Revised 1/10/2011

BELUGA WHALE (*Delphinapterus leucas*): Cook Inlet Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Beluga whales are distributed throughout seasonally ice-covered arctic and subarctic waters of the Northern Hemisphere (Gurevich 1980) and are closely associated with open leads and polynyas in ice-covered regions (Hazard 1988). Depending on season and region, beluga whales may occur in both offshore and coastal waters, with concentrations in Cook Inlet, Bristol Bay, the Yukon Delta, Norton Sound, Kasegaluk Lagoon, and the Mackenzie Delta (Hazard 1988). The following information was considered in classifying beluga whale stock structure based on the Dizon et al. (1992) phylogeographic approach: 1) Distributional data: geographic distribution discontinuous (Frost and Lowry 1990); 2) Population response data: possible extirpation of local populations; distinct population trends between regions occupied in summer; 3) Phenotypic data: unknown; and 4) Genotypic data: mitochondrial DNA analyses indicate distinct differences among summering areas (O'Corry-Crowe et al. 2002). Based on this information, 5 stocks of beluga whales are recognized within U. S. waters: 1) Cook Inlet, 2) Bristol Bay, 3) eastern Bering Sea, 4) eastern Chukchi Sea, and 5) Beaufort Sea.

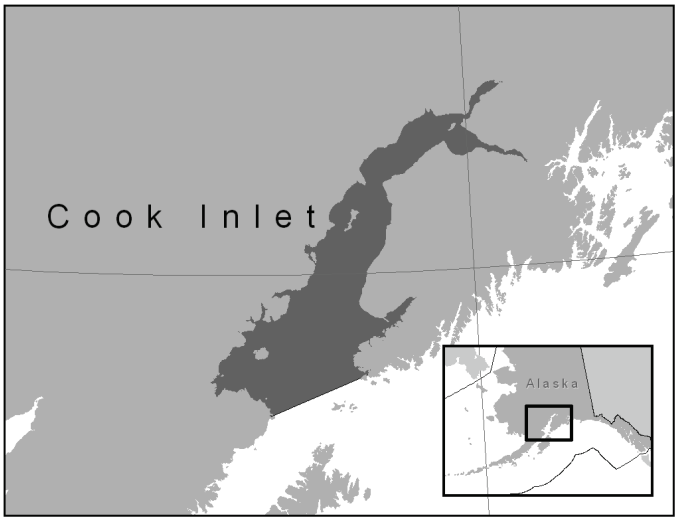

Figure 19. Approximate distribution of beluga whales in Cook Inlet. The dark shading displays the summer distribution.

During spring and summer months, beluga whales in Cook Inlet are typically concentrated near river mouths in the northern Inlet (Rugh et al. 2000). Although the exact winter distribution of this stock is unknown, there is evidence that some, if not all, of this population may inhabit Cook Inlet year-round (Fig. 19; Hansen and Hubbard 1999, Rugh et al. 2000). Satellite tags have been attached to 17 belugas in late summer in order to determine their distribution through the fall and winter (Hobbs et al. 2005). Ten tags lasted through the fall, and of those, three lasted through the winter. The three tags that transmitted through the winter stopped working in April and late May. No tagged beluga moved south of Chinitna Bay on the west side of Cook Inlet. A review of all cetacean surveys conducted in the Gulf of Alaska from 1936 to 2000 discovered only 31 sightings of belugas among 23,000 sightings of other cetaceans, indicating that very few belugas occur in the Gulf of Alaska outside of Cook Inlet (Laidre et al. 2000). A small number of beluga whales (fewer than 20 animals; Laidre et al. 2000, O'Corry-Crowe et al. 2006) also occur in Yakutat Bay; while not included in the Cook Inlet DPS as listed under the ESA, the Yakutat beluga group is considered part of the Cook Inlet stock (73 FR 62919, 22 October 2008).

POPULATION SIZE

Aerial surveys for beluga whales in Cook Inlet have been conducted by the National Marine Fisheries Service each year since 1993. Starting in 1994, the survey protocol included paired, independent observers so that the number of whale groups missed can be estimated. When groups were seen, a series of aerial passes were made to allow each observer to make independent counts at the same time that a video camera was recording the whale group (Rugh et al. 2000).

The annual abundances of beluga whales in Cook Inlet are estimated from counts by aerial observers and aerial video group counts. Each group size estimate is corrected for subsurface animals (availability correction) and animals at the surface that were missed (sightability correction) based on an analysis of the video tapes (Hobbs et al. 2000). When video counts are not available, observer's counts are corrected for availability and sightability using a regression of counts and an interaction term of counts with encounter rate against the video group size estimates (Hobbs et al. 2000). The most recent abundance estimate of beluga whales in Cook Inlet, resulting from the 2010 aerial survey is 340 (CV = 0.11) (NMFS unpubl. data 2010). While this estimate is larger than the estimates of 278

for 2005 and 302 for 2006, it fits well with the declining trend for the years 1999-2010. Abundance estimates based on aerial surveys of Cook Inlet beluga over the last 3-year period were 375 (2008), 321 (2009), and 340 (2010). Based on an average population estimates of the Cook Inlet beluga over the last 3 years, the abundance estimate for this stock is 345 (CV = 0.13).

Minimum Population Estimate

The minimum population size (N_{MIN}) for this stock is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997): $N_{MIN} = N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{½})$. Using the 3-year average population estimate (N) of 345 and its associated CV(N) of 0.13, N_{MIN} for the Cook Inlet stock of beluga whales is 309.

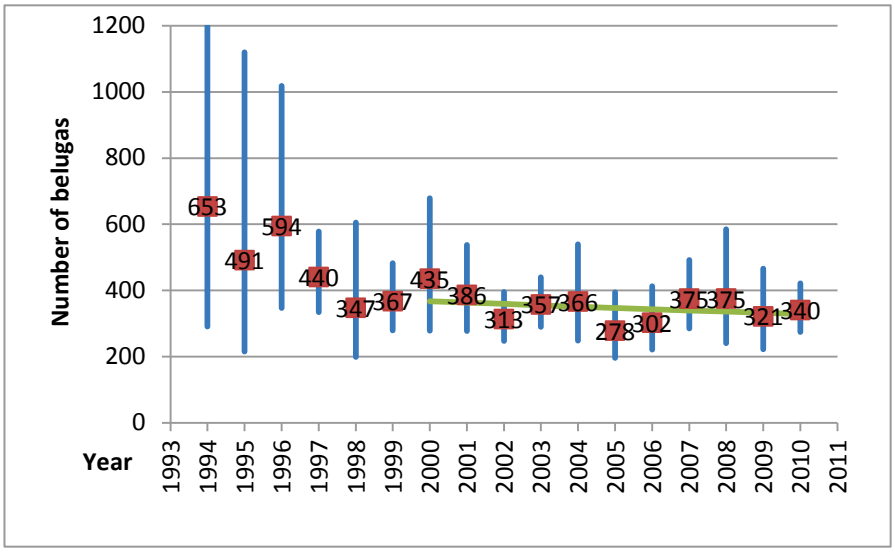

Figure 20a. Abundance of beluga whales in Cook Inlet, Alaska 1994-2009 (Rugh et al. 2005, Hobbs and Shelden 2008). Error bars depict 95% confidence intervals. In the last 10 years (2000-2010), the rate of decline (red trend line) has been -1.11% per year.

Current Population Trend

The corrected abundance estimates for the period 1994-2010 are shown in Figure 20a. A statistically significant declining trend in abundance was detected between 1994 and 1998 (Hobbs et al. 2000b), although the power of the analysis was low due to the short time series. A Bayesian inference on the population size estimates for 1994-2005 gave a modal estimate of the trend during that period of -1.2% per year, with a 71% probability that the population was declining (Lowry et al. 2006). A trend line fit to the estimates for 2000 to 2010 estimates an average rate of decline of 1.11% (SE = 0.009) per year. A recent review of the status of the population indicated that there is an 80% chance that the population will decline further (Hobbs and Shelden 2008).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently not available for the Cook Inlet stock of beluga whales. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed for this stock (Wade and Angliss 1997). This figure is similar to the 4.8% percent annual increase that has been documented for the Bristol Bay beluga stock (Lowry et al. 2008).

POTENTIAL BIOLOGICAL REMOVAL

Under the 1994 reauthorized Marine Mammal Protection Act (MMPA), the potential biological removal (PBR) is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The F_R and PBR for the Cook Inlet stock of beluga whale were both undetermined in Small and DeMaster (1995). In reports from 1998 through 2005, NMFS calculated a value for PBR. However, given the low abundance relative to historic estimates and low known levels of human caused mortality since 1999 this stock should have begun to grow at or near its maximum productivity rate, but for unknown reasons the Cook Inlet stock of beluga whale does not appear to be increasing. Because this stock does not meet the assumptions inherent to the use of the PBR, NMFS cannot determine a maximum number that may be removed while allowing the population to achieve OSP. Thus, the PBR is undetermined for the Cook Inlet stock of beluga whale.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

In 1999 and 2000, observers were placed on Cook Inlet salmon set and drift gillnet vessels because of the potential for these fisheries to entangle beluga whales. No mortalities or serious injuries were observed in either year (Manly 2006).

A photogrammetric study by Kaplan et al. (2009) did not find any instances where Cook Inlet belugas appeared to have been entangled in, or to have otherwise interacted with, fishing gear. However, a recent series of photos of an animal with a rope entangled around its girth was observed during the period of June through September with no more current photo indicating whether the gear was still present (pers comm. Dr Tamara McGuire, LGL Alaska Research Associates, Inc. 2000 W International Airport Road, Anchorage, AK 99502).

Based on a lack of reported mortalities, the estimated minimum mortality rate incidental to commercial fisheries is zero belugas per year from this stock.

Subsistence/Native Harvest Information

Subsistence harvest of beluga whales in Cook Inlet has been important to local villages. Between 1993 and 1999, the annual subsistence take ranged from 30 to over 100 animals (Mahoney and Shelden 2000). The average annual subsistence harvest for 1995 and 1996 was 87 whales.

Following a significant decline in Cook Inlet beluga whale abundance estimates between 1994 and 1998, the Federal Government took actions to prevent further declines in the abundance of these whales. In 1999 and 2000, Public Laws 106-31 and 106-553 established a moratorium on Cook Inlet beluga whale harvests except for subsistence hunts by Alaska Natives conducted under cooperative agreements between NMFS and affected Alaska Native organizations. There were no signed co-management agreements in 1999, 2004, and 2007, so no harvest was authorized. Harvest from 2001 through 2004 was conducted under harvest regulations (69 FR 17973, 6 April 2004) following an interim harvest management plan developed by the Alaska Native organizations and NMFS. Three belugas were harvested in Cook Inlet under the interim harvest plan (2001-2004). In August 2004 an administrative law judge hearing was held to determine a long-term harvest plan. The recommended decision allowed a total of 8 whales to be harvested between 2005 and 2009, followed by the use of a table of allowable harvest levels from 2010 until recovery. This table would set harvest levels dependent on the previous 5-year periods for an average abundance and previous 10-year period to determine the growth rate (increasing, stable, or decreasing). No harvest would be allowed if the 5-year average abundance dropped below 350 beluga. Because the 5–year average abundance was below 350 whales for the 2003-2007 time period, the allowable harvest during the subsequent 5–year period, 2008–2012, was set at zero. (73 FR 60976; 15 October 2008).

Table 24. Summary of the Alaska Native subsistence harvest from the Cook Inlet stock of beluga whales, 2006-2010.

Year	Reported total number taken	Reported number harvested	Estimated number struck and lost
2006	0	0	0
2007	0	0	0
2008	0	0	0
2009	0	0	0
2010	0	0	0
Mean annual take (2006-2010)	0		

OTHER MORTALITY

Mortalities related to stranding events have been reported in Cook Inlet (Table 25). Since improved recordkeeping was initiated in 1994, there are more reports of stranded belugas in Cook Inlet, including live strandings. These live strandings resulted in suspected mortalities of 5 animals in 1996, 5 animals in 1999, and 5 animals in 2003 (Vos and Shelden 2005) and 1 animal in 2005 (Hobbs and Shelden 2008). Many of the live strandings occurred in Turnagain Arm. Because Turnagain Arm is a shallow, dangerous waterway, it is not frequented by motorized vessels, and thus it is unlikely that the strandings resulted from human interactions on the water. A live stranding of 17-20 animals occurred in Knik Arm in 2009; however, there were no mortalities reported from that event. Two live stranding

events occurred in 2010, one consisting of 11 animals and another of 2 animals, during which no mortalities occurred. Another source of mortality in Cook Inlet is killer whale predation. Killer whale sightings were rare in the upper Inlet prior to the mid-1980s, but have increased and include 18 reported sightings from 1985 to 2002 (Shelden et al. 2003). The three most recent predation events that occurred in the upper Inlet were in 1) September 1999 in which the outcome was unknown, 2) in September 2000 that involved two lactating female belugas that subsequently died (Shelden et al. 2003), 3) August 2003 where a male beluga died (Vos and Shelden 2005), and 4) in September 2008 where an adult beluga (sex not yet determined) died (Hobbs and Shelden 2008).

Year	Total Dead of Natural or Unknown Cause	Number of Belugas per Live Stranding Event* (associated known mortalities)
1994	10	186 (0)
1995	3	0
1996	12	63(0), 60(4), 25(1), 1(0), 15(0)
1997	3	0
1998	10	30(0), 5(0)
1999	12	58(5), 13(0)
2000	13 (2 killer whale)	8(0), 17(0), 2(0)
2001	10	0
2002	13	0
2003	20 (1 killer whale)	2(0), 46(5), 26(0), 32(0), 9(0)
2004	13	N/A
2005	6	7(1)
2006	8	12(0)
2007	15	0
2008	11 (1 killer whale)	28(0), 30(0)
2009	4	17-20 (0)
2010	5	11(0), 2(0)
Total	173	690-698 (16)

Table 25. Cook Inlet beluga strandings investigated by NMFS (Vos and Shelden 2005; Hobbs and Shelden 2008). * Harvested beluga are not included in the number dead. ** Many belugas that strand do not die. Although some mortalities may have been missed by observers, and animals may die later of stranding-related injuries, the majority of animals involved in a stranding event often survive.

STATUS OF STOCK

Efforts to develop co-management agreements with Alaska Native organizations for several marine mammal stocks harvested by Native subsistence hunters across Alaska, including belugas in Cook Inlet, have been underway for several years. An umbrella agreement on co-management among the Indigenous People's Council for Marine Mammals, U.S. Fish and Wildlife Service, and NMFS was signed in August 1997, and an updated co-management agreement was signed in October 2006. During 1998, efforts were initiated to formalize a specific agreement between local Alaska Native organizations and NMFS regarding the management of Cook Inlet belugas, but without success. Federal legislation was implemented in May 1999, placing a moratorium on beluga hunting in Cook Inlet except under cooperative agreements between NMFS and affected Alaska Native organizations. Co-management agreements between NMFS and the Cook Inlet Marine Mammal Council have since been signed for 2000-2003 and 2005-2006.

Habitat Concerns

Observation and tagging data both indicate that the northernmost parts of upper Cook Inlet, including the Susitna Delta, Knik Arm, and Chickaloon Bay, are the focus of the stock's distribution in both summer (Rugh et al. 2000; Goetz et al. 2007) and winter (Hobbs et al. 2005). Because of the very restricted range of this stock, Cook Inlet beluga can be assumed to be vulnerable to human-induced or natural perturbations within their habitat. Although the best available information has indicated that human activities, including oil and gas development, had not caused the stock to be in danger of extinction as of 2000 (65 FR 38778; 22 June 2000), potential effects of human activities on recovery remain a concern (73 FR 62919, 22 October 2008). Additional concerns which have the potential to impact this stock or its habitat include changes in prey availability due to climate changes; competition with fisheries for available prey; contaminants and sounds associated with oil and gas exploration; vessel traffic; waste management and urban runoff; and physical habitat modifications that may occur as upper Cook Inlet becomes increasingly urbanized (Moore et al. 2000, Lowry et al. 2006). A photogrammetric study by Kaplan et al. (2009) recorded a few instances where belugas had probably been struck by boat propellers or ships. Projects

planned that may alter the physical habitat include a highway bridge across Knik Arm, ferry operations in lower Knik Arm, construction and operation of a coal mine near Chuitna, and improvements to the Port of Anchorage. NMFS released a proposed rule to designate two areas comprising 7,809 square miles of marine habitat as critical habitat for the Cook Inlet beluga (74 FR 63080, 2 December 2009).

CITATIONS

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

Frost, K. J., and L. F. Lowry. 1990. Distribution, abundance, and movements of beluga whales, *Delphinapterus leucas*, in coastal waters of western Alaska. Pp. 39-57 *In* T. G. Smith, D. J. St. Aubin, and J. R. Geraci (eds.), Advances in research on the beluga whale, *Delphinapterus leucas*. Can. Bull. Fish. Aquat. Sci. 224.

Goetz, K.T., D. J. Rugh, A. J. Read, and R. C. Hobbs. 2007. Summer habitat preferences of beluga whales (*Delphinapterus leucas*) in Cook Inlet, Alaska. Mar. Ecol. Prog. Ser. 330:247-256.

Gurevich, V. S. 1980. Worldwide distribution and migration patterns of the white whale (beluga), *Delphinapterus leucas*. Rep. Int. Whal. Comm. 30:465-480.

Hansen, D. J., and J. D. Hubbard. 1999. Distribution of Cook Inlet beluga whales (*Delphinapterus leucas*) in winter. Final Rep. OCS Study. MMS 99-0024. U.S. Dep. Int., Minerals Manage. Serv. Alaska OCS Region, Anchorage, AK. v. p.

Hazard, K. 1988. Beluga whale, *Delphinapterus leucas*. Pp. 195-235 *In* J. W. Lentfer (ed.), Selected marine mammals of Alaska. Species accounts with research and management recommendations. Marine Mammal Commission, Washington, D.C.

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., and K. E. W. Shelden. 2008. Supplemental status review and extinction assessment of Cook Inlet belugas (*Delphinapterus leucas*). AFSC Processed Rep. 2008-08, 76 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.

Hobbs, R.C., J. M. Waite, and D.J. Rugh. 2000a. Beluga, *Delphinapterus leucas*, group sizes in Cook Inlet, Alaska, based on observer counts and aerial video. Mar. Fish. Rev. 62(3):46-59.

Hobbs, R.C., J. M. Waite, and D.J. Rugh. 2000b. Abundance of beluga whales, *Delphinapterus leucas*, in Cook Inlet, Alaska, 1994-2000. Mar. Fish. Rev. 62(3):37-45.

Kaplan, C.C., T.L. McGuire, M.K. Blees, and S.W. Raborn. 2009. Longevity and causes of marks seen on Cook Inlet Beluga Whales. Chapter 1 *In*: Photo-identification of beluga whales in Upper Cook Inlet, Alaska: Mark analysis, mark-resight estimates, and color analysis from photographs taken in 2008. Report prepared by LGL Alaska Research Associates, Inc., Anchorage, AK, for National Fish and Wildlife Foundation, Chevron, and ConocoPhillips Alaska, Inc. 32 p.

Laidre, K. L., K. E. W. Shelden, D. J. Rugh, and B. Mahoney. 2000. Beluga, *Delphinapterus leucas*, distribution and survey effort in the Gulf of Alaska. Mar. Fish. Rev. 62(3):27-36.

Lowry, L., O'Corry-Crowe, G., and Goodman, D. 2006. *Delphinapterus leucas* (Cook Inlet population). In: IUCN 2006. 2006 IUCN Red List of Threatened Species.

Lowry, L. F., K. J. Frost, A. Zerbini, D. DeMaster, and R. R. Reeves. 2008. Trend in aerial counts of beluga or white whales (*Delphinapterus leucas*) in Bristol Bay, Alaska, 1993-2005. J. Cetacean Res. Manage. 10:201-207.

Mahoney, B. A., and K. E. W. Shelden. 2000. Harvest history of belugas, *Delphinapterus leucas*, in Cook Inlet, Alaska. Mar. Fish. Rev. 62(3):124-140.

Manly, B. F. J. 2006. Incidental catch and interactions of marine mammals and birds in the Cook Inlet salmon driftnet and setnet fisheries, 1999-2000. Report to the NMFS Alaska Region. 98 pp. (Available online: http://www.fakr.noaa.gov/protectedresources/observers/bycatch/1999-2000cookinlet.pdf)

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

O'Corry-Crowe, G. E., A. E. Dizon, R. S. Suydam, and L. F. Lowry. 2002. Molecular genetics studies of population structure and movement patterns in a migratory species: The beluga whale, *Delphinapterus leucas*, in the western neoarctic. Pp. 464 *In* C. J. Pfeiffer (ed.), Molecular and cell biology of marine mammals. Kreiger Publishing Company. Malabar, Florida.

O'Corry-Crowe, G., W. Lucey, C. Bonin, E. Henniger, and R. Hobbs. 2006. The ecology, status, and stock identify of beluga whales, *Delphinapterus leucas*, in Yakutat Bay, Alaska. Report to the U.S. Marine Mammal Commission. 22pp.

Rugh, D. J., K. E. W. Shelden, and B. Mahoney. 2000. Distribution of beluga whales in Cook Inlet, Alaska, during June/July, 1993 to 1999. Mar. Fish. Rev. 62(3):6-21.

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

Small, R.J., and D. P. DeMaster (eds.) 1995. Alaska marine mammal stock assessments, 1995. U. S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-57, 93 pp.

Vos, D., and K.E.W. Shelden. 2005. Unusual mortality in the depleted Cook Inlet beluga (*Delphinapterus leucas*) population. Northwest. Nat. 86:59–65.

Wade, P. R., and R. Angliss. 1997. Guidelines for assessing marine mammal stocks: report of the GAMMS workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp.