Development of Beluga, *Delphinapterus leucas*, Capture and Satellite Tagging Protocol in Cook Inlet, Alaska

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Introduction

Belugas, *Delphinapterus leucas*, are widely distributed across Arctic and subarctic waters of the northern hemisphere (Gurevich, 1980), with five stocks recognized in coastal areas of Alaska (Frost and Lowry, 1990; O'Corry-Crowe et al., 1997). Among the Alaska stocks, only the belugas in Cook Inlet are endemic to the Gulf of Alaska; all others occur north of the Alaska Peninsula (Frost and Lowry, 1990). The Cook Inlet stock is the least abundant, with a population estimate as low as 347 animals in 1998, down from 653 in 1994 (Hobbs et al., 2000a).

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ABSTRACT—Attempts to capture and place satellite tags on belugas, Delphinapterus leucas, *in Cook Inlet, Alaska were conducted during late spring and summer of 1995, 1997, and 1999. In 1995, capture attempts using a hoop net proved impractical in Cook Inlet. In 1997, capture efforts focused on driving belugas into nets. Although this method had been successful in the Canadian High Arctic, it failed in Cook Inlet due to the ability of the whales to detect and avoid nets in shallow and very turbid water. In 1999, belugas were successfully captured using a gillnet encirclement technique. A satellite tag was attached to a juvenile male, which subsequently provided the first documentation of this species' movements within Cook Inlet during the summer months (31 May–17 September).*

Belugas in Cook Inlet are considered an important resource for Native Alaskans, and they are harvested by members of local tribes and emigrants from Native communities in western Alaska (Huntington, 2000; Shelden and Mahoney, 2000). However, the combination of low abundance and recent trends in exploitation has raised concerns for the viability of belugas in Cook Inlet. Consequently, determination of population status and trends in abundance has become a high priority mission for NOAA's National Marine Fisheries Service (Hill and DeMaster, 1998).

Monitoring the status of the Cook Inlet belugas requires an estimation of the number of animals in the population. Estimation of population number requires: 1) the conduct of annual aerial surveys (Rugh et al., 2000) and 2) calculation of correction factors to account for animals below the surface at the time of survey (Hobbs et al., 2000b). Calculation of correction factors requires a means of determining the dive profile of belugas during typical survey conditions.

Since 1994, the NMFS has fielded four tagging efforts to deploy instrumentation on belugas to collect dive profile data. These projects involved either pursuit and subsequent application of short-duration telemetry transmitters (Lerczak et al., 2000) or attempts to capture and attach long-term satellite-linked time/depth recorders, the subject of this paper.

Beluga capture and tagging has been successfully accomplished many times in the Canadian High Arctic (Martin and Smith, 1992), and recently along the northwestern coast of Alaska (Suydam et al., 2000). This paper chronicles three field seasons of beluga capture in Cook Inlet since 1995, with emphasis on the 1997 and 1999 seasons. In particular, the development of the capture strategy and the constraints imposed by the challenging environmental conditions in upper Cook Inlet are described.

Methods and Materials

Study Area and Conditions

The study area at the mouth of the Susitna River is about 35 km west of Anchorage (Fig. 1). Extreme tides, high winds, and extensive shallows characterize this area of upper Cook Inlet (Moore et al., 2000) and often compromise beluga capture attempts. For example, tidal range at Anchorage is roughly 9.5 m (30 ft). Thus, at low tide, the exposed flats at the mouth of the Susitna River extend as much as 6 km, while at high tide, those flats and much of the coastal lowlands may be under water. Typically, the incoming tide will rise at a brisk rate of about 2 m/h.

Strong winds, particularly easterlies out of Turnagain Arm, often occur in the afternoon as cooling air descends the Chugach Mountain slopes and surges across the inlet. Such turbulence often degrades survey conditions, making beluga sightings or tracking impossible, even at close range. Often, the combination of winds driven over shallows and the rapid pace of the tidal exchange create confused seas that are marginal or unsuitable for small boats. Under these conditions, transit to or from Anchorage is extremely hazardous and capture work is impossible.

Thus, typical of many large river deltas in such an extreme environment, the water in the study area is both dan-

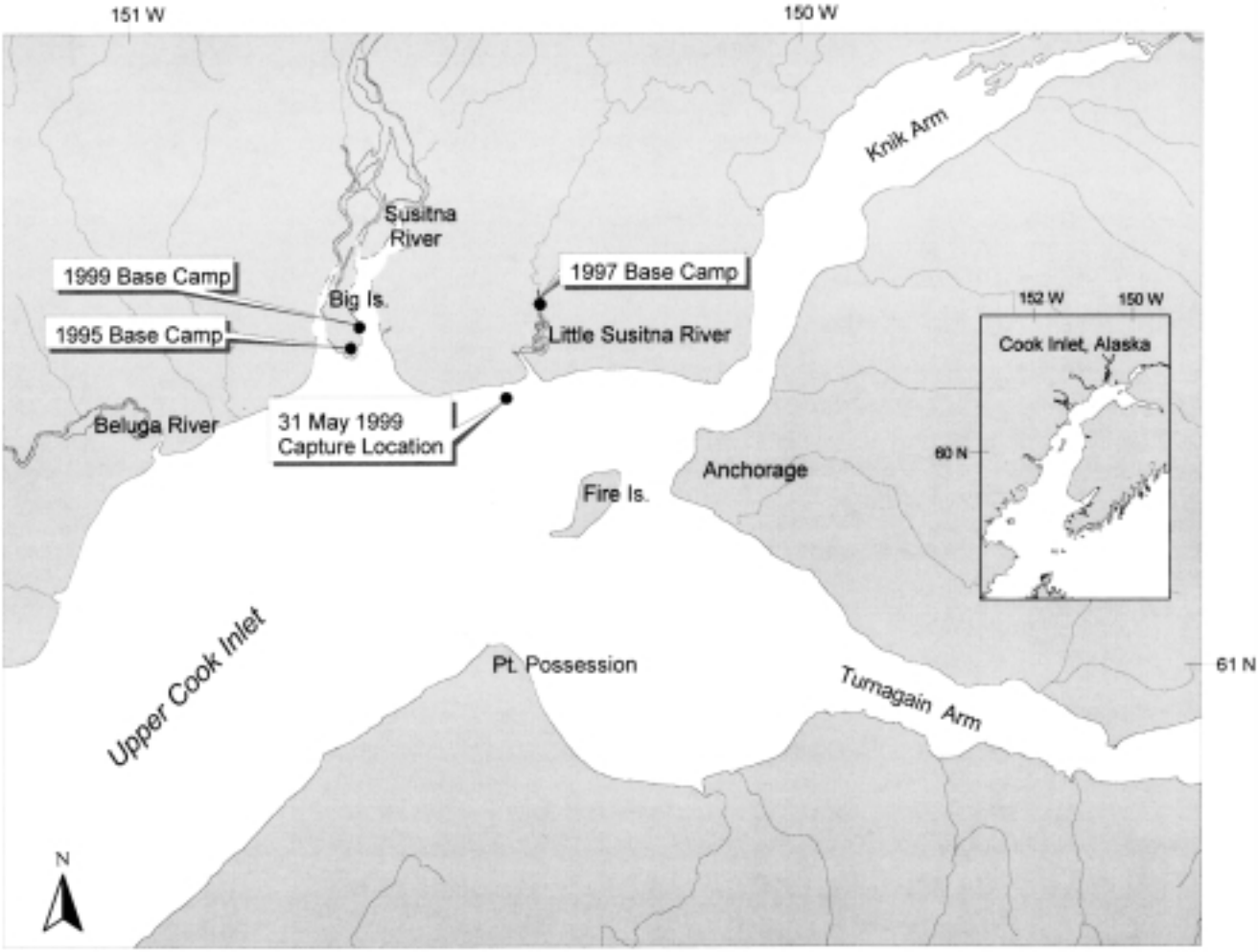

Figure 1.—Upper Cook Inlet, showing locations of base camps in 1995, 1997, and 1999 and location of beluga capture in 1999.

gerous and highly turbid, often with visibility < 20 cm (Moore et al., 2000). Such conditions limit direct observation of belugas to 3-sec intervals when they surface (Hobbs et al., 2000b), which makes visual tracking difficult. Rugh et al. (2000) describe problems that turbidity presents for interpretation of aerial survey counts; similar difficulties plague location and monitoring of belugas while on the water. In addition, belugas in Cook Inlet are not easily approached, possibly a result of many years of human pursuit for harvest. When disturbed, the belugas often move toward deep water and resist herding to shallower, more suitable capture locations. If belugas can be herded to shallow water (i.e. <2 m), a "bow" wave is generated by their movement through the water which provides a reference to their location underwater.

In summary, these factors dictate a narrow set of field conditions within which beluga capture techniques have been developed in Cook Inlet. Specifically, whales must be found and herded to shallow water when winds are light and seas are relatively calm (7–10 kn; Beaufort sea state ≤3) and the tide is near its high level (± 2 h). Of note, belugas are more likely to swim into shallow areas on extreme high tides (i.e. above +8 m). Means to maximize field time under these conditions have developed over the years, as have the capture techniques.

Boats and Tags

A variety of small boats were used as platforms for tagging over the years. Generally, such craft consisted of one or more inflatables, ranging in size from 3.5 to 6 m, and open aluminum or wooden skiffs up to 8 m. For net deployment, Boston Whalers (6–7 m) were outfitted with net bins aft of the center console and stanchions across the stern to allow the net to travel over the outboard motor. From four to six boats were used at any given time during the capture and search efforts. The four boats used during the successful capture in 1999 included a 6.5 m aluminum Boston Whaler carrying the capture net, a 5.5 m Avon inflatable, a 5 m Zodiak inflatable, and a 7 m aluminum Munson.

Capture nets used in 1997 and 1999 were constructed of 0.3 m braided square mesh gillnet, sewn in panels 125 m long × 4 m deep. The float line was

made of 3.5 cm diameter polypropylene; 2 cm lead-core line ran the full length of the foot. The VHF radio tags are described in Lerczak et al. (2000). Model SDR-T-16 satellite-linked tags (SLT) were purchased from Wildlife Computers, based in Redmond, Wash., with programmable transmission periods to maximize battery life. Details of SLT performance and specifications are available on Wildlife Computers web page [www.wildlifecomputers.com].

Results

Field Studies in 1995

Building on lessons learned during the 1994 field season, when VHF transmitters were first attached to Cook Inlet belugas (Lerczak et al., 2000), attempts were made from 18 to 31 July 1995 to capture and equip belugas with satellite-linked time/depth recorders (SLTDR's). The SLTDR's are capable of recording location and dive data for 3 mo or more. The tag packages also contained a built-in VHF transmitter, identical to those on the suction-cup tags used in 1994 (Lerczak et al., 2000) to allow real-time local monitoring of whale movements.

The wide deltas at the mouths of the Susitna and Little Susitna Rivers were chosen as the study area based on consistent presence of belugas in that area during late spring and early summer (Rugh et al., 2000). The field camp was based on the east side of Big Island near the mouth of the Susitna River. The field crew included two Native Alaska beluga hunters to help locate and track the whales, a beluga researcher who had tagged whales in the Canadian Arctic, and NMFS personnel. The proposed capture method, developed during the Canadian studies (Smith and Martin, 1994; Smith[1]), involved one person outfitted in a dry suit jumping from a small boat (6 m/75 hp) next to a surfacing beluga and sliding a hoop net (2 m diameter, 8 cm web sewn to form a 2.5 m cod end) over the animal's head. A second person would then jump in to fasten a 2.5 cm soft nylon line around the caudal peduncle to further restrain the animal.

Conditions in upper Cook Inlet were completely different from those encountered in northern Canada. The Canadian study area was characterized by clear waters (with little or no tidal influence) adjacent to beaches offering ready access to belugas. Monitoring the location of animals during pursuit, and determination of water depths sufficiently shallow for the "jumper" to stand on the bottom were greatly facilitated by clear water (Smith and Martin, 1994). Turbid waters in the Susitna delta impeded adequate tracking of whales to get in position for a jump. Likewise, because the water depth could not be judged with certainty, neither the safety nor the effectiveness of a jump could be assured, even if a beluga were in the proper position for capture.

Only two jumps were made, neither of which were successful in placing the hoop net. Thus, after >30 h of effort, the combination of water turbidity and evasive whale behaviors thwarted all attempts to use the jump-capture method, and the technique was abandoned. After terminating these capture attempts, the field team resumed working on a day-trip basis out of Anchorage to place suction-cup tags on whales (Lerczak et al., 2000).

Field Studies in 1997

In 1997, the beluga tagging effort focused entirely on attempts to capture one or more whales for SLTDR attachment. To increase opportunities to locate and work with whales, the field plan included a longer season, larger crew (including two Native Alaska beluga hunters), and a more fully equipped field camp. A new capture method was devised based on the recommendations of the Canadian beluga researcher present during the 1995 study (Smith[1]).

The new capture method involved driving target animals into a large-mesh gillnet (Fig. 2), and required four boats. The net was designed for deployment from a bin at the stern of the capture boat (a 6.5 m Boston whaler), over a 1.5 m high stanchion made of 6 cm aluminum pipe clamped to the stern. This arrangement allowed the net to be stored fully inside the boat, keeping its center of gravity low, while providing a means for the net to pay out smoothly astern, over the top of the outboard motor.

Unlike fishing, where a gillnet is set in a suitable location and allowed to passively intercept the target species, the beluga capture net needed to be actively set in real-time and immediately in front of the target animal. This approach required close coordination among at least four boats: 1) a lead boat to single out and track the target animal, 2) a capture boat equipped to deploy the net, and 3) two or more chase boats to drive the target animal towards the net.

As planned, the lead boat was to keep pace with the target animal, herding it in a predictable direction across the submerged flats shallow enough for the net to hit bottom. The capture boat, meanwhile, was positioned for deployment slightly astern and to port of the leader. On a signal from the lead boat, the capture boat accelerated rapidly, and a drag buoy attached to one end of the gillnet was tossed over, laying the net across the animal's path. The lead and chase boats then moved in behind the animal, attempting to drive it into the net. The final step of the capture plan, assuming a successful entanglement, entailed one or more boats moving alongside the animal to stabilize it at the surface. Tag attachment would then proceed in nearby shallower and calmer water.

The project was designed to take advantage of every high tide when weather conditions were suitable for capture work (i.e. high tide ± 2 hours and Beaufort sea state < 3). Because extreme high tides were expected to flood most of the land around the Susitna River mouth during the field period, a new site 7.5 km up the Little Susitna River was chosen for the project base.

Despite nearly 3 wk of effort, no belugas could be driven into the capture net long enough to become entangled. On 14 occasions, the net was set ahead of individual belugas, and each time the animals simply reversed direction, evaded the small boats then stayed well away from the immediate capture-attempt area. Because of the field camp's location, a great deal of crew time and energy was spent monitoring and rescu-

[1] Smith, T. G., Eco Marine Corporation, Ladysmith, B.C., Can. Personal commun.

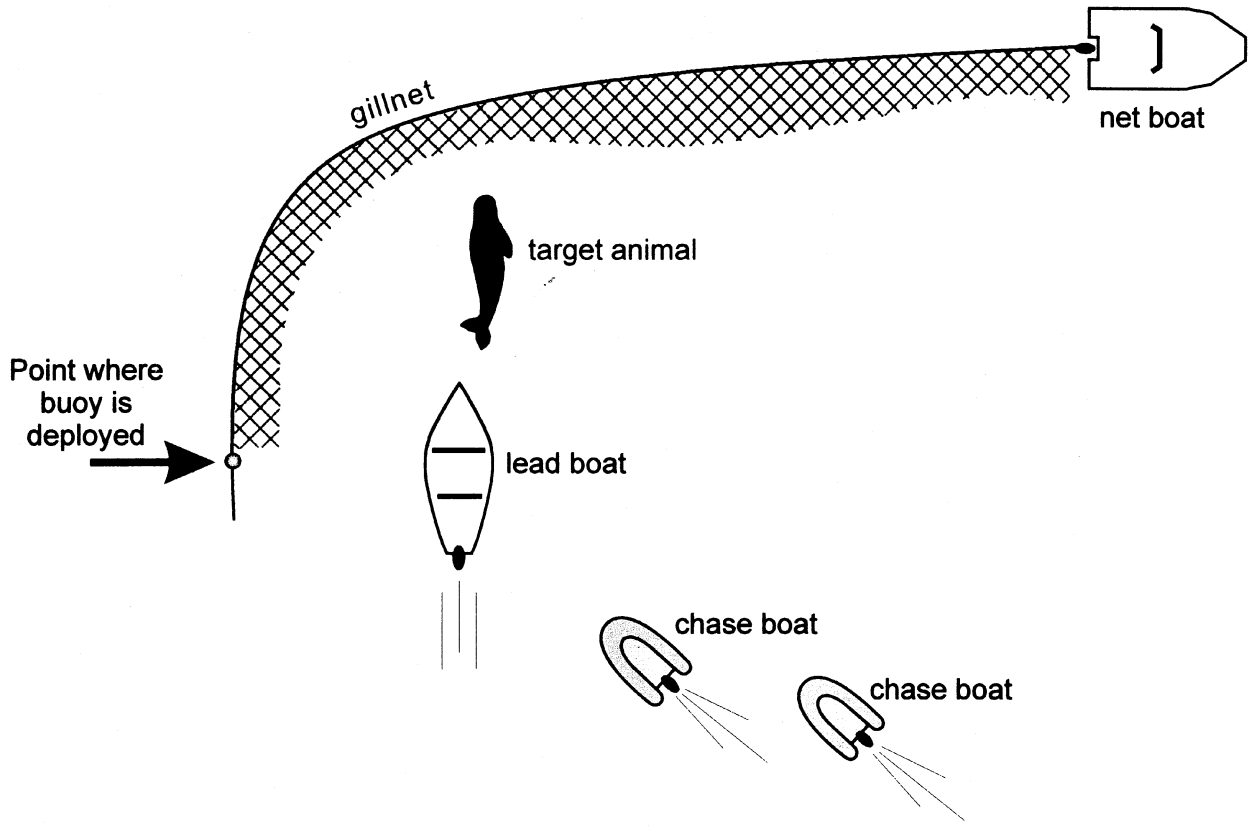

Figure 2.—Schematic drawing of a beluga capture using a "drive approach," as attempted in June 1997.

ing boats and equipment. Finally, wind conditions in upper Cook Inlet and mechanical breakdowns further impacted capture efforts. Over 21 days of field work, winds or logistical problems hampered efforts during one or both tidal windows every day.

In addition to logistical problems, the belugas seemed to change their behavior and distribution during the course of the 1997 field season. After the first week (3–10 June), they became more dispersed, and when located they were more wary of approaching vessels. Two factors may have influenced their behavior: 1) the timing of the Pacific salmon, *Oncorhynchus* spp., and forage fish spawning runs and 2) increased frequency of Native subsistence hunting in the area. Spawning runs peaked in late May, roughly a week before our arrival. At the beginning of the field season, belugas were seen in the rivers or very close to the river mouths, presumably feeding on the fish runs. As the runs diminished, the belugas appeared to be less aggregated at the river mouths. Concurrently, however, the intensity of subsistence hunting activity increased, particularly in the mouth of the Susitna River. During this time, most animals became very difficult to approach, fleeing almost immediately to deep water (see Appendix).

Although no belugas were captured in 1997, three key observations were made which ultimately provided a foundation for success in 1999. First, more whales could be encountered close to the mouths of the Susitna and Little Susitna Rivers in shallow water if the field work occurred earlier, during the peaks of the chinook salmon, *O. tshawytscha*, and eulachon, *Thaleichthys pacificus*, runs. Second, entanglement in large-mesh gillnets could work, but only if the target animal was fully encircled and had no opportunity to double back to open water. Third, to accomplish full encirclement, we found that a longer net was needed with capability for deployment at high speeds (≥ 25kn).

Field Studies in 1999

Beluga capture and satellite tagging in upper Cook Inlet was conducted from 24 May through 3 June, with the aforementioned lessons from 1997 incorporated into a revised capture strategy. Thus, the field season began earlier, the capture gear and methods were modified, and the field camp was relocated to the 1995 site.

When winds did not preclude boat use, a crew of seven biologists and two Native hunters searched for belugas during each high tide during daylight hours. The shallow channels of the Susitna River adjacent to the field camp were generally navigable from about 2 h before to 2 h after high slack tide, which defined the typical "capture effort" window.

Once whales were located, usually between the Susitna River delta and the mouth of the Little Susitna River, the

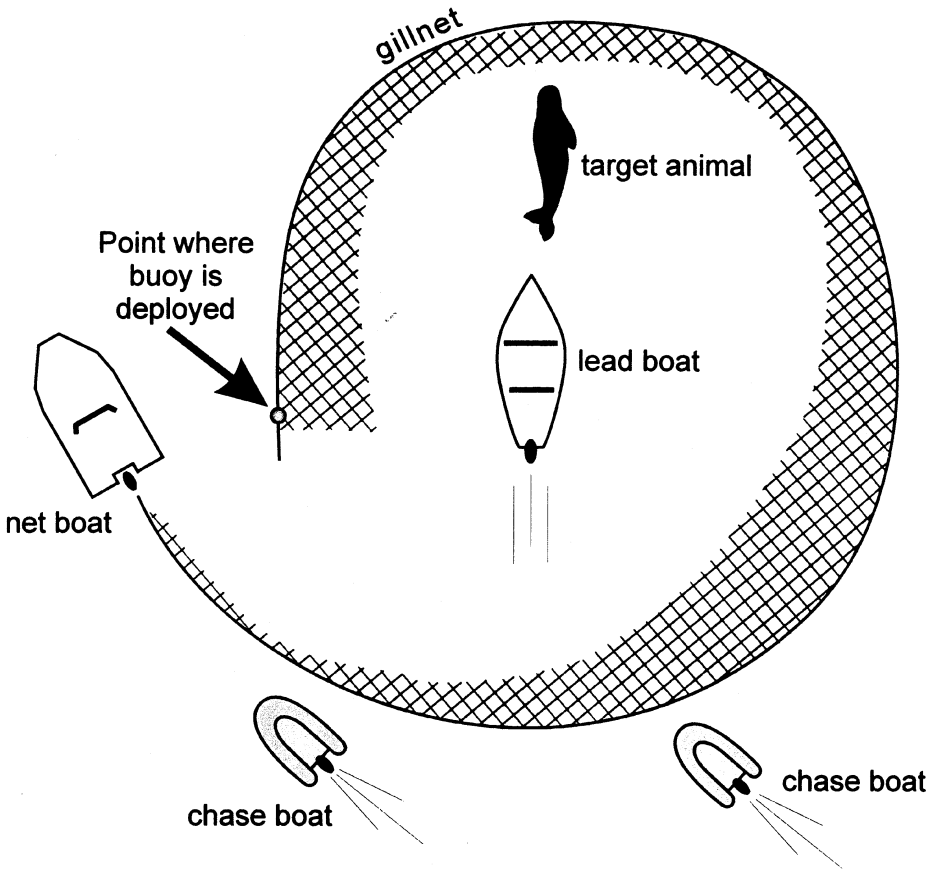

Figure 3.—Schematic drawing of a beluga capture using the "encirclement approach," as successfully accomplished in June 1999.

hunters isolated an individual animal and drove it into water about 2 m deep. When a target animal was moving consistently ahead of the hunter's boat, the catch boat was brought into position on the port stern of the hunters' boat. The drag buoy (a 0.5 m diameter mooring float), attached to about 175 m of net (same depth and mesh size as in 1997) was then deployed. Immediately, the catch boat accelerated to about 25 kn, overtook the target animal and executed a tight clockwise turn back to the point of initial deployment (Fig. 3) to set the net completely around both the beluga and the boat.

This approach eliminated the need to subsequently drive the beluga into the net, as its escape by doubling back was fully blocked by net. As the animal attempted escape, it would eventually contact the gillnet, pushing the mesh and floatline into a "V" shaped channel that progressively closed in around it. Once entangled, the animal was tended to by personnel in the nearby boats. Ultimately, the hoop net was slipped over the animal's head, and a tail loop was placed around it's caudal peduncle. Tag attachment began after moving to waist-deep water where the crew members could work alongside the animal.

Unlike the 1997 effort, camp placement and more favorable weather conditions allowed the crew to maximize the number of possible capture attempts and to avoid the dangers associated with operating in the upper reaches of the Little Susitna River channel. Of 18 possible high tides occurring in daylight, 12 were worked and 6 were not worked due to winds or logistical considerations. Twelve encounters with groups of 50–100 whales occurred during the 12 high-tide cycles. Each of these encounters was followed by capture attempts on individuals in a portion of the total group (see Appendix).

The highlight of the 1999 field season was the successful deployment of a SLTDR on a young male beluga. On the morning of 31 May, weather conditions were favorable and a group of about 100 belugas were located 2 km up the Little Susitna River. A variation of the net deployment system was devised in an attempt to capitalize on the location of so many whales in the relatively narrow river channel. One end of the net was anchored to the beach on the inside of the last bend of the river and deployed upstream along a shallow bar, thus forming a beach seine into which animals might be driven. At least 5 whales approached the seine, with the young female actually entering it and becoming entangled. Too small to tag (at 230 cm), she was quickly measured and released within 10 min of capture.

Soon after, the same group of whales was rediscovered well into the shallows, west of the Little Susitna River, a perfect location for capture. After one unsuccessful try, the crew targeted several whales in the shallows. This time, a full encirclement was achieved, capturing two animals, although one eventually broke free. Once the remaining whale (a grayish-white, 370 cm, male) was stabilized with tail loop and hoop net in place, it continued efforts to swim until the tide dropped enough for it to rest on the bottom. Other than calling during the capture, tagging, and subsequent stranding, the whale showed little response to the tag attachment (Fig. 4). After receiving a continuous water bath over the low tide cycle (about 6 h), the animal responded to the first touch of incoming water, oriented itself toward deep water and began moving, even before fully refloating (Fig. 5), and 10 min later, the whale rejoined a group milling nearby (see Appendix for further details of SLTDR attachment).

Figure 4.—Members of the tagging team attaching a SLTDR package to a juvenile male beluga in upper Cook Inlet on 31 May 1999.

Movement Patterns

Preliminary results from SLTDR data for this animal suggest that belugas remain in the upper inlet over much of the summer (Fig. 6). The SLTDR transmitted for a total of 110 days, providing locations and dive pattern data from 31 May to 17 September, during which time the whale never traveled more than 60 n.mi. from the original point of capture.

Five distinct movement patterns were observed. From 31 May to 13 June, the whale was located near the mouth of the Little Susitna River, consistent with the pattern we observed during the capture (Fig. 6a). From 14 June to 11 July, the whale's movements were more broadly distributed in an area bounded on the west by the Beluga River, Point Possession to the south, and Fire Island to the east (Fig. 6b). Beginning on 12 July, the beluga moved back into the area of the Little Susitna River, perhaps coincident with the progression of the Little Susitna drainage coho salmon run (Fig. 6c). After 18 August, nearly all locations recorded through 12 September were in Knik Arm, particularly in the area adjacent to the mouth of the Eagle River (Fig. 6d).

Occasional trips back to the Little Susitna River area were also observed. On 13 September, the animal left Knik Arm and entered Turnagain Arm where it remained for 5 days after which the signal was lost (Fig. 6e). Dives were predominantly short (1–2 min) and shallow (<2 m) with the exception of an occasional deeper dive (about 55 m) in lower Knik Arm, west of Anchorage.

Discussion

As might be expected with any new field study, the development of successful capture and tagging techniques ultimately involved a good deal of trial and error. In upper Cook Inlet, three seasons of learning were required before a SLTDR was successfully attached in 1999. Collectively, these experiences provide a foundation for refinements to the capture technique, particularly with regard to net construction and deployment. In particular, we hope to improve the stanchion system, modifying it to allow a smoother path for the net over the aft starboard corner of the boat.

A total of 110 days of data were received from the SLTDR before the signal was lost in early September. During that time, the tagged whale never left the upper inlet, a result consistent with recent reports on summer distribution of Cook Inlet belugas (Rugh et al., 2000). While these data report the movements of only a single animal, it is noteworthy that this whale seemingly spent the entire summer in the upper

inlet. In the future, project goals will include deployment of SLTDR's on multiple animals to cover a broad range of ages and sexes. Distribution and movement data from all seasons are also desirable. Given the limited satellite tag life expectancy (up to about 4 mo), information from the fall and winter are unlikely to result from tagging in May or June. Consequently, an expansion of the tagging project to include capture efforts in late summer or fall may also be considered.

Finally, surfacing interval data collected in real-time from the VHF transmitter will be compared with the data collected by the SLTDR package in an effort to refine estimates of surface time and thereby improve estimation of whales missed during aerial surveys. Data from a number of tagged whales is required to improve our understanding of beluga dive profiles and thereby inform our estimates of whales missed due to submergence. Hopefully, additional years of tagging effort will provide those data.

Figure 5.—Beluga with the SLTDR package attached to its dorsal hump swimming away on 31 May 1999.

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Appendix: Chronicle of Attempts to Capture Belugas in Cook Inlet, Alaska, During 1997 and 1999

1997 Field Season

11 JUNE: A group of roughly 50 belugas were loosely aggregated over a 1–2 mi^2 area of the Susitna River delta. Individual belugas were isolated and coaxed

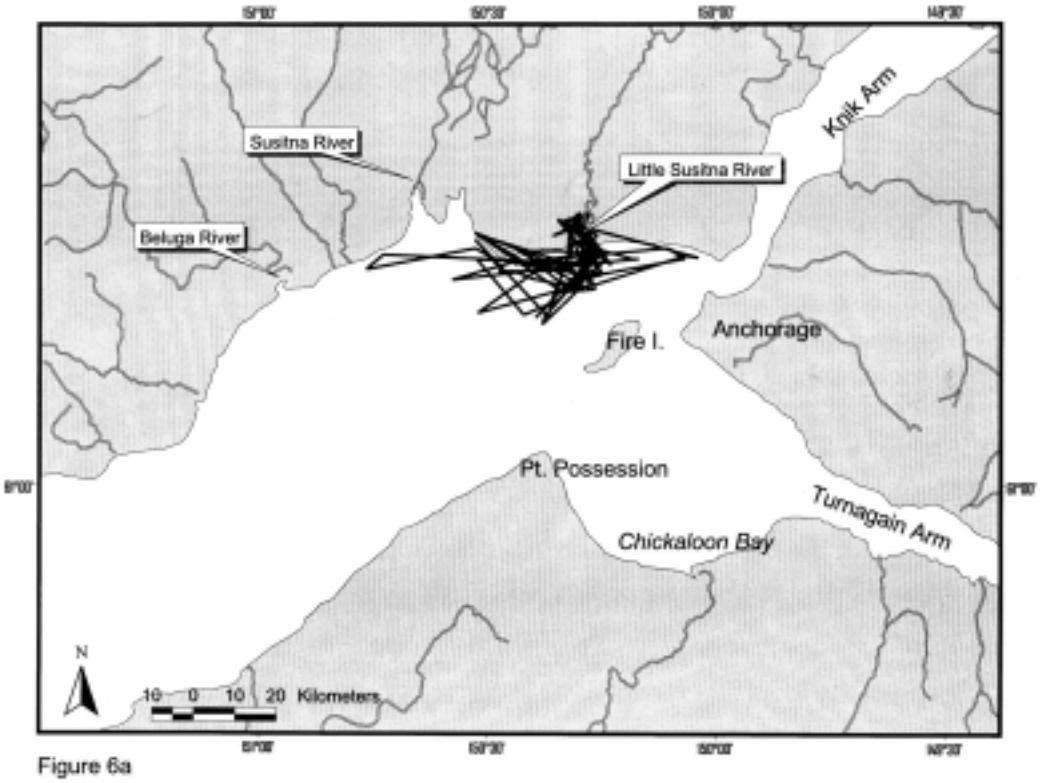

Figure 6.—Preliminary results depicting locations of the tagged beluga, 31 May to 17 Sept. 1999 (straight lines link SLTDR derived positions and do not indicate actual movement patterns). Successive whale positions are summarized for five periods: a) 31 May through 13 June; b) 14 June through 11 July; c) 12 July through 15 Aug.; d) 18 Aug. through 12 Sept.; and e)13–17 Sept.

four times into capture positions in shallow water. Capture attempts were limited to two tries per animal, and thus two separate whales were targeted. On each try, 50 m of net was set ahead of the animal. Three times the animals doubled back from the net and swam around the small boats attempting to drive it into the net; the whales avoided the area of the net despite efforts to move them back toward it. However, on the first set, the animal did hit the net and was briefly entangled. After about 10 sec, it broke free and doubled back under the chase boats. The animals appeared quite capable of detecting the net and moving rapidly into channels offering deeper water.

12 JUNE: A group of about 50 belugas were found near the mouth of the Susitna River. Four capture attempts were made using 100 m of net which allowed formation of a semicircular barrier. Two animals were targeted two times each for a total of four sets. Once again, one animal hit the net, but appeared to graze it rather than becoming entangled. The other three avoided the net by circling around the ends of the net. On all four occasions, the whales moved into deeper water and evaded further efforts to move them into suitable capture position.

13 JUNE: A group of about 100 animals were briefly seen from a distance of about 4 km in Knik Arm, but attempts to approach them were unsuccessful. No animals were targeted, nor were any sets made.

17 JUNE: A scattered group of about 35 whales were located on the west side of the mouth of the Susitna River. One animal was isolated, moved to shallow water, and a set was made with 100 m of net, the middle 35 m of which had been modified to a mesh size of about 0.6 m in hopes of increasing the probability of entanglement with minimal contact. As in earlier attempts, however, the whale turned before hitting the net, reversed direction and swam around the net end. Subsequent attempts to move the animal into capture position were unsuccessful. A second animal was located and two attempts at capture failed. The capture position was adjacent to a deepwater channel which provided an escape route after initial avoidance of the net.

18 JUNE: Small, scattered groups of belugas (4 groups of 5–10 animals each) were seen well outside the Susitna River mouth. None of the animals could be herded to shallow water so no sets were made.

19 JUNE: Rough seas and poor visibility near river mouths curtailed capture efforts in the river deltas; however, a group of about 20 belugas were located 3.0 km up the Little Susitna River and two capture attempts were made.

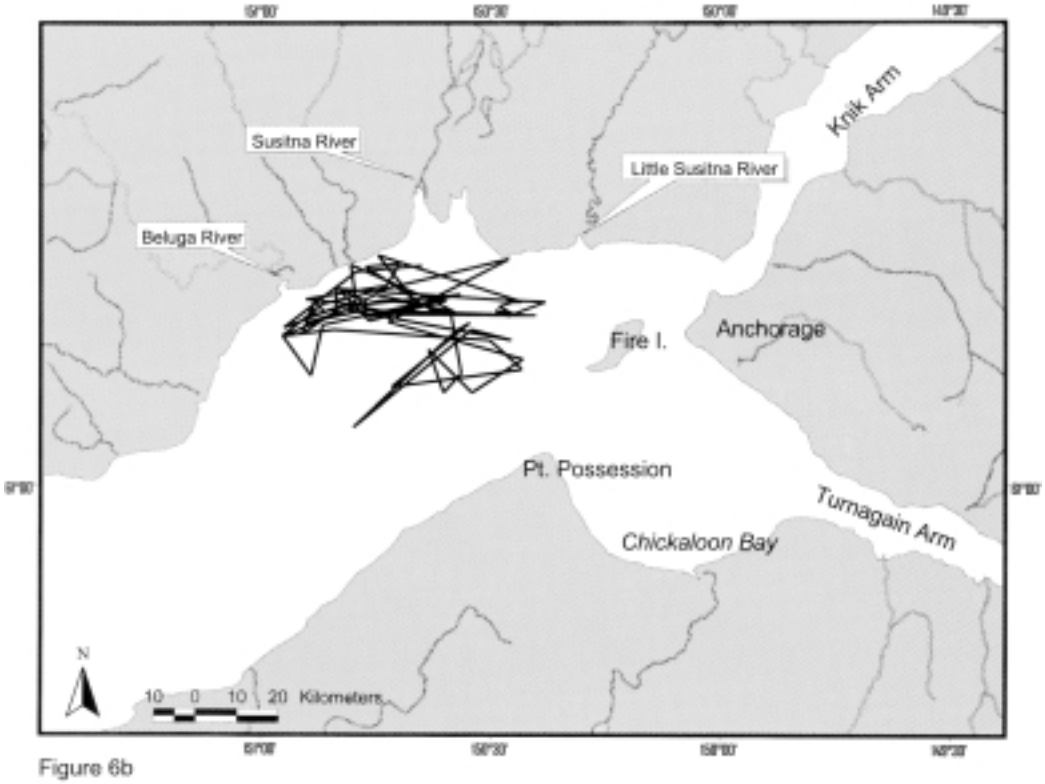

Figure 6b

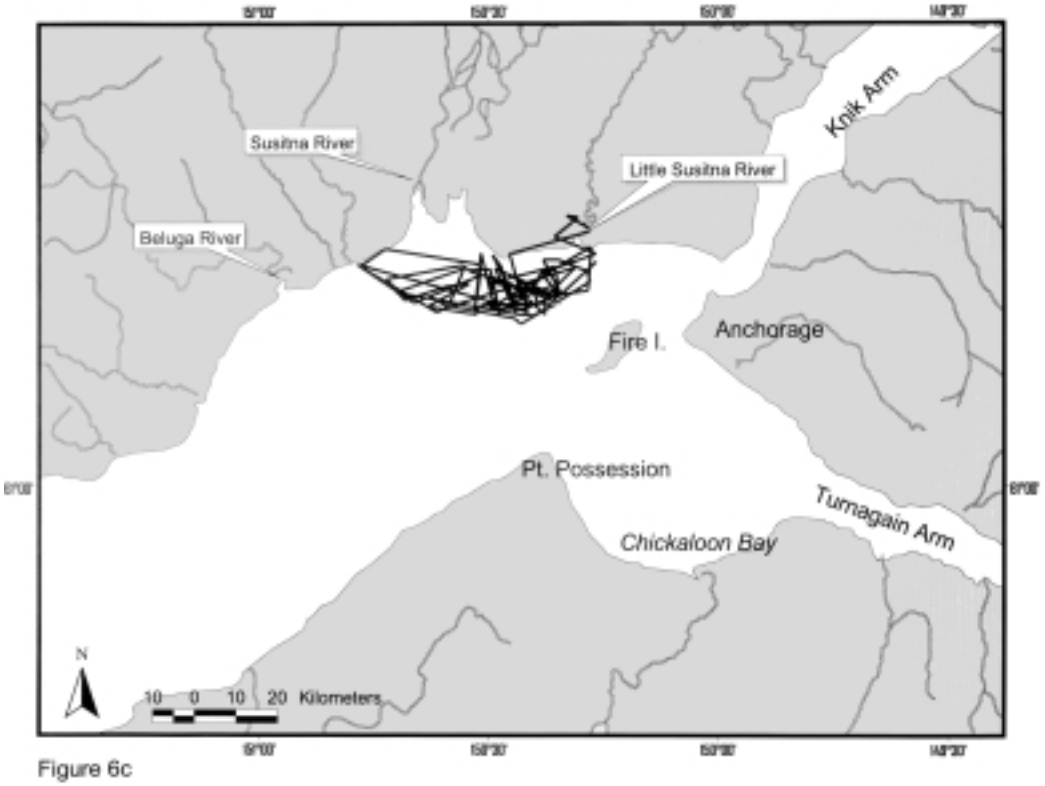

Figure 6c

Figure 6.—*Continued*.

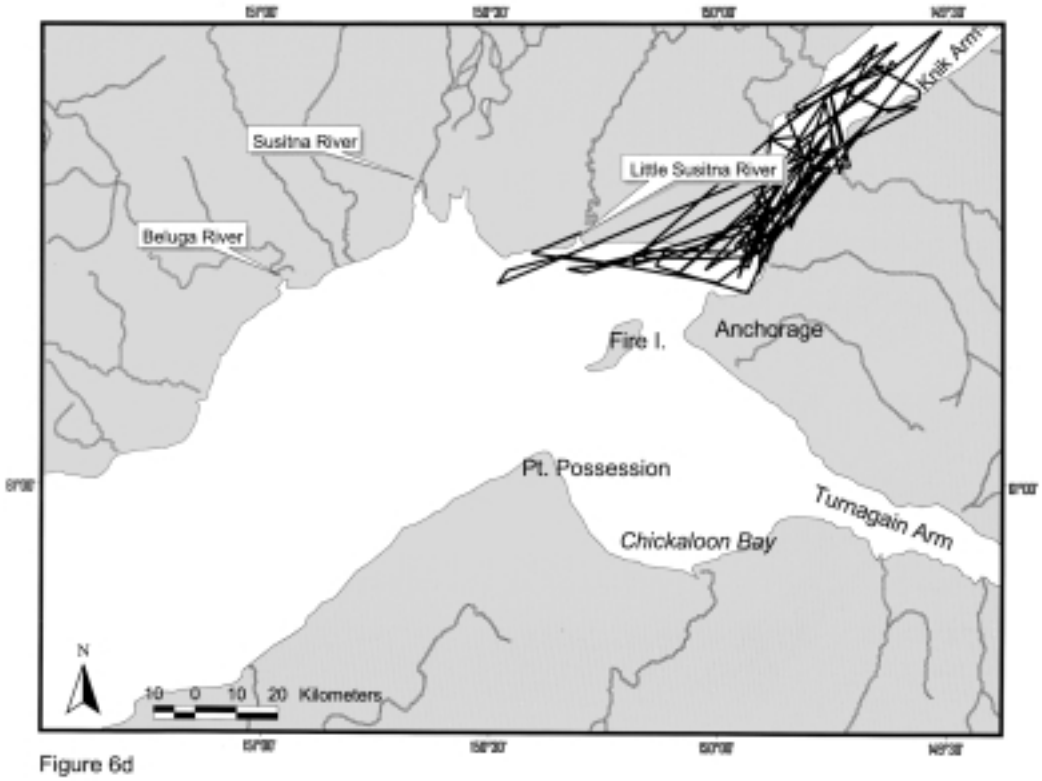

Figure 6d

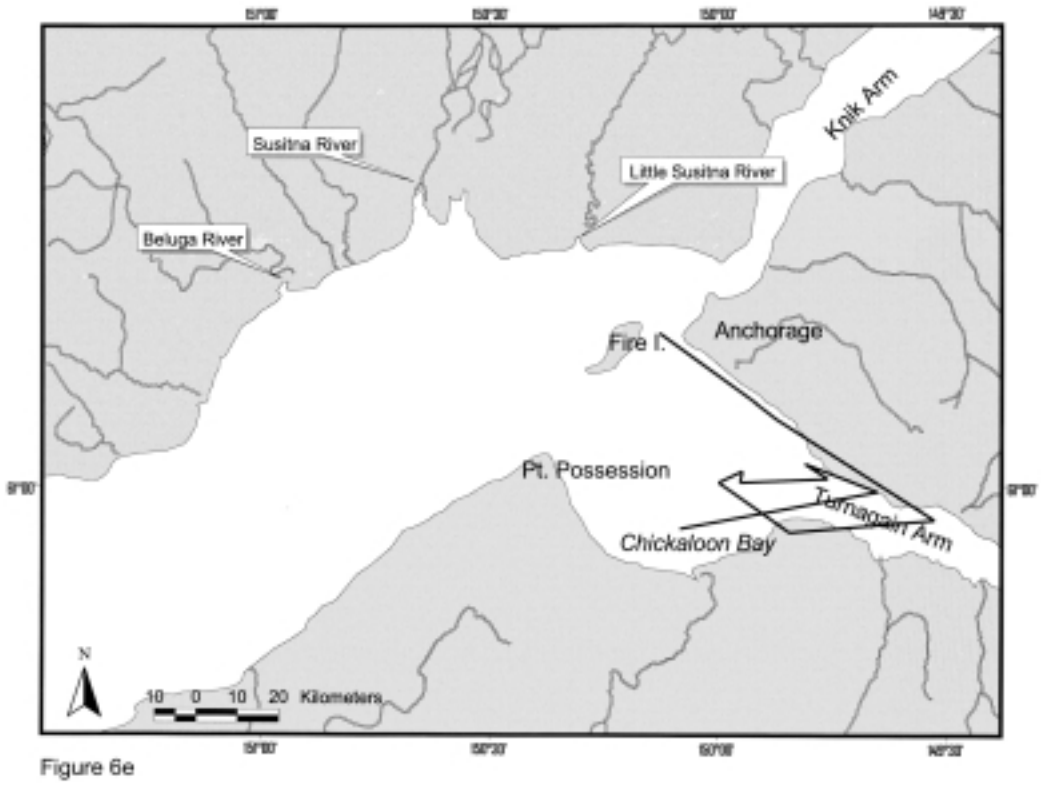

Figure 6e

Figure 6.—*Continued*.

The channel depth was over 8 m, well beyond the reach of our nets, so we set the nets rapidly in front of the animals in hopes of entangling them before they changed direction. But each time a targeted animal approached the net, it dove, subsequently resurfacing downstream. The belugas were clearly able to respond rapidly, avoid the net, and dive beneath it.

20 JUNE: The capture team worked both of the high-tide periods across the entire length of the study area. Belugas were sighted in deep water each time, but well away from the river deltas. Those individuals were in widely scattered small groups, and essentially unapproachable, diving before we could close within 1.0 km. No sets were attempted.

21 JUNE: On the morning tide, a small group of belugas was located in the mouth of the Susitna River. One individual was moved into the shallows in a suitable capture location, and a set was made. The animal struck the net twice, each time very briefly, perhaps with its flukes as it turned away from the net. Attempts to move the animal back toward the net were unsuccessful, and it eventually reached a deepwater channel and swam away from the river.

22 JUNE: A group of 6 belugas were sighted in the Susitna River delta and approached. All six animals were gray, indicating that they were young and not suitable as capture targets. No sets were made, and no other belugas were found in the area.

1999 Field Season

25 MAY: Weather during the morning high tide was too windy to attempt small boat travel. By the afternoon, the winds had subsided and the crew departed camp at about 1430 h. A group of about 100 belugas were found 2 km up the Little Susitna River. Moving slowly downstream, the boats were used to drive the animals out of the river to the adjacent shallows where attempts were made to isolate an individual in shallow water. After nearly an hour of unsuccessful attempts to position an animal, the decision was made to begin the trip back to camp, although the tide had already dropped too low to make reaching it certain. At about 2100 h, the Boston whaler went hard aground on a sand bar while the other two shallower draft boats reached the shoreline on the west channel of the Susitna River, but still stranded 5 km from camp. The team finally reached camp at about 0500 h the following morning. The late return trip on the ebbing tide the previous night eliminated the crew's ability to work the morning high tide due to fatigue and limited time available to refuel the boats.

26 MAY: The crew remained in camp and prepared the boats for the afternoon high tide. By 1500 h, however, the winds had risen too high to work. Instead, a watch was established on an adjacent island (Delta) in case belugas moved into the main channel of the Susitna River. No belugas were sighted.

27 MAY: Winds continued in the morning with marginal sighting conditions. A group of about 50 whales were encountered, but could not be moved to a suitable capture location. No sets were made. Likewise, during the afternoon high tide, conditions were marginal and no whales were found.

28 MAY: Weather during the morning high tide was clear and calm; the team was on the water by 0500 h. No whales were seen between the Susitna River and the shoreline 3 km north of the Little Susitna River and the crew returned to camp several hours later. At about 1830 h, the team headed out on the evening high tide and met the two Native hunters joining the project. Together, the team traveled about 4 km toward the Little Susitna River before encountering a group of 50 whales well into the shallows. Attempts were made for about 0.5 h to position an animal for capture. Eventually, a large white adult was singled out of the group and a set was made. With about half of the net deployed, however, the webbing snagged on the corner of the stanchion, tearing it out of the stern mounts. The stanchion stayed in the stern of the boat, however, and the remaining net was paid out over the aft starboard side by hand.

Despite the mishap, the beluga remained in the net and was forming a "V" channel as it tried to escape to deeper water. The Zodiak crew reached the animal and maneuvered into position to affix a tail loop. The team members had hands on the animal's flukes and caudal peduncle and were just seconds from slipping the tail loop on, when the beluga broke free; the net had slipped over its back. Instead of becoming well wrapped, the whale had been pushing against the taut webbing, which, was not wide enough to securely entangle its head.

29 MAY: The winds were blowing too hard in the morning to go out. In the afternoon, the winds moderated enough to search for belugas, but none were seen. Sighting conditions were marginal with steady rain.

30 MAY: Weather during the morning high tide was favorable, allowing departure by 0600 h. Whales were quickly spotted midway between the Susitna and Little Susitna Rivers, well into the shallows. From the group of about 75 belugas, three individuals were singled out for capture in three separate capture attempts. In each case, major difficulties were again encountered with the net deployment system. In the tight, high-speed turns, the net was snagging on the starboard corner of the net stanchion, which resulted in tearing and incomplete deployment. Although whales were in good position for capture each time, only a portion of the net was out prior to the stanchion collapses, and complete encirclement was not achieved. Upon return to camp, four modifications were made to the deployment gear, including: 1) restacking of the net with the lead line on the starboard side of the net box so that it would be on the extreme inside of the turn, 2) the net box was tipped 15° aft to facilitate its travel up to the stanchion, 3) the stanchion itself was lowered about 0.6 m to reduce the vertical distance required for the net to travel before exiting, and 4) the starboard extension on the top of the stanchion was padded, and its width to starboard was extended by about 0.2 m using a deflated soccer

ball and duct tape to minimize snagging as the webbing rounded the stanchion corner. In addition, two badly torn net panels were replaced, and several tears were resewn.

In late afternoon, the boats and crew were once again ready to attempt captures. Belugas were found in about the same area as in the morning. A group of about 75 animals were targeted twice, and each time a single animal was maneuvered into capture position and a set was made. Given the difficulties with the net deployment earlier in the day, the evening sets were made more slowly to allow close monitoring of the gear. The modifications greatly reduced the net's tendency to snag, suggesting that future sets could once again be attempted at high speed. Given the moderated speed during the two evening sets, however, no animals were captured as they escaped prior to full encirclement.

31 MAY: Weather conditions were good for the morning high tide and the crew departed camp at 0530 h. A group of about 100 belugas were found 2 km up the Little Susitna River. Given the lack of success experienced earlier in the project when we attempted to move whales out of the river and onto adjacent shallows, a different net deployment was tried. One end of the net was anchored to the beach on the inside of the last bend of the river and deployed upstream along a shallow bar, thus forming a beach seine into which animals could be driven as they swam downstream. Most animals avoided the net, opting to swim closer to the opposite riverbank, but at least 5 whales approached the seine, with one eventually entering it and becoming entangled. The animal was a gray, subadult female, too small to tag (about 230 cm). The animal was measured and subsequently released less than 10 min after capture. Upon release it quickly rejoined the main group.

The team reformed and followed the same group of whales into the shallows west of the Little Susitna River. At 1030 h an unsuccessful set was made on a single white adult that escaped before a full encirclement could be achieved. The set was made at full speed with no deployment problems. At 1130 h a portion of the same group was again located in the shallows and the boats positioned for capture. A full encirclement was achieved, capturing two animals. One was well entangled, and tended by the hunter's boat. The second animal was forming a "V" channel when approached by the Zodiak. Adjacent to the animal, the Zodiak tangled in the net, requiring several minutes to be cut free. During that time, the nearby beluga broke free of the net and swam to deep water.

The first animal, still well entangled was then tail looped and its head slipped into a hoop net. The net panel entangling the animal was removed from the net and used to help secure the animal at the surface alongside the hunter's boat. The rest of the net was brought back aboard the Boston Whaler to be repaired and restacked later.

The beluga was slowly moved inshore alongside the hunter's boat until waist-deep water was reached. The animal, a white to grayish-white male measuring 370 cm was in good condition. It continued efforts to swim until the tide dropped enough for it to rest on the bottom, but otherwise showed little response to the tag attachment. Tag number 25850 (with a VHF transmitter 167.423) was attached to the dorsal ridge. Two 17″ identification bands, DL 00142 and DL 00141 were also fitted to the right and left flippers, respectively. The field number RCF 400 was assigned to the animal for entry onto a standard cetacean life history record.

Given the capture location (lat. 61° 13.81′ N, long. 150°17.26′W) well onto the tidal flats and the time required to complete the tag attachment, both the capture team and beluga were stranded through the low tide. During the stranding period, the animal was located in a shallow channel which was eventually dug out into a 0.4 m deep water-filled depression around the animal. Throughout the low tide, the animal was kept wet, and it's condition was monitored constantly. By 1830 h, the incoming tide had reached the animal. It began moving toward deeper water vigorously, even before fully refloating. Within 10 minutes the whale had reached the edge of the deep water and began a regular shallow diving pattern. It immediately rejoined a group of about 75 whales milling about adjacent to the edge of the tidal flats in deep water. The satellite tag was functioning normally at the time of release and continued to transmit dive and location data until 17 Sept. 1999, 110 days after capture. The tag package likely detached from the animal at that time.

1 JUNE: Due to fuel supply constraints, only one tide per day could be worked during the last two days of the project. Weather was good for the morning tide and the crew was on the water by 0700 h. However, no whales were located.

2 JUNE: The weather remained clear and the morning tide was chosen for the last capture attempt. A group of about 100 whales was located 2 km up the Little Susitna River. The whale tagged the previous day was seen in the group, swimming normally with the package securely in place. Two beach sets, similar to the one described on 31 May were attempted, but no whales approached the net.