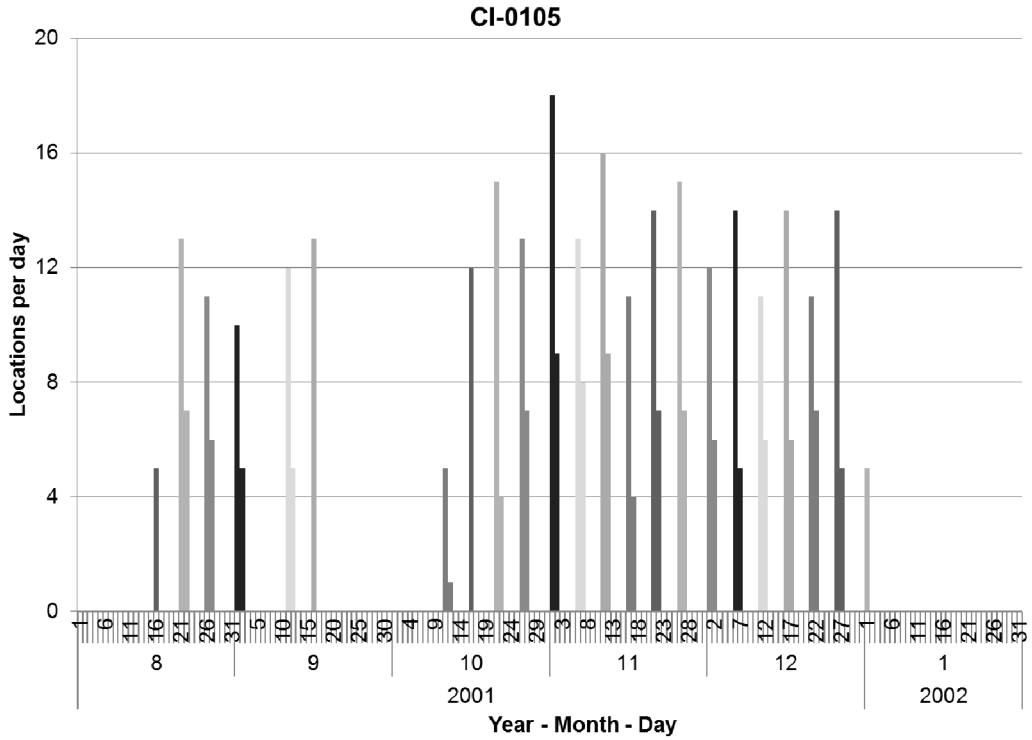


Figure 58. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0105 tagged in Cook Inlet, Alaska, 13 August 2001. Transmissions from the SPOT2 were to occur 6 days per month (1st, 6th, 11th, 16th, 21st, and 26th) for 24 hours, without collecting temperatures. A change in column color denotes transmission gaps > 1 day. Transmissions were received from mid-August 2001 into January 2002 (covering a 141-day period with 14.9 days of data usable for analysis.

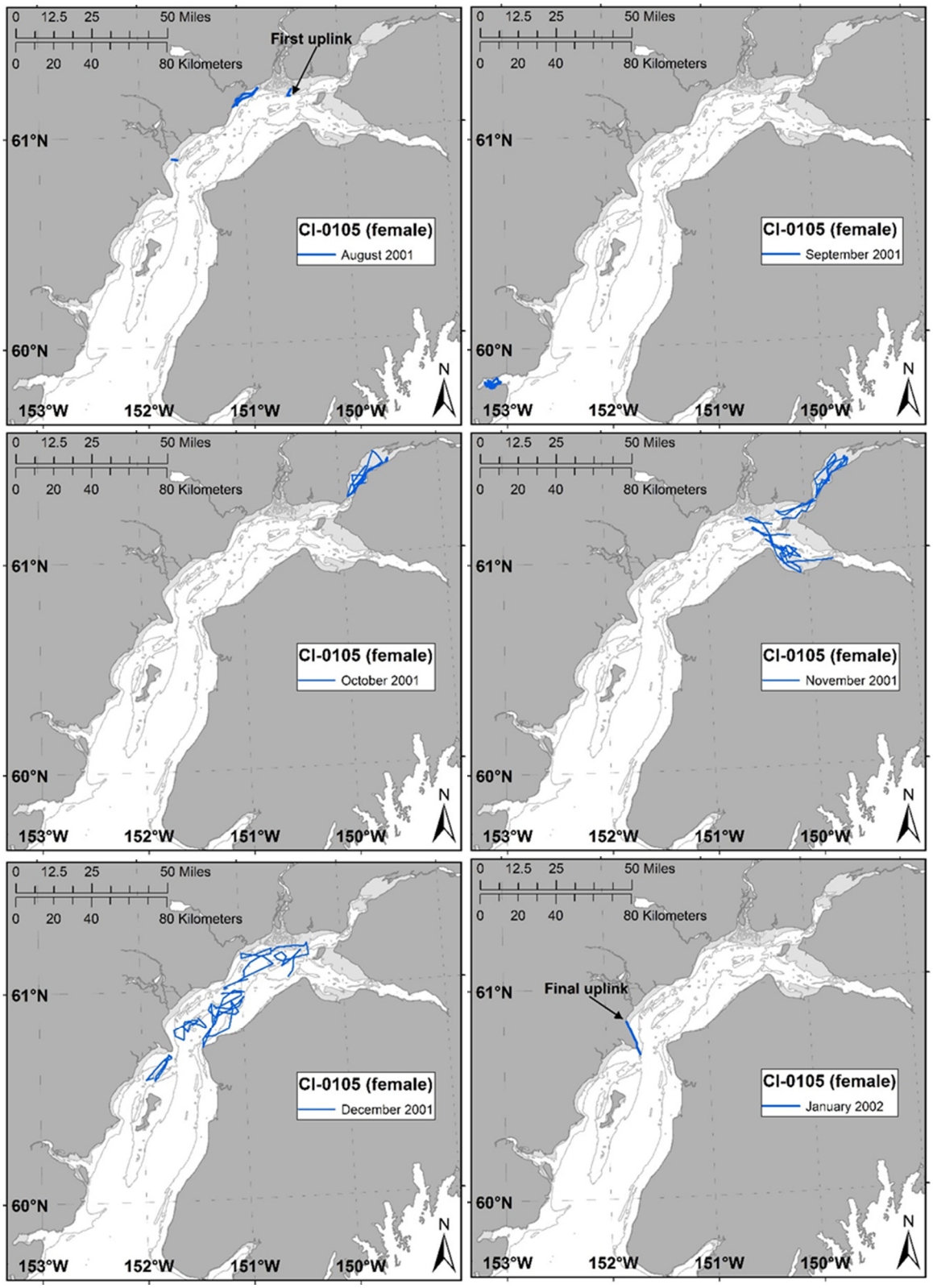


Figure 59. -- Monthly movement tracks (blue) of beluga CI-0105 tagged in Cook Inlet, Alaska, 13 August 2001. Note: SPOT2 tag was duty cycled to transmit only 6 days per month.

When transmissions resumed in September (on the 1st and 2nd), CI-0105 had travelled almost 200 km south to Chinitna Bay (Fig. 59). She was still there during transmissions on 11–12 and 16 September. No transmissions occurred on 26 September or 1 October. On 11–12 October, the SPOT2 transmissions placed CI-0105 back in Knik Arm (Fig. 59), where she was also located during transmissions on 16, 21–22, 26–27 October, and 1–2 and 6–7 November (when she began encountering compact ice (concentration of 91; Fig. 60). During transmissions on 11–12 November, she began moving back-and-forth between Knik Arm and Fire Island (Fig. 59). On 16–17, 21–22, and 26–27 November, she moved back-and-forth between the Susitna delta and Chickaloon Bay. During transmissions in December, CI-0105 moved offshore and traveled south into increasing ice concentrations (Fig. 60) before eventually entering the lower inlet (Fig. 59). She may have remained in the lower inlet during the period between the 26-27 December and the final transmissions in January. On 1 January, she approached West Foreland and reentered the upper inlet headed into Trading Bay just before transmissions ended (Fig. 59).

CI-0105 may have been among the whales present in Knik Arm during NMFS aerial surveys conducted on 12 and 15 October, and 9 November (Rugh et al. 2004; Shelden et al. 2015), and during opportunistic sightings reported those same days in October (Appendix 5), however, the tag did not transmit during those times. CI-0105 was also in the vicinity of three whales seen mid-inlet off Trading Bay on 17 December (Shelden et al. 2015, Appendix 5).

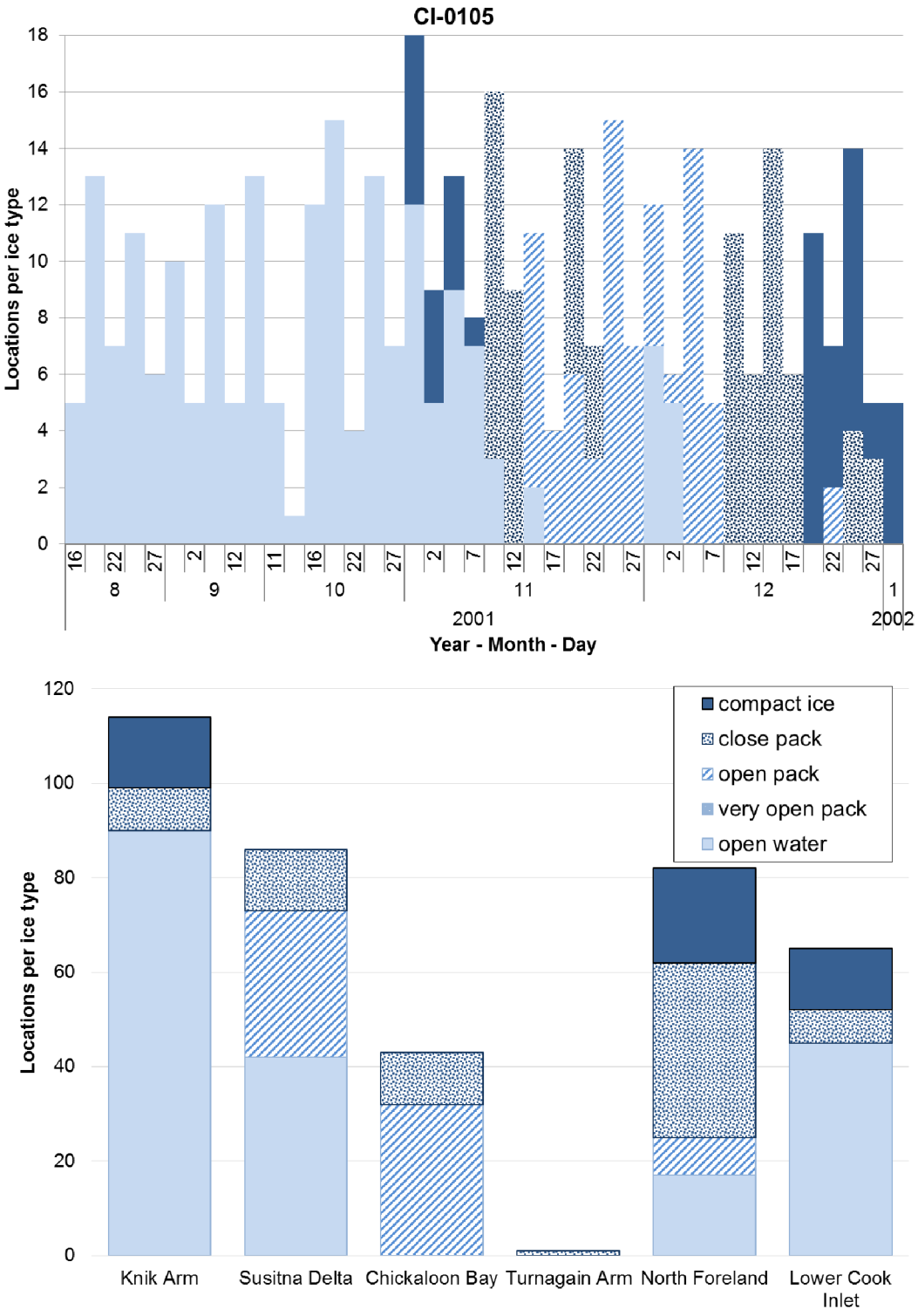


Figure 60. -- Ice associations for beluga CI-0105 tagged in Cook Inlet, Alaska, 13 August 2001. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) in each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0106

CI-0106 was captured and double tagged in Knik Arm on 15 August. Although the ST16 tag began transmitting locations the next day, the first transmission from the SPOT2 tag did not occur until 21 August (Fig. 61). The SPOT2 transmitted 6 days per month until 16 November, failed to transmit on 21 November, and sent final transmissions on 26–27 November. The ST16 tag transmitted daily until it began to fail on 17 November and, after a period of 10 days without transmitting, sent final transmissions on 28 November.

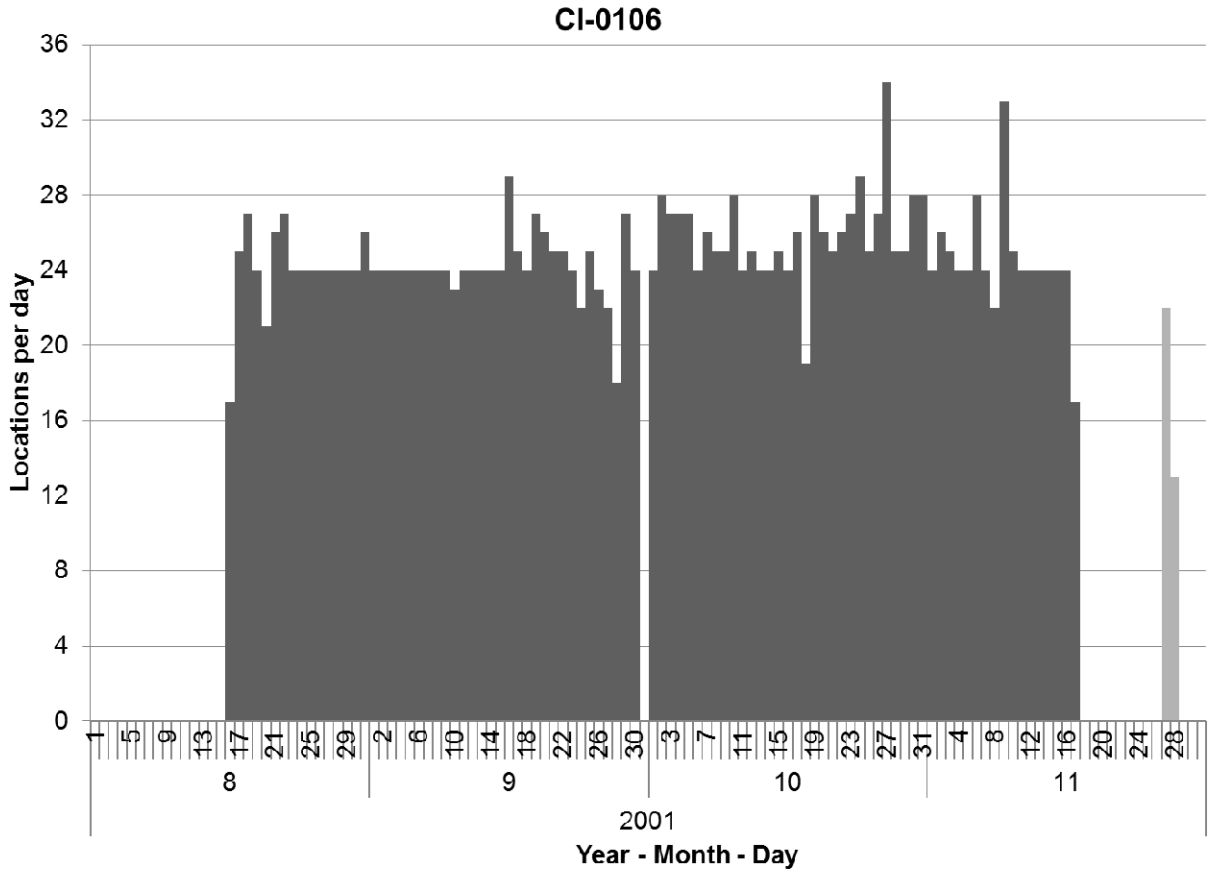


Figure 61. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0106 tagged in Cook Inlet, Alaska, 15 August 2001. The ST16 was programmed to uplink daily. Transmissions from the SPOT2 were to occur 6 days per month (1st, 6th, 11th, 16th, 21st, and 26th) for 24 hours, without collecting temperatures. A change in column color denotes transmission gaps > 1 day. Transmissions were received from mid-August 2001 into November 2001 (covering 105 days with 94.7 days of usable data for analysis).

CI-0106 remained in Knik Arm until 21 August. She may have been among groups of 10 and 20 whales seen on 20 August, and groups of 15 and 20 whales seen on the 21 August (Shelden et al. 2015, Appendix 5). Around noon she exited the Arm and headed into the Susitna River delta (Fig. 62) where she remained until 22 August. Around 04:00 h, she reentered Knik Arm briefly before returning to the Susitna River delta by 08:30 h. She moved back-and-forth between the Susitna River delta and waters off Trading Bay before entering the lower inlet for brief period on 28 August (at 04:00 h returning at 08:00 h), 29 August (at 04:00 h returning at noon), and 31 August (at 06:00 h returning at 08:00 h). NMFS aerial survey observers saw her swimming south by herself in mid-inlet waters off Trading Bay on 27 August (Shelden et al. 2015).

By 1 September, CI-0106 returned to the Susitna River delta, swimming back to waters south of North Foreland on 2 September. She returned again to the Susitna River delta on 4 September. On 6 September at 02:00 h, she rounded the north tip of Fire Island and entered Chickaloon Bay (Fig. 62). CI-0106 was near Point Possession on 8 September when ~50 whales were seen (Appendix 5). She stayed in Chickaloon Bay until 12 September when she entered Turnagain Arm. She briefly returned to Chickaloon Bay on 17 September at 19:00 h before reentering Turnagain Arm at 03:00 h on 18 September. She may have been among whales observed by the NMFS aerial team on 15 and 18 September, and ~20 whales reported in Turnagain Arm on the 19th (Shelden et al. 2015, Appendix 5). On 25 September, CI-0106 returned to Chickaloon Bay, staying until 28 September when she entered Turnagain Arm around 09:00 h. She crossed to Beluga Point around 18:00 h and followed the northern shoreline around Point Campbell arriving in Knik Arm at 04:00 h on 29 September (Fig. 62).

CI-0106 remained in Knik Arm until 10 October when she returned to Chickaloon Bay. She entered Turnagain Arm on 16 October, then departed the next day and returned to Knik Arm where she remained for the rest of the month (Fig. 62). Although CI-0106 was present, NMFS aerial observers did not find whales in Chickaloon Bay during surveys on 12 and 15 October (Shelden et al. 2015).

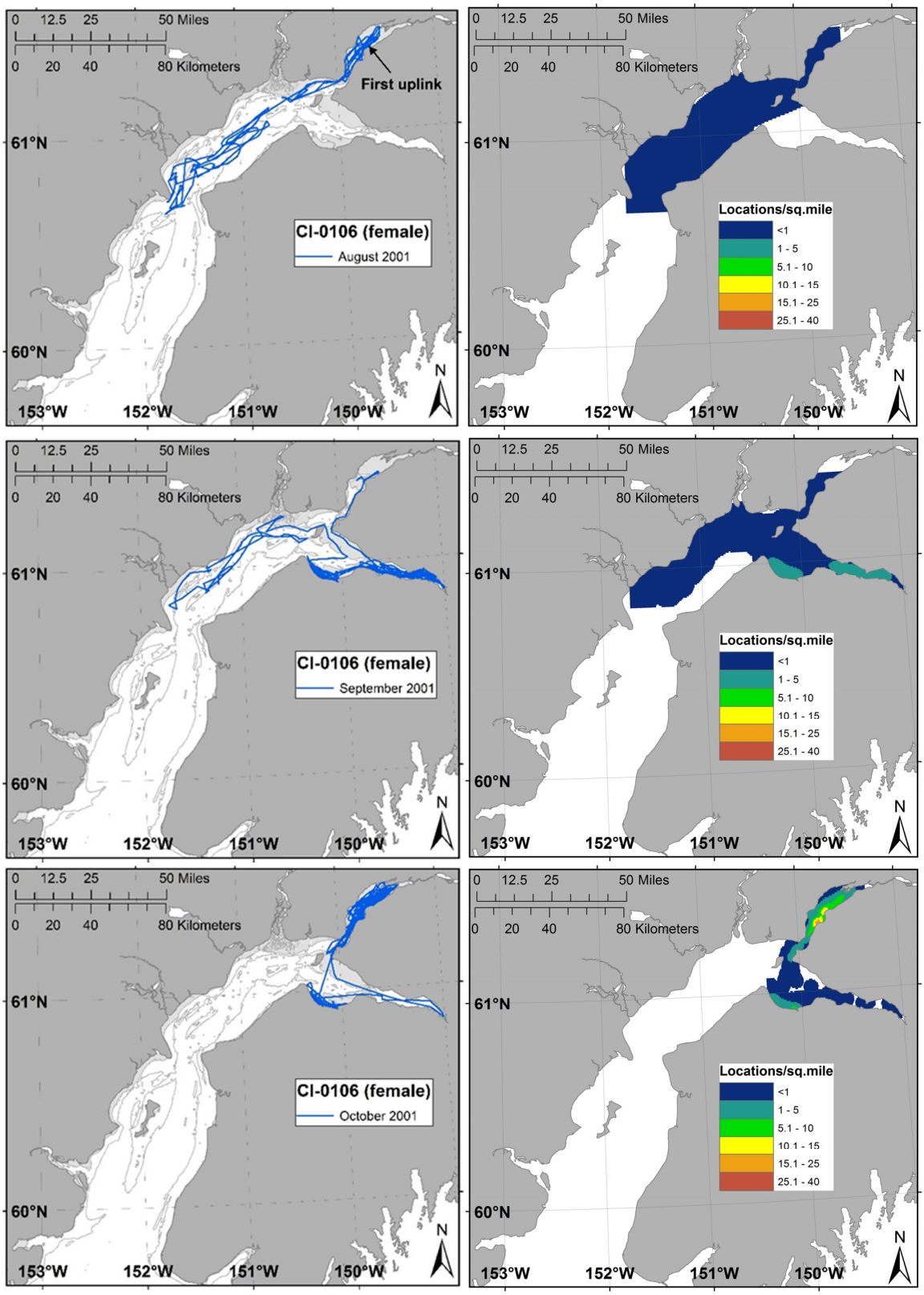


Figure 62. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of beluga CI-0106 tagged in Cook Inlet, Alaska, 15 August 2001.

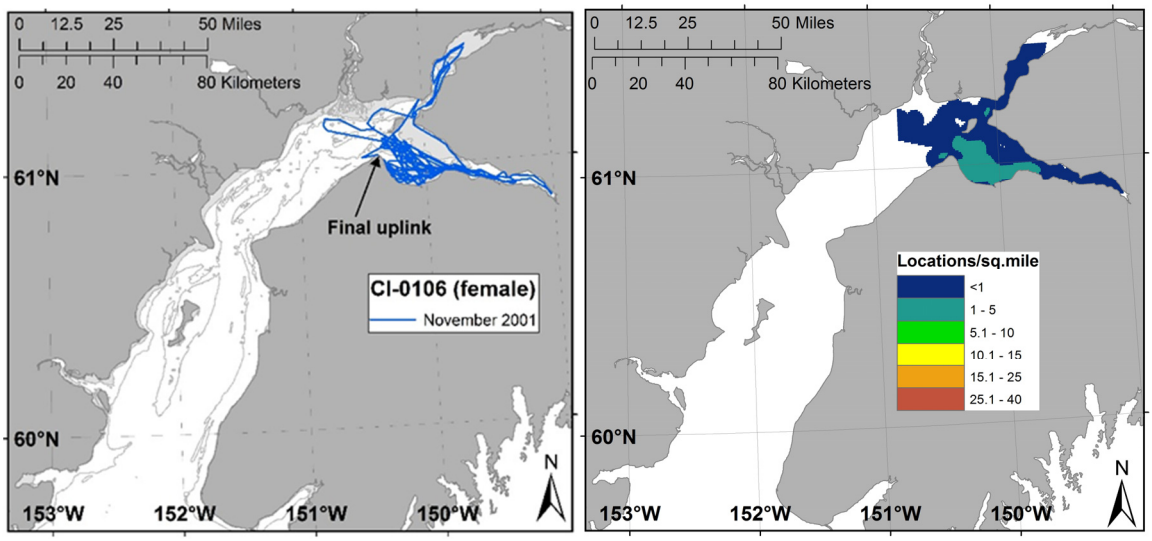


Figure 62. --Cont.

She returned to Chickaloon Bay on 2 November after encountering compact ice (concentration of 91) in Knik Arm (Fig. 63), and spent most of her time moving between Chickaloon Bay and Turnagain Arm, where 65 whales were seen on 5 November and NMFS aerial observers recorded whales on 9 November (Shelden et al. 2015). She swam between Chickaloon Bay and Susitna River delta (within a day) on 12, 14-15, and 16 November, moving through open pack (concentration of 57) and close pack ice (concentration of 79), and had entered the Susitna River delta on 17 November when the ST16 tag began to fail. She was in Chickaloon Bay moving between Fire Island and Point Possession when the final transmissions from ST16 and the SPOT2 occurred on 27–28 November (Fig. 62).

Dive data from the ST16 tag show CI-0106 began diving deeper and for longer periods between the Susitna River delta, North Foreland, and Point Possession near the end of November (Fig. 64). Prior to that, average dive depth and duration tended to be shallower (< 4 m) and shorter (< 2 minutes). This behavior was similar to that observed for the two whales tagged in 2000.

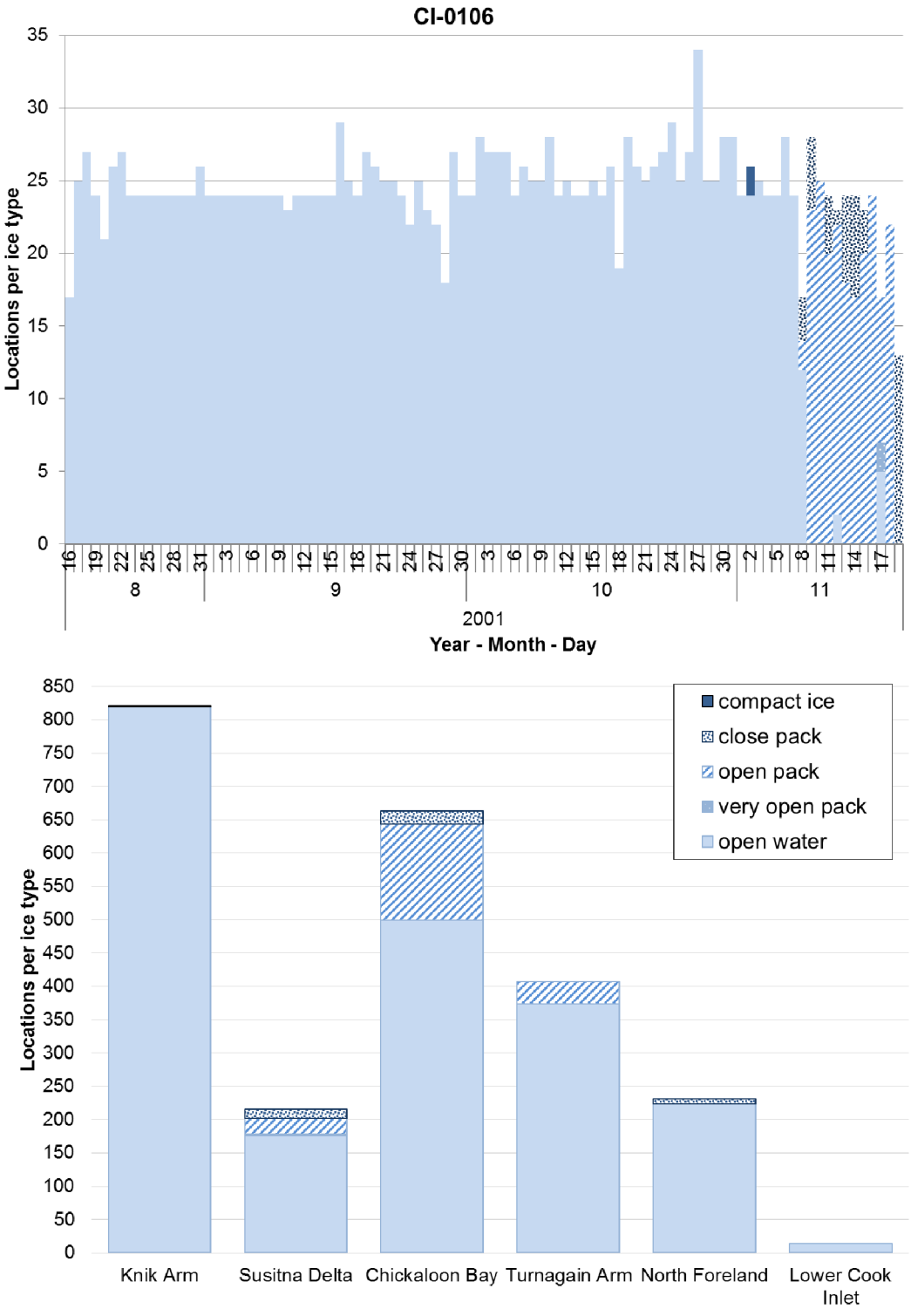


Figure 63. -- Ice associations for beluga CI-0106 tagged in Cook Inlet, Alaska, 15 August 2001. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) in each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

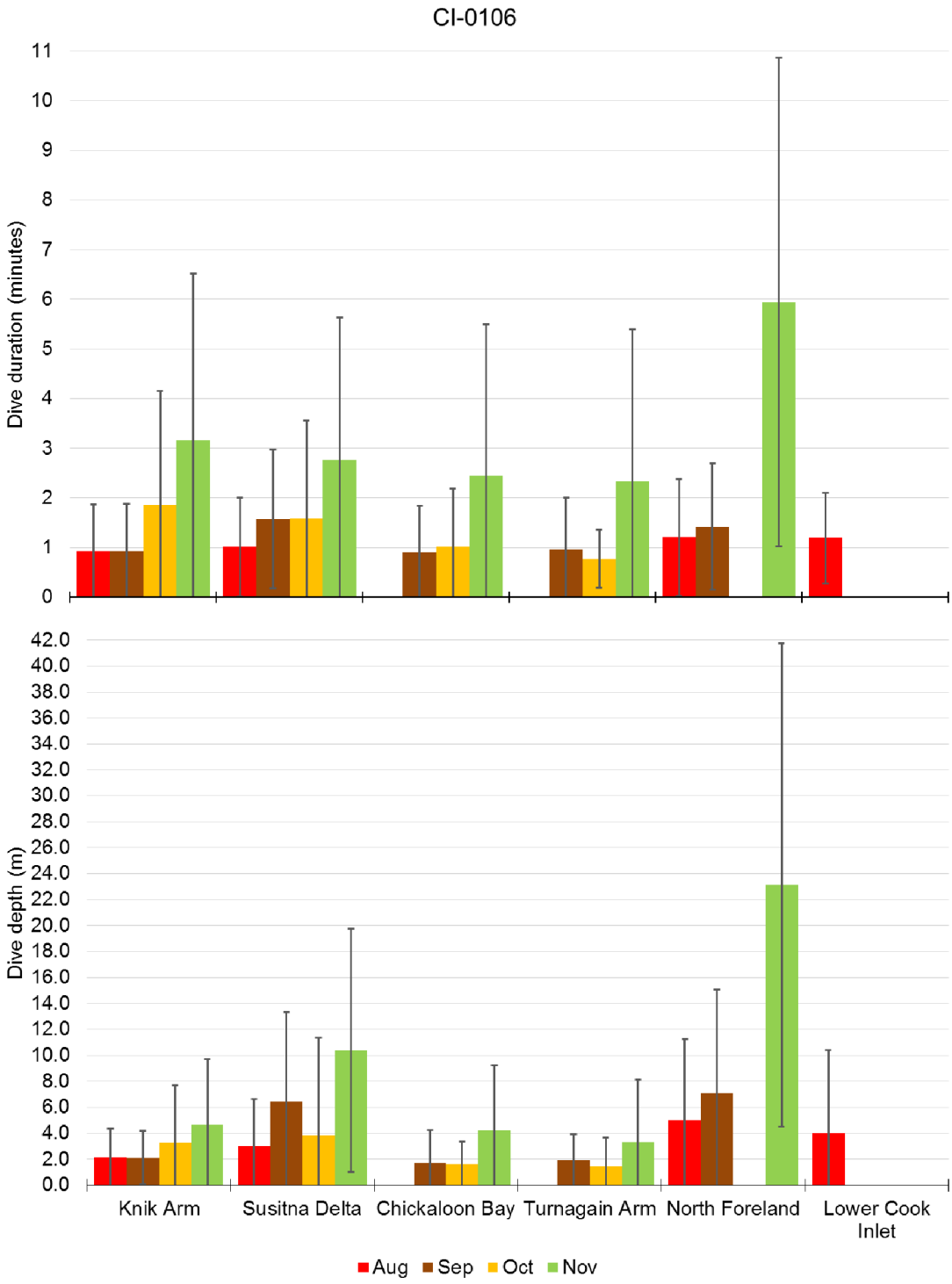


Figure 64. -- Monthly dive behavior of beluga CI-0106 tagged in Cook Inlet, Alaska, 15 August 2001. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0107

CI-0107 was captured and double-tagged in Knik Arm on 20.August 2001. The ST16 tag began transmitting locations the next day and continued to transmit until 9 March 2002 (covering 201 days with 200.3 days of usable data for analysis). This was the first documentation of movement and dive behavior for a Cook Inlet beluga through winter and into early spring (Fig. 65). The first transmission from the SPOT2 did not occur until 21 September. This tag was programmed to transmit 6 days per month (1st, 6th, 11th, 16th, 21st, and 26th) for 24 hours, without collecting temperatures. The SPOT2 failed to transmit on 26 September when CI-0107 was in the Susitna River delta, but afterward consistently transmitted as programmed until 6 January 2002.

When the ST16 tag began transmitting on 21 August, CI-0107 was in Knik Arm along with two of the females (CI-0103 and CI-0106), while CI-0105 (another female) was in the Susitna River delta. CI-0101, CI-0102, and CI-0104 were not transmitting locations at this time. CI-0107 remained in Knik Arm until 27 August, when he rounded Point MacKenzie and circled the Susitna River delta before returning to Knik Arm on 28 August (Fig. 65). By that time CI-0106 had travelled to the lower inlet (CI-0101, CI-0102, CI-0103, and CI-0105 were not transmitting locations).

CI-0107 repeated a similar pattern in September, departing Knik Arm on 24 September, this time going as far west as Beluga River in the Susitna River delta before returning to Knik Arm on 29 September (Fig. 65), often in tandem with CI-0103 when her tag was transmitting. Although CI-0103 did not return to Knik Arm on the 29th, CI-0106 did that day after having spent September in Chickaloon Bay/Turnagain Arm (Appendix 5). CI-0107 remained in Knik Arm for the entire month of October (Fig. 65). All of the tagged whales transmitted locations in Knik Arm during this month, although some also spent time in Chickaloon Bay/Turnagain Arm (CI-0101, CI-0102, and CI-0106).

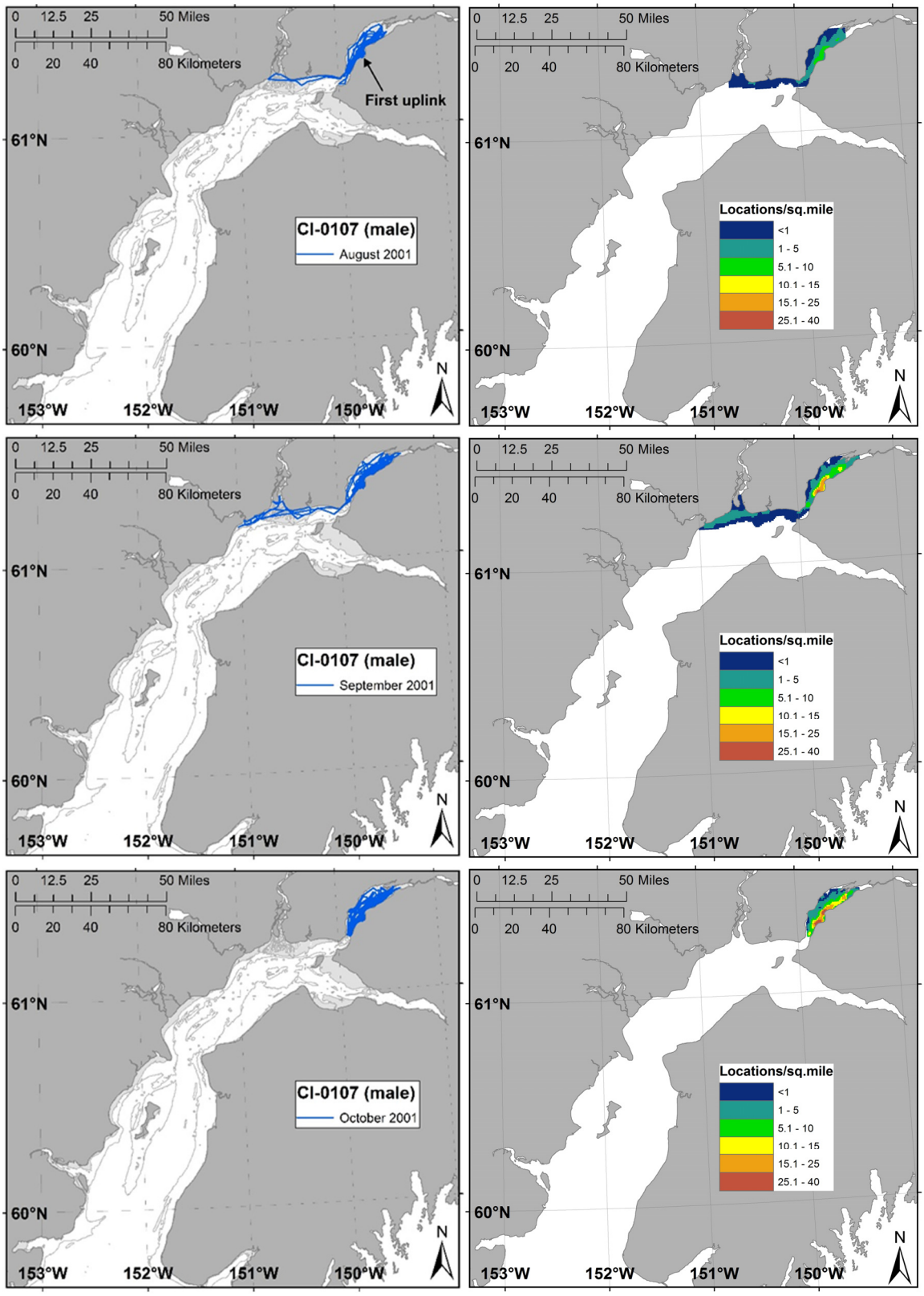


Figure 65. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of beluga CI-0107 tagged in Cook Inlet, Alaska, 20 August 2001.

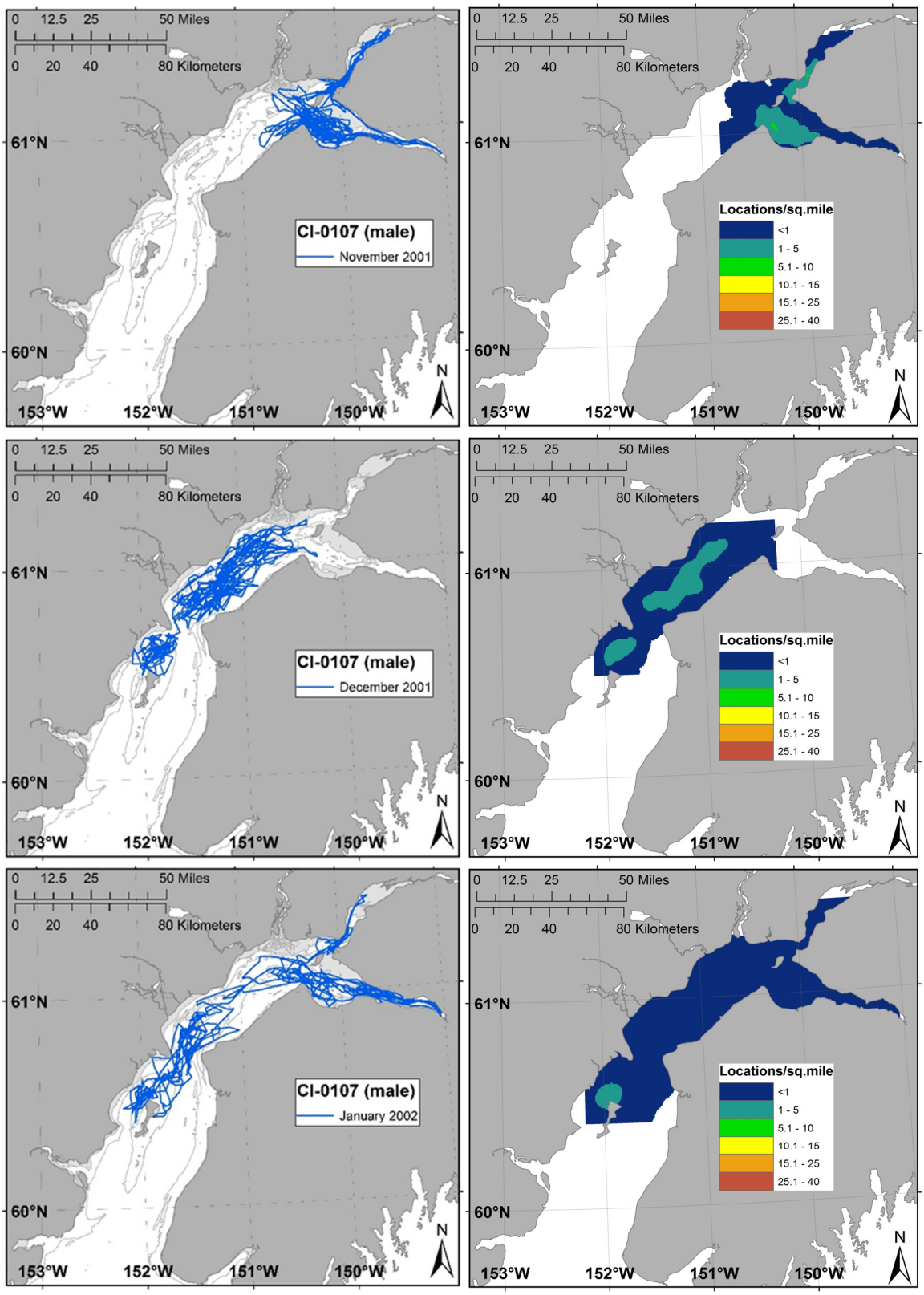


Figure 65. -- Cont.

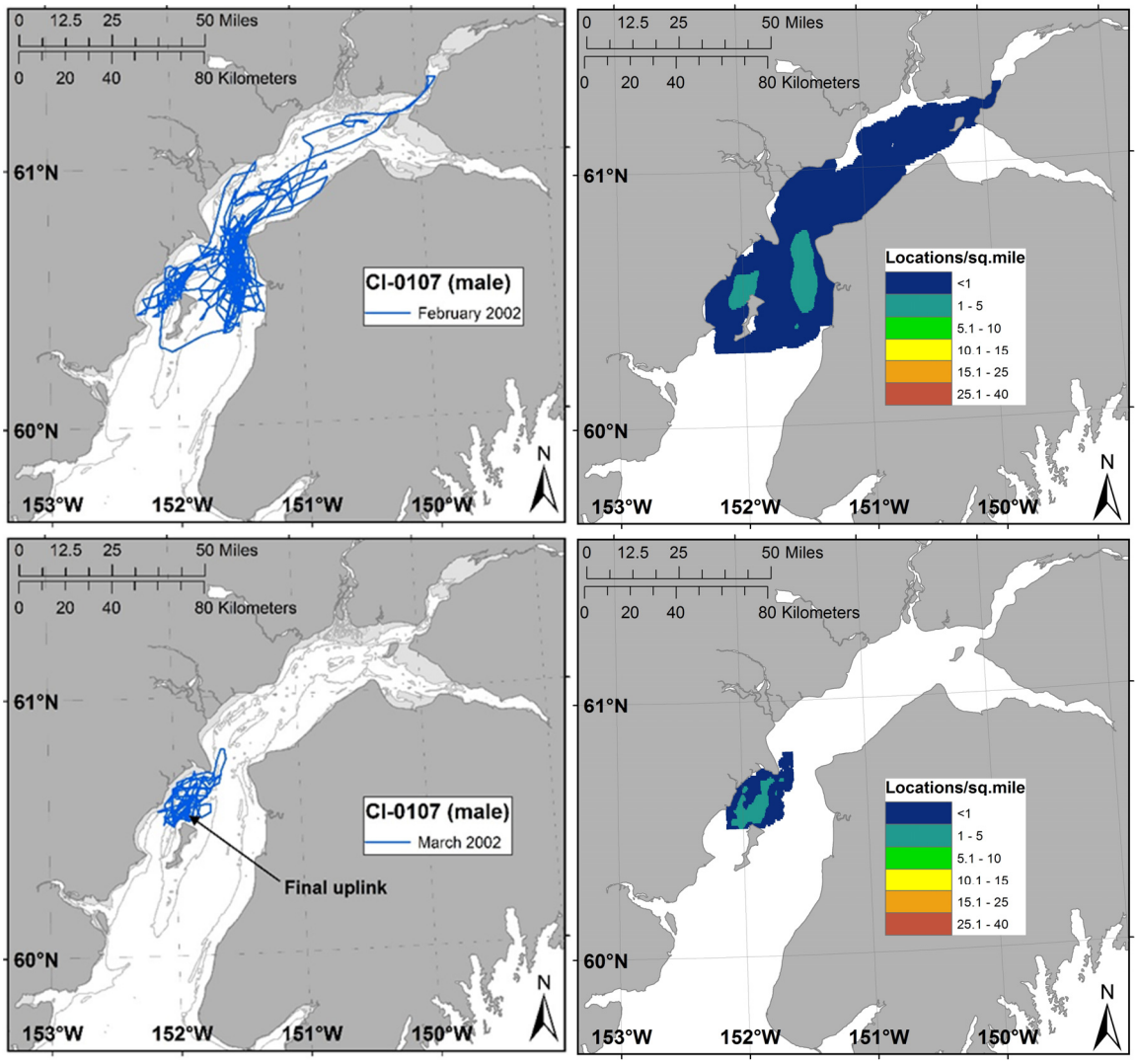


Figure 65. -- Cont.

On 2 November, CI-0107 left Knik Arm with CI-0106 (and possibly CI-0103), rounded Point Campbell, and entered Chickaloon Bay then Turnagain Arm (Fig. 65). He returned to Chickaloon Bay on 3 November, made brief trips into Turnagain Arm on 6 and 7 November (leaving CI-0106 (and possibly CI-0103) in Chickaloon Bay that day), before returning to Knik Arm at 23:00 h on 7 November, joining CI-0105. CI-0103 and CI-0106 swam in tandem into Turnagain Arm on 9 November. CI-0107 made a series of short trips between Fire Island, Point MacKenzie, and Knik Arm, with CI-0105 (when her SPOT2 tag was transmitting) encountering close pack and compact ice (Fig. 66), until 12 November when he returned to Chickaloon Bay and joined CI-0106. From here, he made a series of short trips into the Susitna River delta on 15, 16, and 17 November, at times with CI-0106 and CI-0105.

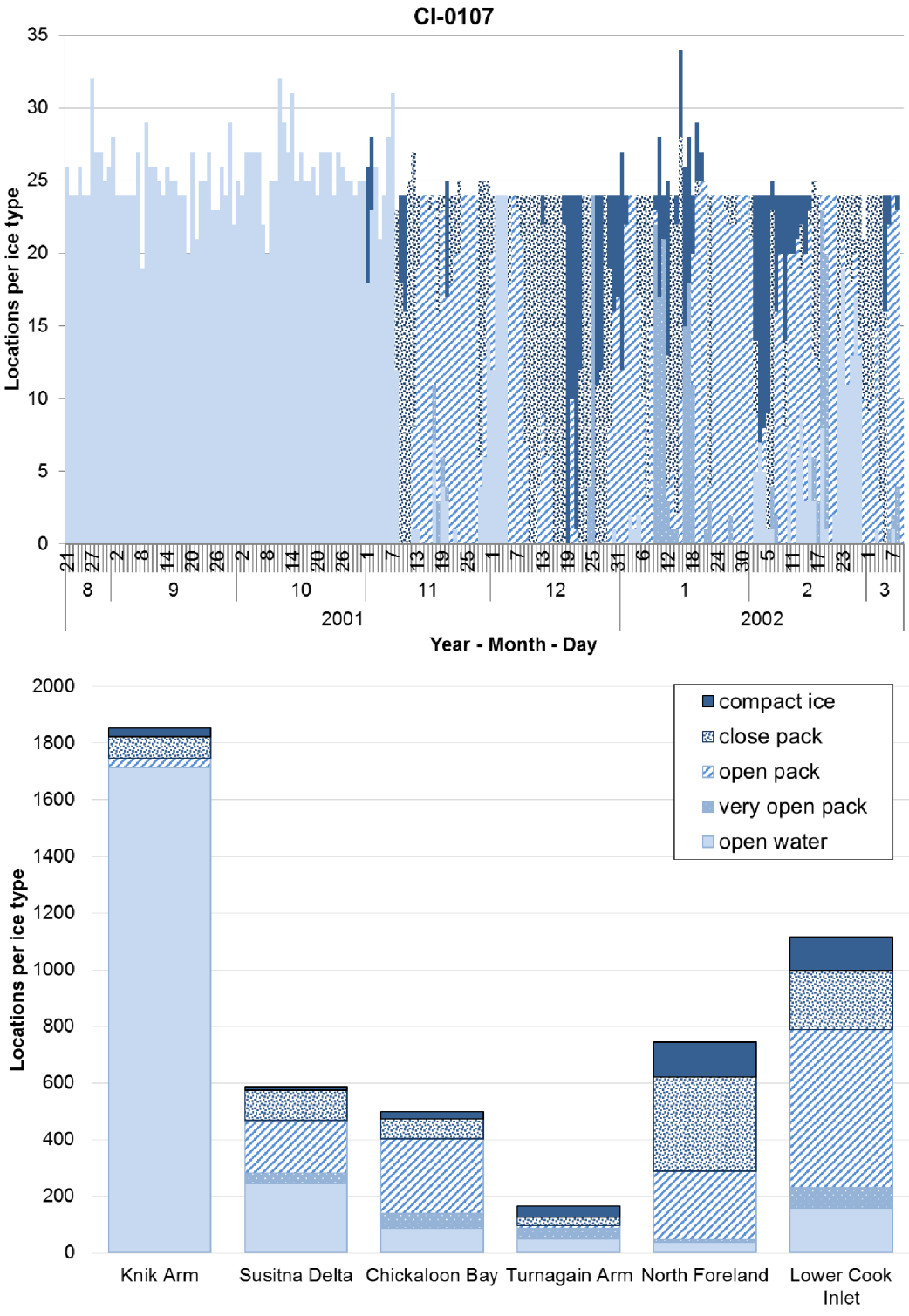


Figure 66. -- Ice associations for beluga CI-0107 tagged in Cook Inlet, Alaska, 20 August 2001. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) in each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0107 returned briefly to Knik Arm on 18 November, then back to Chickaloon Bay via the west coast of Fire Island and Point Possession on 19 November, joining CI-0101 and CI-0103. He repeated a similar pattern throughout the rest of month with short trips to the Susitna River delta each day from 20 to 23 November, to Knik Arm on 23 November, to Chickaloon Bay on 24 November, and back-and-forth between Chickaloon Bay and the Susitna River delta each day from 26 to 28 November. He then began short trips between Chickaloon Bay and south of Point Possession each day from 28 to 30 November. During this period, the sporadic transmissions from the other tagged whales were closely associated with CI-0107's movements.

After a final short trip into Chickaloon Bay on 1 December, CI-0107 spent most of December in offshore waters of the Susitna River delta and south of Point Possession and North Foreland (Fig. 65) in close pack ice (45% of the 744 modelled locations in December; Fig. 66). He entered lower Cook Inlet briefly (for about an hour) on 20 December before returning to Trading Bay. He returned to the lower inlet again on 24 December and remained in Redoubt Bay north of Kalgin Island until the end of the month. His locations overlapped with CI-0105 during the periods when transmissions were recorded from her SPOT2 tag. Because she did not have an ST16 tag, we cannot be sure if they were together the entire time.

On 1 January, both whales rounded West Foreland headed into Trading Bay around 16:00 h (Fig. 65). CI-0107 returned to the lower inlet within the hour and CI-0105 continued into Trading Bay and was approaching the McArthur River when her last location was recorded. CI-0107 moved back-and-forth between the lower inlet near the Forelands and deeper water east of Trading Bay until 8 January when he returned to the Susitna River delta. He circled north of Point Possession before entering Chickaloon Bay, then Turnagain Arm, on the 10th. He followed this pattern back-and-forth between Point Possession and Turnagain Arm until 19 January when he swam north along the western shore of Fire Island and entered Knik Arm. He swam back-and-forth between Fire Island and Knik Arm before returning to Point Possession on 21 January. He continued to make circuits back-and-forth in the waters south of Point Possession and North Foreland, moving south. He was likely among beluga whales observed during NMFS aerial surveys on 22 January, and although whales were not seen by the aerial team on the 23rd, tag transmissions show CI-0107 was in the upper inlet near Trading Bay (Fig. 65) in open pack ice (concentration of 68; Fig. 66), in an area surveyed by NMFS that day (Rugh et al. 2004, Shelden

et al. 2015). On 25 January, 30 beluga whales were seen by workers on the Grayling Oil platform in Trading Bay, an area where tag transmissions also occurred that day (Appendix 5). The whales were in an open patch of water within the ice, swimming north on the incoming tide (Shelden et al. 2015). CI-0107 circled into the lower inlet and back to waters north of East and West Foreland on 26 and 27 January before he returned to the lower inlet where he stayed until 2 February.

From 2 to 5 February, CI-0107 continued to circle back-and-forth between East and West Foreland and the northern tip of Kalgin Island (Fig. 65). At 05:00 h on the 5th, he swam through the Forelands heading north and arrived in the Susitna River delta around noon. He circled there until about 07:00 h on 6 February then entered Knik Arm. At 14:00 h, he swam south out of Knik Arm, circled in waters south of North Foreland off Trading Bay before entering the lower inlet on the 7th. He continued to circle back-and-forth between Kalgin Island and East and West Foreland, circling in Redoubt Bay, crossing to the shore between the Kenai and Kasilof rivers, with brief trips into Trading Bay before returning to the lower inlet. NMFS aerial survey observers did not see whales on 25 and 26 February (Rugh et al. 2004, Shelden et al. 2015). Although tag transmissions from CI-0107 overlapped spatially with parts of the surveyed areas in the lower inlet, he appeared to be in open waters west of the Kenai River more than 10 km from the closest trackline at the time of the survey (Fig. 65).

During March, with the exception of one brief trip north of West Foreland on the morning of 5 March, CI-0107 stayed in the lower inlet in Redoubt Bay (Fig. 65). He remained north of Kalgin Island, most often in open pack and close pack ice (54% and 37% of modelled locations, respectively; Fig. 66), until the ST16 tag stopped transmitting on 9 March (Fig. 65). Battery voltage readings were similar to the whales tagged in 2000 at the time their tags stopped transmitting (Appendix 7).

Similar to CI-0106, CI-0107 began diving for longer periods and deeper in late November in the waters south of North Foreland/Point Possession (Fig. 67). Deeper and longer duration dives on average occurred in all areas of the upper and lower inlet visited by CI-0107 in January. This behavior continued into early March when he was located in lower inlet waters (Fig. 67). We've included monthly density plots for all whales tagged in 2001 when more than one whale's tag was transmitting locations (Fig. 68). Only CI-0107 continued to transmit locations into February and March.

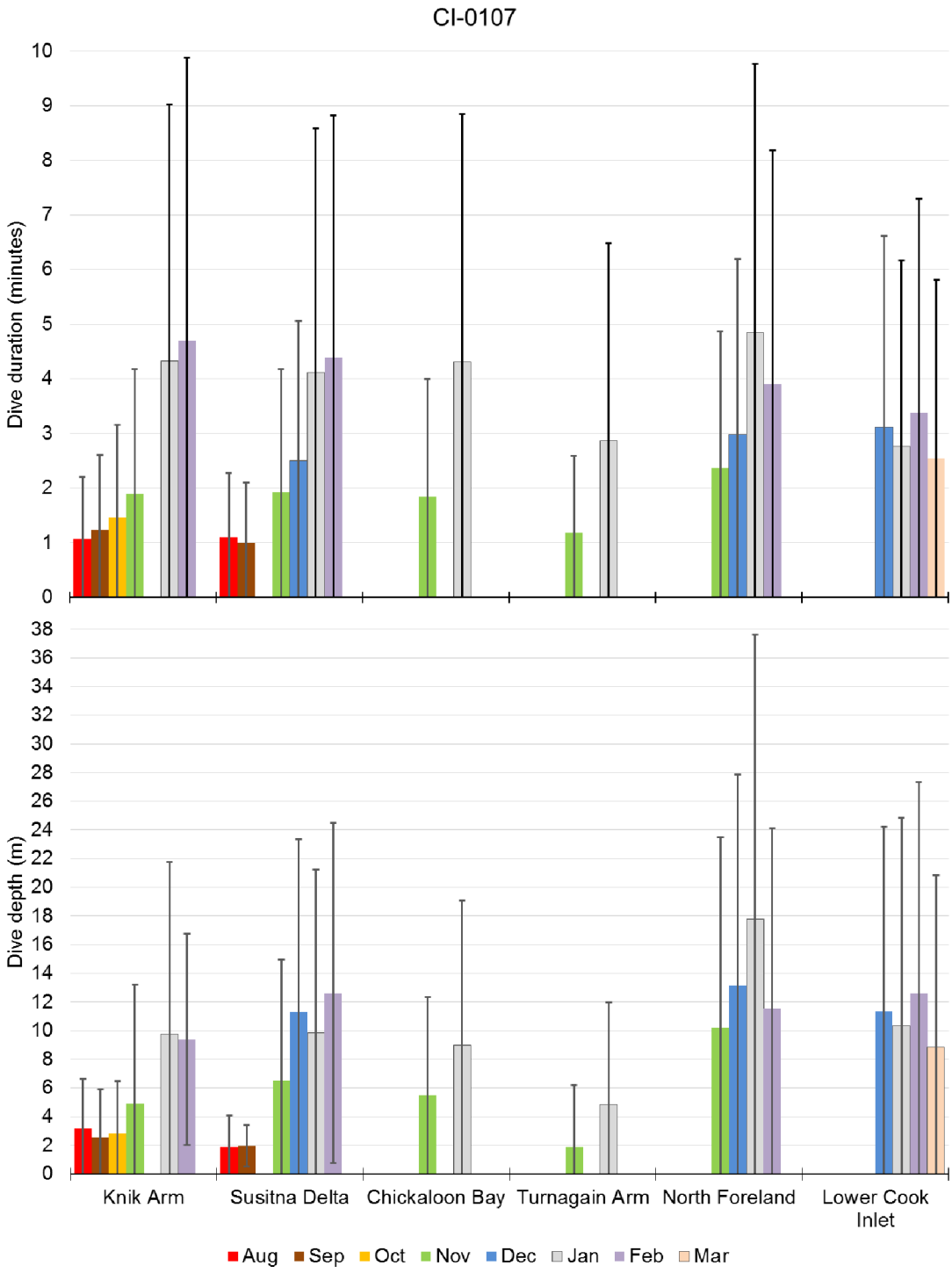


Figure 67. -- Monthly dive behavior of beluga CI-0107 tagged in Cook Inlet, Alaska, 20 August 2001. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

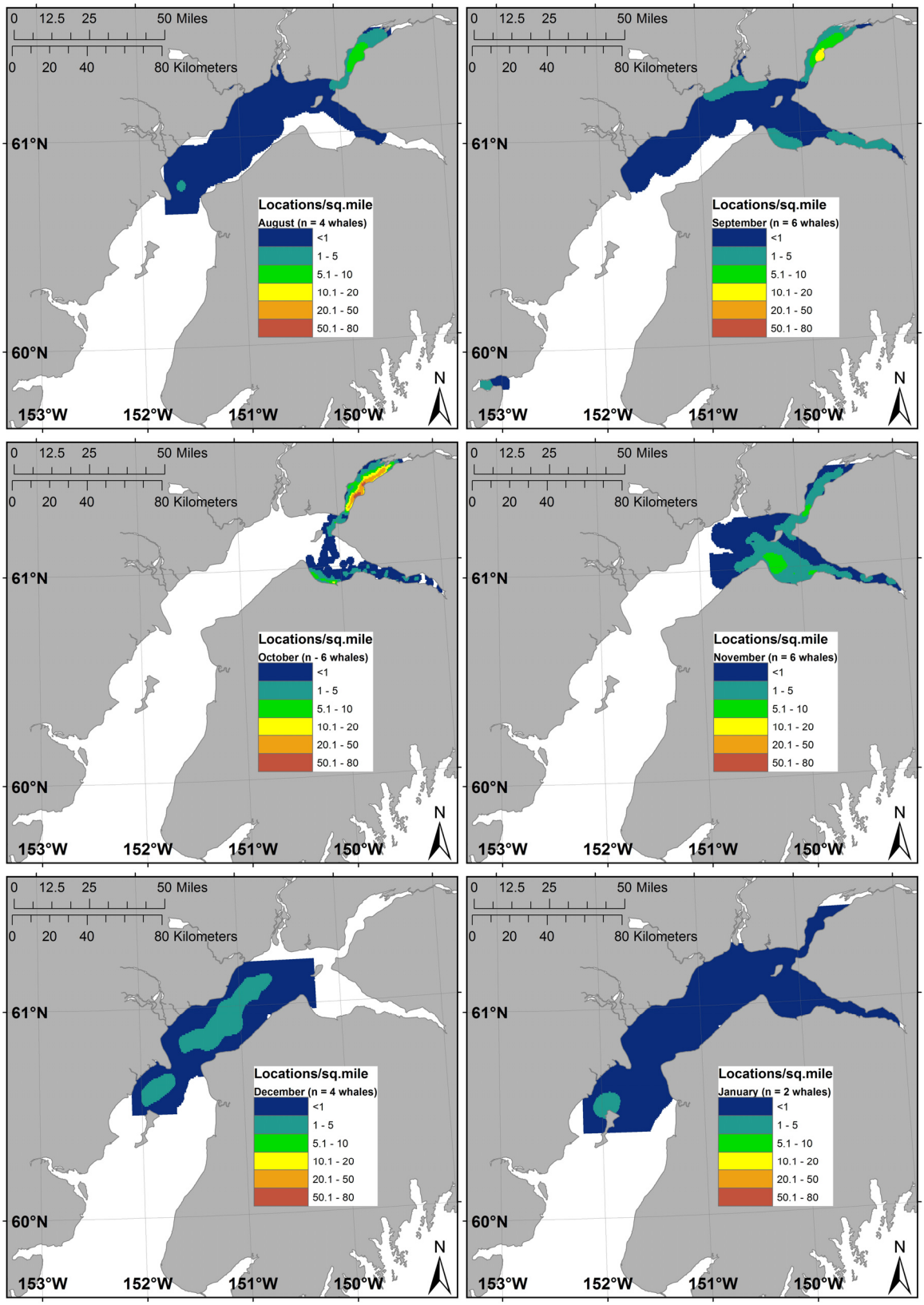


Figure 68. -- Monthly density (low to high kernel of modelled locations per sq. mile) for Cook Inlet beluga whales satellite-tagged in 2001 when more than one whale was transmitting locations.

2002 Tagging Results

Whales tagged during the 2002 season provided further documentation of movements during summer (late July-August), autumn (September-November), and winter (December-February), and extended the spring coverage from early March to late May (Table 3). This was the first documentation of habitat use during all four seasons, and like 2001, all whales remained within Cook Inlet (Fig. 69). Unlike 2001, when whales began encountering ice in the upper inlet in early November, or 2000 when ice began to form by the first week in December, the first appearance of ice in 2002 did not occur until the end of December (Fig. 70, Appendix 12). By this time, only 3 of the 8 tags were still transmitting locations (Table 3). Individual location density plots (see section on each respective whale) were created only for whales with ST16 tags that transmitted more than 2 days after deployment (CI-0201, CI-0203, CI-0205, CI-0206, and CI-0208). SPOT2 tags were not used in 2002, instead whales were tagged with either a two-battery or four-battery ST16 tag (Table 3).

Table 3. -- Satellite tags deployed on belugas in Cook Inlet, Alaska, during the 2002 capture and tagging season.

Whale ID	PTT#	ST16 batteries	Last transmission	Comments
CI-0201	25850	4	31 October 2002	
CI-0202	30719	4	31 August 2002	> 2 days of transmissions (see text)
CI-0203	13943	2	24 August 2002	
CI-0204	25849	4	3 August 2002	Died. Floating carcass identified on 9 Aug. 2002
CI-0205	13947	2	1 April 2003	
CI-0206	13948	2	22 March 2003	
CI-0207	30720	4	5 August 2002	> 2 days of transmissions (see text)
CI-0208	25847	2	26 May 2003	

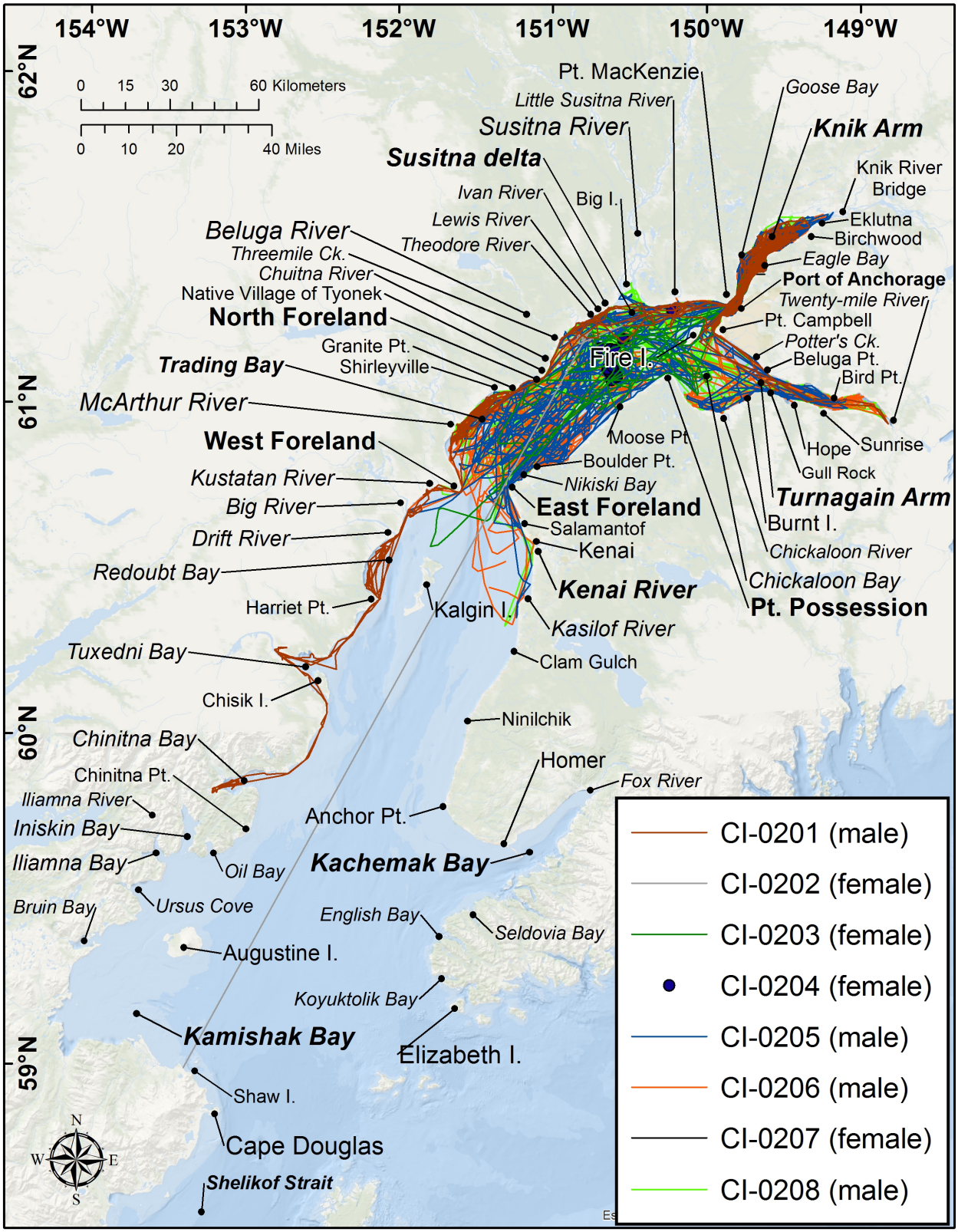


Figure 69. -- Satellite-linked modelled tracks from belugas tagged in Cook Inlet, Alaska, in late July and early August 2002. Tags attached to CI-0202 (female), CI-0204 (female), and CI-0207 (female) transmitted > 2 days post-tagging (see text).

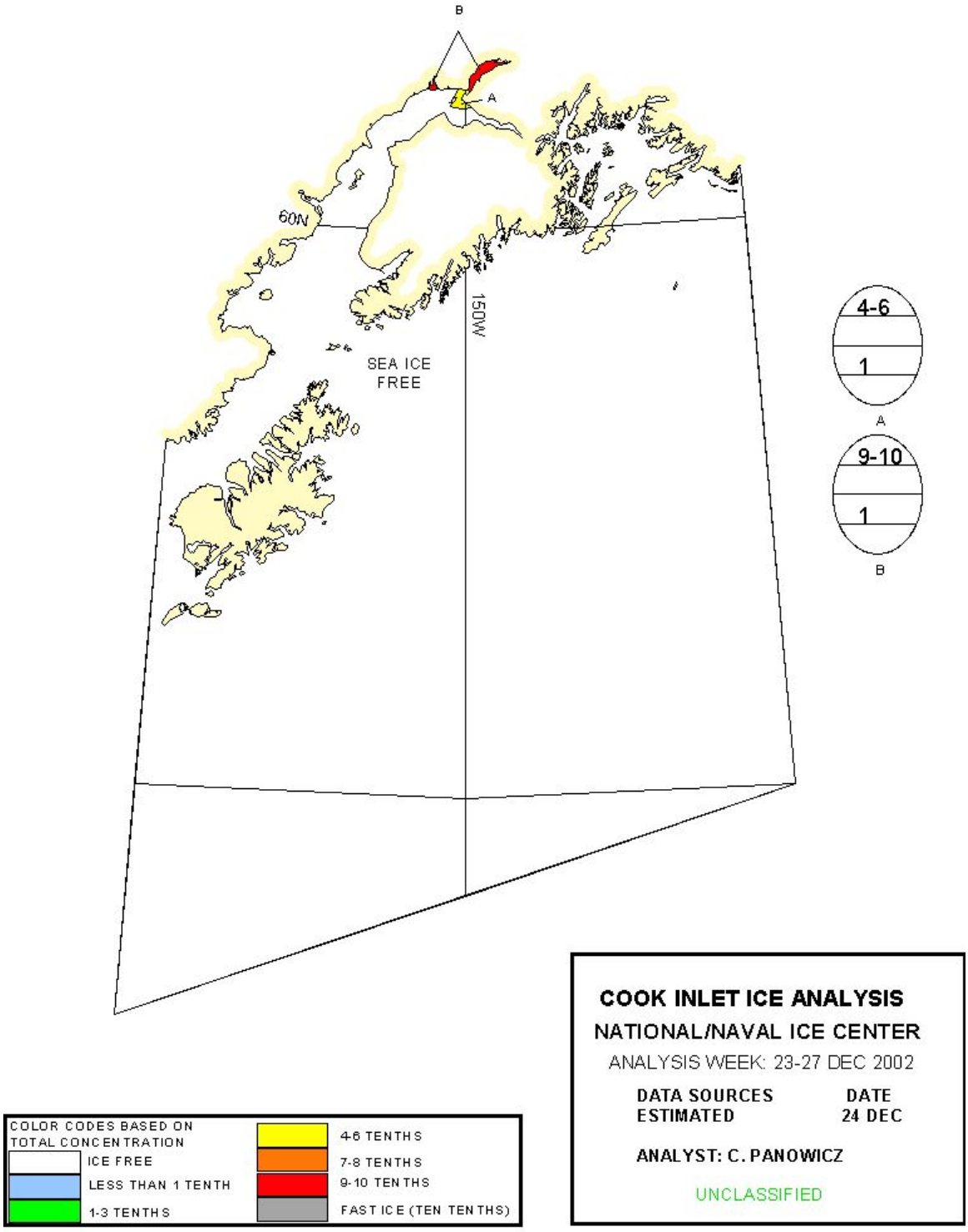


Figure 70. -- First appearance of ice in Cook Inlet, Alaska, in 2002 (image from the U.S. National Ice Center/Naval Ice Center http://www.natice.noaa.gov/products/weekly_products.html accessed 3 Oct. 2016). The "egg code" shows the total concentration in tenths for area A (4-6) and B (9-10), and the stage of development (1 = new ice). (http://www.natice.noaa.gov/products/egg_code.html)

CI-0201

The first whale of the 2002 field season was captured and tagged at the mouth of the Little Sustina River on 29 July. The four-battery ST16 tag began transmitting locations that same day and continued transmitting, with only two breaks of more than a day, until 31 October (Fig. 71).

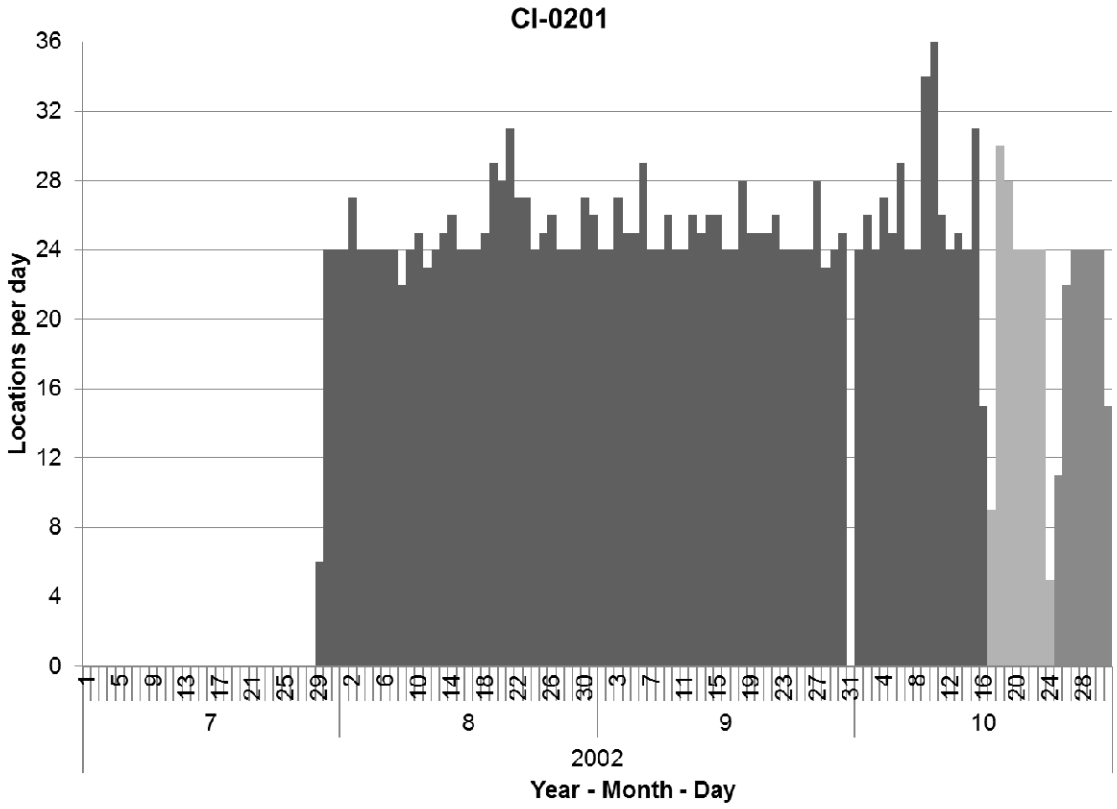


Figure 71. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0201 tagged in Cook Inlet, Alaska, 29 July 2002. A change in column color denotes transmission gaps > 1 day. Transmissions were received from the end of July to the end of October 2002 (covering 94 days with 91.5 days of data available for analysis).

CI-0201 remained in the Susitna delta until 2 August when he rounded the north tip of Fire Island, briefly entering Chickaloon Bay before heading north into Knik Arm (Fig. 72). He moved throughout Knik Arm for most of the month of August, departing on 21 August around noon to swim the length of Turnagain Arm before returning to Knik Arm at 05:00 h on 23 August. He made a similar circuit to the Little Susitna River on 25-26 August then returned to Knik Arm.

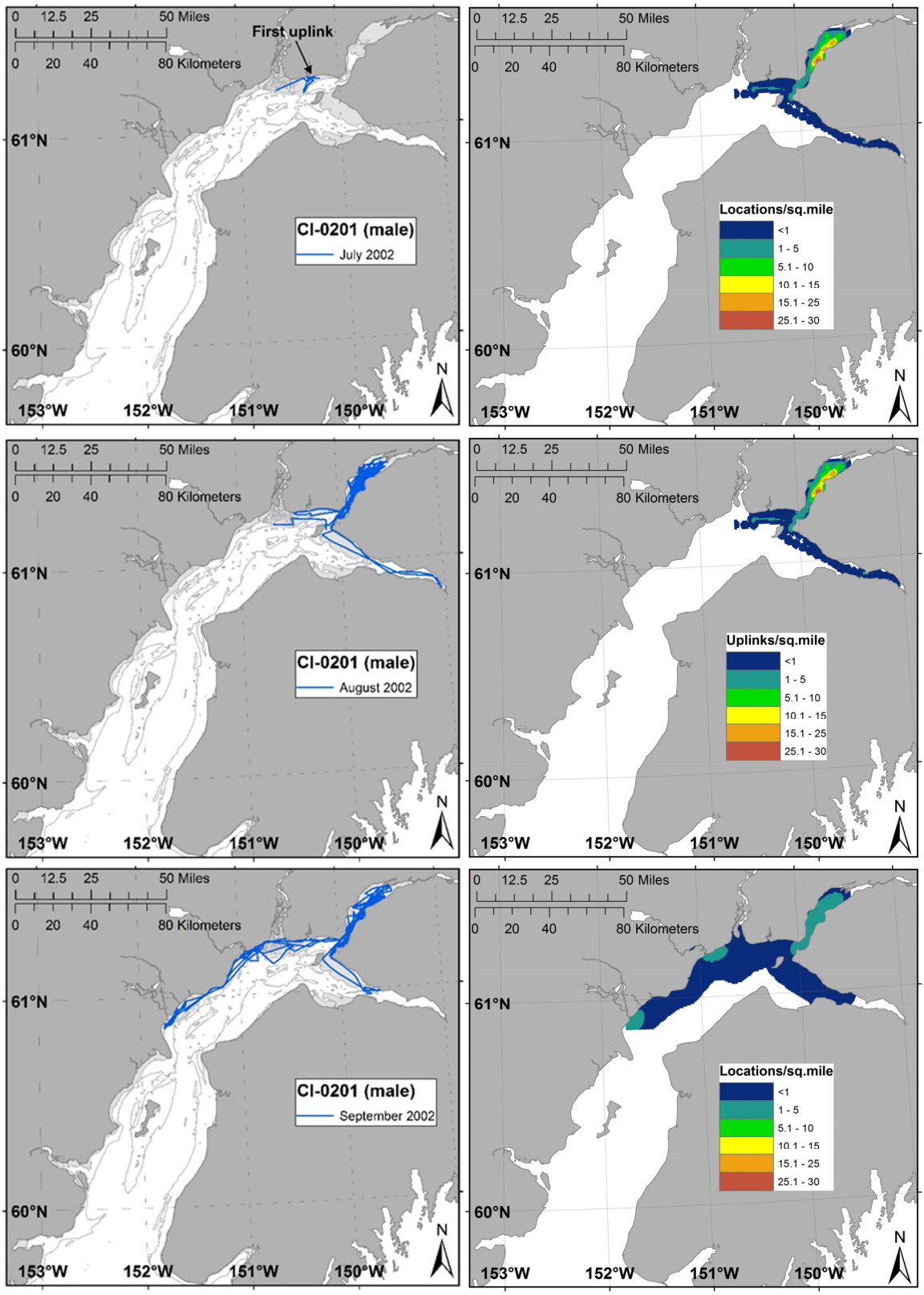


Figure 72. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of beluga CI-0201 tagged in Cook Inlet, Alaska, 29 July 2002.

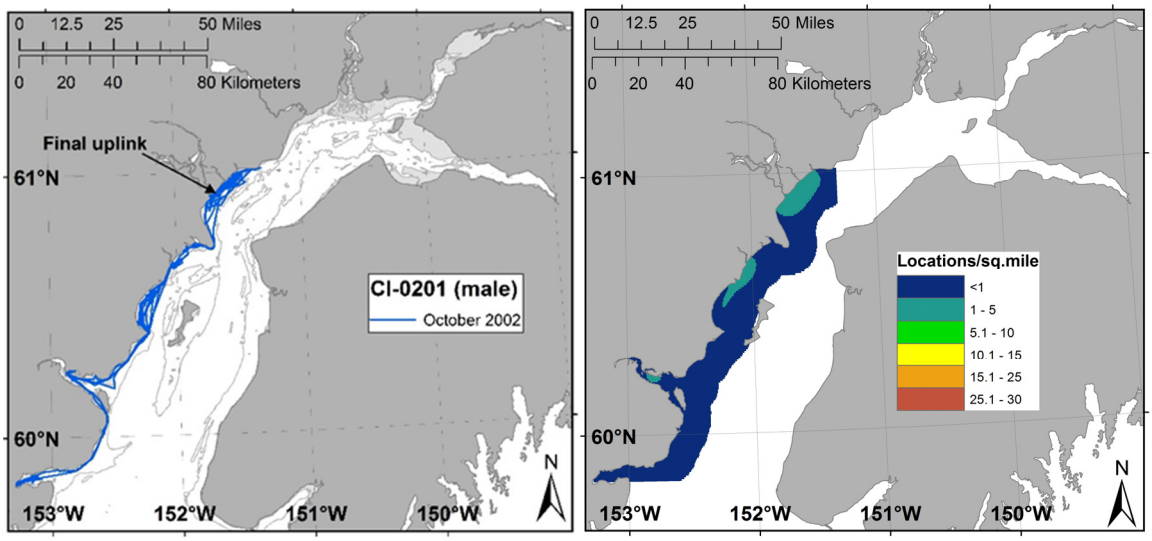


Figure 72. -- Cont.

CI-0201 circled near Point Woronzof in the late evening/early morning hours of 30–31 August, 3–4, 6–7, and 8–9 September, returning to Knik Arm each time until around noon on 11 September (Fig. 72). He then departed once again and swam into Turnagain Arm before looping back and entering Knik Arm around midnight on 12 September. He circled north of Fire Island one more time during the late evening/early morning of 13-14 September. On 15 September, he departed Knik Arm swimming west toward Beluga River before circling back and returning to Knik Arm on 18 September. After midnight on 21 September, CI-0201 left Knik Arm and spent the remainder of the month in Trading Bay and the Susitna River delta.

On 1 October, CI-0201 rounded West Foreland and entered the lower inlet at 07:00 h (Fig. 72). He continued swimming south through Redoubt Bay and Tuxedni Bay, arriving in Chinitna Bay (an area also visited by CI-0105 (a female) in September 2001) on 6 October where he remained until 9 October. He spent the next 10 days heading north following the shoreline into Tuxedni Bay and Redoubt Bay before re-entering the upper inlet on 19 October. He remained in Trading Bay until the end of the month when tag transmissions ended (Fig. 71). Transmissions stopped 2 months before ice began to form in the inlet.

Forty opportunistic sightings of belugas were reported during the period that CI-0201's tag transmitted locations (Appendix 5). Of these, he was likely present during 10 sightings, with group sizes ranging from 10 to hundreds of whales. CI-0201 spent much of his time along the coastline in all areas from July through October. Diving behavior reflected this as dive durations were typically under 2 minutes and depths shallower than 2 m (Fig. 73).

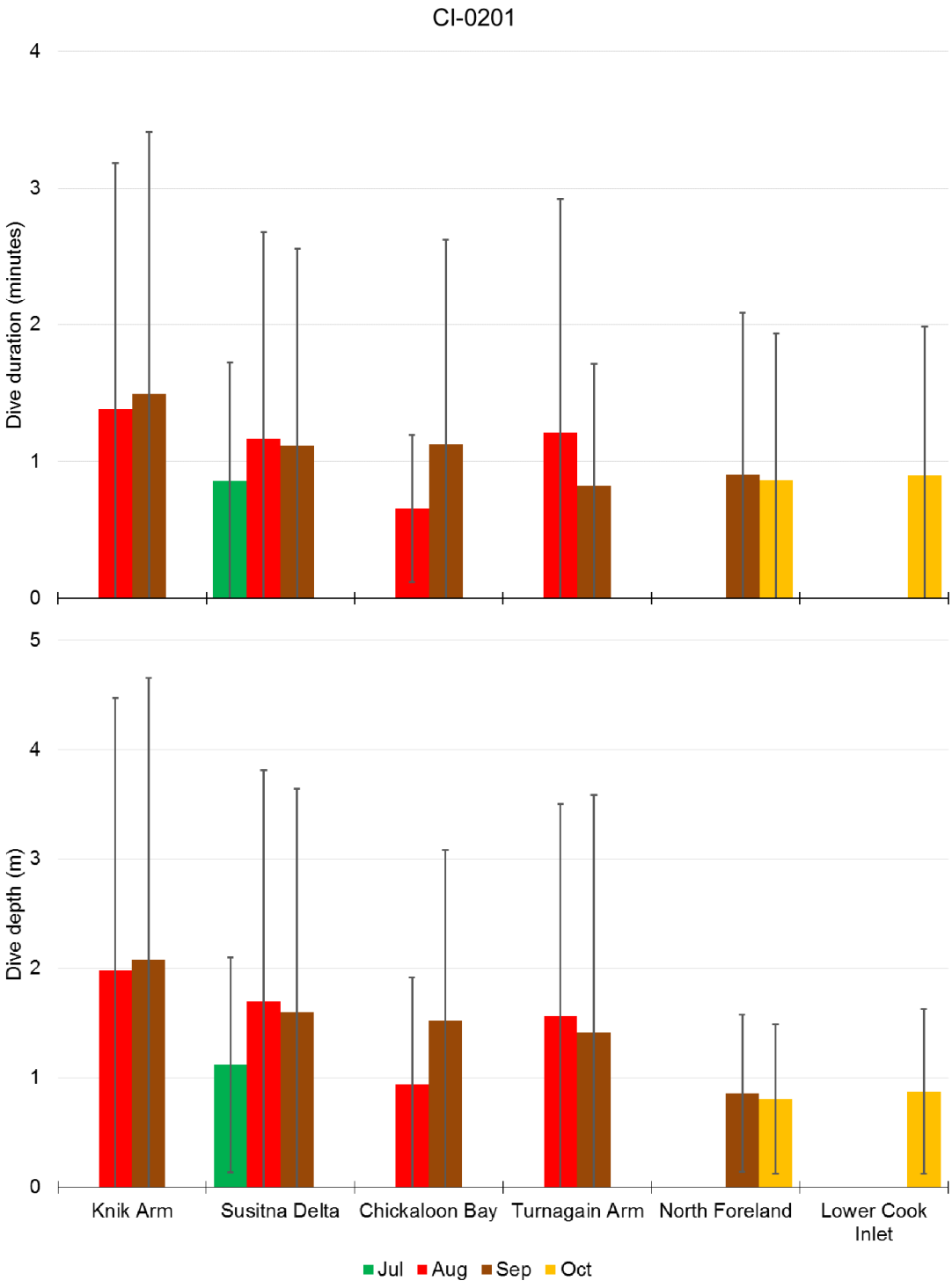


Figure 73. -- Monthly dive behavior of beluga CI-0201 tagged in Cook Inlet, Alaska, 29 July 2002. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0202

On 30 July, a female beluga (CI-0202) was captured and tagged at the Little Susitna River (Fig. 74). Her tag stopped transmitting near Beluga River the next day and did not transmit a location again until a month later on 29-30 August, when transmissions placed the tag at the southern extent of Kamishak Bay near Shaw Island at the entrance of Cook Inlet (Fig. 74). An incomplete transmission was received from PTT# 30719 (noted as "too short" with no location data) in April 2003. Further discussion of CI-0202 is provided in the "Where Are They Now" section.

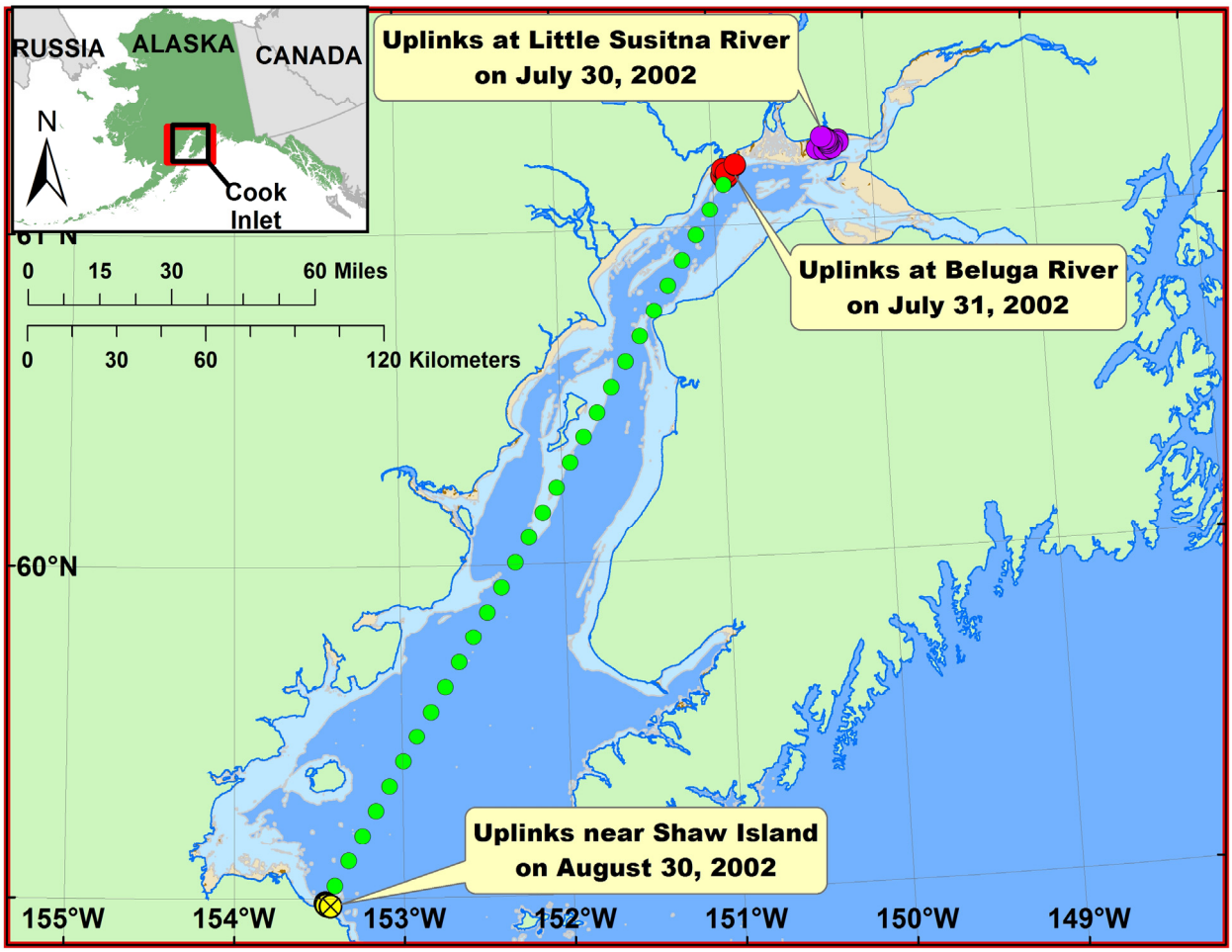


Figure 74. -- Beluga CI-0202 tagged in Cook Inlet, Alaska, 30 July 2002. The tag transmitted for less than two days (30 July = purple circles, 31 July = red circles) before going offline until a month later when transmissions resumed for a brief period near the entrance to Cook Inlet by Shaw Island on 30 August (yellow circles with X symbols). Green circles indicate the direct path between these transmission periods.

CI-0203

On 31 July, after unsuccessful attempts to find and capture whales in the Susitna River delta, the team went to Knik Arm where CI-0203 was captured and tagged near Birchwood. Her tag began transmitting on 1 August and continued transmitting until 24 August (23.2 days available for analysis). CI-0203 departed Knik Arm on the 1st and crossed the Susitna River delta before heading offshore of Moose Point. She remained in the Susitna River delta until 6 August, briefly spent time in Chickaloon Bay on the 6th and 7th, before returning to the Susitna River delta (Fig. 75). She repeated this pattern on 9 and 10 August. She entered Knik Arm for a brief period on the 10th, then departed and crossed the Susitna River delta, heading south past Trading Bay and entered the lower inlet on 11 August (Fig. 75). She returned to the upper inlet on the 13th, and spent time near Moose Point on 14 August.

On 15 August, CI-0203 crossed the inlet to Trading Bay and then crossed the inlet again before entering Chickaloon Bay later that day. She left Chickaloon Bay on the 16th and crossed the inlet to Beluga River. CI-0203 circled back-and-forth between the Susitna River and Beluga River until 19 August when she returned to Chickaloon Bay, then made a brief trip into Knik Arm before returning to Chickaloon Bay. It was during this brief trip into Knik Arm that she may have been among whales observed near the Port of Anchorage (Appendix 5). On the 21st, she returned to offshore waters near Moose Point before heading north into the Susitna River delta. She remained in the Susitna River delta until 23 August when she swam south toward Boulder Point north of East Foreland. On the final day of transmissions, she crossed the inlet to Trading Bay, rounded North Foreland, and was heading toward Beluga River when transmissions stopped.

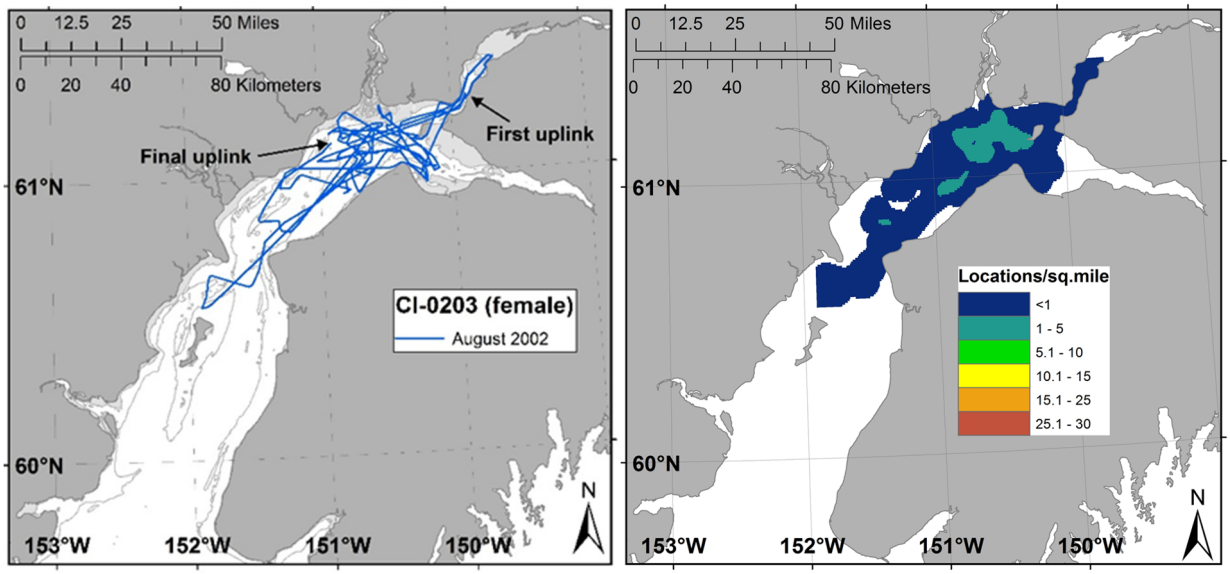


Figure 75. -- Monthly movement tracks blue) and density (low to high kernel of modelled locations per sq. mile) of beluga CI-0203 tagged in Cook Inlet, Alaska, 31 July 2002.

CI-0203's diving behavior was similar to the other whales transmitting locations in August, with the exception that dive depths tended to be deeper (Fig. 76). This was likely due to the offshore areas she occupied south of the Susitna River mudflats. CI-0205 displayed similar behaviors in August when he was offshore of the Susitna River mudflats (see description in his section).

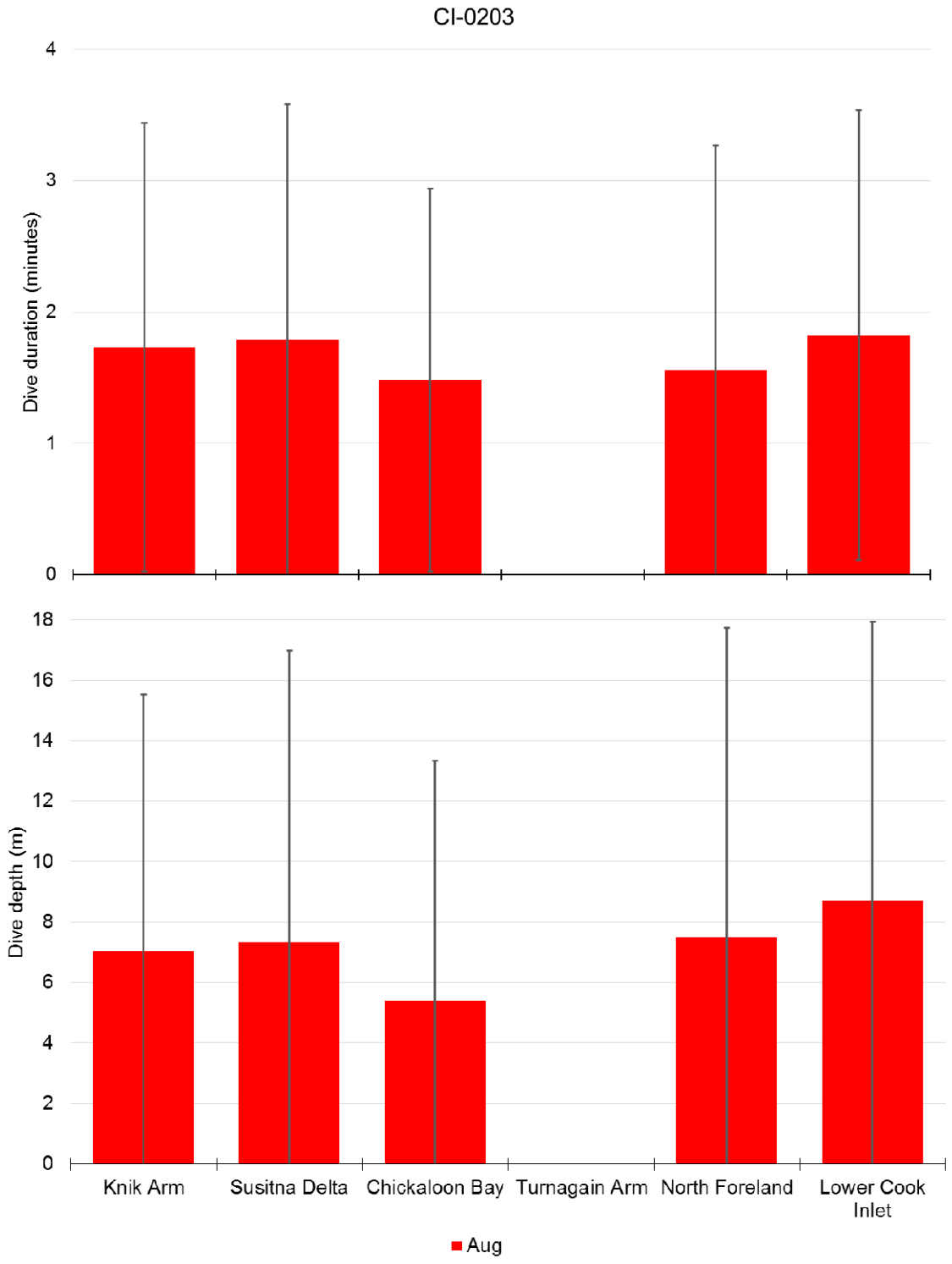


Figure 76. -- Monthly dive behavior of beluga CI-0203 tagged in Cook Inlet, Alaska, 31 July 2002. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0204

On 1 August, the tagging crew returned to the Little Susitna River where CI-0204 was captured, tagged, and released. Her tag began transmitting later that day showing she had travelled offshore and south of the Susitna River mudflats (Fig. 77). Transmissions stopped around 20:00 h on 2 August when she was heading offshore after spending most of the day in the area between Point Possession and Moose Point (Fig. 77: red open circles). The tag transmitted a final poor-quality (Z: no location) uplink on 17 August.

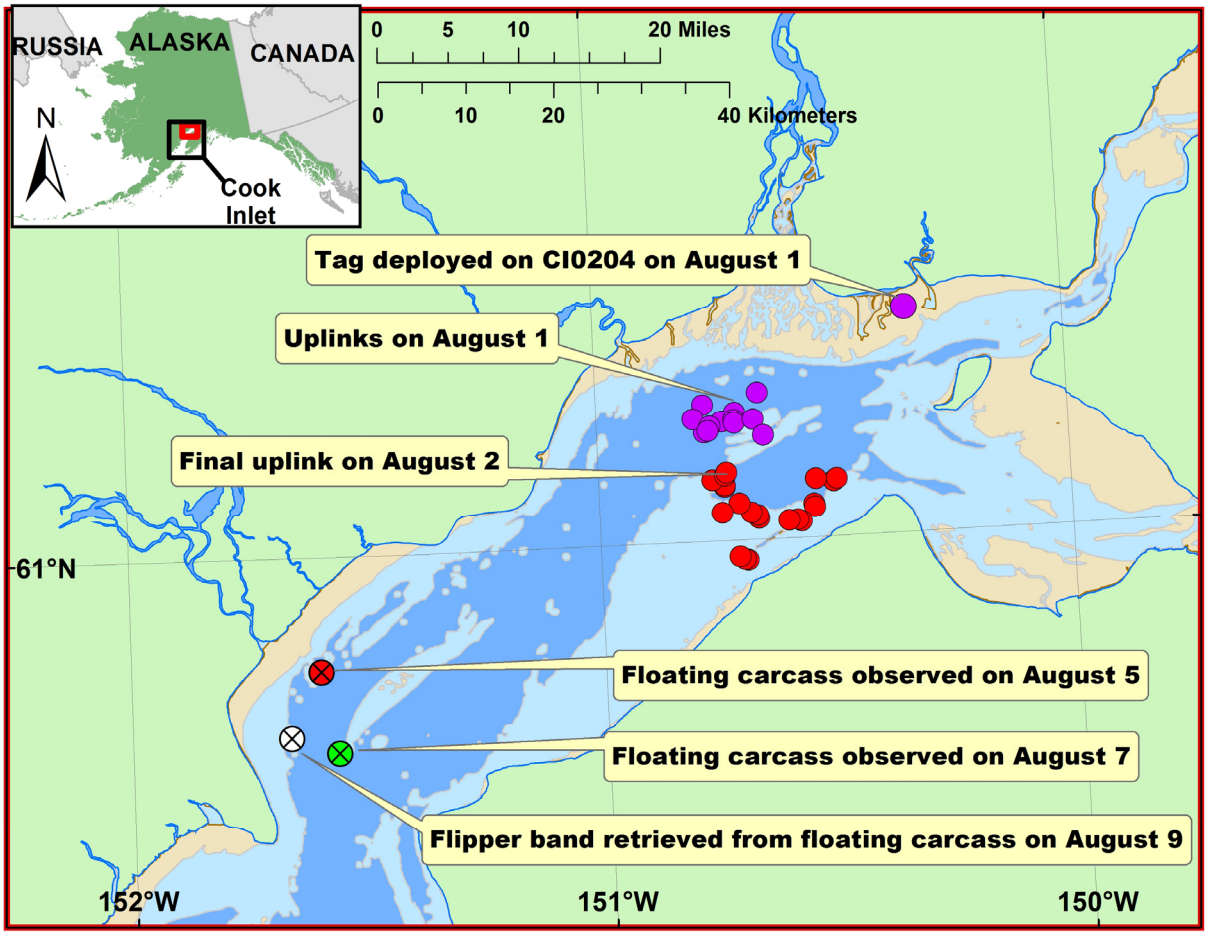


Figure 77. -- Beluga CI-0204 tagged in Cook Inlet, Alaska, 1 August 2002. The tag transmitted for two days before going offline until 17 August when an uplink (Z quality, no location) occurred. A floating carcass was observed on 5 and 7 August, but these sightings were not reported to NMFS personnel until late the following days. NOAA Enforcement searched areas south of East and West Foreland, but did not find a carcass on 7 August. On 3 September, a flipper band was turned in at the ADF&G office in Homer. Salvage operations were planned but abandoned following interviews with the gentleman who collected the band because the whale was seen on 9 August (see text).

NOAA Enforcement flew surveys daily in the Susitna River delta and Knik Arm from 29 July to 4 August, and did not report seeing any dead whales (Mahoney 2002b). On 6 August, NMFS received an email from B. Shavelson (Cook Inlet Keeper). On 5 August, Mr. Shavelson was flying over the oil rigs in mid-Inlet when he and his pilot saw a large, white beluga whale floating at about 15:15 h, approximately 1 mi. southwest of the Monopod oil platform (Fig. 77). They circled the floating beluga twice and thought the beluga was freshly dead. On 7 August, NOAA Enforcement flew a survey south of East and West Foreland but did not find any whales, dead or alive (Mahoney 2002b). On the morning of 8 August, NMFS received a phone message that a pilot with OSK Helicopters (Nikiski) observed a dead beluga in Trading Bay halfway between Platform A and Dolly Varden Platform the night before at about 17:00 h on 7 August (Fig. 77). This carcass was drifting north with the wind and tide (as the high tide at North Foreland was 20.6 ft at 18:43 h). It was presumed this was the same whale observed on 5 August. On 3 September, personnel at ADF&G and NOAA Enforcement in Homer contacted NMFS to report the flipper band of CI-0204 was returned by Mr. G. Elmes. Mr. Elmes had retrieved the band on 9 August from a moderately decomposed, large, white beluga found floating belly-up in the tide rip (60°48.801'N, 151°40.206'W; Fig. 77) near the oil rigs (Mahoney 2002b). Further discussion of CI-0204 is provided in the "Where Are They Now" section.

CI-0205

On 2 August, the tagging crew returned to Knik Arm capturing and tagging CI-0205 south of Birchwood. CI-0205's tag began transmitting the next day and continued sending transmissions until the beginning of April 2003 (Fig. 78), the second male to document winter and early spring distribution following CI-0107 in 2001-2002.

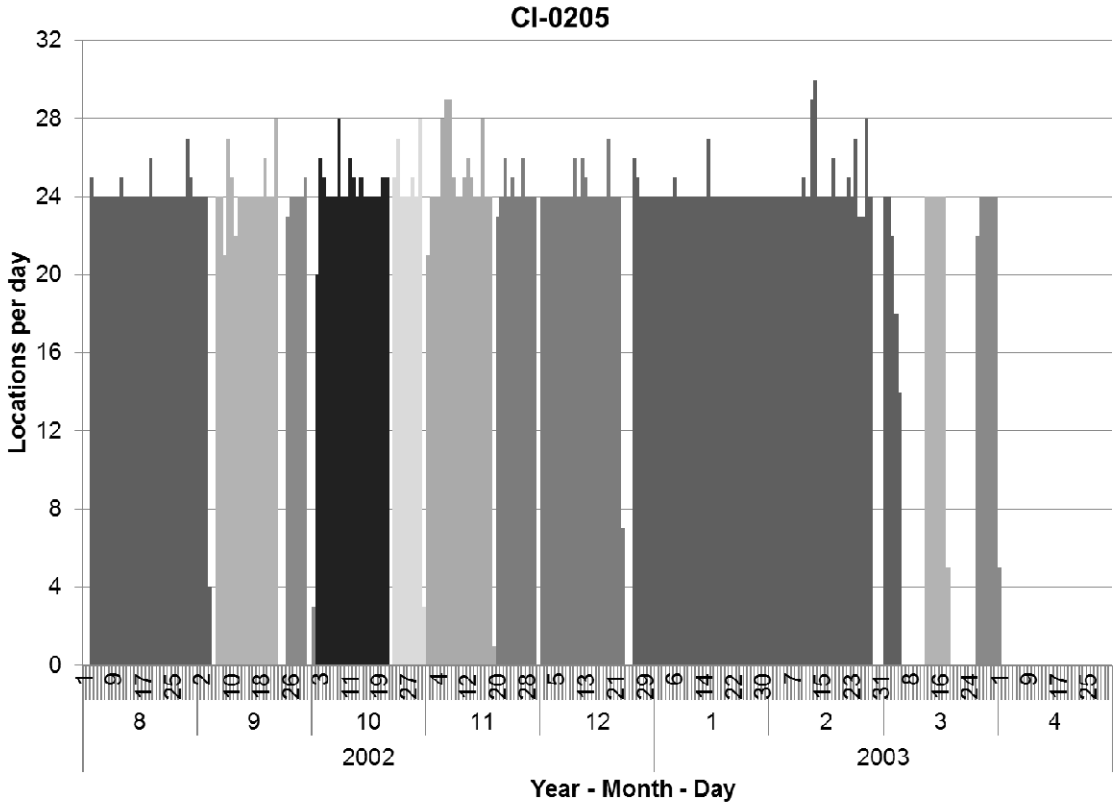


Figure 78. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0205 tagged in Cook Inlet, Alaska, 2 August 2002. A change in column color denotes transmission gaps > 1 day. Transmissions were received from the beginning of August to the beginning of April 2003 (covering 241.2 days with 215.8 days of data available for analysis).

CI-0205 remained in Knik Arm until 19 August when he rounded Point Campbell early in the morning and swam into Turnagain Arm (Fig. 79). He stayed in the area between Bird Point and Hope until the 21st when he swam out of the Arm, crossed Chickaloon Bay, passed the southern tip of Fire Island, and arrived off the Susitna River on 22 August. CI-0205 returned to Chickaloon Bay on the 23rd, approaching Point Possession before turning back toward Fire Island and crossing to the Susitna River delta on the 24th. On 25 August, CI-0205 swam from the Susitna River to the Little Susitna River before turning south and following the west shore of

Fire Island to arrive at Point Possession on the 26th. He stayed in Chickaloon Bay until around noon on the 27th when he began crossing the inlet headed west toward North Foreland. While still offshore CI-0205 turned north, reaching the Susitna River mudflats early in the morning on 28 August. He followed the mudflat edge heading east, entering Knik Arm on the morning of the 29th. Of the 21 opportunistic sightings reported in August, CI-0205 may have been present during three (Appendix 5).

CI-0205 remained in Knik Arm until 19 September (Fig. 79). He then swam west, arriving at Beluga River on the 20th, before looping back to the eastern tributary of the Susitna River. He swam into the river on 22 September. After a gap in transmissions (Fig. 78), CI-0205 was located at the mudflat edge off the western tributary of the Susitna River on the 25th. He began heading west toward Beluga River on the 26th, passing the river mouth before turning around and returning to the Susitna River on 27 September. CI-0205 repeated this path from 28 to 29 September. On the 30th, CI-0205 swam offshore heading southwest before entering Trading Bay early in the morning on 1 October. Nineteen opportunistic sightings were reported in September, CI-0205 was possibly present during four based on the time and locations of his tag (Appendix 5).

When tag transmissions resumed on 2 October (Fig. 78), CI-0205 had returned to the mouth of the Beluga River (Fig. 79). He crossed the mudflats and arrived in Knik Arm around 09:00 h on 3 October. CI-0205 remained there until 11 October, when he briefly departed swimming to within 5 km of the mouth of the Little Susitna River before returning to Knik Arm. On the 14th, he briefly left Knik Arm and was approaching the north tip of Fire Island when he turned and reentered Knik Arm. On the 17th, he left Knik Arm, approached Fire Island, then turned offshore and swam to the western tributary of the Susitna River, arriving early in the morning on 19 October. He then followed the shoreline back to Knik Arm, entering the Port of Anchorage area around noon on 20 October. He traversed the length of the Arm past Birchwood before returning to the Port of Anchorage area around midnight on the 23rd. He spent time in Goose Bay on the 24th and 25th, and Eagle Bay on the 26th. On 27 October, he swam north to Birchwood then returned south to the Port of Anchorage area early on the morning of the 28th. He then left Knik Arm and swam directly to Beluga River, arriving early in the morning on the 29th. CI-0205 swam directly back to Knik Arm, arriving around 17:00 h on the 30th, and continued north to the Cottonwood Creek area on 31 October.

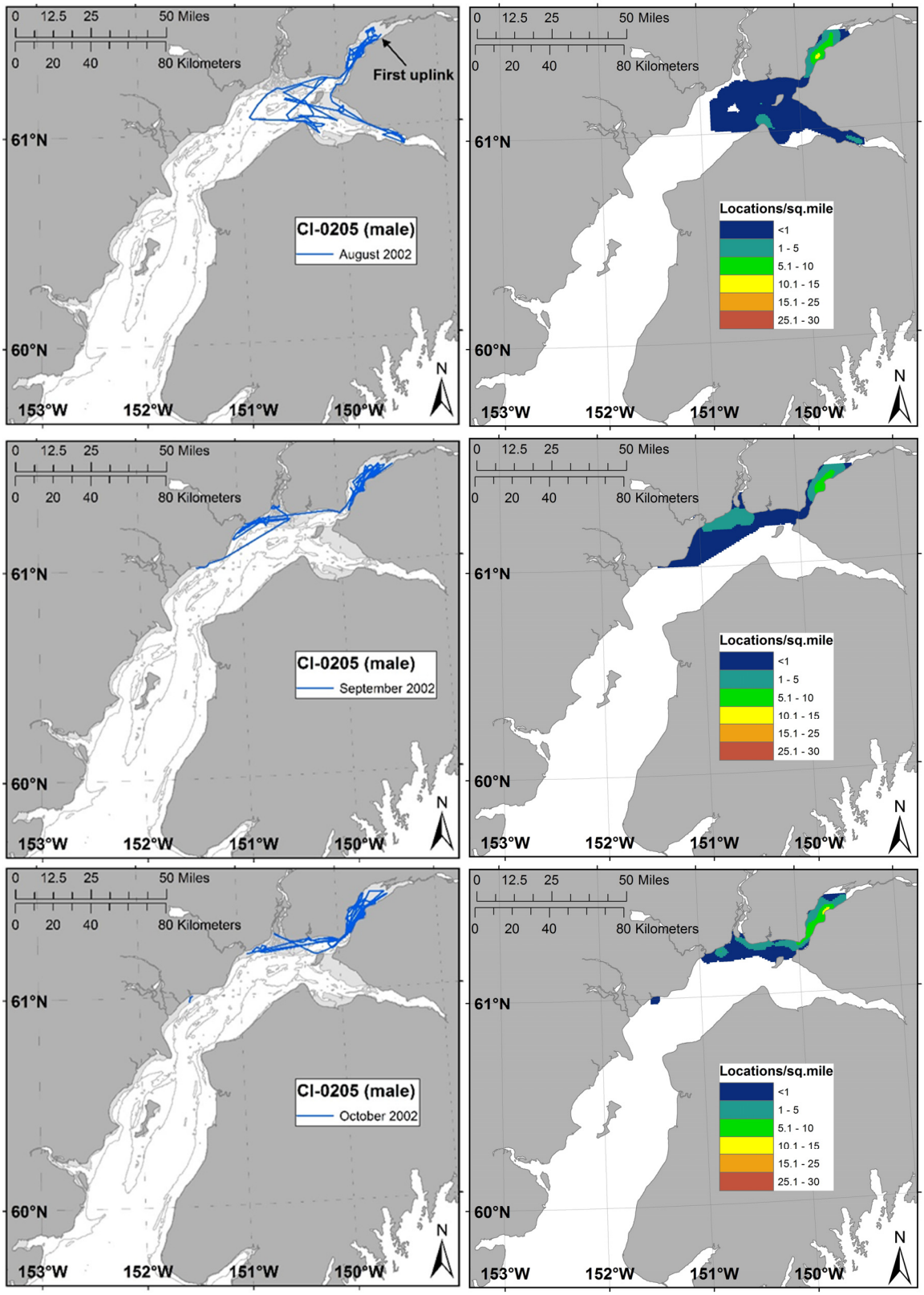


Figure 79. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of beluga CI-0205 tagged in Cook Inlet, Alaska, 2 August 2002.

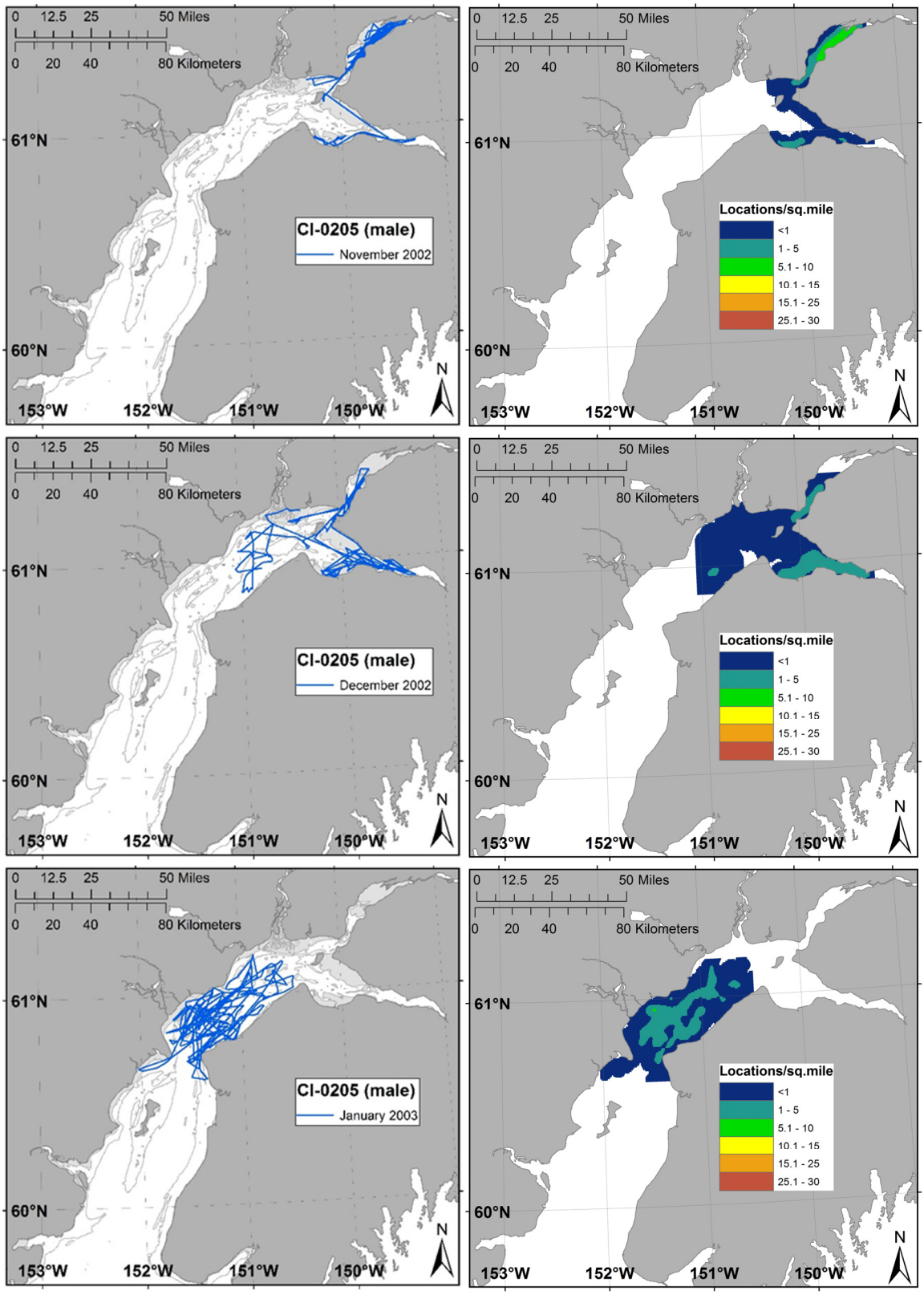


Figure 79. -- Cont.

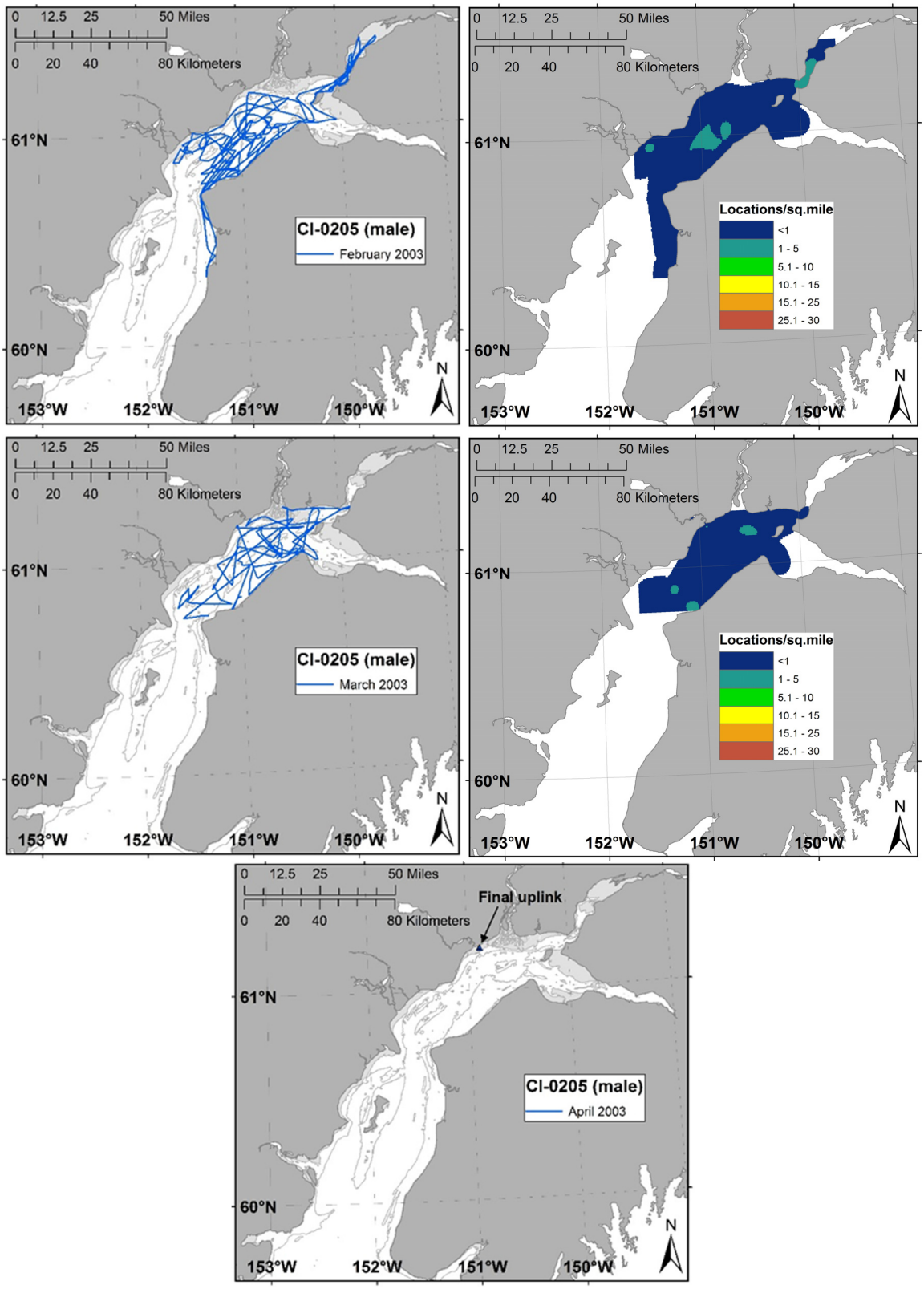


Figure 79. -- Cont.

CI-0205 spent most of November in Knik Arm (Fig. 79). He made a brief trip to the Little Susitna River from the 23rd to the 24th before returning to Knik Arm. Late on the evening of 25 November, he left Knik Arm and swam between Fire Island and Campbell Point into Chickaloon Bay. CI-0205 continued into Turnagain Arm as far as the town of Sunrise before turning and returning to the entrance of the Arm (around 03:00 h on 27 November). He turned back at this point and swam into the Arm to Girdwood, arriving around midnight. On 28 November, he returned to the entrance of the Arm and turned south into Chickaloon Bay.

CI-0205 remained in Chickaloon Bay until 5 December when around midnight he again entered Turnagain Arm (Fig. 79). He left the Arm near midnight on the 7th, crossing Chickaloon Bay to the south tip of Fire Island. He followed the eastern shoreline of the island to the north tip then entered Knik Arm around noon on 9 December. From the 11th to the 12th, he departed Knik Arm and followed the mudflat edge to the eastern tributary of the Susitna River then back to Knik Arm. From the 13th to the 16th, he returned to Turnagain Arm. Early on 17 December, CI-0205 departed Turnagain Arm and swam south into Chickaloon Bay for a brief period before returning to the Arm that same day. He followed a similar pattern from the 19th to the 20th, and from the 21st to the 22nd. Late morning on 22 December, CI-0205 crossed Chickaloon Bay and the upper inlet south of Fire Island, arriving near the Ivan River in the early morning hours of the 23rd. He was approaching the mouth of the Little Susitna River when a gap in transmissions occurred (Fig. 78). On the 26th, he was located in Knik Arm and moved back-and-forth between the Port of Anchorage and the north tip of Fire Island on the 27th. Late on 27 December, he swam south along the eastern shore of Fire Island before turning west and crossing the inlet to Beluga River. He then turned south and crossed the inlet to the eastern shoreline south of Moose Point. If was at this point that ice had started to form in the inlet (Figs. 70 and 80). On 29 December, CI-0205 looped back, following the 10 m contour past Moose Point then began a series of offshore loops through the end of the month.

This period of offshore movements continued until the final transmission in April. In January and February, CI-0205 entered the lower inlet for brief periods (Fig. 79). He swam south along the eastern shoreline to Salamantof (north of Kenai River) on 10 January and 27 February. On 15 January, he rounded West Foreland reaching the mouth of Big River in Redoubt Bay before returning to the upper inlet. From 22-24 February, he traveled south past Kasilof River before returning to the upper inlet. He did not enter Knik Arm or Chickaloon Bay in January, but

did travel to both areas in February. CI-0205 encountered compact ice (concentration of 92) in Knik Arm near Cottonwood Creek on 9 February and near Birchwood on 12 February, but spent most of his time in open water or very open pack ice (Fig. 80).

Overall, CI-0205 spent very little time in close pack and compact ice (12% of modelled locations) in January, with almost 50% of the transmissions occurring in open pack ice (Fig. 80). In February, 84% of the modelled locations occurred in open water and very open pack ice. Transmission gaps increased in March (Fig. 78) and the last transmissions occurred on 1 April at the mouth of the Beluga River (Fig. 79). CI-0205 spent little time in open water during March (4% of modelled locations, Appendix 12), encountering compact ice in the Susitna River delta and along the eastern shoreline south of Moose Point (Fig. 80) after tag transmissions resumed in late March (Fig. 78). When transmissions ended on 1 April, CI-0205 was in compact ice (concentration of 92).

Dive duration and depth increased in the Susitna River delta and the region south of North Foreland/Point Possession in December (Fig. 81). Some deep diving occurred in the Susitna River delta in August, but only for short durations when CI-0205 was offshore (Fig. 79).

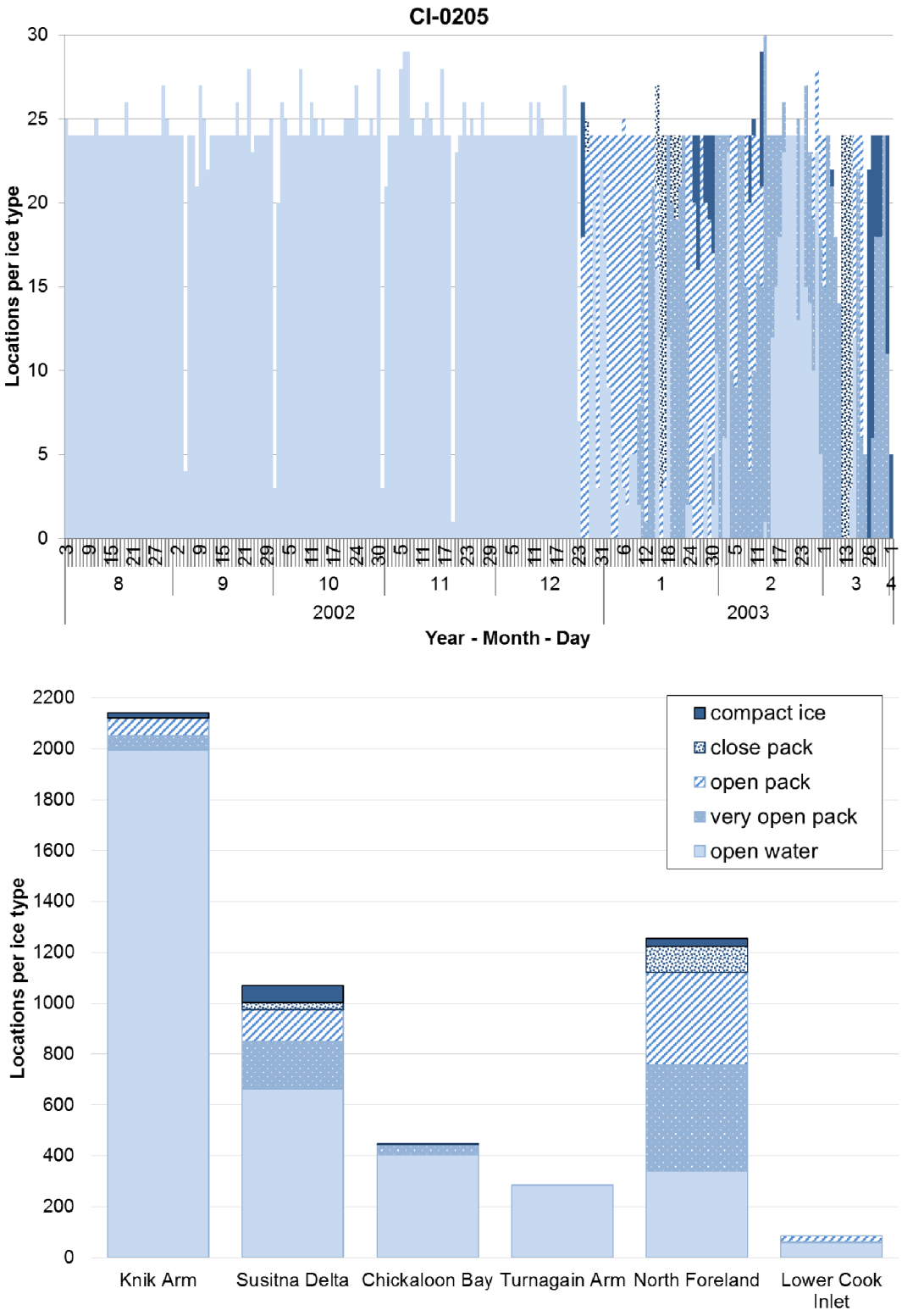


Figure 80. -- Ice associations for beluga CI-0205 tagged in Cook Inlet, Alaska, 2 August 2002. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) for each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

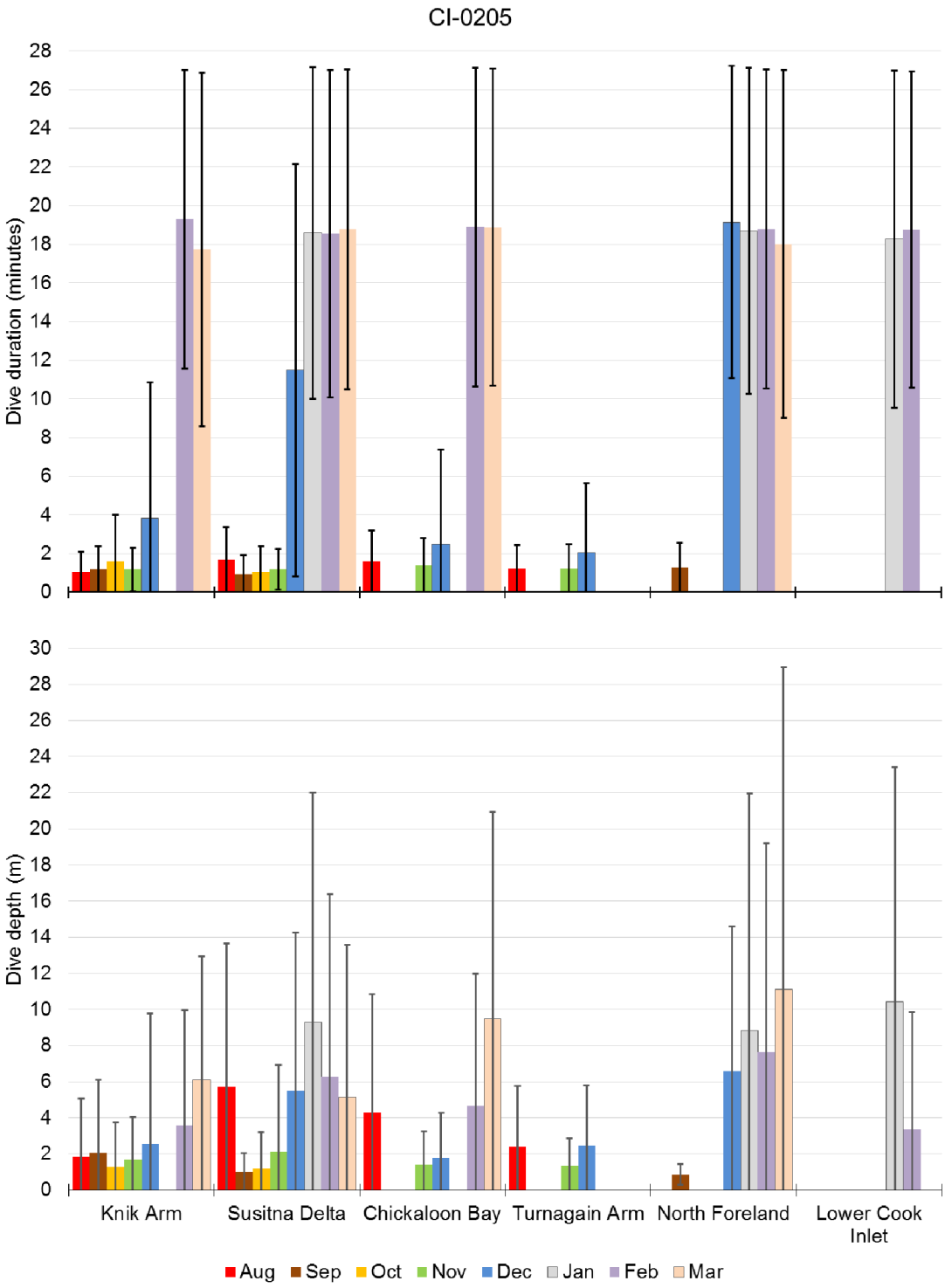


Figure 81. -- Monthly dive behavior of beluga CI-0205 tagged in Cook Inlet, Alaska, 2 August 2002. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0206

CI-0206, a male, was the first of two whales captured and tagged in Knik Arm on 3 August. His tag began transmitting the next day and continued to send transmissions until 22 March 2003 (Fig. 82). He was the third Cook Inlet whale to have a tag that lasted into spring. Of the 45 opportunistic sightings reported during this transmission period, CI-0206 may have been present during 29% of the observations based on the times and locations from his tag (Appendix 5).

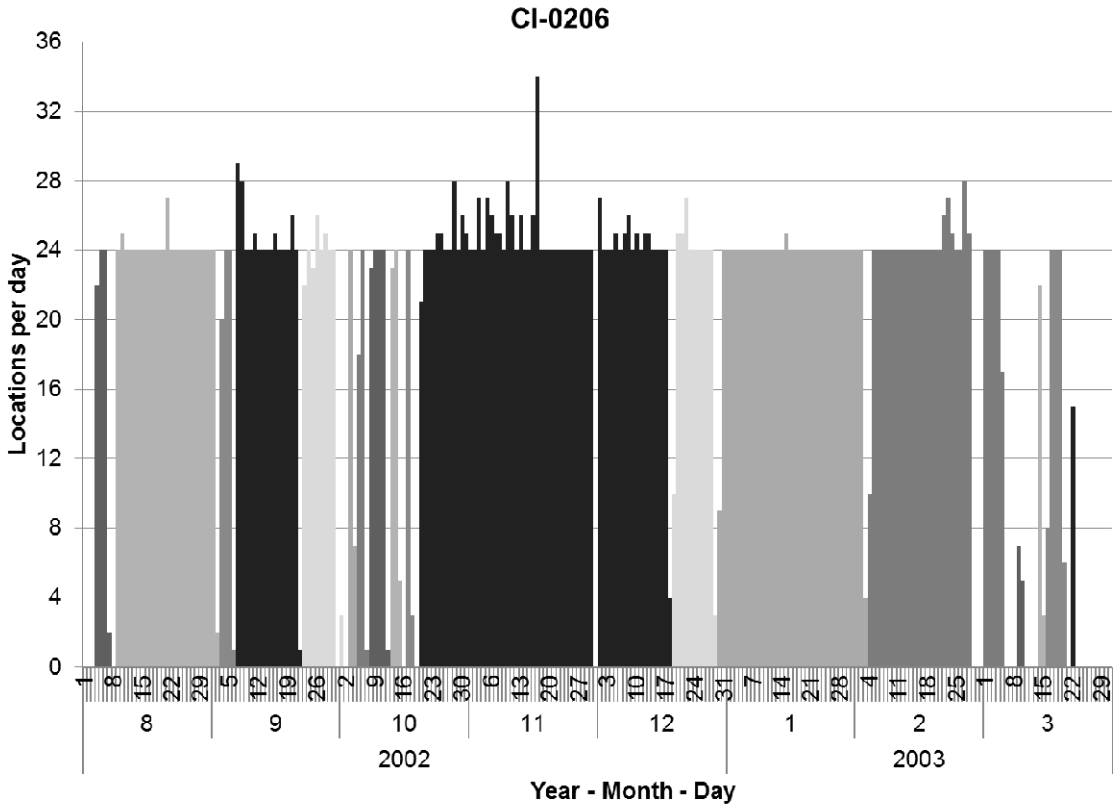


Figure 82. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0206 tagged in Cook Inlet, Alaska, 3 August 2002. A change in column color denotes transmission gaps > 1 day. Transmissions were received from the beginning of August into March 2003 (covering 230.6 days with 200.6 days of data available for analysis).

CI-0206 remained in Knik Arm until 24 August when late that evening he approached the north tip of Fire Island before turning and entering Chickaloon Bay during the early morning hours of the 25th (Fig. 83). He continued into Turnagain Arm where he remained until

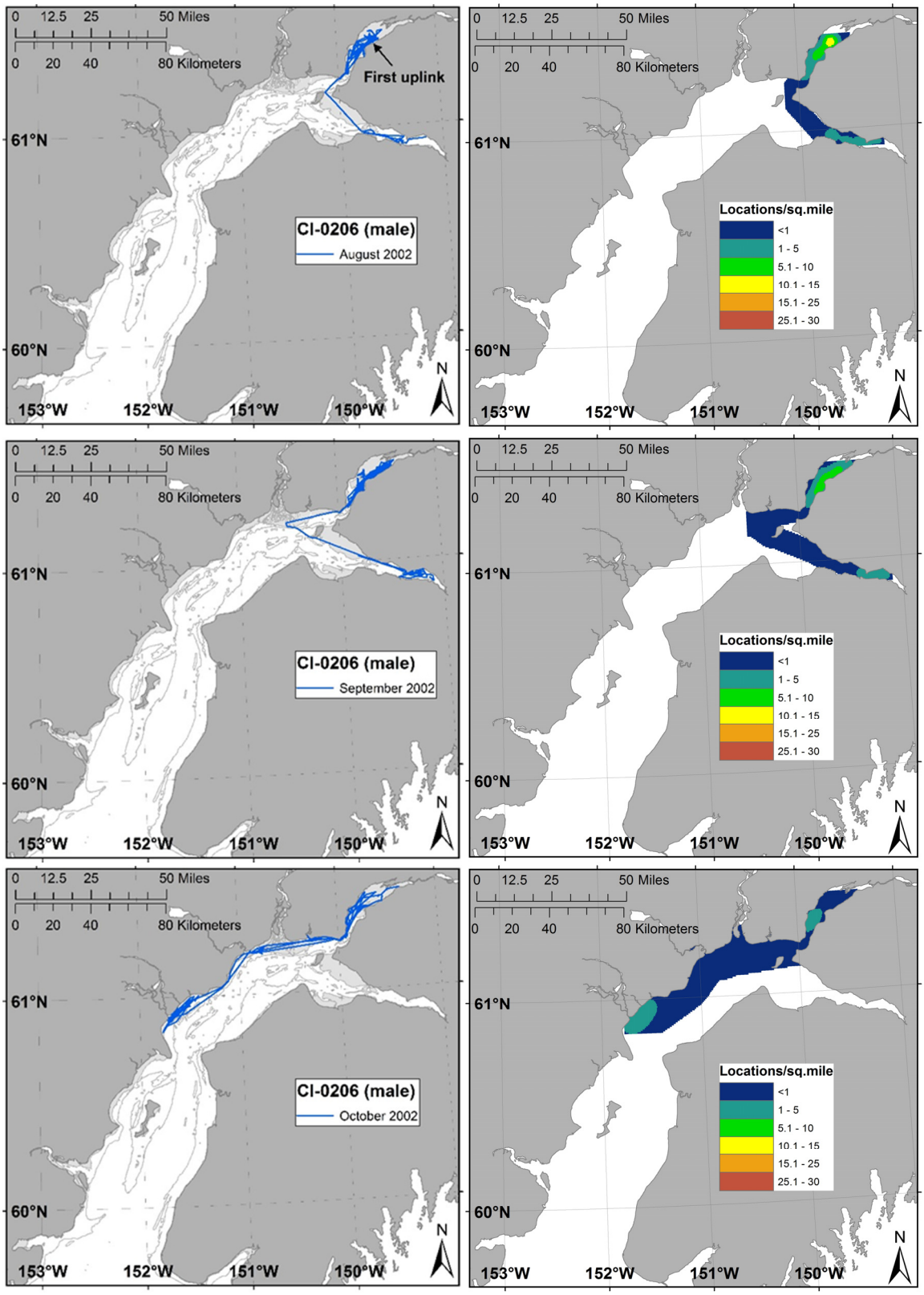


Figure 83. -- Monthly movement tracks (blue) and density (low to high kernel of modelled locations per sq. mile) of beluga CI-0206 tagged in Cook Inlet, Alaska, 3 August 2002.

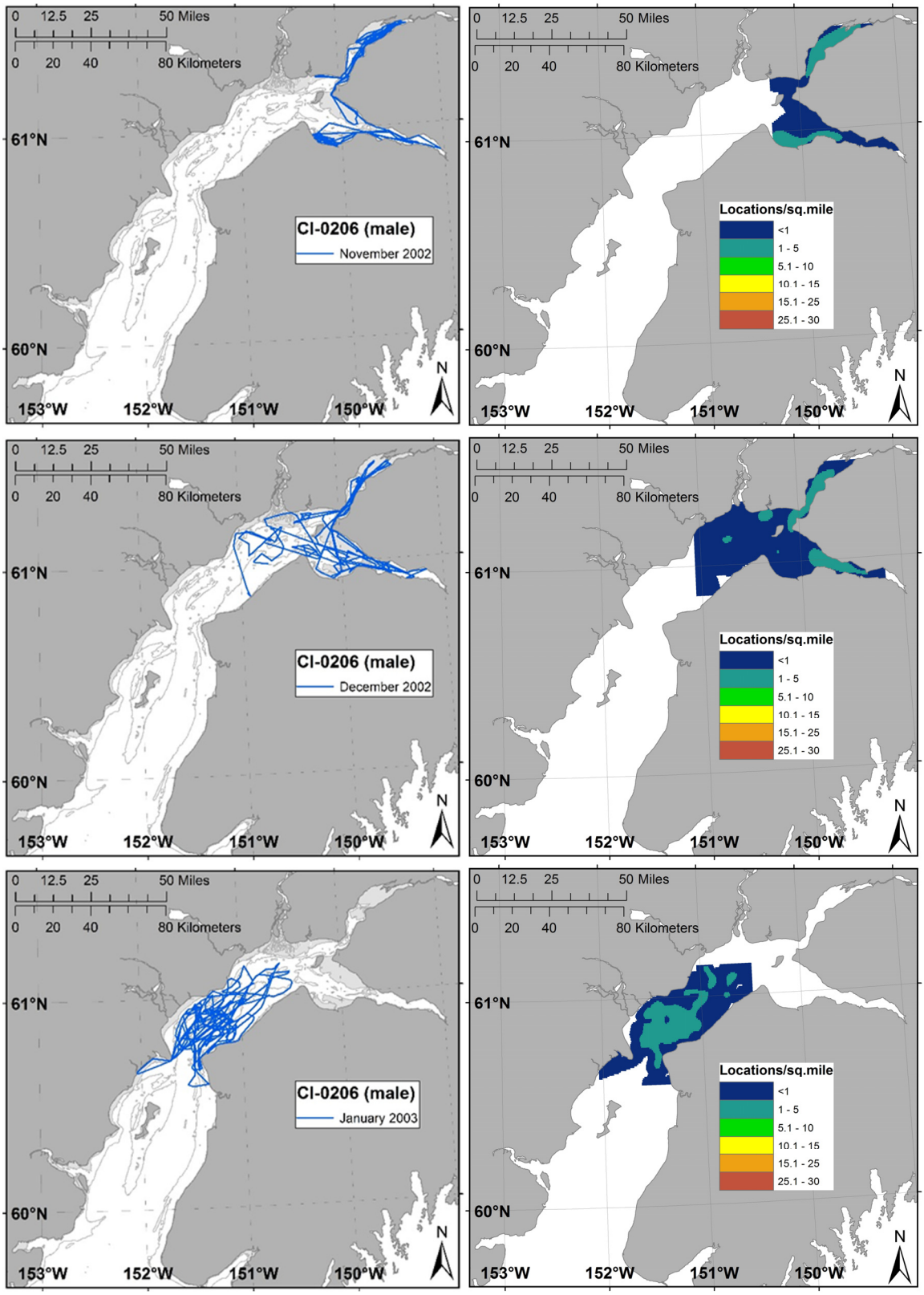


Figure 83. --Cont.

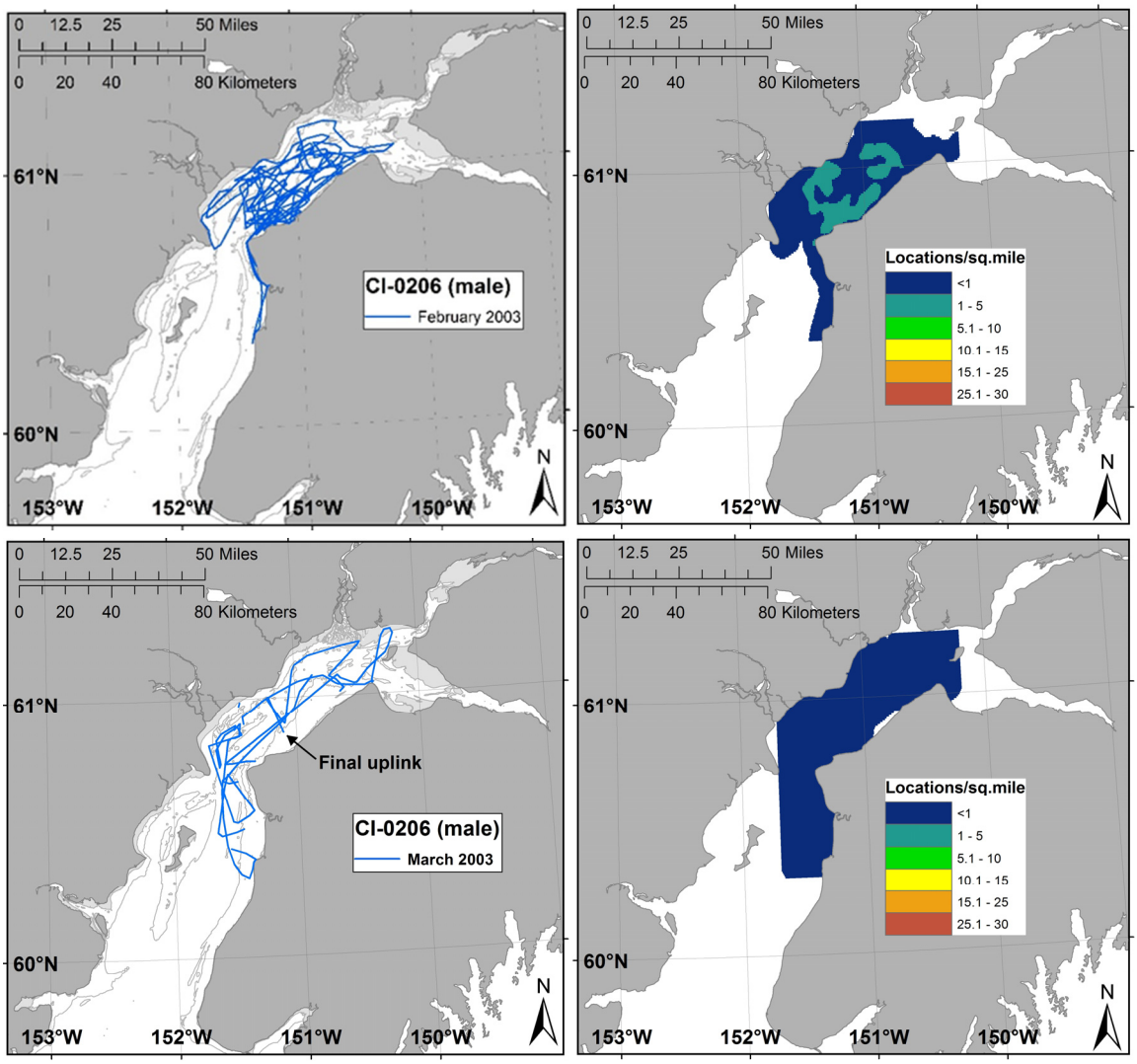


Figure 83. -- Cont.

10 September. On the 10th, CI-0206 crossed Chickaloon Bay passing the south tip of Fire Island enroute to the eastern tributary of the Susitna River (Fig. 83). He turned east, followed the mudflat edge, and entered Knik Arm around 17:00 h on the 11th. Here he remained until 3 October.

At about 18:00h on 3 October, CI-0206 rounded Point MacKenzie and entered the Susitna River delta (Fig. 83). He crossed the delta and continued south, entering Trading Bay around 10:00 h on the 5th. CI-0206 remained in Trading Bay until 23 October when he returned to the Susitna River delta. He continued across the delta and entered Knik Arm about 01:00 h on

the 24th. CI-0206 stayed in Knik Arm moving north and south between Cottonwood Creek and Point MacKenzie (never entering Eagle Bay) until 28 October when he crossed the Susitna River delta to Beluga River and spent a day near the Theodore and Lewis rivers. On the 30th, CI-0206 returned to Knik Arm around 17:00 h and spent the last day of the month near Birchwood.

CI-0206 did not leave Knik Arm again until 8 November when he briefly swam to within 5 mi. of the Little Susitna River before turning back and reentering Knik Arm. On 10 November, he entered Chickaloon Bay, following the northern shore to the entrance of Turnagain Arm before circling back and returning to Knik Arm by mid-afternoon on the 11th (Fig. 83). CI-0206 remained in Knik Arm until 17 November when he swam to Twenty-mile River in Turnagain Arm arriving around 05:00 h on the 18th. He followed the southern shoreline and briefly circled near Hope before leaving Turnagain Arm and heading to Chickaloon River. CI-0206 stayed in the southern portion of Chickaloon Bay until 22 November when he returned to Turnagain Arm. He swam to Bird Point then returned to southern Chickaloon Bay around 14:00 h on the 23rd. He followed a similar path on 28-29 November, entering Turnagain Arm, rounding Bird Point, then returning to Chickaloon Bay.

On 1 December, CI-0206 swam north across Chickaloon Bay and returned to Knik Arm (Fig. 83). He left Knik Arm around 20:00 h on the 5th and swam to Bird Point in Turnagain Arm, arriving around 04:30 on the 7th. CI-0206 swam to the entrance of Turnagain Arm around midnight then circled back into Turnagain Arm arriving at Hope around 05:00 h on 8 December. He crossed to the northern shoreline and returned to Knik Arm at 15:00 h on the 9th. CI-0206 ventured only as far north as Cairn Point before turning and swimming to the Little Susitna River, where he stayed until late evening on the 12th. On 13 December, he swam north past Windy Point in Knik Arm before turning and heading back to Chickaloon Bay. He entered Turnagain Arm around 16:00 h and remained there until the 19th, moving between the entrance and Bird Point, though transmission gaps occurred during this period (Fig. 82). On 20 December, CI-0206 crossed the southern portion of Chickaloon Bay before turning north and entering Knik Arm. He returned to Chickaloon Bay on the 22nd, then crossed the inlet to the Lewis River in the Susitna River delta (Fig. 83). He continued crossing the inlet between Point Possession, the Susitna River delta, and North Foreland for the remainder of December (noting that transmission gaps occurred during this period). CI-0206 encountered open pack ice (concentration of 35) in the Susitna River delta after 25 December (Fig. 84).

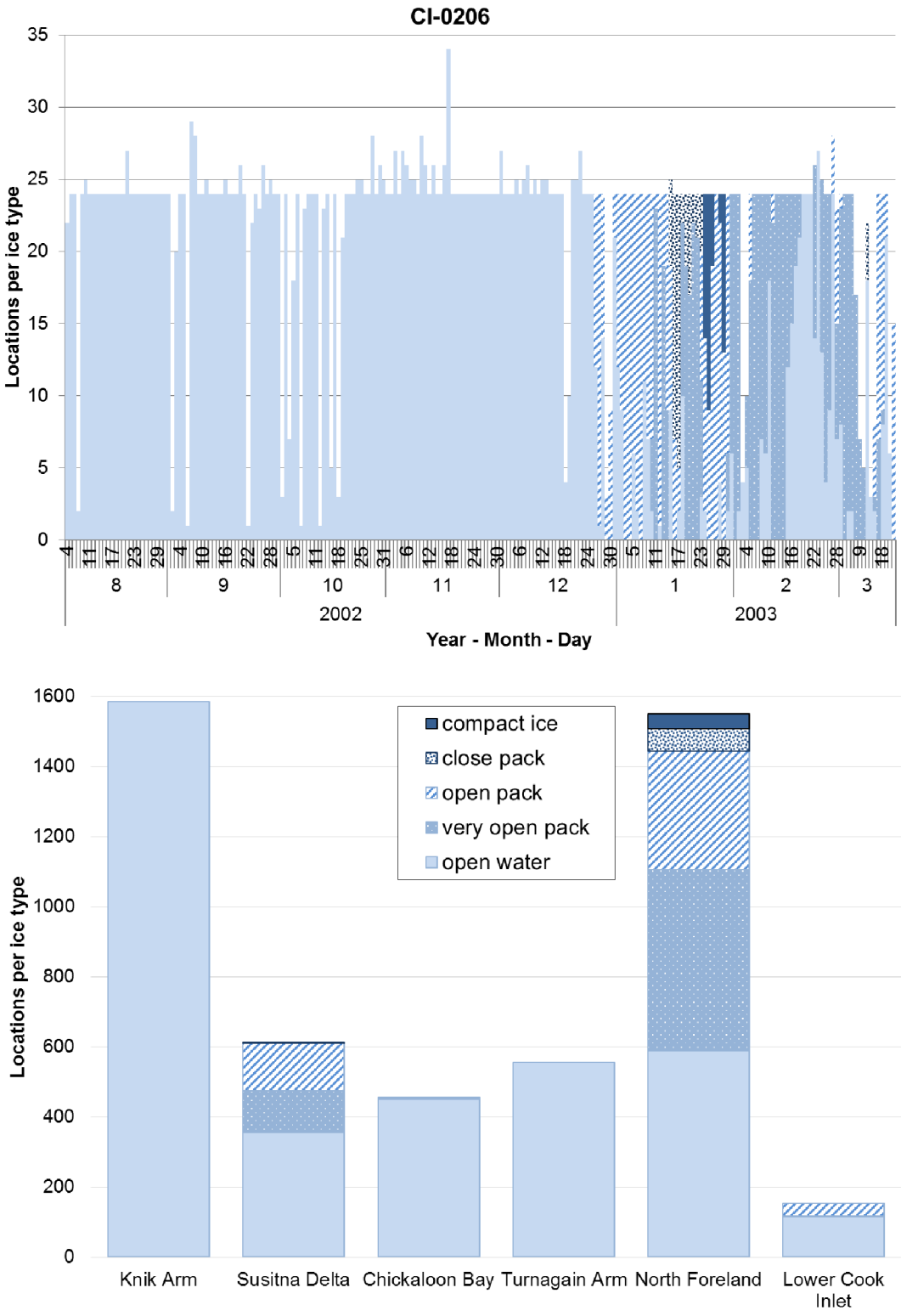


Figure 84. -- Ice associations for beluga CI-0206 tagged in Cook Inlet, Alaska, 3 August 2002. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) for each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0206 did not return to Knik Arm or Turnagain Arm after ice began to form in the inlet (Fig. 70). During January and February, he spent much of his time in offshore waters between Point Possession and East and West Foreland (Fig. 83). Similar to CI-0205, he spent little time in close pack and compact ice (13% of modelled locations) in January, with 50% of modelled locations occurring in open pack ice (Fig. 84). He made brief trips to the lower inlet in January on the 9th-10th (an offshore loop north of Kenai River with CI-0205 and CI-0208), 12th (circling back after reaching Nikiski dock), and 15th (entering Trading Bay with CI-0205).

In February, he visited Chickaloon Bay on the 12th-13th (CI-0205 also briefly entered this area on the 7th and 13th), and the lower inlet from the 22nd-24th (with CI-0205 and CI-0208) (Fig. 83). CI-0206 did not encounter close pack or compact ice during the month (Fig. 84), rather 97% of the modelled locations occurred in open water (43%) and very open pack ice (54%).

As with CI-0205's tag, gaps in transmissions increased dramatically in March for CI-0206 (Fig. 82). CI-0208's tag did not experience similar extensive gaps in transmissions as CI-0205 (5-12, 18–26 March) and CI-0206 (5- 8, 11-13, and 21 March), and these whales were in different regions of the upper inlet when transmissions ended and resumed. CI-0206 entered the lower inlet two times in March before transmissions ended on the 22nd, from the 14th-16th (to Clam Gulch south of Kasilof River), and 18th-20th (offshore of Kenai River). When transmissions resumed on 22 March, CI-0206 was in Trading Bay approaching North Foreland before turning offshore where transmissions ceased (Fig. 83) as he moved through open pack ice (concentrations of 46 increasing to 57) (Fig. 84).

CI-0206 began diving for longer periods and to deeper depths in December (Fig. 85). Depth and duration peaked in January in the Susitna River delta, and deeper and longer dives occurred during the brief period he swam into Chickaloon Bay in February. On average, the longest and deepest dives occurred in the lower inlet in January and March, while in February CI-0206 remained close to the lower inlet shoreline (Fig. 83).

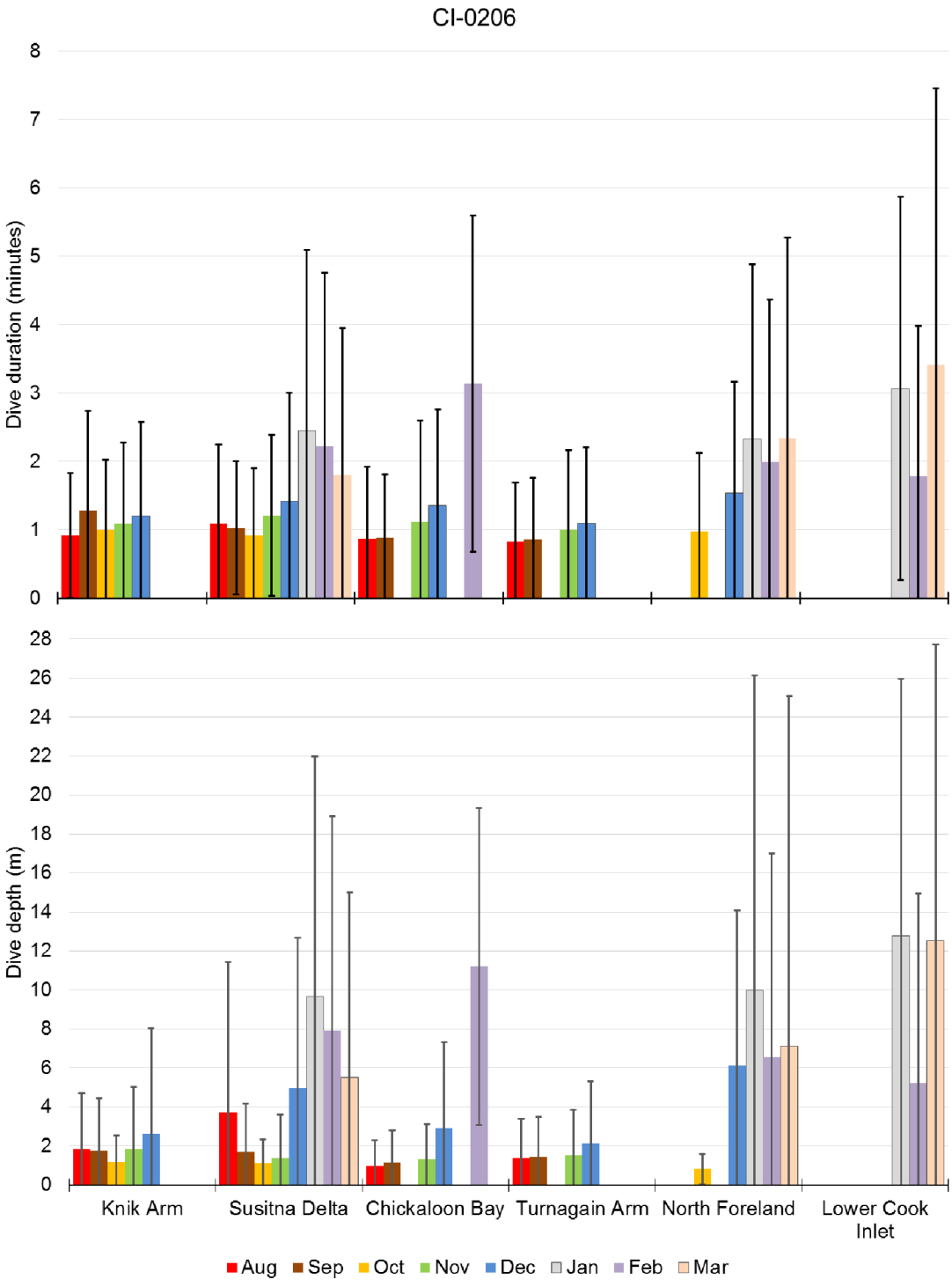


Figure 85. -- Monthly dive behavior of beluga CI-0206 tagged in Cook Inlet, Alaska, 3 August 2002. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

CI-0207

CI-0207, a female, was the second whale captured and tagged on 3 August. Her tag began sending transmissions that evening placing her near the mouth of Eagle River in Knik Arm (Fig. 86: purple circles). Locations and dive data were received through most of the following day (Fig. 86: red line and circles) as she travelled south from the upper reaches in Knik Arm (at 05:14 h) to Eagle Bay (08:00 – 09:00 h) before looping back through Eagle Bay and slowly making her way north of Birchwood (12:00 – 15:00 h) (Fig. 86). Her tag stopped transmitting at 19:29 h and did not transmit again until 8 August.

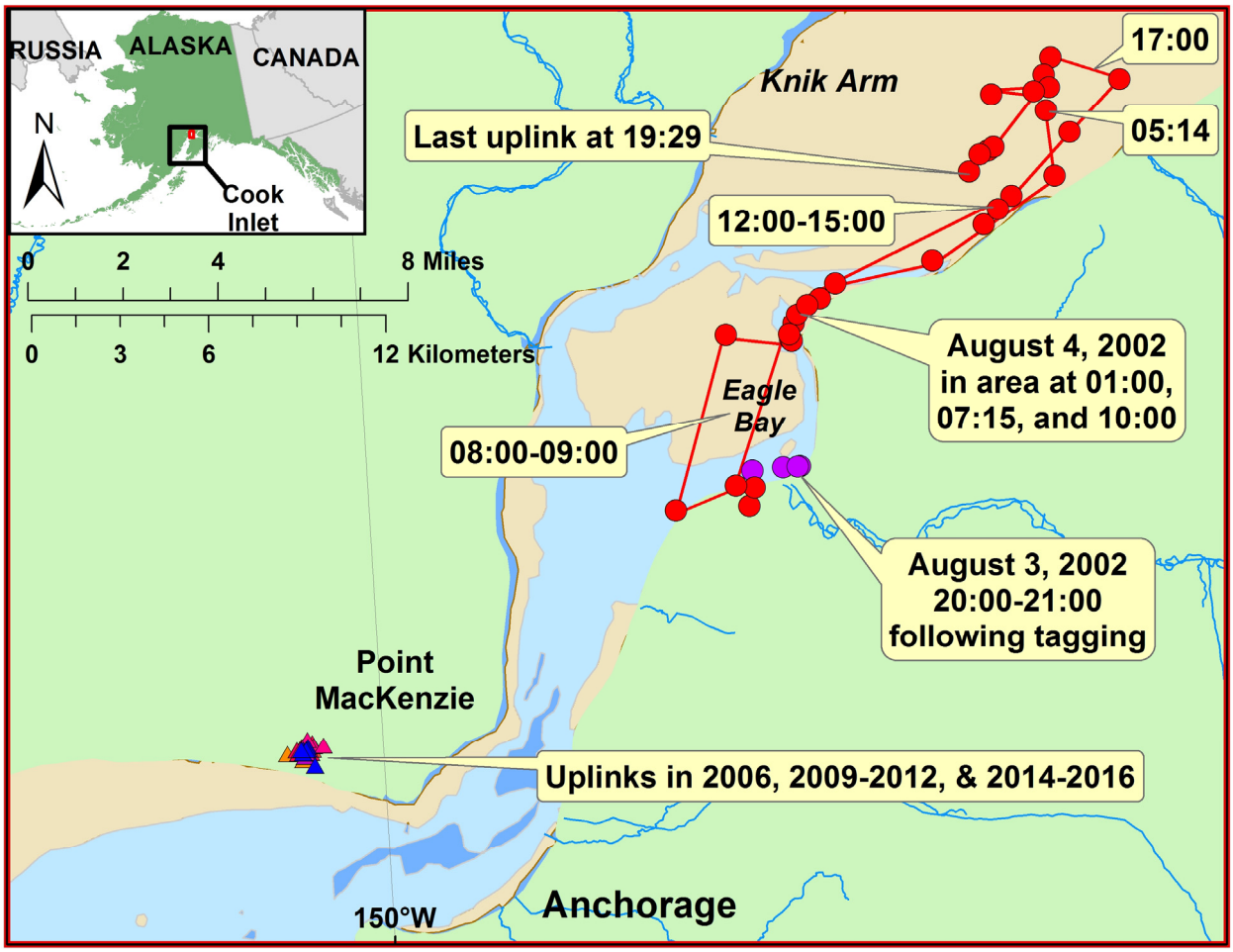


Figure 86. -- Beluga CI-0207 tagged in Cook Inlet, Alaska, 3 August 2002. The tag transmitted for two days (3 August = purple; 4 August = red) before going offline after which sporadic, corrupted messages with no locations were received in 2002 and 2003 (see Table 4). In 2006, while testing the PTT number it was discovered that the tag was providing locations near the bluffs south of Point MacKenzie (see Table 6).

At this time the tag failed to transmit a location but reported the time at depth histogram which indicated she had been in shallow water (0-1 m) during the previous 6-hour period (Table 4). Transmissions were not received again until 9 September (Table 4). Again no location was provided, but the dive depth histogram, which contained zero values for the number of dives within each depth bin, was similar to the histogram received on 3 August. Corrupted messages were also received in October 2002, March 2003, and April 2003 (Table 4).

Table 4. -- Transmission attempts from PTT 30720 deployed on beluga CI-0207 on 3 August 2002 (for the period 2002-2003 when other satellite-tagged Cook Inlet belugas were transmitting locations). TAD = time at depth.

Date	Data type	Error message	Comments
8/9/2002 21:00	TAD		All dives were in the 0-1 m bin.
8/13/2002 16:52	Corrupt	Timestamp	Possible timestamp 8/8/2002 0:00
9/9/2002 21:00	DiveDepth		All depth bins contained zero values
9/22/2002 19:14	Corrupt	Too short	Possible timestamp 9/22/2002 0:00
10/19/2002 4:02	Corrupt	Checksum	
3/4/2003 10:05	Corrupt	Checksum	
3/27/2003 18:37	Corrupt	Checksum	
3/30/2003 10:51	Corrupt	Checksum	
4/4/2003 19:08	Corrupt	Checksum	Possible timestamp 4/3/2003 15:00
4/9/2003 13:59	Corrupt	Checksum	
4/9/2003 21:49	Corrupt	Checksum	Possible timestamp 4/9/2003 15:00
4/10/2003 4:38	Corrupt	Checksum	Possible timestamp 4/9/2003 15:00
4/11/2003 14:11	Corrupt	Too short	Possible timestamp 4/10/2003 9:00

In 2006, when testing PTT 30720 to reassign it for another project, it was discovered that the tag was sending location data (Table 5). The tag has continued to transmit sporadically since that time from a location near the bluffs south of Point MacKenzie (Fig. 86). Review of the tide charts suggests these transmissions are occurring following tides that are greater than +5 ft MHW. An attempt to retrieve the tag in 2017 was not successful (Greg Balogh, Alaska Regional Office, NMFS, pers. comm.). For further discussion of CI-0207, see the "Where Are They Now" section.

Table 5. -- Transmissions (quality 3 only) from PTT 30720 deployed on beluga CI-0207 (2006-2016).

Year	Month	Day	Location quality	Latitude	Longitude
2006	10	10	3	61.256111	-150.05333
2006	10	11	3	61.256667	-150.050278
2009	9	20	3	61.25400162	-150.0509949
2009	9	21	3	61.25600052	-150.0610046
2009	9	21	3	61.25699997	-150.0480042
2009	11	6	3	61.25600052	-150.048996
2009	11	6	3	61.25600052	-150.0500031
2009	11	6	3	61.25799942	-150.048996
2010	9	10	3	61.25699997	-150.0469971
2010	10	9	3	61.25600052	-150.0509949
2010	10	9	3	61.25699997	-150.0549927
2010	10	9	3	61.25799942	-150.0500031
2010	10	10	3	61.25699997	-150.048996
2010	11	5	3	61.25600052	-150.0509949
2010	11	5	3	61.25699997	-150.048996
2010	11	5	3	61.25799942	-150.052002
2010	11	6	3	61.25699997	-150.048996
2010	11	7	3	61.25699997	-150.0449982
2010	11	7	3	61.25699997	-150.0480042
2011	9	28	3	61.25600052	-150.0509949
2011	9	28	3	61.25600052	-150.0540009
2011	9	28	3	61.25899887	-150.0449982
2011	9	29	3	61.25600052	-150.0469971
2011	10	27	3	61.25699997	-150.0500031
2011	10	27	3	61.25699997	-150.0509949
2011	10	27	3	61.25699997	-150.0549927
2011	10	27	3	61.25799942	-150.0509949
2011	10	28	3	61.25600052	-150.0460053
2011	10	28	3	61.25600052	-150.0509949
2011	10	28	3	61.25699997	-150.048996
2011	10	28	3	61.25799942	-150.0469971
2011	10	29	3	61.25799942	-150.0440064
2011	10	30	3	61.25799942	-150.0480042
2012	5	8	3	61.25799942	-150.0440064
2012	9	17	3	61.25699997	-150.0469971
2012	9	17	3	61.25699997	-150.0480042
2012	9	17	3	61.25699997	-150.0529938
2012	10	16	3	61.25999832	-150.0480042
2012	10	17	3	61.25699997	-150.0480042
2012	11	16	3	61.25799942	-150.0379944
2014	10	11	3	61.25500107	-150.0500031
2014	10	11	3	61.25600052	-150.048996
2014	10	11	3	61.25699997	-150.0480042
2014	10	11	3	61.25699997	-150.048996
2015	4	20	3	61.2519989	-150.0440064
2015	9	29	3	61.25699997	-150.0480042
2015	9	29	3	61.25699997	-150.0509949
2015	9	29	3	61.25799942	-150.0480042
2015	9	30	3	61.25600052	-150.0509949
2015	9	30	3	61.25699997	-150.0480042
2015	9	30	3	61.25699997	-150.048996
2015	9	30	3	61.25699997	-150.052002
2016	4	9	3	61.25799942	-150.0440064

CI-0208

CI-0208, a male, was the last whale captured and tagged in 2002. His tag did not transmit until the next day at 14:57 h on 5 August (Fig. 87), at which time he was only 2.5 miles (4 km) from the capture location. Transmissions continued until 25 May 2003, documenting roughly the year-round movements of this whale (assuming once he returned to the upper inlet in May he remained there through June and July of 2003).

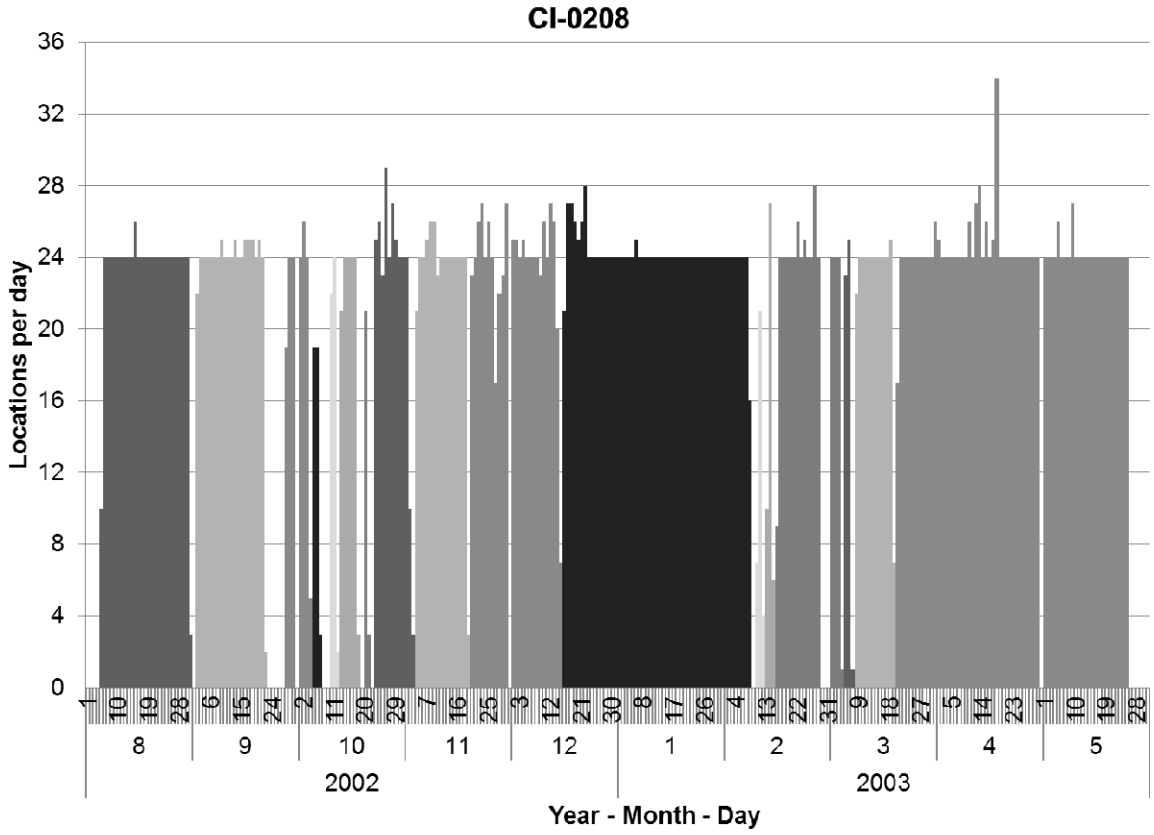


Figure 87. -- Number of modelled locations for satellite-linked transmissions from beluga CI-0208 tagged in Cook Inlet, Alaska, 4 August 2002. A change in column color denotes transmission gaps > 1 day. Transmissions were received from the beginning of August through most of May 2003 (covering 293.4 days with 264.7 days of data available for analysis).

During the transmission period, CI-0208 was often accompanied by CI-0201, CI-0205, and sometimes CI-0206 (see the tag animation videos for 2002 at: http://www.afsc.noaa.gov/News/Cook_Inlet_Beluga_Range_Contracted.htm). CI-0208 was in

the vicinity of 24% of the opportunistic sightings (n = 54) reported during the period his tag transmitted (Appendix 5). However, locations of beluga groups reported opportunistically during the period November-May did not coincide with any of the transmitted locations from whales tagged in 2002 (Appendix 5).

CI-0208 did not venture far from Knik Arm in August and September (Fig. 88). He spent about 4 hours in the area west of Point MacKenzie on 15 August, and in September he traveled to the Susitna River on the 21st–22nd. A break in transmissions occurred at this point and when transmissions resumed on 28 September, CI-0208 was near the mouth of the Ivan River. He swam west past the mouth of Beluga River before turning back and crossing the delta to the east tributary of the Susitna River, arriving on the 30th. He then returned to Ivan River later that day.

On 1 October, CI-0208 swam east across the Susitna River delta and entered Knik Arm on the 2nd (Fig. 88). He remained in Knik Arm until at least 4 October when another break in transmissions occurred (Fig. 87). When transmissions resumed on 5 October, he was located once again near Ivan River in the Susitna River delta. He swam offshore heading southwest and entered Trading Bay that day (Fig. 88). He presumably remained in Trading Bay until 23 October (transmission breaks occurred multiple times between the 15th and 23rd, but CI-0208 was in the bay each time transmissions resumed). On 23 October, he swam north with CI-0206 returning to the Susitna River delta before entering Knik Arm on the 24th. Similar to August, he briefly rounded Point MacKenzie on the 26th then returned to Knik Arm. On 28 October, he returned to Ivan River and remained there until the 30th when he swam south to Trading Bay.

CI-0208 remained in Trading Bay near the mouth of the McArthur River until 6 November when he swam north to the Little Susitna River before entering Knik Arm around 16:00 h on the 7th (Fig. 88). Nineteen days later, he departed Knik Arm and crossed Chickaloon Bay to Chickaloon River. He moved between the river and the bluffs in Chickaloon Bay from 25 to 29 November, entering Turnagain Arm around 08:30 h on the 29th.

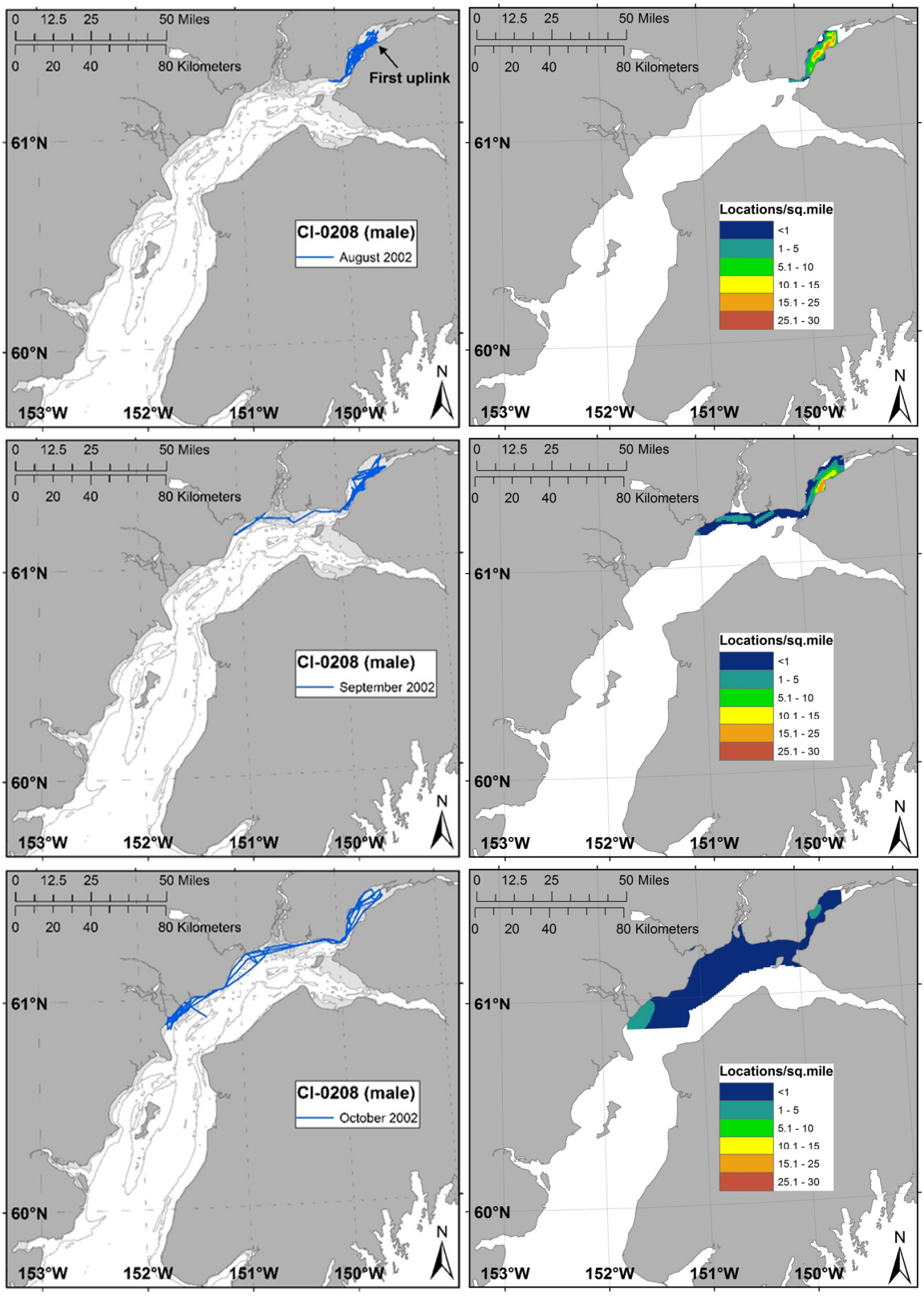


Figure 88. -- Monthly movement tracks (blue) and density (low to high kernel modelled locations per sq. mile) of beluga CI-0208 tagged in Cook Inlet, Alaska, 4 August 2002.

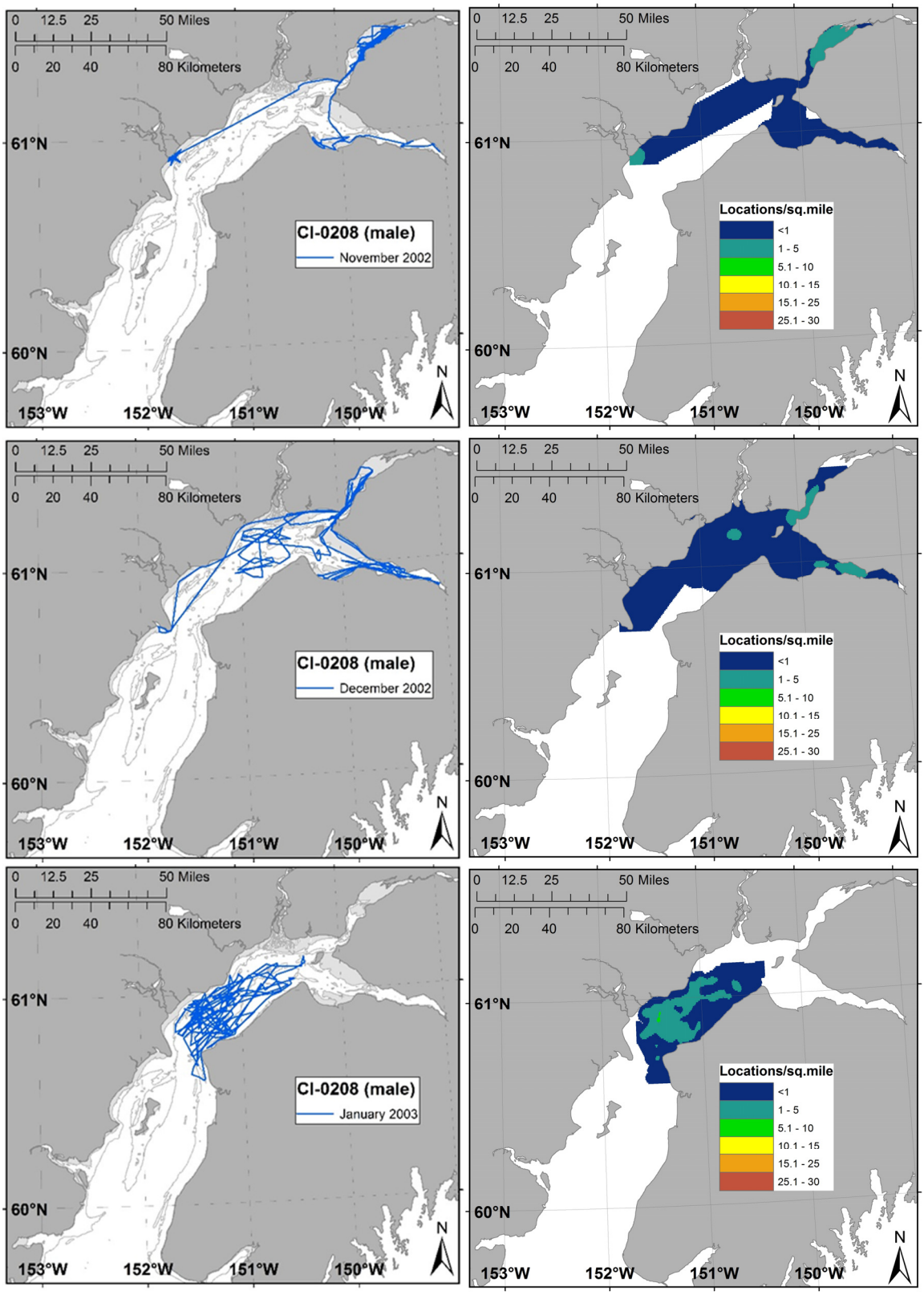


Figure 88. -- Cont.

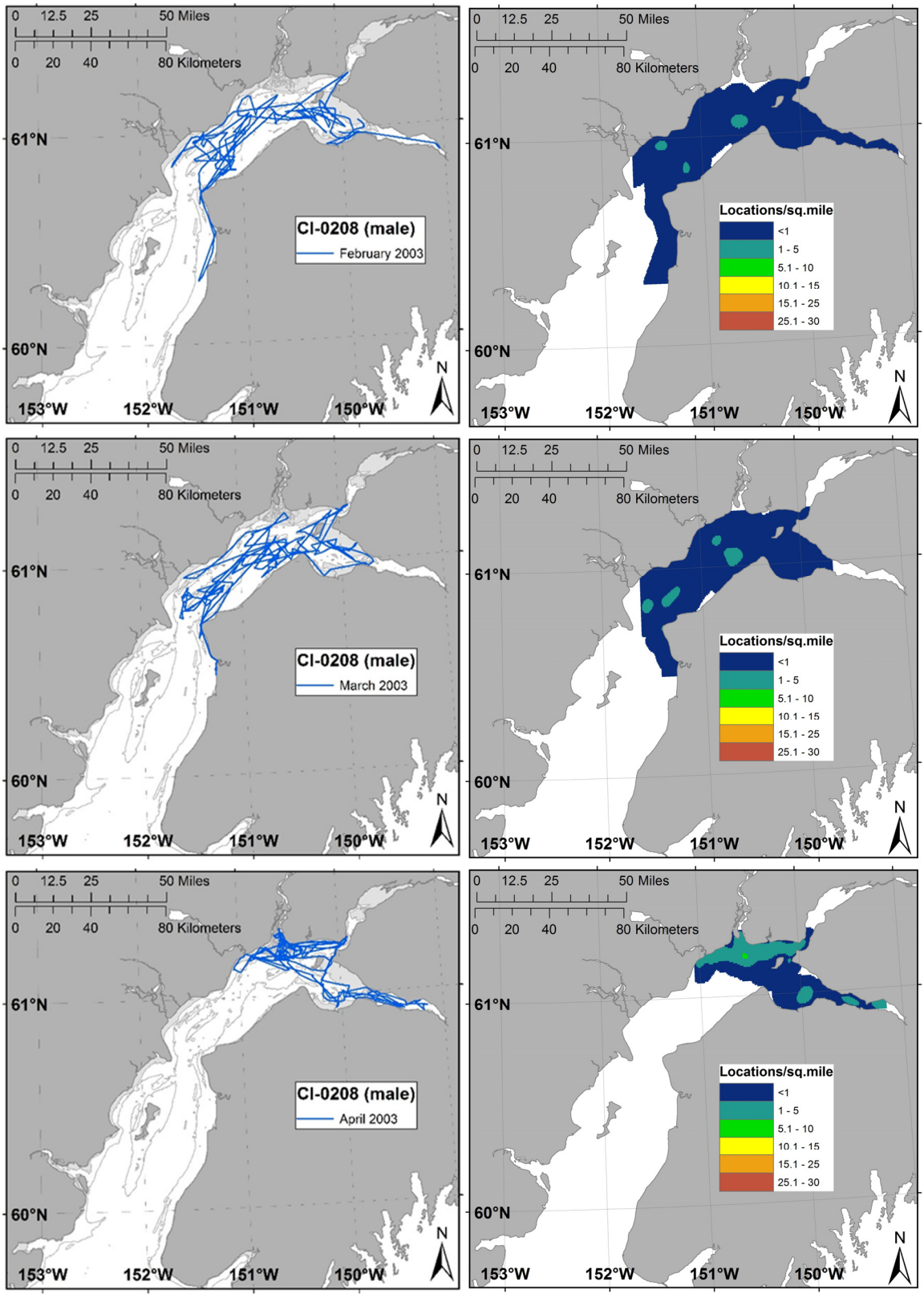


Figure 88. -- Cont.

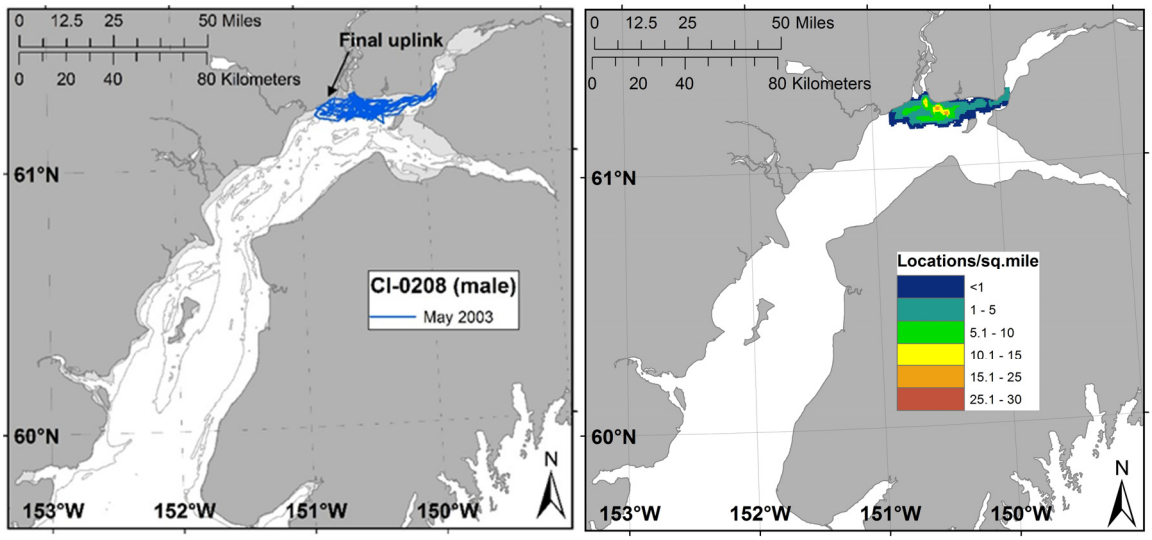


Figure 88. -- Cont.

On 1 December, CI-0208 returned to Chickaloon Bay (Fig. 88). He moved back-and-forth between Chickaloon Bay and Turnagain Arm until 9 December, when he left the arm with CI-0205 and CI-0206. They followed the mudflat edge to Fire Island, cutting between the island and Point Campbell to enter Knik Arm. Around 24:30 h on 11 December, CI-0208 passed the Port of Anchorage and crossed to the north tip of Fire Island. He continued west offshore between Fire Island and the mudflats until he reached the Susitna River where he turned toward shore. He crossed the mudflats, then turned east and followed the shoreline back to Knik Arm, arriving around 15:00 h on 12 December. CI-0208 continued north to Birchwood before turning south and departing Knik Arm for Chickaloon Bay at 07:30 h on 13 December. He followed the shoreline past Potters Marsh and entered Turnagain Arm at 17:30 h. He remained near Sunrise and Bird Point until 04:30 h on 15 December when transmissions stopped.

When transmissions resumed almost 24 hours later, CI-0208 was near Twenty-mile River in Turnagain Arm. He traversed the length of the arm and reentered Chickaloon Bay then followed the shoreline, cutting between Fire Island and Point Campbell, before heading into Knik Arm around 03:00 h on 17 December. He remained near the Port of Anchorage until 16:00 h when he swam north arriving around midnight near Birchwood. CI-0208 turned south and followed the western shoreline into Goose Bay, then continued south around Point Mackenzie. He followed the shoreline to the mouth of the Little Susitna River arriving around 04:00 h on

19 December. At this point, he turned offshore and swam southwest to North Foreland, entering Trading Bay at 15:43 h. He continued south along the shoreline, passing Shirleyville before heading offshore to West Foreland, and entered the lower inlet at 23:00 h on 20 December. CI-0208 returned to the upper inlet at 07:40 on 21 December. He swam directly from West Foreland to North Foreland, then followed the shoreline back to Knik Arm, arriving near the Port of Anchorage at 13:40 h on 22 December. CI-0208 moved between Goose Bay, Eagle Bay, and north to Birchwood where he encountered compact ice (Fig. 89) before returning to Chickaloon Bay on 24 December. He remained in the middle of the bay until 15:40 h on 25 December. He swam west past Point Possession into the middle of the upper inlet where he remained until the end of the month in open pack ice (Fig. 89).

The three males (CI-0205, CI-0206, and CI-0208) travelled together in January (see tag animations for 2002 at: http://www.afsc.noaa.gov/News/Cook_Inlet_Beluga_Range_Contracted.htm) in ice-covered waters ranging from very open pack to compact ice (Fig. 89). On 10 January, the three whales entered the lower inlet, heading offshore before circling back to shore north of Kenai River and returning to the upper inlet (Fig. 88).

In February, the whales split up for brief periods. Unlike CI-0205 and CI-0206, CI-0208's tag did not transmit for extended periods (Fig. 87) and may have been affected by ice cover. Most modelled locations occurred when CI-0208 was in open water (27%) and very open pack ice (60%) during the month (Fig. 89). CI-0208 spent time in Chickaloon Bay on 10–11 February, encountering compact ice (concentration of 92) near Burnt Island before turning back into the bay and very open pack ice (concentration of 13). On 13-14 February, he travelled into Turnagain Arm into areas of compact ice and very open pack ice. He remained in the Chickaloon Bay/Turnagain Arm area until the 17th when he returned to mid-inlet waters off Point Possession. He entered Knik Arm briefly on 19 February before returning to Chickaloon Bay on the 20th. During this time, CI-0206 remained primarily in offshore waters while CI-0205 spent brief periods in the upper reaches of Knik Arm. The three whales met again in the Susitna River delta on 21 February. They travelled together into the lower inlet, following the shoreline south to Clam Gulch, before circling back and returning to the upper inlet on 24 February (Fig. 88).

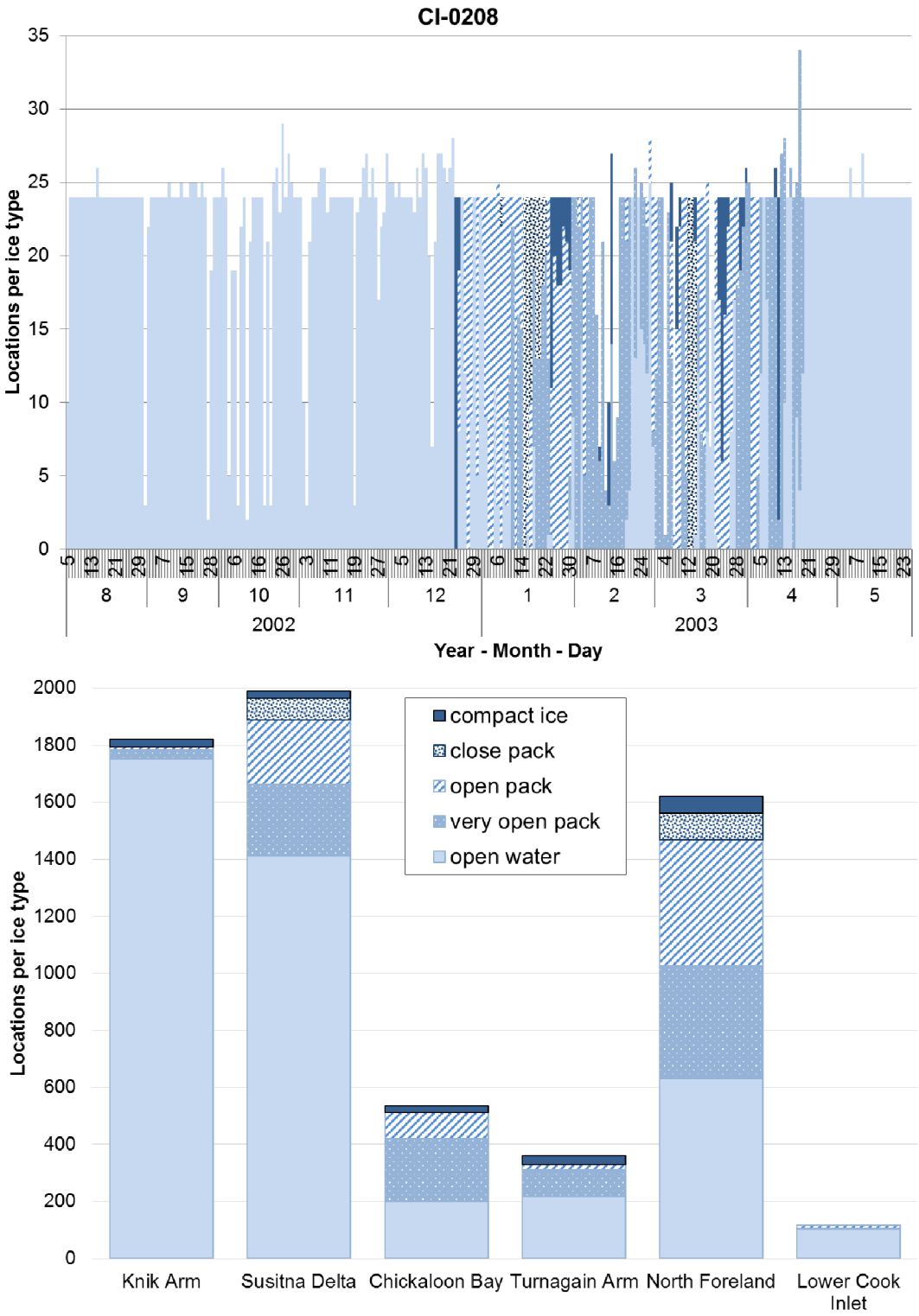


Figure 89. -- Ice associations for beluga CI-0208 tagged in Cook Inlet, Alaska, 4 August 2002. Histograms show number of modelled locations per day (top panel) and per region (bottom panel) for each ice type (see text for details). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

The whales followed similar patterns in March, splitting and rejoining (see 2002 tag animations), but all three experienced gaps in transmissions from their tags (Fig. 87), which may have been due to ice cover (Fig. 89). When not in offshore waters of the upper inlet, CI-0208 spent time in Chickaloon Bay and the entrance of Turnagain Arm from 2 March to at least 6 March, and briefly entered Knik Arm on 8 March before returning to Chickaloon Bay (Fig. 88). He spent most of the month in offshore waters of the upper inlet with trips to Trading Bay on 10 March, the mouth of the Susitna River on 14 March, the lower inlet south of Kenai River from 18 to 20 March, and Chickaloon Bay on 22 March. He began encountering compact ice and open pack ice (concentration of 57) until he reached open water and the lower inlet (north of Salamantof) on 26-27 March. On the 29th, he followed the shoreline from Moose Point to Point Possession through areas of very open pack ice (concentration of 13), then crossed to the south tip of Fire Island. He circled Fire Island clockwise before returning to Knik Arm on 31 March.

After 1 April, CI-0208 was the only whale with a functioning tag. He remained in the upper reaches of the inlet north of North Foreland and Point Possession the entire month (Fig. 88). His last encounter with compact ice was in Turnagain Arm on 10 and 11 April when he approached Girdwood. By that time, much of the upper inlet was ice-free. It was during this ice-free period that CI-0208's diving behavior changed dramatically (Fig. 90). Similar to the other tagged whales, he began diving for longer periods and deeper in December, but this increased by almost four times in April (Fig. 90). In particular, deeper and longer dives occurred mid-channel in Turnagain Arm, Chickaloon Bay, Knik Arm, and offshore of the Susitna mudflats (Fig. 90). By May 2003, CI-0208's diving behavior was similar to that observed during mid to late summer. He spent most of the month in the Susitna River delta, with brief visits to the Port of Anchorage on 5, 9, and 10 May (Fig. 88).

Plots of kernel density monthly composites include modelled locations from all whales (when > 2 individuals' tags transmitted; Fig. 91). CI-0208 was the only whale with a tag that continued to transmit during May (Fig. 88).

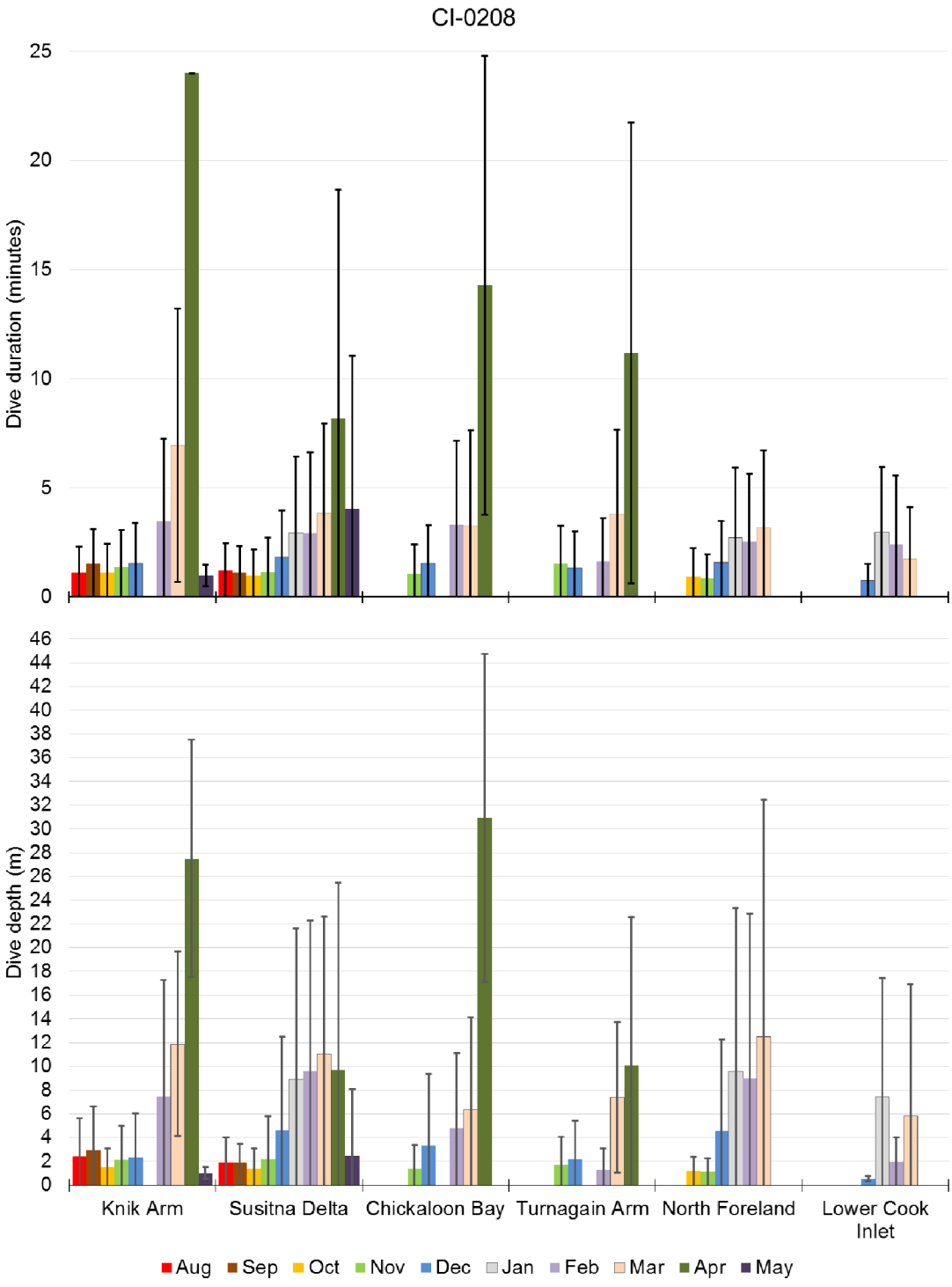


Figure 90. -- Monthly dive behavior of beluga CI-0208 tagged in Cook Inlet, Alaska, 4 August 2002. Histograms show average dive duration in minutes (top panel) and average dive depth in meters (bottom panel) for binned data (see Table 1) within specific regions of the inlet for each month (SD = error bars). Note: "North Foreland" includes all waters south of North Foreland and Point Possession, and north of East and West Foreland.

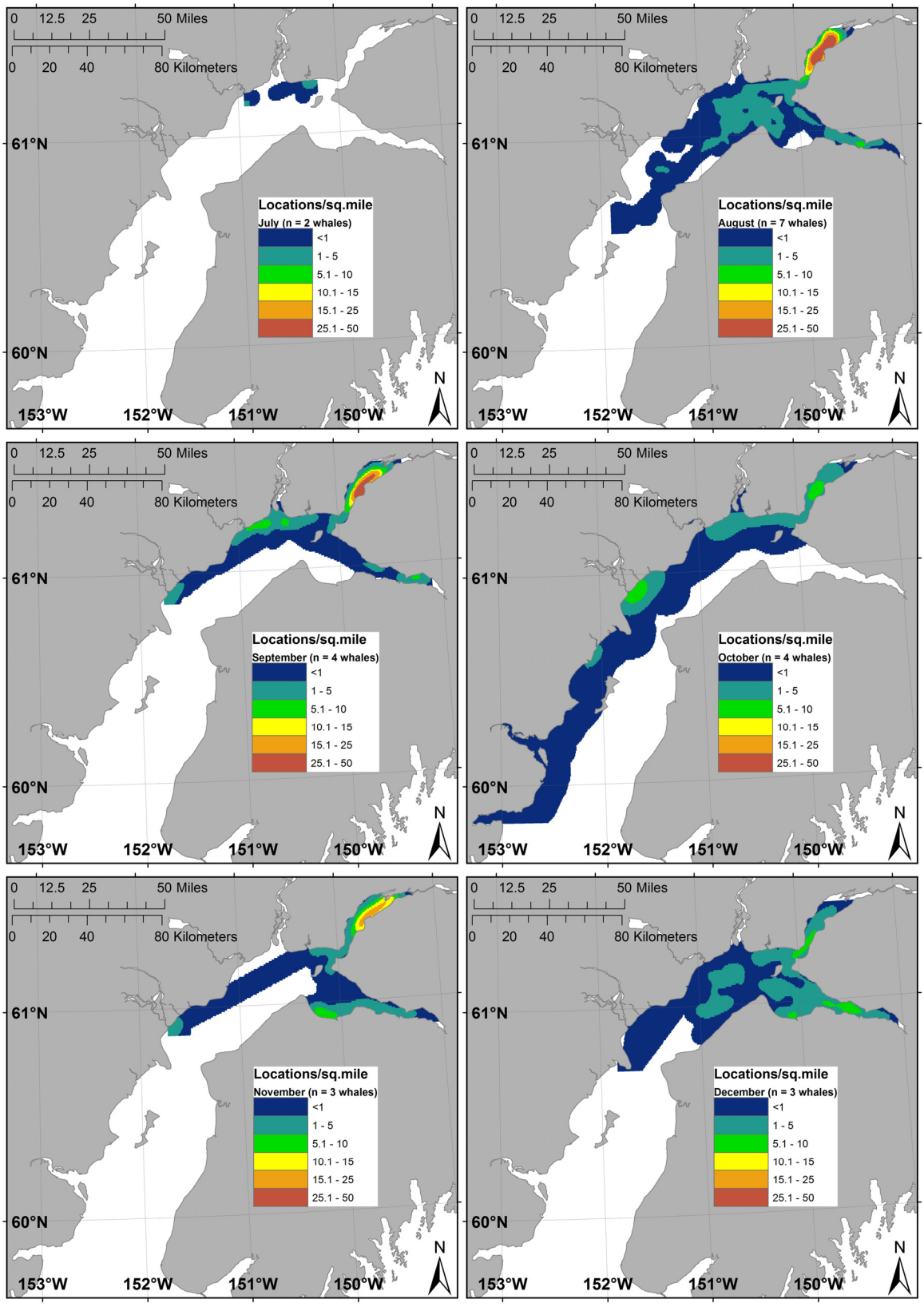


Figure 91. -- Monthly density (low to high kernel of modelled locations per sq. mile) for Cook Inlet beluga whales satellite-tagged in 2002 when more than one whale was transmitting locations.

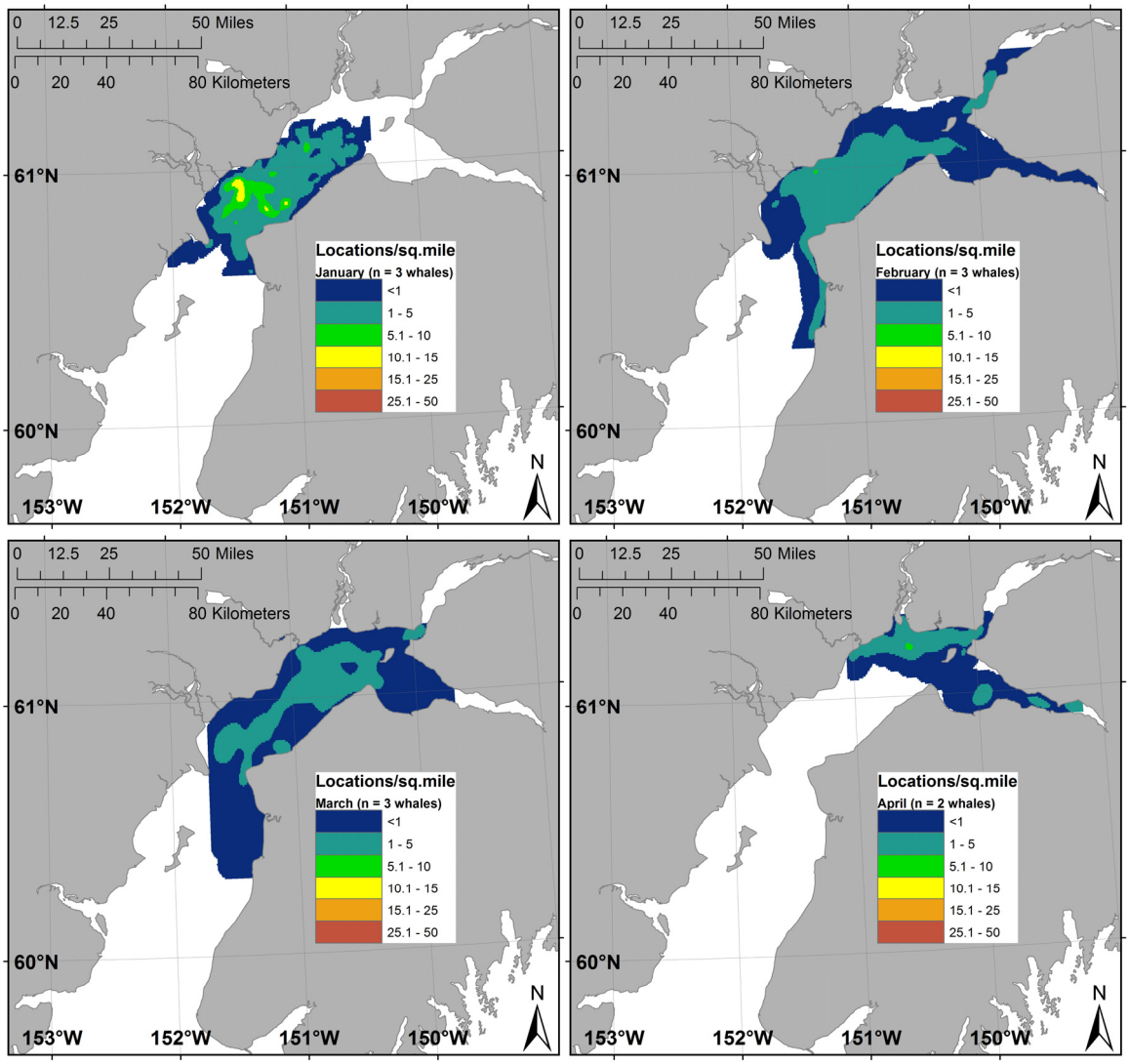


Figure 91. -- Cont.

Where Are They Now?

On 3 September 2002, an ADF&G biologist contacted MML about a flipper band retrieved from a dead beluga found floating belly-up on 9 August in a rip tide at 60°48.801'N, 151°40.206'W (Mahoney 2002b). The ADF&G biologist directed the gentleman to NOAA Enforcement in Homer where he delivered the flipper band to Officer D. Thaute that same day. The flipper band was identified as the one placed on CI-0204. This set off a chain of events after B. Mahoney and Officer D. Thaute interviewed the gentleman (Mahoney 2002b, see also section on CI-0204). A review of CI-0204's bloodwork (Norman 2002a) and dive profile was completed on 24 September 2002 (Hobbs 2002a). This eventually led to a review of all whales tagged in 2002, focusing on CI-0202 and CI-0207, whose tags had also ceased transmitting within 2 days of deployment. A review of blood work (Norman 2002b) and dive data from CI-0202 and CI-0207 was completed on 7 November 2002 (Hobbs 2002b).

CI-0202

What may have happened to CI-0202? In the November memorandum, Hobbs (2002b) noted that CI-0202's diving behavior was similar to CI-0201's behavior during the period of tag transmissions from 30-31 July. We revisited the comparisons presented in the November memorandum and provide updates here. After applying location corrections per Goetz et al. (2012), we found CI-0202 was closely associated with CI-0201 on 30 July near the Little Susitna River (Fig. 92). CI-0202 moved to Beluga River the next day while CI-0201 remained at the Little Susitna River until later that day, when he began traversing the mouth of the Susitna River. He turned back shortly after reaching the mudflat edge on 1 August, following it east toward Fire Island (see Fig. 92).

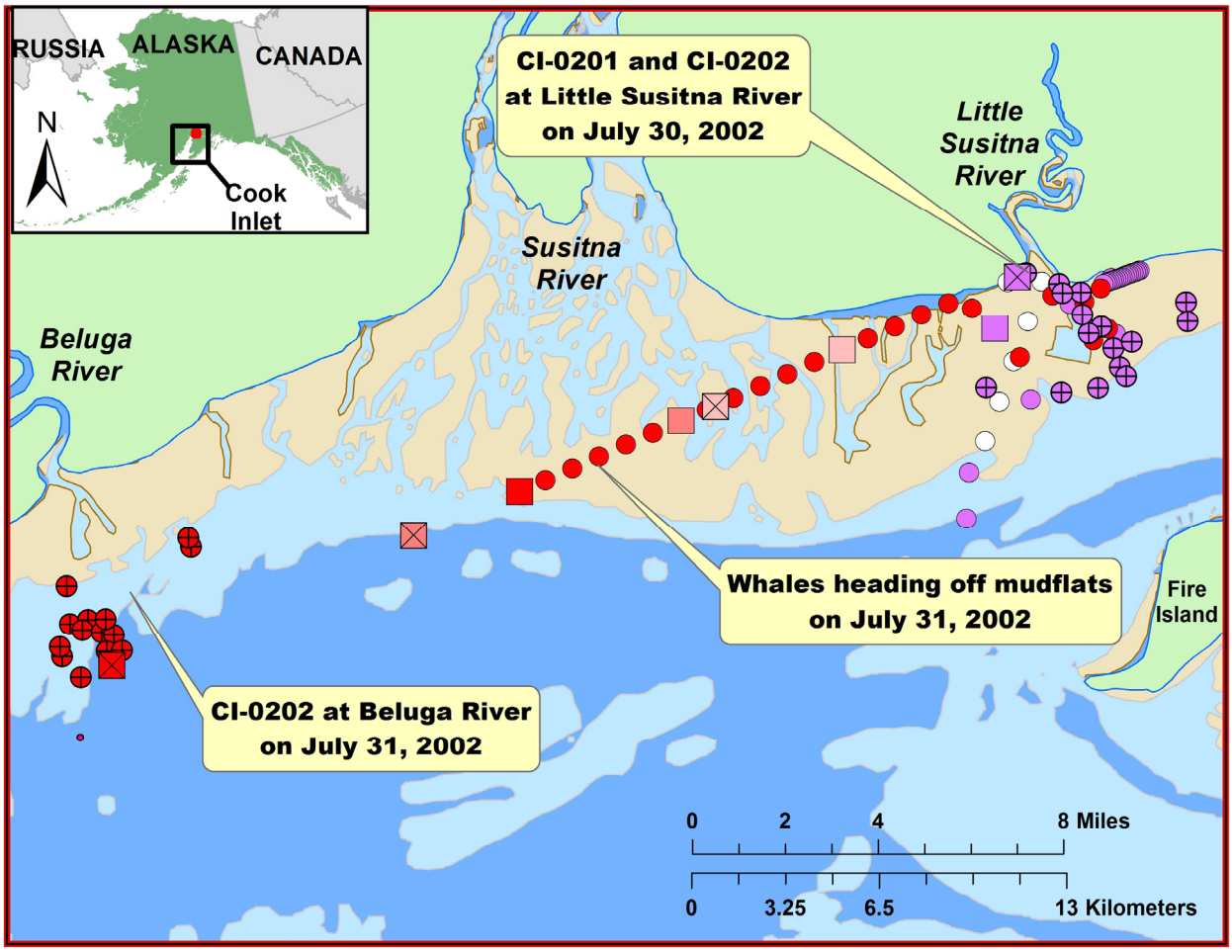


Figure 92. --Beluga CI-0202 locations (circles with + symbols) compared to CI-0201 (open circles) on the days these whales were in proximity to one another in July 2002 (30 July = purple, 31 July = red). White circles are locations of CI-0201 on 29 July. Diving behaviors were recorded over a 6-hour period (the location at the mid-point of each 6-hour period is shown: CI-0202 = squares with X symbols and CI-0201 = open squares). The palest-colored red squares on 31 July represent the first 6-hour time period and the color is progressively darker for each subsequent 6-hour period that day (three 6-hour dive periods were recorded on 31 July). See Figure 93 for dive histograms.

Dive data collected on 30 and 31 July show both whales behaving similarly (Fig. 93), though CI-0201 may have been trapped in shallow water on the mudflats between the Little Susitna and Susitna rivers during the early morning period of 31 July (Fig. 92: palest-red colored square). Low tide occurred at 4:30 h. He rarely submerged during this period (Fig. 93), while CI-0202, located in the Susitna River, was able to continue diving during that period and travel off the mudflats by the next 6-hour period (Fig. 92: medium-red colored square with X symbol).

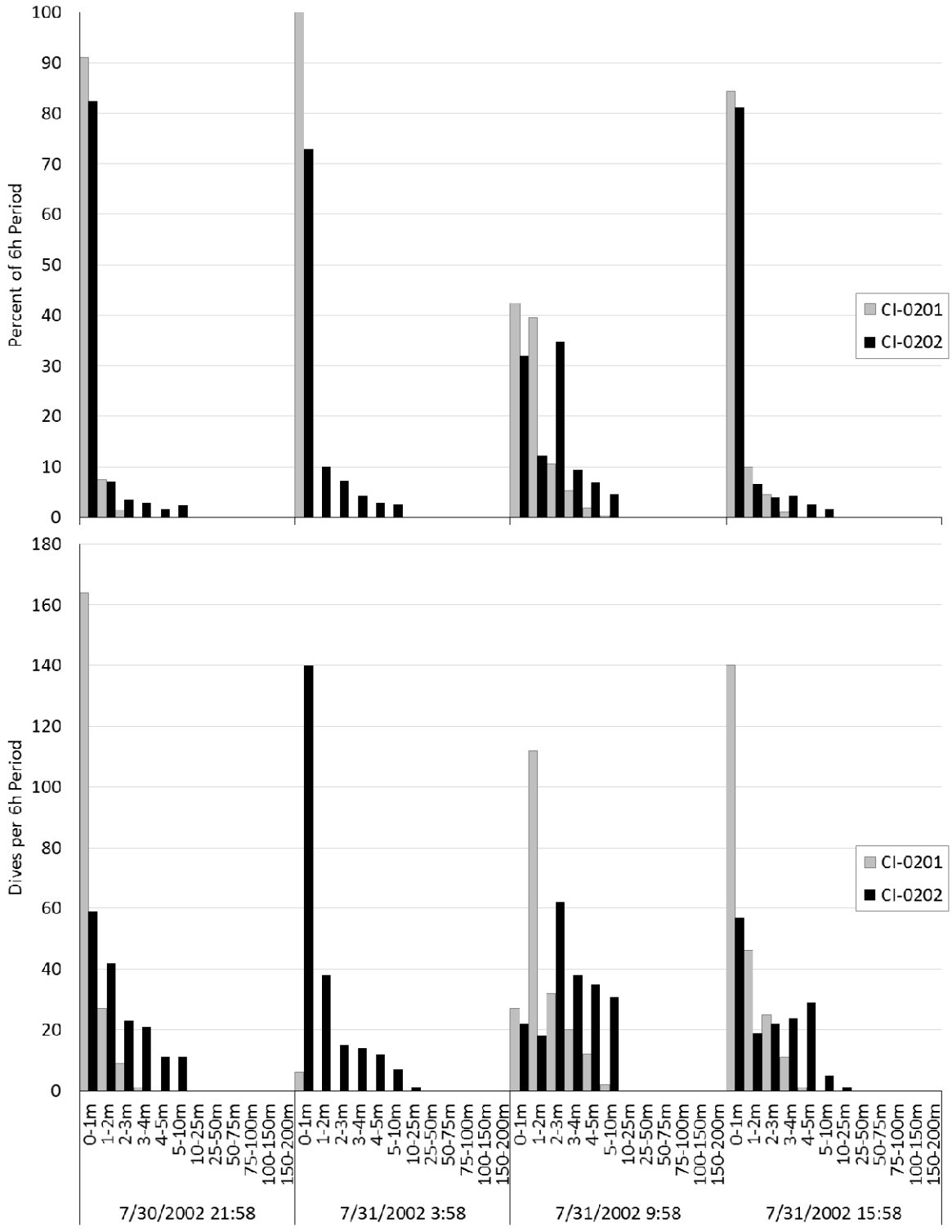


Figure 93. -- Diving behavior of beluga CI-0202 (black bars) compared to CI-0201 (gray bars) during 6-hour periods (mid-point time shown) when the whales were in proximity to one another. Behaviors shown include time at depth (top panel), number of dives per depth bin (middle panel) and number of dives per duration bin (bottom panel, next page).

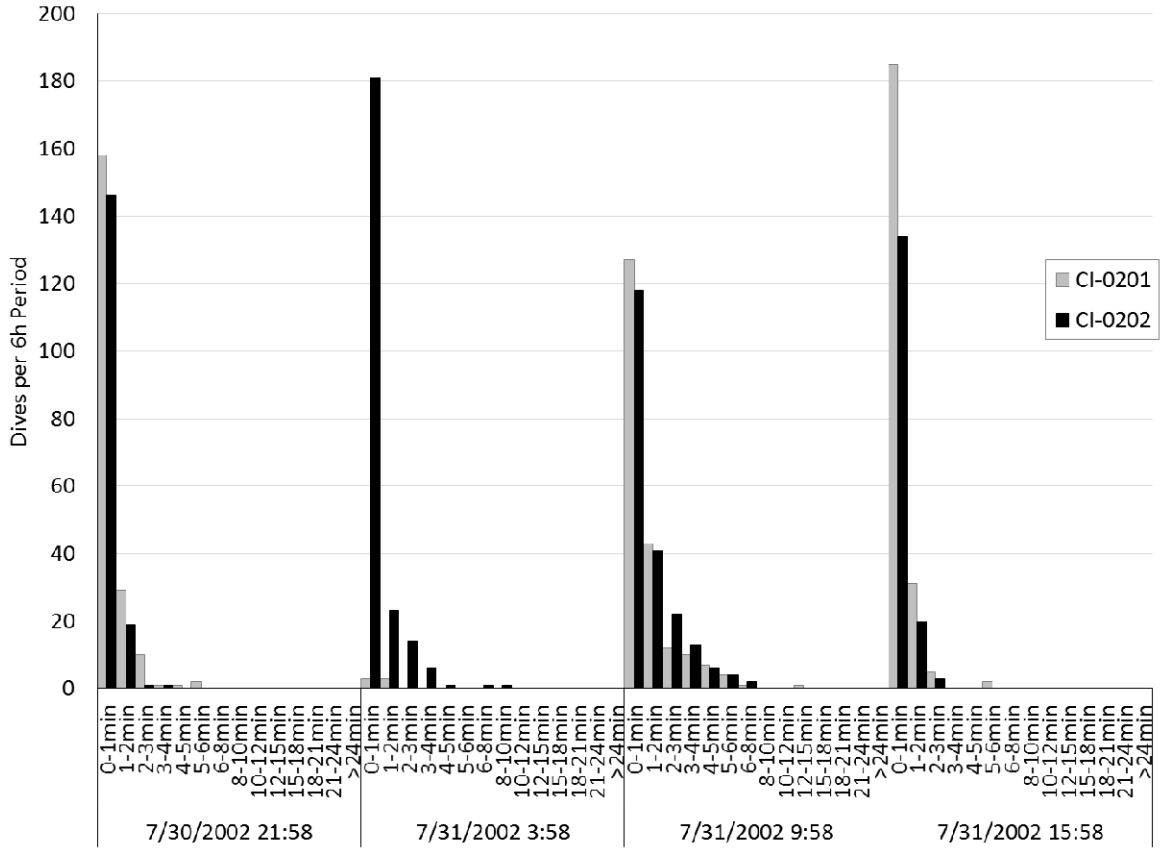


Figure 93. -- Cont.

As with the tag attached to CI-0204, the tag attached to CI-0202 was performing normally on 30 and 31 July. The status messages a month later on 30 August also indicated the tag was working well, but that it had not submerged more than 2 m (Fig. 94). Compared to hundreds of dives reported in July for CI-0202 (Fig. 93), only 13 dives were reported over the three 6-hour periods transmitted in August, most of which were > 24 minutes in duration in extremely shallow water (Fig. 94). This behavior appeared atypical compared to the previous tag data for CI-0202 as well as the other tagged whales.

We present the following explanations for these behaviors. CI-0202 may have died following the last transmissions on 31 July, and, like CI-0204, floated belly-up with the tag submerged as she drifted south to the entrance of the lower inlet, where her carcass briefly ran aground and rolled in the surf. It is possible for a whale to drift from the upper inlet to the lower inlet in a month's time (e.g., Johnson 2008), particularly during the summer when the freshwater

content of Cook Inlet is high (Okkonen et al. 2009). Because most of the freshwater enters the upper inlet, the non-tidal, buoyancy-driven flow is down inlet (southward). However, the path and time taken between point A and point B depend on the integrated effects of tides, winds, and buoyancy currents encountered along the whale's particular drift trajectory (S. Okkonen, UAF, pers. comm. 2016). Her carcass may have refloated on the next high tide at Shaw Island, ending further transmissions until April 2003, when an incomplete transmission was received from PTT# 30719 (noted as "too short" with no location data).

Another explanation may be the tag detached and was carried by currents to the lower inlet. If the whale stranded and rolled at some point (not uncommon in Cook Inlet), the cables may have pulled free and the tag fell off. However, none of the transmitters included flotation and given the depth of the inlet, it is unlikely the tag would sink and be pulled by currents south, and then wash up on shore. Without a carcass or tag to verify any of these scenarios we are left with these possibilities: 1) the whale died, either from tagging or some other source of mortality, and her carcass drifted to the entrance of Cook Inlet; or 2) the tag detached and briefly resurfaced in the lower inlet. No belugas, alive or dead, were observed during NOAA Enforcement aerial patrols that took place in the lower inlet on 7, 14, and 26 August (Mahoney 2002b).

On 7 August, the NOAA Enforcement patrol included: Homer to East Foreland, to West Foreland, back east to Kenai River, south to Elizabeth Island, east to Outer (Pye) Island, turning west due to weather (low clouds and heavy fog) to Flat Island (no Barren Islands due to weather), then north to Kachemak Bay and landing in Homer. The survey altitude was 400-500 ft. with a survey speed of 100 kts. On 14 August, the flight pattern included: coastal of Kachemak Bay, to Seldovia, to Flat Island, to Chugach Pass, into Port Chatham, Cape Elizabeth, around Sugarloaf Island, Sud Island, Ushagat Island, Nuka Point, around Outer (Pye) island, then over land to Kachemak Bay, landing in Homer. On 26 August, three days before the tag transmitted locations near Shaw Island in Kamishak Bay, the flight route included south Kachemak Bay, Seldovia, Chugach Islands, Barren Islands, around Sugarloaf Island, Ushagat Island, to Kamishak Bay, coastal of Kamishak Bay (south to north), then east to Kachemak Bay, and landing in Homer.

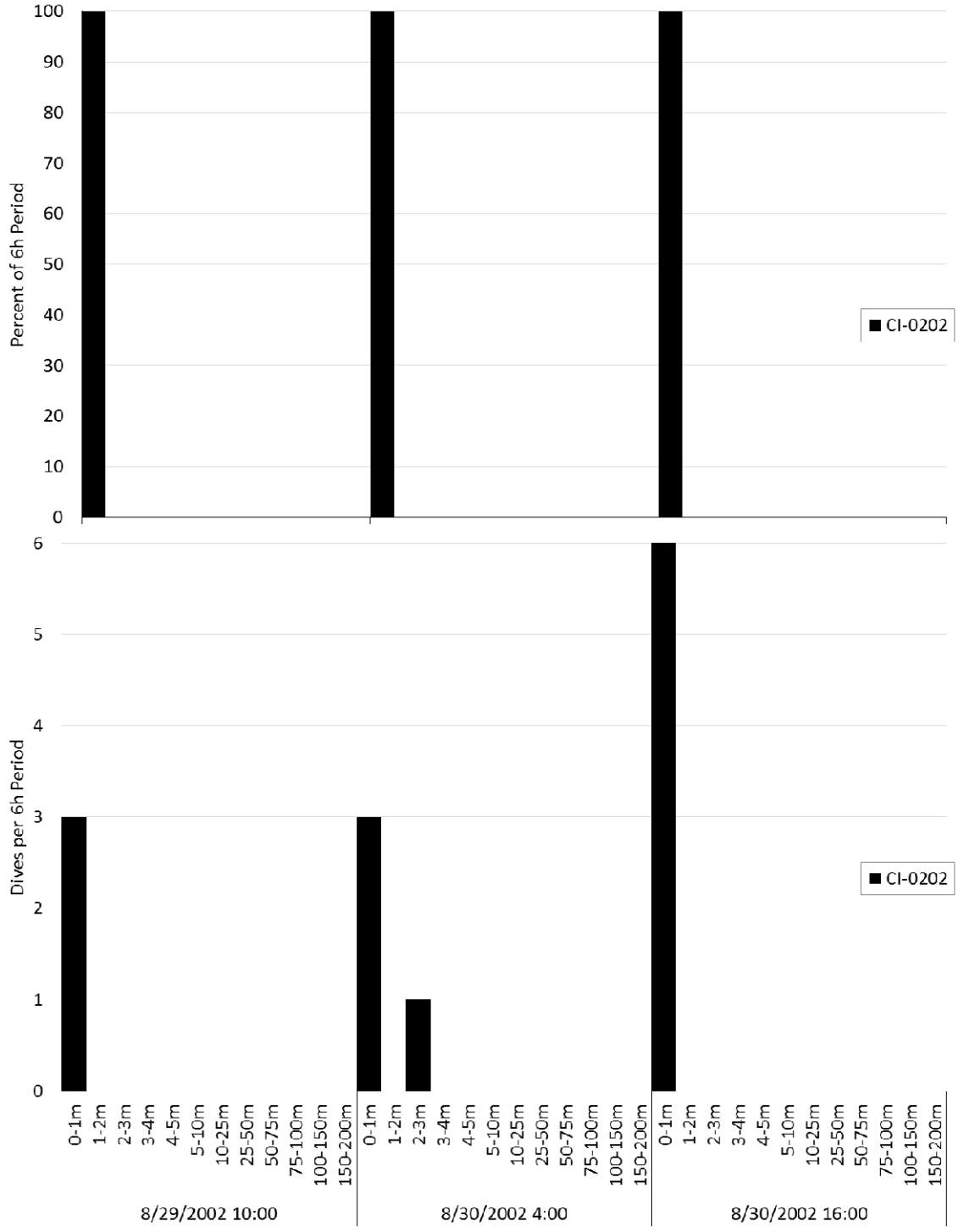


Figure 94. -- Diving behavior of beluga CI-0202 (black bars) during 6-hour periods (mid-point time shown) when the tag transmitted near the entrance of Cook Inlet in August 2002. Behaviors shown include time at depth (top panel), number of dives per depth bin (middle panel) and number of dives per duration bin (bottom panel, next page).

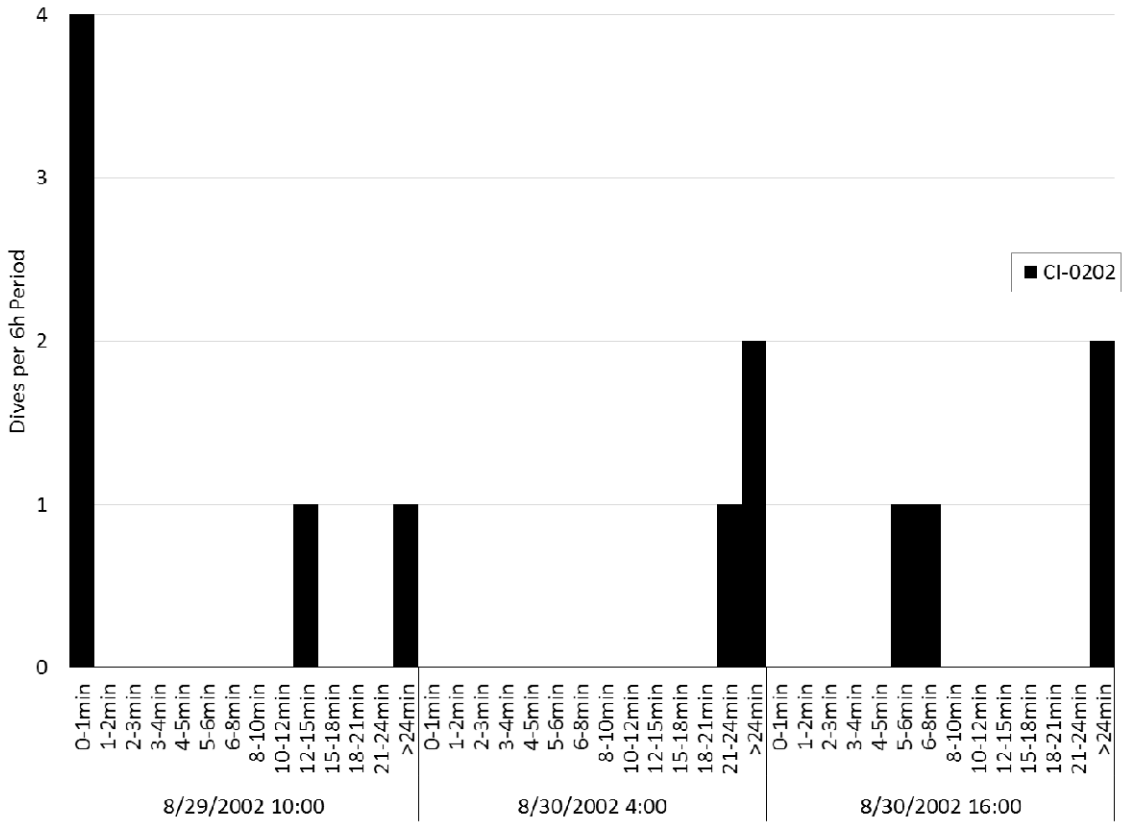


Figure 94. -- Cont.

In 2005, the *Cook Inlet Beluga Whale Photo-identification Project* was initiated by the National Fish and Wildlife Foundations and federal and private partners, with field work and cataloging of beluga whale photographs conducted by LGL Alaska Research Associates, Inc. Some of the whales captured during the satellite-tagging project were matched to living whale photographs in the catalog that were collected during the period 2005-2016 (Appendix 1). A search of the catalog did produce a possible match to CI-0202's tagging photographs (McGuire and Stephens 2016). However, this potential match was based on the type of tag scar alone and not on secondary natural marks. Although there is not very strong evidence of a match, it could not be ruled out completely, and until we have genetic confirmation we cannot be sure.

CI-0204

We know CI-0204 died sometime after her tag last transmitted on 2 August. There were no obvious marks or injuries to the ventral side of the beluga. Mr. Elmes reported that the belly was bloated with skin peeling off and some marks (pecks) from birds. The mouth was gray. The skin on the sides of the whale was white, not burnt or peeling. Mr. Elmes said that he did take a couple of pictures and would bring the copies to Officer Thaute once the film was developed. At no time did they attempt to turn the beluga over. Therefore, no one saw a satellite tag on its back or if there were any injuries on the dorsal surface. Mr. Elmes thought to contact ADF&G right away, however, the one gentleman on the boat with a cell phone worked for the oil industry and did not want to call the authorities to report a dead beluga among the oil rigs.

A review of CI-0204's bloodwork and dive behavior was completed on 24 September 2002 (Norman 2002a, Hobbs 2002a). The tag status files showed battery voltage was sufficient and that the tag was transmitting on a regular basis. As with CI-0202, CI-0204 appeared to behave normally during the 2-day period of tag transmissions. Comparisons were made to dive behavior displayed by CI-0203, who was closely associated with CI-0204 during that period (Fig. 95). Overall, dive duration and depth were similar between these two females, in particular during the final 6-hour period (Fig. 96).

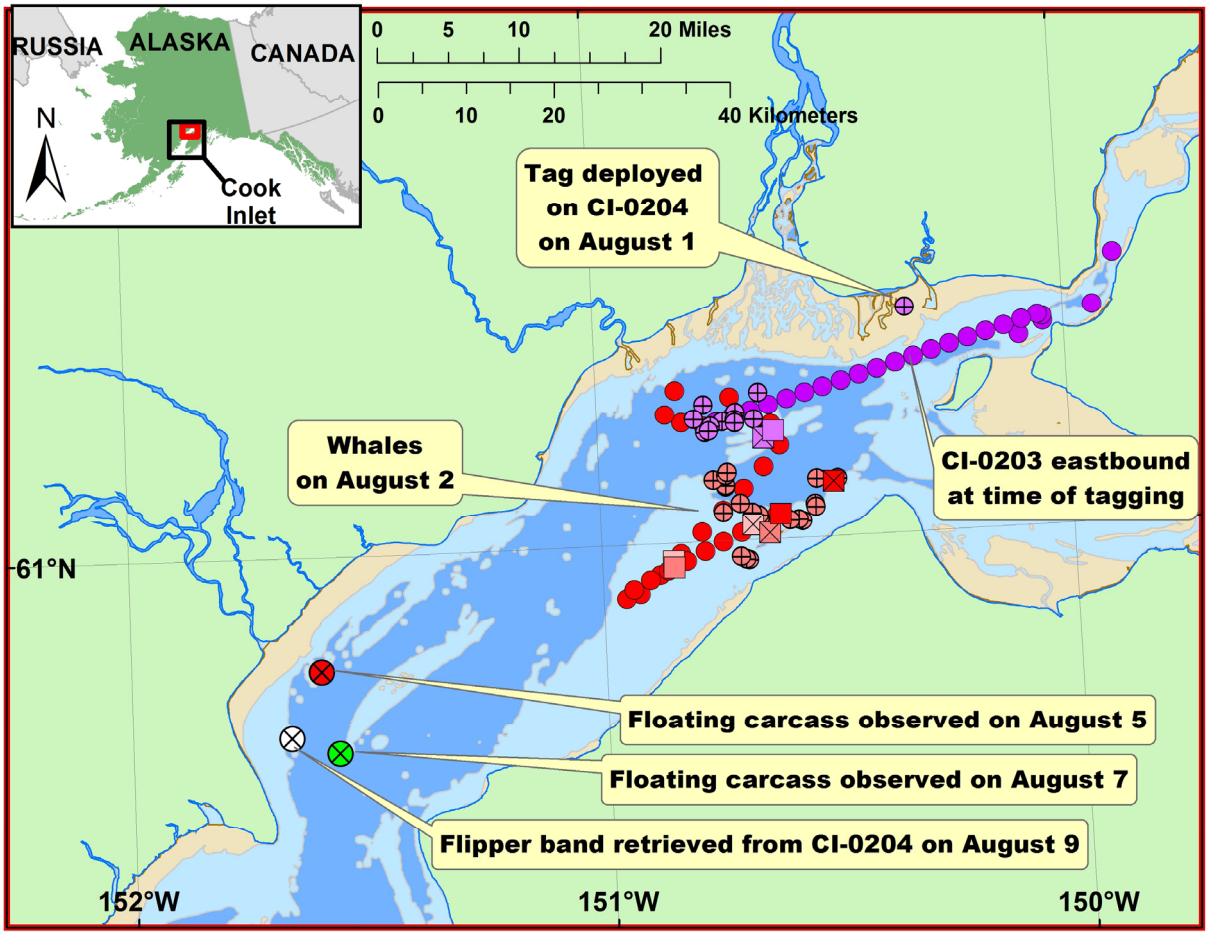


Figure 95. -- Beluga CI-0204 locations (circles with + symbols) compared to CI-0203 (open circles) on the days these whales were near one another in August 2002 (1 Aug. = purple, 2 Aug. = red). Symbols with an X indicate carcass sighting locations. Diving behaviors were recorded over a 6-hour period (the location at the mid-point of each 6-hour period is shown: CI-0204 = squares with X symbols and CI-0203 =open squares). The palest-colored squares on 2 Aug. (red) represent the first 6-hour time period and the color is progressively darker for each subsequent 6-hour period that day. See Figure 96 for dive histograms.

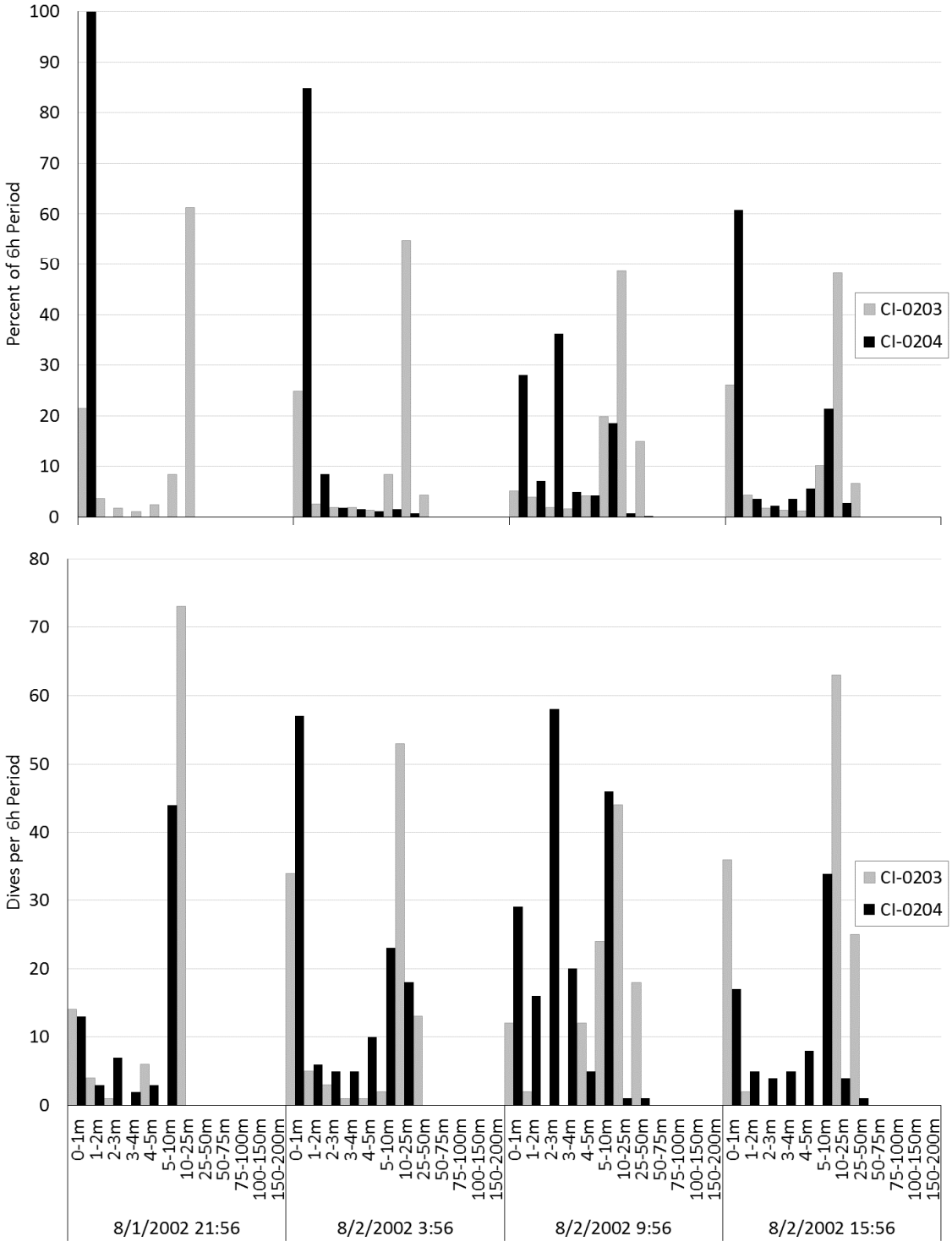


Figure 96. -- Diving behavior of beluga CI-0204 (black bars) compared to CI-0203 (gray bars) during 6-hour periods (mid-point time shown) when the whales were near one another. Behaviors shown include time at depth (top panel), number of dives per depth bin (middle panel) and number of dives per duration bin (bottom panel, next page).

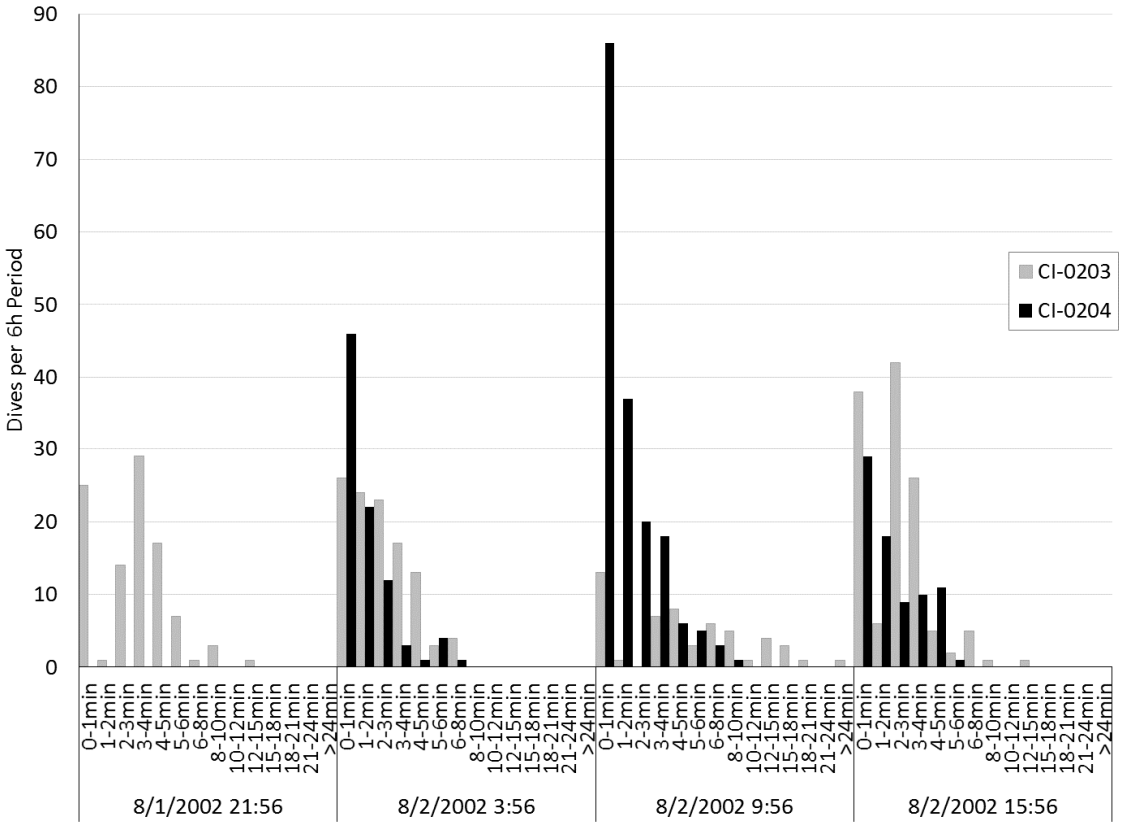


Figure 96. -- Cont.

Without recovery of the carcass, we cannot determine if CI-0204 died due to complications from tagging or some other source of mortality. We also cannot be sure that the carcasses reported on 5 and 7 August were CI-0204. Overall, 13 whale carcasses were reported to the NMFS stranding hotline in 2002 (Vos and Shelden 2005), including several reports of floating carcasses (Table 6).

A co-management agreement was in place that year allowing subsistence hunting to commence after 13 July with one strike allocated to the Native Village of Tyonek (NVT) and one strike to the community of Alaska Native Cook Inlet marine mammal hunters (ANMMHC - CIMMC). In order to allow NMFS and NOAA Enforcement to oversee the hunts, the NVT allowed the ANMMHC to conduct the first hunt (NOAA 2002). By 22 July, ANMMHC hunters had completed their hunt, taking a male beluga south of Big Island in the Sustina River delta (Table 6). After assisting NMFS with satellite-tagging beluga whales from 29 July to 5 August, the NVT attempted several hunts, but were unsuccessful due to bad weather, and no strike was

reported (NOAA 2002). Because the tags from CI-0202, CI-0204, and CI-0207 stopped transmitting locations and dive data before 5 August, it is unlikely that the mortality of CI-0204, and the unconfirmed mortalities of CI-0202 and CI-0207 were incidental to subsistence hunting.

Table 6. -- Beluga carcasses reported in Cook Inlet, Alaska, in 2002. Information from Mahoney (2002b), NOAA (2002), and NMFS stranding database.

Date	Location	Disposition
May 20	Point Woronzof	Stranded calf 130 cm (4 ft. 3 in.).
May 29	0.5 miles from the OSK dock at Nikiski, East Foreland	Carcass drifting south on the tide at 15:49 h. Reported again later that day but vessels did not tow it to shore.
May 29	Point Possession	NMFS sampled 16-17 June. Male (429 cm, 26 GLG age).
May 31	Native Village of Tyonek	Carcass observed floating in the morning. NOAA Enforcement searched the area in the afternoon but no carcass was found. NMFS assigned to 29 May whale.
July 22	Susitna River	Subsistence hunt. Male (457 cm).
Aug. 5	1.0 mile SW of Monopod oil platform, Trading Bay	Carcass observed floating at 15:15 h but location not reported until 20 hours later (see text). No search for carcass.
Aug. 7	Between oil platforms A and Dolly Varden – N. Foreland	Carcass observed floating at 17:00 h but not reported until the next morning (see text). No search for carcass.
Aug. 9	North of West Foreland	Carcass observed at 60°48.801'N, 151°40.206'W, flipper band collected but not reported until Sept. 3 (see text). No search for carcass. Unknown if observations reported on 5 and 7 Aug. were this same whale.
Aug. 14	Between Ship Creek and Point MacKenzie, Knik Arm	Carcass observed floating by tug operators and public at 17:00 h. Towed to shore by barge company. Extremely bloated male beluga with no external signs of trauma. Lower jaw (22 GLG age) and skin sample collected.
Aug. 26 or 27	Tidal area 200 yards offshore near Anchorage	Carcass observed floating around 10:00 h, a small (5-6 ft) gray/brown beluga with one pectoral flipper out of water that appeared to be injured. Another fisherman also observed a young dead beluga float by his camp on the Susitna River. On 28 Aug., NOAA Enforcement surveyed Kenai to Tuxedni Bay, the west coast north to Little Susitna River, crossed to Pt. Possession then followed east coast to south of East Foreland. Observed no carcasses and 30-40 beluga feeding at mouth of Little Susitna River.
Sept. 24	Port of Anchorage, Knik Arm	Adult carcass, floating.
Sept. 28	Chuitna River, near Tyonek	Stranded on 28 Sept; reported on 30 Sept; NMFS response on 1 Oct. Female (23 GLG age) length 366 cm.
Sept. 28	Trading Bay	Adult carcass reported, unconfirmed.
Sept. 30	Port of Anchorage, Knik Arm	Adult carcass floated away on tide, unconfirmed.
Oct. 11	Cairn Point, Knik Arm	Adult female (29 GLG age) length 372 cm. NMFS assigned to 30 Sept. whale.
Nov. 1	Seattle Creek, Turnagain Arm	Grayish/white carcass reported, unconfirmed.
Nov. ?	Point Woronzof	Adult (386 cm). Notes state sampled on 17 Jan. 2003. NMFS determined whale was from 14 Aug. necropsy.

CI-0207

What may have happened to CI-0207? CI-0207 was closely associated with three other tagged whales (CI-0201, CI-0205, and CI-0206) for much of the period that her tag transmitted location data on 4 August (Fig. 97). During this time, her diving behaviors were similar to these three male belugas (Fig. 98). It appears that all of the whales may have stranded on the low tide during the final 6-hour diving period before the break in transmissions from CI-0207's tag (Fig. 98). All were proximate to one another off Birchwood at that time (Fig. 97: dark-colored square symbols). During that period, tagging operations were occurring north of Birchwood where CI-0208 was captured at 15:15 h and released at 16:26 h (Fig. 97: star symbol). No information was provided on the Level A form or Beluga Capture form about weather conditions, tides, or if other whales were in the area.

If CI-0207 stranded and rolled when refloating on the incoming bore tide, it is possible the antenna was damaged or the cables pulled free and the tag fell off. Breaks in transmissions may have been a result of: 1) CI-0207 may have died on 4 August, and floating belly-up, rolled enough to send incomplete transmissions, eventually stranding near the bluffs south of Point MacKenzie; or 2) the tag became partially detached, eventually fell off, and washed up near the bluffs. No beluga carcasses were observed in the area at that time (see Table 6), but later in August floating carcasses of a male beluga (on the 14th) and juvenile (gray-colored with damaged pectoral flipper, on the 26th-27th) were reported in Knik Arm, neither of which matched CI-0207. Similar to CI-0202, a search of Cook Inlet beluga photographs taken of live whales did produce a possible match to CI-0207 (McGuire and Stephens 2016), but without genetic confirmation we cannot be sure.

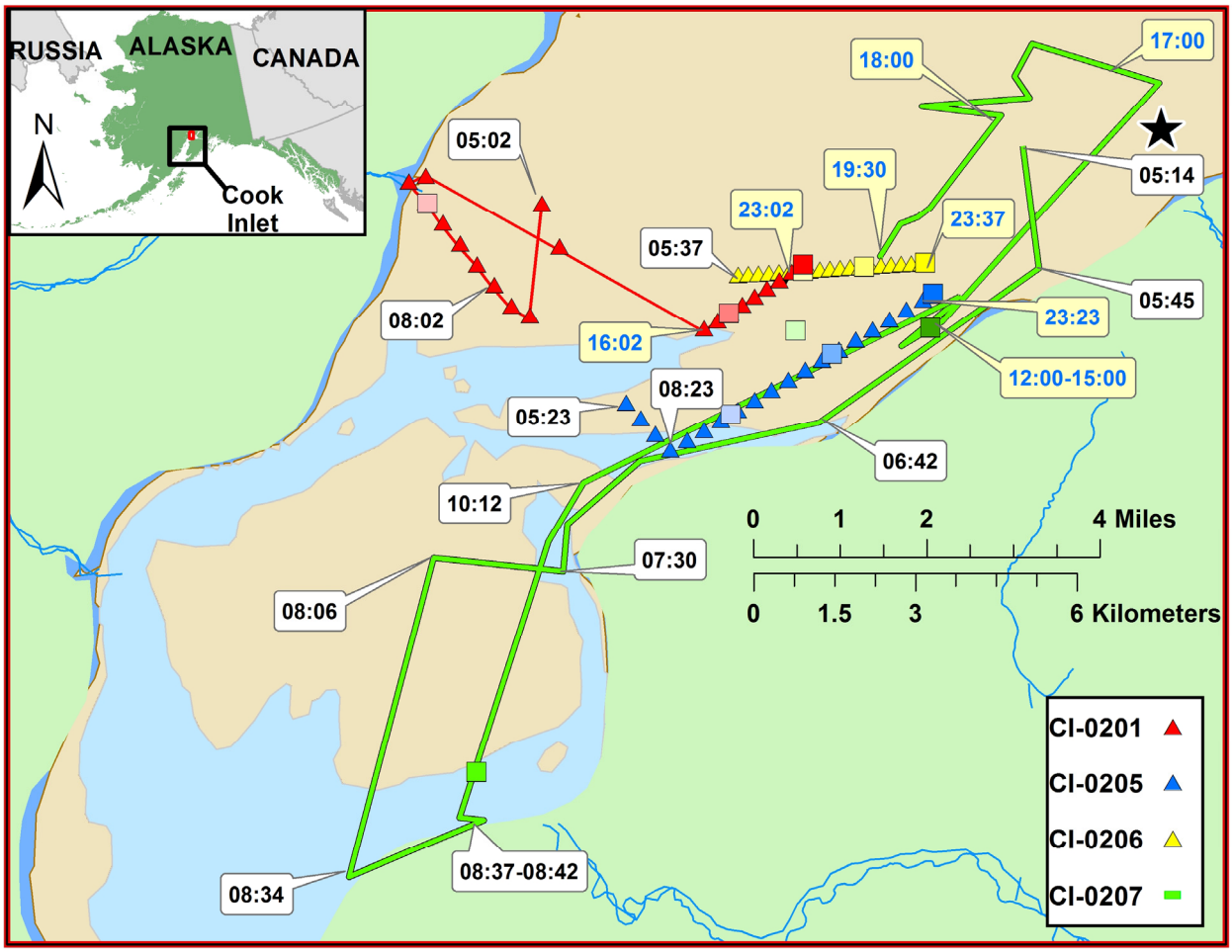


Figure 97. -- Beluga CI-0207 locations (green symbols and line) in Knik Arm compared to CI-0201 (red symbols and line), CI-0205 (blue symbols and line), and CI-0206 (yellow symbols and line) when these whales were proximate to one another on 4 August 2002. Time of day is shown in the call-out boxes associated with each whale's location. Diving behaviors were recorded over a 6-hour period (the location at the mid-point of each 6-hour period (three periods were recorded on 4 August) is shown as a square symbol with colors progressing from lighter (earlier in the day) to darker (late in the day). See Figure 98 for dive histograms for each 6-hour period. The star symbol shows the location of the tagging crew during the capture of CI-0208 which occurred between 15:15 h and 16:45 h.

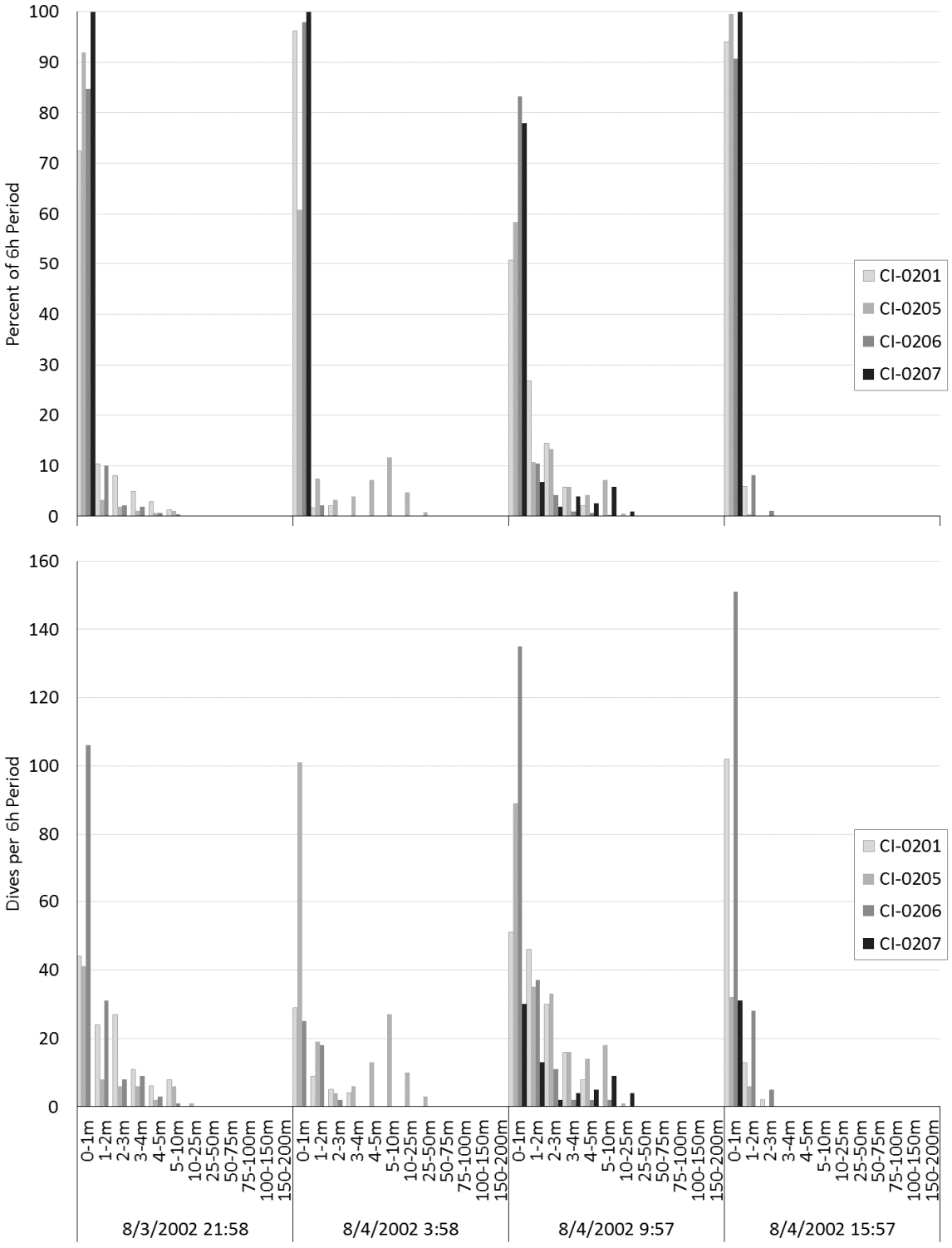


Figure 98. -- Dive behavior of beluga CI-0207 (black bars) compared to CI-0201 (light gray bars), CI-0205 (medium gray bars), and CI-0206 (dark gray bars) during 6-hour periods (mid-point time shown) when the whales were proximate to one another. Behaviors shown include time at depth (top panel), number of dives per depth bin (middle panel) and number of dives per duration bin (bottom panel, next page).

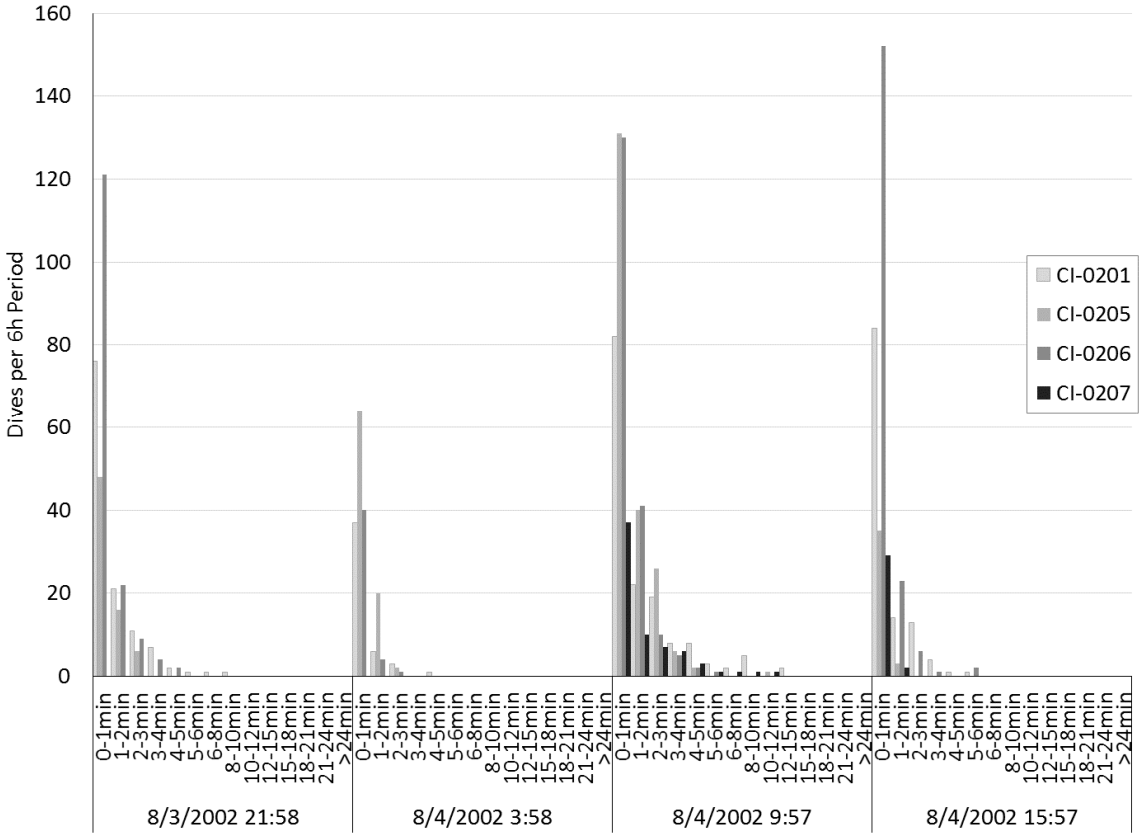


Figure 98. -- Cont.

More Photo-ID Matches

McGuire and Stephens (2016) conducted a comprehensive review of the photo-ID catalog, synthesizing all available photographs and sighting records of confirmed and suspected tagged whales, and were able to match seven whales from photographs taken during the captures (Appendix 1). Eight additional whales in the photo-ID catalog have satellite-tag scarring patterns similar to the confirmed matches, but these whales could not be matched to the original photographs taken at the time of capture (McGuire and Stephens 2016). At least eight more whales in the photo-ID catalog have scarring in and near where tags had been placed, however, these patterns could not be conclusively attributed to tagging. It is hoped that future biopsy sampling will allow us to use genetics to match these whales.

Of the seven whales with confirmed matches between photos in the photo-ID catalog and photos taken during the captures for tagging, one was from the 1999 season, one from 2000, two from 2001, and three from 2002 (Table 7). RCF-399, the small female captured and released in 1999, was "recaptured" in photographs only in 2007. "Paula" (CI-0002) was photographed in all years but 2006. Two females from 2001, CI-0101 and CI-0106, were photographed every year but 2006 and 2016, and in all years (2005-2016), respectively (Table 7). See appendices in McGuire and Stephens (2016) for the photograph time-series for these four whales. The three males from 2002, CI-0205, CI-0206, and CI-0208 often accompanied one another during the time their tags were transmitting. With the exception of the first year of the photo-identification project, CI-0205 was photographed every year up to the year he died in 2015 (Table 7). CI-0208 was also photographed every year until his death in 2014. CI-0206 has not been photographed since 2007 (Table 7).

The identities of CI-0205 and CI-0208 were confirmed using photographs obtained when they stranded and verified via genetics (G. O'Corry-Crowe, FAU) with samples collected during the necropsy (Appendix 1). CI-0208 was in apparent good health at the time of his death in 2014, 12 years post-tagging, but had asphyxiated sand and muddy water when he stranded (K. Burek-Huntington, AVPS). He was 24 years old at the time of his death (based on counts of one growth layer group per year using his teeth: D. Vos, pers. comm.). The tag site did not show signs of infection, and only a slight concavity of the dorsal crest had been noted in identification photographs (McGuire and Stephens 2016). It was noted, however, that his pectoral flipper had significant damage where the band had been placed.

In 2007, CI-0208 was photographed swimming on his side near Eagle River with his pectoral flipper raised out of the water. There were signs of flipper damage and the band was still partially attached, 5 years after tagging (Fig. 99). Bands were expected to last 2 years on average on free-ranging belugas, or up to four years on whales in aquaria (Orr and Hait-Saif 1992). A free-ranging whale that was captured within 12 months of banding in the Canadian Arctic in 1996 had small indentations on the leading edge of the flipper, but no signs of abrasion or infection (Orr et al. 1998). While the band was critical to identifying CI-0204's carcass when she died in 2002, future consideration should be given to the injuries that may occur with long-term deployments. The entire carcass of CI-0208 was added to the University of Alaska Museum of the North (UAM MAMM:120617) mammal collection. It was loaned to Dr. Atkinson in 2015,

and a skeletal articulation took place in spring 2016. The skeleton now hangs in Thunder Mountain High School in Juneau, Alaska, and is on long-term loan to the school.

Table 7. -- Photo-identification matches to belugas captured during satellite-tagging operations in Cook Inlet, Alaska, 1999-2002. Shaded cells indicate whales that cannot be matched to photographs in the database. Photographed at time of capture: 1 = capture photographs too poor to get conclusive match but shows enough to possibly match a whale with satellite-tag scarring pattern in the photo-ID catalog, 2 = video of capture but no photographs, 3 = capture photographs too blurry to find any potential match in the catalog, and 4 = no match, died before photo-ID project began. Under each year (2005-2016): P = photographed, X = not photographed, CD = confirmed dead, n/a = not applicable (i.e., whale died).

ID	Photo at time of capture?	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
RCF-399	Yes	X	X	P	X	X	X	X	X	X	X	X	X
CI-9901	Yes1												
CIDL0100	Yes2												
CI-0001	Yes1												
CI-0002	Yes	P	X	P	P	P	P	P	P	P	P	P	P
CI-0101	Yes	P	X	P	P	P	P	P	P	P	P	P	X
Cow/calf	No												
CI-0102	Yes1												
CI-0103	Yes1												
CI-0104	No												
CI-0105	Yes1												
CI-0106	Yes	P	P	P	P	P	P	P	P	P	P	P	P
Cow/calf	No												
CI-0107	Yes3												
CI-0201	Yes1												
CI-0202	Yes1												
CI-0203	Yes1												
CI-0204	Yes4	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
CI-0205	Yes	X	P	P	P	P	P	P	P	P	P	CD	n/a
CI-0206	Yes	P	P	P	X	X	X	X	X	X	X	X	X
CI-0207	Yes1												
CI-0208	Yes	P	P	P	P	P	P	P	P	P	CD	n/a	n/a

Figure 99. -- CI-0208 swimming with his left pectoral flipper above the water. The flipper band (red and beige colored in upper panel) is visible dangling from the deep cut along the trailing edge of the pectoral flipper (loop in lower panel). Photographs taken 8 August 2007 at Eagle River, Knik Arm, by C. Garner, JBER.

CI-0205 stranded and died near Tyonek in 2015, 13 years post-tagging. Infection of the tag site was noted in his first photographs in 2006, and appeared to deteriorate yearly thereafter in photographs obtained during the period 2007-2015 (McGuire and Stephens 2016). Similar to CI-0208, CI-0205 had a deep cut in his pectoral flipper from the flipper band, which was no longer attached when he stranded (Fig. 100). He was 20 years old at the time of his death (D. Vos, pers. comm.).

CI-0206 was photographed in 2005, 2006, and 2007. Despite having very large conspicuous marks that are clearly recognizable in photographs (Fig. 101), this whale has not been photographed since 2007, suggesting he may have died (McGuire and Stephens 2016). His carcass was not identified among whales necropsied since 2007, though, to our knowledge, skin samples collected during necropsies are not routinely cross-referenced with the genetic samples from whales that were satellite-tagged.

Figure 100.--Necropsy of CI-0205 on 12 June 2015 showing pectoral flipper damage (upper panel) and concavity (lower panel) at the tag site (photographed by K. Burek-Huntington, AVPS).

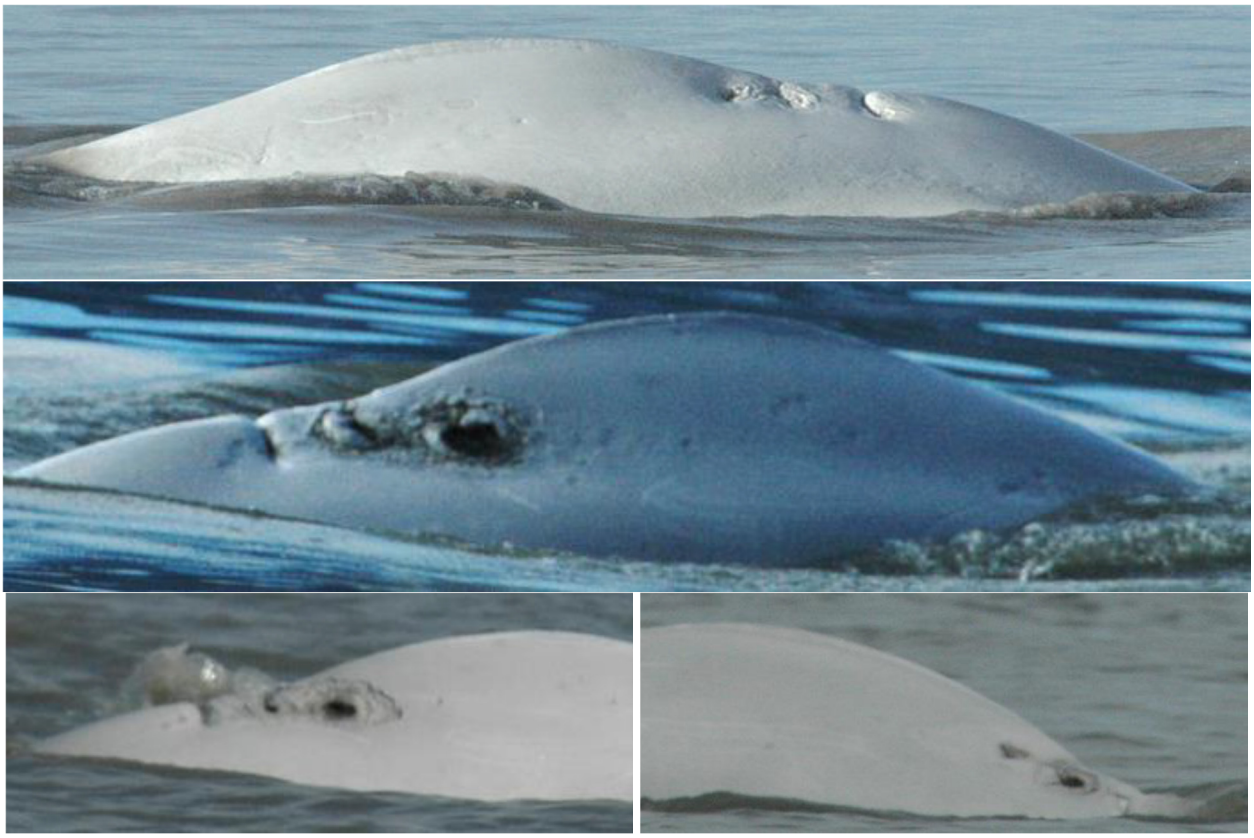


Figure 101. --CI-0206 photographed in 2005 (top panel), 2006 (middle panel), and 2007 (bottom panel: showing view from left-side and right-side) (source: McGuire and Stephens 2016).

Recommendations for Future Tagging Studies

McGuire and Stephens (2016) provided a list of recommendations following their review of capture photographs (or lack thereof). A number of these recommendations are presented below.

- Photographs should be taken of captured whales prior to tagging, during tagging, post-tagging, pre-release, and immediately post-release, if possible.
- Photographs should be of the right and left sides, as well as over the dorsal of the individual to link both sides.
- Photographers should use the time and date stamp option on digital photographs and should verify the accuracy of the information prior to taking photographs.

- Photograph any unique identifying features of the satellite tag while visible on the animal (such as the tag serial number).

- Photograph flipper bands or additional tags, including suction cup tags.

- If a biopsy sample is taken, the biopsy site should be photographed, pre-and post- sample collection.

- Photograph any misplaced nylon rods that were later removed so that these scars may be used for identification.

- Photograph any obvious natural scars or pigment marks.

- Photographs should be inventoried and entered into the chain of custody, as with other samples collected under permitted research.

- Dedicated photo-id surveys of tagged animals should be conducted weeks to months post-capture in order to monitor tag attachment, tag site healing, and body condition, ideally with real-time or near real-time locations from transmitters provided to the photo-ID team in order to increase the odds of finding and photographing tagged whales.

- Due to extensive damage to pectoral flippers from long-term retention of flipper bands, an alternative should be considered.

- When confirmed and suspected satellite-tagged whales die, and if their bodies are recovered and necropsied, we recommend their genetic samples taken during necropsy be compared to those taken from satellite-tagged whales at the time of capture.

According to McGuire and Stephens (2016), the photo-ID catalog has 14 confirmed and eight suspected satellite-tagged whales, more than the 18 whales that were actually tagged. Therefore, biopsy studies and necropsy responders should note possible tagged whales and request genetic confirmation to help eliminate individuals from the "suspected tagged" list.

Acknowledgments

The satellite-tagging project was funded by NMFS, Office of Protected Resources and conducted under NMFS Scientific Research Permits 957 and 782-1438. Rod Hobbs, Task Leader for the Cook Inlet beluga studies, helped coordinate funding and logistics for this project. This project was made possible thanks to local knowledge provided by Alaska subsistence hunters and the many field project participants, including but not limited to: Peter Merryman (Native Village of Tyonek (NVT)), Randy Standifer (NVT), Robert Stephan Jr. (NVT), Charles Saccheus (Native Village of Elim), Gusty Tallekpalek (Levelock Village Council), Rod Hobbs (NMFS-MML), William Walker (NMFS-MML), Laura (Litzky) Hoberecht (NMFS-MML/WRC), Kristin Laidre (NMFS-MML/UW), Lori Quakenbush (ADFG), Douglas Baird (NOAA Corp), Carolyn Goode (NOAA), Sue Moore (NOAA), Barbara Mahoney (NMFS-AKR), Daniel Vos (NMFS-AKR), Matthew Eagleton (NMFS-AKR), Dana Seagars (NMFS-AKR), Brad Smith (NMFS-AKR), Greg O'Corry-Crowe (SWFSC/FAU), Dan Bogan (Ft. Richardson), Colin Dovichin (Ft. Richardson), William Gossweiler (Ft. Richardson), Kellie Peirce (Ft. Richardson), Alison Vrem (Ft. Richardson), Melanie Wahl (Ft. Richardson), Nancy Lord (author), and Joe Metz (pilot).

Sample analyses were provided by Dynacare Laboratories Consumer's Medical Lab (CML), SeaWorld, NOAA Fisheries Northwest Fisheries Science Center (NWFSC) and Southwest Fisheries Science Center (SWFSC), Florida Atlantic University (FAU), Alaska SeaLife Center (ASLC), University of Alaska Fairbanks, College of Fisheries and Ocean Sciences, Endocrine Laboratory (UAF), Alaska Veterinary Pathology Service (AVPS), and personnel including but not limited to: Kelly Robertson (SWFSC), Margaret (Peggy) Krahn (NWFSC), Jon Buzitis (NWFSC), David Herman (NWFSC), Catherine Sloan (NWFSC), Douglas Burrows (NWFSC), Ann Nowinski (NWFSC), Don Brown (NWFSC), Daryle Boyd (NWFSC), Richard Boyer (NWFSC), Ronald Pearce (NWFSC), Jennie Bolton (NWFSC), Karen Tilbury (NWFSC), Carrie Goertz (ASLC), and Tatiana Ferrer (FAU). Photo-identification support was provided by Amber Stephens (LGL Alaska Research Assoc.) and tagging photographs were made available to the Cook Inlet Beluga Whale Photo-identification project from NMFS-AKR and NMFS-MML.

Sue Moore, Paul Wade, and Phillip Clapham have each in turn served as Program Leaders of MML's Cetacean Assessment and Ecology Program during the conception, preparation, and conduct of this multi-year project. This document was reviewed by Amy Kennedy (UW-JISAO), Janice Waite (MML-CAEP), and Michelle Lander (MML-AEP). Technical edits were provided by James Lee (AFSC Publications Division).

CITATIONS

Aguilar, A., and A. Borrell. 1994. Reproductive transfer and variation of body load of organochlorine pollutants with age in fin whales (*Balaenoptera physalus*). Arch. Environ. Contam. Toxicol. 27(4):546-54.

Aguilar, A., A. Borrell, and T. Pastor. 1999. Biological factors affecting variability of persistent pollutant levels in cetaceans. J. Cetacean Res. Manage. (special issue) 1:83-116.

Ferrero, R. C., S. E. Moore, and R. C. Hobbs. 2000. Development of beluga, *Delphinapterus leucas*, capture and satellite tagging protocol in Cook Inlet, Alaska. Mar. Fish. Rev. 62(3):112-123.

Frost, K. J., and L. F. Lowry. 1990. Distribution, abundance, and movements of beluga whales, *Delphinapterus leucas*, in coastal waters of western Alaska. Advances in research on the beluga whale, *Delphinapterus leucas*. Can. Bull. Fish. Aquat. Sci, 224:39-57.

Goetz, K. T., P. W. Robinson, R. C. Hobbs, K. L. Laidre, L. A. Huckstadt, and K. E. W. Shelden. 2012. Movement and dive behavior of beluga whales in Cook Inlet, Alaska. AFSC Processed Rep. 2012-03, 40 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Hazard, K. 1988. Beluga whale, *Delphinapterus leucas*, p. 195-235. *In* J. W. Lentfer (editor), Selected marine mammals of Alaska: Species accounts with research and management recommendations. Mar. Mammal Comm., Washington, D.C.

Hobbs, R. C. 2002a. Review of blood analysis and dive data for beluga CI2002-04 and incident report with recommendations for future projects. Memorandum to S. Moore from R. Hobbs, dated September 24, 2002. 3 p.

Hobbs, R. C. 2002b. Review of blood analysis and dive data for beluga CI2002-02 and beluga CI2002-07. Memorandum to S. Moore and M. Payne from R. Hobbs, dated November 7, 2002. 2 p.

Hobbs, R. C., K. L. Laidre, D. J. Vos, B. A. Mahoney, and M. Eagleton. 2005. Movements and area use of belugas, *Delphinapterus leucas*, in a subarctic Alaskan estuary. Arctic 58(4): 331-340.

Hobbs, R. C., K. E. W. Shelden, D. J. Rugh, C. L. Sims, and J. M. Waite. 2015. Estimated abundance and trend in aerial counts of beluga whales, *Delphinapterus leucas*, in Cook Inlet, Alaska, 1994-2012. Mar. Fish. Rev. 77(1):11-31. (doi: 10.7755/MFR.77.1.2).

Johnson, M. 2008. Water and ice dynamics in Cook Inlet. Final Report, OCS Study MMS 2008-061. Mineral Management Service, 1-106. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.376.1479&rep=rep1&type=pdf

Johnson, D. S. 2011. Crawl: Fit continuous-time correlated random walk models for animal movement data. R package version 1.2.

Kawai, S., M. Fukushima, N. Miyazaki, and R. Tatsukawa. 1988. Relationship between lipid composition and organochlorine levels in the tissues of striped dolphin. Mar. Poll. Bull. 19(3):129-33.

Krahn, M. M., P. R. Becker, K. L. Tilbury, and J. E. Stein. 1997. Organochlorine contaminants in blubber of four seal species: Integrating biomonitoring and specimen banking. Chemosphere 34:2109-21.

Krahn, M. M., D. G. Burrows, J. E. Stein, P. R. Becker, M. M., Schantz, D. C. G., Muir, T. M. O'Hara, and T. Rowles. 1999. White whales (*Delphinapterus leucas*) from three Alaskan stocks: concentrations and patterns of persistent organochlorine contaminants in blubber. J. Cetacean Res. Manage. 1(3):239-49.

Krahn, M. M., G. M. Ylitalo, D. G. Burrows, J. Calambokidis, S. E. Moore, M. Gosho, P. Gearin, P. D. Plesha, R. L. J. Brownell, S. A. Blokhin, K. L. Tilbury, T. Rowles, and J. E. Stein. 2001. Organochlorine contaminant concentrations and lipid profiles in eastern North Pacific gray whales (*Eschrichtius robustus*). J. Cetacean Res. Manage. 3(1):19-29.

Krahn, M. M., D. P. Herman, G. M. Ylitalo, C. A. Sloan, D. G. Burrows, R. C. Hobbs, B. A. Mahoney, G. K. Yanagida, J. Calambokidis, and S. E. Moore. 2004. Stratification of lipids, fatty acids and organochlorine contaminants in blubber of white whales and killer whales. J. Cetacean Res. Manage. 6(2):175–189.

Laidre, K., R. Hobbs, and R. Ferrero. 2017. Summer, fall, and early winter behavior of beluga whales, *Delphinapterus leucas*, satellite-tagged in Cook Inlet, Alaska, in 1999 and 2000. K.E.W. Shelden (editor). AFSC Processed Rep. 2017-09, 33 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Litzky, L. K., R. C. Hobbs, and B. A. Mahoney. 2001. Field report for tagging study of beluga whales in Cook Inlet, Alaska, September 2000, pp. 13-19 *In*: A. L. Lopez and R. P. Angliss, editors, Marine Mammal Protection Act and Endangered Species Act implementation program 2000. AFSC Processed Rep. 2001-06, 115 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Mahoney, B. 2002a. Beluga found dead after being tagged with a satellite transmitter in August 2002. Memorandum to S. Moore and P.M. Payne from B. Mahoney, dated September 9, 2002. 10 p.

Mahoney, B. 2002b. The finding of a dead beluga whale that was tagged with a satellite transmitter during the 2002 Cook Inlet beluga satellite tagging project (29 July - 4 August). Memorandum to S. Moore and P.M. Payne from B. Mahoney, dated September 12, 2002 (updated with additional stranding report from 25 or 26 August). 6 p.

Mahoney, B. A., and K. E. W. Shelden. 2000. Harvest history of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska. Mar. Fish. Rev. 62(3):124-133.

Martin, A. R., and T. G. Smith. 1992. Deep diving in wild, free-ranging beluga whales, *Delphinapterus leucas*. Can. J. Fish. Aquat. Sci. 49: 462-466.

McGuire, T., and A. Stephens. 2016. Summary Report: Status of previously satellite- tagged Cook Inlet beluga whales. Report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK, for National Marine Fisheries Service, Alaska Region. 86 p. available at www.cookinletbelugas.org.

Muir, D. C. G., R. Wagemann, B. T. Hargrave, D. J. Thomas, D. B. Peakall, and R. J. Norstrom. 1992. Arctic marine ecosystem contamination. Sci. Total Environ. 122:75-134.

NOAA. 2000a. Designating the Cook Inlet, Alaska, stock of beluga whale as depleted under the Marine Mammal Protection Act (MMPA). 65 Fed. Regist. 34590 (31 May 2000), p. 34,590–34,597 (avail. online at: https://federalregister.gov/a/00-13371).

NOAA. 2000b. Taking of the Cook Inlet (CI), Alaska, stock of beluga whales by Alaska Natives. 65 Fed. Regist. 59164 (04 Oct. 2000), p. 59,164–59,170 (avail. online at: https://federalregister.gov/a/00-25481).

NOAA. 2002. Annual report - 2002 Cook Inlet beluga whale enforcement effort. Prepared by NOAA Enforcement for the period April 1 – September 30, 2002. 5 p.

NOAA. 2008. Endangered and threatened species; endangered status for the Cook Inlet beluga whale. 73 Fed. Regist. 62919 (22 Oct. 2008), p. 62,919–62,930 (avail. online at: https://federalregister.gov/a/E8-25100).

Norman, S. 2002a. Review of blood analysis for beluga CI2002-04. Memorandum to R. Hobbs from S. A. Norman, dated September 24, 2002, 3 p.

Norman, S. 2002b. Review of blood analysis for belugas CI2002-02 and CI2002-07. Memorandum to R. Hobbs from S. A. Norman, dated September 24, 2002, 4 p.

Norman, S. A., C. E. C. Goertz, K. A. Burek, L. T. Quakenbush, L. A. Cornick, T. A. Romano, T. Spoon, W. Miller, L. A. Beckett, and R. C. Hobbs. 2012. Seasonal hematology and serum chemistry of wild beluga whales (*Delphinapterus leucas*) in Bristol Bay, Alaska, USA. J. Wildl. Dis. 48(1):21–32.

Norstrom, R. J., and D. C. G. Muir. 1994. Chlorinated hydrocarbon contaminants in Arctic marine mammals. Sci. Total Environ. 154(2-3):107-28.

O'Corry-Crowe, G. M., R. S. Suydam, A. Rosenberg, K. J. Frost, and A. E. Dizon. 1997. Phylogeography, population structure and dispersal patterns of the beluga whale *Delphinapterus leucas* in the western Nearctic revealed by mitochondrial DNA. Mol. Ecol. 6:955–970.

O'Corry-Crowe, G. M., C. Lydersen, M. P. Heide-Jørgensen, L. Hansen, L. M. Mukhametov, O. Dove, and K. M. Kovacs. 2010. Population genetic structure and evolutionary history of North Atlantic beluga whales (*Delphinapterus leucas*) from West Greenland, Svalbard and the White Sea. Polar Biol. 33:1179–1194.

Okkonen, S. R., S. Pegau, and S. Saupe. 2009. Seasonality of boundary conditions for Cook Inlet, Alaska. Final Report, OCS Study MMS 2009-041. Mineral Management Service, 1-60. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.214.1404&rep=rep1&type=pdf

Orr, J. R., and M. Hiatt-Saif. 1992. A flipper band for individual identification of beluga whales (*Delphinapterus leucas*). Canadian Tech. Rep. Fish. Aquatic Sci. 1856, 9 p.

Orr, J. R., D. J. St. Aubin, P. R. Richard, and M. P. Heide-Jørgensen. 1998. Recapture of belugas, *Delphinapterus leucas*, tagged in the Canadian Arctic. Mar. Mammal Sci.

R Core Team. 2012. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/

Ridgway, S., and M. Reddy. 1995. Residue levels of several organochlorines in Tursiops truncatus milk collected at varied stages of lactation. Mar. Poll. Bull. 30(9):609-14.

Rugh, D. J., B. A. Mahoney, and B. K. Smith. 2004. Aerial surveys of beluga whales in Cook Inlet, Alaska, between June 2001 and June 2002. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-145, 26 p.

Rugh, D. J., K. E. W. Shelden, C. L. Sims, B. A. Mahoney, B. K. Smith, L. K. Litzky, and R. C. Hobbs. 2005. Aerial surveys of belugas in Cook Inlet, Alaska, June 2001, 2002, 2003, and 2004. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-149, 71 p.

Shelden, K. E. W., D. J. Rugh, B. A. Mahoney, and M. E. Dahlheim. 2003. Killer whales predation on belugas in Cook Inlet, Alaska: implications for a depleted population. Mar. Mammal Sci. 19(3):529-544.

Shelden, K. E. W., K. T. Goetz, D. J. Rugh, D. G. Calkins, B. A. Mahoney, and R. C. Hobbs. 2015. Spatio-temporal changes in beluga whale, *Delphinapterus leucas*, distribution: Results from aerial surveys (1977-2014), opportunistic sightings (1975-2014), and satellite tagging (1999-2003) in Cook Inlet, Alaska. Mar. Fish. Rev. 77(2):1-31. (doi: dx.doi.org/10.7755/MFR.77.2.1).

Shelden, K. E. W., R. C. Hobbs, C. L. Sims, L. Vate Brattström, J. A. Mocklin, C. Boyd, and B. A. Mahoney. 2017. Aerial surveys, abundance, and distribution of beluga whales (*Delphinapterus leucas*) in Cook Inlet, Alaska, June 2016. AFSC Processed Rep. 2017-09, 62 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Tilbury, K. L., J. E. Stein, J. P. Meador, C. A. Krone, and S. L. Chan. 1997. Chemical contaminants in harbor porpoise (*Phocoena phocoena*) from the north Atlantic coast: tissue concentrations and intra- and inter-organ distribution. Chemosphere 34(9/10):2159-2181.

Vos, D. J., and K. E. W. Shelden. 2005. Unusual mortality in the depleted Cook Inlet beluga (*Delphinapterus leucas*) population. Northwestern Naturalist 86(2):59-65. (doi: 10.1898/1051-1733(2005)086[0059:UM ITDC]2.0.CO;2).

APPENDICES

Appendix 1. – Identification (ID) numbers and physical characteristics of beluga whales captured and released or tagged in Cook Inlet, Alaska, 1999-2002. Animal ID was created for the mapping database to provide a unique identifier for PTT numbers that were used over multiple years. Length was measured as straight length usually in feet and inches then converted to centimeters (note: some conversion errors occurred in Hobbs et al. (2005)). * = incorrect sex listed on Level A, Beluga Capture, and Dynacare Laboratories Consumer's Medical Lab (CML) forms. Photo-ID is currently in progress, therefore, only sightings with 100% confirmation are shown, SWFSC = Southwest Fisheries Science Center (genetics), NWFSC = Northwest Fisheries Science Center (fatty acids/stable isotopes), CML = Dynacare Laboratories Consumer's Medical Lab (blood hematology and serum chemistry), UAF = University of Alaska Fairbanks, S. Atkinson (hormones), SeaWorld (blood hematology and serum chemistry), Photo-ID data are collected by T. McGuire, LGL Research Associates, Anchorage (note: 8 whales in the catalog appear to be tagged whales but were unable to be conclusively matched to any of the photos taken at the time of tagging). Necropsy samples were collected and distributed by K. Burek-Huntington, Alaska Veterinary Pathology Services (AVPS), CNR = carcass not recovered.

Field ID	Flipper band (Left/ Right)	Hobbs/ Goetz	Animal ID	Tag type	PTT	Capture location	Capture date	Sex	Color	Length feet(cm)	SWFSC ID	NWFSC ID	CML ID	UAF ID	SeaWorld ID	Photo-ID (aft.2005)	Stranded/ Died	AVPS ID
RCF-399				none		Little Susitna	5/31/1999	F	Gray	7'6"(230)	13343					L2191		
RCF 400	DL00141L DL00142R	CI-9901	25850111	ST16	25850	Little Susitna	5/31/1999	M	White	12'2"(370)	13344							
CI-DL-01-00				none		Knik Arm	9/8/2000	F	White/ gray	9'(274)	17295							
CI-DL-03-00		CI-0001	25850112	ST16	25850	Knik Arm	9/13/2000	M	White	13'7"(413)	17297							
CI-DL-02-00		CI-0002	30719114	ST16	30719	Knik Arm	9/13/2000	F	White/ gray	8'11"(272)	17296					L2467/ R111		
CI-01-01		CI-0101	13934102	SPOT2	13934	Little Susitna	8/10/2001	F	Gray	8'5"(257)	24851	120-181				L7861/ R243		
CI-01-02		CI-0102	13937103	ST16/ SPOT2	30720/ 13937	Knik Arm	8/11/2001	M	White	10'7"(323)	24852	120-182						
CI-01-03		CI-0103	13933101	ST16/ SPOT2	25847/ 13933	Knik Arm	8/12/2001	F	White	10'3"(312)	24853	120-183						
CI-01-04		CI-0104		ST16/ SPOT2	25849/ 13945	Knik Arm	8/13/2001	F	White	11'2"(340)	24854	120-184						
CI-01-05		CI-0105	13938104	SPOT2	13938	Knik Arm	8/13/2001	F	White	11'8.5"(357)	24855	120-185 120-186	5691					
CI-01-06		CI-0106	13942105	ST16/ SPOT2	13947/ 13942	Knik Arm	8/15/2001	F	White	13'2"(401)	24856	120-195 120-196				L493/ R103		
CI-01-07		CI-0107	13943106	ST16/ SPOT2	13948/ 13943	Knik Arm	8/20/2001	M	White	14'6"(442)	24857	120-187 120-188	5716					
CI2002-01	DL00126R	CI-0201	25850113	ST16L	25850	Little Susitna	7/29/2002	M*	White	13'6"(412)	28912	120-306 120-307	10					
CI2002-02	DL00129L	CI-0202		ST16L	30719	Little Susitna	7/30/2002	F*	White/ gray	11'2"(340)	28913	120-308 to 120-311	64	64				
CI2002-03	DL00202L	CI-0203	13943107	ST16S	13943	Knik Arm	7/31/2002	F*	White	12'0"(366)	28914	120-312 to 120-314	170	170 & 03	CI-02-03			
CI2002-04	DL00196R	CI-0204		ST16L	25849	Little Susitna	8/1/2002	F	White	12'5"(379)	28915	120-315 to 120-317	265		CI-02-04	No (dead pre-2005)	8/9/2002	CNR
CI2002-05	DL00200L	CI-0205	13947108	ST16S	13947	Knik Arm	8/2/2002	M*	White/ gray	12'8"(386)	28916	120-320 to 120-322	465	05	05	L2303/ R17366	6/12/2015	V15-071
CI2002-06	DL00078R	CI-0206	13948109	ST16S	13948	Knik Arm	8/3/2002	M*	White/ gray	11'7'(353)	28917	120-323 120-324	498	06	06	L2204/ R17367		
CI2002-07	DL00133R	CI-0207		ST16L	30720	Knik Arm	8/3/2002	F	White	12'3"(374)	28918	120-325 to 120-327	516	07	07			
CI2002-08	DL00219L	CI-0208	25847110	ST16S	25847	Knik Arm	8/4/2002	M	White/ gray	12'4"(376)	28919	120-328 to 120-330	517	08	08	L2579/ R115	5/26/2014	V14-091

Appendix 2.-- Hematology values of belugas captured and tagged in Cook Inlet, Alaska, in 2001 and 2002 (only successful blood draws are shown). Values are compared to blood samples collected from belugas captured in Bristol Bay, Alaska (Norman et al. 2012[a]). Gray shading indicates value was not within the range of combined values (May and September) for Bristol Bay belugas. na = not available in results attached to Level A. P = results were pending. TNP = test not performed. nt = no tube provided. * = sample had hemolyzed (which may lower or increase certain values). If two values are shown the first is from Dynacare Laboratories Consumer's Medical Lab and the second from SeaWorld.

Analyte (units)	Bristol Bay values	Cook Inlet beluga ID number and sex									
		CI-0105 F	CI-0107 M	CI-0201 M	CI-0202 F	CI-0203 F	CI-0204 F	CI-0205 M	CI-0206 M	CI-0207 F	CI-0208 M
Red blood cells (10^3/µl)	2.8 - 4.5	na	3.38	na	P	2.97, nt	na, 2.92	3.07, 3.07	2.92, 2.93	3.01, 2.97	3.03, 3.03
Hemoglobin (g/dl)	16.5 - 22.8	na	TNP	na	P	19.2, nt	TNP, 19.6	18.3, 18.2	17.5, 17.5	17.7, 17.6	18.2, 18.1
Hematocrit (%)	43.0 - 60.0	na	51.5	na	43.5	51.6, nt	47.0, 52.0	51.5, 52.0	49.0, 50.0	48.7, 48.0	50.8, 52.0
Mean corpuscular volume (fL)	100.0 - 204.2	na	152	na	P	174, nt	na, 180	168, 170	168, 171	161, 165	168, 170
Mean corpuscular hemoglobin (pg)	44.3 - 70.4	na	na	na	P	64.6, nt	na, 67.0	59.7, 59.0	60.0, 60.0	58.7, 60.0	60.2, 60.0
Mean corpuscular hemoglobin conc. (g/dl)	34.5 - 46.2	na	na	na	P	37.2, nt	na, 37.0	35.6, 35.0	35.7, 35.0	36.3, 36.0	35.9, 35.0
Erythrocyte sedimentation rate (mm/hr)	10 - 40	na	na	na	na	na	Na	na	na	na	na
White blood cells (10^3/µl) and differentials (below):	12.0 - 27.8	na	8.0	na	P	16.0, nt	13.9, 12.2	19.8, 16.2	18.3, 14.5	10.4, 9.2	22.8, 20.3
Neutrophils (10^3/µl)	3.3 - 8.6	na	6.48	na	na	4.80, nt	na, 5.49	na, 4.37	na, 3.19	na, 3.86	na, 5.28
Lymphocytes (10^3/µl)	3.4 - 11.1	na	0.72	na	na	2.56, nt	na, 3.29	na, 6.32	na, 6.67	na, 1.20	na, 5.68
Monocytes (10^3/µl)	0.2 - 1.6	na	0.16	na	na	0.32, nt	na, 0.12	na, 0.65	na, 0.44	na, 0.55	na, 1.02
Eosinophils (10^3/µl)	2.2 - 6.5	na	0.56	na	na	8.16, nt	na, 3.17	na, 4.86	na, 4.06	na, 3.50	na, 8.32

[a] there appear to be errors in the Norman et al. (2012) tables. Combined ranges appear to be wrong for RBC, Neutrophils, Lymphocytes, and Eosinophils, as they do not cover the ranges shown for May and September separately.

Appendix 3. -- Serum chemistry values of belugas captured and tagged in Cook Inlet, Alaska, in 2001 and 2002. Values are compared to blood samples collected from belugas captured in Bristol Bay, Alaska (Norman et al. 2012) with some additional values from captive and other free-ranging populations (Atkinson et al. [footnote c]). Gray shading indicates not within the range of combined values (May and September) for Bristol Bay (Norman et al. 2012). na = not available in results attached to Level A. * = sample had hemolyzed (which may lower or increase certain values). QNS = quantity not sufficient. nt = no tube provided. If two values are shown the first is from Dynacare Laboratories Consumer's Medical Lab and the second is from SeaWorld. Note: In 2002, Dynacare had incorrect sexes assigned for some whales so some reference ranges for females were used on whales CI-0201, CI-0205, CI-0206, and for males on CI-0202 and CI-0203, including pregnancy tests which came back negative for all whales tested including CI-0204 and CI-0207. S. Atkinson (UAF) results suggest CI-0207 was pregnant.

Parameter (units)	Bristol Bay values	Cook Inlet beluga ID number and sex									
		CI-0105 F	CI-0107 M	CI-0201 M	CI-0202 F	CI-0203 F	CI-0204 F	CI-0205 M	CI-0206 M	CI-0207 F	CI-0208 M
Sodium (mmol/l)	157 - 171	159	152	157	153	156, 193	163, QNS	157, 196	157, nt	151, QNS	159, QNS
Potassium (mmol/l)	2.9 - 8.5	7.1	6.1*	4.3*	4.6	4.2*, 5.3	4.0*, QNS	7.5, 9.1	6.4, nt	5.3, QNS	5.1, QNS
Chloride (mmol/l)	101 - 118	105	106	113	111	112, 139	111, QNS	106, 135	109, nt	109, QNS	110, QNS
Calcium (mg/dl)	10.7 - 14.6	11.4	10.0	10.5	10.0	9.6, 9.7	10.2, 10.8	11.4, 11.5	11.1, nt	9.8, 9.8	10.9, 11.1
Phosphorus (mg/dl)	6.4 - 10.8	11.8*	12.0*	10.5	10.8	8.8, 8.9	11.2, 15.9	12.7, 15.3	11.7, nt	6.6, 6.5	11.6, 11.6
Magnesium (mg/dl)	2.0 - 3.2	2.96	1.66	2.88*	2.19	2.51*	2.49	3.14	2.86	2.18	2.81
Blood urea nitrogen (mg/dl)	52 - 94	73	95	86	75	79, 75	83, 77	92, 91	81, nt	90, 85	98, 94
Creatinine (mg/dl)	0.1 - 3.8	1.3*	1.3*	1.7	1.4	1.4, 1.3	1.3, 1.2	1.5, 1.4	1.3, nt	1.2, 1.1	1.4, 1.3
Total protein (mg/dl)	2.0 - 2.4[b]	2.46	2.10	2.15	2.12	2.19, 1.97	2.23, 2.34	2.22, 2.05	2.19, nt	2.16, 2.04	2.23, 2.07
Albumin (g/dl)	3.7 - 5.3	0.5	0.6	1.0	1.1	1.2, 4.1	1.2, 3.8	1.0, 4.1	1.1, nt	1.1, 3.7	0.9, 3.8
Globulin (g/dl)	2.9 - 6.0	11.2	7.6	7.6	7.2	7.7, 3.1	8.1, 6.6	8.2, 3.7	7.8, nt	7.6, 3.9	8.4, 4.2
Fibrinogen (mg/dl)	76 - 240	na	na	na	na	na	na	na	na	na	na
Albumin/Globulin ratio[a]	0.8 - 1.8	0.0	0.1	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1
Glucose (mg/dl)	99 - 159	159	106	129	157	104, 104	96, 114	113, 128	153, nt	127, 118	134, 128
Alanine amino-transferase (IU/l)	1.4 - 3.8[b]	2.64	3.76	2.94	1.95	2.20, 2.20	2.08, 2.71	2.83, 2.77	2.64, nt	1.95, 1.95	2.89, 1.79
Aspartate amino-transferase (IU/l)	58 - 188	117*	173*	121	71	73, 70	108, 120	138, 136	87, nt	72, 71	84, 85
Alkaline phosphatase (IU/l)	3.3 - 6.1[b]	5.14	4.51	5.08	4.01	4.82, 4.85	4.41, 4.47	5.31, 5.32	5.69, nt	4.95, 4.98	5.65, 5.71
Gamma-glutamyltranspeptidase (IU/l)	1.9 - 4.3[b]	3.22	4.17	4.61	3.22	3.64, 3.30	3.43, 3.40	3.61, 3.53	3.58, nt	3.22, 3.18	3.71, 3.85
Total bilirubin (mg/dl)	0.0 - 0.3	0.1	0.1	0.0	0.0	<0.1, 0.1	0.0, 0.1	<0.1, 0.1	<0.1, nt	<0.1, 0.1	<0.1, 0.1
Cholesterol (mg/dl)	126 - 254	274	258	196	142	198, 206	250, 263	240, 253	160, nt	249, 258	185, 200
Creatine kinase (IU/l)	70 - 664[b]	na	na	na	na	na, 201	na, 192	na, 430	na, nt	na, 214	na, 232
Iron (ug/dl)	117 - 442	351	359	289	116	297, 327	404, 390	339, 371	358, nt	277, 344	344, 388
Progesterone (ng/ml)	0.05 - 40.0[c]	na	na	na	11.0	22.8	na	1.1	0.6	26.6	0.7
Total estrogen (pg/ml)	1.25 - 100[c]	na	na	na	205	167	na	346	183	222	278
Testosterone (ng/ml)	0.06 - 10.0[c]	na	na	na	0.5	0	na	2.4	1.2	1.2	0
Cortisol (ng/ml)	5.0 - 500[c]	na	na	na	104.3	41.7	na	58.8	59.4	105.7	69.1
Total T4(ng/ml)	5.0 - 240[c]	na	na	na	33.2	46.3	na	57.2	71.6	31.5	35.7
Total T3 (ng/ml)	0.1 - 6.0[c]	na	na	na	1.0	1.0	na	1.8	1.7	1.2	1.3

[a] All ratios were from CML only and may be spurious given all Albumin and Globulin values from this lab also appear to be suspect when compared to the instances when values were also available from SeaWorld.

[b] values were log-transformed (Ln), note: range and median values shown for creatine kinase in Norman et al. (2012) appear to be incorrect for May based on mean value provided.

[c] value range includes results from aquaria studies and other free-ranging beluga populations including Bristol Bay (S. Atkinson, UAF).

Appendix 4. -- Lipid compositions, stable isotope ratios, fatty acids, and persistent organic pollutant values for skin/blubber trocar biopsies collected from Cook Inlet belugas during tagging operations in 2001 and 2002. Methods and analyses are documented in Krahn et al. (2004).

Animal ID	CI-0101	CI-0102	CI-0103	CI-0104	CI-0105		CI-0106		CI-0107		CI-0201		CI-0202				CI-0203			CI-0204			CI-0205			CI-0206		CI-0207			CI-0208		
Sex	F	M	F	F	F		F		M		M		F				F			F			M			M		F			M		
Lab#	120-181	120-182	120-183	120-184	120-185	120-186	120-195	120-196	120-187	120-188	120-306	120-307	120-308	120-309	120-310	120-311	120-312	120-313	120-314	120-315	120-316	120-317	120-320	120-321	120-322	120-323	120-324	120-325	120-326	120-327	120-328	120-329	120-330
Set#	FA751	FA751	FA751	FA751	FA751	FA751	FA753	FA753	FA751	FA751	FA1002	FA1002	FA1002	FA1002	FA1002	FA1002	FA1002	FA1002	FA1002	FA1002	FA1002	FA1002	FA1003	FA1003	FA1003	FA1003	FA1003	FA1003	FA1003	FA1003	FA1003	FA1003	FA1003
Biopsy trocar	partial	all?	partial	partial	1st half	2nd half	1st half	2nd half	all?	Repl.	1st half	2nd half	1st quarter	2nd quarter	3rd quarter	4th quarter	1st third	2nd third	3rd third	1st third	2nd third	3rd third	1st third	2nd third	3rd third	1st half	2nd half	1st third	2nd third	3rd third	1st third	2nd third	3rd third
Depth (cm)	outer only?	no skin, inner?	outer only?	outer only?	outer - + skin	inner - near muscle	outer - + skin	inner - near muscle	no skin, inner?		0-1.25 cm	inner - near muscle	0-1.63 cm	inner blubber	inner blubber	inner - nearest muscle	0-1.33 cm	inner - blubber	inner - near muscle	0-1.33 cm	inner - blubber	inner - near muscle	0-1.67 cm	inner - blubber	inner - near muscle	0-1.25 cm	inner - near muscle	0-1.17 cm	inner - blubber	inner - near muscle	0-1.5 cm	inner - blubber	inner - near muscle
Sample wt. (g)	0.24	0.77	0.33	0.26	0.57	0.82	0.48	0.6	0.95		0.228		0.135				0.332			0.245			0.375			0.266		0.336			0.322		
Sample type	wet	wet	wet	wet	wet	wet	wet	wet	wet		wet		wet				wet			wet			wet			wet		wet			wet		
Lipid (%) (FA study)							12.20	24.20			79.50	90.50	92.00	88.40	94.20	81.30	93.70	55.30	71.10	60.30	81.70	75.80	77.88	92.72	93.19	90.29	88.06	98.64	95.31	91.49	68.00	94.63	92.55
Lipid (%) (POP study)	58.9	52.9	27.1	23.6	20.2	50.0	12.3	24.2	88.6		79.5		92				93.7			60.3			77.9			90.3		98.6			68		
Lipid Gravimetric	58.9	52.9	27.1	23.6					88.6		79.5		92				93.7			60.3			77.9			90.3		98.6			68		
TLC/FID*					10.0	37.0	5.8	13.0																										
CB103 Recovery (%)	80	84	87	78	89	83	103	105	96		120		118				127			75			120			119		120			119		
DOB Recovery (%)											108		104				108			69			103			99		102			103		
Stable isotopes (from skin)																																	
Nitrogen-15											14.78		14.40				14.81			14.11			14.68			14.70		15.11			14.82		
Carbon-13											-18.06		-17.54				-17.64			-18.03			-18.27			-18.04		-17.93			-18.26		
Fatty acids (weight %)*																																	
C10:0	0.1048	0.0714	0.0757	0.1224	0.1284	0.0838	0.0633	0.0459	0.0827	0.0676	0.0422	0.0710	0.0612	0.0422	0.0432	0.0391	0.0538	0.0258	0.0223	0.1847	0.0477	0.0286	0.0658	0.0218	0.0207	0.0652	0.0282	0.0486	0.0425	0.0262	0.0893	0.0492	0.0239
C11:0	0.0097	0.0079	0.0097	0.0204	0.0155	0.0090	0.0086	0.0064	0.0097	0.0081	0.0047	0.0076	0.0058	0.0040	0.0037	0.0000	0.0051	0.0000	0.0000	0.0188	0.0043	0.0000	0.0073	0.0000	0.0000	0.0064	0.0000	0.0050	0.0000	0.0000	0.0131	0.0045	0.0000
C11:1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2093	0.2087	0.2976	0.2867	0.1397	0.1396	0.1206	0.1172	0.1439	0.1742	0.1966	0.1523	0.1228	0.1672	0.1418	0.1497	0.1349	0.1083	0.1273	0.1132	0.1723	0.1164	0.1022
C12:0	0.5376	0.3713	0.4903	0.9319	0.7939	0.4989	0.3842	0.2993	0.5576	0.4467	0.2271	0.4277	0.3480	0.2308	0.2353	0.2121	0.3217	0.1317	0.1252	1.1927	0.2837	0.1626	0.4018	0.1412	0.1419	0.3650	0.1697	0.2968	0.2583	0.1684	0.6097	0.2401	0.1490
C12:1	0.1016	0.0501	0.0924	0.2614	0.1634	0.0788	0.0848	0.0472	0.0919	0.0416	0.0320	0.0313	0.0322	0.0187	0.0188	0.0163	0.0311	0.0000	0.0000	0.1415	0.0000	0.0000	0.0574	0.0000	0.0000	0.0442	0.0000	0.0373	0.0180	0.0000	0.1211	0.0000	0.0000
4812-Me-C13:0	0.0669	0.0275	0.0644	0.0475	0.0662	0.0549	0.0358	0.0296	0.0365	0.0323	0.0201	0.0228	0.0333	0.0325	0.0320	0.0314	0.0271	0.0225	0.0200	0.0409	0.0306	0.0255	0.0244	0.0161	0.0143	0.0327	0.0232	0.0283	0.0287	0.0234	0.0251	0.0200	0.0144
C14:0	6.9663	5.7425	6.1038	6.3911	6.1668	6.3314	5.0729	5.0807	5.7063	5.8540	5.2768	5.8175	6.4645	6.3599	6.4566	6.4019	6.6195	6.0048	5.9252	7.4481	6.7372	6.0781	5.6840	5.2378	5.2670	6.6200	6.1691	5.8928	6.0292	5.8516	5.2834	5.3896	5.3427
iso-C14:0	0.2154	0.1195	0.1357	0.3107	0.1909	0.1220	0.1058	0.0812	0.1121	0.0886	0.0549	0.0857	0.0686	0.0463	0.0482	0.0435	0.0493	0.0211	0.0199	0.1150	0.0355	0.0228	0.0970	0.0236	0.0225	0.0963	0.0312	0.0583	0.0442	0.0267	0.1452	0.0341	0.0228
11-Me-C14:0	0.0064	0.0060	0.0069	0.0094	0.0087	0.0065	0.0065	0.0053	0.0080	0.0071	0.0056	0.0058	0.0000	0.0000	0.0000	0.0000	0.0039	0.0000	0.0000	0.0058	0.0000	0.0000	0.0050	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0061	0.0000	0.0000
C14:1n5	1.6242	0.7696	1.5366	3.5932	2.2258	1.2244	1.1187	0.6918	1.0969	0.6436	0.4093	0.4735	0.6634	0.4125	0.4468	0.4018	0.5928	0.1763	0.1507	1.6581	0.2554	0.1659	0.9003	0.1769	0.1537	0.8269	0.2496	0.5166	0.3569	0.1948	1.4229	0.2580	0.1354

Animal ID	CI-0101	CI-0102	CI-0103	CI-0104	CI-0105		CI-0106		CI-0107		CI-0201		CI-0202				CI-0203			CI-0204			CI-0205			CI-0206		CI-0207			CI-0208		
Sex	F	M	F	F	F		F		M		M		F				F			F			M			M		F			M		
Lab#	120-181	120-182	120-183	120-184	120-185	120-186	120-195	120-196	120-187	120-188	120-306	120-307	120-308	120-309	120-310	120-311	120-312	120-313	120-314	120-315	120-316	120-317	120-320	120-321	120-322	120-323	120-324	120-325	120-326	120-327	120-328	120-329	120-330
C14:1n7	0.2738	0.1532	0.2736	0.9393	0.4781	0.2800	0.1810	0.1412	0.3140	0.1816	0.1011	0.1430	0.1692	0.0963	0.1008	0.0925	0.2009	0.0541	0.0476	0.7981	0.0985	0.0566	0.2097	0.0434	0.0421	0.2108	0.0678	0.1515	0.1094	0.0603	0.2612	0.0621	0.0394
C14:1n9	0.3790	0.2166	0.4430	1.3550	0.9742	0.5106	0.3226	0.2304	0.5311	0.2493	0.1700	0.1776	0.2056	0.1223	0.1245	0.1086	0.2795	0.0549	0.0483	1.3418	0.1370	0.0704	0.2989	0.0469	0.0447	0.2783	0.0864	0.2465	0.1633	0.0731	0.4626	0.0775	0.0425
C15:0	0.4562	0.4738	0.4054	0.4969	0.4158	0.4185	0.4289	0.4397	0.4600	0.4694	0.4307	0.4640	0.4158	0.3686	0.3637	0.3603	0.3523	0.3387	0.3617	0.4406	0.3761	0.3810	0.4462	0.4121	0.4366	0.4047	0.4036	0.4110	0.4066	0.4138	0.4687	0.4400	0.4654
iso-C15:0	0.9263	0.3717	0.4630	0.8554	0.5638	0.3990	0.3962	0.2952	0.3897	0.3347	0.2454	0.2839	0.2959	0.2459	0.2525	0.2432	0.2286	0.1642	0.1553	0.4280	0.2092	0.1671	0.3733	0.1722	0.1720	0.3704	0.1985	0.2603	0.2211	0.1831	0.5043	0.2079	0.1835
anteiso-C15:0	0.1185	0.0980	0.0976	0.1786	0.1286	0.1063	0.0954	0.0840	0.1219	0.1220	0.0704	0.1106	0.0776	0.0597	0.0610	0.0582	0.0731	0.0466	0.0444	0.1153	0.0622	0.0455	0.0800	0.0474	0.0494	0.0879	0.0534	0.0646	0.0607	0.0508	0.1097	0.0632	0.0535
261014-Me-C15:0	0.2222	0.1342	0.2499	0.1814	0.1894	0.2557	0.1131	0.1102	0.1382	0.1513	0.1212	0.1525	0.2885	0.3112	0.3327	0.3234	0.3108	0.2281	0.1849	0.3027	0.3719	0.2418	0.1073	0.0899	0.0745	0.2365	0.1654	0.2191	0.2406	0.1966	0.0997	0.1322	0.0871
C15:1n5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0061	0.0058	0.0000	0.0000	0.0060	0.0057	0.0056	0.0047	0.0052	0.0048	0.0055	0.0046	0.0045	0.0071	0.0044	0.0000	0.0053	0.0052	0.0059	0.0053	0.0046	0.0050	0.0052	0.0000	0.0061	0.0058	0.0061
C16:0	8.8212	11.1014	7.9141	7.0820	7.4342	10.5207	10.1255	11.4082	9.0569	9.4573	11.7157	10.3151	10.8123	12.5714	12.1546	12.7221	11.6827	14.7422	15.3666	9.3469	13.4373	14.8186	9.7072	13.6312	14.2097	10.9940	14.1328	11.7992	12.6200	14.0955	7.1064	11.0560	13.6240
iso-C16:0	0.4731	0.2074	0.2446	0.3749	0.2588	0.1997	0.1731	0.1420	0.1674	0.1505	0.1113	0.1549	0.1444	0.1070	0.1086	0.1032	0.1014	0.0697	0.0696	0.1593	0.0847	0.0744	0.1809	0.0744	0.0752	0.1753	0.0809	0.1207	0.1065	0.0822	0.2511	0.0982	0.0810
anteiso-C16:0	0.0045	0.0041	0.0000	0.0064	0.0046	0.0000	0.0000	0.0050	0.0042	0.0046	0.0045	0.0059	0.0047	0.0042	0.0034	0.0043	0.0038	0.0000	0.0000	0.0050	0.0000	0.0000	0.0048	0.0042	0.0042	0.0045	0.0000	0.0054	0.0000	0.0000	0.0049	0.0049	0.0041
7-Me-C16:1	0.0698	0.0864	0.0789	0.1040	0.0869	0.0824	0.0973	0.0924	0.0979	0.1034	0.0769	0.0830	0.0664	0.0617	0.0594	0.0599	0.0580	0.0547	0.0513	0.0814	0.0676	0.0596	0.0710	0.0646	0.0644	0.0606	0.0556	0.0665	0.0680	0.0617	0.0780	0.0748	0.0649
78-MeC16:1na	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C16:1n11	0.7539	0.7738	0.8810	1.2977	1.1862	0.8378	0.8489	0.7475	0.9484	0.7662	0.2909	0.2834	0.2923	0.2730	0.2750	0.2676	0.2631	0.3250	0.3284	0.2911	0.2877	0.2904	0.3043	0.2995	0.3190	0.2948	0.3530	0.2803	0.2921	0.3556	0.3006	0.2787	0.3715
C16:1n5	0.3042	0.3215	0.3186	0.3711	0.3422	0.3008	0.3559	0.3375	0.3147	0.2992	0.2852	0.2837	0.2650	0.2434	0.2403	0.2410	0.2291	0.2337	0.2473	0.2758	0.2363	0.2481	0.2768	0.2700	0.2873	0.2588	0.2680	0.2665	0.2595	0.2684	0.3112	0.2845	0.2917
C16:1n7	15.1121	10.2752	13.5934	20.0615	16.3719	11.6782	11.0240	9.1261	10.5471	8.6627	7.2738	7.7947	10.1237	8.2180	8.6958	8.2060	9.1741	6.6430	6.2855	12.7069	6.6253	5.8451	11.3319	6.9228	6.2842	11.0331	6.7650	7.8407	7.3500	5.9670	13.1017	7.4467	6.0247
C16:1n9	1.4488	1.0166	1.4742	2.9583	2.2057	1.4552	1.1228	0.9288	1.4906	1.1012	0.7458	0.9550	1.0568	0.7872	0.8069	0.7373	1.0408	0.5325	0.5028	2.4521	0.8134	0.5393	1.0960	0.5108	0.4997	1.1878	0.6149	0.8722	0.7544	0.5422	1.3588	0.6436	0.4993
C16:2n4	0.3671	0.2967	0.3404	0.4705	0.3822	0.3374	0.3122	0.3040	0.2926	0.2557	0.2847	0.2380	0.3070	0.3164	0.3136	0.3221	0.3244	0.3372	0.3372	0.3524	0.3102	0.3147	0.3010	0.2856	0.2833	0.3551	0.3292	0.3134	0.3010	0.3002	0.2851	0.2798	0.2774
C16:2n6	0.0696	0.0539	0.0797	0.1249	0.0990	0.0667	0.0651	0.0551	0.0617	0.0482	0.0549	0.0531	0.0619	0.0579	0.0583	0.0544	0.0581	0.0510	0.0474	0.0747	0.0488	0.0493	0.0705	0.0464	0.0440	0.0660	0.0560	0.0630	0.0575	0.0504	0.0837	0.0490	0.0432
C16:3n4	0.0783	0.0728	0.0810	0.0000	0.0729	0.0767	0.0747	0.0750	0.0598	0.0652	0.0891	0.0830	0.0902	0.0968	0.0960	0.0991	0.0958	0.1109	0.1063	0.0871	0.0985	0.1062	0.0969	0.0967	0.0955	0.1102	0.1084	0.1034	0.1036	0.1015	0.0821	0.0974	0.0924
C16:3n6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0319	0.0347	0.0000	0.0000	0.0000	0.0000	0.0000	0.0560	0.0519	0.0545	0.0469	0.0587	0.0606	0.0000	0.0537	0.0000	0.0000	0.0000	0.0000	0.0000	0.0528	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C16:4n1	0.0709	0.0690	0.0714	0.0613	0.0746	0.0673	0.0676	0.0732	0.0633	0.0606	0.0853	0.0750	0.0864	0.0857	0.0862	0.0848	0.0852	0.0983	0.0929	0.0809	0.0884	0.0918	0.0954	0.0867	0.0844	0.1078	0.0999	0.0934	0.0964	0.0960	0.0779	0.0940	0.0883
C16:4n3	0.2819	0.1962	0.3620	0.4941	0.6705	0.3274	0.2830	0.2105	0.4190	0.2260	0.1827	0.1975	0.1604	0.1120	0.1205	0.1156	0.1551	0.0709	0.0748	0.5435	0.1039	0.0809	0.3028	0.0988	0.0984	0.1618	0.0961	0.2015	0.1425	0.1027	0.4635	0.1318	0.0966
C17:0	0.4022	0.3931	0.4116	0.2973	0.3317	0.4477	0.3766	0.4109	0.3746	0.3887	0.4009	0.3520	0.4308	0.4605	0.4607	0.4639	0.3939	0.4219	0.4219	0.4255	0.5244	0.4926	0.2973	0.3884	0.4088	0.3675	0.4205	0.4463	0.4610	0.4816	0.2702	0.3956	0.4463
anteiso-C17:0	0.1256	0.1049	0.1002	0.1359	0.1102	0.1069	0.1030	0.0997	0.1145	0.1164	0.0846	0.1017	0.0902	0.0776	0.0778	0.0773	0.0823	0.0726	0.0714	0.0993	0.0767	0.0704	0.0940	0.0746	0.0751	0.0917	0.0720	0.0822	0.0813	0.0748	0.1085	0.0886	0.0807
iso-C17:0	0.3370	0.2167	0.2254	0.2338	0.2180	0.2063	0.2132	0.2002	0.2010	0.1996	0.1733	0.1700	0.1769	0.1689	0.1669	0.1692	0.1513	0.1564	0.1596	0.1685	0.1555	0.1626	0.1981	0.1678	0.1657	0.1810	0.1631	0.1798	0.1749	0.1760	0.2107	0.1799	0.1816
C17:1n7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0174	0.0147	0.0149	0.0139	0.0144	0.0144	0.0155	0.0169	0.0149	0.0152	0.0148	0.0131	0.0147	0.0154	0.0143	0.0137	0.0171	0.0130	0.0143	0.0132	0.0173	0.0180	0.0164
C17:1ne	0.6399	0.6540	0.6171	0.7459	0.7079	0.5704	0.6611	0.6116	0.6499	0.6015	0.5046	0.5227	0.4929	0.4093	0.4082	0.4020	0.3981	0.3753	0.3768	0.5092	0.3749	0.3722	0.6195	0.5087	0.4960	0.4997	0.4138	0.4655	0.4481	0.4146	0.7534	0.5659	0.5227
C18:0	1.3616	2.3301	1.4511	1.2174	1.2349	2.0815	2.5218	2.8493	2.0798	2.1550	3.4038	2.2948	2.0775	2.7422	2.5547	2.7268	2.3962	3.5737	3.7468	1.6785	3.0874	3.6275	1.9382	3.4217	3.7197	2.1096	3.4468	3.0696	3.0188	3.6921	1.4397	2.9511	3.9426
iso-C18:0	0.0378	0.0377	0.0339	0.0243	0.0312	0.0343	0.0334	0.0365	0.0343	0.0367	0.0331	0.0367	0.0312	0.0293	0.0294	0.0293	0.0292	0.0298	0.0284	0.0251	0.0309	0.0288	0.0306	0.0294	0.0295	0.0285	0.0267	0.0269	0.0290	0.0265	0.0303	0.0300	0.0427

Animal ID	CI-0101	CI-0102	CI-0103	CI-0104	CI-0105		CI-0106		CI-0107		CI-0201		CI-0202				CI-0203			CI-0204			CI-0205			CI-0206		CI-0207			CI-0208		
Sex	F	M	F	F	F		F		M		M		F				F			F			M			M		F			M		
Lab#	120-181	120-182	120-183	120-184	120-185	120-186	120-195	120-196	120-187	120-188	120-306	120-307	120-308	120-309	120-310	120-311	120-312	120-313	120-314	120-315	120-316	120-317	120-320	120-321	120-322	120-323	120-324	120-325	120-326	120-327	120-328	120-329	120-330
anteiso-C18:0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0033	0.0000	0.0000	0.0048	0.0055	0.0051	0.0056	0.0038	0.0046	0.0044	0.0037	0.0050	0.0041	0.0040	0.0043	0.0057	0.0050	0.0049	0.0041	0.0046	0.0046	0.0041	0.0052	0.0046	0.0051	0.0055
C18:1n11	1.8096	2.1827	2.1976	2.0471	2.1694	1.9442	2.2388	2.2659	2.5090	2.5585	2.0776	2.5907	1.8740	1.5327	1.5168	1.4910	1.4109	1.3269	1.3490	2.1355	1.5593	1.4382	2.0251	1.8288	1.8510	1.6477	1.6515	1.7576	1.7703	1.6681	2.6711	1.9454	1.8949
C18:1n13	0.1708	0.2419	0.2248	0.1966	0.2278	0.2196	0.2687	0.2824	0.2456	0.2439	0.2365	0.2037	0.2016	0.1909	0.1766	0.1820	0.1514	0.1742	0.1901	0.1763	0.1713	0.1979	0.2063	0.2277	0.2473	0.1872	0.2185	0.2204	0.2139	0.2401	0.2686	0.2194	0.2571
C18:1n5	0.3979	0.5283	0.4441	0.3023	0.3864	0.4383	0.5139	0.5480	0.5038	0.5265	0.5153	0.5226	0.4499	0.4287	0.4209	0.4249	0.3882	0.4337	0.4421	0.3734	0.4237	0.4466	0.4656	0.4977	0.5265	0.4006	0.4554	0.4681	0.4647	0.5024	0.4915	0.5231	0.5439
C18:1n7	4.2009	3.1495	3.7554	2.7761	3.5182	3.7519	3.3724	3.2834	2.7993	2.7168	3.3626	2.7185	3.9120	4.3557	4.4318	4.5137	4.5339	4.9077	4.8149	3.0575	4.2892	4.2496	3.2409	3.6371	3.5083	4.1574	4.2672	3.8087	3.8766	3.8782	2.8909	3.4192	3.4893
C18:1n9	28.6485	24.4638	27.5688	24.9123	27.8707	26.8385	25.6616	24.5172	23.6401	22.9060	25.0208	23.9918	28.6531	29.2963	30.2313	29.6798	31.2831	30.1510	29.8131	27.3470	28.5570	27.3144	27.0008	26.8333	25.9093	29.6672	27.8727	26.4504	26.9136	25.5280	26.1097	26.5501	25.8340
C18:2n4	0.0957	0.1124	0.0981	0.0741	0.0900	0.0955	0.1153	0.1220	0.0934	0.0978	0.1110	0.0987	0.0992	0.0962	0.0922	0.0969	0.0867	0.1084	0.1093	0.0771	0.0946	0.1065	0.1058	0.1120	0.1159	0.0986	0.1066	0.1088	0.1062	0.1132	0.1103	0.1153	0.1209
C18:2n6	1.1639	1.4050	1.1841	1.1249	1.2513	1.1608	1.3704	1.3819	1.4303	1.4440	1.3386	1.3830	1.0813	0.9969	0.9852	0.9952	0.9604	0.9885	1.0066	1.0772	0.9974	1.0145	1.3198	1.3121	1.3365	1.0808	1.1606	1.1467	1.1338	1.1575	1.4300	1.3781	1.4156
C18:2n7	0.1083	0.0781	0.0909	0.0695	0.0861	0.0824	0.0794	0.0799	0.0691	0.0659	0.0832	0.0698	0.0856	0.0938	0.0924	0.0933	0.0864	0.0980	0.0973	0.0774	0.0872	0.0917	0.0889	0.0844	0.0846	0.0946	0.0893	0.0891	0.0897	0.0834	0.0945	0.0902	0.0834
C18:3n1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C18:3n3	0.5659	0.7596	0.6115	0.5642	0.6587	0.6088	0.7752	0.7852	0.7373	0.7201	0.7625	0.7099	0.5441	0.4972	0.4705	0.4905	0.4272	0.5082	0.5449	0.5253	0.4965	0.5810	0.7602	0.7988	0.8315	0.5541	0.6452	0.6480	0.6112	0.6910	0.8479	0.8152	0.8848
C18:3n4	0.0744	0.0745	0.0682	0.0000	0.0704	0.0697	0.1010	0.0831	0.0694	0.0657	0.0974	0.0876	0.0826	0.0898	0.0831	0.0870	0.0821	0.0935	0.0935	0.0784	0.0800	0.0957	0.1004	0.0970	0.1125	0.0872	0.0937	0.0903	0.0925	0.0957	0.1073	0.1093	0.1088
C18:3n6	0.0507	0.0651	0.0508	0.0326	0.0443	0.0577	0.0609	0.0662	0.0625	0.0588	0.0716	0.0657	0.0607	0.0602	0.0533	0.0614	0.0528	0.0549	0.0600	0.0566	0.0569	0.0566	0.0556	0.0605	0.0606	0.0548	0.0587	0.0512	0.0551	0.0615	0.0625	0.0672	0.0659
C18:4n1	0.0000	0.0532	0.0000	0.0000	0.0000	0.0000	0.0547	0.0566	0.0000	0.0000	0.0588	0.0356	0.0000	0.0385	0.0000	0.0000	0.0246	0.0306	0.0445	0.0000	0.0000	0.0382	0.0467	0.0582	0.0567	0.0391	0.0400	0.0400	0.0382	0.0353	0.0507	0.0460	0.0557
C18:4n3	0.4391	0.6765	0.5174	0.3402	0.4519	0.5529	0.5740	0.6629	0.6375	0.6665	0.6883	0.6734	0.5263	0.4708	0.4547	0.4559	0.4461	0.4950	0.5310	0.4429	0.5015	0.6418	0.6828	0.7470	0.7622	0.5163	0.6312	0.6550	0.6555	0.7227	0.6741	0.7644	0.8167
C19:0	0.0422	0.0715	0.0462	0.0327	0.0368	0.0519	0.0685	0.0774	0.0662	0.0746	0.0839	0.0791	0.0619	0.0640	0.0621	0.0621	0.0512	0.0626	0.0634	0.0437	0.0663	0.0711	0.0581	0.0754	0.0809	0.0513	0.0683	0.0689	0.0709	0.0782	0.0531	0.0848	0.0912
C20:0	0.1144	0.1534	0.1234	0.0815	0.0989	0.1282	0.1288	0.1442	0.1389	0.1569	0.1766	0.1825	0.1681	0.1693	0.1734	0.1729	0.1506	0.1554	0.1501	0.1110	0.1719	0.1658	0.1343	0.1456	0.1472	0.1447	0.1529	0.1555	0.1619	0.1638	0.1204	0.1766	0.1646
C20:1n11	3.3598	5.7947	4.7402	3.2326	3.7842	4.3756	5.4107	5.9035	6.4256	7.3924	5.8425	7.4679	4.1688	4.6266	4.2509	4.3810	4.4674	3.9435	3.9001	4.0791	5.0624	4.5707	4.1539	4.9384	4.9230	4.0489	4.8182	5.0838	4.3223	4.7895	4.5472	5.7630	5.2516
C20:1n15	0.0109	0.0153	0.0112	0.0000	0.0099	0.0158	0.0174	0.0201	0.0143	0.0216	0.0255	0.0248	0.0176	0.0187	0.0198	0.0183	0.0151	0.0171	0.0199	0.0146	0.0230	0.0198	0.0161	0.0163	0.0182	0.0157	0.0176	0.0193	0.0188	0.0202	0.0169	0.0226	0.0206
C20:1n5	0.0658	0.0941	0.0810	0.0510	0.0617	0.0788	0.0873	0.0995	0.0927	0.1051	0.1021	0.1167	0.0908	0.0868	0.0846	0.0857	0.0754	0.0771	0.0749	0.0716	0.0876	0.0863	0.0759	0.0812	0.0850	0.0737	0.0819	0.0880	0.0911	0.0938	0.0822	0.0999	0.0949
C20:1n7	0.2283	0.2795	0.2670	0.2129	0.2221	0.2714	0.2745	0.2860	0.3153	0.3554	0.2799	0.2960	0.2979	0.3000	0.2996	0.2982	0.2705	0.2717	0.2707	0.2402	0.3186	0.3228	0.2795	0.2770	0.2839	0.2750	0.2980	0.3247	0.3359	0.3420	0.2829	0.3053	0.3017
C20:1n9	1.4194	2.7358	1.8196	1.3444	1.5531	1.9952	2.3844	2.7055	2.6238	2.9722	3.1002	3.2834	2.2176	2.2071	2.1610	2.1997	2.0211	2.2478	2.2798	1.6518	2.2294	2.3432	2.4794	2.8111	2.8785	2.0729	2.4665	2.3293	2.4490	2.5334	2.2485	2.9748	2.9895
C20:2n11	0.2503	0.1917	0.2439	0.2596	0.2567	0.2265	0.1955	0.1844	0.2018	0.2020	0.0000	0.0000	0.1268	0.0612	0.0467	0.2395	0.2331	0.1642	0.1816	0.0725	0.0233	0.1331	0.1696	0.1687	0.1732	0.2269	0.2030	0.2196	0.2374	0.2193	0.2170	0.1812	0.1812
C20:2n6	0.2365	0.3942	0.3113	0.2024	0.2365	0.2996	0.3716	0.4076	0.3862	0.4327	0.4146	0.4417	0.3266	0.2911	0.2849	0.3090	0.2747	0.2886	0.3041	0.2538	0.3017	0.3449	0.3527	0.3840	0.4112	0.2822	0.3495	0.3738	0.3842	0.4104	0.3881	0.4326	0.4394
C20:2n9	0.0384	0.0309	0.0328	0.0000	0.0265	0.0268	0.0330	0.0000	0.0000	0.0264	0.0327	0.0307	0.0350	0.0368	0.0374	0.0347	0.0336	0.0390	0.0369	0.0216	0.0320	0.0322	0.0309	0.0330	0.0321	0.0322	0.0309	0.0307	0.0338	0.0328	0.0322	0.0350	0.0322
C20:3n3	0.1225	0.2427	0.1749	0.0000	0.1217	0.1699	0.2351	0.2678	0.2071	0.2354	0.2641	0.2624	0.2094	0.1879	0.1935	0.1839	0.1609	0.2034	0.1997	0.1494	0.2014	0.2280	0.2192	0.2577	0.2629	0.1852	0.2117	0.2212	0.2486	0.2558	0.2387	0.2812	0.2788
C20:3n6	0.0871	0.1312	0.0977	0.0744	0.0796	0.0881	0.1355	0.1405	0.1234	0.1344	0.1371	0.1432	0.1064	0.0968	0.0939	0.0967	0.0865	0.0966	0.0973	0.0785	0.0929	0.1023	0.1116	0.1224	0.1273	0.0916	0.1032	0.1146	0.1140	0.1168	0.1321	0.1429	0.1382
C20:4n3	0.5297	0.7718	0.5862	0.4357	0.5030	0.5882	0.7965	0.8327	0.7471	0.7929	0.8705	0.7783	0.6003	0.5343	0.5166	0.5129	0.4755	0.5946	0.6317	0.4517	0.5633	0.7072	0.8374	0.9412	0.9544	0.5935	0.7042	0.7466	0.7427	0.8285	0.8702	0.9682	1.0214
C20:4n6	0.3844	0.4900	0.4204	0.3382	0.4161	0.3914	0.6630	0.5734	0.4639	0.4939	0.4767	0.4659	0.3777	0.3493	0.3665	0.3413	0.3358	0.3595	0.3498	0.2922	0.3454	0.3664	0.4485	0.4850	0.4779	0.3698	0.3737	0.3909	0.4143	0.4026	0.4986	0.5231	0.4755
C20:5n3	2.3305	2.9070	2.5631	1.9429	2.1786	2.7610	2.9769	3.2091	2.9482	2.9898	2.9665	2.4563	2.6192	2.4039	2.3431	2.3629	2.3644	2.7497	2.8511	2.1681	2.5344	3.1755	3.2441	3.4738	3.2801	2.6481	2.7927	3.0231	2.9930	3.2889	3.2630	3.1416	3.1343

Animal ID	CI-0101	CI-0102	CI-0103	CI-0104	CI-0105		CI-0106		CI-0107		CI-0201		CI-0202				CI-0203			CI-0204			CI-0205			CI-0206		CI-0207			CI-0208		
Sex	F	M	F	F	F		F		M		M		F				F			F			M			M		F			M		
Lab#	120-181	120-182	120-183	120-184	120-185	120-186	120-195	120-196	120-187	120-188	120-306	120-307	120-308	120-309	120-310	120-311	120-312	120-313	120-314	120-315	120-316	120-317	120-320	120-321	120-322	120-323	120-324	120-325	120-326	120-327	120-328	120-329	120-330
C21:5n3	0.1327	0.1939	0.1553	0.1001	0.1084	0.1616	0.1785	0.2032	0.1839	0.2136	0.2358	0.2598	0.1944	0.1927	0.2103	0.1852	0.1715	0.2252	0.1999	0.1414	0.2239	0.2233	0.2104	0.2575	0.2339	0.1893	0.1962	0.2149	0.2485	0.2251	0.2067	0.2682	0.2347
C22:0	0.0276	0.0362	0.0273	0.0169	0.0213	0.0304	0.0320	0.0337	0.0281	0.0308	0.0538	0.0445	0.0447	0.0546	0.0507	0.0491	0.0463	0.0442	0.0419	0.0289	0.0487	0.0467	0.0366	0.0367	0.0401	0.0363	0.0395	0.0463	0.0424	0.0416	0.0292	0.0477	0.0454
C22:1n11	1.5947	3.3075	2.0116	1.3399	1.5769	2.4499	2.5683	3.0632	2.9299	3.3969	4.1576	4.1314	2.7783	3.0516	3.0248	3.0608	2.5065	2.8910	2.8002	1.7765	3.2613	3.3254	2.8089	3.2733	3.2730	2.6690	3.1503	3.0362	3.1006	3.4527	2.1248	3.7727	3.5739
C22:1n5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0192	0.0152	0.0000	0.0200	0.0000	0.0000	0.0154	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C22:1n7	0.0710	0.1014	0.0768	0.0468	0.0549	0.0851	0.0827	0.0939	0.0887	0.1055	0.1217	0.1240	0.1258	0.1335	0.1389	0.1391	0.1163	0.1161	0.1144	0.0776	0.1413	0.1417	0.0923	0.1003	0.0983	0.1094	0.1199	0.1262	0.1332	0.1353	0.0727	0.1258	0.1187
C22:1n9	0.3090	0.5744	0.4103	0.3276	0.3463	0.4674	0.4950	0.5491	0.6091	0.7075	0.6357	0.6593	0.5461	0.5310	0.5927	0.5467	0.4848	0.4904	0.4896	0.4273	0.6725	0.7056	0.5669	0.6022	0.6022	0.5136	0.6025	0.6731	0.6598	0.7099	0.5346	0.7786	0.7932
C22:2n6	0.0169	0.0300	0.0276	0.0000	0.0156	0.0290	0.0284	0.0401	0.0309	0.0402	0.0468	0.0528	0.0366	0.0376	0.0355	0.0332	0.0317	0.0312	0.0323	0.0249	0.0396	0.0368	0.0301	0.0341	0.0345	0.0306	0.0324	0.0342	0.0366	0.0404	0.0332	0.0507	0.0442
C22:3n3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
C22:4n3	0.0821	0.1091	0.0888	0.0000	0.0532	0.0000	0.1169	0.1182	0.1097	0.1259	0.1424	0.1481	0.1127	0.1039	0.1062	0.1070	0.1025	0.1063	0.1073	0.0849	0.1081	0.1040	0.1242	0.1253	0.1318	0.0863	0.1004	0.1336	0.1273	0.1319	0.1243	0.1457	0.1295
C22:4n6	0.0829	0.0948	0.0693	0.0000	0.0762	0.0723	0.1144	0.0000	0.1099	0.1368	0.1493	0.1378	0.0926	0.0960	0.0922	0.0888	0.1003	0.1124	0.1014	0.0820	0.1116	0.1053	0.1174	0.1097	0.1209	0.0795	0.0845	0.1125	0.1201	0.1069	0.1135	0.1375	0.1134
C22:5n3	1.7740	2.3157	2.0219	1.2740	1.4330	1.9095	2.3727	2.6027	2.5577	3.0861	3.0414	2.7501	2.1836	2.3026	1.9970	2.0392	1.9573	2.0739	1.9366	1.9642	2.2103	2.2208	2.8669	2.5868	2.9275	1.8299	2.0692	2.7412	2.5531	2.4614	2.8220	2.7318	2.4680
C22:6n3	5.9523	7.8847	7.7602	4.2629	5.3187	7.3783	7.7925	8.5946	8.7998	9.8839	8.6664	9.7153	8.5672	8.2122	8.0650	8.1564	7.2137	7.6509	7.8149	6.3545	8.1938	8.9924	8.2922	8.5709	8.9366	6.6961	8.0702	9.2169	9.5759	9.7563	8.8966	8.5605	8.5095
C24:0	0.0269	0.0314	0.0278	0.0229	0.0225	0.0295	0.0353	0.0321	0.0250	0.0275	0.0450	0.0419	0.0444	0.0490	0.0480	0.0454	0.0391	0.0388	0.0366	0.0312	0.0424	0.0417	0.0409	0.0297	0.0313	0.0342	0.0349	0.0394	0.0382	0.0385	0.0243	0.0372	0.0337
C24:1n9	0.2156	0.4017	0.2661	0.2050	0.2293	0.3214	0.3035	0.3377	0.3420	0.3925	0.4467	0.4392	0.3532	0.3801	0.3845	0.3822	0.3207	0.3267	0.3123	0.2609	0.4001	0.3787	0.3019	0.3312	0.3232	0.2727	0.3098	0.3450	0.3574	0.3705	0.2501	0.4101	0.3864

Persistent organic pollutants (ng/g, wet weight)

Sum CHLDs	760	190	97	8.2	24	45	48	100	600		260	260		93	87	230	310	80	250													
Sum DDTs	2000	650	280	21	70	120	150	280	1900		840	800		240	170	640	780	190	740													
Sum HCHs	220	59	23	0	8.1	18	17	32	160		100	88		42	49	81	120	38	83													
Sum 40 CBs	1800	590	230	0	66	120	110	230	1600		760	910		320	200	660	840	230	650													
HCB											140	95		33	42	90	99	43	93													
a-HCH											17	12		12	12	12	15	11	14													
b-HCH											79	71		27	32	64	98	23	62													
lindane											8	5.1		3.1	4.2	5.2	6	3.6	6.1													
a-chlor											6	4.9		4	7.1	5.8	8.3	6.8	7.6													
c-nona											17	13		6.8	9.3	17	23	7.5	21													
b-chlor											< 2.3	< 4.4		< 1.8	< 2.4	< 1.5	< 2.1	< 1.8	< 1.7													
hept											< 2.2	< 4.3		< 1.7	< 2.4	< 1.4	< 2.0	< 1.7	< 1.7													
HPE											24	18		6.2	8.6	18	23	6.2	19													
nona3											27	26		9.3	6.7	24	31	7.1	26													
oxychlor											57	55		15	11	45	53	9.4	46													
t-nona											130	140		52	44	120	170	43	140													
aldrin											< 2.2	< 4.3		< 1.7	< 2.4	< 1.4	< 2.0	< 1.7	< 1.7													

Animal ID	CI-0101	CI-0102	CI-0103	CI-0104	CI-0105		CI-0106		CI-0107		CI-0201		CI-0202				CI-0203			CI-0204			CI-0205			CI-0206		CI-0207			CI-0208		
Sex	F	M	F	F	F		F		M		M		F				F			F			M			M		F			M		
Lab#	120-181	120-182	120-183	120-184	120-185	120-186	120-195	120-196	120-187	120-188	120-306	120-307	120-308	120-309	120-310	120-311	120-312	120-313	120-314	120-315	120-316	120-317	120-320	120-321	120-322	120-323	120-324	120-325	120-326	120-327	120-328	120-329	120-330
diel											63		29				12			18			35			45		13			33		
mirex											7.9		6.8				6.1			3.4			5.9			6.5		3.4			4.6		
eslf1											< 2.3		< 4.3				< 1.7			< 2.4			< 1.4			< 2.0		< 1.7			< 1.7		
cb17											< 0.56		1.2				< 0.43			< 0.60			< 0.36			< 0.51		< 0.43			< 0.42		
cb18											4.9		5.5				2.8			4.1			3.9			4.6		3.2			4.5		
cb28											5.3		5.1				3.3			5.5			3.2			3.9		4.6			3.5		
cb31											4.7		8.4				4.3			6.2			6.5			7		5			6.5		
cb33											2.3		4.4				2.2			3.5			2.5			3		2.6			2.9		
cb44											14		13				4.4			5.1			12			12		4.7			12		
cb49											16		19				5			4.9			14			16		4.5			15		
cb52											51		50				12			11			39			45		11			42		
cb66											13		6.7				3.7			5			6.4			6.6		4.2			7.5		
cb70											6.8		8.6				4.9			6.6			8.6			7.5		6.2			7.2		
cb74											13		9.2				3.4			3.7			8.3			9.3		3.3			9.2		
cb82											2.9		3.2				1			1			2.7			2.9		1.1			2.9		
cb87											22		26				6.6			5.9			20			23		6.1			21		
cb95											48		50				13			11			38			45		12			42		
cb99											38		42				11			7.7			32			39		8.6			33		
cb101											75		90				22			15			64			78		18			65		
cb105											14		14				4.4			4			11			13		4.2			12		
cb110											25		37				8.4			8.9			31			31		9.1			31		
cb118											44		43				12			10			35			42		11			38		
cb128											8.5		10				3.5			2.4			7.7			9.7		2.7			7.6		
cb138											79		100				33			18			72			94		24			69		
cb149											55		68				19			12			49			63		14			48		
cb151											19		24				7.4			4.2			16			23		5.1			17		
cb153											110		150				49			25			100			140		34			93		
cb156											2.8		< 1.1				1.8			< 0.60			2.8			3.6		< 0.43			2.7		
cb158											4.2		6.2				1.9			< 2.4			4			5.6		< 1.7			3.7		
cb170											7.5		13				7.7			3.2			7.2			12		4.1			5.6		
cb171											2.7		4.5				2.4			< 2.4			2.5			3.8		< 1.7			2		
cb177											5.7		8.2				3.9			< 2.4			4.9			8.2		2.3			4.3		
cb180											25		39				25			7.4			22			38		11			17		
cb183											7.9		12				7.1			2.9			7.3			12		3.8			6		
cb187											25		32				19			6.2			22			35		9			19		

Animal ID	CI-0101	CI-0102	CI-0103	CI-0104	CI-0105		CI-0106		CI-0107		CI-0201		CI-0202				CI-0203			CI-0204			CI-0205			CI-0206		CI-0207			CI-0208		
Sex	F	M	F	F	F		F		M		M		F				F			F			M			M		F			M		
Lab#	120-181	120-182	120-183	120-184	120-185	120-186	120-195	120-196	120-187	120-188	120-306	120-307	120-308	120-309	120-310	120-311	120-312	120-313	120-314	120-315	120-316	120-317	120-320	120-321	120-322	120-323	120-324	120-325	120-326	120-327	120-328	120-329	120-330
cb191											< 2.3		< 4.3				< 1.7			< 2.4			< 1.5			< 2.0		< 1.7			< 1.7		
cb194											< 2.3		< 4.3				3.8			< 2.4			1.9			3.3		1.8			< 1.7		
cb195											< 2.3		< 4.3				< 1.7			< 2.4			< 1.5			< 2.0		< 1.7			< 1.7		
cb199											3.1		5.4				4.6			2			2.6			4.5		1.7			2.1		
cb205											< 2.3		< 4.3				< 1.7			< 2.4			< 1.5			< 2.0		< 1.7			< 1.7		
cb206											< 2.3		< 4.4				< 1.7			< 2.4			< 1.5			< 2.1		< 1.7			< 1.7		
cb208											< 2.3		< 4.3				< 1.7			< 2.4			< 1.5			< 2.0		< 1.7			< 1.7		
cb209											< 2.3		< 4.3				< 1.7			< 2.4			< 1.5			< 2.0		< 1.7			< 1.7		
opDDD											7.4		5.2				3.3			4.8			6.2			7.6		3.8			8		
opDDE											16		11				4.5			3.9			12			12		3.7			15		
opDDT											75		63				22			16			58			67		17			69		
ppDDD											98		75				26			27			80			100		24			90		
ppDDE											570		600				160			99			430			530		120			490		
ppDDT											73		46				21			17			58			60		17			63		
BDE28											< 5.5		< 11				< 4.2			< 5.9			0			0		0			0		
BDE47											9.3		< 11				5.4			< 5.9			12			13		5.3			10		
BDE49											< 5.6		< 11				< 4.3			< 5.9			0			0		0			0		
BDE66											< 5.5		< 11				< 4.2			< 5.9			0			0		0			0		
BDE85											< 5.5		< 11				< 4.2			< 5.8			0			0		0			0		
BDE99											< 5.5		< 11				< 4.2			< 5.8			4.7			7.5		0			0		
BDE100											< 5.5		< 11				< 4.2			< 5.8			3.6			0		0			0		
Br5DE04											< 5.5		< 11				< 4.2			< 5.8			0			0		0			0		
Br5DE05											< 5.5		< 11				< 4.2			< 5.8			0			NR		0			0		
BDE153											NR		< 11				< 4.2			< 5.8			0			0		0			0		
BDE154											< 5.5		< 11				< 4.2			< 5.9			0			0		0			0		
Br6DE01											< 5.5		< 11				< 4.2			< 5.9			0			0		0			0		
BDE155											< 5.6		< 11				< 4.2			< 5.9			0			0		0			0		
BDE183											< 5.6		< 11				< 4.2			< 5.9			0			0		0			0		
Br7DE01											< 5.6		< 11				< 4.2			< 5.9			0			0		0			0		
Sum BDE											9.3		< LOQ				5.4			< LOQ			20			20		5.3			10		

Appendix 5. -- Opportunistic sightings of beluga whale groups reported during periods when satellite-tagged whales were transmitting locations in Cook Inlet, Alaska, 1999-2003. Only whales with uplinks during the date and time of a sighting are shown (**red bold** indicates the whale was likely among those reported). * = last uplink.

Date	Area	Locale	Time	Tagged whale(s) present?	Group size
5/31/1999	Susitna delta	mouth of Little Susitna River	8:00	CI-9901 had first uplink at 20:13 in the area	30
6/6/1999	Susitna delta	mouth of Little Susitna River	8:15	**Yes, CI-9901 in area**	36
6/10/1999	Knik Arm	Anchorage near Port	10:00	No (in Susitna River delta)	6
6/15/1999	Chickaloon Bay	Chickaloon River	8:30	No (in Susitna River delta)	12
7/24/1999	Kachemak Bay	4 miles south of Anchor Point	16:00	No (in Susitna River delta)	1
8/?/1999	Knik Arm	Port of Anchorage	?	No date or time	?
8/6/1999	Kenai River	near Nikiski, north of Kenai River	9:00	No (in Susitna River delta)	1
8/11/1999	Knik Arm	overlook at Six-Mile Creek (Elmendorf AFB)	14:14	No (in Susitna River delta)	25
8/13/1999	Knik Arm	Elderberry Park, Port of Anchorage	13:15-13:30	No (in Susitna River delta)	5
8/14/1999	Turnagain Arm	?	11:15	No (in Susitna River delta)	12
8/15/1999	Knik Arm	Elderberry Park Coast	15:00-16:00	No (in Susitna River delta)	8
8/15/1999	Turnagain Arm	east shore heading toward Portage	10:30-12:00	No (in Susitna River delta)	9
8/16/1999	Knik Arm	Elderberry Park Coast	16:50	No (in Susitna River delta)	4
8/16/1999	Knik Arm	Port of Anchorage at Terminal 2	1:00	No (in Susitna River delta)	4
8/17/1999	Knik Arm	mouth of Six-Mile Creek (Elmendorf AFB)	13:10	No, not until 23:52	18
8/18/1999	Knik Arm	mouth of Six-Mile Creek (Elmendorf AFB)	16:20-17:30	No, north in Eagle Bay	2
8/18/1999	Susitna delta	west of Little Susitna River	7:32	No (in Knik Arm)	28
8/19/1999	Knik Arm	at Port of Anchorage dock	13:30	No, north of area near Cairn Pt.	15
8/20/1999	Knik Arm	mouth of Six-Mile Creek (Elemendorf AFB)	14:28	No, north of area near Cottonwood Creek	6
8/21/1999	Turnagain Arm	Windy Corner pullout	11:30	**Yes, CI-9901 in area**	17
8/22/1999	Knik Arm	Port of Anchorage	22:13	No, north of area	30
8/27/1999	Knik Arm	1 mile from Port of Anchorage	?	**In area but no time to confirm**	2
8/27/1999	Turnagain Arm	?	?	No (in Knik Arm)	10
8/28/1999	Kenai River	mouth at Kenai River	20:00	No (in Knik Arm)	13
8/28/1999	Knik Arm	at Port of Anchorage dock	?	**In area but no time to confirm**	3
8/29/1999	Knik Arm	1.5 miles from Port of Anchorage dock	11:10	No, on west side of Fire Is.	14
8/29/1999	Knik Arm	along Pt. MacKenzie shore	13:30-14:40	No, between Susitna and Little Susitna rivers	15
8/31/1999	Knik Arm	3 miles from dredge, unspecified direction, Port of Anchorage	14:45	**Yes, CI-9901 in area**	5
9/?/1999	Chinitna Bay	In Chinitna Bay, at the mouth of Fritz Creek	?	No (in upper inlet)	2
9/?/1999	Kenai River	left bank of Kenai River in front of Columbia Ward cannery	?	No (in upper inlet)	25
9/1/1999	Knik Arm	1 mile from Port of Anchorage dock	18:45	No, between Pt. MacKenzie and Little Susitna River	5
9/1/1999	Knik Arm	100 yds from dock at Port of Anchorage	7:50	**Yes, CI-9901 in area**	2
9/4/1999	Knik Arm	1/2 mile from dock at Port of Anchorage	9:55	No, at E. tributary of Susitna R.	1
9/4/1999	Knik Arm	20 yds from shore at Port of Anchorage	16:05	No, at W. tributary of Susitna R.	1
9/5/1999	Knik Arm	1.5 miles from port dock, along Pt. MacKenzie shore	17:55	**Yes, CI-9901 in area**	2
9/5/1999	Knik Arm	3/4 mile from Port of Anchorage	18:40	**Yes, CI-9901 in area**	25
9/5/1999	Knik Arm	along Pt. MacKenzie shore	15:10	**Yes, CI-9901 in area**	12

Date	Area	Locale	Time	Tagged whale(s) present?	Group size
9/6/1999	Knik Arm	1 mile from Port of Anchorage, mid-channel to Pt. MacKenzie	14:00	**Yes, CI-9901 in area**	15
9/6/1999	Knik Arm	100-300 yds from Port of Anchorage dock	7:45	**Yes, CI-9901 in area**	20
9/6/1999	Knik Arm	2 miles from dock, Port of Anchorage	17:55	**Yes, CI-9901 in area**	?
9/6/1999	Knik Arm	3 miles from Port of Anchorage dock	18:40	**Yes, CI-9901 in area**	?
9/6/1999	Turnagain Arm	Beluga Point	18:00	No (in Knik Arm)	275
9/7/1999	Knik Arm	2.5 miles from dock at Port of Anchorage, by Pt. MacKenzie	?	Maybe, CI-9901 there from 0:52 until 16:27	6
9/8/1999	Knik Arm	at Port of Anchorage dock	13:30	No, in Eagle Bay	5
9/9/1999	Fire Island	3/4 mile from Fire Island	11:45	No, in Eagle Bay	12
9/9/1999	Kachemak Bay	Kachemak Bay at base of Homer Spit	?	No (in upper inlet)	?
9/9/1999	Knik Arm	100 yds from Port of Anchorage dock	15:06	No, near Birchwood	1
9/10/1999	Knik Arm	100-500 yds from Port of Anchorage dock	11:05	**Yes, CI-9901 in area**	3
9/10/1999	Knik Arm	2 miles from Port of Anchorage dock	9:30	**Yes, CI-9901 in area**	1
9/11/1999	Kachemak Bay	Homer Spit, Mud Bay	15:00	No (in upper inlet)	2
9/11/1999	Kachemak Bay	Inner Mud Bay	17:30	No (in upper inlet)	?
9/11/1999	Knik Arm	along beach west of Pt. MacKenzie	12:00	**Yes, CI-9901 in area**	4
9/11/1999	Knik Arm	along Pt. MacKenzie shore	13:15	**Yes, CI-9901 in area**	10
9/12/1999	Kachemak Bay	Mud Bay, off Homer Spit	?	No (in upper inlet)	11
9/13/1999	Knik Arm	200-700 yds from Port of Anchorage dock	13:35	No, between Fire Island and Pt. Campbell	7
9/15/1999	Kasilof River	between Kenai and Kasilof River	early evening	No (in upper inlet)	7
9/26/1999	Kenai River	flats 1/2 mile downstream from Warren Ames Bridge	16:00	No (in upper inlet)	37
9/13/2000	Knik Arm	center of harbor toward Ship Creek	12:30	Maybe CI-0002, tag did not transmit in this area until 22:46	4
9/13/2000	Pt Possession	between Point Possession and Moose Point	?	No (in Knik Arm)	10
9/14/2000	Kenai River	Kenai River waste water treatment plant	11:30	No (in upper inlet)	6
9/14/2000	Knik Arm	South end of Port of Anchorage	13:45	No, CI-0002 at Windy Pt., CI-0001 at Birchwood	5
9/17/2000	Knik Arm	Port of Anchorage	17:30	No, CI0001 in Turnagain Arm, CI-0002 near Birchwood	8
9/18/2000	Kachemak Bay	1 mile offshore Fox River Flats	17:30	No (in upper inlet)	1
9/18/2000	Knik Arm	north end Port of Anchorage	16:30	No, CI-0001 in Turnagain Arm, CI-0002 near Birchwood	6
9/18/2000	Turnagain Arm	mile 115 Seward Hwy	11:50	Maybe, CI-0001 near Hope	5
9/18/2000	Turnagain Arm	between Beluga Point and Girdwood	10:30	Maybe, CI-0001 near Hope	22
9/20/2000	Kenai River	Kenai River waste water treatment plant	9:30	No (in upper inlet)	4
9/24/2000	Turnagain Arm	south of Girdwood	16:30	**Yes, CI-0001 in area**	4
9/24/2000	Turnagain Arm	past Peterson Creek toward Twenty Mile River	19:30-20:00	**Yes, CI-0001 in area**	?
10/2/2000	Kenai River	Between the wastewater treatment plant and river mouth	14:30	No (in upper inlet)	12
10/20/2000	Kenai River	Kenai River waste water treatment plant	14:30	No (in upper inlet)	12
10/23/2000	Kenai River	Up the Kenai River	?	No (in upper inlet)	?
10/25/2000	Chinitna Bay	near mouth of Clearwater Creek	16:45	No (in upper inlet)	6
10/26/2000	Kenai River	Kenai River MP 6.2	15:00	No (in upper inlet)	22
10/26/2000	Kenai River	mouth of Kenai River	12:15	No (in upper inlet)	50
10/26/2000	Kenai River	mouth of Kenai River and into Inlet	12:00-12:30	No (in upper inlet)	50
10/27/2000	Knik Arm	Goose Bay Airport area	14:20	No, CI-0001 in Chickaloon Bay, CI-0002 in Redoubt Bay	11

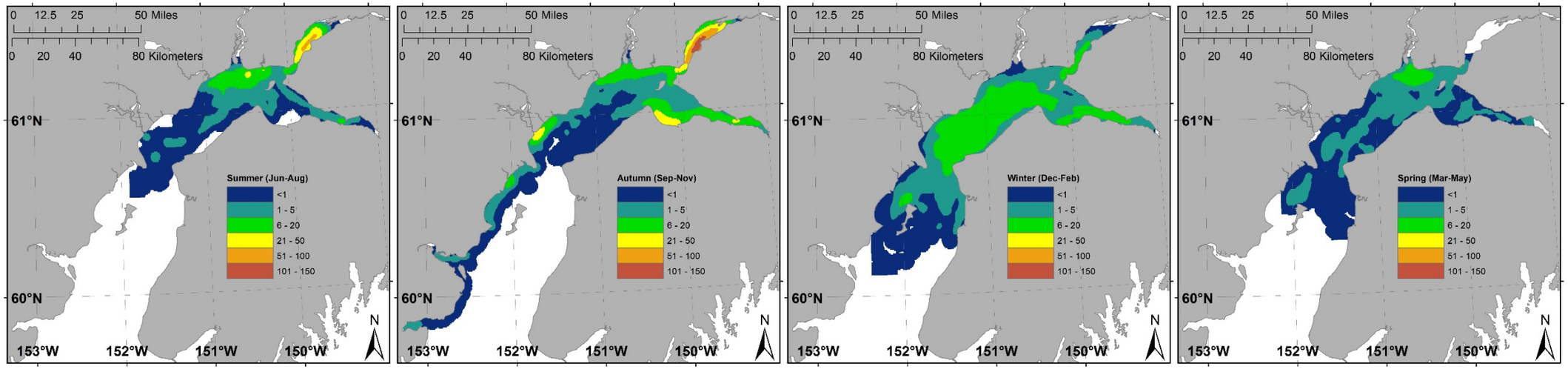
Date	Area	Locale	Time	Tagged whale(s) present?	Group size
10/28/2000	Kenai River	Kenai River waste water treatment plant	9:45	No	10
10/29/2000	Turnagain Arm	by rocks north of McHugh Creek	09:00-09:30	**Yes, CI-0001 near Hope**	20
11/4/2000	Knik Arm	Port of Anchorage (seen from barge and shore)	21:00	No, both near Birchwood	30
11/6/2000	Kenai River	lower Kenai River below William Ames bridge	?	No (in upper inlet)	2
11/9/2000	Kenai River	Kenai River waste water treatment plant.	16:00	No (in upper inlet)	25
11/9/2000	Knik Arm	Port of Anchorage	11:00	Maybe, CI-0001 near Windy Pt, **CI-0002 near POA**	12
11/16/2000	Kenai River	mouth of Kenai River	12:00	No (in upper inlet)	2
11/17/2000	Knik Arm	Port of Anchorage	2:00	Maybe, **CI-0002 near Cairn Pt.**, CI-0001 in Eagle Bay	6
11/19/2000	Knik Arm	Port of Anchorage	14:45	**Yes CI-0001**, CI-0002 south of Moose Pt.	35
11/20/2000	Knik Arm	alongside CSX ship and out 1000' (Port of Anchorage)	10:00	Maybe, **CI-0001 near Cairn Pt.**, CI-0002 south of Moose Pt.	15
1/?/2001	Knik Arm	Point Woronzof	?	No date or time given but both whales were south of Susitna River delta in January	85
1/1/2001	Turnagain Arm	between McHugh and Indian Creeks	?	No, CI-0001 was south of Fire Island, Ci-0002 was near East Foreland	5
8/13/2001	Knik Arm	Port of Anchorage approx. 100' off dock	7:30	Maybe, CI-0103 tag began transmitting at 17:55 in area	10
8/15/2001	Knik Arm	North end of City Dock Port of Anchorage	19:30	No, CI-0103 north of Goose Bay	35
8/16/2001	Knik Arm	S. Port of Anchorage	11:15	No, CI-0103 near Cottonwood Creek, CI-0105 in Susitna River delta, CI-0106 near Birchwood	13
8/20/2001	Knik Arm	Port of Anchorage approx. 100-500' off dock @ T1 and T2	15:00	No, CI-0103 near Windy Pt, CI-0106 Goose Bay	10
8/20/2001	Knik Arm	Pt. MacKenzie Port	14:20	No, CI-0103 near Windy Pt, CI-0106 Goose Bay	20
8/21/2001	Knik Arm	Ship Creek, Boat Launch Ramp	13:30	CI-0105 in Susitna River delta, **CI-0106 in area**, CI-0103 near Goose Bay, CI-0107 near Cairn Pt.	15
8/21/2001	Knik Arm	Ship Creek, South	10:00	CI-0103 near Goose Bay w/ CI-0107, CI-0105 in Susitna River delta, **CI-0106 in area**	20
8/22/2001	Turnagain Arm	bend in Seward Highway between Anchorage and Bird Point	8:50	No, CI-0103, CI-0106, CI0107 in Knik Arm	7
8/23/2001	Knik Arm	City Dock, 100 yds out	17:00	No, CI-0106 mid upper inlet, CI-0107 in Eagle Bay	4
8/23/2001	Knik Arm	north of Ship Creek 100 yd	16:00	No, CI-0106 mid upper inlet, CI-0107 in Eagle Bay	20
8/24/2001	Knik Arm	south of Ship Creek 1/2 mile off	12:00	**CI-0103 in area**, CI-0106 mid inlet off Trading Bay, CI-0107 in Eagle Bay	60
8/24/2001	Knik Arm	south of Ship Creek 1/2 mile off	16:00	**CI-0103 in area**, CI-0106 mid inlet off Trading Bay, CI-0107 in Eagle Bay	10
8/24/2001	Knik Arm	south of Ship Creek 1/2 mile off	19:00	**CI-0103 in area**, CI-0106 mid inlet off Trading Bay, CI-0107 in Eagle Bay	20
8/25/2001	Knik Arm	City Dock 100 yds out	17:30	No, CI-0103 in Eagle Bay, CI-0106 mid inlet off Susitna River delta, CI-0107 near Windy Pt.	6
8/25/2001	Knik Arm	City Dock 100 yds out	20:00	No, CI-0103 in Chickaloon Bay **(crossed area at 18:47)**, CI-0106 mid inlet, CI-0107 at Windy Pt.	30
8/25/2001	Knik Arm	Ship Creek north 2 miles	15:00	No, CI-0103 in Eagle Bay, CI-0106 mid inlet off Susitna River delta, CI-0107 near Windy Pt.	60
8/27/2001	Turnagain Arm	south of Twenty Mile River at mp 84.5	16:00	No, CI-0106 mid inlet, CI-0107 headed into Susitna River delta	25
9/8/2001	Pt Possession	south of Point Possession	?	CI-0103, CI-0107 in Knik Arm, **CI-0106 in Chickaloon Bay near Pt. Possession**	50
9/17/2001	Turnagain Arm	Twenty Mile River	20:00	No, CI-0106 in Chickaloon Bay near Burnt Is., CI-0107 in Knik Arm	20
9/19/2001	Turnagain Arm	from Girdwood to Twenty Mile River	9:00	**CI-0106 in area,** CI-0107 in Knik Arm	20
9/26/2001	Knik Arm	near Eagle River	12:10	No, CI-0103 near Lewis R., CI-0106 in Chickaloon Bay, CI-0107 near Ivan R.	25
10/1/2001	Trading Bay	McArthur River	?	No	?
10/12/2001	Knik Arm	west side across from Birchwood airport	17:00	**CI-0107 in area near Birchwood,** CI-0106 in Chickaloon Bay	120
10/15/2001	Knik Arm	near Eagle River	10:05	No, CI-0107 in Goose Bay, CI-0106 in Chickaloon Bay	15
10/19/2001	Turnagain Arm	between Fire Island and Point Campbell	late afternoon	**CI-0101, CI-0106 in area late afternoon**, CI-0107 north in Knik Arm	3
10/22/2001	Knik Arm	between Ship Creek and boat ramp	14:30	No, CI-0106, CI-0107 near Cairn Pt., north of POA	1
11/5/2001	Turnagain Arm	just north of Bird Point	13:50	No, CI-0106, CI-0107 in Chickaloon Bay	65
11/17/2001	Kachemak Bay	close to Homer spit near shore	?	No (in upper inlet)	?

Date	Area	Locale	Time	Tagged whale(s) present?	Group size
12/17/2001	Trading Bay	Mid Cook Inlet about 1 mile west of Monopod platform	daytime	**CI-0105, CI-0107 in area**	3
1/18/2002	Turnagain Arm	north of Girdwood at curve 20-30 yds offshore	10:00-11:00	No, CI-0107 in Chickaloon Bay	4
1/25/2002	Trading Bay	alongside Grayling Oil Platform, just north of West Foreland	12:30	Maybe, **CI-0107 in area**	30
8/4/2002	Knik Arm	Eagle River spread from south point of Eagle Bay to Windy Point	12:00	No, CI-0201, CI-0205, CI-0206 north of area, CI-0203 in Susitna River delta	200
8/4/2002	Knik Arm	mouth of Eagle River	?	No, CI-0201, CI-0205, CI-0206 north of area all day, CI-0203 in Susitna River delta	200
8/5/2002	Knik Arm	3/4 Miles, Anchorage Side of Earthquake Park	14:30	No, CI-0201, CI-0205, CI-0206, CI-0208 north of area, CI-0203 in Susitna River delta	1
8/9/2002	Knik Arm	Peter's Creek (N. of Birchwood) to Eagle River	?	CI-0203 was south of Fire Island, **CI-0201, CI-0205, CI-0206, CI-0208 in area all day**	100
8/13/2002	Knik Arm	Peter's Creek to Eagle River.	?	CI-0203 was south off Trading Bay, **CI-0201, CI-0205, CI-0206, CI-0208 in area part of the day**	15
8/19/2002	Knik Arm	Port of Anchorage, Terminals 2-3	10:00	CI-0201 CI-0206, CI-0208 north of area, CI-0205 in Chickaloon Bay, **CI-0203 near Pt MacKenzie**	3
8/23/2002	Knik Arm	NW of Windy Point, north side of Eagle Bay	9:20	CI-0203 off Trading Bay, CI-0205 in Chickaloon Bay, **CI-0201, CI-0206, CI-0208 in area**	100
8/23/2002	Knik Arm	south of Birchwood, mid Knik Arm	9:00	CI-0203 off Trading Bay, CI-0205 in Chickaloon Bay, **CI-0201, CI-0206, CI-0208 in area**	10
8/23/2002	Knik Arm	south of Eagle River in Eagle Bay	10:20	No, CI-0203 off Trading Bay, CI-0205 in Chickaloon Bay, CI-0201, CI-0206, CI-0208 north of area	2
8/24/2002	Knik Arm	mouth of Eagle River	?	CI-0203* in Susitna River delta, CI-0205 in Chickaloon Bay, CI-0201 in Goose Bay, **CI-0206, CI-0208 in area during the day**	3
8/25/2002	Knik Arm	by Birchwood	9:00	No, CI-0201 in Goose Bay, CI-0205 in Susitna River delta, CI-0206 in Turnagain Arm, CI-0208 in Eagle Bay	2
8/25/2002	Turnagain Arm	?	13:20	CI-0201, CI-0208 in Knik Arm, CI-0205 in Susitna River delta, **CI-0206 near Campbell Creek**	35
8/26/2002	Knik Arm	mouth of Ship Creek	15:10	No, CI-0201, CI-0208 north of area, CI-0205 in Chickaloon Bay, CI-0206 in Turnagain Arm	5
8/27/2002	Knik Arm	mouth of Eagle River	14:47	**CI-0208 in area,** CI-0201 near Windy Pt, CI-0205 near Pt. Possession, CI-0206 in Turnagain Arm	60
8/27/2002	Knik Arm	mouth of Eagle River	?	**CI-0208 in area,** CI-0201 near Windy Pt, CI-0205 near Pt. Possession, CI-0206 in Turnagain Arm	6
8/27/2002	Knik Arm	north of Pt. MacKenzie	15:15	No, CI-0201, CI-0208 north of area, CI-0205 near Pt Possession, CI-0206 in Turnagain Arm	40
8/27/2002	Knik Arm	south of Pt. MacKenzie	15:20	No, CI-0201, CI-0208 north of area, CI-0205 near Pt Possession, CI-0206 in Turnagain Arm	33
8/28/2002	Susitna delta	mouth of Little Susitna River	15:06	**CI-0205 in area,** CI-0201, CI-0208 in Knik Arm, CI-0206 in Turnagain Arm	40
8/29/2002	Turnagain Arm	near Girdwood	13:30	CI-0206 near area, CI-0201, CI-0205, CI-0208 in Knik Arm	60
8/30/2002	Turnagain Arm	near Rainbow	19:30	**CI-0206 in area,** CI-0201, CI-0205, CI-0208 in Knik Arm	40
8/31/2002	Turnagain Arm	south of Bird Point	15:00	**CI-0206 in area**, CI-0201, CI-0205, CI-0208 in Knik Arm	100
9/3/2002	Turnagain Arm	south of Bird Point	20:45	**CI-0206 in area**, CI-0201, CI-0205, CI-0208 in Knik Arm	40
9/7/2002	Knik Arm	spread 1/4 mi downstream of bridge to 1-2 miles south	20:00	**CI-0201, CI-0208 in area**, CI-0205 in Eagle Bay, CI-0206 in Turnagain Arm	50
9/7/2002	Turnagain Arm	north of Girdwood at first pull out	20:45	**CI-0206 in area**, CI-0201, CI-0205, CI-0208 in Knik Arm	50
9/7/2002	Turnagain Arm	1 mile north of the road to Portage, south of Twenty Mile River	20:30	CI-0206 near area, CI-0201, CI-0205, CI-0208 in Knik Arm	10
9/8/2002	Knik Arm	1/4 to 1/2 mile east of Six Mile Creek	10:30	**CI-0201, CI-0205, CI-0208 in area**, CI-0206 in Turnagain Arm	46
9/8/2002	Turnagain Arm	past Peterson Creek on the north side.	19:00	**CI-0206 in area**, CI-0201, CI-0205. CI-0208 in Knik Arm	46
9/8/2002	Turnagain Arm	just before Twenty Mile River	10:30	CI-0206 near area, CI-0201, CI-0205. CI-0208 in Knik Arm	46
9/9/2002	Knik Arm	at Point MacKenzie	14:30	**CI-0201, CI-0205, CI-0208 in area**, CI-0206 in Turnagain Arm	20
9/15/2002	Knik Arm	north of Cottonwood Creek	?	**CI-0205, CI-0206, CI-0208 in area that day**, CI-0201 near area	4
9/16/2002	Susitna delta	About three bends from the north of Susitna River	?	**CI-0201 in area that day**, CI-0205, CI-0206, CI-0208 in Knik Arm	12
9/16/2002	Knik Arm	Eagle River mouth	14:30	**CI-0205, CI-0208 in area**, CI-0206 near area, CI-0201 in Susitna River delta	27
9/18/2002	Turnagain Arm	Bird Point	10:00	CI-0201, CI-0205, CI-0206, CI-0208 not in Turnagain Arm	30
9/21/2002	Kenai River	north bank at mouth of Kenai River	?	No, CI-0201, CI-0205, CI-0206, CI-0208 in upper inlet	1
9/21/2002	Knik Arm	Knik River bridge	20:00	No, CI-0201, CI-0205, CI-0208 in Susitna River delta, CI-0206 was in North Knik Arm close to area	2

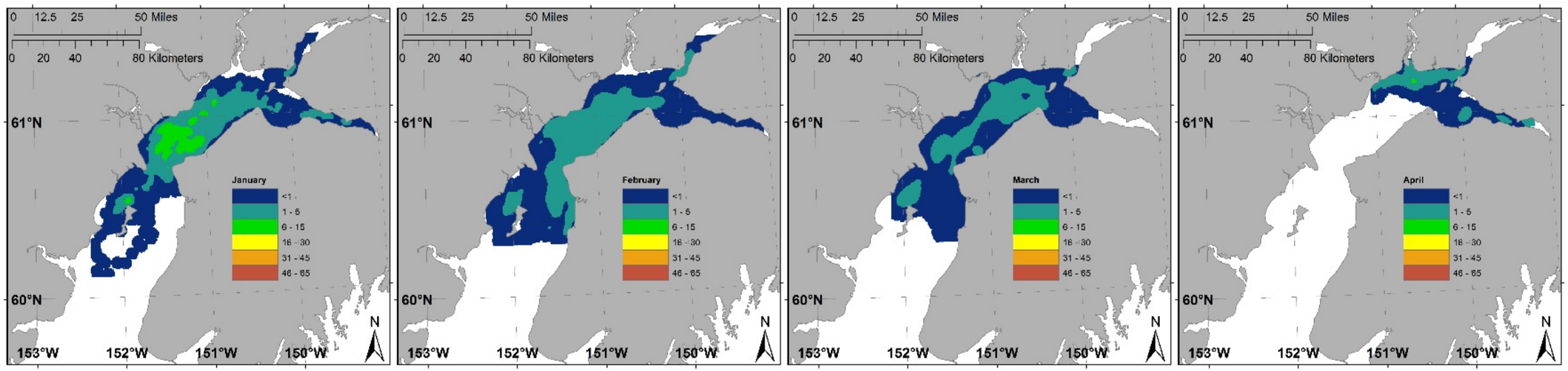
Date	Area	Locale	Time	Tagged whale(s) present?	Group size
9/23/2002	Trading Bay	McArthur River	?	**CI-0201 in area**, CI-0206 in Knik Arm	28
9/24/2002	Kenai River	at mouth of Kenai River	?	No, CI-0201, CI-0205, CI-0206 in upper inlet	1
9/24/2002	Kenai River	mouth of Kenai River	?	No, CI-0201, CI-0205, CI-0206 in upper inlet	2
9/27/2002	Knik Arm	Eagle River	10:45	**CI-0206 in area**, CI-0201, CI-0205 in Susitna River delta	24
9/28/2002	Susitna delta	Beluga River up two bends	?	**CI-0201*, CI-0205, CI-0208 in area**, CI-0206 in Knik Arm	many
11/20/2002	Knik Arm	west of Ship Creek	?	No, CI-0205, CI-0208 north of area, CI-0206 in Chickaloon Bay	3
12/?/2002	Kenai River	Kenai River	?	No, CI-0205, CI-0206, CI-0208 in upper inlet in December	2
1/5/2003	Turnagain Arm	First pullout south of weigh station	19:00	No, CI-0205, CI-0206, CI-0208 mid inlet south of North Foreland	2
1/6/2003	Turnagain Arm	First pullout south of weigh station	20:00	No, CI-0205, CI-0206, CI-0208 mid inlet south of North Foreland	2
2/12/2003	Fire Island	east of Fire Island	16:00	No, CI-0205 in Knik Arm, CI-0206* south of Pt Possession, CI-0208 transmitted in the area earlier	15
3/8/2003	Turnagain Arm	Seward Highway at McHugh Creek	?	No, CI-0208 mid inlet south of North Foreland	6
3/31/2003	Kenai River	north of Kenai River mouth	19:00	No, CI-0205, CI-0208 in upper inlet (but CI-0208 was there on the 19th)	?
4/1/2003	Kenai River	Kenai River MP 5	17:30	No, CI-0205*, CI-0208 in upper inlet	12
4/4/2003	Kasilof River	Kasilof River homesite	17:00	No, CI-0208 in Chickaloon Bay	6
4/15/2003	Kasilof River	Kasilof River	14:15	No, CI-0208 in upper inlet	?
4/18/2003	Turnagain Arm	Seward Highway	18:30	No, CI-0208 in Susitna River delta	6
4/19/2003	Turnagain Arm	Twenty Mile River	?	No, CI-0208 in Susitna River delta	1
4/20/2003	Turnagain Arm	Twenty Mile River	?	No, CI-0208 in Susitna River delta	2
5/4/2003	Knik Arm	Ship Creek, Port of Anchorage	22:00	No, CI-0208 in Susitna River delta	12

Appendix 6. -- Composite density maps of tagged whales in Cook Inlet, Alaska, during each season (A) and month (B) for the period 1999-2003. These maps do not include whales whose tags failed < 2 days after deployment (CI-0202, CI-0204, and CI-0207). Kernel density scale indicates number of modelled locations per square mile using the geodesic method in ArcGIS spatial analyst.

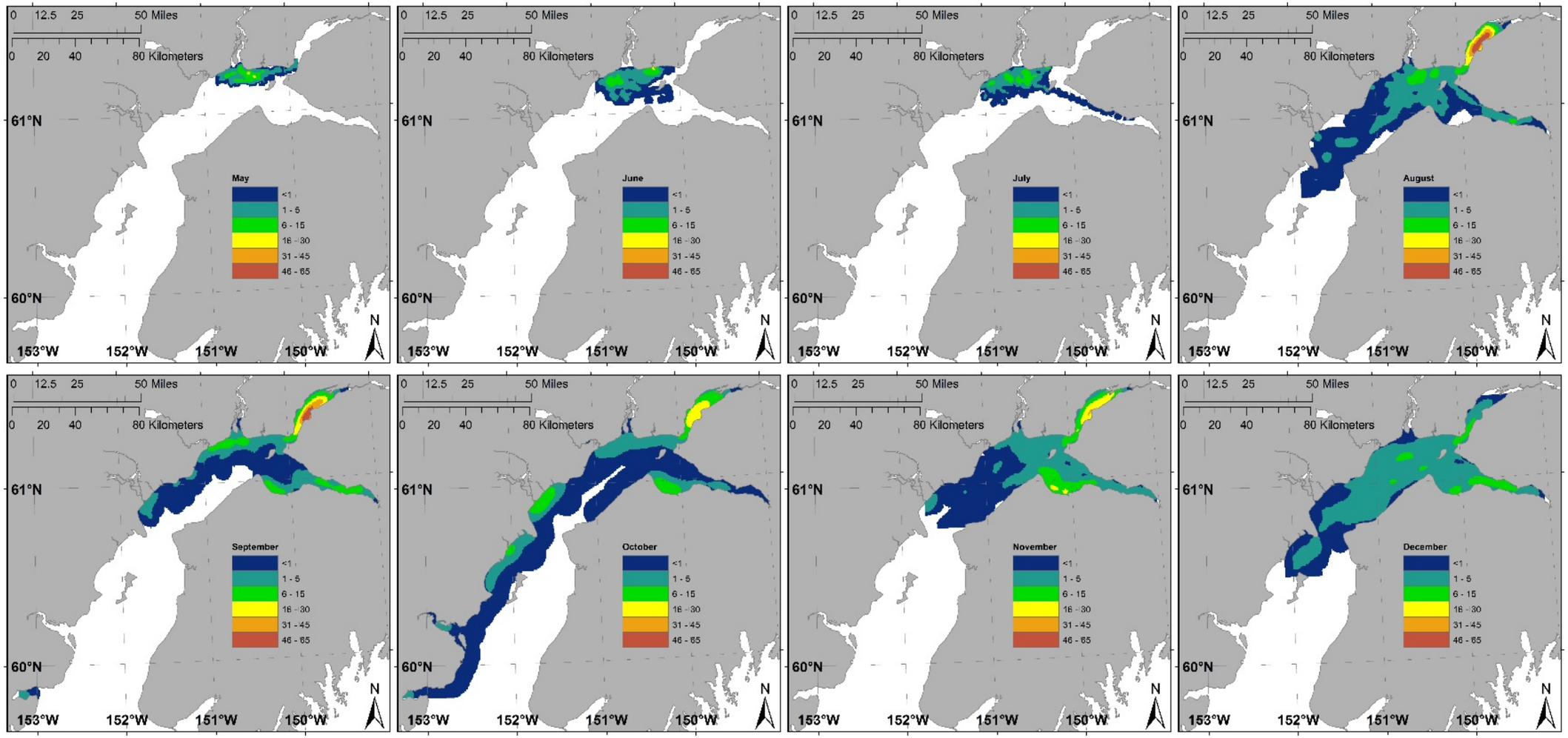
A



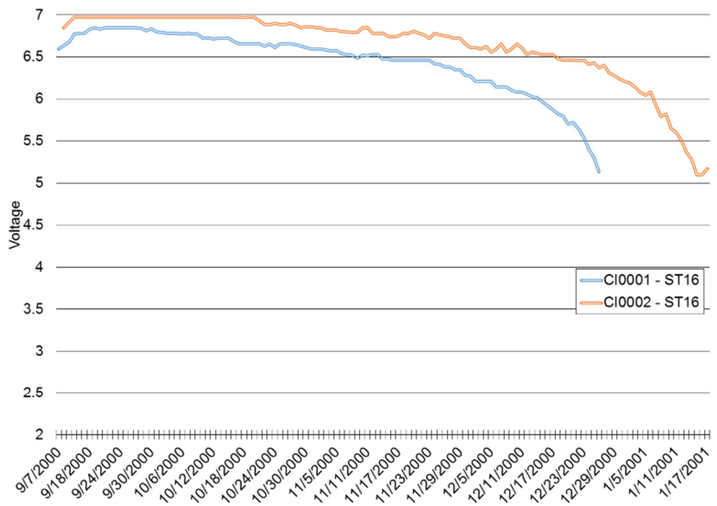
B

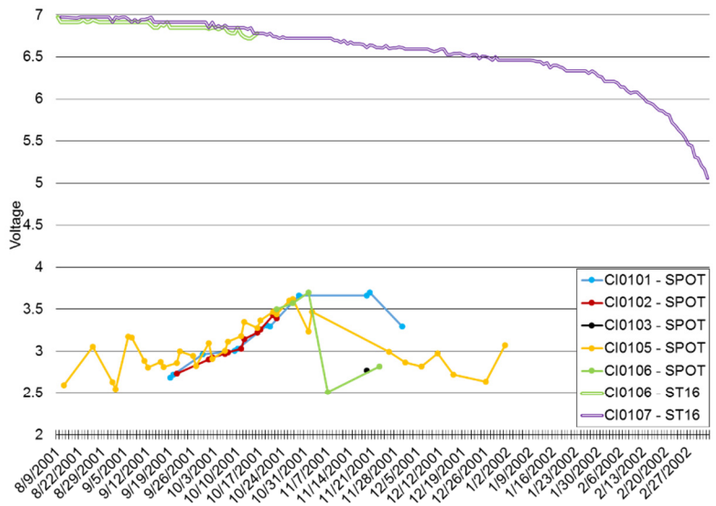


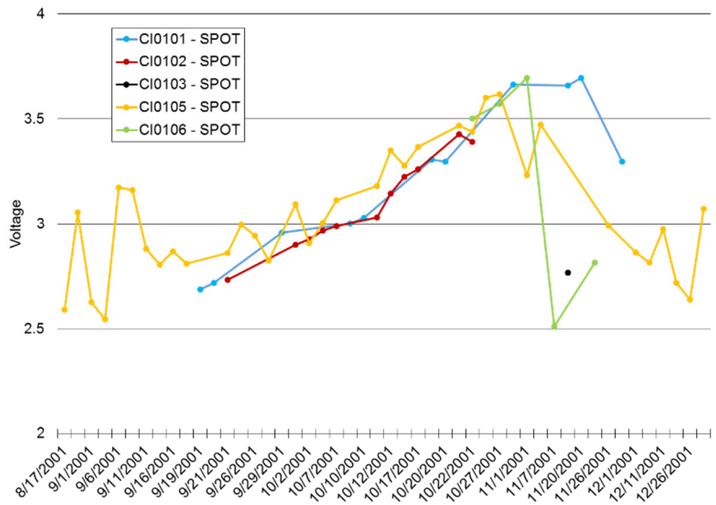
Appendix 6. -- Cont.

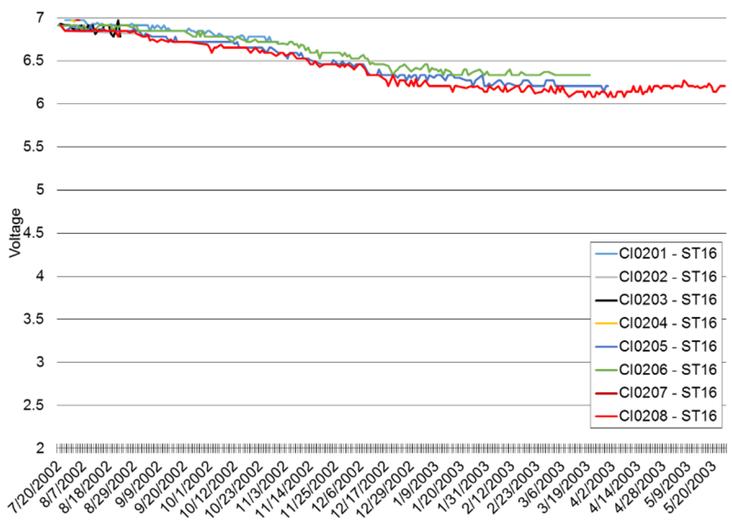


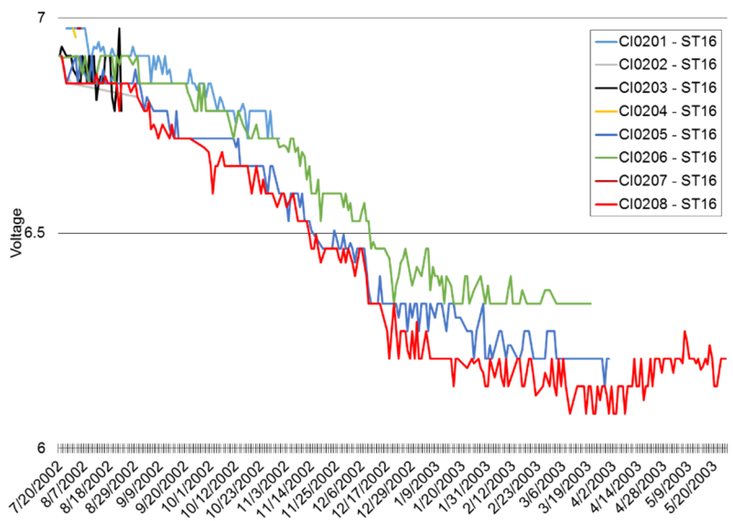
Appendix 7. -- Examples of battery voltage readings from ST16 and SPOT tags attached to belugas in Cook Inlet in 2000 (whales CI0001 and CI0002), 2001 (whales CI0101 – CI0107), and 2002 (whales CI0201 – CI0208). Note: status/voltage updates were missing for whales tagged with two functioning tags: CI0103, CI0106, and CI0107. The SPOT provided status updates only after the ST16 stopped transmitting (CI0106) or tags did not provide status updates at all (CI0103 = ST16, CI0107 = SPOT).





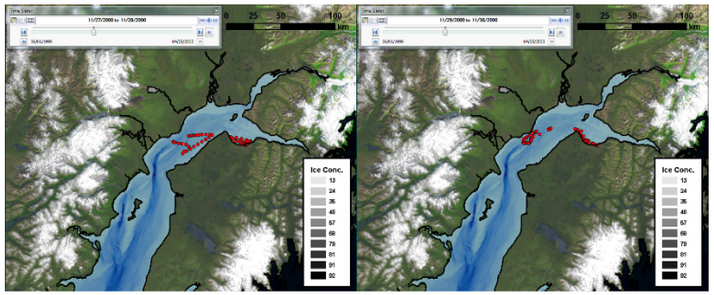




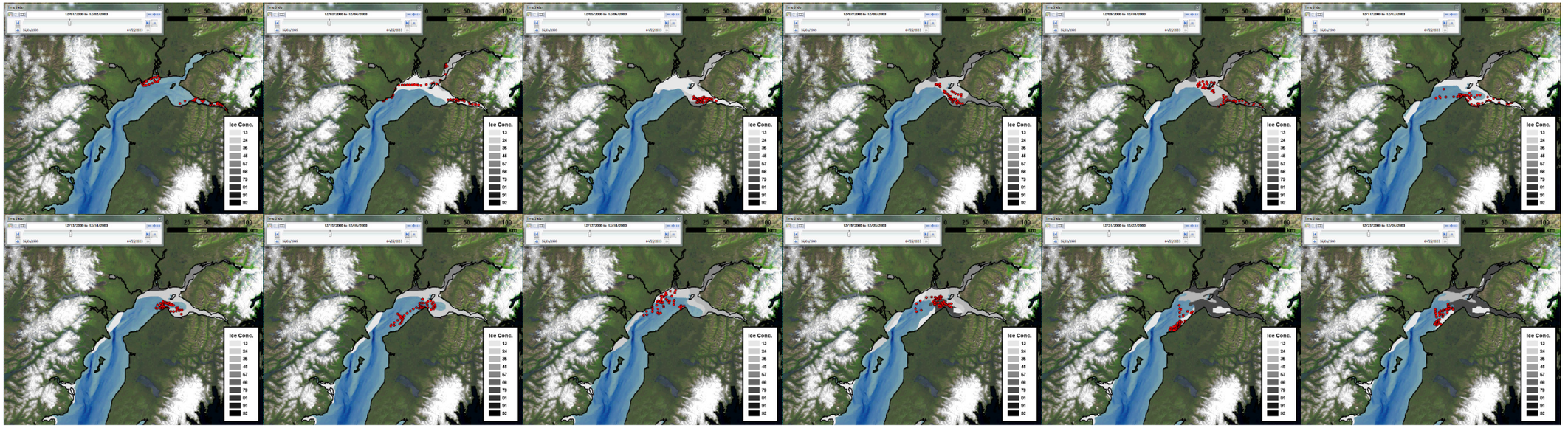


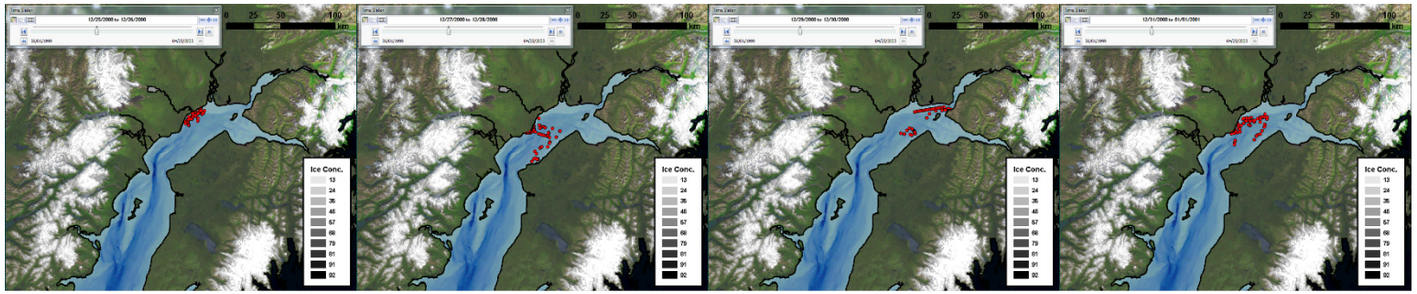
Appendix 8. -- Examples of ice extent and concentration and locations of tagged whales (red circles) in Cook Inlet, Alaska, during the winter of 2000-2001. Two-day maps from 27 November 2000 to 19 January 2001 (screen shots from video animations created by K. Goetz).

November

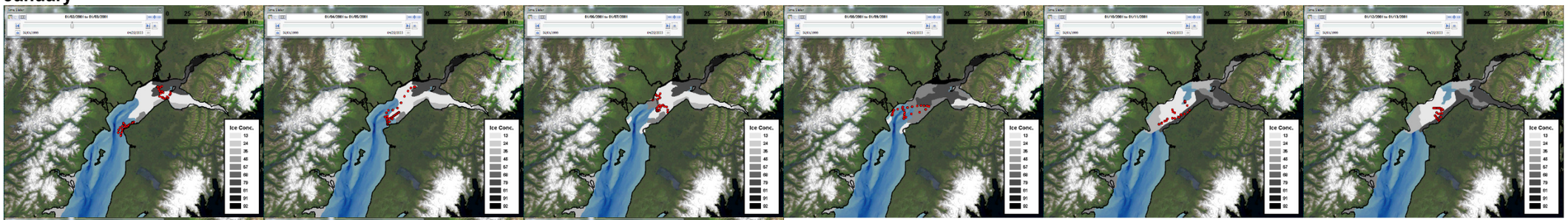


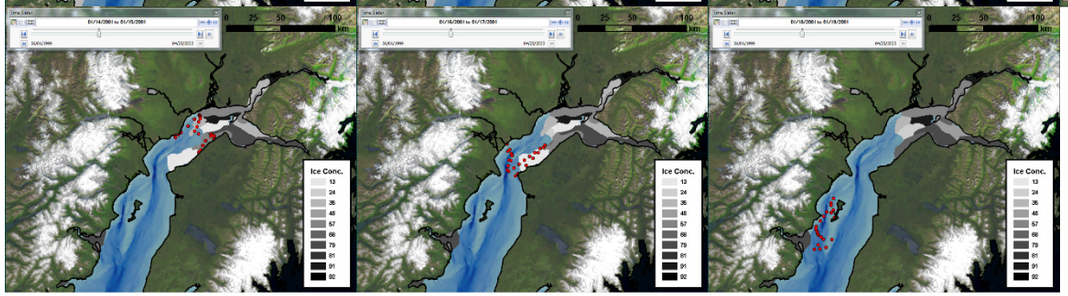
December





January





Appendix 9. -- Data extracted from the suction-cup time-depth recorder (TDR) attached to CI-0002 on 13 September 2000.

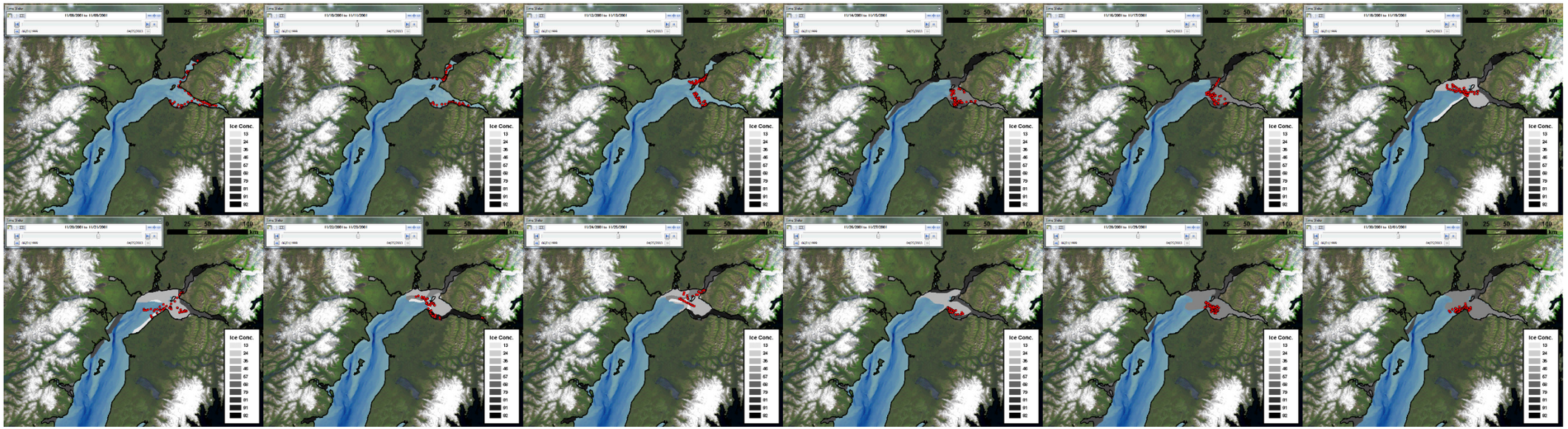
Dive No.	Day/Month	Time	Max. Depth (m)	Duration (min)	Time Since Last Dive	Bottom Time (85% max depth) in min	Average Descent Rate	Average Ascent Rate
61	13/09	15:12:07	12	1.28	77.2	0.55	0.45	-0.56
62	13/09	15:14:58	14	1.87	1.57	1.27	1.04	-0.49
63	13/09	15:20:26	16	2.48	3.6	0.82	0.62	-0.18
64	13/09	15:30:46	13	2.98	7.85	1.03	0.15	-0.31
66	13/09	15:37:33	6	1.9	3.8	0	0.19	-0.07
67	13/09	15:42:12	11	2.05	2.75	0.52	0.23	-0.21
69	13/09	15:51:17	16	2.63	7.03	1.82	0.55	-0.6
70	13/09	15:57:42	14	1.72	3.78	1.07	1.04	-0.44
71	13/09	16:01:04	14	1.47	1.65	0.98	1.14	-0.65
72	13/09	16:03:31	14	2.12	0.98	1.67	0.83	-0.96
73	13/09	16:07:54	14	2.45	2.27	2	0.89	-0.89
74	13/09	16:12:12	14	1.68	1.85	1.32	1.14	-1.04
75	13/09	16:15:53	16	2.62	2	2.03	0.97	-0.68
76	13/09	16:19:47	16	1.7	1.28	1.08	0.85	-0.68
78	13/09	16:23:04	14	1.58	1.58	1.17	1.26	-0.77
79	13/09	16:26:17	10	1.37	1.63	0.55	0.23	-0.95
80	13/09	16:29:00	9	2.55	1.35	2.1	0.48	-0.76
81	13/09	16:32:16	9	0.87	0.72	0.6	1.07	-0.94
82	13/09	16:33:19	9	1.9	0.18	1.37	0.46	-0.55
83	13/09	16:36:25	10	1.72	1.2	1.08	0.42	-0.55
84	13/09	16:39:09	13	1.63	1.02	1.02	0.77	-0.56
85	13/09	16:42:08	16	2.1	1.35	1.37	0.76	-0.55
86	13/09	16:46:51	16	2.35	2.62	1.53	0.68	-0.49
87	13/09	16:50:40	16	4.08	1.47	3.23	0.62	-0.49
88	13/09	16:56:56	14	1.85	2.18	0.68	0.28	-0.45
89	13/09	16:59:40	10	2.4	0.88	1.3	0.3	-0.25
106	13/09	18:17:41	8	2	75.62	0.8	0.17	-0.23
119	13/09	18:47:12	7	2.17	27.52	0.33	0.07	-0.26
120	13/09	18:52:04	7	2.93	2.7	1.25	0.12	-0.12
121	13/09	18:56:31	7	2.75	1.52	0.95	0.08	-0.17
123	13/09	19:07:57	6	2.2	8.68	0.32	0.11	-0.1
124	13/09	19:12:02	7	2.98	1.88	0.68	0.06	-0.17
125	13/09	19:17:27	7	3.68	2.43	1.53	0.06	-0.2
126	13/09	19:23:32	6	4.4	2.4	0.07	0.03	-0.1
128	13/09	19:30:31	7	5.87	2.58	3.97	0.1	-0.11

Dive No.	Day/Month	Time	Max. Depth (m)	Duration (min)	Time Since Last Dive	Bottom Time (85% max depth) in min	Average Descent Rate	Average Ascent Rate
129	13/09	19:40:12	8	3.78	3.82	1.65	0.07	-0.21
130	13/09	19:46:55	8	3.7	2.93	1.97	0.08	-0.34
131	13/09	19:52:21	6	1.6	1.73	0.5	0.2	-0.17
140	13/09	21:15:08	6	1.62	81.18	0.03	0.16	-0.11
143	13/09	21:19:44	6	1.27	2.98	0.12	0.15	-0.2
147	13/09	21:31:36	6	4.08	10.6	0.62	0.07	-0.05
150	13/09	21:38:08	6	3.6	2.45	1.28	0.12	-0.07
161	13/09	22:18:46	7	2.08	37.03	0.3	0.12	-0.11
168	13/09	22:41:16	7	2.17	20.42	0.75	0.09	-0.31
169	13/09	22:46:43	6	0.73	3.28	0.08	0.63	-0.2
378	14/09	04:07:15	6	1.32	319.8	0.17	0.11	-0.36
506	14/09	06:22:21	7	1.23	133.78	0.38	0.2	-0.28
510	14/09	06:25:22	7	1.25	1.78	0.43	0.32	-0.2
553	14/09	12:30:18	26	4.25	363.68	1.62	0.98	-0.17
555	14/09	12:50:37	6	0.38	16.07	0.1	1.09	-0.52
556	14/09	12:52:08	32	4.48	1.13	3.12	0.92	-0.54
559	14/09	13:41:52	24	2.75	45.25	0.37	0.39	-0.24
562	14/09	13:49:21	9	1.45	4.73	0.9	1.07	-0.31
567	14/09	13:51:56	6	0.52	1.13	0.07	0.32	-0.71
568	14/09	13:52:36	6	0.92	0.15	0.28	0.28	-0.36
595	14/09	17:53:07	6	2.23	239.6	0.82	0.17	-0.12
599	14/09	18:08:01	6	1.55	12.67	0.03	0.2	-0.1
603	14/09	20:05:17	12	3.48	115.72	0.22	0.07	-0.32
604	14/09	20:11:31	12	4.08	2.75	1.28	0.59	-0.07
605	14/09	20:18:38	7	4.3	3.03	4	0.92	-0.52
606	14/09	20:25:00	7	2.72	2.07	2.03	0.8	-0.18
607	14/09	20:29:48	8	5.15	2.08	1.08	0.04	-0.15
609	14/09	20:39:01	11	3.48	4.07	1.8	0.31	-0.15
610	14/09	20:45:08	9	3.43	2.63	1.6	0.31	-0.09
613	14/09	21:34:38	10	3.75	46.07	0.48	0.78	-0.05
614	14/09	21:49:10	7	1.98	10.78	1.13	0.52	-0.15
616	14/09	21:52:48	7	1	1.65	0.7	4	-0.36
626	14/09	22:07:34	13	1.2	13.77	0.13	0.3	-0.49
627	14/09	22:09:27	6	0.57	0.68	0.1	0.29	-0.8
649	14/09	22:21:29	11	1.95	11.47	0.28	0.16	-0.27
655	14/09	22:29:41	13	5.7	6.25	1.52	0.07	-0.14
656	14/09	22:37:42	14	7.63	2.32	3.15	0.19	-0.06

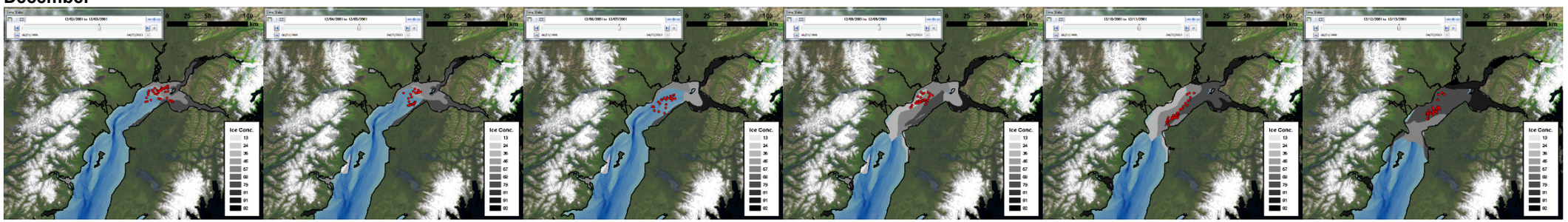
Dive No.	Day/Month	Time	Max. Depth (m)	Duration (min)	Time Since Last Dive	Bottom Time (85% max depth) in min	Average Descent Rate	Average Ascent Rate
657	14/09	22:47:06	12	6.75	1.77	2.07	0.14	-0.05
661	14/09	22:56:26	7	3.63	2.58	1.83	0.11	-0.11
667	14/09	23:15:17	9	2.13	15.22	1.4	0.34	-0.39
669	14/09	23:20:36	14	2.27	3.18	1.42	0.37	-0.65
670	14/09	23:23:28	16	1.95	0.6	0.82	0.31	-0.62
673	14/09	23:42:29	12	2.43	17.07	1.63	0.43	-0.49
681	15/09	00:15:24	10	3.85	30.48	0.25	0.44	-0.05
682	15/09	00:22:56	10	5.52	3.68	1.53	0.18	-0.05
695	15/09	01:02:01	34	6.95	33.57	4.98	0.36	-0.79
696	15/09	01:11:12	33	5.42	2.23	4.13	1.14	-0.56
698	15/09	01:18:50	32	5.15	2.22	1.92	0.67	-0.18
699	15/09	01:26:18	32	3.25	2.32	1.37	0.45	-0.55
702	15/09	01:32:06	27	3.55	2.55	0.35	0.16	-0.45
703	15/09	01:36:51	32	5.17	1.2	4.03	0.81	-0.84
704	15/09	01:44:12	33	6.52	2.18	5.3	1.02	-0.65
705	15/09	01:53:24	31	4.48	2.68	2.08	0.92	-0.24
706	15/09	02:00:26	24	3.77	2.55	2	0.63	-0.29
712	15/09	02:17:16	11	2	13.07	0.53	0.43	-0.16
718	15/09	02:38:57	6	0.37	19.68	0.08	0.57	-0.92
722	15/09	02:46:48	13	1.5	7.48	0.8	0.51	-0.65
723	15/09	02:52:57	40	7.92	4.65	5.92	0.75	-0.48
724	15/09	03:02:23	32	6.47	1.52	4.43	1.1	-0.29
725	15/09	03:11:25	26	4.12	2.57	0.58	0.58	-0.13
728	15/09	03:30:53	9	3.83	15.35	0.57	0.09	-0.07
729	15/09	03:42:20	13	3.33	7.62	0.18	0.27	-0.08
730	15/09	03:48:15	9	4.67	2.58	1.33	0.05	-0.27
732	15/09	03:58:50	6	0.68	5.92	0.12	0.34	-0.36
737	15/09	04:14:41	7	1.9	15.17	0.9	0.16	-0.28
739	15/09	04:19:13	36	4.88	2.63	3.77	1.36	-0.71
761	15/09	13:06:46	7	1.72	522.67	1.28	1.33	-0.28
773	15/09	15:39:02	11	2.85	150.55	1.05	0.25	-0.15
774	15/09	15:44:46	6	2.58	2.88	0	0.08	-0.08
784	15/09	17:59:59	6	0.28	131.63	0.05	0.71	-1.09

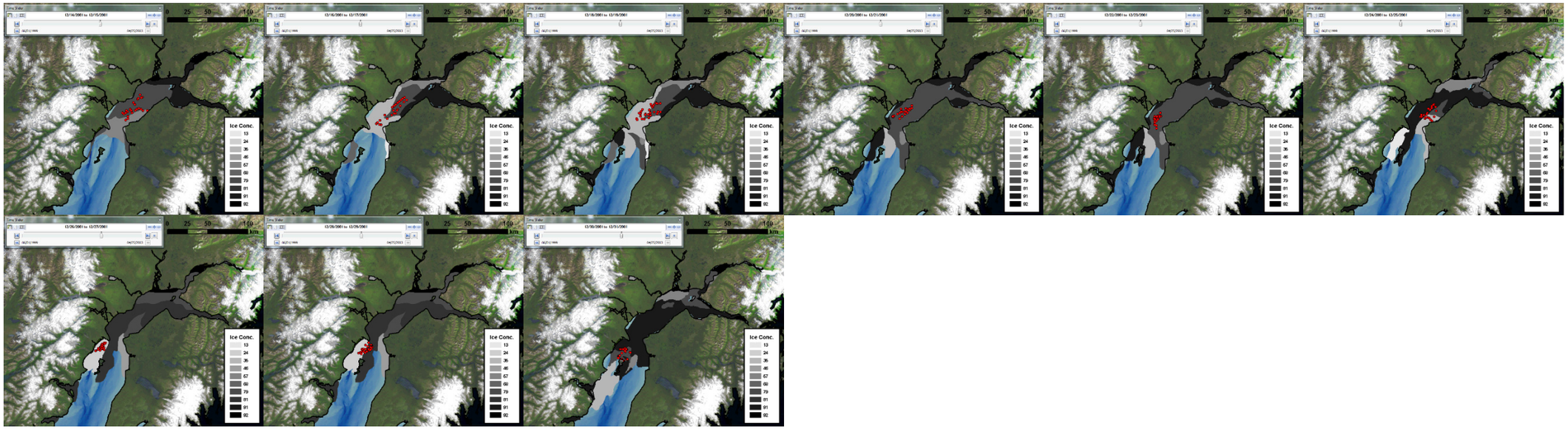
Appendix 10. -- Examples of ice extent and concentration and locations of tagged whales (red circles) in Cook Inlet, Alaska, during the winter of 2001-2002. Two-day maps from 8 November 2001 to 11 March 2002 (screen shots from video animations created by K. Goetz).

November

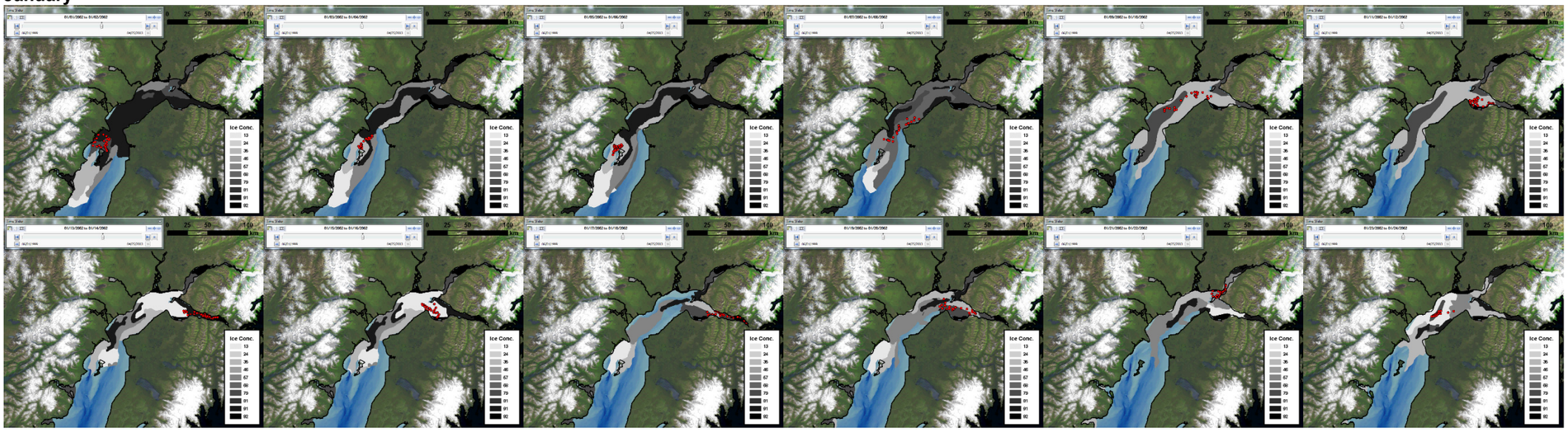


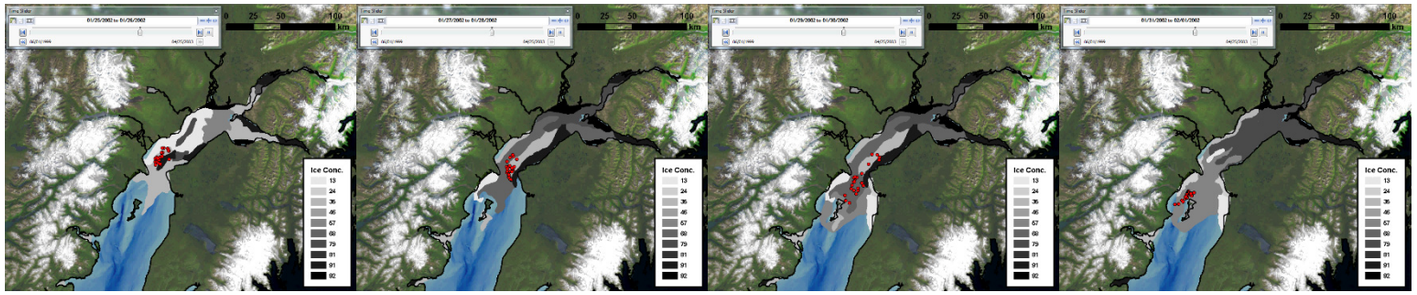
December



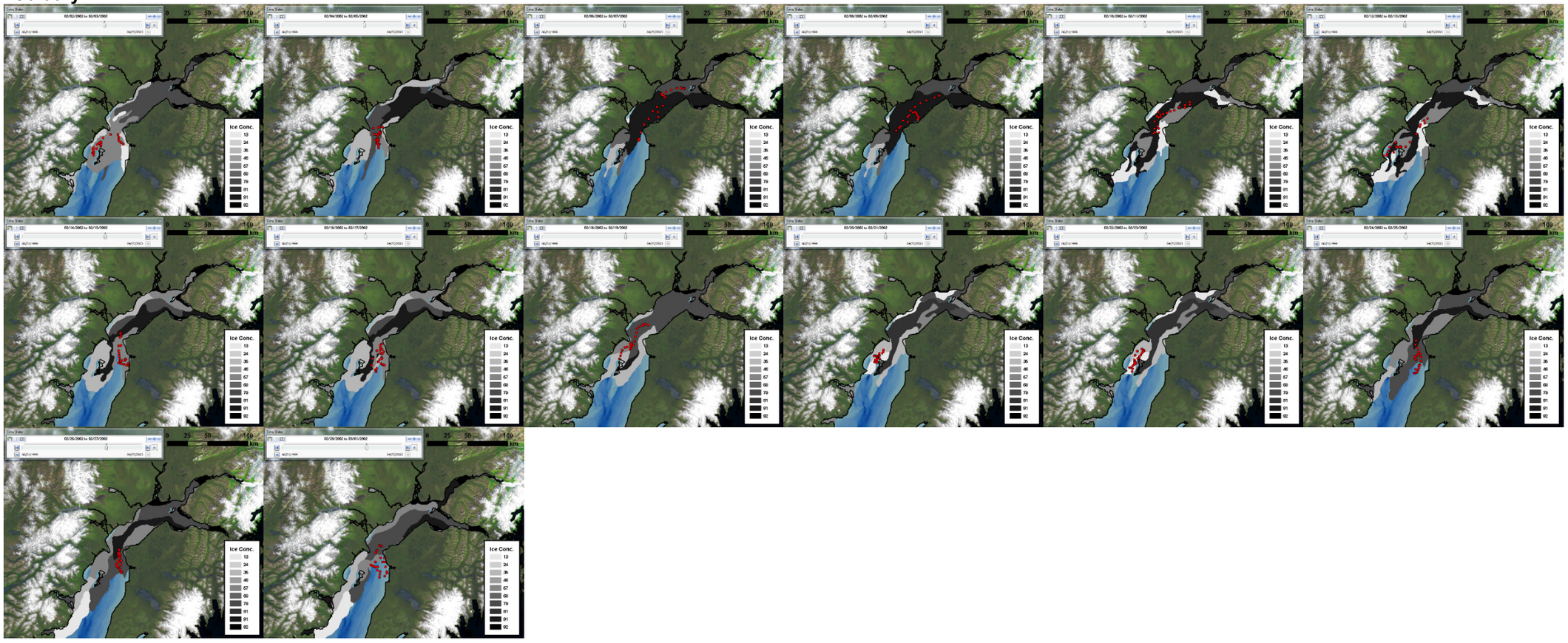

Ice Conc.
13
24
35
46
57
68
79
91
91
92
0 25 50 100
km

January

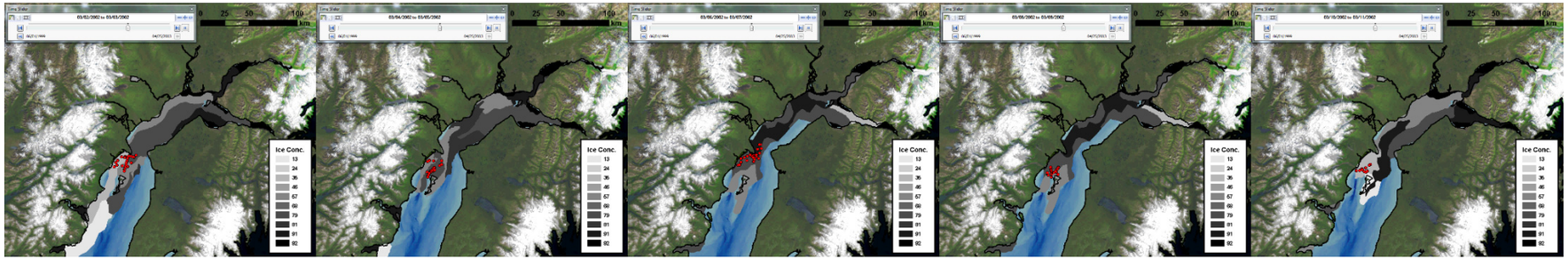

Ice Conc.
13
24
35
46
57
68
79
91
91
92
0 25 50 100
km



February



March



Appendix 11. -- Time at temperature (TAT) data from SPOT2 tags attached to Cook Inlet belugas in 2001. Only two of the four tags programmed to collect temperatures provided TAT histograms. Data for whales CI-0101 (highlighted in gray) and CI-0102 are shown sorted by Date Time. Programming for the 12th temperature bin (**?**) was not provided in the field log book.

							Temperature bins (Celsius)											
Whale ID	PTT#	Date Time	Location Quality	Latitude	Longitude	Sum	1	2	4	6	8	10	12	15	18	21	25	?
CI0102	13937	8/11/01 6:00	1	61.194	-149.948	272	0	0	0	0	0	0	0	0	21	75	4	0
CI0102	13937	8/13/01 21:00				432	0	0	0	0	0	0.7	50.7	48.6	0	0	0	0
CI0102	13937	8/15/01 9:00				433	0	0	0	0	5.5	19.6	22.4	52.4	0	0	0	0
CI0102	13937	8/15/01 15:00				540	0	0	0	15.6	11.7	35.7	15.4	21.7	0	0	0	0
CI0101	13934	8/17/01 9:00				432	0	0	0	0	0	27.1	14.4	58.6	0	0	0	0
CI0101	13934	8/18/01 3:00				309	0	0	0	0	0	80.6	19.4	0	0	0	0	0
CI0101	13934	8/18/01 9:00				432	0	0	0	0	0	6.5	51.9	41.7	0	0	0	0
CI0102	13937	8/24/01 9:00				309	0	0	0	0	0	0	21.4	78.6	0	0	0	0
CI0101	13934	8/26/01 21:00				360	0	0	0	5.6	26.7	61.1	6.7	0	0	0	0	0
CI0101	13934	8/27/01 9:00				719	0	0	0	12.7	31.2	27.3	28.9	0	0	0	0	0
CI0101	13934	8/28/01 15:00				432	0	0	0	0	0	29.6	47.7	22.7	0	0	0	0
CI0101	13934	8/29/01 3:00				541	0	0	0	0	0	24.8	37.5	37.7	0	0	0	0
CI0102	13937	9/4/01 3:00				309	0	0	0	0	0	11	71.2	17.8	0	0	0	0
CI0102	13937	9/5/01 15:00				432	0	0	0	0	0	22.5	22	55.6	0	0	0	0
CI0101	13934	9/7/01 9:00				541	0	0	0	0	12	43.3	44.7	0	0	0	0	0
CI0101	13934	9/7/01 21:00				540	0	0	0	9.3	33.1	40.9	16.7	0	0	0	0	0
CI0102	13937	9/13/01 3:00				359	0	0	0	0	17.5	64.9	17.5	0	0	0	0	0
CI0102	13937	9/13/01 9:00				271	0	0	0	0	0	4.8	83	12.2	0	0	0	0
CI0102	13937	9/13/01 15:00				270	0	0	0	0	7.8	92.2	0	0	0	0	0	0
CI0102	13937	9/13/01 21:00				361	0	0	0	0	0	59.6	40.4	0	0	0	0	0
CI0102	13937	9/14/01 9:00				361	0	0	0	0	0	40.7	59.3	0	0	0	0	0
CI0102	13937	9/14/01 15:00				309	0	0	0	0	0	81.2	18.8	0	0	0	0	0
CI0102	13937	9/14/01 21:00				360	0	0	0	0	0	34.7	65.3	0	0	0	0	0
CI0102	13937	9/15/01 3:00				270	0	0	0	0	0.7	83	16.3	0	0	0	0	0
CI0102	13937	9/15/01 9:00				270	0	0	0	0	0	2.6	92.6	4.8	0	0	0	0
CI0102	13937	9/15/01 15:00	2	61.336	-149.694	361	0	0	0	0	0	39.9	60.1	0	0	0	0	0
CI0102	13937	9/15/01 21:00	2	61.336	-149.694	240	0	0	0	0	0	0	100	0	0	0	0	0
CI0101	13934	9/16/01 9:00				270	0	0	0	0	0	5.9	94.1	0	0	0	0	0
CI0101	13934	9/16/01 21:00				240	0	0	0	0	0	2.5	97.5	0	0	0	0	0
CI0101	13934	9/17/01 3:00				360	0	0	0	0	35.8	61.4	2.8	0	0	0	0	0
CI0101	13934	9/17/01 9:00				240	0	0	0	0	0	3.3	96.7	0	0	0	0	0
CI0101	13934	9/17/01 15:00				240	0	0	0	0	0	0.8	99.2	0	0	0	0	0
CI0101	13934	9/17/01 21:00				240	0	0	0	0	0	0	100	0	0	0	0	0
CI0102	13937	9/17/01 21:00				240	0	0	0	0	0	0	100	0	0	0	0	0
CI0101	13934	9/18/01 3:00				309	0	0	0	0	0	17.8	82.2	0	0	0	0	0
CI0102	13937	9/18/01 3:00				270	0	0	0	0	0	11.1	88.9	0	0	0	0	0
CI0102	13937	9/18/01 9:00				240	0	0	0	0	0	0	100	0	0	0	0	0
CI0101	13934	9/18/01 15:00				177	0	0	0	0	19.2	80.8	0	0	0	0	0	0
CI0102	13937	9/18/01 15:00				270	0	0	0	0	0	6.7	93.3	0	0	0	0	0
CI0101	13934	9/18/01 21:00	B	61.438	-149.515	240	0	0	0	0	0	0	100	0	0	0	0	0
CI0102	13937	9/18/01 21:00				270	0	0	0	0	0	14.4	85.6	0	0	0	0	0
CI0101	13934	9/19/01 3:00	2	61.314	-149.812	308	0	0	0	0	0	27.6	72.4	0	0	0	0	0

Whale ID	PTT#	Date Time	Location Quality	Latitude	Longitude	Sum	Temperature bins (Celsius)											
							1	2	4	6	8	10	12	15	18	21	25	?
CI0102	13937	9/19/01 3:00				240	0	0	0	0	0	0	100	0	0	0	0	0
CI0102	13937	9/19/01 9:00				240	0	0	0	0	0	0	99.2	0.8	0	0	0	0
CI0102	13937	9/19/01 15:00				239	0	0	0	0	0	0	100	0	0	0	0	0
CI0102	13937	9/19/01 21:00				270	0	0	0	0	0	7.8	92.2	0	0	0	0	0
CI0102	13937	9/20/01 3:00				270	0	0	0	0	0	8.9	91.1	0	0	0	0	0
CI0102	13937	9/20/01 9:00				309	0	0	0	0	0	13.9	80.6	5.5	0	0	0	0
CI0102	13937	9/20/01 15:00	3	61.316	-149.846	239	0	0	0	0	0	0	97.9	2.1	0	0	0	0
CI0102	13937	9/20/01 21:00	3	61.316	-149.846	270	0	0	0	0	0	6.7	93.3	0	0	0	0	0
CI0102	13937	9/21/01 3:00	3	61.325	-149.716	270	0	0	0	0	0	10	90	0	0	0	0	0
CI0102	13937	9/21/01 9:00	3	61.325	-149.716	14	0	0	0	0	0	0	0	100	0	0	0	0
CI0102	13937	9/23/01 3:00	A	61.423	-149.551	361	0	0	0	0	0	29.9	70.1	0	0	0	0	0
CI0102	13937	9/23/01 9:00				309	0	0	0	0	18.4	73.8	7.8	0	0	0	0	0
CI0102	13937	9/23/01 15:00				270	0	0	0	0	0	10.7	89.3	0	0	0	0	0
CI0102	13937	9/23/01 21:00				309	0	0	0	1	17.2	80.6	1.3	0	0	0	0	0
CI0102	13937	9/24/01 9:00				309	0	0	0	10.4	13.3	76.4	0	0	0	0	0	0
CI0102	13937	9/24/01 21:00				541	0	0	0	25.1	36.8	38.1	0	0	0	0	0	0
CI0101	13934	9/26/01 9:00				720	0	0	11.5	31.5	29.4	27.5	0	0	0	0	0	0
CI0102	13937	9/27/01 21:00				432	0	0	0	0	0	58.1	41.9	0	0	0	0	0
CI0102	13937	9/28/01 3:00				240	0	0	0	0	0	99.2	0.8	0	0	0	0	0
CI0102	13937	9/28/01 9:00				360	0	0	0	0	0	36.1	63.9	0	0	0	0	0
CI0102	13937	9/28/01 15:00				240	0	0	0	0	2.1	97.9	0	0	0	0	0	0
CI0102	13937	9/28/01 21:00				271	0	0	0	1.5	10	88.6	0	0	0	0	0	0
CI0102	13937	9/29/01 3:00				361	0	0	0	28	64.8	7.2	0	0	0	0	0	0
CI0102	13937	9/29/01 9:00				270	0	0	0	0	0	94.1	5.9	0	0	0	0	0
CI0102	13937	9/29/01 15:00				360	0	0	0	5	33.3	61.7	0	0	0	0	0	0
CI0102	13937	9/29/01 21:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	9/30/01 3:00				360	0	0	0	7.5	61.1	31.4	0	0	0	0	0	0
CI0102	13937	9/30/01 9:00				240	0	0	0	0	0	99.2	0.8	0	0	0	0	0
CI0102	13937	9/30/01 15:00	1	61.324	-149.813	270	0	0	0	0	11.9	88.1	0	0	0	0	0	0
CI0102	13937	9/30/01 21:00	3	61.332	-149.747	270	0	0	0	0	11.5	88.5	0	0	0	0	0	0
CI0102	13937	10/1/01 3:00	3	61.332	-149.747	309	0	0	0	0	18.8	81.2	0	0	0	0	0	0
CI0102	13937	10/1/01 9:00	3	61.448	-149.52	240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/3/01 3:00	3	61.448	-149.52	240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/3/01 9:00				240	0	0	0	0	1.3	98.8	0	0	0	0	0	0
CI0102	13937	10/3/01 15:00				308	0	0	0	12	11	76.9	0	0	0	0	0	0
CI0102	13937	10/3/01 21:00				360	0	0	0	6.9	63.1	30	0	0	0	0	0	0
CI0102	13937	10/4/01 3:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/4/01 9:00				432	0	0	0	0	0	55.8	44.2	0	0	0	0	0
CI0102	13937	10/4/01 15:00				240	0	0	0	0	0	2.5	97.5	0	0	0	0	0
CI0102	13937	10/4/01 21:00				432	0	0	0	0	0	45.4	54.6	0	0	0	0	0
CI0102	13937	10/5/01 3:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/5/01 9:00				271	0	0	0	0	0	88.9	11.1	0	0	0	0	0
CI0102	13937	10/5/01 15:00	3	60.973	-149.84	240	0	0	0	0	0	97.9	2.1	0	0	0	0	0
CI0102	13937	10/5/01 21:00	3	60.899	-149.29	240	0	0	0	0	0	100	0	0	0	0	0	0
CI0101	13934	10/6/01 3:00				270	0	0	0	0	7.8	92.2	0	0	0	0	0	0
CI0102	13937	10/6/01 3:00	3	60.899	-149.29	309	0	0	0	0	23.9	76.1	0	0	0	0	0	0

Whale ID	PTT#	Date Time	Location Quality	Latitude	Longitude	Sum	Temperature bins (Celsius)											
							1	2	4	6	8	10	12	15	18	21	25	?
CI0101	13934	10/6/01 9:00				270	0	0	0	0	8.1	91.9	0	0	0	0	0	0
CI0102	13937	10/6/01 9:00	3	60.899	-149.29	308	0	0	0	0	21.8	78.2	0	0	0	0	0	0
CI0101	13934	10/6/01 15:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/6/01 15:00	3	60.899	-149.29	240	0	0	0	0	3.8	96.3	0	0	0	0	0	0
CI0101	13934	10/6/01 21:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0101	13934	10/7/01 3:00				308	0	0	0	0	17.9	82.1	0	0	0	0	0	0
CI0101	13934	10/7/01 9:00				432	0	0	0	5.1	41.9	53	0	0	0	0	0	0
CI0101	13934	10/7/01 15:00				309	0	0	0	0	23.3	76.7	0	0	0	0	0	0
CI0101	13934	10/7/01 21:00				432	0	0	14.4	34.7	50.9	0	0	0	0	0	0	0
CI0102	13937	10/7/01 21:00	3	60.936	-149.368	360	0	0	0	0	69.7	30.3	0	0	0	0	0	0
CI0101	13934	10/8/01 3:00				361	0	0	0	0	59.8	40.2	0	0	0	0	0	0
CI0102	13937	10/8/01 3:00	3	60.936	-149.368	309	0	0	0	0	78.3	21.7	0	0	0	0	0	0
CI0101	13934	10/8/01 9:00				308	0	0	0	26	73.7	0.3	0	0	0	0	0	0
CI0102	13937	10/8/01 9:00				308	0	0	0	25.3	74.7	0	0	0	0	0	0	0
CI0101	13934	10/8/01 15:00	2	61.341	-149.752	432	0	0	0	12.3	49.3	38.4	0	0	0	0	0	0
CI0102	13937	10/8/01 15:00				14	0	0	0	100	0	0	0	0	0	0	0	0
CI0101	13934	10/8/01 21:00	3	61.332	-149.741	721	0	0	25.8	14.1	29.5	30.5	0	0	0	0	0	0
CI0102	13937	10/8/01 21:00				270	0	0	0	0	94.1	5.9	0	0	0	0	0	0
CI0101	13934	10/9/01 3:00	3	61.332	-149.741	240	0	0	0	0	0.4	99.6	0	0	0	0	0	0
CI0102	13937	10/9/01 3:00				270	0	0	0	2.2	90.4	7.4	0	0	0	0	0	0
CI0101	13934	10/9/01 9:00	3	61.332	-149.741	360	0	0	0	7.5	61.7	30.8	0	0	0	0	0	0
CI0102	13937	10/9/01 9:00				309	0	0	0	0.3	78.6	21	0	0	0	0	0	0
CI0102	13937	10/9/01 15:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/9/01 21:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/10/01 3:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/10/01 9:00				240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/10/01 15:00	3	61.278	-149.86	240	0	0	0	0	0	100	0	0	0	0	0	0
CI0102	13937	10/10/01 21:00	3	61.278	-149.86	53	0	0	0	0	100	0	0	0	0	0	0	0
CI0102	13937	10/11/01 3:00	3	61.278	-149.86	308	0	0	0	0	26.6	73.4	0	0	0	0	0	0
CI0102	13937	10/11/01 9:00	3	61.278	-149.86	432	0	0	0	45.8	54.2	0	0	0	0	0	0	0
CI0102	13937	10/11/01 15:00	3	61.278	-149.86	360	0	0	0	37.2	62.8	0	0	0	0	0	0	0
CI0102	13937	10/12/01 21:00	2	61.337	-149.736	360	0	0	0	39.2	60.8	0	0	0	0	0	0	0
CI0102	13937	10/13/01 3:00	2	61.337	-149.736	360	3.6	15.3	59.4	21.7	0	0	0	0	0	0	0	0
CI0102	13937	10/13/01 9:00				240	0	0	1.7	95	3.3	0	0	0	0	0	0	0
CI0102	13937	10/13/01 15:00				308	0	0	19.2	71.4	9.4	0	0	0	0	0	0	0
CI0102	13937	10/13/01 21:00				432	0	0	0	53.9	46.1	0	0	0	0	0	0	0
CI0102	13937	10/14/01 0:00				290	0	0	31.4	66.9	1.4	0	0	0	0	0	0	0.3
CI0102	13937	10/14/01 3:00				308	0	0	0.3	73.1	26.6	0	0	0	0	0	0	0
CI0102	13937	10/14/01 9:00				360	0	0	0	37.5	62.5	0	0	0	0	0	0	0
CI0102	13937	10/14/01 15:00				270	0	0	16.7	83.3	0	0	0	0	0	0	0	0
CI0102	13937	10/14/01 21:00				240	0	0	0	100	0	0	0	0	0	0	0	0
CI0102	13937	10/15/01 3:00				309	0	0	21.4	78.6	0	0	0	0	0	0	0	0
CI0102	13937	10/15/01 9:00				432	0	0	0	47.7	52.3	0	0	0	0	0	0	0
CI0102	13937	10/15/01 15:00	3	61.326	-149.794	270	0	0	0	93.3	6.7	0	0	0	0	0	0	0
CI0102	13937	10/15/01 21:00	3	61.453	-149.498	308	0	0	0	73.7	26.3	0	0	0	0	0	0	0
CI0101	13934	10/16/01 3:00				270	0	0	0	91.1	8.9	0	0	0	0	0	0	0

Whale ID	PTT#	Date Time	Location Quality	Latitude	Longitude	Sum	Temperature bins (Celsius)											
							1	2	4	6	8	10	12	15	18	21	25	?
CI0102	13937	10/16/01 3:00	3	61.453	-149.498	270	0	0	7.4	85.2	7.4	0	0	0	0	0	0	0
CI0101	13934	10/16/01 9:00				361	0	0	0	60.7	39.3	0	0	0	0	0	0	0
CI0102	13937	10/16/01 9:00	3	61.453	-149.498	308	0	0	0	24.7	75.3	0	0	0	0	0	0	0
CI0101	13934	10/16/01 15:00				270	0	0	0	83.3	16.7	0	0	0	0	0	0	0
CI0102	13937	10/16/01 15:00	3	61.453	-149.498	104	0	0	11.5	0	88.5	0	0	0	0	0	0	0
CI0101	13934	10/16/01 21:00				240	0	0	0	97.5	2.5	0	0	0	0	0	0	0
CI0101	13934	10/17/01 3:00				270	0	0	12.6	87.4	0	0	0	0	0	0	0	0
CI0101	13934	10/17/01 9:00				240	0	0	3.8	96.3	0	0	0	0	0	0	0	0
CI0101	13934	10/17/01 15:00				270	0	0	13.7	86.3	0	0	0	0	0	0	0	0
CI0101	13934	10/17/01 21:00				270	0	0	11.9	88.1	0	0	0	0	0	0	0	0
CI0102	13937	10/17/01 21:00	3	61.429	-149.623	240	0	0	1.3	98.8	0	0	0	0	0	0	0	0
CI0101	13934	10/18/01 3:00				271	0	0	5.9	94.1	0	0	0	0	0	0	0	0
CI0102	13937	10/18/01 3:00	3	61.45	-149.604	240	0	0	0.4	99.6	0	0	0	0	0	0	0	0
CI0101	13934	10/18/01 9:00				360	0	0	33.3	66.7	0	0	0	0	0	0	0	0
CI0102	13937	10/18/01 9:00				360	0	0	39.4	60.6	0	0	0	0	0	0	0	0
CI0101	13934	10/18/01 15:00	2	61.303	-149.817	240	0	0	0	100	0	0	0	0	0	0	0	0
CI0102	13937	10/18/01 15:00				270	0	0	11.5	88.5	0	0	0	0	0	0	0	0
CI0101	13934	10/18/01 21:00	2	61.333	-149.758	240	0	0	0.8	99.2	0	0	0	0	0	0	0	0
CI0102	13937	10/18/01 21:00				240	0	0	0	100	0	0	0	0	0	0	0	0
CI0101	13934	10/19/01 3:00	2	61.333	-149.758	240	0	0	0	100	0	0	0	0	0	0	0	0
CI0102	13937	10/19/01 3:00				240	0	0	1.7	98.3	0	0	0	0	0	0	0	0
CI0101	13934	10/19/01 9:00	2	61.333	-149.758	240	0	0	0	100	0	0	0	0	0	0	0	0
CI0102	13937	10/19/01 9:00				432	0	0.9	13.2	55.6	30.3	0	0	0	0	0	0	0
CI0102	13937	10/19/01 15:00				432	8.6	9	25.2	56.7	0.5	0	0	0	0	0	0	0
CI0102	13937	10/19/01 21:00				360	0	0	4.7	27.8	59.2	8.3	0	0	0	0	0	0
CI0102	13937	10/20/01 3:00				360	0	0	0	0	59.7	40.3	0	0	0	0	0	0
CI0102	13937	10/20/01 9:00				432	0	0	0	59	41	0	0	0	0	0	0	0
CI0102	13937	10/20/01 15:00	2	60.975	-150.205	361	0	0	33.8	66.2	0	0	0	0	0	0	0	0
CI0102	13937	10/20/01 21:00	3	60.965	-149.803	240	0	0	100	0	0	0	0	0	0	0	0	0
CI0102	13937	10/21/01 3:00	3	60.965	-149.803	309	0	0	73.1	26.9	0	0	0	0	0	0	0	0
CI0102	13937	10/21/01 9:00	3	60.965	-149.803	240	0	0	0	100	0	0	0	0	0	0	0	0
CI0102	13937	10/23/01 15:00				308	79.2	1.9	8.1	10.7	0	0	0	0	0	0	0	0
CI0102	13937	10/23/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/24/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/24/01 9:00				719	32.7	1.9	3.3	5.4	9.9	32.5	11.1	3.1	0	0	0	0
CI0102	13937	10/24/01 15:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/24/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/25/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/25/01 9:00				541	37	1.7	3.9	15.5	8.3	21.4	7	5.2	0	0	0	0
CI0102	13937	10/25/01 15:00	3	61.107	-149.938	270	84.4	4.8	7	3.7	0	0	0	0	0	0	0	0
CI0101	13934	10/26/01 3:00				270	85.2	14.8	0	0	0	0	0	0	0	0	0	0
CI0101	13934	10/26/01 9:00				432	12	53.9	34	0	0	0	0	0	0	0	0	0
CI0101	13934	10/26/01 15:00				270	86.7	13.3	0	0	0	0	0	0	0	0	0	0
CI0101	13934	10/26/01 21:00				432	49.5	38	12.5	0	0	0	0	0	0	0	0	0
CI0101	13934	10/27/01 3:00				309	75.7	23	1.3	0	0	0	0	0	0	0	0	0
CI0101	13934	10/27/01 8:00				244	100	0	0	0	0	0	0	0	0	0	0	0

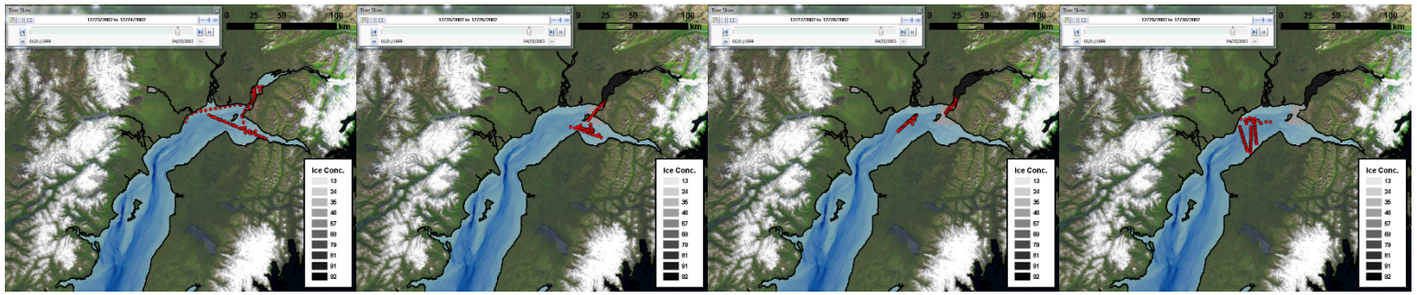
Whale ID	PTT#	Date Time	Location Quality	Latitude	Longitude	Sum	Temperature bins (Celsius)											
							1	2	4	6	8	10	12	15	18	21	25	?
CI0101	13934	10/27/01 9:00				540	44.8	21.5	33.7	0	0	0	0	0	0	0	0	0
CI0101	13934	10/27/01 15:00				361	2.5	65.9	31.6	0	0	0	0	0	0	0	0	0
CI0101	13934	10/27/01 21:00				270	89.6	10.4	0	0	0	0	0	0	0	0	0	0
CI0101	13934	10/28/01 3:00				309	82.5	17.5	0	0	0	0	0	0	0	0	0	0
CI0101	13934	10/28/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	10/28/01 15:00	A	60.911	-149.259	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	10/28/01 21:00	3	60.959	-149.973	240	97.5	2.5	0	0	0	0	0	0	0	0	0	0
CI0101	13934	10/29/01 3:00	3	60.959	-149.973	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/29/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/29/01 9:00				309	82.2	7.8	10	0	0	0	0	0	0	0	0	0
CI0101	13934	10/29/01 15:00	3	60.903	-149.399	240	99.6	0.4	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/29/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/30/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/31/01 15:00	3	61.107	-149.933	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	10/31/01 21:00	3	61.107	-149.933	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/6/01 3:00				309	74.8	25.2	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/6/01 9:00				270	86.3	13.7	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/6/01 15:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/6/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/7/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/7/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/7/01 15:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/7/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/8/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/8/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/8/01 15:00	1	61.267	-149.9	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/8/01 21:00	1	61.267	-149.9	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/9/01 3:00	2	61.388	-149.797	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/9/01 9:00	2	61.388	-149.797	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/15/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/15/01 21:00				240	0	100	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/16/01 3:00				270	84.4	15.6	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/16/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/16/01 15:00				270	93.3	6.7	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/16/01 21:00				309	71.5	28.5	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/17/01 3:00				360	38.1	61.9	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/17/01 9:00				309	0	21.7	78.3	0	0	0	0	0	0	0	0	0
CI0101	13934	11/17/01 15:00				240	0	100	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/17/01 21:00				240	0	100	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/17/01 23:00				1157	14.5	12.1	5	18.2	3.8	2.8	11.4	2.5	9.4	2	5.7	12.5
CI0101	13934	11/18/01 3:00				361	60.9	39.1	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/18/01 9:00				309	73.5	26.5	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/18/01 15:00	1	61.048	-150.737	432	56	44	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/18/01 15:00				309	17.8	1	80.3	1	0	0	0	0	0	0	0	0
CI0101	13934	11/18/01 21:00	3	61.037	-150.541	240	0	100	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/18/01 21:00				240	98.8	1.3	0	0	0	0	0	0	0	0	0	0

Whale ID	PTT#	Date Time	Location Quality	Latitude	Longitude	Sum	Temperature bins (Celsius)											
							1	2	4	6	8	10	12	15	18	21	25	?
CI0101	13934	11/19/01 3:00	3	61.037	-150.541	270	8.9	91.1	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/19/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/19/01 9:00	3	61.037	-150.541	240	0	100	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/19/01 9:00				270	85.2	4.1	4.8	5.9	0	0	0	0	0	0	0	0
CI0102	13937	11/19/01 15:00				271	92.3	3.7	3	1.1	0	0	0	0	0	0	0	0
CI0102	13937	11/19/01 21:00				360	68.3	17.5	14.2	0	0	0	0	0	0	0	0	0
CI0102	13937	11/20/01 3:00				309	0	71.8	28.2	0	0	0	0	0	0	0	0	0
CI0102	13937	11/20/01 15:00	3	60.904	-149.103	270	0	5.6	93.7	0.7	0	0	0	0	0	0	0	0
CI0102	13937	11/20/01 21:00	3	60.904	-149.103	360	63.9	17.2	18.9	0	0	0	0	0	0	0	0	0
CI0102	13937	11/21/01 3:00	3	60.904	-149.103	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/21/01 9:00	3	60.904	-149.103	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/22/01 21:00	3	60.903	-149.111	240	97.5	2.5	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/23/01 3:00				309	72.2	21.4	6.5	0	0	0	0	0	0	0	0	0
CI0102	13937	11/23/01 9:00				432	0	5.1	49.1	45.8	0	0	0	0	0	0	0	0
CI0102	13937	11/23/01 15:00				309	73.5	8.1	17.8	0.6	0	0	0	0	0	0	0	0
CI0102	13937	11/23/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/24/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0102	13937	11/24/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/25/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/26/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/26/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/26/01 15:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/26/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/27/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/27/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/27/01 15:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/27/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/28/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/28/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/28/01 15:00	A	61.021	-150.505	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/28/01 21:00	3	61.009	-150.603	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/29/01 3:00	3	61.038	-150.548	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	11/29/01 9:00	3	61.062	-150.391	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/6/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/6/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/6/01 15:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/6/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/7/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/7/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/7/01 15:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/7/01 21:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/8/01 3:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/8/01 9:00				240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/8/01 15:00	2	60.877	-151.105	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/8/01 21:00	3	60.979	-150.861	240	100	0	0	0	0	0	0	0	0	0	0	0
CI0101	13934	12/9/01 3:00	3	60.979	-150.861	240	100	0	0	0	0	0	0	0	0	0	0	0

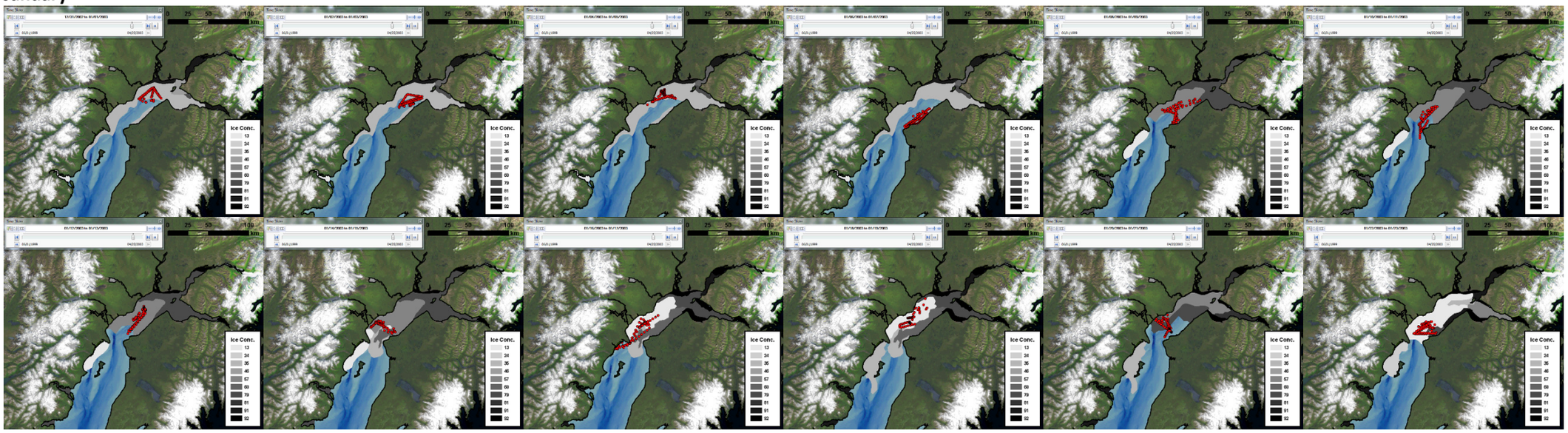
Whale ID	PTT#	Date Time	Location Quality	Latitude	Longitude	Sum	Temperature bins (Celsius)											
							1	2	4	6	8	10	12	15	18	21	25	?
CI0101	13934	12/9/01 9:00	3	60.979	-150.861	240	100	0	0	0	0	0	0	0	0	0	0	0

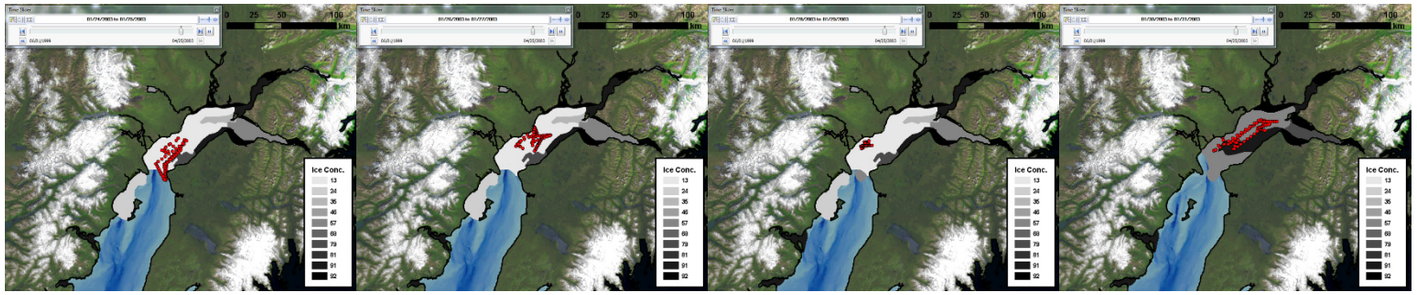
Appendix 12. -- Examples of ice extent and concentration and locations of tagged whales (red circles) in Cook Inlet, Alaska, during the winter of 2002-2003. Two-day maps from 23 December 2002 to 25 April 2003 (screen shots from video animations created by K. Goetz).

December

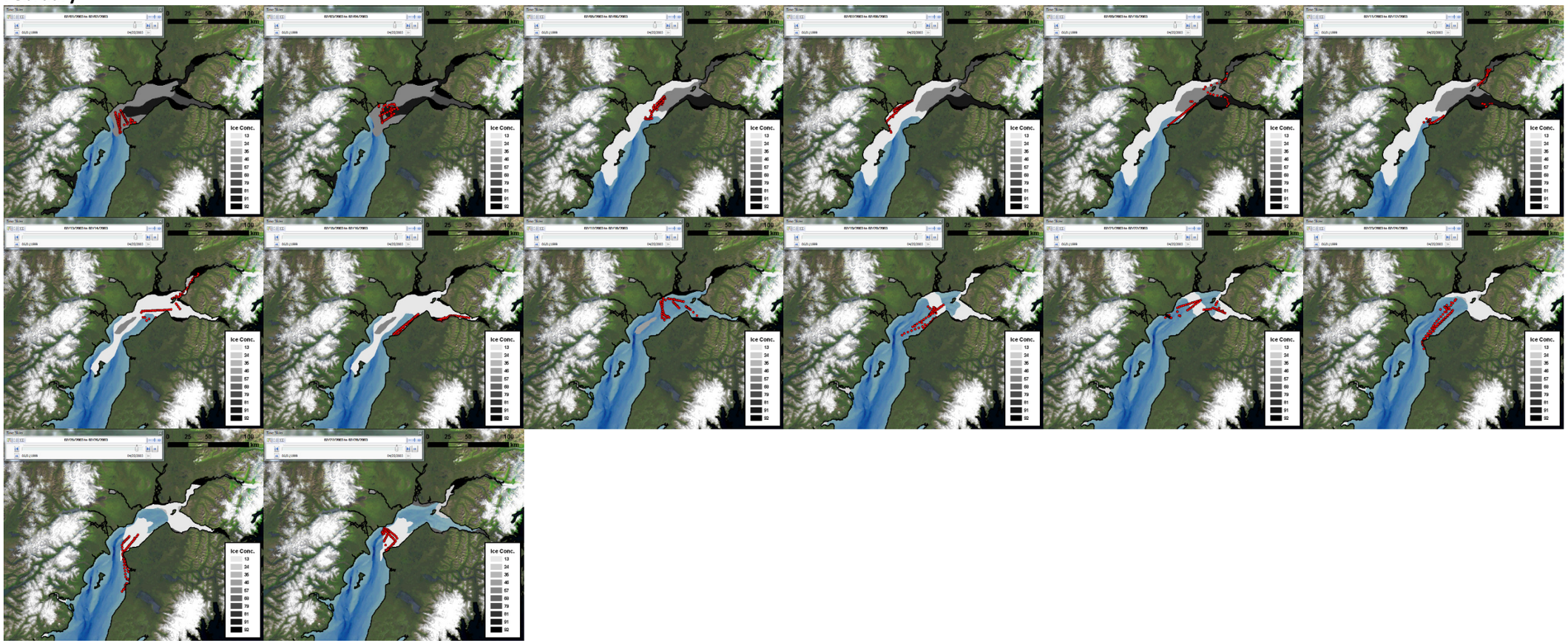


January

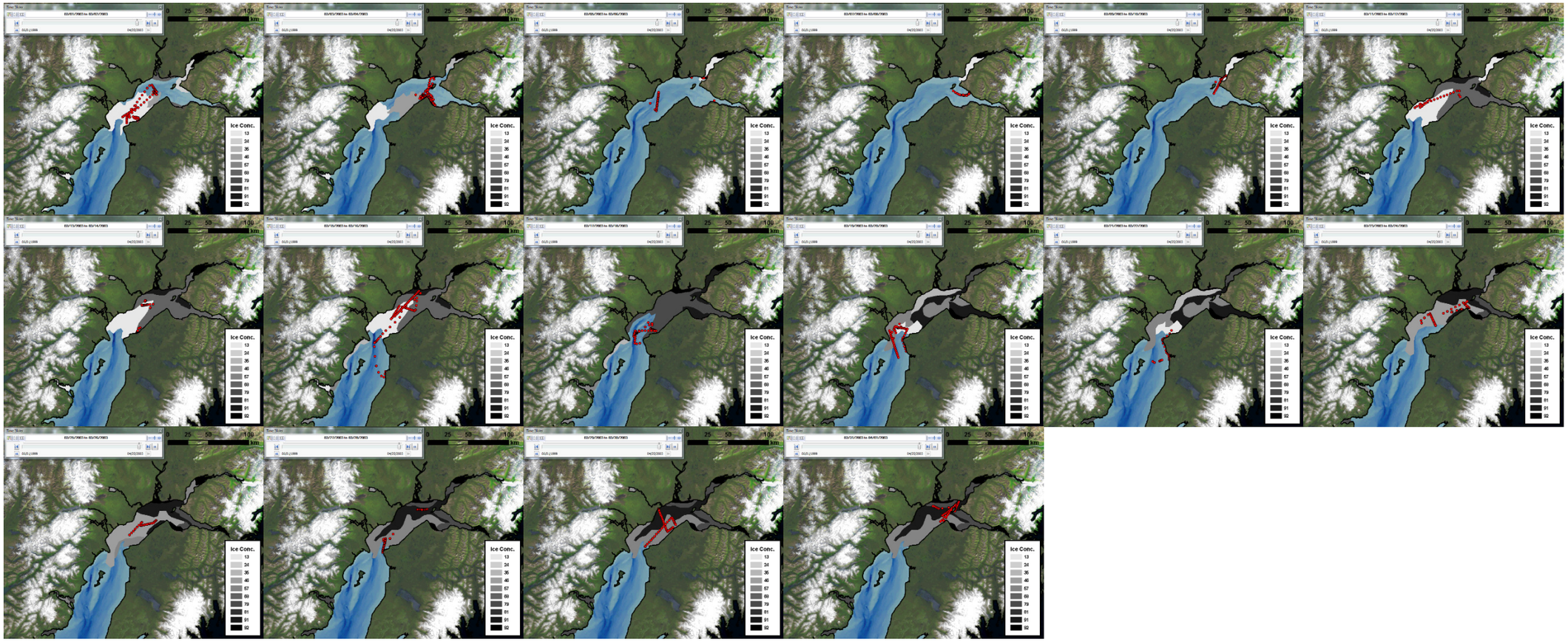



Ice Conc.
13
24
35
46
57
69
79
81
91
92
0 25 50 100
km

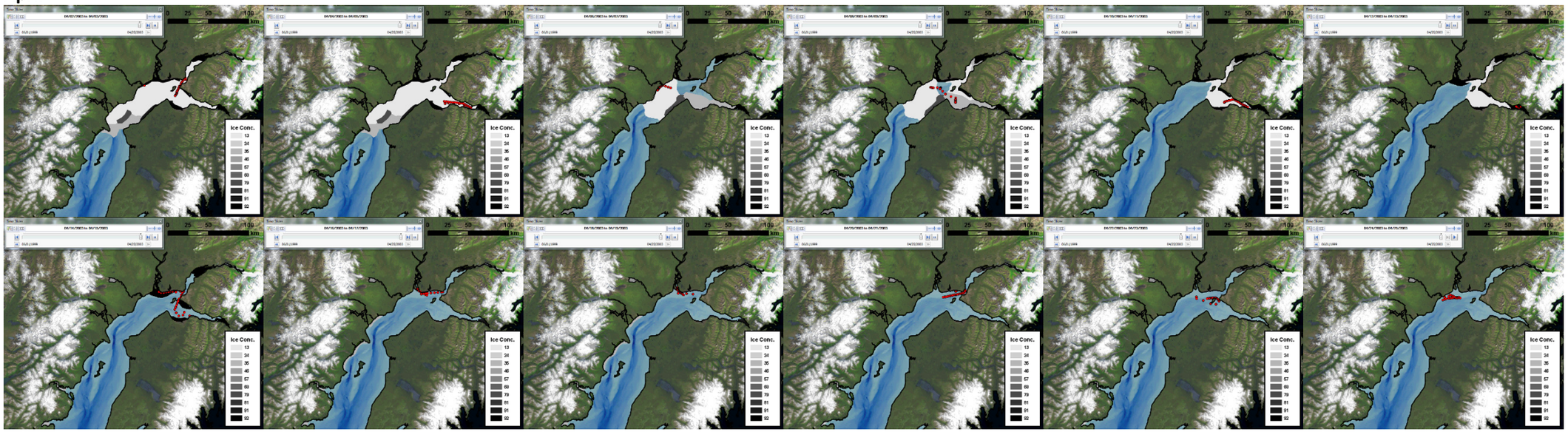
February


Ice Conc.
13
24
35
46
57
69
79
81
91
92
0 25 50 100
km

March



April



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AFSC-

368 FRITZ, L., K. CHUMBLEY, R. TOWELL, K. LUXA, and J. CUTLER. 2018. Short-term survival rates of branded Steller sea lion pups, 33 p. NTIS number pending.

367 STRASBURGER, W. W., J. H. MOSS, K. A. SIWICKE, E. M. YASUMIISHI, A. I. PINCHUK, and K H. FENSKE. 2018. Eastern Gulf of Alaska ecosystem assessment, July through August 2017, 105 p. NTIS No. PB2018-100602.

366 WHITTLE, J. A., C. M. KONDZELA, HV. T. NGUYEN, K. HAUCH, D. CUADRA, and J. R. GUYON. 2018. Genetic stock composition analysis of chum salmon from the prohibited species catch of the 2016 Bering Sea walleye pollock trawl fishery and Gulf of Alaska groundfish fisheries, 56 p. NTIS No. PB2018-100474.

365 GUTHRIE, C. M. III, HV. T. NGUYEN, A. E. THOMSON, K. HAUCH, and J. R. GUYON. 2018. Genetic stock composition analysis of the Chinook salmon (*Oncorhynchus tshawytscha*) bycatch from the 2016 Bering Sea walleye pollock (*Gadus chalcogrammus*) trawl fishery, 32 p. NTIS No. PB2018-100476.

364 SULLIVAN, J., and C. FAUNCE. 2018. Alternative sampling designs for the 2018 Annual Deployment Plan of the North Pacific Observer Program, 30 p. NTIS No. PB2018-100475.

363 STRASBURGER, W. W., J. H. MOSS, K. A. SIWICKE, and E. M. YASUMIISHI. 2018. Results from the eastern Gulf of Alaska ecosystem assessment, July through August 2016, 90 p. NTIS No. PB2018-100430.

362 ORR, A. J., J. D. HARRIS, K. A. HIRSCHBERGER, R. L. DELONG, G. S. SANDERS, and J. L. LAAKE 2017. Qualitative and quantitative assessment of use of offshore oil and gas platforms by the California sea lion (*Zalophus californianus*), 72 p. NTIS No. PB2018-100078.

361 MCCONNAUGHEY, R. A., K. E. BLACKHART, M. P. EAGELTON, and J. MARSH. 2017. Habitat assessment prioritization for Alaska stocks: Report of the Alaska Regional Habitat Assessment Prioritization Coordination Team, 102 p. NTIS No. PB2018-100160.

360 TURNER, K., C. N. ROOPER, E. A. LAMAN, S. C. ROONEY, D. W. COOPER, and M. ZIMMERMANN. 2017. Model-based essential fish habitat definitions for Aleutian Island groundfish species, 239 p. NTIS No. PB2017-102717.

359 RODGVELLER, C. J., P. W. MALECHA, and C. R. LUNSFORD. 2017. Long-term survival and observable healing of two deepwater rockfishes, *Sebastes*, after barotrauma and subsequent recompression in pressure tanks, 37 p. NTIS No. PB2017-102716.

358 FAUNCE, C., J. SULLIVAN, S. BARBEAUX, J. CAHALAN, J. GASPER, S. LOWE, and R. WEBSTER. 2017. Deployment performance review of the 2016 North Pacific Groundfish and Halibut Observer Program, 75 p. NTIS No. PB2017-102715.