Historic and Current Use of Lower Cook Inlet, Alaska, by Belugas, *Delphinapterus leucas*

SUZANN G. SPECKMAN and JOHN F. PIATT

Introduction

The number of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska is small—about 350 individuals in 1998—and the population is declining (Hobbs et al., 2000). The Cook Inlet stock of belugas is currently listed as "depleted" under the Marine Mammal Protection Act (Fed. Regist. 65:34590–4597, 31 May 2000), but it is currently not listed as endangered under the Endangered Species Act (Fed. Regist. 65:38778–38790, 22 June 2000). Belugas have been harvested in Cook Inlet by Native hunters since prehistoric times and by commercial and sport hunters intermittently since the early 1900's (Shelden and Mahoney, 2000). The recent decline of the beluga population in Cook Inlet has been attributed largely to harvesting.

Although hunting has been a point of concern and an obvious source of mortality for this population, belugas are likely affected by other factors that are currently under assessment, such as changes in habitat quality (Moore et al., 2000) and declining prey availability or abundance (Anderson and Piatt, 1999; Moore et al., 2000; Speckman and Piatt[1]). Increased vessel traffic may also disturb belugas (Erbe and Farmer, 2000; Moore et al., 2000). Changes in environmental conditions may exacerbate losses from hunting and contribute to the ongoing population decline, or inhibit recovery.

Most surveys focused on belugas in Cook Inlet have taken place in June, when the whales are concentrated near river mouths and are therefore easier to count (Hobbs et al., 2000; Rugh et al., 2000). Some survey work was conducted in mid February and mid March 1997 (Hanson and Hubbard[2]), but little is known about the distribution and range of Cook Inlet belugas at other times of the year.

We conducted dedicated at-sea surveys for marine birds and mammals in lower Cook Inlet in late July and August of 1995–99. Our main objective was to document the distribution and abundance of marine predators in relation to forage fish and to examine changes in distribution and abundance among years. In addition, we consulted long-term residents of Cook Inlet to obtain anecdotal information on the historical abundance and distribution of belugas within the study area.

Methods

We surveyed for marine birds and mammals in lower Cook Inlet south of Kalgin Island in late July and August from 1995 to 1999 (Table 1). Surveys followed transects established in both "nearshore" and "offshore" habitats. Nearshore transects followed the contours of mainland or island shorelines, where waters were generally deeper than 10 m. Offshore transects cut across open water from one shore to another, over depths ranging from 10 m to >200 m.

In 1995, surveys were concentrated around the mouths of Tuxedni Bay, Kachemak Bay, and northeast of the Barren Islands (Fig. 1), where seabirds are concentrated. In 1996, coverage was more extensive, and in addition to areas surveyed in 1995, included areas in western lower Cook Inlet and south of the Barren Islands that were not surveyed in subsequent years (Fig. 2). In 1997–99, surveys were similar to and slightly more extensive than those in 1995 (Fig. 3). Transects surveyed from 1997–99 were identical in all 3 years of the study with the exception of the

Suzann G. Speckman (Speckman@u.washington.edu) is with the University of Washington School of Aquatic and Fishery Sciences, 1122 N.E. Boat Street, Seattle, WA 98105. John F. Piatt is with the Biological Resources Division, U.S. Geological Survey, 1011 E. Tudor Road, Anchorage, AK 99503.

ABSTRACT—Dedicated at-sea surveys for marine birds and mammals conducted in lower Cook Inlet in late July and early August from 1995–99 failed to locate any belugas, Delphinapterus leucas. *Surveys covered a total of 6,249 linear km and were conducted in both nearshore and offshore habitats. Sightings included 791 individual marine mammals of 10 species. Both historical data and local knowledge indicate that belugas were regularly seen in summer in nearshore and offshore areas of lower Cook Inlet up until the early 1990's. Diminished presence of belugas in lower Cook Inlet may be a direct function of reduced numbers but may also indicate changes in habitat quality that may inhibit recovery.*

[1] Speckman, S. G., and J. F. Piatt. 2000. Biological Resources Division, U. S. Geological Survey, 1011 E. Tudor Road, Anchorage, AK 99503. Unpubl. data.

[2] Hanson, D. J., and J. D. Hubbard. 1999. Distribution of Cook Inlet beluga whales (*Delphinapterus leucas*) in winter. Final Report. OCS Study MMS 99-0024. U.S. Department of the Interior, Minerals Management Service, Alaska Outer Continental Shelf Region, Anchorage, AK.

furthest north nearshore transect, which was not surveyed in 1997.

In 1995 and 1997–99, surveys were conducted from the R/V *Pandalus*, a 22 m stern trawler operated by the Alaska Department of Fish and Game. Surveys in 1996 were conducted from the R/V *Tiglax*, a 36 m vessel operated by the Alaska Maritime National Wildlife Refuge, U.S. Fish and Wildlife Service. In all years, surveys in some shallow nearshore areas were conducted from the R/V *David Grey*, an 11 m cabin cruiser operated by the Biological Resources Division of the U.S. Geological Survey. Ground speed for all vessels was approximately 11–15 km/h (6–8 kn).

Surveys were conducted according to protocols established by the U.S. Fish and Wildlife Service for marine birds (Gould and Forsell[3]). Observers actively scanned by naked eye ahead of and alongside the survey vessel. Special effort was made to locate and identify cetaceans beyond transect boundaries. Species identifications were confirmed using 7- or 10-power binoculars. All surveys took place during weather conditions suitable for sighting small marine birds at 150 m.

Bird and mammal sightings were recorded by entering them directly into a real-time computer data-entry system (DLOG[4]) that plots animal positions continuously using GPS coordinates. At all times, 1 person entered data into the computer, located in the wheelhouse, while observers surveyed from the best vantage points of each vessel (Table 2). Sightings were immediately called to the data entry person over hand-held VHF radios. Transects widths ranged from 200 to 300 m (Table 2).

For all surveys, swimming birds and mammals within transect boundaries were counted, identified to species, and recorded as "on transect." Birds and mammals sighted in front of the survey vessel at a distance of approximately twice the width of the transect were also considered "on transect," to counteract biases introduced when timid species avoided the survey vessel. Mammals were recorded as "off transect" when identified beyond the transect boundary.

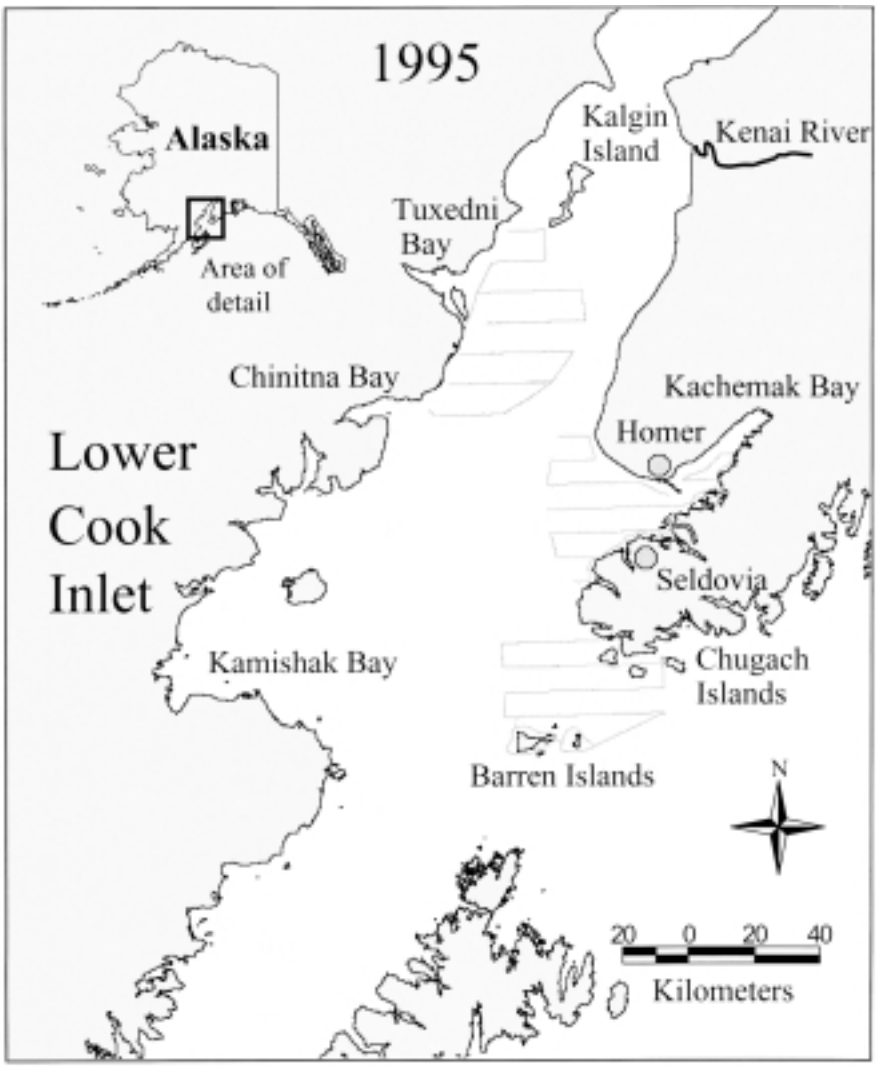

Figure 1.—Transects surveyed in both nearshore and offshore areas in 1995.

Table 1.—Total number of linear and square kilometers surveyed in lower Cook Inlet and harbor porpoise sighting rates during marine bird and mammal surveys, 1995–99.

Survey year	Survey dates	Nearshore		Offshore		Total		Harbor porpoise sighting rate[1]
		km	km²	km	km²	km	km²	#/km
1995	10–23 Aug.	115	15	705	138	820	153	0.00
1996	14–31 July	561	126	1,491	447	2,052	574	0.05
1997	19 July–08 Aug.	459	138	651	195	1,110	333	0.81
1998	21 July–12 Aug.	482	145	649	195	1,130	339	0.62
1999	25 July–16 Aug.	481	144	656	197	1,137	341	1.06

[1] Speckman and Piatt, unpubl. data

Results and Discussion

The number of linear kilometers surveyed each year ranged from 820 to 2,052 (Table 1). Nearshore transects comprised from 14 to 43% of the total kilometers surveyed; the remainder were

[3] Gould, P. J., and D. J. Forsell. 1989. Techniques for shipboard surveys of marine birds. U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Fish and Wildlife Technical Report 25, 22 p.

[4] DLOG, Ecological Consulting Inc., Portland, Oreg. Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA.

offshore transects. A total of 791 marine mammals of 10 species were sighted; however, no belugas were seen in any year. It seems unlikely that belugas were missed on these surveys, given that they are easily identified and that our sightings included many small marine mammal species such as sea otters, *Enhydra lutris*; harbor seals, *Phoca vitulina*; harbor porpoises, *Phocoena phocoena*; and minke whales, *Balaenoptera acutorostrata*.

Table 2.— Summary of survey vessel parameters and survey effort in lower Cook Inlet during marine bird and mammal surveys, 1995–99.

Survey year	Transect type	Transect width (m)	Vessel	Observer height (m)	Number of observers
1995	Nearshore	200	*Pandalus*	3.4	2–3
	Offshore	200	*Pandalus*	3.4	2–3
1996	Nearshore	200	*David Grey/Pandalus*	0/3.4	2–3
	Offshore	300	*Tiglax*	8.5	4
1997	Nearshore	300	*David Grey/Pandalus*	2.4/3.4	1–2
	Offshore	300	*Pandalus*	3.4	1–2
1998	Nearshore	300	*David Grey/Pandalus*	2.4/3.4	1–2
	Offshore	300	*Pandalus*	3.4	1–2
1999	Nearshore	300	*David Grey/Pandalus*	2.4/3.4	1–2
	Offshore	300	*Pandalus*	3.4	1–2

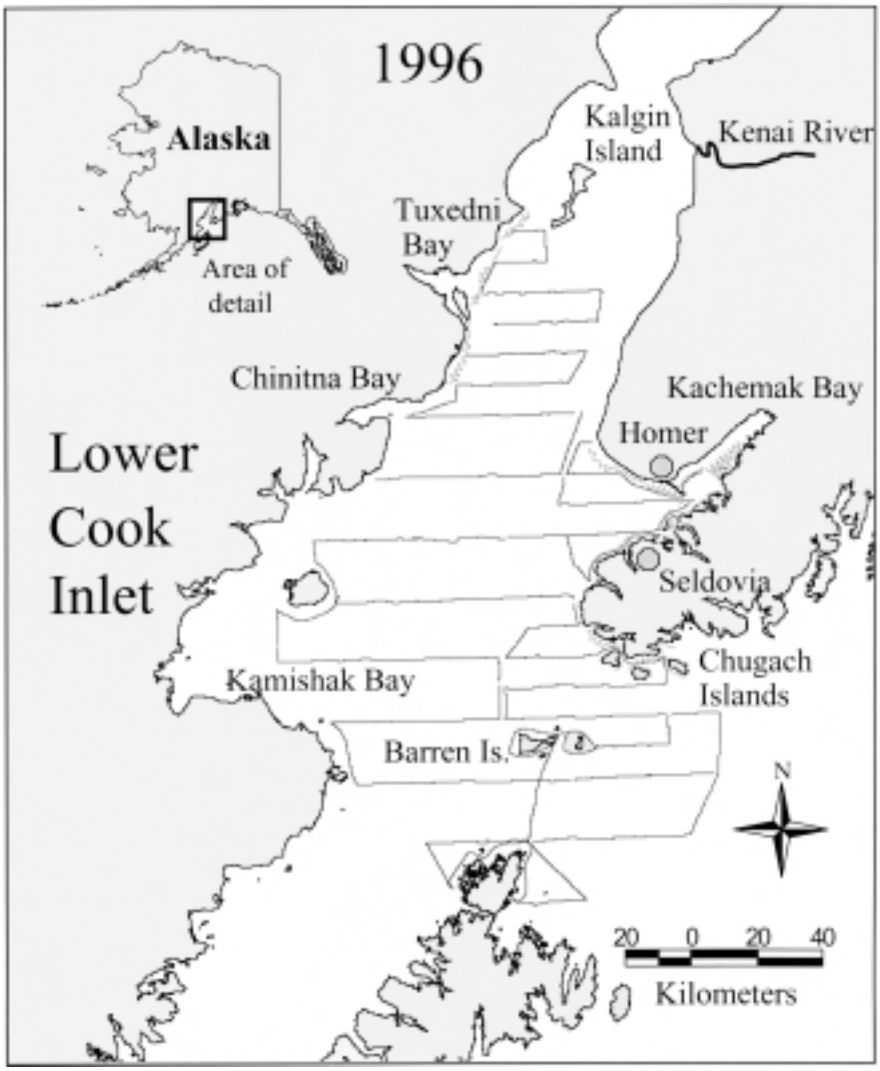

Figure 2.— Transects surveyed in 1996. Survey coverage was most extensive in 1996, and included areas not surveyed in other years.

The lack of beluga sightings during our intense surveys in lower Cook Inlet suggests that there were no large groups in the survey area during late July and August 1995–99. To index our ability to see small cetaceans during our surveys, we calculated annual sighting rates for harbor porpoises (Table 1), which are arguably more difficult to detect than larger, white belugas. Harbor porpoise sighting rates varied annually, probably in large part due to the different areas surveyed. Although belugas were not seen, harbor porpoises were reliably detected, especially in 1997, 1998, and 1999, over a relatively broad survey area in lower Cook Inlet (Fig. 3).

The results of our study are corroborated by those of a study on beluga distribution in Cook Inlet conducted in 1993–99 by Rugh et al. (2000), who concluded that the summer range of belugas in Cook Inlet had diminished over the past 3 decades, becoming progressively more restricted to the northern reaches of Cook Inlet.

Local knowledge and other historical evidence show that, prior to the 1990's, belugas were regularly seen in lower Cook Inlet waters, both nearshore and offshore (Rugh et al., 2000). Sightings were most frequent in spring and fall, and belugas were regular visitors in lower numbers throughout the summer months.

In Kachemak Bay, beluga sightings now are far fewer and group sizes are smaller than 7 or 8 years ago (Matkin[5]). In the past, belugas were regular visitors to the Homer Spit and the head of Kachemak Bay, appearing during spring and fall of some years in groups of 10–20 individuals that remained for a few days at a time. In the fall of 1999, only 4 belugas were seen near the spit (Matkin[5]). The previous reported sight-

[5] Matkin, C. 2000. North Gulf Oceanic Society, P.O. Box 15244, Homer, AK 99603. Personal commun.

ing for Kachemak Bay was 8 individuals in 1994 (Rugh et al., 2000).

A similar pattern has been noticed in Chinitna Bay by 25-year residents (Haeg and Haeg[6]). In the late 1970's and 1980's, groups of 50 or more belugas were common in Chinitna Bay, gathering at the mouths of streams during salmon runs. Smaller groups of 5–20 animals were seen occasionally in June and commonly in July. For the past 10 years, beluga sightings have been far fewer and group sizes have been smaller than in the 70's and 80's. Near Polly Creek, just north of Tuxedni Bay, use of the area by belugas has decreased markedly since 35 years ago (Swiss[7]). Belugas were seen regularly all summer in groups of 25–300 animals until 5–6 years ago; now, sightings are rare, and group sizes range from 10 to 75.

Belugas exhibit a variety of responses to vessel traffic, from little discernable response to desertion of an area with frequent boat traffic (reviewed by Richardson, 1995). Increased boat traffic in lower Cook Inlet, especially the use of loud vessels such as air boats in and around Pacific salmon, *Oncorhynchus* spp., spawning rivers and streams, may negatively impact the availability of salmon to belugas if belugas are avoiding such vessels. Residents of Chinitna Bay (Haeg and Haeg[6]) are concerned about the impacts of air boats on belugas, and such concerns should be investigated as part of a management plan for Cook Inlet belugas.

Diminished presence of belugas in lower Cook Inlet may be a result of reduced population size. As the population has declined, belugas may simply be sighted less often. Their range may be contracting as peripheral habitats are abandoned in favor of preferred habitats. Alternatively, diminished presence of belugas may indicate that the importance of various habitats to belugas has changed as prey species have declined, or as belugas have begun to utilize alternate prey species in other areas. Fish species composition in the Gulf of Alaska has changed dramatically over the past 20 years (Piatt and Anderson, 1996; Anderson and Piatt, 1999), and shifts in prey species composition may be accompanied by shifts in prey quality (van Pelt et al., 1997) for predators.

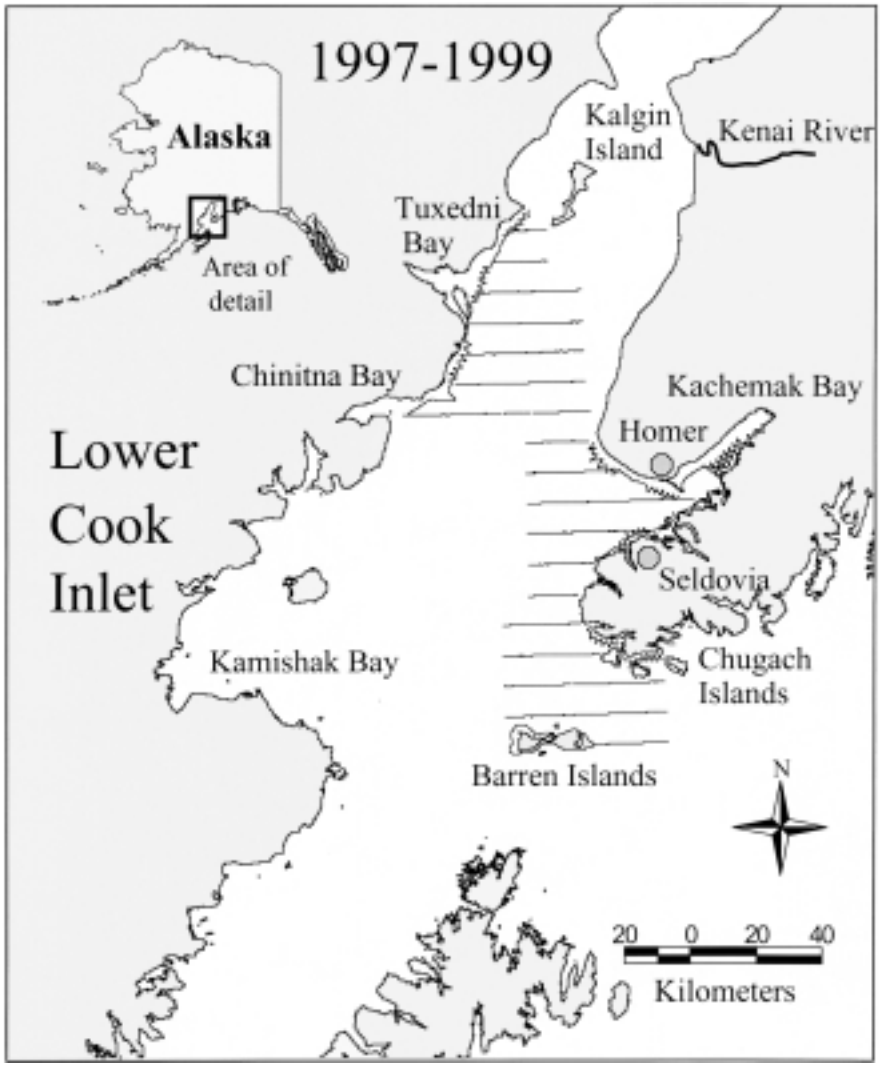

Figure 3.— Transects surveyed from 1997 to 1999.

Moore et al. (2000) discuss habitat associations of belugas and review the status of salmon stocks in Cook Inlet. Another common beluga prey species, eulachon, *Thaleichthys pacificus*, is of uncertain status. Sport fishing harvests of eulachon have declined dramatically during the past 20 years in upper Cook Inlet, possibly indicating declines in eulachon stocks, decreased fishing effort, or both, but lack of data on species-specific fishing effort precludes interpretation of the catch data (Stratton and Cyr[8], Howe et al.[9], Howe[10]). Anecdotal observations indicate declines in numbers

[6] Haeg, M., and B. Haeg. 2000. P.O. Box 338, Soldotna, AK 99669. Year-round residents of Chinitna Bay for 25 years. Personal commun.

[7] Swiss, T. 2000. 8341 Blackberry Street, Anchorage, AK 99502. Resident of Polly Creek for 35 summers. Personal commun.

[8] Stratton, B., and P. Cyr. 1997. Annual management report for the Anchorage area, 1995. Alaska Department of Fish and Game, Fishery Management Report No. 97-01, Anchorage, Alaska, 98 p.

[9] Howe, A. L., R. J. Walker, C. Olnes, G. Heineman, and A. E. Bingham. 1999. Harvest and catch in Alaska sport fisheries during 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-41, Anchorage, Alaska, 128 p.

[10] Howe, A. L. 2000. Alaska Department of Fish and Game, Division of Sport Fish, 333 Raspberry Road, Anchorage, AK 99518. Personal commun.

in the northern part of the inlet (Kitto[11]). Eulachon populations in lower Cook Inlet have not been assessed, and no information is available to suggest major changes (Fox[12]).

Hunting by Alaska Natives may be a primary cause of the recent decline in the beluga whale population in Cook Inlet, but other factors need to be examined. Shifts in the distribution of belugas in the lower inlet may indicate local or ecosystem-level changes in habitat or prey quality and quantity. Vessel noise and traffic, fishing, and changing sea temperatures and prey communities could all affect beluga habitat choices and exacerbate losses of belugas due to hunting. Such effects may confound or inhibit recovery. A better understanding of these factors, and how they affect belugas both from an individual and a population standpoint, is required before a management plan that affords protection and recovery of belugas in Cook Inlet can be developed.

[11] Kitto, Beth. 2000. U.S. Forest Service, Glacier Ranger District, PO Box 129, Girdwood, AK 99587. Personal commun.

[12] Fox, J. 2000. Alaska Department of Fish and Game, 43961 Kalifornsky Beach Road, Soldotna, AK 99669. Personal commun.

Acknowledgments

This study was directed by the U.S. Geological Survey. Additional funding for the project was provided by the Exxon Valdez Oil Spill Trustee Council (Restoration Project 00163M) and the Minerals Management Service. We are very grateful to all of the observers who helped with surveys: J. Figurski, B. Keitt, G. Drew, G. Snedgen, T. van Pelt, M. Robards, M. Arimitsu, B. Congdon, S. Zador, A. Harding, A. Kitaysky, C. Lascink, V. Lodha, D. Ruthrauff, R. Seymour, K. Hobson, A. Abookire, R. Suydam, and S. Wright. We thank the Captains of the R/V *Pandalus*, P. Desjardins and M. Hottman, Captain K. Bell of the R/V *Tiglax*, and G. Snedgen of the R/V *David Grey*. We also thank their hard-working crews. This manuscript was greatly improved by the helpful comments of S. Moore, R. Suydam, and 3 anonymous reviewers.

Literature Cited

Anderson, P. J., and J. F. Piatt. 1999. Community reorganization in the Gulf of Alaska following ocean climate regime shift. Mar. Ecol. Prog. Ser. 189:117–123.

Erbe, C., and D. M. Farmer. 2000. Zones of impact around icebreakers affecting beluga whales in the Bering Sea. J. Acoustical Soc. Am. 108:1332–1340.

Hobbs, R. C., D. J. Rugh, and D. P. DeMaster. 2000. Abundance of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska, 1994–2000. Mar. Fish. Rev. 62(3):37–45.

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.

Moore, S. E., K. E. W. Shelden, L. K. Litzky, B. A. Mahoney, and D. J. Rugh. 2000. Beluga, *Delphinapterus leucas*, habitat associations in Cook Inlet, Alaska. Mar. Fish. Rev. 62(3):60–80.

Piatt, J. F., and P. Anderson. 1996. Response of common murres to the *Exxon Valdez* oil spill and long-term changes in the Gulf of Alaska marine ecosystem. *In* S. D. Rice, R. B. Spies, D. A. Wolfe, and B. A Wright (Editors), Proceedings of the *Exxon Valdez* oil spill symposium, p. 720–737. Am. Fish. Soc. Symp. 18, Anchorage, Alaska.

Richardson, W. J., C. R. Greene, Jr., C. I. Malme, and D. H. Thomson. 1995. Marine mammals and noise. Acad. Press, San Diego, Calif.

Rugh, D. J., K. E. W. Shelden, and B. A. Mahoney. 2000. Distribution of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska, during June/July 1993–2000. Mar. Fish. Rev. 62(3):6–21.

van Pelt, T. I., J. F. Piatt, B. K. Lance, and D. D. Roby. 1997. Proximate composition and energy density of some North Pacific forage fishes. Comp. Biochem. Physiol. 118 (A): 1393–1398.