

NARWHAL (*Monodon monoceros*): Unidentified Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Narwhals are found year-round north of 60°N, primarily in the waters of the Canadian Arctic, Hudson Bay, Baffin Bay, Davis Strait, West Greenland, East Greenland, and the waters around Svalbard, Franz Josef Land, and Novaya Zemlya (Gjertz 1991, Jefferson et al. 2012, Higdon and Ferguson 2014). While large aggregations are found in eastern Arctic waters, they rarely occur in the western Arctic, namely the East Siberian, Bering, Chukchi, and Beaufort seas (COSEWIC 2004) (Fig. 1). The three recognized narwhal populations are based on geographic separation: Baffin Bay, Hudson Bay, and East Greenland (DFO 1998a, 1998b; COSEWIC 2004). The Baffin Bay population summers in the waters along West Greenland and the Canadian High Arctic and overwinters in Baffin Bay and Davis Strait (Koski and Davis 1994, Dietz et al. 2001, Heide-Jørgensen et al. 2003). Narwhals from the northwest Hudson Bay population are thought to overwinter in eastern Hudson Strait (Richard 1991). The East Greenland population is believed to winter in the pack ice between eastern Greenland and Svalbard (Dietz et al. 1994). A poorly described population inhabits the waters around Svalbard, Franz Josef Land, and Novaya Zemlya (Gjertz 1991, Lydersen et al. 2007). The amount of interchange between these populations is unknown. Populations are defined for management purposes, and these designated populations may actually consist of several populations (COSEWIC 2004). Population definition based on molecular genetic studies of narwhals remains unresolved at this time due to extremely low genetic variability within and among management stocks (Palsbøll et al. 1997; de March et al. 2001, 2003).

Local observations and traditional ecological knowledge are the primary source for any data on narwhals in Alaska waters, dating back to the 1800s (Bee and Hall 1956; Geist et al. 1960; Noongwook et al. 2007; George and Suydam, unpubl. ms.). The earliest record dates back to 1874, with most occasional sightings occurring around the area east of Point Barrow (Scammon 1874, Ray and Murdoch 1885, Turner 1886, Nelson and True 1887, Murdoch 1898, MacFarlane 1905, Dufresne 1946, Anderson 1947, Bee and Hall 1956, Geist et al. 1960). Narwhal occurrences are reported in Bee and Hall (1956) from Point Barrow to the Colville River Delta. Ljungblad et al. (1983) reported a sighting of two male narwhals northwest of King Island in the Bering Sea, during a systematic scientific survey. Sightings have occurred in Russian waters of the northern Chukchi Sea (Yablokov and Bel'kovich 1968, Reeves and Tracey 1980). George and Suydam (unpubl. ms.) summarized observations from Alaska Native hunters during eight sightings of narwhals in the Chukchi and Beaufort seas between 1989 and 2008. Of these records, seven sightings were live animals totaling 11-12 individuals; one record was of a beachcast narwhal tusk at Cape Sabine. Four of the seven live narwhal sightings consisted of mixed groups of belugas and narwhals (George and Suydam, unpubl. ms.).

Several narwhal specimens collected in Alaska have been documented. Murie (1936) reported a single tusk that was found on a sandbar at Cape Chibukak, St. Lawrence Island. Huey (1952) reported on a specimen collected near Cape Halkett, Harrison Bay, at the mouth of the Colville River, in the Beaufort Sea. Three additional specimen records from various locations were documented in Geist et al. (1960): one specimen was found on the beach of Kiwalik Bay (Kotzebue Sound), another was initially sighted alive at the mouth of the Caribou River in Nelson Lagoon (Alaska Peninsula) but later died, and a third specimen was a tusk found on a beach near Wainwright, on the Chukchi Sea.



Figure 1. Potential distribution of narwhals in arctic waters based on extralimital sightings and strandings (George and Suydam, unpubl. ms.; Reeves and Tracey 1980; COSEWIC 2004).

It is believed that these incidental narwhal records that occurred in the Beaufort, Chukchi, and Bering seas and Bristol Bay are whales from the Baffin Bay population, which are known to move into the Canadian Arctic Archipelago and as far north and west as ice conditions will permit (COSEWIC 2004). However, there is no evidence or method to confirm this. There are insufficient data to apply the phylogeographic approach to stock structure (Dizon et al. 1992) for narwhals.

POPULATION SIZE

Reliable estimates of abundance for narwhals in Alaska are currently unavailable.

Minimum Population Estimate

At this time, it is not possible to produce a reliable minimum population estimate (N_{MIN}) for this stock, as current estimates of abundance are unavailable.

Current Population Trend

At present, reliable data on trends in population abundance are unavailable.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for narwhals in Alaska. Hence, until additional data become available, it is recommended that the cetacean maximum theoretical net productivity rate (R_{MAX}) of 4% be employed (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: $PBR = N_{MIN} \times 0.5R_{MAX} \times F_R$. The recovery factor (F_R) for these stocks is 0.5, the value for cetacean stocks with unknown population status (Wade and Angliss 1997). However, in the absence of a reliable estimate of a minimum abundance, the PBR for this stock is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fisheries Information

There are no U.S. commercial fisheries operating within the normal range of narwhals in Alaska. There are no observer program records of narwhal mortality or serious injury incidental to commercial fisheries in Alaska. The estimated mean annual mortality and serious injury rate incidental to U.S. commercial fisheries is zero.

Subsistence/Native Harvest Information

There is no known subsistence harvest of narwhals by Alaska Natives.

STATUS OF STOCK

Narwhals are not designated as depleted under the MMPA or listed as threatened or endangered under the Endangered Species Act. Reliable estimates of the minimum population, population trend, PBR, and status of the stock relative to its Optimum Sustainable Population are currently not available. There are no federal or state commercial fisheries operating in the marine waters of the Arctic, and there are no reports of mortality or serious injury of narwhals in Alaska, therefore, the mean annual mortality and serious injury rate is considered insignificant and approaching zero. The estimated annual rate of human-caused mortality and serious injury is believed to be zero for this stock. Thus, the Unidentified stock of narwhals in Alaska is not classified as strategic.

HABITAT CONCERNS

Narwhals tend to prefer heavy ice cover in the winter and animals studied in Baffin Bay chose areas associated with high concentrations of Greenland halibut, which correspond to the coldest bottom temperatures (Laidre et al. 2004b; Laidre and Heide-Jørgensen 2005b, 2011). Narwhals wintering in Hudson Strait are also found in ice-covered areas of deep water, but the maximum depths are much shallower than the areas used by narwhals in Baffin Bay (Laidre et al. 2003, 2004a). As the Arctic warms through climate change, ice cover will be thinner, form later, melt earlier, and be less predictable. A warming Arctic will also see changes in ocean currents which create conditions that support concentrations of winter narwhal prey species, such as Greenland halibut. This may result in a shift in distribution of narwhals and their prey, requiring changes in migration timing, as well as destinations

(Kovaks and Lydersen 2008; Laidre et al. 2008, 2010, 2015). An increased risk of ice entrapment is associated with the changes in sea-ice formation, because seasonal cues for the timing of freeze up have changed and because later freezing may result in large expanses of open water freezing at one time (Heide-Jørgensen et al. 2002, Heide-Jørgensen and Laidre 2004, Laidre and Heide-Jørgensen 2005a, Laidre et al. 2012).

In addition to changing sea ice, narwhals are threatened by a number of changes associated with warming of the Arctic, including increased shipping and development, which adds noise; risk of pollution and ship strikes; risk of predation by killer whales (*Orcinus orca*) (Laidre et al. 2006); shifts in prey abundance and distribution; and exposure to novel diseases (Laidre et al. 2015).

CITATIONS

- Anderson, R. M. 1947. Catalogue of Canadian recent mammals. Bull. Natl. Mus. Canada, Biol. Ser. No. 31: vi + 238 p.
- Bee, J. W., and E. R. Hall. 1956. Mammals of northern Alaska on the Arctic slope. Univ. Kansas Mus. Nat. Hist., Misc. Publ. No. 8. 309 p.
- Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2004. COSEWIC assessment and update status report on the narwhal, *Monodon monoceros*, in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. vii + 50 p. Available online: http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_narwhal_e.pdf. Accessed December 2016.
- de March, B. G. E., L. D. Maiers, and D. Tenkula. 2001. A preliminary analysis of the molecular genetics of narwhal (*Monodon monoceros*) samples collected from Canadian and adjacent waters from 1982 to 2000. Canada/Greenland Joint Commission on the Management and Conservation of Narwhal and Beluga (JCNB), Scientific Working Group, Quqetarsuaq, Greenland, May 9-13, 2001. Document No. SWG-2001-10.
- de March, B. G. E., D. A. Tenkula, and L. D. Postma. 2003. Molecular genetics of narwhal (*Monodon monoceros*) from Canada and West Greenland (1982-2001). Department of Fisheries and Oceans Canada, Canadian Science Advisory Secretariat Research Document 2003/080. 23 p.
- Department of Fisheries and Oceans Canada (DFO). 1998a. Hudson Bay narwhal. Department of Fisheries and Oceans Canada, Central and Arctic Region, DFO Sci. Stock Status Rep. E5-44. 5 p.
- Department of Fisheries and Oceans Canada (DFO). 1998b. Baffin Bay narwhal. Department of Fisheries and Oceans Canada, Central and Arctic Region, DFO Sci. Stock Status Rep. E5-43. 5 p.
- Dietz, R., M. P. Heide-Jørgensen, E. Born, and C. M. Glahder. 1994. Occurrence of narwhals (*Monodon monoceros*) and white whales (*Delphinapterus leucas*) in East Greenland. Medd. Grøn. Biosci. 39:69-86.
- Dietz, R., M. P. Heide-Jørgensen, P. R. Richard, and M. Acquarone. 2001. Summer and fall movements of narwhals (*Monodon monoceros*) from northeastern Baffin Island towards northern Davis Strait. Arctic 54:244-261.
- 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.
- Dufresne, F. 1946. Alaska's Animals and Fishes. A. S. Barnes, New York. xviii + 297 p.
- Geist, O. W., J. L. Buckley, and R. H. Manville. 1960. Alaskan records of the narwhal. J. Mammal. 41(2):250-253.
- George, J. C., and R. Suydam Unpubl. manuscript. Recent observations of narwhal in the Chukchi and Beaufort Seas by local hunters, 13 January 2009. 3 p. Available from Marine Mammal Laboratory, Alaska Fisheries Science Center, 7600 Sand Point Way NE, Seattle, WA 98115.
- Gjertz, I. 1991. The narwhal, *Monodon monoceros*, in the Norwegian High Arctic. Mar. Mammal Sci. 7:402-408.
- Heide-Jørgensen, M. P., and K. L. Laidre. 2004. Declining open water refugia for top predators in Baffin Bay and adjacent waters. Ambio 33(8):488-495.
- Heide-Jørgensen, M. P., P. Richard, M. Ramsay, and S. Akeagok. 2002. Three recent ice entrapments of arctic cetaceans in West Greenland and the eastern Canadian High Arctic. NAMMCO Scientific Publications 4:143-148. DOI: 10.7557/3.2841.
- Heide-Jørgensen, M. P., R. Dietz, K. L. Laidre, P. R. Richard, J. Orr, and H. C. Schmidt. 2003. The migratory behaviour of narwhals (*Monodon monoceros*). Can. J. Zool. 81:1298-1305.
- Higdon, J. W., and S. H. Ferguson. 2014. History of narwhal aerial surveys and abundance estimates in the Canadian Arctic. Working Paper NAMMCO/SC/21-JCNB/SWG/2014-JWG/09 presented at NAMMCO/JCNB Joint Working Group on narwhals and belugas, 10-12 March 2014, Copenhagen, Denmark.
- Huey, L. M. 1952. An Alaskan record of the narwhal. J. Mammal. 33:496.

- Jefferson, T. A., L. Karkzmariski, K. Laidre, G. O'Corry-Crowe, R. Reeves, L. Rojas-Bracho, E. Secchi, E. Slooten, B. D. Smith, J. Y. Wang, and K. Zhou. 2012. *Monodon monoceros*. The IUCN Red List of Threatened Species. Version 2014.2.
- Koski, W. R., and R. A. Davis. 1994. Distribution and numbers of narwhals (*Monodon monoceros*) in Baffin Bay and Davis Strait. *Medd. Grøn. Biosci.* 39:15-40.
- Kovacs, K. M., and C. Lydersen. 2008. Climate change impacts on seals and whales in the North Atlantic Arctic and adjacent shelf seas. *Sci. Prog.* 91(Pt. 2):117-150.
- Laidre, K. L., and M. P. Heide-Jørgensen. 2005a. Arctic sea ice trends and narwhal vulnerability. *Biol. Conserv.* 121:509-517.
- Laidre, K. L., and M. P. Heide-Jørgensen. 2005b. Winter feeding intensity of narwhals (*Monodon monoceros*). *Mar. Mammal Sci.* 21:45-57.
- Laidre, K. L., and M. P. Heide-Jørgensen. 2011. Life in the lead: extreme densities of narwhals in the offshore pack ice. *Mar. Ecol. Prog. Ser.* 423:269-278.
- Laidre, K. L., M. P. Heide-Jørgensen, R. Dietz, R. C. Hobbs, and O. A. Jørgensen. 2003. Deep-diving by narwhals, *Monodon monoceros*: differences in foraging behavior between wintering areas? *Mar. Ecol. Prog. Ser.* 261:269-281.
- Laidre, K. L., M. P. Heide-Jørgensen, O. A. Jørgensen, and M. A. Treble. 2004a. Deep ocean predation by a high Arctic cetacean. *ICES J. Mar. Sci.* 61(3):430-440.
- Laidre, K. L., M. P. Heide-Jørgensen, M. L. Logsdon, R. C. Hobbs, P. Heagerty, R. Dietz, O. A. Jørgensen, and M. A. Treble. 2004b. Seasonal habitat associations of narwhals in the high Arctic. *Mar. Biol.* 145:821-831.
- Laidre, K. L., M. P. Heide-Jørgensen, and J. Orr. 2006. Reactions of narwhals, *Monodon monoceros*, to killer whale, *Orcinus orca*, attacks in the eastern Canadian Arctic. *Can. Field-Nat.* 120:457-465.
- 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.
- Laidre, K. L., M. P. Heide-Jørgensen, W. Ermold, and M. Steele. 2010. Narwhals document continued warming of southern Baffin Bay. *J. Geophys. Res.* 115:C10049.
- Laidre, K. L., M. P. Heide-Jørgensen, H. Stern, and P. Richard. 2012. Unusual sea ice entrapments and delayed autumn ice-up timing reinforce narwhal vulnerability to climate change. *Polar Biol.* 35(1):149-154.
- Laidre, K. L., H. Stern, K. M. Kovacs, L. Lowry, S. E. Moore, E. V. Regehr, S. H. Ferguson, Ø. Wiig, P. Boveng, R. P. Angliss, E. W. Born, D. Litovka, L. Quakenbush, C. Lydersen, D. Vongraven, and F. Ugarte. 2015. Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century. *Conserv. Biol.* 29(3):724-737.
- Ljungblad, D. K., S. E. Moore, and D. R. Van Schoik. 1983. Aerial surveys of endangered whales in the Beaufort, eastern Chukchi and northern Bering seas, 1982. NOSC Technical Document 605. 110 p + appendix.
- Lydersen, C., A. R. Martin, I. Gjertz, and K. M. Kovacs. 2007. Satellite tracking and diving behaviour of sub-adult narwhals (*Monodon monoceros*) in Svalbard, Norway. *Polar Biol.* 30:437-442.
- MacFarlane, R. 1905. Notes on mammals collected and observed in the northern Mackenzie River District, Northwest Territories of Canada. *Proc. U.S. Nat. Mus.* 28:673-764.
- Murdoch, J. 1898. The animals known to the Eskimos of Northwestern Alaska. *Amer. Nat.* 32:719-734.
- Murie, O. J. 1936. Notes on the mammals of St. Lawrence Island, Alaska, p. 337-326. *In* Archaeological excavations at Kukulik, St. Lawrence Island, Alaska. Univ. Alaska, Misc. Publ. 2.
- Nelson, E. W., and F. W. True. 1887. Mammals of northern Alaska. Pt. 2, p. 227-293. *In* Report upon natural history collections made in Alaska between the years 1877 and 1881 by Edward W. Nelson. Arctic Publ. No. 3, Signal Service, U.S. Army
- Noongwook, G., The Native Village of Savoonga, The Native Village of Gambell, H. P. Huntington, and J. C. George. 2007. Traditional knowledge of the bowhead whale (*Balaena mysticetus*) around St. Lawrence Island, Alaska. *Arctic* 60 (1):47-54.
- Palsbøll, P. J., M. P. Heide-Jørgensen, and R. Dietz. 1997. Genetic studies of narwhals, *Monodon monoceros*, from West and East Greenland. *Heredity* 78:284-292.
- Ray, P. H., and J. Murdoch. 1885. Report of the International Polar Expedition to Point Barrow, Alaska. Government Printing Office, Washington. 695 p.
- Reeves, R. R., and S. Tracey. 1980. *Monodon monoceros*. *Mamm. Species* 127:1-7.
- Richard, P. 1991. Abundance and distribution of narwhals (*Monodon monoceros*) in northern Hudson Bay. *Can. J. Fish. Aquat. Sci.* 48:276-283.

- Scammon, C. M. 1874. *The Marine Mammals of the Northwestern Coast of North America, Described and Illustrated: Together with an Account of the American Whale Fishery.* G. P. Putnam's Sons, New York. 319 p.
- Turner, L. M. 1886. *Contributions to the natural history of Alaska; results of investigations made chiefly in the Yukon District and the Aleutian Islands.* Arctic Publ. No. 2, Signal Service, U.S. Army. 226 p.
- 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 p.
- Yablokov A. V., and V. M. Bel'kovich. 1968. *Cetaceans of the Arctic; their proper utilization and conservation.* Probl. of the North, Nat. Res. Council, Ottawa 11:199-218.