

NORWAY. PROGRESS REPORT ON CETACEAN RESEARCH, JANUARY 2002 TO DECEMBER 2002, WITH STATISTICAL DATA FOR THE CALENDAR YEAR 2002

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This report summarises information obtained from: the University of Tromsø: the Department of Arctic Biology (UIT-AAB) and the Norwegian College of Fishery Science (UIT-NFH), the University of Oslo, Zoological Museum (UIO-ZM), the Norwegian School of Veterinary Science, Department of Arctic Veterinary Medicine, Tromsø (NVH-IAV), the National Veterinary Institute (VI), the Institute of Marine Research, Bergen (IMR), the Norwegian Institute of Fisheries and Aquaculture, Tromsø (NIFA), and the Norwegian Polar Institute, Tromsø (NP).

1. Species and stocks studied

Common name	Scientific name	Area/stock(s)	Items referred to
Bowhead whale	<i>Balaena mysticetus</i>	Arctic Ocean	9
Harbour porpoise	<i>Phocoena phocoena</i>	Norwegian coastal waters	4.3
Humpback whale	<i>Megaptera novaeangliae</i>	North Atlantic	3.1.1; 4.1
Killer whale	<i>Orcinus orca</i>	Northeast Atlantic	3.2; 4.1; 9
Minke whale	<i>Balaenoptera acutorostrata</i>	Northeast Atlantic	2.1.1; 2.2; 3.1.3; 3.2; 4.1; 4.2; 4.4; 5; 6.1; 9
White whale	<i>Delphinapterus leucas</i>	Svalbard	9
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>	Northeast Atlantic	4.1

2. Sightings data

2.1 Field work

2.1.1 SYSTEMATIC

During the period 19 June to 6 August 2002 a sighting survey was conducted with two vessels covering the central Norwegian Sea and the coastal area off Finnmark, northern Norway. This was the first year of a new six-year program 2002-2007 to cover the northeast Atlantic to provide a new abundance estimate of minke whales every sixth year as part of the management scheme established for this species. (IMR)

2.1.2 OPPORTUNISTIC, PLATFORMS OF OPPORTUNITY

In August/September mapping of whale distributions was conducted during 0-group fish surveys in the Barents Sea. (IMR)

Incidental observations of marine mammals have been collected from research survey vessels and Coastguard vessels. Recorded data include date, position, species and numbers. (IMR)

2.2 Analyses/development of techniques

A new estimate for Northeast Atlantic minke whales based on the survey data collected over the six-year period 1996-2001 has been presented (SC/55/NAM1). The estimate indicates a more westerly distribution pattern compared to earlier surveys, however, no specific cause of this has been revealed. (IMR)

3. Marking data

3.1 Field work

3.1.1 NATURAL MARKING DATA

During the minke whale sightings survey (see 2.1.1) fluke photoes of humpback whales were collected from the central Norwegian Sea and the coastal area off Finnmark, northern Norway. (IMR)

3.1.3 TELEMETRY DATA

In May one minke whale was VHF tagged in the North Sea, and dive time data were collected for about four hours. (IMR)

During the sightings survey in the central Norwegian Sea and the coastal area off Finnmark, northern Norway. instrumentation of minke whales with VHF tags for collecting dive time information was conducted, and two whales were followed for about two days. (IMR)

During commercial minke whale catch operations off Jan Mayen attachment devices for VHF and satellite instruments were tested. (IMR)

3.2 Analyses/development of techniques

Dive time data collected by VHF tagging have been analysed. Blow rates calculated are comparable to earlier data collected by VHF instrumentation and visual experiments. (IMR)

Data from seven killer whales instrumented with satellite tags in 2000 and 2001 are being analysed. The tag that functioned longest was a so-called SPOT tag, which is very small in size and transmits only data on the position of the whale. This tag transmitted data 30.11.2001 – 14.9.2002. These data are now being worked up to describe movement patterns, home ranges and dive behaviour. (IMR)

4. Tissue/biological samples collected

4.1 Biopsy samples

During the minke whale sightings survey (see 2.1.1.) biopsy samples were collected from several whale species, including white-beaked dolphins, killer whales, humpback, and minke whales.

Biopsy samples were collected in November for a pilot project on the ecotoxicology of killer whales. (NIFA, UIT-NFH, NP)

4.2 Samples from directed catches

During the commercial whaling season (May-June), stomach samples, body condition data and biological material for studies of demography, reproduction and pollutants were collected from minke whales by scientific personnel on four of the participating vessels. Additionally, tissue materials for studies of stock identity were collected by governmental inspectors from all whales taken by the other vessels participating in the Norwegian small type whaling. (NIFA)

Biological material and especially material relevant for studying alternative age determination techniques for baleen whales, was collected during the commercial minke whale catch operations off Jan Mayen. (IMR)

4.3 Samples from stranded animals

Feeding and reproduction of harbour porpoises are being studied based on material collected in recent years from by-caught animals. (IMR)

4.4 Analyses/development of techniques

Studies of a number of alternative methods, including an evaluation of current methods, for age determination of minke whales have been finalised. Age estimation of minke whales based on reading growth zones in bullae has been shown to be of little use. This conclusion is based on experiments where several readers have done multiple readings of bullae sections and then compared to other length-related parameters like total length and number of ovulations. Growth structures in mandibles have also been investigated but not found to be formed at a regular rate with poor agreement in within and between reader estimates. The contents of specific fatty acids in blubber seem to be correlated to age. Age estimation of minke whales using the aspartic acid racemization reaction is also apparently a promising technique. (IMR)

Preliminary analyses of minke whale stock structure based on the established DNA register were presented to the IWC Scientific Committee. Mitochondrial DNA indicates differences between the Jan Mayen area and the other

catching areas used by Norwegian whalers in the northeast Atlantic, while microsatellite DNA does not show this pattern. (IMR)

Data on the stock identity of minke whales have been analysed and presented using methods based on analyses of DNA, organochlorines, heavy metals, stable isotopes and fatty acid signatures. (NIFA, IMR)

Stomach content samples from minke whales have been analysed using traditional methods where the original biomass of prey items are reconstructed based on remaining hard parts in the contents. Acoustic and biological data from prey estimate surveys on the whaling grounds have also been analysed. (NIFA, UIT-NFH)

Methods used in diet studies of cetaceans have been assessed. (NIFA)

Recent studies of minke whale foraging ecology have been reviewed. (NIFA, NFH-UIT)

Data on temporal diet variations and prey selectivity of Northeast Atlantic minke whales have been analysed and presented. (NIFA, NFH-UIT)

The scientific whaling under special permit and subsequent establishment of a routine sampling scheme during commercial whaling operations have yielded a time series (1992-2001) which permits assessment of spatial, seasonal and year-to-year variations in diets, of foraging behaviour, of prey selectivity, and of the total annual consumption by the minke whales. The collected data has also permitted multispecies modelling exercises with minke whales involved. The dietary composition of the northeast Atlantic minke whales varies considerably both in space and time, presumably due to geographic differences in the distribution and abundance of potential prey. The whales exploit a multiplicity of species, and sizes, of fish and crustaceans. In general, they find capelin, herring and, occasionally, krill more preferable than other prey, which may have several contributory explanations such as mobility, schooling behaviour, prey refuge use and other anti-predator responses. Apparently, minke whales switched to other prey in years of low densities of herring and capelin, thereby reducing the mortality on these two fish species. Although results from the multispecies modelling exercises should be taken as tentative, they all point in the same direction, i.e., that minke whale abundance may affect important fisheries. They show that, for the Barents Sea, it is possible to make predictions regarding ecosystem changes, following a specific management manipulation or change in the ecosystem, that are accurate within an order of the actual response. The results given demonstrate the usefulness of performing ecological investigations over a range of scales. The minimum requirement of data for both the small, medium and large scale investigations are information on the relative diet composition of the animals. Recent reviews of methods used in studies of marine mammal diets have concluded that, although identifying and measuring items in vomit, scats, and gastrointestinal contents have several disadvantages and sources of errors, it provides more information at considerably less cost than other methods (such as fatty acid signatures, stable isotopes and genetics), and cannot be replaced effectively by any other method at present. To assess the large scale variations on population level, information about the body condition of the whales is also of interest. To put the large scale results in an ecological perspective, one needs information about population size and structure, and, of course, large scale information about the resource base. More detailed small scale studies of prey selection must, however, be supported with resource mapping studies which occur concurrently and synoptically with the sampling of whale diet data. (NIFA, NFH-UIT)

5. Pollution studies

During the whaling season minke whale muscle samples were collected from 577 animals, and blubber samples (403 from the back and 103 from tounge) were collected from individuals where the blubber was intentionally stored for human consumption (VI/SNT).

Blubber samples from 4 minke whales were analysed with respect to PCB (NVH).

An extensive mapping on the concentration of the total mercury (T-Hg) in minke whales were preformed on the whale catches from the 2002 season. The overall analyses of mercury (n=125) were performed on 64 grouped samples containing up to 10 individuals and 61 individual samples, including a total of 542 minke whales (VI/SNT).

The concentration of total mercury varied from 0,01 to 0,80 mg Hg/kg wet weight, while the overall mean for the grouped samples was 0,25 mg Hg/kg wet weight, and the overall mean for the individual samples was 0,22 mg Hg/kg wet weight. When grouped according to hunting area the overall mean for the grouped samples was 0,28 mg

Hg/kg wet weight (North Sea, n=7), 0,34 mg Hg/kg wet weight (Jan Mayen, n=2), 0,14 mg Hg/kg wet weight (Barents Sea, n=19) and 0,25 mg Hg/kg wet weight (Spitsbergen, n=9). These concentrations are similar to recent findings of total mercury in muscle of minke whale caught in Norwegian waters during the hunting season 2001, and considerably lower than total mercury concentrations reported from pilot whales in Faroe Island waters. The latest catches from the North Sea and the Spitsbergen had considerably higher total mercury concentrations than the early catches. These variations are likely to be associated with biological aspects (age and sex) and variations in the migratory pattern. Especially for the Spitsbergen material it is notable to report that the latest catches in June had significantly higher total mercury concentrations than minke whales caught one month earlier. It is possible that we here examine minke whales with different origin. However, ongoing studies may reveal different sub-populations of minke whales in the presented material (VI/SNT).

6. Statistics for large cetaceans

6.1 Direct catches for the calendar year 2002

Species	Type of catch	Management Areas					Total catch
Minke whale		EB	EN	ES	EC	CM	
	Small-type whaling	308	132	146	13	35	634

8. Strandings

Information on strandings has been collected by the Institute of Marine Research, Bergen, Norway.

9. Other work

During November, fieldwork was undertaken to study the ecology of killer whales and the manner in which the whales interact with the herring fishery. Behavioural and acoustic data were collected. (NIFA, NFH-UIT, NP)

Data on white whale vocalisation (collected in Spitsbergen waters) have been analysed and presented. (NIFA, NP, NFH-UIT)

In cooperation with the Directorate of Fisheries changes have been made to compulsory fisheries log books to accommodate recording of bycatches of marine mammals. (IMR)

The research work on pathological studies of minke whales killed by penthrite grenades was continued in 2002. Analysing and processing of the material have been finished and some of the results were published in 2002. The above study aims to conclude in a veterinary doctoral degree. (NVH-IAV)

Scientists from NVH-IAV have been engaged in co-operative work with scientists, authorities, whale hunters and whale hunters organisations in Norway, Greenland, Alaska, and Japan to refine the design of hunting gears and penthrite grenades used for whale hunting. They have also been engaged in the planning of workshops, preparation of manuals and lecturing for whale hunters and/or administrators in Norway, Greenland, Faroe Islands, Alaska USA and Japan. (NVH-IAV)

The population structure of bowhead whales during postglacial time is studied using DNA extracted from ancient (bones and baleen) and recent tissue material. The project is performed in a cooperation between UIO-ZM, IMR and Wildlife Conservation Society, NY.

11. Publications

11.1 Published or 'In Press'

- Bjørge, A. and Tolley, K. 2002. Harbor Porpoise. pp. 549-551 I: Perrin, W.F., Wursig, B., Thewissen, J.G.M. (Ed.), *Encyclopedia of Marine Mammals*. Academic Press, San Diego, USA.
- Born, E.W., Dahlgaard, H., Riget, F.F., Dietz, R., Øien, N. and Haug, T. 2002. Regional variation in caesium-137 in minke whales, (*Balaenoptera acutorostrata*) from West Greenland, the North Atlantic and the North Sea. *Polar Biology* 25: 907-913.

- Chilvers, B.L. and Corkeron, P.J. 2002. Association patterns of bottlenose dolphins, *Tursiops aduncus*, off Point Lookout, Queensland, Australia. *Can. J. Zool.* 80:973-979
- Corkeron P.J. 2002. Captivity. Pp. 192-197 in Perrin W.F., Würsig B. and Thewissen J.G.M. *The Encyclopedia of Marine Mammals*. Academic Press. San Diego.
- Haug, T., Lindstrøm, U. and Nilssen, K.T. 2002. Variations in minke whale *Balaenoptera acutorostrata* diets in response to environmental changes in the Barents Sea. *Sarsia* 87: 409-422.
- Heide-Jørgensen, M.P. and Wiig, Ø. (Eds.) Belugas in the North Atlantic and the Russian Arctic. *NAMMCO Scientific Publications* 4, 260pp
- Hop, H., Borgå, K., Gabrielsen, G.W., Kleivane, L. and Skaare, J.U. 2002. Food web magnification of persistent organic pollutants in poikilotherms and homeotherms from the Barents Sea. *Environ Sci Techn* 36: 2589-2597
- Karlsen, J.D., Bisther, A., Lydersen, C., Haug, T., and Kovacs, K.M. 2002. Summer vocalisations of adult male white whales (*Delphinapterus leucas*) in Svalbard, Norway. *Polar Biol.* 25: 808-817.
- Knudsen, S.K., Mørk, S. and Øen, E.O. 2002. A novel method for in situ fixation of brains. *Journal of Neuroscience Methods* 120: 35-44
- Lindstrøm, U. and Haug, T. 2002. Vågehvalens beitevaner i Barentshavet. Pp. 125-126 i Iversen, S.A. (red) 2000. *Havets Ressurser 2002*. Fiskerihavet, Sæmr 1-2002.
- Lindstrøm, U., Haug, T. and Røttingen, I. 2002. Consumption of herring *Clupea harengus* by minke whales *Balaenoptera acutorostrata* in the Barents Sea. *ICES J. mar. Sci.* 59: 58-70.
- Lydersen, C., Nøst, O. A., Lovell, P., McConnell, B. J., Gammelsrød, T., Hunter, C., Fedak, M. A. and Kovacs, K. M. 2002. Salinity and temperature structure of a freezing Arctic fjord - monitored by white whales (*Delphinapterus leucas*). *Geophys. Res. Lett.* 29: art. no. 2119. 4 pp.
- Mansour, A.A.H, McKay, D.W., Lien, J., Orr, J.C., Banoub, J.H., Øien, N. and Stenson, G. 2002. Determination of pregnancy status from blubber samples in minke whales (*Balaenoptera acutorostrata*). *Marine Mammal Science*, 18(1):112-120.
- Nøttestad, L., Fernø, A. and Axelsen, B.E. 2002. Digging in the deep: killer whales' advanced hunting tactic. *Polar Biology*, 25:939-941.
- Parra G.J., Azuma C., Preen A.R., Corkeron P.J. and Marsh H. 2002 Distribution and status of Irrawaddy dolphins, *Orcaella brevirostris*, in Australian waters. *Raffles Bull. Zool.* 10:141-154
- Ruus, A., Ugland, K.I. and Skaare, J.U. 2002 Influence of tropic position on organochlorine concentrations and compositional patterns in a marine food web. *Environ tox and chem.* 21 (11): 2356-2364.
- Ruus, A., Sandvik, M., Ugland, K.I. and Skaare, J.U. 2002 Factors influencing activities of biotransformation enzymes, concentrations and compositional patterns of organochlorine contaminants in members of marine food web. *Aquatic Toxicol* 61: 73-87.
- Skaare, J.U., Larsen, H.J., Lie, E., Bernhoft, A., Derocher, A.E., Norstrom, R., Ropstad, E. and Wiig, Ø. 2002 Ecological risk Assessment of persistent organic pollutants in the artic. *Toxicology* 181-182, 193-197.
- Skaug, H.J. 2002. Automation differentiation to facilitate maximum likelihood estimation in nonlinear random effects models. *Journal of Computational and Graphical Statistics*, 11(2):458-470.
- Tittlemier, S., Borrell, A., Duffe, J., Duignan, P. J., Fair, P., Hall, A., Hoekstra, P., Kovacs, K. M., Krahn, M. M., Lebeuf, M., Lydersen, C., Muir, D., O'Hara, T., Olson, M., Pranschke, J., Ross, P., Siebert, U., Stern, G., Tanabe, S. and Norstrom, R. 2002. Global distribution of halogenated dimethyl bipyrrroles in marine mammal blubber. *Arch. Environ. Contam. Toxicol.* 43: 244-255.
- Tolley, K. A. and Heldal, H.E. 2002. Inferring ecological separation from regional differences in radioactive caesium in harbour porpoises *Phocoena phocoena*. *Marine Ecology Progress Series*, 228:301-309
- Urashima, T., Sato, H., Munakata, J., Nakamura, T., Arai, I., Saito, T., Tetsuka, M., Fukui, Y., Ishikawa, H., Lydersen, C. and Kovacs, K. M. 2002. Chemical characterisation of the oligosaccharides in beluga (*Delphinapterus leucas*) and minke whale (*Balaenoptera acutorostrata*) milk. *Comp. Biochem. Physiol. B* 132: 611-624.
- Valsecchi E., Hale P.T., Corkeron P. and Amos W. 2002. Social structure in migrating humpback whales (*Megaptera novaeangliae*): a molecular analysis. *Molecular Ecology* 11: 507-518.
- Van Parijs S.M., Smith, J. and Corkeron. P.J. 2002. Using calls to estimate the abundance of inshore dolphins; a case study with Pacific humpback dolphins, *Sousa chinensis*. *J. Appl. Ecol.* 39: 853-864.

11.2 Unpublished literature

- Andersen G, Føreid S, Kovacs K, Lydersen C, Jenssen BM, Skaare JU. 2002. Toxaphenes in white whales (*Delphinapterus leucas*) from Svalbard, Norway. *AMAP conference and workshop: Impacts of POPs and mercury on Arctic environments and humans*. Tromsø, 20–24 January 2002. Abstract book p. 61.
- Bavel, B. van, Tysklind, M., Damm, M., Lydersen, C., Kovacs, K., Derocher, A., Wiig, Ø., Gabrielsen, G. W. and Lindström, G. 2002. Polybrominated diphenyl ethers (PBDEs) in the Arctic's marine environment. *AMAP conference and workshop: Impacts of POPs and mercury on Arctic environments and humans*. Tromsø, 20–24 Jan. 2002. Abstract book. p.15.
- Corkeron, P.J. and Van Parijs, S.M. 2002. Pacific humpback dolphins, sound and management: a review. *Int. Whal. Commn* SC/54/SM29: 9 pp.
- Haug, T. and Lindstrøm, U. 2002. Diet studies and Cetaceans – Methodological Aspects. *IWC Modelling Workshop on Cetacean-Fishery Competition*, 25-27 June 2002, La Jolla, USA SC/JO2/FW1: 9pp.
- Kleivane, L, Skåre, JU. Undersøkelse av kvikksølvnivåer i muskel fra vågehval 2002. SNT-rapport 2002.
- Lindstrøm, U. and Haug, T. 2002. On the whale – fisheries issue: A review of Norwegian studies of the feeding ecology of northeast Atlantic minke whales (*Balaenoptera acutorostrata*) during the past decade. *Int. Whal. Commn* SC/54/E6: 25pp.
- Lindstrøm, U., Tjelmeland, S. and Haug, T. 2002. Implementing predation from marine mammals in fish stock assessments – minke whales and Norwegian spring spawning herring as a case study. *IWC Modelling Workshop on Cetacean-Fishery Competition*, 25-27 June 2002, La Jolla, USA SC/JO2/FW6: 25pp.
- Lydersen, C., Krafft, B. A., Andersen, M. and Kovacs, K. M. 2002. Marine mammals in the Bellsund – Van Mijenfjorden – Van Keulenfjorden area. New investigations and status of knowledge. *Norsk Polarinst. Rapp. Ser.* 121. 36 pp.
- Nøttestad, L., Fernø, A. and Misund, O.A. 2002. Finnkval på nattejakt etter sild i Norskehavet. Havets ressurser 2002, Fisken og havet, særnr. 1-2002: 2 pp.
- Nøttestad, L. 2002. Killer whales (*Orcinus orca* L.) and saithe (*Pollachius virens* L.) in shallow water. ICES ASC 2002, Copenhagen. Poster.
- Øien, N. 2002. Norwegian independent Linetranssect Survey 2002. Project 910421, Survey Protocol, 13.06.2002. Havforskningsinstituttet, Bergen.
- Øien, N. 2002. Report of the Norwegian 2002 sighting survey for minke whales. IWC SC/54/RMP1, 9 pp.
- Øien, N., Bøthun, G. and Kleivane, L. 2002. A review of available data on surfacing rates of northeastern Atlantic minke whales. IWC SC/54/RMP 2, 6 pp.
- Olsen, E. 2002. Age determination of minke whales. Dr.Scient.Thesis, University of Bergen, Department of Fisheries and Marine Biology, Bergen, Norway.
- Parra, G.V., Corkeron, P.J. and Marsh, H. The Indo-Pacific Humpback dolphin, *Sousa chinensis* (Osbeck, 1765) in Australian waters: a summary of current knowledge and recommendations for their conservation. *Int. Whal. Commn* SC / 54 / SM27: 28 pp.
- Skåre, J.U. 2002 Analyses of mercury in minke whales from Norwegian waters. Rapport Det Kongelige Utenriksdepartementet 2002.
- Skaug, H.J., Haug, T. and Øien, N. 2002. Spatial genetic structure in NA-minke whales. *Int. Whal. Commn* SC/54/RMP6: 4 pp.
- Skaug, H.J., Øien, N., Bøthun, G. and Schweder, T. 2002. Abundance of the northeastern Atlantic minke whales for the survey period 1996-2001. IWC SC/54/RMP5, 42 pp.