

BELUGA WHALE (*Delphinapterus leucas*): Eastern Chukchi Sea 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). It is assumed that most beluga whales from these summering areas overwinter in the Bering Sea, excluding those found in the northern Gulf of Alaska (Shelden 1994). Seasonal distribution is affected by ice cover, tidal conditions, access to prey, temperature, and human interaction (Lowry 1985).

The general distribution pattern for beluga whales shows major seasonal changes. During the winter, they occur in offshore waters associated with pack ice. In the spring, they migrate to warmer coastal estuaries, bays, and rivers where they may molt (Finley 1982) and give birth to and care for their calves (Sergeant and Brodie 1969). Annual migrations may cover thousands of kilometers (Reeves 1990).

Eastern Chukchi Sea belugas move into coastal areas along Kasegaluk Lagoon in late June and animals are sighted in the area until about mid-July (Frost and Lowry 1990, Frost et al. 1993). Satellite-linked tags attached in summer to eastern Chukchi belugas occur in Kasegaluk Lagoon showed that whales traveled 1,100 km north of the Alaska coastline and to the Canadian Beaufort Sea within 3 months of tagging (Suydam et al. 2001), indicating an overlap in distribution with the Beaufort Sea stock of beluga whales. Satellite telemetry data from 23 whales tagged during 1998-2002 suggest variation in movement patterns for different age and/or sex classes during July – September (Suydam et al. 2005). Adult males used deeper waters and remained there for the duration of the summer; all belugas that moved into the Arctic Ocean (north of 75°N) were males, and males traveled through 90% pack ice cover to reach deeper waters of the Beaufort Sea and Arctic Ocean (79-80°N) by late July/early August. Adult and immature females remained at or near the shelf break of the Chukchi Sea. After October, only three tags continued to transmit, and those whales migrated south through the Bering Strait into the northern Bering Sea north of Saint Lawrence Island. Data from a whale tagged in the eastern Chukchi Sea in 2007 overwintered in the waters north of Saint Lawrence Island during 2007/2008 and was still transmitting in this location as of April 2008 (Suydam 2009).

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 in summer (Frost and Lowry 1990), distribution unknown outside of summer; 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. 1997). 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 (Fig. 16).

POPULATION SIZE

Frost et al. (1993) estimated the minimum size of the eastern Chukchi stock of belugas at 1,200, based on counts of animals from aerial surveys conducted during 1989-91. Survey effort was concentrated on the 170 km

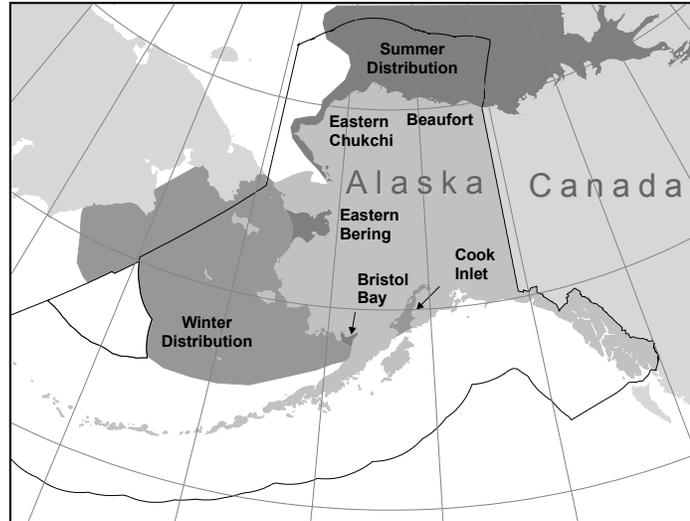


Figure 16. Approximate distribution of beluga whales in Alaska waters. The dark shading displays the summer distribution of the five stocks. Winter distributions are depicted with lighter shading.

long Kasegaluk Lagoon, an area known to be regularly used by belugas during the open-water season. Other areas that belugas from this stock are known to frequent (e.g., Kotzebue Sound) were not surveyed. Therefore, the survey effort resulted in a minimum count. If this count is corrected, using radio telemetry data, for the proportion of animals that were diving and thus not visible at the surface (2.62, Frost and Lowry 1995), and for the proportion of newborns and yearlings not observed due to small size and dark coloration (1.18; Brodie 1971), the total corrected abundance estimate for the eastern Chukchi stock is 3,710 ($1,200 \times 2.62 \times 1.18$).

During 25 June to 6 July 1998, aerial surveys were conducted in the eastern Chukchi Sea (DeMaster et al. 1998). The maximum single day count (1,172 whales) was derived from a photographic count of a large aggregation near Icy Cape (1,018), plus animals (154) counted along an ice edge transect. This count is an underestimate because it was clear to the observers that many more whales were present along and in the ice than they were able to count and only a small portion of the ice edge habitat was surveyed. Furthermore, only one of five belugas equipped with satellite tags a few days earlier remained within the survey area on the day the peak count occurred (DeMaster et al. 1998).

In July 2002, aerial surveys were conducted again in the eastern Chukchi Sea (Lowry and Frost 2002). Those surveys resulted in a peak count of 582 whales. A correction factor for animals that were not available for the count is not available. Offshore sightings during this survey combined with satellite tag data collected in 2001 (Lowry and Frost 2001, Lowry and Frost 2002) indicate that nearshore surveys for beluga will only result in partial counts of this stock.

It is not possible to estimate the abundance for this stock from the 1998 survey. Not only were a large number of whales unavailable for counting, but the large Icy Cape aggregation was in shallow, clear water (DeMaster et al. 1998). Currently, a correction factor (to account for missed whales) does not exist for belugas encountered in such conditions. As a result, the abundance estimate from the 1989-91 surveys (3,710 whales) is still considered to be the most reliable for the eastern Chukchi Sea beluga whale stock.

Minimum Population Estimate

The survey technique used for estimating the abundance of beluga whales is a direct count which incorporates correction factors. Although CVs of the correction factors are not available, the Alaska Scientific Review Group concluded that the population estimate of 3,710 can serve as an estimate of minimum population size because the survey did not include areas where beluga are known to occur (Small and DeMaster 1995). That is, if the distribution of beluga whales in the eastern Chukchi Sea is similar to the distribution of beluga whales in the Beaufort Sea, which is likely based on satellite tag results (Suydam et al. 2001, Lowry and Frost 2002), then a substantial fraction of the population was likely to have been in offshore waters during the survey period (DeMaster 1997).

Current Population Trend

The maximum 1998 count (1,172 animals) is similar to counts of beluga whales conducted in the same area during the summers of 1989-91 (1,200 animals) and counts of 1,104 and 1,601 in the summer of 1979 (Frost et al. 1993, DeMaster et al. 1998). Based on these data, there is no evidence that the eastern Chukchi Sea stock of beluga whales is declining.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this 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).

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: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. This stock is considered relatively stable and not declining in the presence of known take, thus the recovery factor (F_R) for this stock is 1.0 (DeMaster 1995, Wade and Angliss 1997). Using the abundance estimate calculated from 1991 surveys, the PBR for the eastern Chukchi Sea stock of beluga whales would be calculated to be 74 animals ($3,710 \times 0.02 \times 1.0$). However, the 2005 revisions to the SAR guidelines (NMFS 2005) state that abundance estimates older than 8 years should not be used to calculate PBR due to a decline in confidence in the reliability of an aged abundance estimate. Therefore, the PBR for this stock is considered undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

Three different commercial fisheries that could have interacted with beluga whales from this stock were monitored for incidental take by fishery observers during 1990-97: Bering Sea (and Aleutian Islands) groundfish trawl, longline, and pot fisheries. Observers did not report any mortality or serious injury of beluga whales incidental to these groundfish fisheries. In the nearshore waters of the southeastern Chukchi Sea, substantial effort occurs in gillnet (mostly set nets), and personal-use fisheries. Although a potential source of mortality, there have been no reported takes of beluga whales as a result of these fisheries.

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

The subsistence take of beluga whales from the eastern Chukchi Sea stock is provided by the Alaska Beluga Whale Committee (ABWC). The most recent subsistence harvest estimates for the stock are provided in Table 21 (Frost and Suydam in press, Alaska Beluga Whale Committee, 18 February 2010). Given these data, the annual subsistence take by Alaska Natives averaged 94 belugas landed during the 5-year period 2005-2009 based on reports from ABWC representatives and on-site harvest monitoring. Data on beluga that were struck and lost have not been quantified and are not included in these estimates.

Table 21. Summary of the number of beluga whales landed by the Alaska Native subsistence harvest of eastern Chukchi Sea beluga whales, 2005-2009.

2005	43
2006	31
2007	270
2008	74
2009	53
Mean annual number of animals landed (2005-2009):	94.2

STATUS OF STOCK

The estimated minimum annual mortality rate incidental to U. S. commercial fisheries (0) is not known to exceed 10% of the PBR (7) and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate. Based on currently available data, the estimated annual rate of human-caused mortality and serious injury (94) would exceed the PBR (74) if a PBR were to be calculated based on the most recent abundance estimate of 3,710. Because this estimate is based on surveys from 1989-1991 and is greater than 8 years old, the PBR for this stock is considered undetermined. Eastern Chukchi Sea beluga whales are not listed as “depleted” under the MMPA or listed as “threatened” or “endangered” under the Endangered Species Act. Therefore, the eastern Chukchi Sea stock of beluga whales is not classified as a strategic stock. The population size is considered stable; however, at this time it is not possible to assess the status of this stock relative to its Optimum Sustainable Population size.

HABITAT CONCERNS

Evidence indicates that the Arctic climate is changing significantly and that one result of the change is a reduction in the extent of sea ice in at least some regions of the Arctic (ACIA 2004, Johannessen et al. 2004). These changes are likely to affect marine mammal species in the Arctic. Ice-associated animals, such as the beluga whale, may be sensitive to changes in Arctic weather, sea-surface temperatures, or ice extent, and the concomitant effect on prey availability. Currently, there are insufficient data to make reliable predictions of the effects of Arctic climate change on beluga whales, but Laidre et al. (2008) and Heide-Jørgensen et al. (2010) concluded that on a worldwide basis belugas were likely to be less sensitive to climate change than other arctic cetaceans because of their wide distribution and flexible behavior. Increased human activity in the Arctic, including increasing oil and gas exploration and development, and increased nearshore development, have the potential to impact habitat for beluga whales (Moore et al. 2000, Lowry et al. 2006), but predicting the type and magnitude of the impacts is difficult at this time.

CITATIONS

- ACIA. 2004. Impacts of a Warming Arctic: Arctic Climate Impact Assessment. Cambridge University Press, Cambridge, U.K.
- Brodie, P. F. 1971. A reconsideration of aspects of growth, reproduction, and behavior of the white whale with reference to the Cumberland Sound, Baffin Island, population. *J. Fish. Res. Bd. Can.* 28:1309-1318.
- DeMaster, D.P. 1995. Minutes from the 4-5 and 11 January 1995 meeting of the Alaska Scientific Review Group, Anchorage, Alaska. 27 pp. + appendices. (available upon request - D. P. DeMaster, Alaska Fisheries Science Center, 7600 Sand Point Way, NE, Seattle, WA 98115).
- DeMaster, D. P. 1997. Minutes from fifth meeting of the Alaska Scientific Review Group, 7-9 May 1997, Seattle, Washington. 21 pp. + appendices. (available upon request - D. P. DeMaster, Alaska Fisheries Science , 7600 Sand Point Way, NE, Seattle, WA 98115).
- DeMaster, D. P., W. Perryman, and L. F. Lowry. 1998. Beluga whale surveys in the eastern Chukchi Sea, July, 1998. Alaska Beluga Whale Committee Rep. 98-2. 16 pp.
- 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.
- Finley, K. J. 1982. The estuarine habitat of the beluga or white whale, *Delphinapterus leucas*. *Cetus* 4:4-5.
- 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.
- Frost, K. J., L. F. Lowry, and G. Carroll. 1993. Beluga whale and spotted seal use of a coastal lagoon system in the northeastern Chukchi Sea. *Arctic* 46:8-16.
- Frost, K. J., and L. F. Lowry. 1995. Radio tag based correction factors for use in beluga whale population estimates. Working paper for Alaska Beluga Whale Committee Scientific Workshop, Anchorage, AK, 5-7 April 1995. 12 pp. (available upon request- Alaska Dept. Fish and Game, 1300 College Rd., Fairbanks, AK 99701).
- Frost, K. J., and R. S. Suydam. *In Press*. Subsistence harvest of beluga or white whales (*Delphinapterus leucas*) in northern and western Alaska 1987-2006. *J. Cetacean Res. Manage.*
- Gurevich, V. S. 1980. Worldwide distribution and migration patterns of the white whale (beluga), *Delphinapterus leucas*. *Rep. Int. Whal. Comm.* 30:465-480.
- 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.
- Heide-Jørgensen, M., Laidre, K., Borchers, D., Marques, T., Stern, H. and Simon, M. 2010. The effect of sea-ice loss on beluga whales (*Delphinapterus leucas*) in West Greenland. *Polar Res.*, 29: 198–208. doi: 10.1111/j.1751-8369.2009.00142.x
- Johannessen, O. M., L. Bengtson, M. W. Miles, S. I. Kuzmina, V. A. Semenov, G. V. Alexseev, A. P. Nagurnyi, V. F. Zakharov, L. P. Bobylev, L. H. Pettersson, K. Hasselmann, and H. P. Cattle. 2004. Arctic climate change: observed and modeled temperature and sea-ice variability. *Tellus.* 56A:328-341.
- Laidre, K. L., I. Stirling, L. Lowry, Ø. Wiig, M. P. Heide-Jørgensen, and S. Ferguson. 2008. Quantifying the sensitivity of arctic marine mammals to climate-induced habitat change. *Ecol. Appl.* 18(2):S97-S125.
- Lowry, L. F. 1985. The belukha whale (*Delphinapterus leucas*). Pp. 3-13 *In* J. J. Burns, K. J. Frost, and L. F. Lowry (eds.), *Marine mammals species accounts*. Alaska Dep. Fish and Game, Game Tech. Bull. 7.
- Lowry, L., and K. Frost. 2001. Beluga whale surveys in the Chukchi Sea, July 2001. Alaska Beluga Whale Committee Rep. 01-1 submitted to NMFS, Juneau, AK. 9 pp.
- Lowry, L., and K. Frost. 2002. Beluga whale surveys in the eastern Chukchi Sea, July 2002. Alaska Beluga Whale Committee Rep. 02-2 submitted to NMFS, Juneau, AK. 10 pp.
- 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.
- Moore, S.E., K.W. Sheldon, 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.
- NMFS. 2005. Guidelines for Preparing Stock Assessment Reports Pursuant to Section 117 of the Marine Mammal Protection Act, SAR Guidelines Revisions, June 2005, 24 pp.
- 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.

- Reeves, R. R. 1990. An overview of the distribution, exploitation and conservation status of belugas, worldwide. Pp. 47-58 *In* J. Prescott and M. Gauquelin (eds.), *For the future of the beluga: Proceedings of the International Forum for the Future of the Beluga*. Univ. Quebec Press, Canada.
- Sergeant, D. E., and P. F. Brodie. 1969. Body size in white whales, *Delphinapterus leucas*. *J. Fish. Res. Bd. Can.* 26:2561-2580.
- Shelden, K. E. W., 1994. Beluga whales (*Delphinapterus leucas*) in Cook Inlet - A review. Appendix *In* Withrow, D. E., K. E. W. Shelden, and D. J. Rugh. Beluga whale (*Delphinapterus leucas*) distribution and abundance in Cook Inlet, summer 1993. Annual report to the MMPA Assessment Program, Office of Protected Resources, NMFS, NOAA, 1335 East-West Highway, Silver Spring, MD 20910.
- Small, R. J., and D. P. DeMaster. 1995. Alaska marine mammal stock assessments 1995. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-57, 93 pp.
- Suydam, R. S., L. F. Lowry, and K. J. Frost. 2005. Distribution and movements of beluga whales from the eastern Chukchi Sea stock during summer and early autumn. OCS Study MMS 2005-035 Final Report. 48 pp.
- Suydam, R. S., L. F. Lowry, K. J. Frost, G. M. O'Corry-Crowe, and D. Pikok, Jr. 2001. Satellite tracking of eastern Chukchi Sea beluga whales in to the Arctic Ocean. *Arctic*. 54(3):237-243.
- Suydam, R. S. 2009. Age, growth, reproduction, and movements of beluga whales (*Delphinapterus leucas*) from the eastern Chukchi Sea. Ph.D. Dissertation, University of Washington, School of Aquatic and Fishery Sciences.
- 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.