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BELUGAS IN THE NORTH ATLANTIC AND THE RUSSIAN ARCTIC

ABSTRACTS

An overview of genetic relationships of Canadian and adjacent populations of belugas *(Delphinapterus leucas)* with emphasis on Baffin Bay and Canadian eastern Arctic populations

de March, B.G.E., Maiers, L. D., and Friesen, M.K. 2002. An overview of genetic relationships of Canadian and adjacent populations of belugas *(Delphinapterus leucas)* with emphasis on Baffin Bay and Canadian eastern Arctic populations. *NAMMCO Sci. Publ.* 4:17-38.

Our current knowledge of the molecular genetics of high Arctic beluga (*Delphinapterus leuca*s) populations (West Greenland, Lancaster Sound/Barrow Strait, Grise Fiord) and populations that are related (southeast Baffin, Beaufort Sea), is presented. In general, genetic analyses confirm the designation of putative stocks and suggest the existence of more stocks than previously described. Comparisons based on mitochondrial DNA haplotypes show that West Greenland (1992) belugas were significantly differentiated from Lancaster Sound/Barrow Strait, Kimmirut, Iqaluit, and/or Pangnirtung but not from Grise Fiord . Grise Fiord haplotypes were not significantly differentiated from Lancaster Sound/Barrow Strait and not from southeast Baffin locations in some years. Lancaster Sound and southeast Baffin collections were not significantly differentiated from each other. These patterns existed for most years within locations, however a few yearly collections within major locations had different patterns. The collections that differed were small groups with few haplotypes, most likely relatives. Patterns in microsatellite differentiation were slightly different than those for haplotypes. This may be due to the fact that individuals in sampled summering populations breed with individuals in other populations during migration or in overwintering areas. West Greenland and Grise Fiord microsatellites were not significantly differentiated from each other. However, Greenland differed from Lancaster Sound and southeast Baffin Island, while Grise Fiord did not. In southeast Baffin Island, Pangnirtung samples differed from Kimmirut using both haplotypes and microsatellites. Iqaluit samples had intermediate genetic characteristics between Pangnirtung and Kimmirut. Patterns of significant differentiation among collections within locations was believed to be due to a combination of temporal patterns, sampling of relatives, chance, seasonal hunting, small sample sizes, and actual differences among populations.

Analysis of mitochondrial control region nucleotide sequences from Baffin Bay belugas (*Delphinapterus leucas*): detecting pods or sub-populations?

Palsbøll, P.J., Heide-Jørgensen, M.P. and Bérubé, M. 2002. Analysis of mitochondrial control region nucleotide sequences from Baffin Bay belugas (*Delphinapterus leucas*): detecting pods or sub-populations? *NAMMCO Sci. Publ.* 4:39-50.

We report the results of an analysis of the variation in the nucleotide sequence of the mitochondrial control region obtained in 218 samples collected from belugas, *Delphinapterus leucas*, around the Baffin Bay. We detected multiple instances of significant heterogeneity in the distribution of genetic variation among the analyzed mitochondrial control region sequences on a spatial as well as temporal scale indicating a high degree of maternal population structure. The detection of significant levels of heterogeneity between samples collected in different years but within the same area and season was unexpected. Re-examination of earlier results presented by Brown Gladden and co-workers also revealed temporal genetic heterogeneity within the one area where sufficient (n>15) samples were collected in multiple years. These findings suggest that non-random breeding and maternally directed site-fidelity are not the sole causes of genetic heterogeneity among belugas but that a matrilineal pod structure might cause significant levels of genetic heterogeneity as well, even within the same area. We propose that a maternal pod structure, which has been shown to be the cause of significant genetic heterogeneity in other odontocetes, may add to the overall level of heterogeneity in the maternally inherited DNA and hence that much of the spatial heterogeneity observed in this and previous studies might be attributed to pod rather than population structure. Our findings suggest that it is important to estimate the contribution of pod structure to overall heterogeneity before defining populations or management units in order to avoid interpreting heterogeneity due to sampling of different pods as different populations/management units.

Stock identity of beluga (*Delphinapterus leucas*) in Eastern Canada and West Greenland based on organochlorine contaminants in their blubber

Innes, S., Muir, D.C.G., Stewart, R.E.A., Heide-Jørgensen, M.P. and Dietz, R. 2002. Stock identity of beluga (*Delphinapterus leucas*) in Eastern Canada and West Greenland based on organochlorine contaminants in their blubber. *NAMMCO Sci. Publ.* 4:51-68.

Beluga caught by hunters from various hamlets in the Arctic differed in the concentrations of organochlorine contaminants in their blubber. By applying Canonical Discriminant Analysis (CDA) it was possible to separate all seven sampling locations from each other. Over 90% of the samples could be classified back to their landing location based on the data transformations developed by CDA. This analysis suggested that "stock" or management unit for beluga is best described by the culturally transmitted behaviour of their migration route. The analysis also provides evidence that most beluga caught by hunters from Grise Fiord are not the same as beluga caught while migrating along West Greenland; that some beluga caught in Sanikiluaq are not the same as beluga caught in the Nastapoka River estuary; and that the beluga caught in Kimmirut are not the same as beluga caught in Cumberland Sound. There is a need to redefine the stock descriptions of some beluga in Canada and Greenland.

Distribution and migrations of cetaceans in the Russian Arctic according to observations from aerial ice reconnaissance

Belikov, S.E. and Boltunov, A.N. 2002. Distribution and migrations of cetaceans in the Russian Arctic according to observations from aerial ice reconnaissance. *NAMMCO Sci. Publ.* 4:69-86.

This paper is based on 748 observations of belugas (*Delphinapterus leucas*) and 382 observations of baleen whales in the Russian Arctic, the majority of the data provided by aerial reconnaissance of sea ice (ARSI). Although the data are not suitable for the estimation of the number and density of the animals, they represent a multi-year (1958-1995) range of observations to update our knowledge on the seasonal distribution and migrations of the species. Belugas inhabit not only shelf waters but also the zone of the shelf slope and the abyssal zone of the Arctic Ocean, where the animals appear mostly in summer. In winter belugas were observed only in the Barents Sea. In June-August, the frequency of beluga observations was highest in the Laptev Sea, which has previously been believed to have considerably lower numbers of beluga than the the Kara and Barents seas. Patterns of seasonal distribution and ice cover suggest the existence of a natural border preventing or reducing population exchange between belugas inhabiting western and eastern parts of the Russian Arctic. A brief review of available data on distribution of the narwhal (*Monodon monoceros*) in the Russian Arctic is also given. Two species of baleen whales were frequently seen in the Russian Arctic: the bowhead whale (*Balaena mysticetus*), and the grey whale (*Eschrichtius robustus*). The majority of such observations were made in the southeastern part of the East-Siberian Sea and the southern part of the Chukchi Sea. In the Bering Sea baleen whales were usually seen near the Chukotka Peninsula, in Anadyr Bay and southeast of it. Whales were usually seen in ice-free water: observations of whales among rarefied ice and near the ice edge were rare. There were considerable annual and seasonal variations in distribution and migrations of baleen whales in the region, probably caused mainly by the dynamics of ice conditions.

Distribution and abundance of Canadian High Arctic belugas, 1974-1979

Koski, W.R., Davis, R.A. and Finley, K.J. 2002. Distribution and abundance of Canadian High Arctic belugas, 1974-1979. *NAMMCO Sci. Publ.* 4:87-126.

We conducted >236,000 km of aerial surveys and some supplementary studies of belugas (*Delphinapterus leucas*) in the central and eastern Canadian High Arctic in 1974-79. Belugas that wintered in the "North Water" in Baffin Bay moved southwest into Lancaster Sound in April and early May. The main westward migration into Lancaster Sound occurred over a 2-3 week period during late June to late July. Estuaries along Somerset Island were occupied for =3 weeks from mid-July to mid-August. Little feeding occurred in estuaries. From mid-August until fall migration began in mid-September belugas occupied estuaries and offshore waters in Peel Sound. Fall migration eastward through Lancaster Sound was exclusively along the south coast of Devon Island, highly co-ordinated, and rapid; most of the population passed through the sound in <1 week. The whales then moved north along the east coast of Devon Island; some entered Jones

Sound while others crossed directly to SE Ellesmere Island. Most calving occurred in July and early August; calving was not been seen in estuaries and probably occurred offshore. Excluding calves, adults and yearlings formed 77% and 8.4%, respectively, of the population. The proportion of calves during mid-August was consistent with a triennial calving cycle. During late summer, belugas fed on coastal concentrations of polar cod (*Boreogadus saida*), under pan ice offshore (probably on cod), and in deep offshore waters. The size of the Canadian High Arctic population in the late 1970s was estimated to be at least 10,250-12,000 animals without allowing for animals that may have passed between surveys or that were below the surface at the time of the counts.

Catch statistics for belugas in West Greenland 1862 to 1999

Heide-Jørgensen, M.P. and Rosing-Asvid, A. 2002. Catch statistics for belugas in West Greenland 1862 to 1999. *NAMMCO Sci. Publ.* 4:127-142.

Information and statistics including trade statistics on catches of white whales or belugas (*Delphinapterus leucas*) in West Greenland since 1862 are presented. The period before 1952 was dominated by large catches south of 66^{o} N that peaked with 1,380 reported kills in 1922. Catch levels in the past five decades are evaluated on the basis of official catch statistics, trade in mattak (whale skin), sampling of jaws and reports from local residents and other observers. Options are given for corrections of catch statistics based upon auxiliary statistics on trade of mattak, catches in previous decades for areas without reporting and on likely levels of loss rates in different hunting operations. The fractions of the reported catches that are caused by ice entrapments of whales are estimated. During 1954-1999 total reported catches ranged from 216 to 1,874 and they peaked around 1970. Correcting for underreporting and killed-but-lost whales increases the catch reports by 42% on average for 1954-1998. If the whales killed in ice entrapments are removed then the corrected catch estimate is on average 28% larger than the reported catches.

Three recent ice entrapments of Arctic cetaceans in West Greenland and the eastern Canadian High Arctic

Heide-Jørgensen, M.P., Richard, P., Ramsay, M. and Akeeagok, S. 2002. Three recent ice entrapments of Arctic cetaceans in West Greenland and the eastern Canadian High Arctic. *NAMMCO Sci. Publ.* 4:143-148.

Three ice entrapments of Monodontids have been reported in the western North Atlantic since 1993. Hunters in Disko Bay, West Greenland, discovered one in March 1994 that included about 150 narwhals (*Monodon monoceros*). The entrapment occurred during a sudden cold period which caused ice to form rapidly. The trapped whales were subject to hunting, but about 50 of the killed whales could not be retrieved in the ice. The whales were trapped in a small opening in the ice and because of that they would probably have succumbed even if not discovered by hunters. Two entrapments involving white whales or belugas (*Delphinapterus leucas*) occurred in the eastern Canadian Arctic in May 1999; one in Lancaster Sound discovered by polar bear (*Ursus maritimus*) researchers and one

in Jones Sound discovered by hunters. The first included one bowhead whale (*Balaena mysticetus)* and about 40 belugas that were being preyed upon by polar bears. The second involved at least 170 belugas, of which about 100 were killed by polar bears and 17 were taken by hunters. The entrapments in Disko Bay and Jones Sound both occurred in areas where entrapments have previously been reported, whereas the one in Lancaster Sound was in a new area.

Belugas (*Delphinapterus leucas*) of the Barents, Kara and Laptev seas

Boltunov, A.N. and Belikov, S.E. 2002. Belugas (*Delphinapterus leucas*) of the Barents, Kara and Laptev seas. *NAMMCO Sci. Publ.* 4:149-168.

This paper reviews published information on the white whale or beluga (*Delphinapterus leucas*) inhabiting the Barents, Kara and Laptev seas. Some data obtained during multi-year aerial reconnaissance of sea ice in the Russian Arctic are also included. Ice conditions, considered one of the major factors affecting distribution of belugas, are described. The number of belugas inhabiting the Russian Arctic is unknown. Based on analysis of published and unpublished information we believe that the primary summer habitats of belugas in the Western Russian Arctic lie in the area of Frants-Josef Land, in the Kara Sea and in the western Laptev Sea. Apparently most belugas winter in the Barents Sea. Although it has been suggested that a considerable number of animals winters in the Kara Sea, there is no direct evidence for this. Apparent migrations of animals are regularly observed at several sites: the straits of the Novaya Zemlya Archipelago, the waters north of the archipelago, and Vilkitskiy Strait between the Kara and Laptev seas. Calving and mating take place in summer, and the beluga mother feeds a calf for at least a year. Females mature earlier than males, and about 30% of mature females in a population are barren.; Sex ratio is apparently close to 1:1. The diet of the beluga in the region includes fish and crustaceans and shows considerable spatial and temporal variations. However, Arctic cod (*Boreogadus saida*) is a main prey most of the year, and whitefish (*Coregonidae*) contribute in coastal waters in summer. Usually belugas form groups of up to 10 related individuals of different ages, while large aggregations are common during seasonal migrations or in areas with abundant and easily available food. Beluga whaling in Russia has a history of several centuries. The highest catches were taken in the 1950s and 1960s, when about 1,500 animals were caught annually in the Western Russian Arctic. In the 1990s, few belugas were harvested in the Russian Arctic. In 1999 commercial whaling of belugas in Russia was banned. Belugas can be caught only for research, cultural and educational purposes and for the subsistence needs of local people. With the absence of significant whaling, anthropogenic pollution seems to be the major threat for the species.

Surveys of belugas and narwhals in the Canadian High Arctic in 1996

Innes, S., Heide-Jørgensen, M.P., Laake, J.L., Laidre, K.L., Cleator, H.J., Richard, P. and R.E.A. Stewart, R.E.A. Surveys of belugas and narwhals in the Canadian High Arctic in 1996. *NAMMCO Sci. Publ.* 4:169-190.

The summer range of belugas (*Delphinapterus leucas*) and narwhals (*Monodon monoceros*) in Prince Regent Inlet, Barrow Strait and Peel Sound in the Canadian High Arctic was surveyed from 31 July to 3 August 1996 with a visual aerial survey of offshore areas and photographic aerial surveys of concentration areas. The visual survey estimate based on the number of belugas visible to the observers using systematic line transect methods was 10,347 (cv = 0.28). This included corrections for whales that were missed by the observers, observations without distance measurements and an estimate of 1,949 (cv=0.22) belugas from a photographic survey in southern Peel Sound. Using data from belugas tagged with satellite-linked time-depth recorders, the estimate was adjusted for individuals that were diving during the survey which resulted in an estimate of 18,930 belugas (cv = 0.28). Finally, counts of belugas in estuaries, corrected for estuarine surface time, were added to provide a complete estimate of 21,213 belugas (95% CI 10,985 to 32,619). The estimated number of narwhals corrected for sightings that were missed by observers was 16,364 (cv = 0.24). Adjusting this for sightings without distance information and correcting for whales that were submerged produced an estimate of 45,358 narwhals (95% CI 23,397 to 87,932).

Size and trends of the bowhead whale, beluga and narwhal stocks wintering off West Greenland

Heide-Jørgensen, M.P and Acquarone, M. 2002. Size and trends of the bowhead whale, beluga and narwhal stocks wintering off West Greenland. *NAMMCO Sci. Publ.* 4:191-210.

To assess the size and trends of the abundance of the bowhead whale (*Balaena mysticetus*), the beluga, or white whale (*Delphinapterus leucas*), and the narwhal (*Monodon monoceros*) visual aerial surveys were conducted in West Greenland in March 1998 and 1999. An estimated 49 bowhead whales (95% CI: 13-188) were present at the surface in 1998. Data from land-based observations enabled correction for bowhead whales that were not available at the surface to be seen during the survey. By applying a rounded average of 80% (SE=3) for submergence an estimate of 246 bowhead whales (95% CI: 62-978) in 1998 was obtained. The 76 and 47 sightings of beluga pods in 1998 and 1999, respectively, had distributions similar to those of previous surveys with the highest concentration at the northern edge of the northern part of Store Hellefiskebanke. No belugas were seen in the southernmost area between Maniitsoq and Paamiut. The index estimate of the abundance of belugas comparable with previous surveys was 929 (95% CI: 563-1,533) in 1998 and 735 (95% CI: 436-1,239) in 1999. When analysing the sightings as a line-transect survey and correcting for whales that were either submerged or at the surface but missed by the observers an estimated 7,941 (95% CI: 3,650-17,278) belugas wintered in West Greenland in 1998-1999. The uncorrected estimate of narwhal abundance was 524 (95% CI: 214-1,284) and correcting for the same biases as for the belugas gives a total abundance of 2,861 (95% CI: 954-8,578) narwhals in 1998-1999.

Resource assessment and projections for the belugas off West Greenland using the population model of HITTER-FITTER

Butterworth, D.S., Plagányi, É.E. and Geromont, H.F. 2001. Resource assessment and projections for the belugas off West Greenland using the population model of HITTER-FITTER. *NAMMCO Sci. Publ*. 4:211-224.

The population model of the HITTER-FITTER package is applied to compute trajectories for single and two stock scenarios for the beluga population wintering off West Greenland. Values of $MSYR^{1+}$ from 1% to 4% are considered, with results computed to hit best estimates and lower 5%-iles for total abundance in 1999. Twenty year projections show that even for the most optimistic of these options in the single stock case, the resource is rendered extinct within 20 years if recent estimated annual catch levels of some 700 are continued. A time series of relative abundance information from surveys indicates that $MSYR^{1+}$ may be no more than 0.5%. All scenarios considered are suggestive of a heavily depleted resource for which catch levels need to be substantially reduced to secure against possible further reduction of the population.

Status of the belugas of the St Lawrence estuary, Canada

Kingsley, M.C.S. 2002. Status of the belugas of the St Lawrence estuary, Canada. *NAMMCO Sci. Publ.* 4:239-258.

A population of belugas (*Delphinapterus leucas*) inhabiting the estuary of the St Lawrence river in Quebec, Canada, was depleted by unregulated hunting, not closed until 1979. Surveys in 1977 showed only a few hundred in the population. Surveys since then have produced increasing estimates of population indices. An estimate of the population, fully corrected for diving animals, was 1,238 (SE 119) in September 1997. The population was estimated to have increased from 1988 through 1997 by 31.4 belugas/yr (SE 13.1). Observations of population age structure, as well as data on age at death obtained from beach-cast carcasses, do not indicate serious problems at the population level, although there are indications that mortality of the oldest animals may be elevated. Few animals appear to live much over 30 years. From examination of beach-cast carcasses, it appears that most deaths are due to old age and disease; hunting is illegal, ship strikes and entrapments in fishing gear are rare, ice entrapments and predation are unknown. Among beach-cast carcasses recovered and necropsied, about 23% of the adults have malignant cancers, while most of the juveniles have pneumonia; other pathological conditions are diverse. No factors are known to be limiting numbers of this population. Habitat quality factors, including persistent contaminants, boat traffic and harassment, may affect the population's rate of increase, but these effects have not been quantitatively evaluated. Comprehensive legislation exists with powers to protect the population and the environment of which it is a component, but application and enforcement of the laws is not without problems.

Visibility of St Lawrence belugas to aerial photography, estimated by direct observation

Kingsley, M.C.S. and Gauthier, I. 2002. Visibility of St Lawrence belugas to aerial photography, estimated by direct observation. *NAMMCO Sci. Publ*. 4:259-270.

The depleted population of belugas (*Delphinapterus leucas*) inhabiting the St Lawrence estuary, Canada, was monitored by periodic photographic aerial surveys. In order to correct counts made on aerial survey film and so obtain an estimate of the true size of the population, the diving behaviour and the visibility from the air of these animals was studied. A Secchi-disk turbidity survey in the belugas' summer range showed that water clarity varied between 1.5 m and 11.6 m. By studying aerial photographs of sheet-plastic models of belugas that had been sunk to different depths below the surface, we found that models of white adults could be seen down to about the same depth as a Secchi disk, but no deeper. Smaller models of dark-grey juveniles could only be seen down to about 50 % of Secchi-disk depth. By observing groups of belugas from a hovering helicopter and recording their disappearances and re-appearances, it was found that they were visible for 44.3% of the time, and that an appropriate correction for single photographs would be to multiply the photographic count by about 222% (SE 20%). For surveys in which there was overlap between adjacent frames, the estimated correction would be 209% (SE 16%). This correction factor was slightly conservative and gave an estimate of the true size of the population, based on a single survey, of 1,202 belugas (SE 189) in 1997. An estimate for 1997 based on smoothing 5 surveys 1988–1997 was 1,238 (SE 119).